XX International Scientific Conference

FIS COMMUNICATIONS 2017

in Physical Education, sport and recreation

Book of Proceedings

Ministry of Education, Science and Technological Development Republic of Serbia

UNIVERSITY OF NIS FACULTY OF SPORT AND PHYSICAL EDUCATION FSFV 1971

University of Niš
Faculty of Sport and Physical Education

XX Scientific Conference
„FIS COMMUNICATIONS 2017"
in physical education, sport and recreation

(Niš, Serbia, october 19-21st, 2017)

Book of Proceedings

Niš, 2017.

XX Scientific Conference
„FIS COMMUNICATIONS 2017" in physical education, sport and recreation

Book of Proceedings

Publisher:

Faculty of sport and physical education , University of Niš

For the publisher:

Faculty dean, prof. Milovan Bratić, PhD

Editor in chief:

prof. Saša Pantelić, PhD

Printed by:

Medivest, Niš

Computer editor:

Predrag Živanović

Cover design:

Dragan Radojković

Circulation:

200 copies

ISBN: 978-86-87249-85-1

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FOREWORD

Faculty of Sport and Physical Education University of Nis in its 46 years long tradition organizes a scientific conference "FIS COMMUNICATIONS". This year we are organizing 20th scientific conference "FIS COMMUNICATIONS 2017". Our profound years long experience in organizing of the conference has contributed to ever increasing high quality of the conference over years.

International scientific conference "FIS COMMUNICATIONS 2017" is organized by the Faculty of sport and Physical Education University of Nis under the auspices of the Ministry of Education, Science and Technological Development of the Republic of Serbia.

We are proud to announce the key speakers in our plenary sessions as eminent renowned experts in their field of expertise who are coming from the countries taking part in this conference for the first time.
This conference can boast submission of 90 full text papers. Upon the review process 68 papers were accepted and approved for the publication. Papers are divided into five sessions depending on the topics investigated as follows: Individual Sports, Team Sports, Physical Education, Physical Activity and Health, Interdiciplinary, Sports Medicine and Physiology and Poster session.

Organizers are satisfied with the participation of already renowned researchers and the young, oncoming authors following the thorny path of the scientific investigation, as well. Also a large number of foreign authors and thematic diversity have widen the horizon of the expert and scientific insights, put some new incentive for the cooperation and expression of the new creative efforts.

Enclosed you can find the Proceedings of the International scientific conference "FIS COMMUNICATIONS 2017" incorporating all the papers presented at the scientific conference. We would like to express our gratitude to all the participants, especially to the authors of the papers and we expect that all this conference contributes to enhance and further the development of the scientific and expertise thought in the area of sport, physical education and recreation.

Chair of the Scientific Committee
Saša Pantelić, PhD, prof.

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Individual Sports

ANALYSIS OF UNSUCCESSFULLY PERFORMED THROWING TECHNIQUES BY FEMALE COMPETITORS AT BOSNIA AND HERZEGOVINA STATE CHAMPIONSHIP

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UDC 796.43_055.2(497.15)

SUMMARY

The aim of this research is to analyze n=81 unsuccessfully performed throwing techniques by seniors on Bosnia and Herzegovina State Championship in judo, held in 2017. One third is related to successful throws while two thirds are unsuccessful throws. The largest number of unsuccessful throwing techniques is in leg (Ashi), hand (Te), side sacrifice (Yoko sutemi) and hip (Koshi) throws. The most unsuccessful throwing techniques are Ippon Seoi Nage, O Uchi Gari and Soto Makikomi. In the first place, the reasons for their failure are the lack of breaking the balance (Kuzushi) of their opponent, insufficient rotation during throws and attempt to attack from long distance. These results can be useful for trainers and contestants so they can, through the training process, work on reducing certain disadvantages during attempts of throwing their opponent.

Keywords: combat sport, women, error, performance analysis

INTRODUCTION

Judo is a highly intensive and dynamic activity where competitors try to apply certain throwing technique (Kajmović, Rađo, & Mekić, 2011). Judo contains a large number of different throwing techniques (Daigo, 2005), but only few of them are applied on competitions. For that reasons, many authors (Kajmović, Rađo, & Kapo, 2007; Miarka, et al., 2014; Kajmović. & Rađo, 2016; Kajmović, et al., 2017) analyzed competitors' performances on different levels of competition, with intention to determine which of the throwing techniques and grappling techniques are most efficient and for that reason, use these informations for training process.

However, there are two sides of the same coin, and the other side is that during the competition, competitors have large number of attempts to apply throwing techniques, but for certain reasons, i.e. mistakes, these throws were unsuccessful, meaning that they couldn't achieve certain number of Ippon and Waza-ari points in accordance with criteria defined by rules of International Judo Federation, and which in certain moments forced judges to penalize competitors for fake attacks.

Of course, it is important to emphasize that more high quality scientific research gave much clearer picture of mistakes issues during performance of certain throwing techniques in judo competitions (Gutiérrez-Santiago, et al., 2009, Gutiérrez-Santiago, et al., 2013, Prieto, et al., 2013, Prieto, et al., 2014; Prieto, et al., 2016).

Also, mistakes that appear during throw performance, can contribute injuries (Prieto, et al., 2014) and because of that, knowing mistakes that appear during performance of throwing technique in competition, so as in training, can decrease their number within competitors.

The aim of this research is to analyze unsuccessfully performed throwing techniques by female seniors at Bosnia and Herzegovina State Championship in judo, held in 2017.

METHODS

Subjects

The sample of respondents make sum of n=81 unsuccessfully performed throwing techniques by senior female competitors in all seven weight categories.

Variables

Variables are sub-groups of the following techniques: hand (TE), leg (ASHI), hip (KOSHI) and side sacrifice (YOKO SUTEMI) throws and individual throwing techniques.

Procedure

The data is collected based on video recordings of unsuccessfully performed throwing techniques in Bosnia and Herzegovina Championship in judo, in 2017. Three Sony video cameras were used to record each single competition area. Two observers had a task to watch each unsuccessful technique three times to be sure that the analyzed throwing technique is exactly that technique, as well as the mistakes that appeared during throw attempts. The data was entered in prepared protocols of tracking unsuccessful throwing techniques.

Statistical analysis

All unsuccessful throwing techniques are shown in percentages value (%).

RESULTS

The results showed that seniors in Bosnia and Herzegovina State Championship in judo have much higher number of unsuccessful throws (66,4%) compared to successfully performed throwing techniques (33,6%) (Figure 1). In Figure 2., the largest number of unsuccessful attempts of throwing techniques is from leg group techniques (Ashi) 35,8% and hand (Te) 33,3%. Followed by side sacrifice throwing techniques (Yoko Sutemi) 18,5% and in the end, hip (Koshi) throws 12,4%. The largest number of unsuccessfully performed throwing techniques relates to the techniques Ippon Seoi Nage, O Uchi Gari, Soto Makikomi, Uchi Mata (Table 1).

Figure 1. Percentages of successfully and unsuccessfully performed throwing techniques.

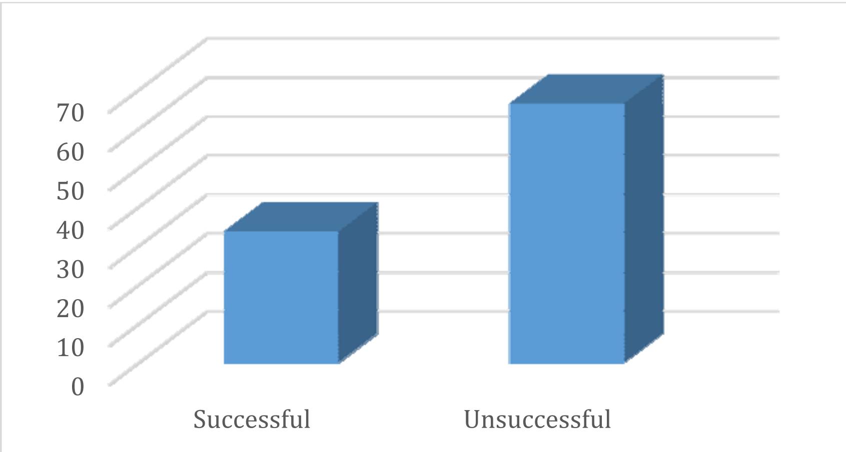

Figure 2. Percentages of unsuccessfully performed throwing techniques sub-groups.

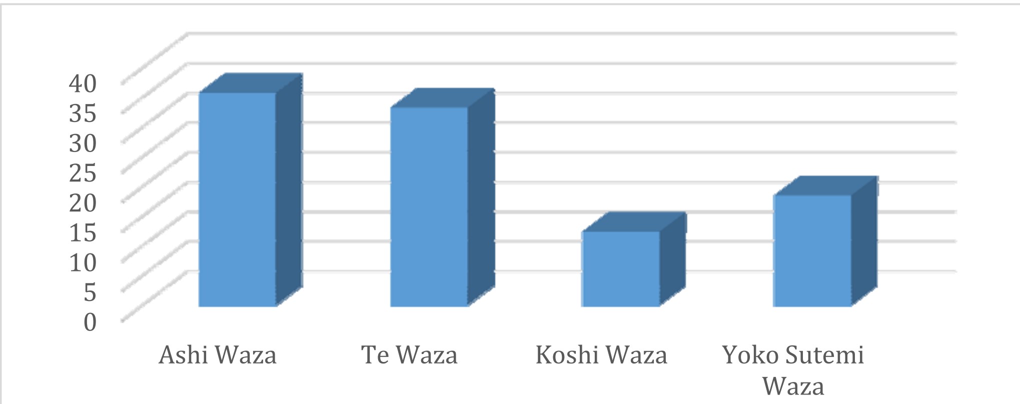

Table 1. Percentages of unssuccesfully performed throwing techniques.

Unsuccessful throwing techniques	%
Ippon Seoi Nage	28,4
O Uchi Gari	13,6
Soto Makikomi	13,6
O Soto Gari	11,1
Uchi Mata	11,1
Harai Goshi	9,9
Seoi Nage	3,7
Sumi Gaeshi	3,7
Sode Curikomi Goshi	2,5
Tani Otoshi	1,2
Kata Guruma	1,2

DISCUSSION

The results of this analysis have helped to achieve the defined goal of this research, to determine which are the most unsuccessful throwing techniques and what are the reasons for that failure. The mistakes that occur in throwing techniques (Table 1) are: during attempt to perform throws, the competitors lose established guard, poorly disrupted balance of the opponent, hand (Hikite) that holds the the opponents' sleeve doesn't pull it forward and it is next to the Tori's body, insufficient rotation during throw, the attack begins from large distance, the weight of Ukea is not on the leg which is supposed to be attacked.

Several authors have investigated the mistakes in different throwing techniques. Gutiérrez-Santiago, et al. (2009) conducted a research with purpose to provide a tool, based on the knowledge of technical errors, which helps to improve the teaching and learning process of the Uki Goshi technique.

The results show that the absence of a correct initial unbalancing movement (45,5%), the lack of proper right-arm pull (56,8%), not blocking the faller's body (Uke) against the thrower's hip –Tori- (54,5%) and throwing the Uke through the Tori's side are the most usual mistakes (72,7%). They came to conclusion that not blocking the body with the Tori's hip provokes the Uke's throw through the Tori's side during the final phase of the technique (95,8%), and positioning the right arm on the dorsal region of the Uke's back during the Tsukuri entails the absence of a subsequent pull of the Uke's body (73,3%).

Gutiérrez-Santiago, et al., (2013) researched the most common technical errors, and their behavioural sequences, in the judo throw Morote Seoi Nage. The results showed that a sub-optimal knee bend produces a throw around the side rather than over and towards the front of the shoulder, an inadequate hip and trunk position, caused by prior incorrect placement of the left foot, leads to a failure of weight bearing, which itself is the cause of the side throw. As regards the teaching and learning of judo, these findings enable us to propose motor drills to correct the errors detected, and movement sequences that will ensure a successful throw.

Prieto, et al., (2014) investigated errors in the teaching-learning process of judo-techniques: Osoto-Guruma. The aim of this article was to suggest some changes in the teaching-learning process methodology of the judo osoto-guruma technique, establishing the action sequences and the most frequent technical errors committed when performing them. They identified the following mistakes: the presence of typical inaccuracies during the technique performance; a number of chained error affecting body balance, the position of the supporting foot, the blocking action and the final action of the arms.

Prieto, et al. (2016) conducted a research and the aim of the study was to detect the most frequent errors and their associated behavioral sequences in realtion to the judo technique Ouchi-gari, the ultimate objective being to propose improvements to the way in which judo is taught. The most common errors detected were related to an initial failure to put the adversary off balance, an inadequate position of the right arm, an incorrect positioning of the face and trunk, the height of the center of gravity during the tsukuri and kake phases of the throw, insufficient traction effect of both arms in the final phase of the throw, and an incorrect reaping action.

Obviously, on the basis of this research and research conducted by other authors who tackled the issue of mistakes when performing the throwing technique, indicates that it is necessary to make more serious dedication to correct the mistakes by using new motorical tasks and technologies during training.

CONCLUSION

Data collected from Bosnia and Herzegovina State Championship in judo, held in 2017., about number of unssuccesfully performed throwing techniques as well as reasons that led to that failure as seniors' mistakes, can serve coaches and competitors to innovate training process with the intention of eliminating mistakes while performing throwing techniques. Also, trainers have the ability to eliminate those mistakes in throwing techniques in the younger age categories, and thus contribute to be more efficient with less injuries as possible.

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BODY COMPOSITION IN RHYTHMIC GYMNASTS OF DIFFERENT COMPETITION PROGRAM

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UDC 796.412

SUMMARY

The main objective of this study was to examine the body composition profile of rhythmic gymnasts competing in different programs, as well as to determine possible differences between them. The sample consisted of 254 club-, national- and international-level gymnasts, distributed in five age group categories (25 seniors, aged 16 years and older; 39 juniors, aged 14-16 years; 50 advanced, aged 12-14 years; 83 intermediate, aged 9-12 years; 57 beginners, aged six to nine years) and three competition programs (“A“ program, N=84; “B“ program, N=101; “C“ program, N=69). Their baseline characteristics (age, body height, body mass, body mass index, years of training experience, training hours) were established, as well as their body composition profile (BF%- body fat percentage and Muscle%- muscle mass percentage). By means of One-way ANOVA, statistically significant differences in body composition of “A”, “B” and “C” advanced- and intermediate-level gymnasts and beginners were established (BF%: F=12.84, p=0.000; F=17.77, p=0.000; F=5.97, p=0.005, respectively; Muscle%: F=7.63, p=0.001; F=17.69, p=0.000; F=5.10, p=0.009, respectively). The differences in body composition were missing in the group of senior and junior RGs, as well as between “A” and “B” intermediate-level gymnasts and between “B” and “C” beginners. Also, neither were established statistically significant differences in Muscle% between “A” and “B” advanced-level gymnasts and beginners, nor between “B” and “C” advanced-level gymnasts.

Keywords: rhythmic gymnastics, body fat, muscle mass, age categories

INTRODUCTION

Activity in any kind of sports creates the preconditions for the development of a sport-specific body, caused by morphological changes occurring in the body of an athlete, which allows us to determine not only the sport specialization of athletes, but also their performance level (Zhumanova, 2013). Namely, athletes are characterized by a certain “biotype”, a particular combination of body composition and build, affording them an advantage relating to success in a given sport (Purenović-Ivanović, Popović, Bubanj, & Stanković, in press). Rhythmic gymnastics (RG) is a sport that requires considerable specificity from an athlete in relation to body composition (Oliveira, Gonçalves, Oliveira, Silva, Fernandes, & Fernandes Filho, 2017), which can be attributed to aesthetic requirements in sports performance evaluation (Àvila-Carvalho, Klentrou, da Luz Palomero, & Lebre, 2012). However, apart from the aesthetic moment, body composition is favorable kinanthropometric factor which leads to exceptional biomechanical and metabolic efficiency in RG and may be treated as very important health-related anthropometric indicator. Vieira, Amorim, Rocha, Amorim, & Vieira (2009) indicated that the specific physical form and body patterns of gymnasts favor the technical movements of the modality that contribute to their balance, flexibility, speed, and agility. Having a low body mass appears to be an obvious advantage when performing skills that require movements with intricate routines (Sinning, 1978).

Rhythmic gymnastics has its specific physiological and biomechanical demands, and these sport-specific demands change with the level of skills, training load (i.e. frequency and intensity of training), and they usually increase with the competition level. In Serbia, as well as in many other European countries, national Gymnastics Federation has formed three competition programs: “A”, “B” and “C”, i.e. high-, medium- and low-level program. They all differentiate in competition rules, i.e. in items like: final score, the maximum number of body difficulties, lengths of routines, training hours per week, age category classification, etc., and it is legitimate to assume that different requirements in different competition programs produce differences in kinanthropometric variables among the three groups. As tribute of this assumption, there were some researches interested in comparing gymnasts of different performance level (di Cagno, Baldari, Battaglia, Brasili, Merni, Piazza, Toselli, Ventrella, & Guidetti, 2008; Broda, & Poliszczuk, 2009; da Silva, & Rocha, 2011), where dissimilarities in anthropometric (and many other) values between elite and low(er) profile gymnasts of the same age were recorded. The purpose of the current study was to examine and compare body composition of rhythmic gymnasts (RGs) of different competition programs, within each of five age group categories.

METHODS

Subjects

Two hundred and fifty-four rhythmic gymnasts (RGs), between the ages of 6 and 20 years, voluntarily participated in the study (Mean±SD, age: 11.45±3.03 years, body height: 146.39±14.71 cm, body mass: 37.47±11.38 kg, BMI: 17.73±7.84 kg/m^2, sports experience: 6 months to 14 years, training hours: 4 to 16 hours/week). All of the participants are the "A", "B" and "C" program (i.e. high-, medium- and low-level competition program) individual and/or group competitors at national and/or international level, distributed in five age group categories according to the official age classification of the Serbian Gymnastics Federation (see Table 1).

Table 1. Distribution of study participants according to age group category, program and country of competition

Age Categories	2012 (RG clubs from Niš, Serbia)	2012 National Championships (Belgrade, Serbia)	6th "Montenegro Cup 2013" (Budva, Montenegro)	2014 National Championships (Belgrade, Serbia)	TOTAL
Seniors	1B + 1C	6A	2A	7A + 8B	15A + 9B+ 1C = **25**
Juniors	1B + 3C	10A	1A + 5B	12A + 7B	23A + 13B + 3C = **39**
Advanced	2B + 15C	7A	2A + 7B	5A + 12B	14A + 21B + 15C = **50**
Intermediate	6B + 25C	13A	5A + 14B	4A + 16B	22A + 36B + 25C = **83**
Beginners	4B + 25C	4A	6A + 5B	13B	10A + 22B + 25C = **57**
TOTAL	**14B + 69C = 83**	**40A = 40**	**16A + 31B = 47**	**28A + 56B = 84**	**84A + 101B + 69C = 254**

Legend: A- "A" program (national- and international-level RGs competing according to FIG rules), **B-** "B" program (national- and international-level RGs, but with less demands for difficulties compared to an "A" program gymnasts), **C-** "C" program (club- and national-level RGs which are competing under less demands compared to a "B" program gymnasts).

Procedure

The first part of the testing included 83 club-level (i.e. "C" program competitors, N=69) and national-level RGs (i.e. "B" program competitors, N=14) from Niš (Serbia). The second one included 40 top-level Serbian gymnasts (i.e. "A" program competitors) and it was performed on December 16th, during the 2012 National Championships held in Belgrade (Serbia). The third one was conducted at the end of June 2013 in Budva (Montenegro), when a further 16 elite (i.e. "A" program competitors) and 31 international-level gymnasts (i.e. "B" program competitors) were tested. During the 2014 National Championships held in Belgrade (Serbia) on October 25th, the fourth testing included 28 top-level (i.e. "A" program competitors) and 56 national-level Serbian gymnasts (i.e. "B" program competitors). All testing was performed in accordance with the ethical standards of the Helsinki Declaration (WMA, 2002).

All the measurements were taken by the authors in optimal climatic conditions, with the participants in their underwear, and according to the methods proposed by the International Biological Programme (Weiner & Lourie, 1969). The Martin anthropometer was used for obtaining the RGs' body height (in cm), while for obtaining the body composition parameters [body mass (in kg), body mass index (BMI, in kg/m^2), body fat percentage (BF%) and muscle mass percentage (Muscle%)] a tetrapolar bioelectrical impedance device, Omron BF511 (Kyoto, Japan), was used. Data on years of sports experience and training hours were collected by interviewing the participants.

Statistical analysis

Data were analyzed using the Statistical Package for the Social Sciences, version 21.0 (IBM SPSS 21.0, SPSS Inc, Chicago, USA). Descriptive statistics [average value (Mean), standard deviation (SD), Range] were summarized for all variables. Normality was tested using the one-sample Kolmogorov-Smirnov test (K-S). One-way Analysis of Variance (ANOVA) followed by Tukey post hoc HSD test, was performed with the aim of determining the differences in body composition between RGs of high, medium and low competition and training level. The level of significance was set at $p<0.05$.

RESULTS

The baseline characteristics of the study participants, divided into five age group categories, are presented in Table 2. In Table 3 are presented the descriptive statistics data of the measured body composition parameters in RGs of each age category, and in Figure 1 also according to competition program.

Table 2. Baseline characteristics and body composition of the study participants

Age Group Categories	Variables	Age (yrs)	Body Height (cm)	Body Mass (kg)	BMI (kg/m^2)	Sports Experience (yrs)
Seniors (N=25)	*Mean±SD*	17.55±1.23	166.25±6.32	55.69±4.73	20.14±1.26	9.36±2.39**†**
	Range	16.16 – 20.34	150.0 – 178.2	47.4 – 60.0	17.4 – 23.3	5.0 – 14.0
	K-S (Sig.)	.358	.842	.972	.594	.500
Juniors (N=39)	*Mean±SD*	14.41±0.69◊	163.22±6.17	49.4±5.81	18.49±1.54**‡**	7.5±1.89•
	Range	13.18 – 15.82	146.1 – 176.7	31.0 – 62.7	14.5 – 23.6	3.0 – 11.0
	K-S (Sig.)	.911	.661	.719	.919	**.047***
Advanced (N=50)	*Mean±SD*	12.25±0.81	152.85±7.53	40.93±7.7•	17.38±2.25∆	5.18±2.08**†**
	Range	10.57 – 13.8	136.0 – 164.4	25.5 – 59.0	13.8 – 24.6	0.5 – 9.0
	K-S (Sig.)	.991	.833	.901	.394	.376
Intermediate (N=83)	*Mean±SD*	10.18±0.83○	140.85±6.74	32.22±5.83	16.17±2.12○	3.89±2.01○
	Range	8.71 – 12.02	123.6 – 158.4	22.6 – 50.1	12.7 – 23.3	0.5 – 8.0
	K-S (Sig.)	.588	.993	.514	**.027***	.158
Beginners (N=57)	*Mean±SD*	7.91±0.71	128.58±6.23	25.93±4.05	15.63±1.76•	2.28±1.44□
	Range	6.24 – 9.08	116.3 – 141.6	18.6 – 38.1	12.9 – 20.9	0.5 – 6.0
	K-S (Sig.)	.798	.819	.660	.212	**.013***

Legend: N- number of study participants, **Mean**- average value, **SD**- standard deviation, **K-S-** Kolmogorov-Smirnov test, **Sig.**- significance, **yrs**- years, **BMI**- Body Mass Index.

*absence of normal distribution (significant at p=0.05)

○†□‡**∆**•◊ ANOVA ("A" vs. "B" vs. "C"): ○ p=0.000, † p=0.001, □ p=0.004, ‡ p=0.005, **∆** p=0.007, • p=0.025, ◊ p=0.031.

Based on the BMI cut-off points for girls of different ages (CDC, 2000), it can be stated that BMI value of most of the RGs (N=226, or 88.98%) is within the normal range; few of them are bellow the recommended BMI values (N=16, or 6.3%), and some have BMI value above the recommended one: eight RGs (3.15%) have high BMI value, and in four gymnasts (1.58%) even very high BMI values were recorded. When considering the competition program, situation is as follows: in the group of an "A" program gymnasts, all senior and intermediate-level RGs have normal BMI value, and one junior, one beginner and four intermediate-level gymnasts have low BMI value; in the group of gymnasts competing in a "B" program, all seniors and juniors have BMI in the range of the recommended values, lower values were recorded in three advanced-level, five intermediate-level gymnasts and one beginner, and higher BMI values were recorded in two intermediate-level RGs; in the group of a "C" program gymnasts, situation is a bit different (except for the seniors which all have normal BMI): low BMI value was recorded only in one beginner, unlike one junior, one advanced-level, two intermediate-level gymnasts and two beginners with high BMI value, so as one advanced-level, one intermediate-level gymnast and two beginners with very high BMI value.

One-way ANOVA and Tukey post hoc test results indicated the statistically significant differences in BMI of "A", "B" and "C" gymnasts in every age group category (except senior RGs): juniors: F=6.17, p=0.005 ("A" vs. "C", p=0.006 and "B" vs. "C", p=0.004); advanced: F=5.56, p=0.007 ("A" vs. "C", p=0.005); intermediate: F=11.16, p=0.000 ("A" vs. "C", p=0.000 and "B" vs. "C", p=0.002); beginners: F=3.93, p=0.026 ("A" vs. "C", p=0.019). When speaking about body mass, it differentiate only advanced-level "A" from "C" gymnasts (p=0.020), and sports experience differentiate gymnasts in every single age category.

The absence of normal distribution was recorded among intermediate-level RGs' BMI (K-S, p=0.027), so as in sports experience of juniors (K-S, p=0.047) and beginners (K-S, p=0.013).

Table 3. Body composition in RGs of different age group categories

Age Categories	Variables	BF%	Muscle%
Seniors (N=25)	*Mean±SD*	23.01±4.13	33.18±2.28
	Range	12.9 – 32.6	28.5 – 39.2
	K-S (Sig.)	.874	.598
Juniors (N=39)	*Mean±SD*	16.32±4.59	36.34±1.86
	Range	6.9 – 27.5	31.7 – 39.9
	K-S (Sig.)	.860	.405
Advanced (N=50)	*Mean±SD*	13.92±5.89†	35.96±2.77‡
	Range	5.4 – 30.8	26.3 – 40.0
	K-S (Sig.)	.790	.324
Intermediate (N=83)	*Mean±SD*	14.82±7.06†	33.85±2.31†
	Range	5.2 – 34.6	28.0 – 38.2
	K-S (Sig.)	.151	.640
Beginners (N=57)	*Mean±SD*	14.46±6.38◊	30.91±2.65∆
	Range	5.0 – 28.4	21.8 – 36.4
	K-S (Sig.)	.730	.593

Legend: N- number of study participants, **Mean-** average value, **SD-** standard deviation, **K-S-** Kolmogorov-Smirnov test**, Sig.-** significance, **BF%-** body fat percentage, **Muscle%-** muscle mass percentage.

†‡◊∆ ANOVA ("A" vs. "B" vs. "C"): **†** p=0.000, **‡** p=0.001, **◊** p=0.005, **∆** p=0.009.

Kolmogorov-Smirnov test showed no deviation from the normal distribution of data when it comes to the body composition parameters of RGs of all age group categories (Table 3). Regarding body fat percentage (BF%) established among RGs, compared with the standards of a healthy age- and gender-matched population (McCarthy, Cole, Fry, Jebb, & Prentice, 2006), the situation is as follows: most of the RGs have low body fat (n=131, or 52.82%), 42.34% have normal values of BF% (22 seniors, 20 juniors, 17 advanced-level, 26 intermediate-level and 20 beginners), eight RGs have high BF% (one senior and one advanced-level, four intermediate-level gymnasts and two beginners), and four RGs have very high value of body fat percentage (two intermediate-level gymnasts and two beginners). When considering the competition program, in the group of an "A" program gymnasts, 12 out of 15 seniors have normal value of BF%, two of them have low and one has high value of BF% (i.e. 32.6% of body fat); in the group of junior RGs, 11 have normal and 12 have low value of BF%; in the group of advanced-, intermediate-level RGs and the beginners almost all of them have BF% below the recommended values. In a "B" program all seniors have BF% in the range of the recommended values; 58.3% of junior RGs have normal value of BF%, and the rest of them are below the recommended values, which is almost the same situation as in the case of the beginners; in the group of advanced-level RGs 2/3 have low value of BF%, and 1/3 is in the range of the recommended ones, and in the group of intermediate-level RGs, the majority (n=24) has BF% below the recommended values, somewhat have normal BF% (n=9), and one of them has very high BF% (i.e. 34.6% of body fat). In the case of a "C" program, older age group categories (seniors, juniors, advanced-level gymnasts) do not differ much from "A" and "B" program gymnasts, but in younger age group categories a situation is a bit different: the majority of intermediate-level RGs and beginners (i.e. 60%, or 15 gymnasts, and 44%, or 11 gymnasts, respectively) have normal values of BF%, 20% (n=5) of intermediate-level gymnasts and 40% (n=10) of beginners have BF% below the recommended values, 16% (n=4) and 8% (n=2), respectively, have high and 4% of intermediate-level RGs (n=1) and 8% of beginners (n=2) have very high value of BF%, i.e. more than 28% of body fat.

When considering obtained values of RGs' relative muscle mass, there is a problem for interpretation since there are no available standards of age- and gender-matched population of children. There are only referent lists for the adults, i.e. 18+ (Omron, 2012, 12), and that is way we can only compare Muscle% of seniors with those standards. According to that referent list, senior RGs have high values of muscle mass percentage, which is not surprising considering the fact that physical activity has a positive impact on the skeletal muscle mass (Bubanj, Živković, Stanković, Obradović, Purenović-Ivanović, & Đošić, 2013).

The applied One-way ANOVA neither showed a statistically significant difference between seniors of different competition program (BF%: p=0.627; Muscle%: p=0.633), nor in the case of junior RGs (BF%: p=0.087; Muscle%: p=0.364). According to the same analysis, statistically significant differences were found within each of the rest age categories. Namely, in the group of advanced-level RGs (ANOVA: BF%, F=12.84, p=0.000; Muscle%, F=7.63, p=0.001), gymnasts of all of three programs differentiate significantly in body fat percentage (Tukey HSD: "A" vs. "B", p=0.024; "A" vs. "C", p=0.000; "B" vs. "C", p=0.021), and in the case of muscle mass percentage, statistically significant differences were found only between gymnasts of "A" and "C" program (p=0.001). Also, intermediate-level RGs do differentiate significantly in BF% (F=17.77, p=0.000), so as in Muscle% (F=17.69, p=0.000), and according to Tukey HSD, differences were not found only between gymnasts competing in "A" and "B" program (BF%, p=0.397; Muscle%, p=0.816). When speaking about body composition of beginners competing in different programs, statistically significant differences were found (ANOVA: BF%, F=5.97, p=0.005; Muscle%, F=5.10, p=0.009), and according to Tukey HSD, only between "B" and "C" beginners significant differences in body fat percentage were not found (p=0.427), and in the case of muscle mass percentage, differences were recorded only between "A" and "C" beginners (p=0.012).

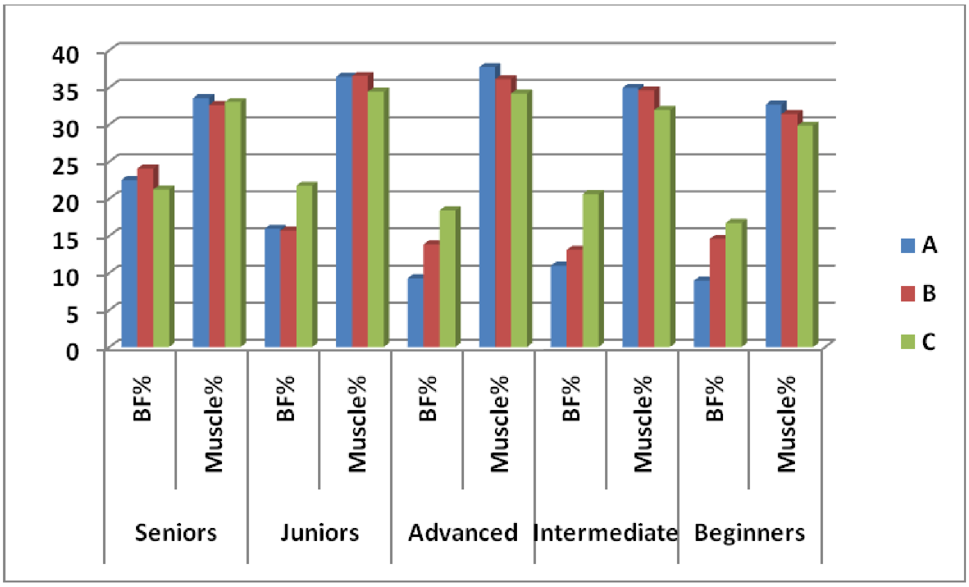

Figure 1. Values of body composition parameters recorded in RGs of different age categories (seniors, juniors, advanced-level, intermediate-level and beginners) and competition programs ("A", "B" and "C")

DISCUSSION

This research objective was to establish body composition profile and examine possible differences between RGs of different competition programs, within each of five age group categories. It was assumed that different requirements in different competition programs (primarily training load) would produce differences in the body composition among the three groups of RG competitors, and the assumption was reasonable (at least when it comes to the younger age group categories). Namely, according to the analysis results, body composition does differentiate advanced-, intermediate-level RGs and beginners of different competition program (within the same age group category). The obtained dissimilarity was expected if one have in mind the RG program requirements. Namely, RG is an Olympic sport comprised of two categories: the individual competition and the group one (each group comprises five gymnasts, at least when it comes to an "A" program). In competitions, individual gymnasts present four routines corresponding to the four, out of five authorized apparatus (rope, hoop, ball, clubs and ribbon). Groups present two routines: the first with five identical apparatus and the second one with two mixed apparatus (three gymnasts have one type of RG apparatus and two gymnasts have some other type). Each national federation has possibility of forming his own competition program(s), and Gymnastics Federation of Serbia (and many other European countries) has three: "A", "B" and "C" program. "A" program is absolutely in accordance with International Gymnastics Federation's (FIG) RG Code of Points, which makes it an elite program that gathers only top-level gymnasts: "A" gymnasts train in average two to three hours a day, four to six times per week, final score is 20.00 points maximum. "B" program has its own requirements, similar to those in an "A" program, but less demanding in terms of body difficulties and length of routines. For example, in "B" group competitions the minimum length of routine is 15 seconds shorter, final score can range from maximum of 15.00 (beginners) to maximum of 18.00 points (advanced-level gymnasts and juniors), group comprises four, five or six gymnasts, and they train one to two hours, two to three times per week. In "B" individual competitions, final score can range from maximum of 16.00 (intermediate-level gymnasts) to maximum of 19.00 points (seniors), and this program does not have beginners as an age group category. "B" individual gymnasts train one to two, or three hours a day, four to six times per week. "C" program is program proposed by Gymnastics Federation of Serbia, which is less demanding than "B" and "A" program, and it has one goal- RG popularization. This program has also individual and group competitions and less age group categories. In "C" group competitions the length of routine is one minute shorter, final score is 16.00 points maximum and group comprises eight and more gymnasts. In "C" individual competitions final score is 15.00 points maximum and juniors and seniors are excluded as age group categories. "C" gymnasts train one hour, two times per week.

A literature review revealed the existence of similar comparative studies, but with much smaller samples of study participants and with lack of data on muscle mass percentage. In their study, da Silva, & Rocha (2011) performed a comparison of 10 national- (G1), 10 state-level RGs (G2) and 10 sedentary girls (control group, C), all 13 years of age. The differences were recorded in the case of BF%: national-level gymnasts' body fat percentage (13.4±2.8%) was lower than state-level gymnasts' BF% (18.4±8.3%), which was also lower than the BF% recorded in control group (26.2±5.5%) (G1 vs. C and G2 vs. C, $p<0.005$). Àvila-Carvalho et al. (2012) compared elite-level gymnasts (participants of 2009 and 2010 RG World Championships), 15 to 25 years of age, group competitors of different ranking (first half vs. second half of the ranking) and determined statisticaly significant differences in BF%: the first half ranking gymnasts had lower values of BF% (15.96±2.74%) than the second half ranking gymnasts (17.53±2.81%). di Cagno et al. (2008) wanted to examine the differences between eight elite and 17 sub-elite RGs, aged 14.7±2.2 years, and found statistically significant differences in body height, body mass, thigh length, leg length, sitting height, fat free mass and training hours, but no differences were recorded in BMI and fat mass. By analyzing these results of the selected studies one can notice that with the increase of gymnasts' performance level BF% decreases, which cannot be said for this study's results when speaking about senior and junior RGs. This could be explained by the fact that in older age group categories body composition is not a significant predictor of successful performance, i.e. the correlations between anthropometric measures and performance are helpful in the early stages of RG training and selection process (di Cagno, Baldari, Battaglia, Monteiro, Pappalardo, Piazza, & Guidetti, 2009). This does not diminish the importance of the body fat percentage, yet it rather simply suggests the presence of more important factors which discriminate the successful from less successful gymnasts in older age group categories (Пуреновић-Ивановић, 2017).

According to Đurašković (2009), the relative amounts of bone, muscle and fat tissue in women are: 15-16%, 40-45% and 18-20%, respectively. However, the amounts of these body components in athletes are contingent not only upon gender, but also upon competition level and the specific sport considered (Slaughter & Christ, 1995), as well as upon age which is very important factor, The content of muscle tissue in the structure of body composition is relatively little studied compared to fat mass, and there are only few studies with the data about Muscle% in RGs of different age group categories, the club-, national- and/or international-level competitors (Amigo, Sala, Faciabén, Evrard, Marginet, & Zamora, 2009; Quintero, Martín, &

Henríquez, 2011; Vernetta, Fernández, López-Bedoya, Gómez-Landero, & Oña, 2011; Purenović-Ivanović, Popović, Stefanović, & Aleksić, 2013; Arriaza, Rodríguez, Carrasco, Mardones, Niedmann, & López-Fuenzalida, 2016; Пуреновић-Ивановић, 2017; Purenović-Ivanović et al., in press). In three researches (Amigo et al., 2009; Quintero et al., 2011; Vernetta et al., 2011) body composition of national-level Spanish RGs was examined, and much higher values of Muscle% were recorded (approximately 47.5%), which can be attributed to different methodology of body composition evaluation (by mathematical formula, and not by means of bioimpedance).

CONCLUSION

It is well known that body composition of rhythmic gymnasts is of great importance because it could directly influence the biomechanics of movements and thus the resulting performance. The obtained dissimilarity in values of body fat and muscle mass percentage between RGs competing in "A", "B" or "C" program of the same age, is expected. The absence of significant differences within "A", "B" and "C" senior and junior RGs' body fat and muscle mass percentage does not diminish the importance of these body composition parameters, yet it rather suggests the presence of more important determinants of RG performance in older age group categories.

ACKNOWLEDGEMENT

This research is part of a project of the Ministry of Science and Technological Development of the Republic of Serbia (No: 179019, Head researcher: Prof. R. Stanković). The authors would like to thank Ms. Vesna Radonić, the president of the Gymnastics Federation of Montenegro, the organizer of the 6th "Montenegro Cup 2013", the participating rhythmic gymnasts and coaches of the following RG clubs: "Allegro" (Banja Luka, Republic of Srpska), "Baltic Flower" (Jelgava, Latvia), "Budva" (Budva, Montenegro), "Danilovgrad" (Danilovgrad, Montenegro), "Partizan" (Belgrade, Serbia), "Ryazan" (Ryazan, Russia), "Sinegoria" (Moscow, Russia), "Viljandi Sports School" (Viljandi, Estonia) and "Vladimir" (Vladimir, Russia). The authors would also like to extend their deepest gratitude to the Gymnastics Federation of Serbia and its esteemed president Mrs. Milena Reljin Tatić, the organizer of the 2012 and 2014 National Championships, the rhythmic gymnasts and coaches of Serbian RG clubs: "Gimnastix" (Niš), "Palilula" (Belgrade), "Paraćin" (Paraćin), "Radnički" (Belgrade), "Ritam" (Belgrade), "Ritam-Pinki" (Belgrade), "Ritmix" (Novi Sad) and "TiM" (Belgrade), who made this study possible. We are also grateful to the rhythmic gymnasts and coaches of RG clubs from Niš: "Fokica", "Gracia", "Gimnastix" and "Ritmik".

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CORRELATION BETWEEN EXPERT MODEL EVALUATION AND COMPETITIVE SUCCESSFULNESS OF YOUNG CATEGORIES IN ALPINE SKIING

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UDC 796.921

SUMMARY

Expert modelling has been represented as an important part of planning and conducting training and analysing the effects of training of different categories of competitors in Alpine skiing in Slovenia. On the basis of a heuristic approach, a model of successfulness was formed. In the category of older boys (U16), the model consists of 17 dimensions of a motor subsystem and of 8 dimensions of a morphological subsystem; on the other hand the competitive successfulness (criterion variable) is assessed on the basis of the calculation of the points won in the Rauch Cup competitions in the 2015/16 season. Motor and morphological dimensions were measured on the sample of 31 active competitors in the category of older boys (U16). With the help of the SMMS program package, marks were calculated at all levels of a potential model of successfulness. Marks calculated for an individual competitor as well as for the whole group serve the coaches as a useful orientation when planning and conducting the training process. In the second part of the survey, we intended to establish the connection between the marks calculated by means of the expert system method (heuristic approach) and the criterion variable. The calculated Pearson's correlation coefficient confirmed the statistically significant connection between the calculated marks (expert system method) and the actual successfulness (points won in the Rauch Cup competitions). The result obtained ($r=0.47$) is a relevant indicator of the validity and appropriate configuration of a reduced model of potential successfulness.

Key words: Alpine skiing, expert modelling, assessment of successfulness, young competitors

INTRODUCTION

In Slovenia, expert modelling therefore represents an important part in planning and conducting training as well as in analysing the effects of training in different categories of competitors in Alpine skiing. This is based on a holistic handling of problems and on a regular adaptation of the contents of the exercises to the developmental trends in the technique and tactics of movement in competitions (Jošt, Pustovrh & Ulaga, 1998). The methods of determining the state of sportsmen should also be adapted to the requirements of a modern competitive skiing technique and a system of competitions (Lešnik & Žvan, 1998). For many decades we were therefore oriented primarily towards the determination of those sets of factors that were – according to the results of scientific studies – the best indicators of a psychomotor state of a particular category of competitors in Alpine skiing (Bandalo & Lešnik, 2011; Lešnik, 1996; Žvan & Lešnik, 2000). In determining the successfulness of sportsmen, we could come quite close to objective reality only if in the process of observation we were able to take into account and measure all dimensions which may in some way or another influence the achievement of an individual's end result (Leskošek, Bohanec & Rajković, 2002). Since we know that this is not possible, we are working on the development of the model of successfulness. This is divided into the model of potential successfulness and the model of competitive successfulness. The ***model of potential successfulness*** consists of hierarchically arranged potential dimensions such as motor abilities, morphological characteristics, psychic characteristics and other. ***The model of competitive successfulness*** comprises hierarchically arranged sets of competitions of a higher or lower rank (international, national, regional and lower competitions). The mutual connection of the results of the potential and competitive models of successfulness is an indicator of the suitability and quality of both models that have been developed (Lešnik, 1996). The successfulness of a sportsman is determined on the basis of the results achieved in competitions. In Alpine skiing as well as in other sports, results achieved in competitions are the best criterion of the quality of the training process in the transition, preparatory and competitive periods (Maffiuleti et al., 2007). This means that the developed model of successfulness will only be reliable if it consists of suitably weighted potential dimensions of the successfulness of a particular sample of subjects; on the other hand, competitive successfulness will be assessed on the basis of the most important competitions, in which the same sample of subjects took part (Bandalo, 2016).

Taking the basic goal of our study into consideration, we intended to check the validity of the set model of successfulness. For this reason, we first had to determine the criterion which is represented by the actual successfulness of the subjects in the high level national U16 competition Rauch Cup (SAS, 2016). Then two methods were used: the first one is the method of expert modelling with the help of which the marks at all levels of the tree of successfulness were calculated, the second method (the calculation of Pearson's correlation coefficient) was used to determine the connection between the marks obtained at the highest level of the tree of successfulness and the points scored in the Rauch Cup competitions (SAS, 2016).

METHODS

The measurements of morphological and motor dimensions of younger categories of competitors in Alpine skiing have been carried out at the Faculty of Sport. The research included 31 competitors in the U16 category of older boys (born in 1999 and 2000) who took part in the Rauch Cup competitions in the 2015/16 season (SAS, 2016). The battery of tests for the younger categories of competitors has consisted of 17 motor and 8 morphological tests (Fig 1) according to the results of studies (Lešnik, 1996; Lešnik & Žvan, 1998; Žvan & Lešnik, 2000; Reid et al., 1996; Rosenhagen et al., 2009), they can be good predictors of successfulness in Alpine skiing.

Figure 1 Hierarchically arranged expert model of morphological and motor variables for U16 category of competitors in alpine skiing

Code	Names of nodes and variables*
Ocena	final mark
Code	MORPHOLOGY: Names of nodes and variables*
├─MORFO	MORPHOLOGY
│ ├─MASA	internal geometric dimensions
│ │ └─**AT**	**Variable: body weight**
│ ├─EKSEGOR	external geometric dimensions
│ │ ├─DOLRAZ	longitudinal body dimensions
│ │ │ ├─**AV**	**Variable: body height**
│ │ │ └─**ADN**	**Variable: length of leg**
│ │ ├─PRAZSO	transverse body dimensions
│ │ │ ├─**APKOLL**	**Variable: diameter of the left knee**
│ │ │ └─**APSSL**	**Variable: diameter of the left ankle joint**
│ │ └─VOLSO	circumference of the legs
│ │ └─**AOSL**	**Variable: circumference of the left thigh**
│ └─INTEGOR	internal geometric dimensions
│ ├─**AKGT**	**Variable: stomach skin fold**
│ └─**AKGSL**	**Variable: skin fold of the left thigh**
Code	MOTOR SKILLS: Names of nodes and variables*
└─MOTOR	MOTOR SKILLS
├─OSMOT	basic motor skills
│ ├─ENKOGI	energy component of movement
│ │ ├─MOČ	basic power
│ │ │ ├─ODRMOČEN	takeoff power – single leg
│ │ │ │ └─**MMEN3SM**	**Variable: standing triple jump**
│ │ │ ├─ODRMOČSO	takeoff power – double leg
│ │ │ │ ├─**MMENSDM**	**Variable: standing long jump**
│ │ │ │ └─**MSKOK10**	**Variable: ten consecutive double leg jumps**
│ │ │ └─REPMOČROK	repetitive power

Code	Names of nodes and variables*
Ocena	final mark
Code	**MORPHOLOGY: Names of nodes and variables***
├─MORFO	MORPHOLOGY
│ ├─MASA	internal geometric dimensions
│ │ └─**AT**	**Variable: body weight**
│ ├─EKSEGOR	external geometric dimensions
│ │ ├─DOLRAZ	longitudinal body dimensions
│ │ │ ├─**AV**	**Variable: body height**
│ │ │ └─**ADN**	**Variable: length of leg**
│ │ │ └─**MZGIBE**	**Variable: bent arm hangs with an undergrip**
│ │ └─HITROST	Speed
│ │ ├─HITRMAKEKS	speed of the maximum muscle excitation
│ │ │ └─**MMENS20**	**Variable: 20-metre sprint – crouch start**
│ │ ├─HITRMAKS	maximum speed
│ │ │ └─**MHGNS20L**	**Variable: 20-m sprint – running already before the start**
│ │ └─HITRVZDR	speed endurance
│ │ └─**MT300**	**Variable: 300-metre run**
│ └─INKOGI	Information component of movement
│ └─REGSINANT	regulation of synergists and antagonists
│ ├─RAVNOTEŽJE	Balance
│ │ ├─**MRSOSPT**	**Variable: balance transversely on a T-bench**
│ │ └─**MRSOSVT**	**Variable: balance longitudinally on a T-bench**
│ └─GIBLJIVOST	Flexibility
│ └─**MGATPK**	**Variable: forward bend on the bench**
└─SPMOT	special motor skills
├─ENKOGI	energy component of movement
│ ├─MOČ	special power
│ │ ├─ODRMOČEL	elastic power
│ │ │ └─**MMRNPK**	**Variable: jumps over the bench for 30 seconds**
│ │ └─STATMOČ	static power
│ │ └─**SMPRE**	**Variable: Egg (downhill) position**
│ └─HITROST	Speed
│ └─MHALTN	speed of performing alternating movements with legs
│ ├─**MHFNTD**	**Variable: right leg tapping**
│ └─**MHFNTL**	**Variable: left leg tapping**
└─INKOGI	Information component of movement
└─KOORDIN	special coordination
├─MHK	speed of performing complex motor tasks
│ └─**MKHRVIS**	**Variable: ascending and descending**
├─MAG	Agility
│ └─**SKI9**	**Variable: figures 8 around 9 clubs**
└─MRE	ability of reorganization of motor stereotypes
└─**MMENSDN**	**Variable: standing long jump backwards**

The data are processed by means of the SMMS (Sport Measurement Management System) program (Rajković et al., 1990; Leskošek et al., 1997; Leskošek et al., 2002). The criterion variable is represented by a sum of points scored in competitions within the Rauch Cup in the 2015/16 season (SAS, 2016). When seeking answers to the research questions, two methods were used. The first one is the method of expert modelling which belongs to the methods of artificial intelligence. The expert model is composed of hierarchically arranged dimensions of the specification equation which have the characters of multi-dimensionality. This means that at individual levels and at the end also at the highest level the characteristics of all the other (hierarchically lower) variables as well as the lowest possible share of mistake are encompassed. Individual variables were joined in a hierarchical tree, where the potential successfulness of an individual within the group of test subjects was calculated on the basis of a criterion function (normalizers) and weights (Jošt, Pustovrh & Ulaga, 1998). The second part of research dealt with the calculation of the basic statistical parameters and the calculation of Pearson's correlation coefficient between the calculated marks (obtained by means of the expert model method) and competitive successfulness (results obtained by the final calculation of all the Rauch Cup competitions). By calculating the correlation, we tried to answer the dilemma whether those competitors who had better motor abilities or who were morphologically more suitable achieved better or worse results in the Rauch Cup in the 2015/16 season.

RESULTS

The values of final marks based on the expert system method are in accordance with the quality of the selected sample. This sample consists of competitors who differ to a great extent in marks at the highest level as well as in marks at hierarchically lower levels. This is also proved by the range of the calculated marks from the lowest 1.64 (satisfactory) to the highest 4.15 (excellent). The normal distribution of the results obtained is confirmed by the calculated value of the coefficient of the normality of distribution according to the K–S test (r=0.884).

The presented final order of the potential successfulness of the sample of test subjects (Table 1) shows that the competitors with the mark 'good' are most numerous (14 test subjects). At the highest level of the tree of successfulness, the 'very good' mark was achieved by 9 test subjects, 4 test subjects were marked 'suitable', 2 competitors obtained the 'excellent' mark and 2 'satisfactory' mark. On the basis of the calculation of Pearson's correlation coefficient between the marks obtained by the expert system method and the actual successfulness (points scored in the Rauch Cup competitions), we established a statistically significant level of connection. The calculation of the level of connection between the assumed assessment of the competitive successfulness (expert system) and the actual successfulness (points) is a relevant indicator of the validity and quality of the reduced model of potential successfulness.

Table 1 The calculation of the marks at the highest level according to the expert system method, final Rauch Cup classification with achieved points and calculation of Pearson's correlation coefficient (r) between the calculated marks and competitive successfulness

Expert system rank	competitor	expert system mark	descriptive mark	Final Rauch Cup rank (2015/16)	Achieved points	Correlation (r)
1.	C	4.15	Excellent	2.	645	r=0.47**
2.	F	4.02	Excellent	9.	315	
3.	AC	3.88	very good	15.	206	
4.	E	3.84	very good	1.	750	
5.	L	3.8	very good	12.	231	
6.	G	3.78	very good	27.	73	
7.	AD	3.77	very good	3.	533	
8.	N	3.76	very good	10.	286	
9.	D	3.7	very good	17.	193	
10.	AE	3.65	very good	21.	150	
11.	Z	3.54	very good	8.	327	
12.	A	3.47	good	24.	120	
13.	J	3.46	good	19.	174	
14.	M	3.45	good	12.	231	
15.	V	3.43	good	6.	374	
16.	AF	3.41	good	25.	112	
17.	S	3.35	good	7.	341	
18.	AH	3.35	good	23.	143	
19.	AA	3.33	good	4.	435	
20.	T	3.26	good	31.	57	
21.	H	3.23	good	20.	153	
22.	K	3.23	good	16.	203	
23.	I	3.22	good	14.	230	
24.	O	3.15	good	5.	412	
25.	R	3.09	good	26.	198	
26.	B	2.93	suitable	18.	182	
27.	AI	2.8	suitable	29.	69	
28.	AG	2.62	suitable	22.	148	
29.	AB	2.61	suitable	11.	283	
30.	P	2.34	satisfactory	28.	72	
31.	U	1.64	satisfactory	30.	64	

The value of Pearson's correlation coefficient of the connections between the assumed assessments of successfulness based on the expert model method and competitive successfulness of older boys in Alpine skiing is statistically significant and amounts to 0.47. The value of the obtained coefficient is statistically significant at the level of 1 % risk, which proves not only the quality of the chosen sample of variables of morphology and motor skills but also the suitability of the configuration of the developed potential model of successfulness for the treated sample of test subjects. The calculation of the marks at the highest level according to the expert system method, final Rauch Cup classification with achieved points and calculation of Pearson's correlation coefficient between the calculated marks and competitive successfulness are shown in Table 1.

Taking the entire group into consideration, the obtained results show the average level of the morphological and motor dimensions of the sample of young competitors in Alpine skiing. The marks obtained show that there are quite a few differences among them and that those competitors, in particular, who obtained worse marks could make progress in future if their training process was planned and suitably led. If a coach wants to plan the training process well, he must know the better and worse developed dimensions of each individual and on the basis of this, the training process should be adapted in terms of quantity and contents. A suitable analysis of an individual's state and well-planned and organized training can have a positive effect on the achievement of better placings in competitions in the season to come.

DISCUSSION AND CONCLUSION

In Alpine skiing, the quality of this ability is useful in testing and in the selection of the skis for the competitive skiing season as well as when adapting topical knowledge and techniques to new trends which are a key to achieving better or even the best results in competitions (Bandalo, 2016).

On the basis of information obtained by the coach about each individual competitor in the training process, the coach can numerically and descriptively assess the competitor's state of motor abilities and morphological characteristics with the help of expert modelling. The data processing with the SMMS program also makes various presentations of results (profiles, graphs, histograms, etc.) possible; these presentations enable the coach to quickly understand the state of each individual (Leskošek, Bohanec, Kapus & Rajković, 1997). Taking the individual's advantages and disadvantages into account, the coach can make more detailed plans concerning the quantity as well as the contents of training in future (Lešnik, 1996, Dolenec, 1996).

The results obtained are a relevant indicator of the quality of the formed model, but despite this we have to be aware that the extension of the model of successfulness can help us to come even closer to the actual state of an individual competitor as well as the whole group (LeMaster, 2007). In the past, expert modelling was used to establish not only the motor and morphological but also the psychological status of young competitors. In younger categories of competitors, the psychological model did not show statistically significant influence on the competitive successfulness (Lešnik, 1996, Dolenec, 1996). The reasons for that can be due to the fact that the 15 and 16-year old children are immature personalities, therefore they are unable to appropriately answer the questionnaires concerning the personality characteristics and motivation (Cobb, 2007; Davis & Mogk, 1994). Besides psychological and other aspects of treating young competitors (social, medical status, etc.), the quality and quantity of work on snow is another important factor in the training process itself. In this respect and in case of a suitable distribution of cycles and determination of the number of days with snow, it is important to emphasize the exercise of technical and tactical elements in different course settings and exercise conditions (SAS, 2015).

Expert modelling represents a method of holistic study and establishment of the dimensions of a psychomotor status of competitors in a certain period of training and these dimensions are important for success (Auersperger, Ulaga & Škof, 2009). Due to a high number of factors and influences which accompany competitors on their way to success (Gorski, Rosser & Hoppeler, 2014), it is hard to know all of them, but we do strive to reduce the unresearched and unknown to a minimum. The starting point for the development of the model of potential successfulness is, therefore, objective reality which is, however, too wide to be encompassed in its entirety. This is why we limited ourselves to certain aspects of treatment only (Figure 1) which provide a profound insight into the psychosomatic status of an individual competitor on the one hand, and open up new possibilities of research and closeness to objective reality on the other. The training process that is focussed on an individual must aim at developing positive young personalities who develop in accordance with the rules of the biopsychosocial development (LeMaster, 2007). The consequences of unharmonized growth of the musculoskeletal system are primarily reflected in a reduced ability for the regulation of movement (information component) and the dimensions of basic motor skills play an important role in this process (Malina, Bouchad & Bar-Or, 2004). Especially in this age category, these motor skills represent the widest necessary part of motor abilities which are a basis for the development into a top competitor (Lešnik, Šimunič, Žvan & Pišot, 2012).

The results of the present study are important from the point of view of theory and practice, since they confirm the validity of the set model and the suitability of the selection of the encompassed dimensions which should represent a basis for the monitoring of the development of the psychosomatic status of competitors in future. The set model is intended primarily for the work with young categories of competitors; with certain modifications it is also intended for the work with older categories of competitors in Alpine skiing (SAS, 2015). The established values play an important role in the direction of the training process of young categories of Alpine skiers. On the basis of the results obtained in this study, it is possible to regulate the process of transformation with the aim of influencing the development of those abilities which are most important for achieving top sports results. Here, we should not forget the importance of a further development of the model as well as the continuous monitoring of the development (possibly not only the phychomotor development) of young Alpine skiers. This is only possible with a regular and systematic performance of measurements and the establishment and control of the initial and final state of the subjects in particular periods of the training process (Lešnik, 1996).

In Slovenia, there is an increasing number of coaches who make use of the SMMS program in planning and conducting training. On the basis of the results of studies that have been obtained in the period of more than twenty years (Bandalo, 2016; Lešnik, 1996), the coach can (with greater certainty) include those contents in the training process with the help of which an individual will make progress in worse assessed dimensions and will consequently have a greater chance to achieve better results in competitions. The regular checking of the dimensions of the psychosomatic status of competitors with the help of expert modelling is useful in planning and directing the training process of younger categories of Alpine skiers (Žvan & Lešnik, 2000).

With the help of expert modelling we have confirmed that the coaches' work concerning the motor preparation of competitors is well planned. The calculation of the correlation between the potential and competitive successfulness has confirmed the quality of the choice of predictors which form the current model of potential successfulness. Despite that the obtained curve of the connection between the calculated marks of the expert model and criterion variable leads to the conclusion that besides the morphological and motor status, competitors possess quite a few potentials that are not exploited sufficiently (psychology, technique, tactics, etc.). In future, it will be necessary to find ways and methods that can be used to measure and evaluate those factors of successfulness in younger categories of competitors that will enable an even better insight into the work with younger competitors. Good work carried out by the coaches can be observed in the results achieved by the Slovene competitors in international competitions. These results are also the best proof of the quality-oriented selection process and this process is important for younger as well as for older categories of competitors. The results achieved in the most important international competitions for children (Trofeo Topolino, Loka Cup, etc.) already confirm the correct orientation of the coaches' work. We will try to make use of this in the future. Our task is to help the greatest possible number of young potentials in order to direct them to become champions in senior competitions.

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DESCRIPTIVE PROFILE OF CONTRACTILE AND BALLAST TISSUE IN BODY COMPOSITION OF CADET AND JUNIOR JUDO ATHLETES PARTIALIZED ON LONGITUDINAL BASIS: PILOT RESEARCH

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UDC 796.853.23

SUMMARY

The aim of this paper is to define a descriptive profile of contractile and ballast tissue in body composition of cadet and junior judo athletes, using partialisation on longitudinal basis. In this research the following derived indexes were used: FMI – fat mass index, PMI – protein mass index, SMMI – skeletal muscle mass index, PFI – protein fat index, PFMI – protein fat mass index. Assessment of the body composition of the subjects in this study was performed by the method of direct multisegmental multifrequency analysis of the impedance, using the InBody 720 system. The sample of respondents consisted of 20 male judo athletes, competing in different weight categories within the cadet and junior age division within the system of individual national championships for a given age category. The results have shown that the average values of the tested variables or indexes are at the following level: 1.615 ± 1.365 kg•m^{-2} for index of fat tissue (FMI); 4.356 ± 0.580 kg•m^{-2} for protein mass index (PMI); 12.521 ± 1.788 kg•m^{-2} for skeletal muscle mass index (SMMI); 4.165 ± 2.272 kg for protein fat index (PFI); and 1.336 ± 0.781 kg•m^{-2} for protein fat mass index (PFMI). By determining the characteristics of the body structure in judo athletes of cadet and junior age using the modern methodology of measuring the body composition, initial information was obtained which indicates the specificity of the variables of the body composition and the specificity of the morpho-functional characteristics of young judo athletes in this developmental period.

Keywords: judo, indexes, bioelectric impedance, morphology, body composition

INTRODUCTION

Judo is an Olympic martial sport, in which competitors, regardless of the age category, are divided into clearly defined weight categories in relation to body weight. In this sense, according to the applicable rules in the cadet age division we can distinguish 8 weight categories: up to 50 kg, up to 55 kg, up to 60 kg, up to 66 kg, up to 73 kg, up to 81 kg, up to 90 kg and over 90 kg. In the junior age division, the same categories relative to body weight are present, with a difference in terms of existence of weight category up to 90kg and weight category over 100kg (Sport and organization rules of the international judo federation, ed. 2017).

The noticeable density of weight categories suggests that, even during the developmental periods, the influence of body weight on competitive rules is recognized within the competitive judo sport. In this respect, judo is not an exception as a relatively similar situation can be seen in other martial sports and other sports disciplines (Dopsaj et al., 2017; Bridge et al., 2011; Wilmore, 2000) where athletes are divided into categories according to body mass so that the competition is more equitable or better balanced in terms of body size, strength and agility (Langan-Evans et al., 2011). This can be attributed to the fact that higher body weight, assuming a consequent increase in the overall mass of skeletal muscle, predisposes competitors to generate higher absolute values of muscle strength and power, which is one of the main factors in the judo sport performance (Thomas et al., 1989). However, since in the total body mass there can be a different proportion and different distribution of the basic components of body composition, that is, water, fat, proteins (pure muscle tissue) and minerals, the optimization of the body composition is an imperative in competitive judo. This applies, first of all, to the planned correction of the relationship between fat and muscle tissue, simultaneously avoiding possible drastic changes in the proportion of water in the body composition which may result in a decrease in physical and working capacity (Ilic, 2010; Nikolic, 2003). This can occur as a consequence of acute weight adjustment in order to adapt to the set weight limits. Regardless of the previous, the use of acute weight loss techniques using potentially harmful and/or unauthorized means in judo sport and other martial sports, is on average at the level above 50% of involved competitors (Franchini et al., 2012), and it is further dominant in relation to planned training and nutrition programs. In this regard, a large number of papers dealt with the research of morphological characteristics and body composition, and with the assessment of the optimal proportion of the fat and muscle component of the body composition in the total body mass in judo competitors and competitors in other related martial disciplines (Dopsaj et al., 2013; Franchini et al., 2011; Franchini et al., 2007). In that sense, it can be said that successful judo athletes are typically characterized by a low fat content in body composition (less than 10%) as well as an increased proportion of fat-free mass, and pronounced mesomorphism. This can be considered a consequence of both genetic predisposition and/or sport selection, as well as a consequence of adaptation to the requirements of the training and competition. In accordance with the above, the main goal of this research is to obtain the initial descriptive profile of contractile and ballast tissue in judo athletes in developmental age categories, that is, in cadet and junior age, using partialisation of results based on longitudinality. This increases the informativeness of the obtained results and the possibility of their application in practical work where they can serve as initial standards in the function of evaluating given characteristics of the body status of young judo athletes both for the needs of adapting the training process, and for the needs of improving the selection system in judo sport. The secondary goal of this research is to obtain the initial values of the derived variables or indexes, which reflect the specific morphological characteristics of the judo athletes of a given age, further contributing to the increase in the overall knowledge base of the subject area and the consequent improvement of the existing training technology in judo sport.

METHODS

The method used in this research was laboratory testing. Assessment of the body composition of the subjects was performed by the method of direct multisegmental multifrequency analysis of the impedance, using the InBody 720 system.

THE RESEARCH SAMPLE

The sample of subjects in this study consisted of 20 male judo athletes, competing in different weight categories within the cadet and junior age divisons. The basic descriptive characteristics of the sample were: Age = 16.35 ± 1.34 years, BH = 179.82 ± 9.89 cm, BM = 77.33 ± 20.91 kg, BMI = 23.53 ± 4.35 kg•m^{-2}, PBF% = 6.54 ± 4.48, PSMM% = 53.30 ± 2.49, training experience = 5.58 ± 3.47 years, weekly training frequency = 4.0 ± 0.5 sessions per week, weekly training volume = 420 ± 30min.

The subjects were members of several different judo clubs and all were competing in the Republic of Serbia system of the national championship of the cadet and junior age categories. Of the overall sample, one competitor was a member of the national cadet representative selection.

MEASUREMENT METHODS

In this study, the assessment of the body composition of the respondents was performed using the bioelectric impedance analysis (BIA) using the InBody 720 system (Biospace Co., Ltd.). This system uses the latest technology of the body composition measurement using the Direct Multiple-Frequency Impedance Analysis (DSM-BIA) method. The applied body metering technology uses a measuring frequency range of 1kHz - 1MHz, which ensures a high level of reliability of measurement of water, protein, mineral and fat content. In other words this ensures high level of reliability of measurement for all major components of the body composition.

All measurements were performed on University of Belgrade Faculty of sport and physical education in Methodological research laboratory (MIL) in the period january-february 2017, during the preparatory training phase of the cadet and junior judo athletes training cycle.

In accordance with the manufacturer's recommendations, all measurements were performed in the morning (between 8.30 and 10.00 A.M.); the subjects did not take any food or liquid before the testing procedure; the subjects did not have any intense physical activity within 12 hours prior to measuring, they did not consume any alcohol within 48 hours prior to testing and were asked to perform all physiological needs before the measurement. Subjects were in the standing position for at least 5 minutes prior to measurement for redistribution of body fluids. The measurement was done in a standing position in accordance with the manufacturer's recommendations (hands aside placed 15 cm laterally from the body) (Dopsaj et al., 2013).

VARIABLES

For the purposes of this research, the following basic and derived variables (indexes) that defined the morphological structure and body composition of the subjects were used:

- BH - Body height expressed in cm;
- BM - Body weight expressed in kg;
- BMI - Body mass index expressed in kg•m^{-2};
- FMI – fat mass index, calculated according to the formula BFM/BH^2, expressed in kg•m^{-2};
- PMI - protein mass index, calculated according to the formula PM/BH^2, expressed in kg•m^{-2};
- SMMI - skeletal muscle mass index, calculated according to the formula SMM/BH^2, expressed in kg•m^{-2};
- PFI - protein fat index calculated according to the formula PM/BFM, expressed in kg;
- PFMI - protein fat mass index, calculated according to the formula PFI/BH^2. expressed in kg•m^{-2}

STATISTICAL ANALYSIS

For the purposes of this paper, in the first step of the analysis all raw data obtained by laboratory testing were subjected to descriptive statistical analysis in order to define the basic measure of central tendency (MEAN), indicators of data dispersion - standard deviation and coefficient of variation (SD, cV%) and results span indicators – minimum and maximum (MIN, MAX). The accuracy of the measurement in relation to the used variables is shown by the standard measurement error expressed in absolute and relative values. The regularity of the distribution of the variables was estimated using the non-parametric test Kolmogorov-Smirnov. The characteristic quantitative values of the variables, as the initial normative values, were calculated through the percentile distribution of the same. All data processing was carried out using the IBM SPSS v23 software package.

RESULTS

Table 1 shows the basic descriptive indicators of the derived body composition variables (indexes) with the value of absolute and relative measurement error and the results of the Kolmogorov-Smirnov test.

Table 1. Basic descriptive indicators of the tested variables with the results of statistical testing of the regularity of the distribution of results

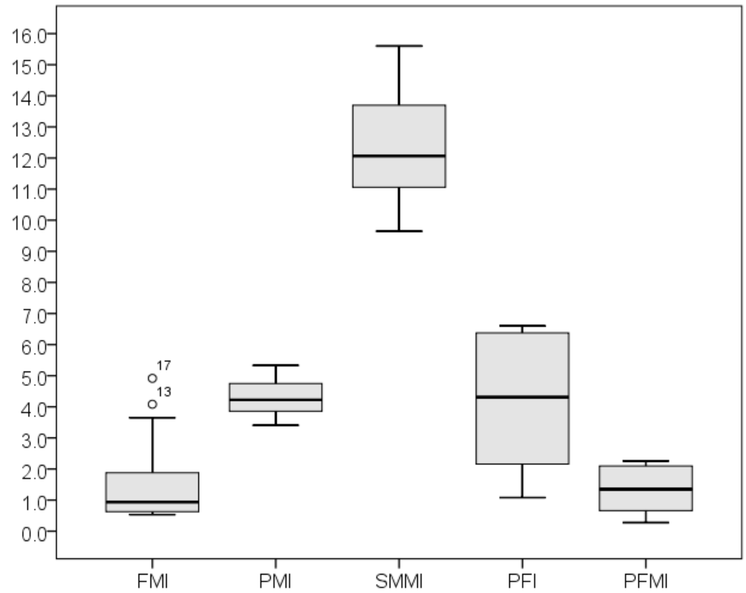
Variable	MEAN	SD	cV%	Min	Max	Std. Error (Abs.)	Std. Error (Rel.)	K-S Z	p
FMI (kg•m^{-2})	1.615	1.365	84.50	4.915	0.536	0.305	18.90	1.031	0.238
PMI (kg•m^{-2})	4.356	0.580	13.32	3.405	5.331	0.130	2.98	0.560	0.912
SMMI (kg•m^{-2})	12.521	1.788	14.28	9.647	15.603	0.400	3.19	0.618	0.840
PFI (kg)	4.165	2.272	54.55	1.080	6.600	0.508	12.20	1.163	0.134
PFMI (kg•m^{-2})	1.336	0.781	58.46	0.274	2.261	0.175	13.08	1.038	0.231

Table 2. Characteristics of percentile distribution of examined variables

Percentiles	FMI (kg•m^{-2})	PMI (kg•m^{-2})	SMMI (kg•m^{-2})	PFI (kg)	PFMI (kg•m^{-2})
5	4.873	3.425	9.706	1.080	0.274
10	4.037	3.803	10.819	1.101	0.290
25	1.981	3.843	11.016	2.105	0.655
50	0.938	4.221	12.067	4.310	1.349
75	0.615	4.748	13.742	6.378	2.104
90	0.541	5.302	15.464	6.468	2.246
95	0.536	5.330	15.597	6.594	2.260

Table 2 shows the characteristics of the percentile distribution of the examined derivative variables (indexes) as possible initial reference values of all given indexes determined for 7 characteristic percentile ranks obtained on the sample of cadet and junior age judo athletes.

Figure 1. Comparative graphic representation of the quantitative characteristics of the tested variables



FMI - BFM/BH² (kg•m⁻²); **PMI** - PM/BH² (kg•m⁻²); **SMMI** - SMM/BH² (kg•m⁻²), **PFI** - PM/BFM (kg), **PFMI** - PFI/BH² (kg•m⁻²)

DISCUSSION

Based on the values of coefficients of variation (% cV) of the measured variables, it can be argued that the sample is relatively homogeneous given the fact that of the total of 5 observed variables (indexes), 4 meet the general statistical standards. The two observed variables that define the contractile tissue status, both PMI and SMMI, have a coefficient of variation (%cV) at a level below 15%, indicating exceptional homogeneity, while two variables that define the relationship or mutual relation of contractile and ballast (fat) tissue, both PFI and PFMI, have coefficients of variation below 60%, which can be considered as the average homogeneity of the results. FMI, or fat mass index, i.e. the only variable that defines the status of a pure ballast (fat) tissue, has a coefficient of variation above 80%, which indicates that the sample is highly heterogeneous in terms of that variable (Table 1). Considering the fact that athletes of different weight and age categories are included in the sample, the variation of the results of the fat mass index can be considered expected. It is important to point out the fact that in all observed variables, the correct distribution of results is evident, as can be seen from the results of the Kolmogorov-Smirnov test (K-S Z = 0.560 - 1.163). In accordance with the forementioned, and taking into account that the indexes or derived variables observed in this study are obtained by combining several basic variables, and that there is a possibility of multiplying their variation which may affect the values of %cV, it can be concluded that the obtained results are representative in terms of further scientific interpretation.

Based on the obtained results shown in Table 1 it can be argued that, at the group level, tested cadet and junior judo athletes have average values of FMI, i.e. the fat mass index, at the level of 1.615±1.365 kg•m^{-2}. When these results are compared with the results of another study (Dospaj et al., 2013) carried out on a sample of senior judo athletes, where the FMI values at the level of 2.98 ± 1.49 kg•m^{-2} were determined a difference in fat mass index values is evident. One of the possible reasons for this is the fact that a suitable sample was used for the purposes of this paper, while the forementioned work used a stratified sample and a larger number of heavyweight competitors who were confirmed to have a significantly higher proportion of fat tissue compared to competitors of light weight categories. The average value of FMI in heavyweight competitors of 5.55±2.50 kg•m^{-2} most likely influenced the shift of the results of this index to higher values. However, since very similar values of the fat mass index were found in senior athletes from other martial sports, where at the level of wrestlers and karateka subsamples FMI was 2.36±0.98 and 2.60±1.03 kg•m^{-2}, respectively (Dopsaj et al ., 2017), the second reason for the existence of the established differences can be the fact that the tested judo athletes (juniors and cadets) are still in the period of growth and biological maturation due to which they have a reduced amount of fat tissue (Rogol et al., 2000) and consequently, the lower value of the FMI.

Based on the results of this study, average values of the skeletal muscle mass index, or SMMI at the level of 12.521±1.788 kg•m^{-2} were determined. This result is consistent with the results of a previously published study conducted on a sample of elite competitors in 3 martial sports (karate, judo and wrestling) where the values of SMMI at the level of 13.00±1.39 kg•m^{-2} were found (Dopsaj et al., 2017). Also this is in accordance with the results of the aforementioned study conducted on senior judo athletes where the values of SMMI at the level of 13.09±1.26 kg•m^{-2} were determined (Dopsaj et al., 2013). On the basis of the forementioned, it can be said that the tested cadet and junior judo athletes are characterized by a slightly smaller mass of skeletal muscles per unit of body surface compared to competitors of senior age, both in judo and in other martial sports. A possible cause of this, in addition to the aforementioned specificity of growth and development of the organism, can be the fact that senior athletes who were included in the sample in previous studies of this type are already formed and selected athletes in which cumulative effects of training and competition on morphological characteristics, i.e. body composition is evident.

Observed from the aspect of the protein index value (PMI) or the purest contractile potential indicator, it can be argued that the average value of this index at the level of observed group of judo athletes is 4.356±0.580 kg•m^{-2}. This result correlates with the results of previous studies (Dopsaj et al., 2017; Dopsaj et al., 2013) where the values of this index were determined at the level of 4.51±0.46 and 4.54±0.41 kg•m^{-2}, respectively. When these values are compared with the results of a study conducted on adult, physically active, students of the University of Belgrade (Dopsaj et al., 2015), where the average PMI values at 4.24 kg•m^{-2} was determined it can be argued that athletes involved in judo sport at the cadet and junior level, and then at the level of the senior age category are characterized by higher values of the protein mass index compared to physically active non-sportsmen, whereby these differences with age, or progression through age categories, become more pronounced.

When it comes to PFI, i.e. the index of muscle and fat tissue relation, and PFMI, i.e. index of the ratio of muscle and fat tissue per unit area of the body, it was established that the tested group of judo athletes had an average value of these indexes at the level of 4.161±2.272 kg and 1.336±0.781 kg•m^{-2}, respectively. In this study, slightly higher PFI values were found in relation to the results of a study conducted on elite greco-roman style wrestlers (Kasum & Dopsay, 2012) and senior judo athletes (Dopsaj et al., 2013), where the values of this index were found to be at the level 2.69 ± 1.54 kg and 1.91 ± 1.05 kg, respectively. Also, the PFI values determined in this study differ significantly from the values previously determined for physically active students of the University of Belgrade where an average PMI of 1.29 kg was found (Dopsaj et al., 2015). When considering the PFMI variable, or the index of muscle and fat tissue ratio per unit area of the body, previous studies have determined the average values of this index at the level of 3.06 kg•m^{-2} in wrestlers (Kasum & Dopsay, 2012), 3.31 kg•m^{-2} in senior judo athletes (Dopsaj et al., 2013) and 3.37 kg•m^{-2} in physically active students of the University of Belgrade (Dopsaj et al., 2015). Based on the above, it can be concluded that the sample of the judo athletes involved in this study is characterized by an exceptionally high level of PMI, with consequently low PFMI values. This can be considered as a consequence of a smaller proportion, or less of fat mass in body composition, in junior and cadet age judo athletes compared to senior subjects. This above all, can be attributed to the characteristics of the process of biological maturation of the organism itself.

CONCLUSION

The aim of this paper is to define an initial descriptive profile of contractile and ballast tissue variables in body composition of cadet and junior judo athletes, using partialisation of results on longitudinal basis. The basic method used in this study was a laboratory testing method where the measurement of body composition was performed by means of direct multisegmental multifrequency impedance analysis using the InBody 720 system. The sample of respondents consisted of 20 male judo athletes competing in junior and cadet age categories. Variables, or indexes, used to define the body structure from the aspect of contractility were SMMI, that is, skeletal muscle mass index and PMI, i.e. protein index, while for defining body structure from the aspect of ballast tissue the fat mass index - FMI, was used. The mutual relationship between contractile and ballast tissue was determined by variables PFI and PFMI, i.e. protein fat index and protein fat mass index per unit area of the body. It has been found that junior and cadet age judo athletes, covered by this research, have average values of the body composition indexes at the following level: 12.521±1.788 kg•m-2 for SMMI, 4.356±0.580 kg•m-2 for PMI, 1.615±1.365 kg•m-2 for FMI, 4.165±2.272 kg for PFI and 1.336±0.781 kg•m-2 for PFMI. On the basis of the obtained results, the initial reference values of all given indexes were determined for 7 characteristic percentile ranks (Table 1). In this way, initial information was obtained indicating the specificity of the variables of body composition and the specificity of the morpho-functional characteristics of young judo athletes during the developmental period. All of this contributes to the increase of overall knowledge base in the system of sport preparation of young judo athletes, that is, contributes to the improvement of the existing training technology in judo sport. Taking into account the fact that the given variables, i.e. indexs, have shown the potential for determining the age related differences in body composition, further studies on a larger sample that would include each of the distinct age categories significant in the system of long-term sports preparation are recomanded. Further more, defining standards in function of evaluating and correcting the body composition of judo athletes involved in continuous training and competition could be augmented.

ACKNOWLEGMENTS

The paper is a part of the project "Effects of the Applied Physical Activity on Locomotor, Metabolic, Psychosocial and Educational Status of the Population of the Republic of Serbia", number III47015, funded by the Ministry of Education, Science and Technological Development of the Republic of Serbia – Scientific Projects 2011 – 2016 Cycle.

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EMOTIONAL EXPERIENCE AND LOCUS OF CONTROL IN JUDO ATHLETES

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SUMMARY

Human functioning is largely determined by emotions, which are an integral part of life. Emotional states and experiences are ever-changing, and as such they notify us that something important is happening in the world around us. People's reactions to life situations with which they are faced each day greatly depend on the locus of control, which is one of the core components of the self-concept. The aforementioned psychological phenomena can significantly affect athletes and their career accomplishments. The aim of this paper is to examine the relationship between emotional competence and the locus of control in judo athletes.

Keywords: emotional competence, locus of control, judo athletes

INTRODUCTION

Emotions are some of the strongest and most fundamental mental experiences of one's own personality. In its broadest sense, the term 'emotions' denotes an excited state of the organism manifesting on three different levels: *emotional experience* – a person feels anger, sadness, or joy; *emotional behavior* – a person becomes infuriated with or attacks their enemy; and *physiological changes* in the body, a phenomenon that accompanies intense emotional reactions/experiences. Thus, emotionality, as a relatively permanent disposition, i.e. personal trait, is manifested through mild and strong affective response.

Conceptual overview

In order to understand the versatility of emotional experiences, it is important to find a limited number of general aspects representing the core of all emotional responses. The main four aspects are: *intensity of feelings; level of tension; hedonic tone;* and *degree of complexity*. With regard to the intensity of feelings, emotional experiences range from a barely noticeable nuance of the current mood to the strongest of passions. For instance, *anger* can vary from mild anxiety to intense irritation; *joy* can vary from mild pleasantness to complete ecstasy. Emotional experiences considerably differ regarding their level of tension, which refers to the impulse toward activity. This involves active and passive emotions. Pleasantness or unpleasantness of emotional experiences are associated with the third aspect – the hedonic tone. Feelings of joy, pride, and pleasure are pleasant, while feelings of sadness, shame, and fear are unpleasant. The final aspect is the degree of complexity, which often leads to such a mental state that a person is unable to describe an emotional experience and cannot be certain whether the experience is pleasant or unpleasant. Krech, D., & Crutchfield, R. (1958).

Many studies have confirmed that the success of athletes and their accomplishment of significant results directly correlate with their ability to manage and reshape their emotions in accordance with the demands of reality, i.e. with their emotional control. Emotional control is an important feature of emotional maturity. Hence, emotional maturity and emotional stability are fragments of a person's emotional life, which can greatly influence the efficiency of sports activities.

Locus of control and emotional inteligency

Self-concept is an important factor of human personality and its motivation and mental health.

(Oljača, 1996). The self-concept or self-identity is defined as "a collection of a person's observations, thoughts, feelings, evaluations, and predictions about themselves as an experiential object and participant in the interaction with the physical and social surrounding" (Havelka, 1992, p. 175). One of the constituent components and an important aspect of the self-concept is the locus of control (Bezinović, 1998).

The concept of the locus of control originated from the social learning theory (Rotter, 1954; Rotter et al., 1972, as cited in Rotter, 1975). This theory emphasizes the significance of an individual's interaction with their surrounding and the understanding that most of the learning occurs within a social context and that previous experiences have a considerable influence.

The locus of control signifies the degree to which a person believes that what happens to them is caused by external factors, which they are unable to control, or the degree to which they believe that they themselves are responsible for what happens to them.

When a person believes to be under the influence of forces that are beyond their control, when they ascribe the reasons for their behavior to external forces, and when they believe they are slightly or in no way responsible for what happens to them, the locus of control is external.

If a person finds the causes in their own behavior and considers themselves responsible for such behavior, i.e. when they believe they control their own life, the locus of control is internal (Crnjaković et al., 2008).

As children develop and accumulate experiences, they distinguish between events that are causally related to the events preceding them and those that are not. What is crucial for the development of internal or external locus of control is not only the recording of successes or failures, but also the analysis of the causes of events experienced as either successes or failures. For children to be able to draw conclusions about the cause-and-effect relationships, they have to reach a certain level of cognitive development. McMahan (1973, as cited in Lugomer, 1988) states that the youngest age at which children's perception of causes determines their expectations of future success just like in adults is 11.

It was initially thought that the locus of control is a stable personality trait, which as such was unchangeable (Rotter, 1966, as cited in Goldsmith et al., 1996; Rotter, 1975). However, the locus of control is subject to change to a certain degree.

According to some studies (Burger, 1989; Skinner, 1996, as cited in Creed and Bartrum, 2008), the locus of control is strongly connected with psychological well-being. The internal locus of control is associated with a higher level, while the external locus of control is associated with a lower level of psychological well-being. This data can be connected to the results of this study, which show that older respondents are more prone to turn to the internal locus of control, because they have already gone through the turbulent period of reexamination and sudden changes – physical, mental, and sociological – which can significantly affect the aforementioned psychological well-being.

Therefore, it could be said that internally oriented individuals are better adjusted and more successful at resolving life issues, while externality is associated with the tendency toward depressed and anxious behavior. The internal locus of control is associated with: assuming responsibility for one's own actions; independence; a higher degree of self-control (Lefcourt, 1976); reduced anxiety; and the ability to set aside less meanigful rewards in order to achieve long-term goals, all of which are acquired over the years, thus supporting the findings that older respondents have a more prominent internal locus of control. Likewise, some studies suggest that internally oriented individuals place greater trust in their problem-solving ability than individuals with the external locus of control (Hjelle & Ziegler, 1992, as cited in Golubović, 2001). By definition, emotional intelligence includes the expression of one's own and assessment of other people's emotions, regulation of those emotions, and their use for adaptation (Mayer, Salovey & Caruso, 2002). Takšić (2002) presupposes a tri-factor structure of emotional intelligence (or emotional competence, as he calls it) comprising the following factors: the ability to perceive and understand emotions; the ability to express and name emotions; and the ability to manage emotions. According to some studies, students of the Faculty of Sport and Physical Education who are actively involved in combat sports and gymnastics possess a more prominent total emotional intelligence and are better at managing their emotions than the students who practice other sports (Todorović et al., 2013).

METHODS

Statistical analysis

The main subject of this study pertains to the connection and significance of the emotional component and the locus of control in judo athletes and to the manner in which these phenomena are manifested. The research sample includes 29 judo practitioners from the university judo club "Kinesis". The following instruments were used for the study: *Emotional skills and competence questionnaire (ESCQ*

15), created by Vladimir Takšić, PhD, and *Locus of control – externality scale* (Rotter, 1966). The scale consists of 10 items for which respondents express a degree of agreement on a five-point Likert-type scale, from 1 (completely disagree) to 5 (completely agree). The content of the items leans towards the idea that only external factors, such as fortune or fate, determine what will happen to a person or what the outcome will be. The scale assesses the tendency of individuals to ascribe the outcomes of their own behavior to outside forces, i.e. to regard their own behavior as influenced by events completely out of their control and caused by such factors as fortune, chance, authority, or fate: "Bad things in my life happen because I am unlucky" or "No matter what I do to prevent it, if something bad is meant to happen, it will happen". Higher scores reflect the external orientation, i.e. the external locus of control, while a lower score indicates the internal locus of control. The scale has been widely applied to our population. The reliability coefficient is α=.81 (Bezinović, 1988). The result varies from the minimum of 10 to the maximum of 50.

RESULTS

The tables below provide an overview of descriptive statistics and the relevant correlations.

Table 1 Descriptive statistics

Descriptive Statistics						
	N	Range	Minimum	Maximum	Mean	Std. Deviation
Duration of practicing a sport	28	25	2	27	12.07	4.959
Locus of control	28	23	11	34	22.25	7.447
Ability to perceive and understand emotions	29	10	13	23	19.69	2.222
Ability to express and name emotions	29	15	10	25	19.14	2.875
Ability to manage emotions	29	10	14	24	20.24	2.132
Total emotional competence	29	31	39	70	59.07	5.757
Valid N (listwise)	27					

Table 2 Correlations between study variables

Correlations				
		Age	Duration of practicing a sport	Locus of control
Locus of control	Pearson Correlation	-.498**	-.536**	1
	Sig. (2-tailed)	.007	.004	
	N	28	27	28
Ability to perceive and understand emotions	Pearson Correlation	-.134	-.018	.058
	Sig. (2-tailed)	.488	.926	.769
	N	29	28	28
Ability to express and name emotions	Pearson Correlation	.043	-.080	-.187
	Sig. (2-tailed)	.824	.687	.341
	N	29	28	28
Ability to manage emotions	Pearson Correlation	.216	.054	-.201
	Sig. (2-tailed)	.261	.783	.305
	N	29	28	28
Total emotional competence	Pearson Correlation	.050	-.027	-.154
	Sig. (2-tailed)	.798	.892	.434
	N	29	28	28

**. Correlation is significant at the 0.01 level (2-tailed).

Table 2 shows that there is no statistically significant correlation between emotional competence and the locus of control. In this study, the two components of personality are manifested as separate phenomena. However, a statistically significant and negative correlation was obtained between age and the locus of control (Table 2). The relationship between these two variables is inversely proportional, which suggests that older and more experienced athletes have a more prominent internal locus of control, deal with new and more difficult challenges more easily, and do not underestimate their own or overestimate other people's abilities. They handle defeats decisively, try to learn from their mistakes, and always see more room for acquiring new skills. This study shows that the internal locus of control increases with age.

DISCUSSION

Younger athletes have yet to complete the process of identity formation, which can be difficult and accompanied by bad life experiences. They have more difficulty processing and overcoming problematic life events. This period is commonly characterized by rebellious and problematic behavior. The still insufficiently developed identity leads to the wrong perception of oneself and the reality. This is largely reflected on the locus of control, whereby young people tie themselves to the external environment and attribute all their achievements to external factors. General confusion of personality, often present among young people on all levels, can result in unpredictable teenage behavior. Peer opinion is highly relevant, self-confidence is not yet fully built, and there is uncertainty in the construction of their own style of behavior, ideas, and goals. All of this supports the case for the dominant external locus of control. Finally, it can be added that, in addition to the parents, who play a decisive role in the development of their children, the sports coach is another person who guides young people through the most sensitive stages of their psychological development and maturation. The coach's impact on the formation of young people is considerable, which is why it is essential for the coach to have a proper approach, motivation, pedagogical competence, and the ability to set goals suited to the emotional nature of the children being trained. Coaches thus need to possess not only the knowledge of the sport they specialize in, but also specific knowledge about the characteristics of physical, motor, and psycho-social development of athletes of various ages (Bačanac, Petrović, & Manojlović, 2011). Coaches form athletes and their contribution is invaluable to the athletes' sports career advancement.

CONCLUSION

Practicing a sport and doing it professionally are highly complex activities, which require a lot of sacrifice and serious commitment, both from athletes and from coaches. Success and pleasure related to doing sports greatly depend on external and internal factors with which athletes are extensively faced. Regardless of the narrower or wider surrounding, which can inspire young people to take up sports, the family environment has the biggest impulse and plays the most important role in choosing a sport. Of course, one must not neglect the influence of the media, school teachers, peers, and famous and popular athletes. In addition to all the important components that contribute to the accomplishment of results and the pleasure of doing sports, emotional experiences and the locus of control are also crucial, as they are integral parts of personality. In addition, the locus of control, which changes over time and with age, can also motivate an athlete and influence exceptional results. The results obtained from the investigated sample revealed that the internal locus of control is more prominent in the older than in the younger respondents. This further confirms the hypothesis that intense developmental period and turbulent psychophysiological changes in young judo athletes strengthen the connection with the external environment and the dominant external locus of control.

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FREQUENCY SPEED IN DANCERS: COMPARISON OF FOLKLORE AND MODERN DANCES

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SUMMARY

The aim of this study was to determine the differences in motor ability "speed" between male and female dancers of modern and folklore dances and their comparison to non-dancers of both sexes. The research was conducted on 120 subjects randomly divided into six groups: male modern dance dancers (MODM), female modern dance dancers (MODŽ), male folklore dance dancers (FOLM), female folklore dance dancers (FOLŽ), control group of male non-dancers (KONM) and control group of female non-dancers (KONŽ). All groups subjects were tested for all speed variables: lag tapping against the wall (TANZ); side turning, touch(PZDO); hand tapping (TARU); leg tapping (TANG); gymnastics bench jumping (PGKL). Statistically significant differences were found in all variables between modern and folk dancing dancers and control groups (TANZ, PZDO, TARU, TANG, PGKL; $p<0.01$). Between the dancers of modern and folk dances there is a statistically significant difference in the tests TANZ, TARU and PGKL ($p<0.05$) in favour of folk dancers in the TANZ variable and in favour of modern dance dancers in TARU and PGKL variables. In female dancers of modern and folk dances a statistically significant difference was found in variables PZDO, TARU, TANG, and PGKL ($p <0.05$). The conclusion is that the differences in speed in male and female dancers of folk and modern dances exist as a consequence of the characteristics of the style and variety of the training process, and that under their influence, they have led to the development of this ability in relation to male and female non-dancers.

Keywords: frequency speed, modern dance, folk dances, dancers

INTRODUCTION

At the most basic level, both dance and sport rely on movement of the human body, and each involves a design element that influences how and where the body can move in a designated space. In sport the focus is on competition with objective criteria and quantitive measurements, and in dance the focus is on the artistic and aesthetic value which is subjective and qualitative. (Corvera, 2014: 3). Since dance choreographies are becoming more and more demanding in order to meet competitive criteria and rules, as well as outmaster other competitors, dancers are under constant pressure to perfect their physical and mental abilities to the maximum. Precisely because of this combination of the artistic aspects and outstanding physical abilities, dancers are considered to be top-level athletes who reflect a perfect balance, intense control over muscles, elegance, rhythm and fast movements. (Haas, 2010).

Speed represents one of the most important motor skills in dance as it affects performance in dance competitions. The research by Kostic and Dimova (1997) found that the frequency speed is one of the ability on the basis of which the prediction of success in sport dance can be determined, i.e. it explains 66% of the variance of success in standard dances in female dancers and 71% of the variance of success in male dancers (Uzunovic, Kostic and Miletic, 2009). Srhoj, Katić and Kaliterna (2006) also concluded that the general dance performance depends on coordination, explosive power and frequency speed. In addition to the hierarchical contribution to performance, dance training can be applied as a training tool for the development of speed and other motor skills in athletes. (Kostic, 1997).

The training of dancers, which included the combined elements of folk, sport, jazz and hip hop dancing, led to a significant improvement in coordination, speed and power. (Uzunovic, 2008). Dance training does not have to be focused solely on dancers and recreators, but it can also be used in other sports as an additional means of training. Increasing speed and agility, as well as flexibility in joints and muscles, was observed at cross-country skiers after applying three-month and eight-month dance training. (Alricsson, Harms - Ringdahl, Eriksson, & Werner, 2003). Each dance is distinguished by different physical and physiological loads, depending on the type of dance and style, and this is the very reason for this diversity, since it can be applied in a wide range of different sports and be focused on targeted abilities with some of the great number of dance styles.

Modern and folklore dance are two very different dance styles. Folklore folk dance reflects in its own way the socio-economic and cultural characteristics of an individual region and plays an important social role in the life of people, while modern dance tends to connect the mind and body through liquid dance moves and emphasizes versatility and improvisation in contrast to strictly structured ballet on which it is based. Folk dances feature richness in types, plurality of steps, among which there can be syncopes, lag steps, improvised decorative steps and movements. Although totally different in style, these two types of dances can have common elements of technique such as various hops, syncopes, turns, etc. which due to different dynamics of performance and rhythm have a different effect on the dancers and their formation of physical abilities.

Folk dancers do not distinguish themselves for better physiological and morphological indicators as compared to other athletes and untrained persons (Macura, Pešić, Đorđević-Nikić, Stojiljković & Dabović, 2007; Ranđelović, Đurašković & Mutavdžić, 2006), and there are no differences between dancers in professional and amateur folklore ensembles (Kocić, Karanov and Šolaja, 2014), which is probably the result of the insufficiently paid attention to the physical preparation of dancers, and more stylistic arrangement of choreography. Modern dance dancers on the other hand, have much better results of the morphological and physiological indicators, not only in relation to the untrained population, but also between different dance styles (Liiv, Wyon, Jurimae, Saar, Maestu, & Jurimae, 2013; Liiv, Wyon, Maestu , & Jurimae, 2013). Given that speed is an important ability for both types of dance, and according to our knowledge so far there have been no studies that have compared the frequency speed of folk and modern dance dancers, the aim of this research is to determine the differences in the motor skill "speed" of the male and female dancers of the folk and modern dance, as well as comparing them to male and female non-dancers.

METHODS

Subjects

The sample consisted of 120 subjects, aged 15 to 16, who were classified in six sub-samples. The first subsample (FOLM; n=20; average height: 172 cm; average weight: 66 kg) consisted of male dancers of folk dance, members of KUD (ensemble) "Spasovdanski vez" from Paracin and KUD (ensemble) "Abrasevic" from Kraljevo. The second subsample (FOLŽ; n=20; average height:165; average weight: 51kg) consisted of female dancers of the same KUD(ensemble). Both male and female dancers of these ensembles were engaged in this kind of dance for an average of four years, three times a week for 90 minutes. The third subsample (MODM; n = 20; average height: 175 cm; average weight: 63 kg) consisted of male dancers of the modern dance club "La Luna" from Paracin and dance club "Spektar" from Kraljevo. The fourth subsample (MODŽ; n=20; average height: 163 cm; average weight: 48 kg) consisted of female dancers of modern dance of the same dance clubs. Both male and female dancers were training three times a week, and the average training experience was four years. The fifth subsample (KONZ; n=20; average height: 166 cm, average weight: 58 kg) was the female non-dancers control group consisting of elementary schools "Stevan Jakovljević", "Đura Jakšić", grammar school, techanical- electrical and technological schools female students. The sixth subsample (KONM; n=20; average height: 177 cm, average weight: 75 kg) was also composed of non-dancers control group composed of students from the same schools. Control group subjects did not engage in other activities other than regular activities in primary and secondary schools.

Procedure

Measurement was performed in a sports hall room on a flat surface, minimum dimensions of 2x2 m at a temperature of 22° C to 25° C.

All groups subjects were tested for all speed assessment variables:lag tapping against the wall (TANZ); side turning, touch(PZDO); hand tapping (TARU); leg tapping (TANG); gymnastics bench jumping (PGKL).

1. *Lag tapping against the wall (TANZ), (Kurelić, 1975)*

The test is applied in such a way that the subject is facing the wall at a distance of at least 20 cm to a maximum of 30 cm from the wall (the subject himself/herself estimates the most appropriate distance). The subject raises one leg and seeks to touch the interior of the square drawn on the wall as quickly as possible twice. Square on the wall is 20x20 cm, 36 cm from the ground. After that, he/she puts his/her foot back in the starting position, and the same movement is performed with the other leg for 15 seconds. The subject must be dressed. Evaluation is done by counting the number of correct touches. Two tapes with one leg are worth one point. The total number of points of correctly performed touches is counted. The prop needed is a stopwatch.

2. *Side turning, touch (PZDO), (Kurelić et al, 1975)*

The test is carried out first by drawing a square of 15x15 cm at a distance of 50 cm from the wall, and on the wall the same square at the height of the shoulders of the subject is drawn. (One should draw several squares at different heights due to the different heights of the subjects). The subject stands with his back facing the wall so that the square is on the floor in front of him, and the square on the wall behind his back. In 20 seconds, the square on the floor should be touched as quickly as possible, and the square on the wall with both hands without moving the foot, turning the body to the right and the other way to the left (alternately). Evaluation is performed by counting touches of the square on the ground and the square behind the back which is worth one point. (Both worth 1 point). One counts the number of points achieved in 20 seconds. Legs must be fixed. The prop needed is a stopwatch.

3. *Hand tapping (TARU), (Kurelić, 1975)*

The test is performed by placing two plates of 20 cm diameter at a distance of 40 cm. The subject puts a "weaker" hand in the middle. By his "better" hand, on the mark, he tries to touch the two plates as many times as possible. The total number of touches is estimated in 20 seconds (2 touches are worth 1 point). The props needed are two plates of 20 cm in diameter and a stopwatch.

4. *Leg tapping (TANG), (Kurelić et al, 1975)*

The test is performed on the chair where the subject sits and puts his "stronger" leg on the board of the balance bar. On the mark "go" the subject raises his leg and shifts it as quickly as possible over the vertical balance bench. He touches the board on the other side, then immediately returns his foot to the starting position. The same movement he repeats for 20 seconds. A regular cycle is awarded one point. The test result is the number of points achieved in 20 seconds. Unfinished cycles are not counted. The requisite required are a balance bench, a chair without a backrest and a stopwatch. The size of the board is 60x30 with a ridge through the middle at a height.

5. *Gymnastics bench jumping (PGKL), (Roters, 1989, according to Kostić, 1996)*

The test is performed by the subject standing sidewise the gymnastic bench and on the mark of the examiner moves with both leg jumps from one side of the bench to the other, for a duration of 10 seconds. The number of jumps over the gymnastics bench is estimated in ten seconds. The equipment required are the gymnastics bench and a stopwatch.

Statistical analysis

The analysis of the results was performed using the statistical package "SPSS 17" (v17.0, SPSS Inc., Chicago, IL, USA). Descriptive statistics as well as Kolmogorov - Smirnov test (for distribution normality) were calculated for all data before determining differences between groups. In order to determine the statistical significance of the differences of the arithmetic means between the groups the "T - test" for independent samples was applied.

RESULTS

The results of the Kolmogorov-Smirnov test show a normal distribution of data. All tests have high sensitivity and variability, because within the range there are always about 3 standard deviations, with the exception of the TARU variable in female non-dancers that has poor variability and the TARU, TANZ, PZDO and PGKL variables in male non-dancers which has a relatively poor variability, which can be explained by a small sample of subjects.

The female and male dancers of modern and folk dances had better results than male and female non-dancers. Statistically significant differences were found for all variables (TANZ, PZDO, TARU, TANG, PGKL, $p < 0.01$). Between the male dancers of modern and folk dances there is a statistically significant difference in TANZ, TARU and PGKL tests ($p < 0.05$) in favour of male folk dancers in the TANZ variable and in favour of male modern dance dancers in TARU and PGKL variables. In female dancers of modern and folk dances, a statistically significant difference was found in variables PZDO, TARU, TANG, and PGKL (p <0.05). The TANG test was more difficult for female dancers, while the PZDO, TARU and PGKL tests were more difficult for female dancers of folk dances.

Table 1. Descriptive statistical parameters for all groups

	n	FOLM Mean±SD (min-max)	FOLŽ Mean±SD (min-max)	MODM Mean±SD (min-max)	MODŽM Mean±SD (min-max)	KONM Mean±SD (min-max)	KONŽM Mean±SD (min-max)
TANZ	20	26,95±2,31 (21-30)	24,68±1,67 (22-27)	25,10±2,05 (20-28)	24,10±2,17 (20-28)	12,60±2,30 (9-17)	12,25±2,07 (9-16)
PZDO	20	21,40±1,76 (19-25)	20,95±2,07 (18-25)	21,75±2,40 (18-26)	22,95±2,14 (20-26)	13,35±2,13 (10-17)	9,85±1,66 (7-13)
TARU	20	47,10±3,23 (41-52)	49,74±2,73 (45-55)	50,45±2,42 (47-55)	53,30±7,37 (41-66)	24,75±2,99 (20-32)	24,20±2,21 (20-29)
TANG	20	32,40±3,23 (27-40)	35,79±1,90 (33-40)	31,95±2,65 (27-37)	33,30±2,72 (28-38)	16,50±3,62 (11-23)	12,70±2,25 (9-17)
PGKL	20	14,05±2,46 (10-18)	11,37±2,56 (7-16)	19,95±2,06 (16-24)	19,90±3,73 (11-24)	3,80±1,47 (1-7)	4,30±1,38 (2-7)

Legenda: **Mean** – arithmetic mean; **SD** – standard deviation; **min –** minimal value; **max** – maximum value

Table 2. Differences in arithmetic means between groups

Var.	MODM FOLM		MODŽ FOLŽ		MODM KONM		MODŽKONŽ		FOLM KONM		FOLŽ KONŽ	
	df	Sig.	df	Sig.	df	Sig.	df	Sig.	df	Sig.	df	Sig.
TANZ	38	**0,01***	37	0,35	38	**,000****	38	**,000****	38	**,000****	37	**,000****
PZDO	38	0,60*	37	**0,01***	38	**,000****	38	**,000****	38	**,000****	37	**,000****
TARU	38	**0,00***	24,33	**0,05***	38	**,000****	22	**,000****	38	**,000****	37	**,000****
TANG	38	0,63	37	**0,00***	38	**,000****	38	**,000****	38	**,000****	37	**,000****
PGKL	38	**0,00***	37	**0,00***	38	**,000****	24	**,000****	31	**,000****	27	**,000****

Legenda: df – degree of freedom; *Sig.- statistical significance p≤ 0.05; **Sig.- statistical significance p≤ 0.01

DISCUSSION

Dancers of various dance forms show a different level of physical fitness, which ultimately brings about significant differences in dance performance (Angioi, 2010). In order to successfully perform the given dance structures, male and female dancers of folk and modern dance must have a sense of rhythm, orientation in space, coordination in the performance of individual movements, and movements in general. Matching of the game and choreography, nowadays, requires of male and female dancers of any kind of dance a high degree of connectivity, orientation, balance and speed along with the qualities such as grace and aesthetics. Although the style and artistic aspect of dance is very important, today's choreographies require dancers to make their physiological abilities and development of physical abilities equally important. (Redding & Wyon, 2003).

In the previous research, no papers were found on the concrete case of the frequency speed of dancers of folk and modern dance, but some of the authors have analyzed the characteristics of the frequency speed of the movement, namely Kostic & Dimova (1997b), Kostic & Dimova (1997a) and Kostic (1997). In these studies, speed is indicated as one of the hierarchical essential skills which contributes to the success of the dancers and on the basis of which it is possible to predict the performance of the dancers.

Results of the *Lag tapping against the wall* test (TANZ) and *Leg tapping* (TANG) of this study show that the test was more difficult for boys and girls of the modern dance, so we can conclude that different types of movement and rapid changes in the direction of lower extremity movements are more evident in folk dances. They are dominated by small and explosive steps and choreographic elements are based on fast and complicated dance patterns that are mostly related to the legs work, while the movements of the trunk and arms are not so emphasized.

In the Rotation, Touch (PZDO) test, the obtained results indicate that the test was more difficult for girls of folk dance, presumablz for the reason characteristic of modern dance dancers, which are fast, powerful, frequent movements of the trunk, shoulders and hips, while dancers of folk dances do not need these movements. Considering the nature of modern dances, the physiological and physical demands of modern dance involve large power reserves necessary for explosive movements and acrobatic elements, as well as muscular endurance to maintain a high level of explosiveness. (Koutedakis & Jamurtas, 2004). According to Wyon & Redding (2005) modern dance is an activity that requires short explosive actions that are followed by moments of precision and good control of the body. Explosive actions, a large number of hops and jumps, and high speed movements are the reason for achieving better results in the *Gymnastics bench jumping* test (PGKL) in favor of boys and girls of modern dance as compared to the dancers of folk dance.

The results of the *Hand tapping* (TARU) test in both boys and girls of modern and folk dance, show that the test was more difficult for boys and girls of folk dance, because in modern dance they have the possibility of a greater number of movements with their hands. More energetic, faster, more powerful movements are visible, while these movements with male and female folk dancers are somewhat slower, as they are in the formation of a kolo.

Statistically significant differences in all variables in male and female dancers of both modern and folk dances as compared to the non-dancers were expected and were the result of a long-lasting training process. The results of this research completely coincide with the research of Kostic (1997) and Uzunovic (2008), who influenced the increase in speed, coordination, strength and flexibility by applying an experimental dance program and dance training. Mandarić (1999) also studied changes in the motor skills of coordination, speed and feelings for the rhythm by applying a dancing program on a sample of the students of the Faculty of physical education. The speed of performing the movement is an essential ability in all dance styles, so the transformation of this ability in the dancers is expected.

Contrary to these research studies, Macura, Pešić, Đorđević-Nikić, Stojiljković & Dabović (2007) concluded that the physical condition of the folklore dancers is insufficient and that the values of the maximum consumption of oxygen of folklore dancers are at the level of the untrained men and women, and that one should pay more attention to physical preparation of dancers of folklore ensembles. In line with this recommendation, Kocic, Karanovic & Solaja (2014) compared motor skills of professional and amateur ensembles and concluded that professional dancers should expand the content and increase the intensity of their training.

CONCLUSION

Differences in the frequency speed between male and female dancers of modern and folk dances are expected given the great diversity in the rhythm, character, dynamics and training mode of these dances. These differences will also determine the primary goal of the choreographer and trainer who, apart from the artistic aspect and styling, should take into account physical demands of dance styles. Paying attention to one segment of dance and neglecting other aspects leads to the inability of the dancer to respond to all the physiological and physical demands that are set before him, and in accordance with this there is a need for a scientific approach to the physical preparation of the dancers. The diversity of dance styles and the inability to compare them due to a scarce number of research on this subject represent one of the objective problems of the scientific approach to dance research, and we hope that recent research on this topic will enable more verifiable conclusions in this area to be made.

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INFLUENCE OF SITUATION MOTOR ABILITIES ON 50m FREESTYLE RESULTS

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UDC 797.21:012.1

SUMMARY

The aim of this study was to determine the influence of situation motor abilities on swimming results in the 50 m freestyle in elite male swimmers. The sample of participants comprised of 16 swimmers (Age = 20.88 ± 3.83 yrs., Fina points = 661.69± 36,72, 50m freestyle - long course = 24.00 ± 0.43 s), participants of the Open Championship of Serbia "Serbia Open 2017". The selection of participants was made based on the quality of performance i.e. the best 16 swimmers who participated in the A and B finals in the 50 m freestyle. Both races were recorded and analyzed with specialized software Kinovea. The basic situation motor abilities were calculated, including: stroke length, stroke index, stroke rate and stroke effectiveness. Swimming results on 50m was taken from the official race report. Regression analysis was used to determine the influence of of situation motor abilities on swimming results. The average swimming results significantly correlated with variables: stroke length (r = -0.425, p = 0.05), stroke index, (r = -0.594, p = 0.01) and stroke effectiveness (r = -0.445, p = 0.04). Results of regression analysis have shown statistically significant influence (p= .000) of following variables: stroke length, stroke index and stroke effectiveness, with multiple correlation coefficient of .99 (R= .991), and multiple correlation squared of .98, explaining about 98% of variance (R^2= 0.978), on swimming results on 50m. Based on the results, we can conclude that swimmers who have greater values of stroke length, stroke index and stroke effectiveness be able to swim faster on 50m freestyle.

Keywords: swimming, stroke length, stroke index, stroke rate

INTRODUCTION

Competitive performance in swimming is influenced by morphological characteristics, motor skills, functional abilities and psychological characteristics (Volčanšek, 1996). Since swimming represents the motor activity, motor abilities have a very important impact on swimming results (Maglischo, 2003). Motor skills are one of the main factors of all movement and movement of human. They participate in solving motor assignments and enable successful movement, regardless of whether they have been acquired by training practice or not (Malacko & Rađo, 2004). They can be divided into basic, specific and situational abilities. Basic motor abilities are not specific to a particular sports discipline, but during the training proces those abilities can be transformed into specific (Malacko et al., 2004). Specific motor abilities are mostly related to success in sport because they are the cloesest to the activities that are preformed in the competitions. One of the reasons is their structure as well as the intensity of the load (Aleksandrović, 2005). Development and improvement of specific motor abilities within the basic training program is carried out by learning and improving the swimming technique and development of aerobic and anaerobic capacities. Parameters witch represents specific motor abilities in swimming, such as: start and turn time, absolute swimming time, stroke length, stroke index, stroke rate etc. can be developed and followed trough training and swimming competition (Ahmetović, 1994; Maglischo, 2003; Okičić, 1999). Development of specific motor abilities is important for achieving efficienty technique and reach better results in swimming. There are several studies investigating the impact of specific motor abilities on swimming results (Jurimae, Halljaste, Cichel, Latt, Purge et al., 2007; Latt, Jurimae, Maestu, Purge, Ramson et al., 2010). The aim of this study was to determine the influence of situation motor abilities on swimming results in the 50 m freestyle in elite male swimmers, participants of 2017 Serbian Open Championship “Serbia Open 2017”.

METHODS

Subjects

The sample of participants comprised of 16 swimmers (Age = 20.88 ± 3.83 yrs., Fina points = 661.69± 36,72, 50m freestyle - long course = 24.00 ± 0.43 s), participants of the Open Championship of Serbia "Serbia Open 2017". The selection of participants was based on the quality of performance i.e. the best 16 swimmers who participated in the A and B finals in the 50 m freestyle (mean standard 87,13% of the world record).

Procedure

The sample of variables comprised of four predictive (situational motor abilities) and one criterion variable (swimming results on 50m). The following parameters were used to assess the situation motor abilities: Stroke Length (SL), Stroke Index (SI), Stroke Rate (SR) and Stroke Effectiveness (SE). The tests for the assessment of situational motor abilities were taken from (Costill & Maglischo, 1992; Okičić, 1999; Maglischo, 2003; Okičić et al., 2007; Đurović et al., 2012).

- Stroke Length= D-d1/N (D- swimming distance, d1- length of the underwater gliding after the start, N- number of strokes per D-d1).The SL is expressed in 0.01 m,
- Stroke Index= SS (m/s) x Stroke Length (SS-Swimming Speed was calculated by the formula: D/T; D-swimming distance, T-swimming time at a swimming). The SI is expressed in arbitrary units,
- Stroke Rate= N/T-t1 x 60 (N- number of strokes per D-d1, T- swimming time, t1-time of the underwater gliding after the start, 60- needed to obtain stroke frequency per minute),
- Stroke Effectiveness= SS x SL/SR x 10 (SS-swimming speed, SL-stroke length, SR-stroke rate, 10-a constant). The SS is expressed in arbitrary units.

Swimming results on 50 m was taken from the official race report. This study utilized recordings from one transverse GoPro (HERO4 Black) camera with a frequency of 120 frames/s. Camera were positioned perpendicular to the long axis of the pool, at 25 m (half of the pool length). The pool was divided into 8 lanes by floating buoys that alternated in color on 5 m, 15 m, 25 m, 35 m and 45 m and used as calibration markers for distance measurements. Each race was analyzed with specialized software Kinovea, Version 0.8.15 (https://www.kinovea.org/).

Statistical analysis

A regression analysis was used to determine the influence of the overall predictor system of variables on the criterion variable, where the following statistical parameters were calculated: Unstd. Beta = Unstandardized regression coefficients values, Beta = Standardized regression coefficients values, t = Standardized regression coefficients significance tests, p = Standardized regression coefficients level of significance, R= Multiple correlation coefficient, R2 adjust = Adjusted determination coefficient, Std. Err. Est. = Standard error of the estimate, F= Multiple regression analysis significance tests, p = Multiple correlation level of significance.

RESULTS

Table 1. Descriptive statistics of swimming results on 50 m and situation motor abilities

Variables	N	Mean	Std. Deviation	Minimum	Maximum
Age	16	20.88	3.83	16.00	28.00
Fina points	16	661.69	36.72	619.00	729.00
SL	16	1.00	.08	.84	1.19
SI	16	2.08	.19	1.73	2.53
SR	16	117.81	7.55	102.84	133.40
SE	16	.18	.03	.13	.25
T50	16	24.00	.43	23.23	24.53

Legend: **SL**= Stroke Length, **SI**= Stroke Index, **SR**= Stroke Rate, **SE**= Stroke Effectiveness, **T50**= Time at 50m, **N** – number of participants, **Mean** - mean, **Std. Dev** - standard deviation, **Min** - minimal value, **Max -** maximal value

Table 2. Pearson's correlation coefficient between swimming results on 50 m and situation motor abilities (n=16).

Variables	T50	p
Stroke Length - SL	-0.425	0.05
Stroke Index - SI	-0.594	0.01
Stroke Rate - SR	0.238	0.19
Stroke Effectiveness - SE	-0.445	0.04

Legend: **T50** = Time at 50m, **p** = Pearson's correlation coefficient level of significance.

Table 3. Backward method multiple-regression analysis of swimming results on 50 m with situation motor abilities variables in elite male swimmers (n=16).

Variables	Unstd. Beta	Beta	t	p	R	R^2adjust	Std. Err. Est.	F	p
SL	19.604	3.631	15.284	.000					
SI	-10.736	-4.592	-23.253	.000					
SE	7.024	.453	2.330	.038	.991	.978	.06394	226.411	.000

Legend: **SL**= Stroke Length, **SI**= Stroke Index, **SE**= Sroke Effectiveness, **Unstd.Beta** = Unstandardized regression coefficients values, **Beta** = Standardized regression coefficients values, **t** = Standardized regression coefficients significance tests, **p** = Standardized regression coefficients level of significance, **R**= Multiple correlation coefficient, **R^2 adjust** = Adjusted determination coefficient, **Std. Err. Est.** = Standard error of the estimate, **F**= Multiple regression analysis significance tests, **p** = Multiple correlation level of significance.

Table 1. shows results for the descriptive statistic of all applied variables. Table 2. shows the results of Pearson correlation. Swimming results on 50 m (24.00±0.43 s) was significantly inversely related to SL (1.00±0.08) with correlation values of (r = -0.425, p = 0.05), to SI (2.08±0.19) with correlation values (r = -0.594, p = 0.01) and SE (0.18± 0.03) with correlation values (r = -0.445, p = 0.04).

Table 3. shows results of backward method multiple-regression analysis and the best model to predict swimming results on 50 m . Best model of regression analysis is represent by the following variables: SL, SI and SE with multiple correlation coefficient of .99 (R= .991), and multiple correlation squared of .98, explaining about 98% of variance (R^2= 0.978).

DISCUSSION

The aim of this study was to determine the influence and connections of situation motor abilities, which are represented by stroke length, stroke index, stroke rate and stroke effectiveness, on swimming results in the 50 m freestyle. Correlation results showed a statistically significant connections between swimming results on 50 m and the variables: SL (r = -0.43, p = 0.05), SI (r = -0.59, p = 0.01) and SE (r = -0.45, p = 0.04). In the study of Jorgić et al., 2011, swimming results on 50 m (long course mean values= 25.39 ± 1.10 s) was significantly related to SL (r= -0.69, p=0.00) and SI (r= -0.87, p=0.04). Sánchez & Arellano (2002) were investigate correlation between final time and SI at a sample of 313 swimmers at the First World Short Course Championship and 420 swimmers at the Spanish National Championship. They found statistical significant correlation between SI and final time (r>0.75, p<0.01) at both championships, and they concluded that SI is good model to use as predictor of elite level performance of swimming, as a previous researchers. Chollet et al., 1997, concluded that SL can be used as indicator of performance level of swimming results. Đurović et al., (2012) in the study on a participants of elite swimmers (mean standard= 98.85 % of the world record in 100m freestyle), found significant correlation between SL (fourth 25m of the race), SI (third 25m of the race) and success in swimming results. Differences in the SI, SR and SL can be used as an indicator of the performance level (Sanchez, 2000; Seiffert et al., 2005; Chollet et al., 1997).

Specific motor abilities, represent through SI, SL, SR and SE, are directly connected with swimming results on 50m, 100m, 200m and 400m (Sánchez & Arellano, 2002; Djurović et al., 2012; Kennedy et al., 1990; Jorgić et al., 2010; Jorgić et al., 2011; Huot-Marchand et al., 2005) respectively. Because of this facts, they should be included in practice to improve swimming technique.

CONCLUSION

From the results of this study we can conclude that specific motor abilities (stroke length, stroke index, and stroke effectiveness) have significant inversely correlation with 50m freestyle results. The greatest influence on criterion variable (swimming results on 50m) can be attributed to stroke index, stroke length and stroke effectiveness. Such results could be used by coaches to assess technical skills and planning training for certain racing strategies.

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MULTIDIMENSIONAL MODEL OF GENERAL CONTRACTILE POTENTIAL ESTIMATION OF BASIC MUSCLE GROUPS IN CADET JUDO ATHLETES

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UDC 796.853.23:591.473

SUMMARY

The aim of this paper is to define simple and initial mathematical model for estimation of general contractile potential of basic muscle groups in male cadet judo athletes for basic dimensions of isometric muscle force, both maximal isometric muscle force – SCORE_F_{max} and maximal isometric explosive muscle force – SCORE_RFD_{max}. All tests were performed on 4 muscle groups as follows: sum for flexor muscles of both left and right hand (HG_SUM), back extensor muscles (DL), leg extensor muscles (LE) and ankle joint plantar flexors (PF). All tests were performed using isometric dynamometry method, with use of tensiometric probes. The sample in this research consisted of 12 male judo athletes aged 15.5±0.89 years, who compete in different weight categories within cadet age division. Statistical method applied was descriptive statistics, whereas models were calculated by application of mathematical modeling using multidimensional scaling. The defined models have explained 100% of measured variance ($_{Adj}R^2$ = 1.000), which implies absolute predictive potential for both contractility models considering characteristics of the sample. Standard error of prediction was 0.0022 points for SCORE_F_{max} and 0.0028 points for SCORE_RFD_{max}.

Keywords: judo, cadets, modeling, maximal isometric force, explosive isometric force

INTRODUCTION

Judo is an Olympic combat sport that can be classified in group of polystructural, acyclic sports, in which highly intensive intermittent activity is dominant (Franchini et al., 2009, Franchini et al., 2011). According to current rules within judo sport there are several distinct age divisions, further divided in weight categories in accordance to athletes body mass. While indisputable importance of participation in competition for younger athletes implies importance of evaluation of their potential for achieving adequate sport results it is necessary to point out the fact that younger age categories are only a phase of athletes complete psycho-physical and sport development aimed at preparation for achieving results in senior age.

As a precondition for successful performance in international competition, as seniors, judo players have to achieve extremely high level of physical fitness (Franchini et al., 2011). Also, from the physiological standpoint, anaerobic power and capacity, and all characteristics of muscle force and power are considered key physical features that have to be developed in judo athletes (Thomas et al., 1989). Because of that, fore mentioned abilities are in focus of professional and scientific sport community. Still, considering the fact that the basic effort of a judo athlete in combat is to throw his opponent on back or to control him on the ground (Bala & Drid, 2010) the extreme importance of developing a monitoring system for achieved level o contractile ability is obvious. This can be regarded as a first precondition of achieving high level of sport performance (Milišić, 2003).

Degree of development of these characteristics, integrally considered trough value of basic muscle group force parameters can be considered as basis of high athletic fitness with direct influence on use of technical and tactical mastery. Furthermore, fore mentioned characteristics are essential for efficient use of technique, and can be considered as basic precondition for injury prevention.

In general, adequately developed contractile abilities of all engaged muscle groups provide good base for efficient competitive performance. Also, this can be considered a basis of unhampered training progression trough different stages of athletes sports development directed and dedicated to achieving excellence and winning international competitions (Koprivica, 2013; Dopsaj, 2015).

In available scientific literature, some attention has been directed to testing and evaluation of results achieved in both maximal isometric and explosive isometric muscle force tests of different muscle groups. Also, considerable attention has been directed to testing and monitoring muscle power parameters of relevant muscle groups (Franchini et al., 2011; Detanico et al., 2012; Monteiro, 2016). Although it should be kept in mind that complexity of a judo fight requires, at least, satisfying level of development of all athletes motor potentials, and also adequate level of technical, tactical and psychological preparedness, it is indisputable that selection process begins in cadet age category. It can be assumed that talents identified in this age will have potential that can be, trough planed and continuous training, developed to level required for successful performance on competition in senior age categories.

From scientific and professional standpoint this implies the need for quantification of muscle force parameters in this initial age. Also, it implies the need for developing models aimed at estimation of currently achieved level of fitness that can be used as predictive indicators for long-term influence on selection model and as a guide for improvement of sports training system.

In accordance to previous, this paper presents one of the initial researches in domain of defining quantitative model of maximal isometric muscle force and explosive isometric muscle force (explosiveness) in male cadet judo athletes. In that manner, relevant information on contractile characteristics of basic muscle groups for judo athletes of fore mentioned age will be obtained. The ultimate goal of this research is contribution to fundus of scientific knowledge in this area of sport with consequential improvement of technology of sports training in judo sport.

METHODS

The method used in this research was laboratory testing. All data sampling was performed by dynamometry method, using tensiometric probes.

THE RESEARCH SAMPLE

The research sample in this study consisted of 12 male judo athletes competing in different weight categories within cadet age division. Basic descriptive characteristics of the sample were: age = 15.5±0.89 years, BH = 174.9±5.46 cm, BM = 66.6 ± 8.56 kg, BMI = 21.9 ± 3.25 kg/m^2, PBF% = 3.5 ± 1.12, PSMM% = 54.5 ± 1.71, training experience = 4.3 ± 3.32 years, weekly training frequency = 4.0 ± 0.5 sessions per week, weekly training volume = 420 ± 30 min.

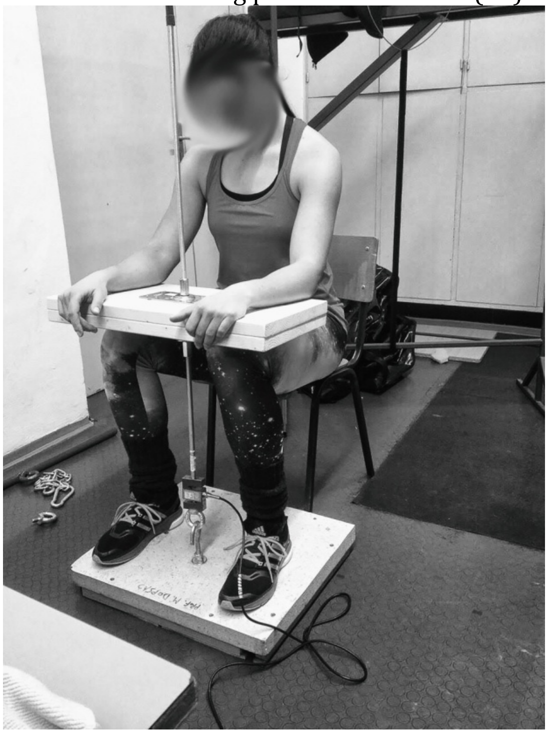
All subjects were members of Judo team “Vinča” and were competing in Republic of Serbia system of national championship for cadet age category. One subject was a member of Republic of Serbia cadet national team.

MEASUREMENT METHODS

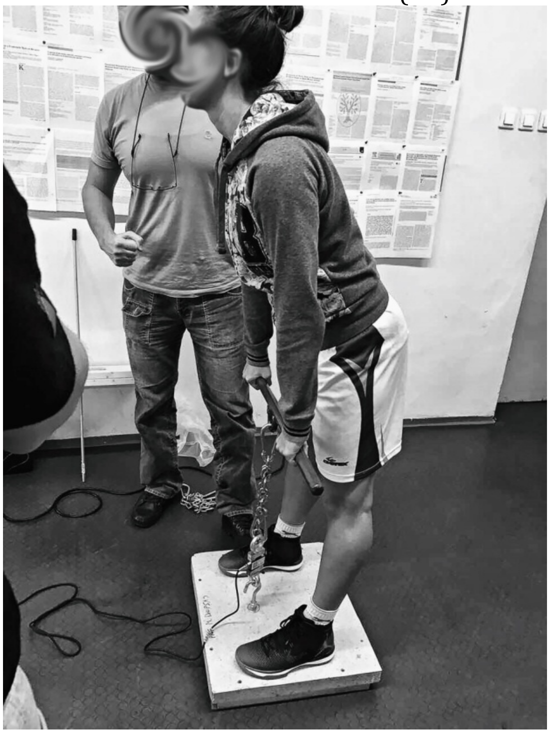
Testing of muscle force characteristics was performed using dynamometry method, by application of isometric tensiometry, by means of tensiometric probes (Isometrics SMS All4Gym, Belgrade). All tests were performed on University of Belgrade Faculty of sport and physical education in Methodological research laboratory (MIL). All tests were carried out in the morning (between 09:00 and 11.30 a.m.) by application of standardized testing procedure and standardized test battery described in previously published literature (Dopsaj et al., 2000; Dopsaj et al., 2001; Dopsaj et al., 2004; Dopsaj et al., 2007).

Before the beginning of the testing all subjects have performed 10 min individual warm-up. After that the testing was carried out. The testing procedure required an explanation of the way each test is performed. Each subject had two trial attempts performed in high and sub maximal intensity for the purpose of familiarization with the testing procedure. After having at least 5 min pause, the testing was carried out using trial-to-trial method, where the break between testing attempts was 2 min. Better test result was taken for statistical processing (Ivanovic and Dopsaj, 2013). Positions of the subject during testing procedure are shown on pictures 1 to 4.

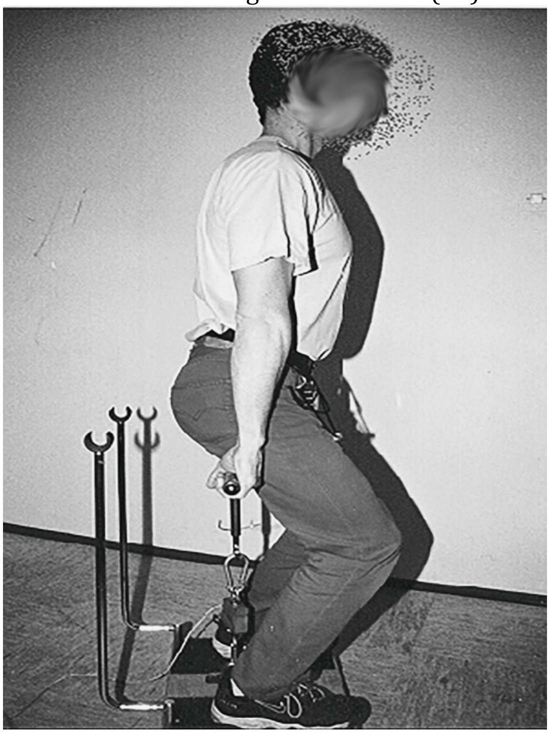
Picture 1. Sitting plantar flexion test (PF)



Picture 2. Dead lift test (DL)



Picture 3. Leg extension test (LE)



Picture 4. Handgrip test (HG)

VARIABLES

In the purpose of defining multidimensional model for evaluation of general contractile potential separate models were defined in regards to two different contractile dimensions: maximal isometric muscle force – F_{max} and maximal isometric explosive muscle force (explosiveness) – RFD_{max}. All tests were performed on 4 muscle groups as follows: sum for flexor muscles of both left and right hand (HG_SUM), back extensor muscles (DL), leg extensor muscles (LE) and ankle joint plantar flexors (PF).

Following variables were used for assessment of maximal isometric muscle force:

- HG_SUM_F_{max} – sum for maximal isometric force of flexor muscles of both left and right hand expressed in N;
- DL_F_{max}, maximal isometric force of back extensor muscles expressed in N;
- LE_F_{max}, maximal isometric force of leg extensor muscles expressed in N;
- PF_F_{max}, maximal isometric force of ankle joint plantar flexors expressed in N;

Following variables were used for assessment of maximal explosive isometric muscle force (explosiveness):

- HG_SUM_RFD_{max} – sum for maximal explosive isometric muscle force of flexor muscles of both left and right hand expressed in $N \cdot s^{-1}$;
- DL_RFD_{max}, maximal explosive isometric muscle force of back extensor muscles expressed in $N \cdot s^{-1}$;
- LE_RFD_{max}, maximal explosive isometric muscle force of leg extensor muscles expressed in $N \cdot s^{-1}$;
- PF_RFD_{max}, maximal explosive isometric muscle force of ankle joint plantar flexors expressed in $N \cdot s^{-1}$;

STATISTICAL ANALYSIS

For the purposes of this paper, in the first step of the analysis all raw data obtained by laboratory testing were subjected to descriptive statistical analysis in order to define the basic measure of central tendency (MEAN), indicators of data dispersion - standard deviation and coefficient of variation (SD, cV%) and results span indicators – minimum and maximum (MIN, MAX). The method of mathematical modeling by use of multidimensional scaling used in next step of the analysis as a final result defined a total numerical score of general fitness in function of measured contractile characteristic (Dopsaj et al., 2010; Dopsaj, 2015). In this way general preparedness for both the maximal isometric muscle force aspect (SCORE_F_{max}) and maximal isometric explosive muscle force aspect (SCORE_RFD_{max}) was presented by mathematical analogy where the value of test score for each individual subject was transformed in proportional point score on scale from 0 (hypothetical minimum) to 100 (hypothetical maximum) points. In further process of defining statistical model the value of point score represented the criterion variable, and the results of 4 isometric tests represented a system of predictor variables. The final form of the model was defined by application of Multivariate Regression Analysis (MRA). All analysis were conducted by use of statistical packages Microsoft Office Excel 2007 and IBM SPSS v23.0, where the level of statistical significance was defined based on criterion $p=0.05$ (Hair et al., 1998).

RESULTS

The results of descriptive statistical analysis relative to examined variables of maximal isometric muscle force – F_{max} and maximal isometric explosive muscle force (explosiveness) – RFD_{max}, as well as all calculated contractile fitness point scores (SCORE_F_{max} and SCORE_RFD_{max}) are shown in Table 1.

The results of defined MRA models have shown that separate structure explained 100% of measured variance ($_{Adj}R^2$ = 1.000) for both models of contractility. This means that predictive potential relative to characteristics of the sample is absolute for both models of contractility. ANOVA regression has shown extremely high level of statistical significance of score prediction: for SCORE_F_{max} on the level of $F=160667482.37$ and $p = 0.000$ and for SCORE_RFD_{max} on the level of $F=94737849.57$ and $p = 0.000$. Standard error of prediction was 0.0022 points for SCORE_F_{max} and 0.0028 points for SCORE_RFD_{max}.

Table 1. Descriptive statistics of measured contractile characteristics

	N	Mean	Std. Dev.	cV%	Min	Max
HG_SUM_F_{max} (N)	12	845.97	220.42	26.05	586.00	1199.00
DL_F_{max} (N)	12	1241.35	341.17	27.48	845.00	1779.00
LE_F_{max} (N)	12	1187.57	293.04	24.67	804.00	1628.00
PF_F_{max} (N)	12	2886.80	473.36	16.39	2228.00	3497.00
HG_SUM_RFD_{max} (N•s^{-1})	12	4756.92	1366.78	28.73	3555.00	7297.00
DL_RFD_{max} (N•s^{-1})	12	6638.50	3605.33	54.30	3673.00	13679.00
LE_RFD_{max} (N•s^{-1})	12	4995.88	1541.24	30.85	3329.00	7425.00
PF_RFD_{max} (N•s^{-1})	12	12413.37	2121.92	17.09	9819.00	15997.00
SCORE_F_{max} (point score)	12	50.00	16.67	33.33	28.42	75.59
SCORE_RFD_{max} (point score)	12	50.00	16.66	33.33	31.52	83.12

Table 2. The defined model of regression equation of the prediction specification of general fitness from the aspect of maximal isometric muscle force and maximal isometric explosive muscle force.

SCORE_F_{max}	= -25.315973 + (HG_SUM_F_{max} • 0.019546) + (DL_F_{max} • 0.012681) + (LE_F_{max} • 0.014647) + (PF_F_{max} • 0.008884)
SCORE_RFD_{max}	-16.768112 + (HG_SUM_RFD_{max} • 0.003539) + (DL_RFD_{max} • 0.001413) + (LE_RFD_{max} • 0.002506) + (PF_RFD_{max} • 0.002259)

DISCUSSION

Based on results obtained by use of descriptive statistical analysis, it can be concluded that measured values of examined variables are in adequate span of results. Coefficients of variation for maximal isometric muscle force variables of tested muscle groups are in range of 16.39% (PF_F_{max}) to 27.48% (DL_F_{max}) while for variables of maximal isometric explosive muscle force coefficients of variation range from 17.09 % (PF_RFD_{max}) to 54.30% (DL_RFD_{max}). Based on the fact that 7 of 8 examined variables have coefficients of variation under 30% and only one variable has a coefficient of variation under 60% it can be claimed that measured results of contractile characteristics of tested judo athletes are homogenous and valid in terms of further scientific interpretation.

In regard to achieved level of development for the variable HG_SUM_F_{max} – sum of maximal isometric muscle force of flexor muscles of both left and right hand – it can be claimed that tested judo athletes have achieved, on average, absolute force of 845.97 N or 12.70 N/kg BM relativized in relation to body mass. For variable HG_SUM_RFD_{max} – maximal isometric explosive muscle force (explosiveness) – based on results it can be claimed that tested judo athletes have achieved, on average, absolute explosiveness of 4756.92 N•s^{-1} or 71.43 N/s/kg relativized in relation to body mass.

In relation to the achieved level of development of the variable DL_F_{max}, i.e. maximal isometric muscle force of back extensor muscles, on the basis of the obtained results, it can be argued that the tested judo athletes have achieved an average score of 1241.35 N or 18.64 N/kg BM for the relative value of the force. For the variable DL_RFD_{max}, i.e. maximal isometric muscle explosiveness on the same test athletes achieved the average result of 6638.92 N•s^{-1} or 99.68 N/s/kg BM relativized in relation to body mass.

Regarding the results achieved on the leg extension test, that is, in terms of the achieved level of development of the variables LE_F_{max} and LE_RFD_{max}, on the basis of the obtained results it can be argued that the tested judo athletes on average achieve the maximum isometric muscle force at the level of 1187.57 N and the maximum isometric explosive muscle force of the same muscle group at the level of 4995.88 92 N•s^{-1}. Relativized in relation to body mass they achieve maximal isometric muscle force at the level of 17.83 N/kg BM and maximal isometric explosive muscle force of 75.01 N/s/kg BM.

On the seated planter flexion test, that is, in terms of the achieved level of development of the variables PF_F_{max} (maximal isometric muscle force) and PF_RFD_{max} (maximal isometric explosive muscle force) it can be argued that the tested judo athletes have achieved an average score of 2886.80 N and 12413.37 N•s^{-1}, respectively. Relativized in relation to body mass they achieve maximal isometric muscle force at the level of 43.35 N/kg BM and maximal isometric explosive muscle force at the level of 186.39 N/s/kg BM.

On the basis of all fore mentioned a mathematical model for each of the dimensions of isometric muscle force was defined. The defined models for maximal isometric muscle force – F_{max} and maximal isometric explosive muscle force RFD_{max} in both cases explained 100% of the measured variance ($_{Adj}R^2$ = 1,000). In other words, it can be claimed that the prediction error is minor, as can be seen from the size of the standard prediction error value of 0.0022 points for the maximal isometric muscle force

$SCORE\_F_{max}$, and 0.0028 points for the maximal isometric explosive muscle force $SCORE\_RFD_{max}$. The influence of individual variables on the general score in the model of maximal isometric muscle force, as well as the model of maximal isometric explosive muscle force (explosiveness) can be viewed through the values of coefficients obtained using the Multivariate Regression Analysis (MRA). The relatively low values of these coefficients, ranging from 0.008884 for variable PF_F_{max} to 0.019546 for variable $HG\_SUM\_F_{max}$, and from 0.001413 for variable DL_RFD_{max} to 0.003539 for variable $HG\_SUM\_RFD_{max}$, indicate that individual variables relatively equally affect the ultimate performance defined by total point score, both for the maximal isometric muscle force and for the maximal isometric explosive muscle force. However, influence of both sum of maximal isometric muscle force of flexor muscles of both left and right hand and sum of maximal isometric explosive muscle force of flexor muscles of both left and right hand indicates slightly increased significance of the variables $HG\_SUM\_F_{max}$ and $HG\_SUM\_RFD_{max}$ on the total score. In other words, this data indicates a slightly increased significance of the measured contractile characteristics of a given segment (hand) on general manifestation of maximal isometric and maximal isometric explosive muscle force in the system of measured muscle groups in judo athletes of a given age.

CONCLUSION

The aim of this paper is to define an initial mathematical model for estimating the general contractile potential of the basic muscle groups in male cadet judo athletes for the basic dimensions of the muscle force – maximal isometric muscle force – $SCORE\_F_{max}$ and maximal isometric explosive muscle force – $SCORE\_RFD_{max}$. Based on the results, two highly statistically significant multidimensional equations of specification were obtained that explained 100% of the measured variance ($_{Adj}R^2$ = 1,000). In other words, the tested contractile characteristics of the examined sample of judo athletes are defined at the absolute level in terms of predictive potential for both models of contractility, with the standard prediction error for $SCORE\_F_{max}$ of 0.0022, and for $SCORE\_RFD_{max}$ of 0.0028 points. The resulting models had the following form: $SCORE\_F_{max} = -25.315973 + (HG\_SUM\_F_{max} \bullet 0.019546) + (DL\_F_{max} \bullet 0.012681) + (LE\_F_{max} \bullet 0.014647) + (PF\_F_{max} \bullet 0.008884)$; $SCORE\_RFD_{max} = -16.768112 + (HG\_SUM\_RFD_{max} \bullet 0.003539) + (DL\_RFD_{max} \bullet 0.001413) + (LE\_RFD_{max} \bullet 0.002506) + (PF\_RFD_{max} \bullet 0.002259)$.

ACKNOWLEGMENTS

The paper is a part of the project “Effects of the Applied Physical Activity on Locomotor, Metabolic, Psychosocial and Educational Status of the Population of the Republic of Serbia”, number III47015, funded by the Ministry of Education, Science and Technological Development of the Republic of Serbia – Scientific Projects 2011 – 2016 Cycle.

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MORPHOLOGICAL CHARACTERISTICS WITH STUDENTS – KARATE ATHLETES AND NON ATHLETES

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UDC 159.988.85

SUMMARY

Positive and evident is the appearance of practitioners and researchers in the teaching of school physical education, which more often indicate that the current knowledge of the theory of physical culture, general pedagogy and (in general) methodology, applied to the school conditions of teaching of school physical education. Every sport and sport discipline possesses certain specificity, knowing this, there is an expressed need for continuous research and in practice by checking the specificities of individual sports, including primarily the genetic conditionality of the individual anthropological abilities and characteristics, then their hierarchical value in sports, as well as their structure and development under the influence of certain training means, methods and loads. The purpose of this research is to compare indicators for assessing the composition of the body, between karate athletes and non-athletes from rural and urban environment, at the age of 16-18 years old. A battery of 5 tests for assessment of the body composition was applied to the respondents. The obtained values from the measurement were processed by standard descriptive procedures, where the basic central and dispersion parameters were calculated. The normality of the distribution and the distribution of the results with the coefficient of curvature (skew), the coefficient of elongation (kurt), and Kolmogorov-Smirnov's method were calculated. The univariate and multivariate differences in the composition of the body, among the three different sub-population of respondents, were determined by multivariate analysis of variance (MANOVA) and univariate variance of analysis (ANOVA). Differences in the components of the body composition were found in favor of karate athletes.

Keywords: karate athletes, non-athletes, urban environment, rural environment

INTRODUCTION

Since physical education is inappropriately represented by the number of lessons in the school curriculum, the teaching approach is realized with a low energy component, which is a major problem in the realization of the program tasks (Višnjić, 2006). For this reason, there is an increase in the number of children involved in the training process in sports clubs or sections of physical education in schools (Sallis, 1997). Every sport and sport discipline possesses certain specificity, but with this there is an expressed need for continuous research and in practice by checking the specificities of certain sports, including primarily the genetic conditionality of the individual anthropological abilities and characteristics, then their hierarchical value in sports, as well as their structure and development under the influence of certain training means, methods and loads. Karate as a poly structural acyclic sport in which acyclic unpredictable movements are dominating has only symbolic destruction of the opponent. This "positive destruction", the karate athlete seeks to give by giving controlled strokes to the opponent's head and body, although the movements are a combination of maximum and sub maximal intensity. According the criterion of dominance of the energetic processes or according the physiological classifications, the karate sports belongs to anaerobic sports (glycolytic energy process) where there is high intensity of duration between 5 seconds and 3 minutes (Kostovski, Ž., at. all 2013). The study of karate helps to develop a strong personality character and builds a sense of respect (Soklevska, E. 2010). Through regular practice of karate sports, in a longer period of time, it influences on the optimal development of the athlete, on improving the psychosomatic status and affects the anthropometric and motor dimensions of the athletes.

METHODS

The survey was conducted on a deliberate sample of respondents at the age of 16-18 years old (± 6 months). The sample consists of 85 respondents and it is divided into three sub-samples, of which: the first sub-sample includes 25 respondents of karate athletes who are in a continuous training process for at least one year, the second sub-sample covers 30 respondents' non-athletes from rural areas, and the third sub-sample covers 30 respondents' non-athletes from urban areas. The subject of this research was the composition of the body among students dealing with karate sports and students non-athletes from urban and rural areas who do not deal with sports activities. The research was conducted in order to compare the indicators for assessing the composition of the body in the three groups of respondents. The sample of variables consists of 5 variables for estimation of the body composition of the respondents. For the assessment of the body composition were used; Fat Free Mass (FFM - Fat)%, Muscle Mass (MMAS) kg, Physical Assessment (FRAT) 1-9, Bone mass (BMAS) kg, and Body Mass Index (BMI). For the evaluation of the variables applied in the survey, were used instruments with determined measurement characteristics and who successfully find their application in a large number of studies so far. For assessment of the body composition digital scale Tanita (Body composition analyzer tanita TBF-300 A) was used. The obtained data are processed using the statistical software package IBM Statistic SPSS 20.0 Inc., Chicago, USA. For the applied variables in this study the Arithmetic Mean and Standard Deviation (Sd) were calculated. The normality of the distribution and the distribution of the results with the coefficient of curvature (skew), the coefficient of elongation (kurt), and Kolmogorov Smirnov's method were calculated. The univariate and multivariate differences in the composition of the body, among the three different sub-population of respondents were determined by multivariate analysis of variance (MANOVA) and univariate variance of analysis (ANOVA).

RESULTS

From the results obtained in table no. 1 that refer to the indicators of the body composition of the three groups of respondents, it can be concluded that the distribution of the variables is within the limits of the normal distribution of the results. The values of symmetric of the Gaussian curve (Skew) in almost all variables in the three groups are in the range of moderate symmetry (from +1 to -1). A slight insignificant deviation can be observed among the respondents non-athletes from rural areas in the variable Body Mass Index (BMI = 1.08), which indicates the concentration of the results towards the lower values. As for the curvature coefficient of the Gaussian curve (Kurt), it can be said that it moves within the limits of the normal values, in all variables and in all three groups of respondents. In the results referring to the normality of the distribution of the results K-S = p <.01 there is statistically significant deviation in the variable Physical Assessment (FRAT) for all three groups of respondents.

Table no. 1 Body composition

VAR	GRUPS	Mean	Sd	Skew	Kurt	K-S
FFM	Karate (n=25)	11.09	4.84	0.73	-0.45	p > .20
	Urban (n=30)	11.49	4.15	0.39	-0.06	p > .20
	Rural (n=30)	10.26	3.23	0.77	0.19	p > .20
MMAS	Karate (n=25)	58.34	8.70	-0.07	-0.77	p > .20
	Urban (n=30)	54.81	7.14	-0.62	-0.38	p > .20
	Rural (n=30)	53.44	5.99	0.08	0.00	p > .20
FRAT	Karate (n=25)	7.12	1.36	-0.56	-1.25	p < .01
	Urban (n=30)	6.03	1.33	0.60	-1.56	p < .01
	Rural (n=30)	6.17	1.32	0.16	-1.63	p < .01
BMAS	Karate (n=25)	3.02	0.42	0.00	-0.52	p > .20
	Urban (n=30)	2.88	0.37	-0.61	-0.47	p > .20
	Rural (n=30)	2.86	0.27	0.03	0.13	p > .20
BMI	Karate (n=25)	22.62	2.66	0.04	0.38	p > .20
	Urban (n=30)	21.39	2.74	-0.32	1.01	p > .20
	Rural (n=30)	20.64	2.29	1.08	1.52	p > .20

The results presented in Table no. 2 refer to the three groups of respondents, analyzed by multivariate analysis of variance (MANOVA) on the tests for assessing the composition of the body. From the analysis of the results we can conclude that there are intergroup differences in the entire analyzed space. On the basis of the obtained results for Wilk's Lambda which is equal to .23, together with Rao's F=4.52 approximation and the degree of freedom df1 = 32 and df2 = 134 give significance to the differences p = 0.00 of the entire analyzed space.

With the application of the uni variate analysis of variance (ANOVA) Table no.3, a statistically significant difference can be seen in the respondents from the three groups in the following test battery: Muscle Mass (MMAS), Physical Assessment (FRAT) and Body Mass Index (BMI).

Table no. 2 Multivariate analysis of variance

	Test	Value	F	Effect (df)	Error (df)	p
GRUP	Wilks	0,231	4,52	32	134	0.00

Table no. 3 Uni variate analysis of variance

	SS (Effect)	df (Effect)	MS (Effect)	SS (Error)	df (Error)	MS (Error)	F	p
FFM	23,25	2	11,62	1366,95	82	16,67	070	0,50
MMAS	341,79	2	170,89	4336,61	82	52,89	3,23	0,05
FRAT	18,63	2	9,31	145,77	82	1,78	5,24	0,01
BMAS	0,42	2	0,21	10,32	82	0,13	1,66	0,12
BMI	53,51	2	26,76	540,35	82	6,59	4,06	0,02

DISCUSSION

The results obtained from this research concerning the amount of fat (FFM-Fat%) in average are: Karate = 11.09, Urban = 11.49 and Rural = 10.26%, and can be compared with the research of other authors. Lutoslawska G, Borkowski L, Krawczyk B, and Lerczak K. (1996), in a survey carried out with Polish karate athletes; found that the amount of fat was 12.6%. Shaw DK, and Deutch DT, (1982), were researching the amount of fats among American karate athletes, determined values with average of 10.9%. The same analysis was carried out by Imamura H, Yoshimura Y, Uchida K, Tanaka A, Nishimura S, Nakazawa AT, (1996), among Japanese karate athletes, where they have determined body fat with average of 12.8%. Marković G, Mišigoj-Duraković M, and Trninić S. (2005) conducted a survey in which they compared the amounts of body fat among Croatian athletes who deal with Taekwondo and found that those who won a medal at top competitions have a smaller amount of body fat (FAT %) 15.3%, compared to the body fat in those athletes who did not win a medal in numerous competitions (17.6%).

The BMI values in this research range from 22.62 in karate, 21.39 among students from urban areas and 20.64 among students from rural areas, which results can be compared by researches from other authors. Sterkowicz-Przybycień K.L. (2010), in a survey he conducted with Polish karate athletes, analyzed the body composition of athletes. From the obtained results it was established that the BMI values range from 22.9-31.0 kg / m2, and a determined percentage of fat between 12.9 and 20.8%. The BMI values in the majority of respondents were around 25 kg / m2, indicating the presence of overweight in this population. Koropanovski N et. all. (2011) conducted a survey with 31 karate athletes aged 16-18 years, competitors in kumite (19) and kata (12). The obtained results of the research indicate higher values of the indicators for the body composition with the kumite competitors in relation to the kata competitors, while in the comparison of the BMI in the two groups of respondents there were no statistically significant differences. The results from this research with karate athletes were comparable to those of elite karate athletes tested in the previous studies (Ravier, 2004; Zemakova, 2004). The obtained results in relation to the body mass index (BMI) in the research karate athletes in this study can be compared with studies conducted in previous studies, which refer to tested elite karate athletes

(Ravier G, at all. 2006) and (Fritzschel J & Raschka C 2007).

CONCLUSION

By analyzing the obtained results of the research and referring to the composition of the body among the respondents, it can be concluded that in the variables for estimation of the body composition, karate athletes are dominating in the variables Muscle Mass (MMAS), Physical Assessment (FRAT), Bone Weight (BMAS). It can be said that these are also expected results because the regular training process positively influences the changes in the body composition. The weakest results from the three groups of respondents show the respondents from the urban areas.

In general, it can be concluded that the karate athletes achieved these results as a result of the regular training technology. The systematic loading leads to improved motor abilities among the respondents, as well as to better values in muscle mass, physical assessment, bone mass, and fat-free mass. The results achieved by the respondents from the rural areas are most likely due to the activities that they had in their environments, as well as the way of using the free time. The students who live in rural areas and do not engage in regular physical activity, the free time most often spend outside in various physical activities, which contributes to the achievement of the displayed values. The modern urban way of life connects students to their homes, in front of their computers and social networks, and does not allow them to be physically active, as proved by this study.

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REACTION AND BODY MASS INDEX TO YOUNG WRESTLERS

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UDC 796.82:613

SUMMARY

The purpose of the study was to look at the relationship the between visual, auditory and mixed reaction with body mass index to wrestlers 13-16 year old (average age: 14.25 ± 1.83).Wrestlers (n = 28) from three sports clubs in Tirana attend training six times a week. The measurements were made twice, the first in April 2017 and the second six weeks after the program, speed exercises are performed for 10 minutes three times a week, in addition to wrestling training. Visual, auditory, and mixed response times were measured with Newtest 1000. Three trials were performed for each reaction time. Body Mass Index (BMI) tested was 22.16 ± 3.78 kg / m2 (Height: 164.29 ± 2.02, Weight: 68.03 ± 4.11). The best result in the measurements is used for statistical analysis. The data were analyzed using the ANOVA program, where correlation between reaction and BMI was low ($p > 0.05$). Positive results were found between visual, auditory, and mixed reaction ($p > 0.01$). As a result of this study, it can be said that the 6-week speed training applied to the tested wrestlers has a positive effect on the reaction performance.

Key words: reaction performance, speed trainning, wrestlers

SYSTEM OF SPORT SELECTION AND ORIENTATION IN CYCLING OPTIONS FOR IMPROVEMENT

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UDC 796.61.015

SUMMARY

In the development of modern time sport, there is a tendency towards a constant decrease of age of which organized training process begins, and hence the readiness of athletes for high level sport results at younger age. This tendency places demands on the young and unstable organism. To achieve high results in cycling a good knowledge of anatomy, physiology and functional characteristics of child's organism is necessary, which will help for selection and provision of optimal training methods and will ensure maximum sport realization of individual abilities. The aim of the following study is to reveal the peculiarities of sport selection and sport orientation in cycling. The written above gave us the reason to assume that the problems of sport selection, in contemporary conditions of sport development are of particular importance.

Keywords: features, description, cycling, development, revealing

INTRODUCTION

Reaching highest levels of sport mastery is impossible mission without the joint effort of numerous sport specialists – medical staff, pedagogues, psychologists, etc. – including scouts who will have to find gifted children and develop their talent through the years. The role of the coach in this process is extremely important. The specialized knowledge are no longer sufficient for successful realization in coaching. Sport specialists must possess solid knowledge of anatomy, physiology, sports medicine, psychology, pedagogy, sociology – but not in all aspects, but on those applicable in sport practice. The value and the quality of all this knowledge are not measured only by the amount of information and experience, but also particularly depend on coaches' ability to apply them successfully in their professional activity where is needed continues adaptation to new circumstances. [13]

There are number of training schools in the world whose cyclists dictate "fashion" in this sport – Italian, Spanish, Russian, German and French. A number of prominent specialists, most of whom combine science and sport activities, present their experience and researches both in terms of cyclists training process and sport orientation of most talented athletes. Almost all cycling experts recommend that prior sport selection, along with their specific abilities, skills and talents, a model characteristic of young cyclists must be build. This characteristic will be as basis for sport selection in cycling.

The aim of the following study is to reveal the peculiarities of sport selection and sport orientation in cycling.

METHODS

The study was carried using the methods: literary sources study, document analysis, theoretical analysis and synthesis.

Subject of the following study is the system of sport selection and orientation of young cyclists in the Republic of Bulgaria.

RESULTS

Research tests and measurements during the stage of initial sport training are an excellent mean for revealing skills for the most suitable discipline in cycling. As a result of many years of experience in the sport selection in cycling, the following features are determined to reveal the sport abilities of future cyclists:

1. First, we evaluate the performance of cyclists in a certain age, assessing the degree of sport talent for cycling, as well as some aspects of his overall training.
2. Second, programing the development of cyclist in one-year period. It is expressed in a program for development of relevant physical abilities (according to research indexes), which at the end of the period is reconciled with the sport-technical abilities.

In both approaches the evaluation of cyclists have quantitative and qualitative side.

The whole sport-pedagogical process of training and educating of adolescent cyclists should be accompanied by maintaining the interest of young cyclists in the preferred sport. Continuous and vigorous increase in sport performance, equalization of training process and athletes' abilities, representative of different countries are stimulating the development and opportunities to improve the system of sport selection and orientation in cycling. The limits of sport performances are extremely mobile. Achievements once considered fantastic and triggering excitement in the world of sports are already surpassed and forgotten. The system for sport selection determines the meaning of selection, its personal and social significance. Overcoming the empirical and intuitive selection means disclosing the relevant rules of how selection criteria should be applied for the needs of elite sport.

It is necessary to emphasize that the principle of systematics in sport selection requires a complex approach in disclosure of relevant abilities, research in the field of sport medicine, physiology, biochemistry, psychology, etc. The solving of individual tasks allows for a comprehensive assessment of the individual's potential abilities for achieving high level sport results in cycling. With its specific problems, it covers all levels of sport training process – from initial training period to elite sport cycling.

From a social, physiological and sport-pedagogical point of view, it is important to assess the impact of training volume on health, physical development and functional status of adolescent athletes. Before conducting a specific training exercise, it is necessary to specify and explore the basic patterns of multi-annual training process. This regularity is determined by: formulation of tasks, determining training means and methods during different preparation stages, age ratio of components of training process through different stages, development of pedagogical and medico-biological norms for evaluation of training and competition loads depending on age, gender, typological characteristics and the specifics of practiced sport.

At present time, children and adolescents training process is based on the premise that childhood to elite sport training is a complete process under the fundamental laws of sport performance development. Beginners adolescents training in cycling is characterized by the solid foundation of sport preparedness and readiness, and the training for advanced cyclists is characterized towards the requirements of the particular sport discipline.

In the development of modern time sport, there is a tendency towards a constant decrease of age of which organized training process begins, and hence the readiness of athletes for high level sport results at younger age. This tendency places demands on the young and unstable organism. To achieve high results in cycling a good knowledge of anatomy, physiology and functional characteristics of child's organism is necessary, which will help for selection and provision of optimal training methods and will ensure maximum sport realization of individual abilities. The main task to be solved in the selection of young cyclists is that with the utmost precision it is predictable that young athlete is able to successfully pass the early specialization so that in the process of sport perfection to poses real perspective for further development.

The following specific principals must be observed when conducting multi-annual sports training process [9]:

1. Continuity of training process: completeness in the physical abilities development; strict dosing and wave-like alternation of training volume and intensity of workload, unity of general and special training, cyclicality of training process.
2. Organization and methodology of training process, selection of appropriate training tools, volume and intensity, based on the age norms valid for young organism development.
3. Age problems in sport training are considered from the point of unity and mutual condition of healing, training (motor) and education.

Of great importance is the timely discovery of talented for cycling sport adolescents. This will be a good foundation for identification of means and methods for full reveal of these talents in order to achieve physical and mental perfection afterwards and opportunities to improve the system for sport selection and orientation in cycling.

Some authors define, as a sport selection starting point, the creation of groups of people willing to practice cycling. During the formation of the groups, the coach should be aware of: age, weight, height, functional abilities, chest circumference, lower limbs measurements, and information regarding practicing another sports prior entering the group. [7]

Preliminary sport training process for children acquires a comprehensive development applying variety of sports as:

1. Athletics, short-distance running and cross-country running from 10 to 30 min.
2. Gymnastic exercises for development of different muscle groups.
3. Variety of games.
4. Cycling has, above all, a technical character, and is just as much as to keep interest and love for bike and cycling as sport.
5. Study of bicycle construction and parts.
6. Getting to know the traffic regulations.
7. Participation in examinations and competitions for children.
8. Distinct study of bicycle riding elements using visual help to design and build individual riding style.

The specific way of performing the individual technical elements of cyclists is his riding style. The style may be good or bad depending on the correct or incorrect execution of individual movements. Not all good cyclists have the right riding style, so each young athlete has to build his riding style on the bike rather than imitate others. The coach must take a special part in the development of the style. The important thing for young cyclists is to form a good and correct riding style on the bicycle at the very beginning of the training process. Incorrectly learned elements spoil it and in future it is hard to correct it. The good riding style, besides being good for the eye, must also correspond with other conditions that are of great importance, including the requirement not to make unnecessary movements, but to be also economical and rational and not to include unnecessary stiffness and tension.

Most mistakes are made in the so-called “forced training” of children and adolescents, which is result of a “reduced” training pattern from adults’ cyclists. This means that boys and girls are trained directly, without taking into account the specifics and patterns valid for adolescents training process, so that they can quickly take part into competitions.

From the review of the peculiarities and problems of the children’s and adolescents training, we can formulate the most important criteria for systematization of children and adolescent training:

- the nature and requirements of sport;
- regularities of functional development maturity;
- individual development pace.

The main indexes included in the model characteristic of cyclists, according to a number of sport specialists, are:

1. Expected sport result.
2. Optimal age and sport experience required to achieve maximum result.
3. Morphological features of the cyclists as a factor of sport achievement. Each sport has a specific requirement for athletes in terms of height, weight, optimal body structure, and so on. Along with the baseline data, some authors recommend using different indexes: ration between weight and height, ratio between height standing-seating, etc.
4. The development of specific for the sport physical qualities as one of the main factors of sport achievements. The model characteristics feature tests providing information regarding the abilities that are relevant for particular sport.

In practice, this means that for solving the problem of sport selection, the coach should rely on an objective model of ideal cyclists, in which he quantifies the factors and mechanism that determine the achievements of maximum results in specific king of sport activity.

Regardless of the mentioned above, modeling at this stage is feasible. It is connected with the accumulation of huge factual material from medical, biological biomechanical and sport-pedagogical research on athletes with cyclists from different qualification and training level and their process using appropriate mathematical and statistical methods. This is not in the power of a person, as factors of a different nature (morpho-functional, motor, sports-pedagogical, etc.) must be studied and specified. Joint efforts of sport educators and researchers from various fields are also needed: anatomy, physiology, age morphology, biomechanics, biochemistry, etc.

Sport selection has not only a significance for sport, but also is important as social function that gives young people the opportunity to orient themselves towards the motor activity that would best meet their abilities.

From the discovery of the talent to the creation of the elite athlete, it is necessary to go through the long and difficult path of specialization and improvement – the "jewelry processing of the diamond – the talent".

CONCLUSION

The written above gave us the reason to assume that the problems of sport selection, in contemporary conditions of sport development are of particular importance. Training goals, although relatively independent of ag, are not limited to the methodology and content of the overall training. They are primarily determined by the morphological and physiological features of adolescent organism and the individual motor abilities development.

Training process in cycling becomes more and more science. Fortunately, this science of "body and spirit" does not reduce the joy and satisfaction of cycling sports as it gives new depth and fuller sense of cycling. [1]

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THE SPEED DEVELOPMENT OF TEENAGE CYCLISTS

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UDC 796.61:012.13

SUMMARY

The speed is manifested in one or another form in every discipline of cycling - from the shortest to the longest. In most cases, it is crucial for ultimate success. It is not possible to imagine a race in which victory is not solved with sprint, and it is hardly possible to overcome your opponent in one case or another without the typical powerful demarage followed by a sprint. The speed of cycling is reflected in rapid response, rapid performance of one movement, the rapid rhythm of the cyclical movements of the feet, and the frequency of muscle contraction and speed of movement in space. The main task of speed training is to increase the body's ability to maximize intensive work per unit of time. The purpose of the theoretical study is to reveal the peculiarities of motor quality "speed" in adolescent cyclists.

Keywords: cycling, age, movement, quality

INTRODUCTION

Cycling is a sport that has always been on focus of spectators, athletes and specialists because of its attractiveness. This is a sport that has traditions and successes in Bulgaria. Cycling demands high requests on the athletes and thier bodies, it is a sport that finds mass application among people from different ages and professions as a means of physical development and psychological unloading [3]. Cycling can be multicultural dialogue especially in multi-ethnicity and multicultural environment. Bulgaria is an example for good relationship among cultures and it is because of the well developed sport [15].

The training process is a continuous upbringing and improvement of the athletes, whereby they receive the physical and moral-voluptuous training necessary to achieve high sporting results. The concept of learning and training is a lot and it involves all the problems, phases and moments that the athletes go through to achieve perfect sporting mastery. One of these moments is to develop the motor quality "speed".

The speed is manifested in one or another form in every discipline of cycling - from the shortest to the longest. In most cases, it is crucial for ultimate success. It is not possible to imagine a race in which victory is not solved with sprint, and it is hardly possible to overcome your opponent in one case or another without the typical powerful demarage followed by a sprint. In one case the decisive factor is the speed: the speed of pedaling, the speed of the reflex to react instantaneously to the opponent's attack or to surprise him with his quick attack.

According to Tsv. Jeliazkov and D. Dasheva [4] - speed is a motor quality of the person, which allows him to perform separate or complete movements for the shortest possible time, ie with the greatest speed in the specific conditions of the motor activity.

The purpose of the theoretical study is to reveal the peculiarities of motor quality "speed" in adolescent cyclists.

METHODS

The methods we applied were: study the history of the specialized information, expert analysis, theoretical analysis and synthesis.

RESULTS

The analysis of special literature of the leading practical experience testifies that the normalization of the workload must be adequate to age specificities and be oriented to a level typical of higher mastery.

Speed (or so called - speed abilities) is the ability to perform these or those driving activities for a minimum of time. In sports practice, it is important to have the speed that occurs during the performance of the competition or in the means of special training, allowing the athlete to develop a certain speed

The speed of cycling is reflected in rapid response, rapid performance of one movement, the rapid rhythm of the cyclical movements of the feet, and the frequency of muscle contraction and speed of movement in space. The main task of speed training is to increase the body's ability to maximize intensive work per unit of time.

In the initial sports specialization young cyclists begin specialized training. When determining the specific workloads, account must be taken of the age-specific features inherent in the development of the physical qualities of young athletes. In order to achieve high results in cycling sports, it is necessary to have a good knowledge of the anatomy-physiological and functional features of the child's organism, which will maximally support the choice and provide optimal methods of training and will ensure maximum realization of the individual possibilities. In the work of speed, the coach selects one or the other method, which would be most appropriate for the individual qualities of a competitor depending on his current training. Applying one or another method of work requires that the annual plan puts out such training activities that will affect the work both in the preparatory and the basic period.

The development of rapidity in adolescents is subject to many years of research. V. Fárfelj [13] found the maximum rate of movement to 12-13 years of age. This is explained by the great plasticity of nerve processes in children.

Children and adolescents have favorable prerequisites for developing velocity abilities because they are inherently high excitement is the high intensity of the exchange processes. The main means of developing speed are speed exercises, which are performed at maximum speed. However, this must be in full compliance with the following conditions:

The technique of exercise has been mastered to perfection, which ensures performance at maximum speed. A suitable way of doing this is acceleration (pedaling) with increased frequency

The exercises (accelerations) have been absorbed to such an extent that during the movement the willpower is directed to the way, but to the speed of execution

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The exercises (accelerations) have been utilized to such an extent that during the movement the wills are directed towards the way and the speed of execution.

The duration of the exercise is such that at the end of the performance the speed does not fall under the influence of fatigue.

Speed is a complex quality, consisting of the frequency of movements and the speed of movement in space. The development of speed is dependent on biological age, increasing from stage to stage approximately uniformly, according to the speed of movement in space, and the maximum frequency does not change from the middle of the period of sexual maturation. The dosage of the workout to develop the quality of the speed is determined by the continuous duration, which observes that the maximum speed obtained does not suffer a decrease. Any reduction in speed over several times indicates that fatigue and weakening of the will have occurred.

Highest efficiency from speed exercises is achieved through the interval and re-training method. It is due to the fact that they allow the next load to be fulfilled at a certain degree of recovery of the nervous system, which is necessary to assume a high rate of work. In this respect, the coach's creative approach is the decisive factor, ie the attitude of the athlete after the consumption of certain loads. The principle is every new stretch, each new series starting on the background of a beneficial restored organism.

In the development of adolescents, periods of varying intensity of growth of motor skills are highlighted. There are ages and ages with increased results on all tests used, and at other ages and periods, no more or too few tests, there is a significant increase in the results. The degree of impact of physical exercise on the body is largely determined by the level of biological maturation of young cyclists.

It has been shown that the different forms of speed are influenced by the following factors: age, body structure, momentum of other motor skills, degree of physical and mental concentration during the activity. As the development of motor nerve centers ends at about 13-14 years of age1, the greatest increase in speeds is seen in pupils at 10-15 years of age. This is the age at which it is best mastered

This is the age at which the speed movements are best controlled.

In Table 1 we present the average pedaling frequency indices on the bicycle in a different age range with (turnover 48 x 15).

Age [years]	Quantity of the cyclometer for 10 sec. for a moment	Quality of the cyclometer for 1 min.
11-12	20,6	123,6
13-14	25,7	154,2
15-16	31,3	187,8
17-18	34,5	207,0
19-20	35,8	215,4

According to the table, it appears that the frequency of pedaling is quite substantial up to 17-18 years of age. In the coming years, the growth is insignificant. A purposeful pedagogical impact is to achieve an effective development of the quality of the speed in the most favorable age period.

The rapid perception and assessment of moving objects, the spatial assessment of their location, the rapid change of the decisions for action are of particular importance in cycling.

As far as the physical structures are concerned, their variety is extremely large. This also sets out the approaches to their practical development, which is of particular importance to sports practice. Coordination speed is generally the most common form of speed in cycling.

On the other hand, it is known that the speed of cycling races must take place from the beginning to the end of the race. Another problem arises. Not only from the point of view of the nature of the racing activity, but also in order to preserve the level of its manifestation in the race itself. Such a prolonged manifestation of speed gives an idea of he "speed endurance" of cycling riders . The latter largely depends not only on the individual's ability to fight fatigue, but to have a high "speed potential" that can be a reserve for longer on the background of the optimum effort.

Thus, the problem of developing the forms of speed in cycling, which are of particular importance, yields a three dimensional dimension:

Training and improving the speed of thought actions;

Mastering a wide range of options for quick techno-tactical action;

Increasing the basic physical forms of the speed for the successful realization of the motor technical-tactical actions in the course of the race.

Consequently, the content of each exercise for speed will be determined by its focus on solving these tasks. This highlights the problem of selecting the training tools and methods and their place in the training process.

CONCLUSION

Increasing the sporting skill of children and adolescents depends to a large extent on the management of sports activities. Studies are currently actively conducted to determine the parameters of these loads at different ages and levels of training, taking into account the individual development of each cyclist.

For many years, sport-pedagogical scientific thought has experimented and analyzed the peculiarities of man's physical qualities, including speed, in practice there are a number of unexplained situations waiting for her illumination. There is still a great deal of effort and research to address the issues of age dynamics of speed and opportunities to increase it in individual ages with the means of sports training.

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Interdisciplinary

HISTORICAL ASPECTS OF STATISTICAL ANALYSIS IN SPORT SCIENCE

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UDC 93/99:796

SUMMARY

The aim of this paper was to present the historical development of statistical procedures for data processing within the methodology of scientific research in sport and physical education in Serbia. The presentation of historical aspects of statistical data processing in scientific researches was carried out by quantitative and qualitative analysis of the extensive corpus of scientific papers published in the leading scientific journals in Serbia: 1. Facta Universitatis, Series: Physical Education and Sport; 2. Serbian Journal of Sports Sciences; 3. Exercise and Quality of Life; 4. Physical culture. In this way, a significant segment of the scientific research methodology in sports and physical education is considered. In the study of historical aspects of statistical procedures in sport and physical education, a historical and descriptive method has been applied.

Keywords: statistical analysis, physical education, sport science, research design

INTRODUCTION

Methods of statistical data processing can be applied in various scientific disciplines that involve some type of numerical data. Each quantitative research contains a kind of statistical data processing in itself. One of the goals of this article was to determine which statistical methods were applied in works published in scientific journals in the field of sports and physical education in Serbia, as well as to determine the frequency of using different statistical procedures applied in the works that are the subject of this research.

All the sciences are based on precise and consistent data, and for this reason researchers use statistical methods to make the information easier to organize and draw conclusions from them. Statistical analysis is inextricably linked to the design of scientific research. In this article, statistical procedures applied in the science of sports and physical education, as well as their historical development, will be presented.

The method of data collection, data collection instruments and sample variables are verz important steps in performing scientific research. They determine the design of scientific research. After that, statistical data processing is followed. Statistics is a simple way of interpreting the data collected. With the help of various statistical techniques, we describe the characteristics of the obtained data, check the correlation between the individual variables or sets of variables, we examine the differences and the influences between the variables. Statistics can be defined as a mathematical technique by which data are organized, treated and presented for interpretation and evaluation purposes (Vincent, 2005).

Statistics are present in all sciences dealing with quantitative research. The history of applying statistics in science begins in the mid-18th century, when it was exclusively used for the purpose of presenting demographic and economic data of a state. It is also true that certain forms of statistics were used much earlier, even in the period from the beginning of the new era when in the Roman Empire data on the number of inhabitants were collected, the geographical expansion of the empire and the amount of wealth that this empire possessed (Stigler, 1986). In ancient Greece some forms of the simplest statistics were also used, even they were familiar with the notion of an arithmetic mean, which at that time was used only to calculate the mean value of two numbers, and not three or more numbers that began to count only in 16. century when a decimal system was introduced that allowed such calculations (Stigler, 1986). The method of calculating the arithmetic mean was first applied in the field of astronomy when the Danish astronomer of Tiho Brahe attempted to reduce the error that arose when assessing the location of various celestial bodies. Shortly thereafter, in 1599, Edward Wright introduced the notion of a mediator. In his book titled "Certain errors in navigation", in the chapter dealing with the location of the compass, he pointed to the median as one of the most accurate values derived from the series of observations. It was only in 1774 that Pierre Simon Laplace proposed that the median, with the mean value, become one of the values that will be used standardly in describing the characteristics of a set of observations (Stigler, 1973).

Even though some parameters of statistics were used earlier, as the year of the beginning of the application of statistics in science, it was taken in 1662 when John Graun, together with William Pettie, developed the first human statistics and method of censuses or methods of enumerating the population, which represented the framework of modern demography. He was the first to make the so-called mortality table, which contained mortality rates for each year. His book titled "Natural and Political Observations Based on Death Records" is the first book in which statistical analyzes of the role of mortality, based on data on the London population. He had information that annually there were about 13,000 burials in London, that the average number of household members was 8 and that the number of deaths for every 11 families was 3 (Tankard, 1984). Significant progress in the development of statistics was made with the development of the probability theory in which Blaze Pascal and Pierre de Fermat worked (Tankard, 1984). Mathematical probability theory was created as a result of the probability study in games of chance.

The period of modern statistics, when the application of statistics in science to a form that is well known to us today, begins at the end of the 19th and the beginning of the 20th century when Karl Pirson and Frensis Galton transform statistics into a rigorous mathematical discipline that will be used for analysis and conclusions in science, but also in industry and politics. Frensis Galton will remain remembered in the history of science as a scientist who introduced the concept of standards of deviance, correlation and regression. He is the first to apply the above analyzes to study the different characteristics of a person, such as body height and weight, and, in this way, explain the effect of inheritance on certain physical characteristics of humans (Galton, 1877). Karl Pirson also established the concept of the correlation coefficient and defined it as the Pirson product of the moment of correlation, which is still widely used today in the science of sports and physical education. Pirson also introduces the term modus as the most common value in a series of observations in statistics (Pearson, 1895). Frensis Galton and Karl Pirson founded in 1901 a journal called Biometrics (Stigler, 2002). This is the first scientific journal published by papers in the field of mathematical statistics and biometrics. Works that dealt with the anthropometric characteristics of different categories of respondents were regularly published, with more or less complex statistical procedures that were used to investigate correlations among variables, their mutual influence and differences between different categories of respondents. Shortly after the founding of the charcoal they founded the two at the University of London and the first Department of Statistics in the world (Guttorp, & Lindgren, 2009). The second wave of science statistics development was led by Ronald Fisher, who advocated that statistics become an academic discipline that will be taught at universities around the world. One of the more important works he published is the title "Statistical methods for researchers". This book has been translated into many different languages, making it one of the main references in the works of scientists from different fields. In 1935, he published a book titled "Design of Experiments", which also came to be widely used in science. Summarizing Fischer's work, we can, as its greatest contribution, distinguish the introduction of the notion of variance in statistics and the application of the variance analysis method (ANOVA). (Box, 1978). In addition, he appointed and promoted the method of maximum credibility (Fisher, 1925). The method of maximum credibility was introduced into mathematical statistics in the second decade of the twentieth century. The idea of this method is to select the value θ for the parameter estimation where the probability of the realization of the obtained sample is greatest. It turned out that this method gives estimates that are asymptotically (ie for a large sample) more efficient than estimates obtained in any other way. However, the application of this method is often related to complex calculations. In this period, there were other important discoveries in the field of statistics when Spearman introduced the ranking correlation coefficient, which, according to him, would be named Spearman's coefficient (Tankard, 1984). This coefficient was a useful addition to Pirson's correlation coefficient and was used when the data on which the statistical analysis was carried out were divided into ranks. Spearman is also attributed that he is the creator of the factor analysis first applied in the field of psychology (Tankard, 1984). After Fischer, Egon Pirson and Jerzy Neumann, who worked the thirties of the 20th century (Walker, 1975), made a significant contribution to the development of the application of statistics in science. Egon Pirson was son of Karl Pearson and one of the leading British statisticians.

The aim of this research is to analyze historical aspects of application statistical procedures in the published papers in the four scientific journals in Serbia (Physical culture from Belgrade; Facta universitatis - Series: Physical Education and Sport from Niš; Serbian journal of sports sciences from Belgrade; Exercise and Quality of Life from Novi Sad)

METHODS

In the study of historical aspects of statistical data processing in scientific research in sports and physical education, the historical method was applied. This is the basic method of research in a historical methodology that primarily uses historical sciences. However, today this method finds application in other social and natural sciences, so it can be applied as one of the basic methods in the history of physical culture (Savić, 2008).

For the purposes of conducting this research, an instrument was created for the classification and profiling of scientific research published in scientific journals in the field of sports and physical education in Serbia. Based on this instrument all published works were classified into certain categories, and then analyzed methods of statistical data processing (statistical analysis) applied in works published in journals. Considering that the works according to the above criteria were classified and tabulated, the frequency of application of certain statistical procedures was determined as one of the key characteristics of the methodology of scientific research.

RESULTS & DISCUSSION

In the field of sports and physical education science in Serbia, descriptive statistics are starting to be applied in the first scientific publications published in the first issues of the *Fiskultura* magazine published by the FNRJ Committee on Physical Education In these works, in general, there were no other more complex procedures that can be seen from Table 1.

Table 1. Parameters of Descriptive Statistics for Facta Universitatis Physical Education and Sport, Serbian Journal of Sports Sciences, Exercise and Quality of Life and Physical Culture (period 1947-2013): Statistical Procedure

		Frequency	Percentage	Valid percentage	Cumulative percentage
	T test	274	12.2	22.4	22.4
	Non parametric	92	4.1	7.5	29.9
	ANOVA	256	11.4	20.9	50.8
	ANCOVA	31	1.4	2.5	53.3
	MANOVA	62	2.8	5.1	58.4
	MANCOVA	24	1.1	2.0	60.4
	Correlation	194	8.6	15.8	76.2
	Canonical discriminant	38	1.7	3.1	79.3
	Canonical correlational	49	2.2	4.0	83.3
	Regression	128	5.7	10.5	93.8
	Factorial	64	2.8	5.2	99.0
	Taxonomy	5	.2	.4	99.4
	Mathematical modeling	4	.2	.3	99.8
	Neural network	2	.1	.2	99.9
	Claster	1	.0	.1	100.0
	Total	1224	54.4	100.0	
Missing	Descriptive statistics	1025	45.6		
Total		2249	100.0		

In order to apply statistical methods in works published in Physical Culture (Belgrade), Facta Universitatis: Series Physical Education and Sport (Niš), Serbian Journal of Sports Sciences (Belgrade) and Exercise and Quality of Life (Novi Sad) methods are classified into the following categories:

1. Descriptive statistics;
2. T-test;
3. Non-parametric statistics;
4. Univariant Variance Analysis (ANOVA);
5. Univariant analysis of covariance (ANKOVA);

Multivariate Variance Analysis (MANOVA);
Multivariate analysis of covariance (MANKOVA);

8. Correlations;
9. Canonic discriminatory analysis;
10. Canonic correlation analysis;
11. Regression analysis;
12. Factor analysis;
13. Taxonomic analysis;
14. Method of mathematical modeling;
15. Neural networks;
16. Cluster analysis.

The results obtained are presented in Table 1. Based on the insight into the results, it can be concluded that almost all papers that had some kind of statistics started with the parameters of the basic descriptive statistics describing the basic characteristics of the selected sample of the respondents. It should be noted that the descriptive statistics parameters did not contain from the beginning all the parameters that are common today. In the first papers published in the Physical Culture journal from 1947 to 1956, descriptive statistics usually included only the minimum and the maximum value, the mean value, and the range. Only data on standard deviation could be found. It should also be noted that in this period, the authors presented the basic parameters of descriptive statistics with the term "variational statistics". Frequency (frequency) of some phenomenon, or the number of cases of one class, was also frequently used during this period. By simply counting cases in isolated classes or categories, authors determined distribution in a particular set of respondents. In addition to descriptive statistics in the first two decades of the Physical Culture, only the procedures for determining simple correlations between individual variables, occasional regression analysis, and a somewhat more frequent t-test for testing the differences between the two groups, as well as the ANOVA for the univariate examination of differences in variance between several groups . Correlation is if we exclude descriptive statistics that are represented in all papers with some kind of statistical analysis, with t-test (23.3%) quite certainly one of the most commonly used statistical methods (18.2%). Its etymological root lies in the expression relation, which literally translated means the relationship between two or more phenomena (Perić, 1996). The "co" prefix in the "correlation" column indicates the reciprocal relationship. It is clear why this type of statistical analysis very soon found its application in papers in the field of sports and physical education. Scientists from this field immediately after determining the quantitative indicators of one's abilities and characteristics seek to determine the interrelation of these variables by expressing it with a value called the coefficient of correlation and which, as already mentioned at the beginning of this chapter, is pioneered by Frensis Galton, and then perfected by Karl Pirson (Perić, 1996). In addition to the simple correlation that began to apply already in the first papers published in the Physical Culture Journal, other more complex correlation procedures, such as the canonical correlation analysis, which quantify the relationship between two complex (multidimensional, multi-tematic) variables systems, appear in time. The first works that applied the canonical correlation analysis in our oldest journal Physical Culture appear in the period from 1977 to 1986. Since then, until 2013, the percentage of papers with this type of analysis has steadily increased. It is a very complex and mathematically complex analysis performed exclusively with the help of computers and statistical software packages, so it is understandable why this analysis has not previously appeared in the works.

Examination of differences in the abilities of the respondents through the t-test or ANOVA method began to apply only in the period from 1957 to 1966. Since then, until the end of the 1980s, the application of methods for examining the differences between dependent or independent samples has been steadily increasing. The application of multivariate analysis of variance to the sample of papers from the journal Physical Culture has only been in use since the eighties, in order to further increase its use with the highest percentage of representation in the period from 1997 to 2006.

The first work with the application of factor analysis was published in the journal Physical Culture from 1970, when a group of authors (Momirović et al., 1970) led by Kosta Momirović worked on determining the factor structure of some motor tests. On the basis of 14 motor tests for the male and female sex group, the motor factorization was performed by separating three factors that were valid for both sexes (factor of explosive force, repetitive force factor and cardiovascular factor). In addition, one more factor specific for half of the respondents was identified. In women this was a factor of balance, and in men it was a factor of coordination.

Factor analysis is a set of mathematical-statistical procedures that enable in a greater number of variables, among which there is connection, to determine a smaller number of fundamental variables explaining such interconnectedness. These fundamental variables are called factors. In the application of factor analysis, the variables observed are called manifest variables, and the factors that are determined in the process of factor analysis of the mutual relations of manifest variables are called latent variables (Fulgosi, 1988). This method, as was apparent from the previous example, began to be applied in works in the journal Physical Culture during the 1970s. The peak in the applied factor analysis was achieved in the period from 1977 to 1986. and from 1987-1996. when the most prominent scientists in the area of the former SFRY worked on defining the structure of latent motor dimensions. Already in the second half of the nineties, the number of works with factor analysis decreased in the journal Physical Culture.

It should be noted that a group of researchers gathered around Dr. Kosta Momirovic worked on the development of new statistical analyzes and the improvement of existing ones. A simple algorithm for analyzing structural changes is one of the analyzes done by domestic researchers and keynotes. She was first applied in the journal Physical Culture in 1985 in the work of Gordana Čačija (1985). In 1990, for the first time, Physical Culture magazine published works with statistical analysis called SSDIF by Koste Momirović (Bosnar, Prot & Momirović, 1984). It was an analysis based on discriminatory and factorial analysis.

One statistical analysis that represents the true exclusivity in the science of sports and physical education is the application of neural networks. These are Arteficial Neural Network that are presented as a sum of artificial neurons that are interconnected and interactive through signal processing operations. This method is modeled on the human brain and represents a very abstract method. The network can have a series of inputs or only one input and always only one output. Among them is one or more so-called. hidden layers (multilayer networks). Individual neurons, as well as layers, are interconnected by the links through which the signals go. Connections between them are activated if the set condition is satisfied through the activation function. In all publications published in the journals covered by this doctoral dissertation, only two papers using neural networks were found in the Physical Culture Journal in 1988 and the 2011 Exercise and Quality of Life journal.

When it comes to non-parametric statistical methods, we can conclude that their representation in the works was very small and that on the sample of all journals it was 7.2%. It should be taken into account that in this category all the different techniques of nonparametric statistics, which are represented with even lower percentage, are classified into each category if we observe each of them individually.

CONCLUSION

The study of the genesis of statistical procedures for data processing in scientific research in the area of Serbia gave the answer to the question how some research methods from other scientific disciplines, such as mathematics, physics, and certainly medicine and physiology, have settled in scientific research practice in sport and physical education, that certain data analysis procedures were overcome, although some of them had a very high level of applicability for many years. The development of statistical procedures in the science of sports and physical education had a common trend that followed technological development. It can also be somewhat derived that in the period when the testing procedures did not have sufficient metric characteristics or indirectly measured certain physical and motor characteristics of different categories of respondents, the researchers tried to improve the quality of the obtained data with very complex statistical procedures.

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CORRELATION BETWEEN SELF-EFFICACY AND DIFFERENT STRATEGIES FOR COPING WITH STRESSFUL SITUATIONS IN FEMALE HANDBALL PLAYERS

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UDC 796.322

SUMMARY

Almost every competition, especially a championship or one of greater importance to an athlete, represents a "stressful situation", or more precisely an objective state that stimulates or causes stress. Numerous studies have shown that self-efficacy, as one of socio-psychological factors, affects the way of overcoming stressful situations in sports. The aim of this research is to determine the correlation of self-efficacy with different strategies for dealing with stressful situations in female handball players who, during the testing period, competed at the highest level of national handball competition of the Republic of Serbia. There were 15 participants in this study. Variables in the research: *Strategies for overcoming stressful situations and Self-efficacy.* Tests were conducted to determine the significance of correlation between strategies of overcoming stress and self-efficacy. The obtained data was analyzed using the program for statistical data processing IBM SPSS Statistics 19.

Keywords: sports psychology, handball, stress, self-efficacy, correlation

INTRODUCTION

Achieving maximum results has always been the ultimate goal of every athlete. Improvements in sports technology and discoveries of new information in the field of sports science have enabled superb athletes to realize their full potential, which could later result in materialization through financial profit, thus existential stability for athletes, as well as other people engaged in sports. Financial motives have become an indispensable part of modern sport, especially in poorly developed countries, where financial investments vary from sport to sport. An athlete is the main actor in a sport and everyone has the highest expectations from the athlete, making him/her subject to numerous stressful situations that can often jeopardize the athlete's contribution to the sport he/she plays. One of the most recent problems that sports psychology is addressing is overcoming stressful situations in athletes.

Almost every competition, especially a championship or one of greater importance to an athlete, represents a "stressful situation", or more precisely an objective state that stimulates or causes stress. Today, stress is treated as a generic term, i.e. not as a variable, but as a section that consists of a number of variables and processes (Lazarus and Folkman, 2004).

In research conducted so far, some authors (Mellalieu, Hanton & Fletcher, 2006) have identified the highest ranked stressors in sports: athlete's physical fitness, opponent's level, pressure and expectations related to performance, team atmosphere, problems in relationships with other important people, nature of the event and questions related to self-representation and assessment by the environment. Socio-psychological factors are dominant in most of the above mentioned stressors. The existence of a large number of stressors, their intensity and frequency in competitive sports entails the assumptions that successful overcoming of stressful situations is an extremely important factor for success in sports and that more successful athletes overcome stressful situations more adequately in comparison to less successful athletes (Mitić, 2016). Any educated coach or psychologist should recognize the acute stress in an athlete in timely manner and respond in order to remove the source of the stress. Some of the known sources of acute stress in sports context are the following: making a physical or mental mistake, anticipating criticism or warnings from the coach, observing the opponent while cheating, experiencing pain or injury, poor decision by officials, perceiving that the opponent's good performance, poor performance due to bad weather or bad playing conditions, and obstructiion by the audience (Anshel & Kaissidis, 1997).

Kaličanin (2001) defines stress as a comprehensive bio-psycho-social response of the body to the action of any stressors from external and internal environment. Due to the above statement, it can be concluded that socio-psychological factors can influence overcoming stressful situations in sports. The aim of this research is to determine the correlation of self-efficacy with different strategies for dealing with stressful situations in female handball players who, during the testing period, competed at the highest level of national handball competition of the Republic of Serbia.

Having the transactional approach as a starting point, there are three dimensions (styles) of overcoming stress: problem or task-oriented overcoming, emotion-oriented overcoming and avoidance-oriented overcoming (Endler & Parker, 1990). Given that self-efficacy is defined as an individual's assessment of his/her own ability to organize and execute certain actions necessary to achieve a desired outcome (Bandura, 1999, according to Smederevac and Mitrović, 2009), it is considered that female handball players with greater level of confidence would overcome stress by focusing on the problem, i.e. completing the task. Numerous studies conducted in other sports prove that self-efficacy is associated with different strategies for overcoming stressful situations. According to that, it can be mentioned that one study has proven that individuals with higher self-efficacy achieve better results in overcoming more complex elements of skiing technique (Cigrovski, Matković & Ivanec, 2008). Matić's research (2016) has shown that, statistically, overcoming stress while focusing on the problem is significantly related to self-efficacy, whereas, on the other hand, emotion-oriented overcoming is negatively correlated with self-efficacy based on the entire sample of 509 participants (340 athletes and 169 non-athletes). Handball is a team sport and it is necessary to, in addition to physical preparation, work on the psychological preparation of players. For that matter, this research seeks to establish the correlation between self-efficacy and different strategies of dealing with stressful situations as well as to determine which strategy is the most appropriate for professional female handball players.

METHODS

Subjects

The number of participants who have completed the survey is 15. The sample consists of female handball players from Handball Club "Radnički", Kragujevac, who competed in the highest ranked state competition at that time (season 2016/2017). The participants were 18-26 years old. All participants volunteered for the testing.

Procedure

Research variables:

- *Strategies for overcoming stressful situations* (problem or task-oriented overcoming, emotion-oriented overcoming and avoidance-oriented overcoming - distraction and social diversion) – put into use with scores from Endler & Parker's CISS instrument (The Coping Inventory for Stressful Situations, Endler & Parker, 1990);
- *Self-efficacy*, put into use with scores from the Generalized Self-Efficacy Scale (GSE, Schwarzer & Jerusalem, 1995).

Statistical analysis

The significance of correlation between strategies for overcoming stress on one hand and self-efficacy on the other hand was tested. The data were analyzed in the statistical data processing program IBM SPSS Statistics 19. For this purpose, Pearson's correlation coefficient was applied, whereas the relationship between tests was interpreted using the following criteria: 0-0.1 trivial, 0.11-0.30 small, 0.31-0, 50 moderate, 0.51-0.70 large, 0.71-0.90 very large,> 0.91 almost perfect (Hopkins, 2000). The level of statistical significance is $p<0.05$.

RESULTS

Table 1. Correlation analysis of self-efficacy and different strategies for overcoming stressful situations

Correlations

		Self-efficacy
Task-oriented overcoming	Pearson Correlation	,359
	Sig. (2-tailed)	,189
	N	15
Emotion-oriented overcoming	Pearson Correlation	-,152
	Sig. (2-tailed)	,589
	N	15
Avoidance-oriented overcoming	Pearson Correlation	,168
	Sig. (2-tailed)	,550
	N	15
Subscale 1	Pearson Correlation	,229
	Sig. (2-tailed)	,412
	N	15
Subscale 2	Pearson Correlation	-,058
	Sig. (2-tailed)	,838
	N	15

Criteria according to Hopkins (r): 0-0.1 trivial, 0.11-0.30 small, 0.31-0.50 moderate, 0.51-0.70 large, 0.71-0.90 very large, >0.91 almost perfect. Subcale 1- Distraction. Subscale 2 - Social diversion. p<0.05 (2-tailed).

DISCUSSION

Based on the obtained results (Table 1), it can be concluded that all variables related to strategies for dealing with stressful situations have no statistical significance ($p<0.05$) and have a very small (trivial), as well as one moderate correlation with self-efficacy according to one variable. There is a possibility that the cause of these results were limitations in the conducted research, which mostly relate to the use of instruments used for a general, but not specific situation in sports. The reason these instruments were used was the intention to compare the sports sample with the general sample in the future. There is no point in using the instruments exclusively meant for athletes on the general population, whereas that does not apply for the instruments intended for everyone. As always, the lack of one research should serve as a message for new and better future research (Mitić, 2016).

According to Parker & Endler (1992), avoidance-oriented strategies for overcoming can be divided into two subcategories: avoidance directed at people (social diversion) and orientation to a new task that is not related to the stressful situation or event (distraction). The obtained results show that self-efficacy of female handball players trivially correlates with the social diversion variable with the negative sign ($r= -0.058$), which means that there is a possibility that the players with a low level of self-efficacy overcome stress by using avoidance-oriented overcoming directed at people, whereas small correlation ($r= 0.229$) between self-efficacy and the distraction variable suggests that individuals with medium level of self-efficacy decide to shift to a new task in order to overcome a stressful situation. The avoidance-oriented overcoming variable has also shown a small correlation ($r= 0.168$) with the self-efficacy variable, which is not a surprising result for the participants who play a team sport. According to Parker & Endler (1992), this category of athletes is more concerned with group functionality than the individual, thus it is very likely that they will use some of the avoidance strategies in dealing with stressful events because group dynamics and interpersonal relationships can be a significant resource in overcoming stress. Therefore, female handball players can, within a group, focus on a new task that is not related to a stressful situation or event they have experienced individually (e.g. if one player makes a mistake on defense and the opposing team scores, she will, along with other players on her team, put her attention to scoring a goal in offense, thus solve the problem that caused the stressful situation). However, individuals who play a collective sport, in this case handball, are not only exposed to stressful situations during the course of a game, but they also face many problems off the court. Situations where coaches react in affect as a response to a player's mistake during training are frequent and this, depending on the personality of the player, can be an initial factor for causing stress in players. In this situation, through socializing with team members and receiving social support, often through some form of verbal stimulation such as a word of encouragement, players can try to avoid confronting the problem. This kind of strategy for dealing with a stressful situation may be considered appropriate at times because it prevents the emergence of conflicts that would cause many additional problems and thus disrupt the harmony of the entire team. The results show that emotion-oriented overcoming of stress is negatively associated to self-efficacy in female handball players (r= -0.152). These findings were expected, as many studies have proven that low self-efficacy is associated with strategies that are less adaptive, and that individuals with high self-efficacy use coping mechanisms oriented to the problem (Matić, 2016, according to Maddux, 2005 and Trouillet, Gana, Lourel & Fort, 2009, according to Genc, Pekić and Matanović, 2013; Avramović and Petrović, 2012). Strategies with emotion-oriented dealing with stress aim to control emotional reactions, to maintain an optimistic attitude by refusing to accept the so-called "worst" scenarios (Zotović, 2004). An example of such response in handball can be detected in team's individuals who do not give up on the faith in winning, even though their team is losing by a large goal difference, where they are not able to contribute to the realization of their wishes.

Moderate, and at the same time the largest, correlation in this study (r= 0.359) is expressed between the variable of self-efficacy and the problem or task-oriented overcoming variable. Problem-oriented strategies for dealing with stress consist of defining the problem and looking for different ways to solve the problem, making a decision about the concrete solution that will be implemented and undertaking concrete actions to solve the problem. These forms of overcoming stress are oriented towards solving the problem that arose in the interaction of the individual and his/her environment, whereby self-confidence and confidence in their abilities and capacities can have a significant role (Wang & Caudino, 2011, Chu-Lien, Chao, 2011 according to Genc, Pekić and Matanović, 2013 according to Matić, 2016). Beliefs about self-efficacy are constructed from sources of information that were previously related to the social context: "power of experience", modeling, social pressure and physical and emotional states (Smederevac and Mitrović, 2009). Therefore, more experienced handball players, who are more secure in their playing skills, will direct their knowledge and skills to solving the problem in order to cope with stress. If, for example, the players have previously not been introduced to the opposing team, they need to make decisions about the game tactics on the go. If the opposing team is made of exceptionally tall players, they will notice this problem during the pregame period. In consultation with the coach, they will make a strategy and then put it into action during the game. Every athlete who deals with stress using the problem-oriented strategy will act this way because he/she has a high level of self-efficacy, hence the correlation of these variables can be considered as a significant predictor of success in a team sport such as handball. High level of perceived self-efficacy reduces the chance that an athlete applies self-handicap, i.e. to look for reasons of poor performance in advance. Therefore, coaches are recommended to work on improving self-efficacy (Kuczka & Treasure, 2005 according to Matić, 2016).

It is well known that there are multiple sources of stress. In handball, as a team sport, athletes mostly encounter social stress that involves other people as potential stressors. They act on individuals as stimuli that raise their level of alertness (arousal), which can at any time pass the limits of an optimal level. Generally, it is considered that a smaller society (fewer people together, one sports team) can raise a low level of alertness to an optimal level, and that a greater number of other people (for example, the audience) raises this level above optimal. In such situations, in order to reduce the burden put on individuals, in this case female handball players, the decision comes down to two types of reactions: the players invest more effort to remove the burden or give up the task. Such reactions are known as "fight or flight" (Selye, 1975). The mentioned reactions can be identified with problem-oriented and avoidance-oriented strategies for dealing with stress, where, based on the results obtained in this research, it can be concluded that players with a higher level of self-efficacy will invest greater efforts to solve the problem than those with a lower level of self-efficacy. Competition in terms of relations among the players of two opposing teams does not have to be the only rivalry that appears in handball. Competition between players on the same team occurs very often, where a situation like that can cause a diffuse emotional tension in each individual and thus reduce the level of players' self-efficacy. There are numerous factors that greatly increase tension, e.g. the desire for the athlete's success before, during and after a competition, referees and the audience at the competition, not only the crowd cheering for the opponents, but also the crowd that, supporting their team, puts pressure on the team seeking victory at all costs. Given that these factors construct players' self-efficacy, it is necessary to work on finding ways as simple as possible for overcoming social pressure, as well as other disturbing factors. The problem-oriented strategy for overcoming stress is in the greatest correlation with self-efficacy, but other socio-psychological factors need to be taken into consideration in order to determine which component is crucial in the selection of the strategy. It is certain that players with greater playing experience will be in favor of players with less playing experience, because when dealing with stress, they will predominantly focus on the problem, whereas players without experience, due to increased tension, fear and insecurity, will decide for another strategy for dealing with stress and it is most often avoiding the problem.

CONCLUSION

The aim of this research was to determine the correlation of self-efficacy with different strategies for dealing with stressful situations in female handball players who competed in the highest rank of national handball competition during the testing period at the level of the Republic of Serbia. The research involved 15 female handball players, 18-26 years of age.

The obtained results show a moderate correlation between self-efficacy of female handball players with the problem-oriented variable (r= 0.359), whereas with the remaining variables (emotion-oriented overcoming of stress and avoidance-oriented overcoming of stress, distraction and social diversion) show trivial and very little correlation. These results indicate that players with a higher level of self-efficacy overcome stress by focusing on the problem that causes the stress. It is assumed that this way of dealing with stressful situations will contribute to better results in the game, but also in the functioning of the athlete within the team. Handball players with a low level of self-efficacy consider themselves to be less effective, insufficiently good to perform tasks given by coaches, as well as the tasks that the game of handball sets itself. This situation is most often the cause of frustration that causes an "internal collision" in handball players with the low level of self-efficacy, and this is, at the same time, one of the main causes of stress. Emotion-oriented or avoidance-oriented strategies in the form of distraction and social diversion are the solutions for which handball players in such situations most often go for. Too much tension and fear are often the fundamental predispositions for reducing efficiency and athletes' impact on the competition. In order to reduce the number of mistakes and thus improve the outcome of the entire game, in addition to improving the technique and tactical elements, it is necessary to work on improving the psychological part of an athlete's personality.

This research has pointed out the importance of correlation of the socio-psychological factor (self-efficacy) with different strategies of overcoming stress in professional athletes (female handball players) in team sports. The suggestion for further research would be to test of all socio-psychological factors and their correlation to different strategies for overcoming stress at the level of the entire Handball Super League of Serbia (the highest rank of the competition) and based on teams' ranking, to determine whether the more successful teams have handball players with the higher level of self-efficacy and how they deal with stress.

This data would be used as a basis for coaches to determine in which way and which personality traits should be developed and emphasized in athletes in order for them to have high self-evaluation of their socio-psychological factors and thus more effectively overcome stressful situations that they encounter in their sport.

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DETERMINANTS OF PROMOTING PHYSICAL AND PSYCHOLOGICAL WELL-BEING

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UDC 159.9:796

SUMMARY

In this paper we used different research findings on the roles of determinants of promoting physical and psychological well-being of regular physical activity. The main factors in promoting physical and psychological well-being of the exercise participants are proper load dosing and the balance between loads and recovery. Properly dosed physical activity may bring changes in several domains: physical, cognitive, emotional and social development. Empirical researches show that in an individual's health status optimum loads are moderate (45-60%) and medium (60-75%). Implementation of physical activity in everyday life, from period of middle childhood (6-11 years) to advanced late adulthood (65 years-death), presents strong health prevention and intervention and searches for an answer on determinants and well-being of regular physical activity from researchers, physiologists, psychologists and kinesiologists. Research findings indicate that balance between training loads and recovery stimulates the functioning of autonomous, endocrine and immune system. Further studies should reveal what forms and physical activity intensities produce positive effects on physical and psychological well-being in different age groups.

Key words: determinants, well-being, physical activity, age, sex.

INTRODUCTION

For scientist-researchers and scientist-practitioners, it is important to examine what are the actual changes encouraged by regular physical activity and games with regard to age and sex and what is the way to enhance human life since these findings are the basis for creating preventive and interventional programmes for children, adolescents and adults (Trninić, Trninić, & Čavala, 2017).

Shaw, Gorely and Corban (2005) claim that the increase of positive effects of regular exercising is based on the following factors: choosing a fun activity, the type of activity, exercise factors: frequency, duration and exercise intensity. At the same time, behaviors regarding health, adequate diet, keeping appropriate body weight and mental activity (improves cognitive functioning) are of extreme importance since they help in reducing physical and cognitive deterioration (Berk, 2010). Thus, crucial basic goals of systematic physical exercising are learning movement skills, prevention of injuries, neuromuscular programmes (focused on strength, power, flexibility and mobility) and metabolic conditioning (enhancing the development of specific energy systems). In the process of regular exercising, it is essential to use developmental maintaining and regenerative training loads.

Exercising should be enjoying and a positive affective reaction to experience in exercising which results in feeling pleasure and fun and this can influence the modeling of personality in an eligible way (Raedeke, 2007). At the same time, while enjoying physical activity, body and cognitive changes can be affected by activity factors such as intensity, duration, and frequency of exercising (Shaw, Gorely, & Corban, 2005), in addition to motivational climate and personal traits of physical activity programme leader (Trninić, 2015). Further on, technical aids are extremely important as well, the selection of exercise forms satisfying individual characteristics as well as the selection, order and the way the exercises are performed. Empirical findings show some kinds of activities can contribute more to well-being than others, i.e. they can encourage various actual changes (Landers & Arent, 2007). For example, a physical activity involving stomach, rhythmic breathing (e.g. swimming, running/walking, yoga) is related to positive physiological and psychological effects. Such physical activities give more possibilities to relax and decrease the arousal level, serving at the same time to reduce stress reactivity. Thus, factor manipulation in exercising which involves exercise frequency (e.g. 3 or 5 times a week), load extensity and load intensity results in adaption stimulating of different organic systems, i.e. in numerous physiological and morphological changes in an organism. For example, Legrand and Heuze (2007) state that exercise frequency may be important in reducing depressive symptoms, suggesting that exercising 3 to 5 times a week significantly reduces depression compared to exercising once a week. The most important psychological variables enabling the change of exercisers' behavior are most likely motivation, openness and personal responsibility for changes. Finally, even personal characteristics in psychologists and kinesiologists and their supporting behavior, in addition to combinations of different intervention programmes, influence physical and psychological well-being (Trninić, Trninić, & Pulja, 2016; Trninić & Trninić, 2017).

PROPER LOAD DOSING AS AN IMPORTANT DETERMINANT OF PHYSICAL AND PSYCHOLOGICAL WELL-BEING

Properly dosed physical activity in different age groups can influence the changes in several domains: physical, cognitive, emotional and social development, all of which are interrelated (Berk, 2010). The author claims that, according to the lifespan development approach, an individual's development is a life spanning, multidimensional (under the influence of biological, psychological and social factors), multidirectional (characterized by incline and decline of characteristics) and neuroplastic process (can be changed under the influence of new experiences). In relation to this, there are research findings on the possibility to change neurobiological system under the influence of physical activity (Viru, 1995; Weineck, 2000); Berk, 2010).

Berk (2010) is discussing the question of how much physical activity is recommended for a healthier, happier and longer life considering that biological aging or senescence starts in early adulthood. The author claims that aging can be encouraged by weakening of the endocrine and immune system. Subsequently, she claims that moderately intensive physical activity, e.g. 30 minutes of brisk walking on most of the days in a week, leads to the stimulation of aerobic metabolic processes as well as to positive consequences for the health of people who were previously physically inactive. Moreover, National Center for Health Statistics (2006) recommends 30 minutes of moderate physical activity on most of the days of the week. However, Health Canada (2000) recommends moderate physical activity of at least 60 minutes a day or it can be reduced to 20 to 30 minutes if the physical activity is done with a higher intensity (e.g. running or fast swimming). It is important to stress that "with all other preventive measures, adequate regular physical activity most certainly will not dismiss causes, but is a significant resistance factor of an organism in coping with unwanted reactions to stress" (Heimer, 2016, p. 56).

In the process of regular exercising, physiologists, psychologists and kinesiologists suggest dynamic activities in individuals with appropriate health status for at least three times a week with the duration from 30 to 60 minutes (National Centre for Health Statistics, 2006; Health Canada, 2000). Thus, different age groups ask for different intensity and volume of training loads. For example, during a health related physical activity, kinesiologists suggest using a relatively low intensity load for individuals younger than 50 years where their heart frequency ranges between 130 and 160 beats per minute due to the influence on cardiovascular, respiratory and metabolic system. However, in individuals over the age of 50, regenerative load is advisable and the primary goal is to relieve in addition to regenerate and recover the organism.

The stimulation of developing aerobic or oxygen energy systems enables a positive influence on reducing quantity and intensity of anxiety and depression symptoms (Landers & Petruzzello, 1994; Bartholomew & Linder, 1998; Craft & Landers, 1998; Shaw, Gorely, & Corban, 2005; Berk 2010; Weinberg & Gould, 2011; Cox, 2012), but also affects regeneration and recovery of an organism (Milanović, 2013). Furthermore, regular aerobic activities of moderate load positively influence the functioning of the nervous system, the increase of blood circulation in the brain as well as the increasing of the dopamine and serotonin level, neurotransmitters which are connected to mood regulation and mental health (Landers & Arent, 2007; Weinberg & Gould, 2011; Cox, 2012; Heimer, 2016). It is assumed that the plasticity of neurobiological functioning is displayed in a way that regular exercising and relaxation techniques can stimulate the release of a large quantity of dopamine and serotonin.

Moreover, physical exercising stimulates brain structures to operate as well as multiple biological processes, neurotransmitters „chemicals in the nerve cells that are responsible for the transmission of a nerve impulse from one cell to another" (Larsen & Buss, 2014, p. 649) and hormones „chemical substances that travel through the blood stream and affect the activity of bodily organs, contribute to psychological characteristic in behavior, and the interplay between psychological and bodily processes“ (Cervone & Pervin, 2008, p. 358) and mood regulation (Pervin, Cervone, & John, 2008). Further on, physical exercise of longer duration with moderate or medium intensity provokes adaptation changes manifested in the increase of oxygen uptake, faster recovery and increased activity of aerobic metabolism enzymes which most likely enables improved and stable functioning of organs and organic systems, "and increased level of endorphin, a hormone in charge of improving mood and energy" (Heimer, 2016, p.9). At the same time, physical activity with moderate intensity has anxiolytic and antidepressive effects which reveal the plasticity of neurobiological functioning (Cervone & Pervin, 2008; Berk, 2010; Trninić, Trninić and Čavala, 2016). Furthermore, it is crucial to point out that applying a continuing method with low intensity is basic for the development of aerobic endurance in health related exercising. Gradual progression of training loads and an appropriate life style (e.g. enough sleeping, balanced diet) can be crucial factors determining the effects of physical activity. In the process of physical exercising, it is essential to focus on the reaction of every exerciser and individualize their programme. Recent researches show high intensity aerobic activity is not essential in order to achieve positive effects (Landers & Arent, 2007).

BALANCE BETWEEN LOADS AND RECOVERY AS PREREQUISITE OF PHYSICAL AND PSYCHOLOGICAL WELL-BEING

It may be assumed that balance between training loads and recovery stimulates the functioning of endocrine and immune system and excludes the possibility of an organism's inadequate adaptive response (e.g. exhaustion, overreaching, overtraining and burnout). As opposed to optimal loads, excessive loads can stimulate immune system function decrease in an organism (Weineck, 2000; Milanović, 2013). This is extremely important in late adulthood when "immune system is less efficient which enables disease progress and manifestation of autoimmune reactions" (Berk, 2010, p. 579). Research findings reveal a positive influence of regular properly dosed aerobic activity on immune functions in young and older individuals, while strength training does not positively affect the immune response (Matković & Ružić, 2009), but leads to neural or functional and structural effect (Siff & Verhoshansky, 1999). Due to given reasons, it is necessary to stimulate strength and power development due to neural changes (e.g. intermuscular and intramuscular coordination) and structural changes (e.g. increase of muscle mass i.e. of cross-section, selective hypertrophy of slow or fast muscle fibres). Further on, exercises stimulating development of strength and power in non-training individuals can encourage fast changes in strength and power, they reduce the possibility of decreasing muscle mass, and at the same time potential biological consequences (Heimer & Rakovac, 2006; Berk, 2010) particularly if exercising is followed by balanced diet and supplementation. In relation to this, in middle adulthood and late adulthood it is essential to encourage neuromuscular control of movements and equally strengthen all muscle groups, develop mobility and flexibility since it can reduce the negative impact of arthrosis and the loss of bone mass or osteoporosis. „The autonomic nervous system functions less well in old age and releases more stress hormones“(Berk, 2010, p. 599) which leads us to the importance of performing aerobic physical activities in everyday life.

Furthermore, „the immune system functions less effectively in late life, permitting diseases to progress and making autoimmune responses and stress-induced infection more likely“ (Berk, 2010, p. 600). Since this leads to the fall in immune system functioning, physical activity at moderate intensity is still a strong health intervention in late adulthood. Regular physical activity over a period of a few years may be a more efficient prevention of osteoporosis, especially if it is performed in childhood, adolescence and early adulthood. At the same time, physical inactivity can influence the decrease of bone mass which increases the risk of bone fractures. Thus programmes focusing on morphological changes, development, and/or maintaining mobility and flexibility, strength and power are of extreme importance since they prevent a severe loss of mobility due to reduced joint flexibility and to the loss of muscles and bone strength.

CONCLUSION

In this paper we used different research findings on what are the determinants for promoting physical and psychological well-being of regular physical activity. The key method for promoting physical and psychological well-being of the participants in exercising is proper load dosing and balance between loads and recovery. The given factors stimulate positive effects of regular health directed exercise training with a particular stress on life style factors.

Empirical researches reveal that according to the amount criterion of training loads, moderate and medium loads are optimal for health status of an individual. Applying physical activity in everyday life from early adolescence to advanced old age gives strong health prevention and intervention and looks for an answer from researchers, physiologists, psychologists, and kinesiologists on determinants and well-being of regular physical activity. Scientific literature suggests that accepting efficiency determinants in a health related exercising is crucial for structural and functional or neural effects in exercisers. Further on, findings suggest that biological growing old can be changed by the influence of environment factors which become more and more important with age. Scientists-practitioners indicate that programming of kinesiological operators should be based on biological and functional age, and on medical condition indicators in addition to an individual's preparedness and that the adequate load amount may be the most sensitive part of programming health-related physical activity in exercisers. At the same time, it is important to stress that following and evaluating the impact of regular physical activity is a precondition to manage the process of actual changes. Future research directions should bring more questions and answers. Finally, further studies should determine what physical exercising forms and intensities produce positive effects on physical and psychological well-being in different age-groups and should involve the impact of physically active lifestyle and environment factors in prevention and lowering the risk of diseases.

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NEGATIVE PHENOMENA IN SPORT REPORTED IN THE DAILY NEWSPAPER BLIC DURING THE WOMEN AND MEN'S HANDBALL WORLD CHAMPIONSHIPS IN 2013

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SUMMARY

The function of the media is reflected in informing population but also in filling their free time, where sport takes an important place. It is hard to realize the huge contribution that sport brings to media. In terms of content, there are hundreds of television and radio programs, newspapers, magazines, video games, and hundreds of thousands websites dealing with the topic of sports. A long time ago it has been noted that there is a huge potential that sports content brings, as well as an insatiable appetite of users (readers, listeners, viewers) for sports information. Sport through sports content allows media to reach hard accessible users (audience), while on the other hand, the media help sport in increasing its popularity and also to provide its funding and become more profitable. As a source of information for this research sports archive internet edition of the daily newspaper Blic has been used. The hypotheses of this research, linked to the fact that in the investigated period, January-February 2013 (World Championships for men) and November-December 2013 (Women's World Cup), handball was the most common sports media.

Keywords: Sport, violence, media, Blic

INTRODUCTION

Nowadays we can say that sport is organized a system of physical exercises, of an agonistic character, which strives to perfect the personality in order to achieve maximum sports results. Its internationality, on the one hand, makes it understandable and accessible to all people in the world, and on the other hand, it incorporates national features. Thus sport grows into a kind of bridge of convergence of different cultures, a bridge of people's rapprochement (Zivanovic, Randjelovic, Stankovic, & Pavlovic, 2010).

In addition to all the positive things that sport brings to the individual and society as a whole, its great popularity is abused, and there are many negative phenomena that accompany sporting events. On the one hand, sport gives us excitement, enjoyment, joy, emotional fulfillment through participation or enhancement of outstanding sports achievements, achievement of records, artistic expression and supremacy, and on the other hand, it makes obvious and offers to the public display numerous scandals, doping affairs, collegial hypocrisies, boycotts , misuse and instrumentalisation of sports by political and economic powers (Stojiljković & Savić, 2013).

The development of technology has made possible the emergence of a multitude of sports that depend on modern technology or has improved sports related props that help achievement of better results. Institutionalization of sports, the development of mass media and technology made sport a social phenomenon, but they also turned it into a business of large profits (Anastasovski, 2010). It will continue to advance, technology will develop, and more and more money will be invested, but human body is determined by its capabilities and cannot go beyond the limits of these possibilities (Anastasovski, 2014).

It is difficult to see the huge contribution that sport brings to media. In terms of content, there are hundreds of television and radio programs, newspapers, magazines, video games, and hundreds of thousands of websites dealing with sports topics. It has long been recognized the enormous potential that brings sports content, as well as the insatiable appetite of users (readers, listeners, viewers) for sports information. Sports through sports content allows the media to reach the desired yet otherwise accessible users (the audience), while on the other hand, the media allow the sport to increase its popularity, but also to get financially secure and become more profitable (Skoric, 2014).

The aim of this paper is to classify and categorize negative phenomena in sport and graphically represent the number of articles on negative occurrences that appear over a certain period of time.

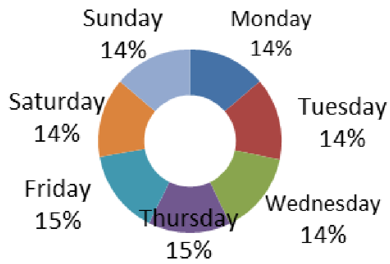
METHODS

For this research, the newspaper articles of the sports section of the daily Blic were used. The time period: January-February 2013 (Men's Handball World Championship), November-December, 2013 (Women's Handball Championship) was processed. A total of 120 days, 6234 newspaper articles were processed. We collected material that occupied more than 500 pages in the WORD program. The research used the method of quantitative and qualitative analysis of the content of electronic media, which enables the authenticity, reliability and verification of the data. This is the method most commonly used in media data analysis.

RESULTS AND DISCUSSION

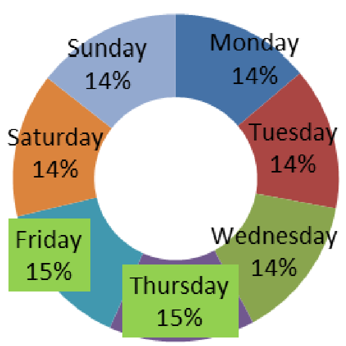
GENERAL STATISTICS

Graph 1. Percentage of articles by days of the week



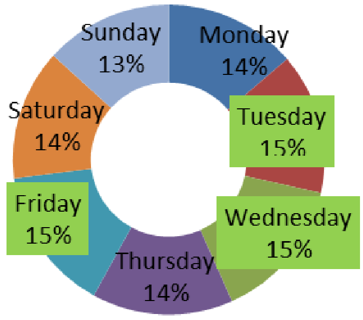
Graph (1) shows that the largest number of articles in the investigated period (926) was published on Fridays. The difference between the number of articles per day is small, Thursday and Friday prevailing (15%), the rest of the weekdays participating with (14%). It is known that most matches are played during the weekend, and it is surprising that more articles were on Wednesdays and Thursdays rather than on Saturdays and Sundays.

Graph 2. Percentage of articles related to domestic athletes by days



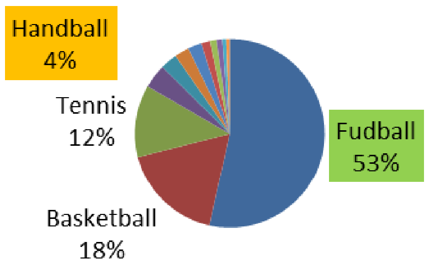
Graph (2) shows that Friday is the day on which the largest number of articles about domestic athletes appeared (407). Thursday and Friday prevail with the number of articles on domestic athletes with 15%, other days participate with 14%. As Friday was the day that the most articles were published on in the researched period, it is expected that the highest number of articles on domestic athletes will be published on this day.

Graph 3. Percentage of articles related to foreign athletes by days



Graph (3) shows that the largest number of articles dealing with foreign athletes was published on Friday. Tuesday, Wednesday and Friday showed 15% of the frequency, 13% on Sunday and the other days showed 14% in frequency. As with the total number of articles and the number of articles on domestic athletes, Friday is the dominant day for the number of articles appearing on foreign athletes.

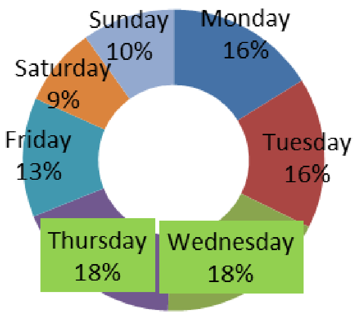
Graph 4. Sports by media representation



Graph (4), shows that football is by far the most represented sport reported on in all four months studied. With a total of (3333) articles and a frequency of over 50%, football ranked first. After football, most articles were about basketball (1096), tennis (767) and handball (256). Despite the fact that the research period included the time when two world handball championships took place, this sport ranked fourth in the number of articles published.

THEMATIC STATISTICS

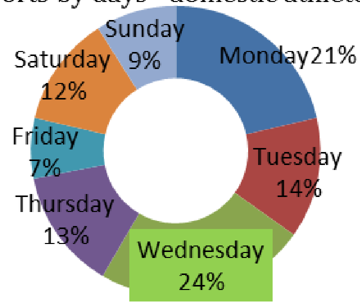
Graph 5. Percentage of articles containing negative phenomena in sports by days



Graph (5), shows that Wednesday and Thursday are the days when the highest number of articles with negative occurrences in the investigated period was published (76). The second ranked Monday and

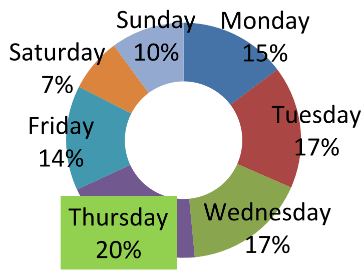
Tuesday with 67 articles. The smallest number of articles with negative occurrences appeared on Saturdays (35). The highest number of articles in the researched period was published on Friday, so it is surprising that most of the articles with negative occurrences were published on Wednesdays and Thursdays.

Graph 6. Percentage of articles containing negative phenomena in sports by days - domestic athletes



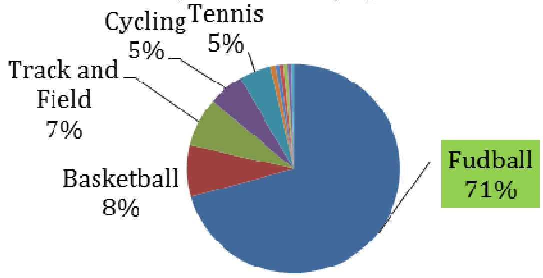
Graph (5), shows that most of the articles with negative occurrences involving domestic athletes were published on Wednesday (24%), followed by Monday with a 21% participation rate, while other days were generally represented by less than 15%. Given the fact that Wednesday is one of the two days when the largest number of articles with negative occurrences was published, it is not surprising that most of the articles with negative phenomena that deal with domestic athletes were published that day.

Graph 7. Percentage of articles containing negative phenomena in sports by days - foreign athletes

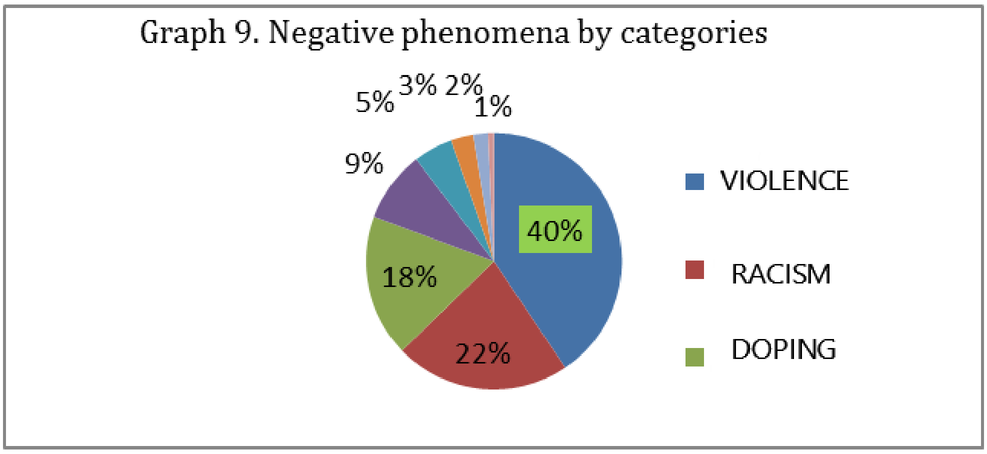


Graph 7 shows that the highest number of negative events involving foreign athletes was published on Thursday (20%), Tuesday and Wednesday were participating with 17% and the frequency of other days is below 15%. It is expected that most articles will be published on Thursdays dealing with negative phenomena that speak of foreign athletes, because this is one of the two days to publish the largest number of articles with negative phenomena.

Graph 8. Percentage of articles containing negative phenomena by sports



Graph 7 shows that most of the articles with negative phenomena are related to football (71%). Basketball, athletics, cycling and tennis have a frequency of less than 10%. In relation to the total number of articles, football is expected to be the first also with the number of articles with negative phenomena. Given the total number of articles, it is surprising that athletics and cycling are ranked third and fourth in the number of articles with negative phenomena.



Graph 9 shows that among the negative phenomena appearing in the sports section, violence is predominant. This category has appeared in 172 sports articles. Second ranked is racism, which appears in 94 articles, and the third is doping, which appears in 76 articles. Other categories of negative phenomena have a frequency of less than 10%. The large presence of violence in the sports section shows that there is no adequate strategy to combat this negative phenomenon.

COMPARATIVE STATISTICS

A total of 6234 newspaper articles were processed. Out of this, 2781 articles refer to domestic athletes, 3453 articles refer to foreign athletes. The total number of newspaper articles dealing with handball is 256. Negative phenomena in handball are reported in two articles. The total number of articles dealing with negative sports appearances is 415. It is amazing that in the most read national daily newspaper, there are remarkably more articles reporting on foreign athletes. In relation to the total number of articles and the total number of articles on negative occurrences, handball proved to be a "clean" sport.

There were more articles on domestic athletes in the investigated period ranging from November-December (1460) than in the period January-February (1321). When it comes to foreign athletes, November-December period (1729) also has a slight advantage compared to the period January-February (1724). Similarl number of articles is related to handball, in the period November-December there were 161 articles on handball, and in the period January February 95. Negative incidents were more reported in the period January-February (258), compared to the period November- December (157). In the period January-February two negative appearances in handball were reported, there were no negative handball phenomena in the second period of research. More coverage of handball were in the period when the world championship was held in our country. In the same period there were more reports about domestic athletes. A number of negative phenomena were observed at the beginning of the year, in the first research period.

Most articles on domestic athletes appeared in November (735). About foreign athletes was most talked about in December, totaling 900 articles. The largest number of handball articles was published in December, 135. The largest number of negative phenomena was recorded in February (144). Negative handball phenomena in handball were recorded in February (2). Most of the handball articles were most likely to have occurred during the period when the world championship for women was held in our country. At the end of the year, there were more articles about both domestic and foreign athletes.

The results of the research also indicate that racism was reported on more in the investigated period November-December (33%) as compared to the period January-February (15%). Violence is the category that has the highest frequency of all categories of negative phenomena; this category appeared more in the period January-February (43%) as compared to the second study period (36%). The policy impact category is equally present in both the investigated periods by 5%. The same case is with sports results fixing, in both the investigated period, the frequency is (9%). The frequency of corruption in sports is higher in the period January-February (4%), as compared to November-December (1%). Doping also has a higher incidence in the first study period (20%), as compared to the other (15%). Serious physical injuries were higher in the period January-February (3%) as compared to the period November-December (1%).

Alcoholism participates with 1% in the period January-February, there was no reporting about this category in the second researched period. Racism is the only category of negative phenomena that has a higher presence in the second research period, November-December. Other categories recorded a higher presence in the period January-February. Most sports registered more negative phenomena in the first research period. In the first exploratory period, football had 144 articles reporting negative occurrences, and in the second 120. Basketball registered 31 articles in the first and 10 in the second research period. Tennis had more articles with negative appearances in the second study period (17), while in the first it had eight articles. Volleyball in the first period had three articles with negative occurrences, in the other there were no articles reports on negative phenomena, similar situation was with handball, in the first period were two, in the second there were no negative occurrences reported. Athletics had many more negative occurrences in the first period (36), three in the second period. Cycling recorded three in the first period, the other period did not report such phenomena. American football had no negative phenomena reported. Cycling had 24 in the first as compared to four in the second period. Winter sports only had three negative occurrences in the first period. Water sports in the first period had two reports, and in the other one negative phenomenon. Combat sports in both periods had two negative occurrences. Football is expected to have the largest number of negative occurrences. Tennis, athletics and cycling are individual sports that record the largest number of negative occurrences.

CONCLUSION

The main objective of this research was the classification and categorization of negative occurrences in sport and the graphic representation of the number of articles on negative occurrences that appear over a certain period of time (the period of the most significant European handball competitions).

Based on the results of the research some conclusions can be reached. First, two world championships in the researched period were not enough to rank handball among the top three sports in the number of articles. If we take into account that football is globally the most popular sport and that the greatest number of articles published were about it, was not surprising, but the impression is that media pay more attention to basketball and tennis than handball. Secondly, the top results achieved by our athletes are not enough to pay more attention to them in the media than to foreign athletes. In each study month, a larger number of articles was devoted to foreign athletes. Thirdly, this research confirms that handball is one of the few sports that has the least number of negative occurrences. Handball is not followed by scandals and things that have nothing to do with sports. Fourth, the largest number of recorded negative phenomena is related to violence. Most of the negative phenomena related to violence in this study show that sports events are abused and used to express various types of problems that have nothing to do with sports.

From all of the above mentioned, we can conclude that different categories of negative phenomena are present every day in sports. Without a decisive fight against people who, by their participation and attitude towards sports, create a field of various malpractice and malversations, sport will lose its positive side, and a lot of negative phenomena will come to the forefront.

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PERCEPTION OF COACHES' BEHAVIOR IN MALE ADOLESCENCE ATHLETES

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UDC 796.015

SUMMARY

The aim of our study was to examine perception of coaches' behavior of male adolescence athletes. The final sample of respondents (67 athletes, mean age 20.28±.92) is selected from the initial sample of 130 subjects, students at the Faculty of Sport and Physical Education in Nis which were active in sport. They completed the two questionnaires: Leadership scale for sport (LSS) and Negative coaches' behavior questionnaire (NCBQ). The results showed significant relationship between dimensions of both questionnaires from -.50 to .60. The coach is the most important person in determining the quality and success of an athlete's sport experience, yet surprisingly, little research exists that identifies optimal coaching behaviors and factors that influence the effectiveness of particular behaviors. Future researches should deal with examining other athlete and coach individual difference variables that might influence coaching behaviors and athletes' perceptions and evaluative reactions to them.

Keywords: team sports, democratic behavior, positive feedback

INTRODUCTION

The relationship between coach and athlete is a very complex phenomenon which is affected by many variables. Also, this relationship influences the development of athletes and their sports career. The atmosphere and the general relationship between athletes in the team are associated with leadership of the coaches. They depend on whether the coach is focused on improving the performance of athletes in a variety of physical training segments, or focused solely on the result, that is, to win the contest. If the coach is focused on performance, he or she gives positive feedback to athletes thereby rewarding their efforts, progress and good teamwork (Aleksic-Veljkovic, A., Djurovic, D., Dimic, I., Mujanovic, R. & Zivcic-Markovic, 2016).

The previous study revealed significant differences between athletes' perception of coaching behaviors in individual and team sports. Individual athletes in this study gave higher ratings to training and instruction, social support and positive feedback leader behavior from their coaches. Also, athletes from individual sports had smaller scores on two dimensions and total score of negative coaching behavior questionnaire (Aleksic-Veljkovic, A., Djurovic, D., Dimic, I., Mujanovic, R.& Zivcic-Markovic, 2016).

Siekanska, Blecharz, & Wojtowicz (2013) examined how active and former athletes (n=80, 44 males and 36 females; 21.89 ±1.48 years of age; 8.35 ± 3.65 years of competitive experience) across a different sports level perceived coaching behavior. The participants responded to a demographic survey and the Coaches' Behaviors Survey. It was confirmed that coaches who perceived their athletes as more skilled, also treated them differently. Female athletes as compared with male athletes, more frequently pointed at the leniency in coach's behavior towards highly skilled athletes, and perceived it as a factor inhibiting athletic development. Additionally, women often found individualization of the training process as a behavior which reinforces development. Less accomplished athletes more often pointed out to "a post-training session interest in the athlete" as directed only towards more accomplished counterparts; however, they indicated "leniency and favouring" less often than the athletes with international achievements. They also listed "excessive criticism" as a type of behavior hindering development, but they indicated coaches' "authoritarianism and distance" less frequently than the more accomplished counterparts.

Considering the importance of the coach in determining the quality and success of an athlete's sport experience, surprisingly little research exists that identifies optimal coaching behaviors and factors that influence the effectiveness of particular behaviors (Kenow & Williams, 1999). The way athletes notice their coaches' behaviors affects all included, as well as the sports achievement, and it is influenced by many psychological variables (attitudes, emotions, goals). The aim of this study was to determine relationship between perceptions of coaches' behavior measured by two questionnaires: Leadership scale for sport (LSS) and Negative coaches behavior questionnaire (NCBQ).

METHODS

Subjects

The population of this study included 67 college athletes engaged in different team sports (basketball, football, and volleyball). Participants were asked to fill Competitive Perfectionism Scale (CPS; Besharat, 2009) and Leadership scale for sport (LSS). Total mean score for the athletes' ages was 20.28±.92 ranging from 19 to 25).

Table 1. Descriptive statistics for general data of athletes

	Min	Max	Mean	SD
Age	19.00	25.00	20.28	.92
Sports experience	2.00	15.00	8.82	3.69
Beginning of sports activity	5.00	17.00	9.22	2.88
Time with coach (per week)	1.00	12.00	3.97	3.39
Hours of training (per week)	1.00	35.00	9.43	6.15

Procedure

Leadership Scale for Sport (LSS) – The LSS is commonly used questionnaire to examine sport specific coaching behaviors (Chelladurai & Saleh, 1980; Cruz & Kim, 2017; Loughead & Hardy, 2005). The LSS is one of the most commonly used questionnaires for assessing sport leadership, which comprises five subscales representing different features of coaching behavior: (1) training and instruction behavior, which describes the sport skill and tactical instructional style of the coach, which are aimed at improving athletes' performance; (2) democratic and (3) autocratic behaviors, which refer to the decision-making style of the coach; and (4) social support and (5) positive feedback, which characterize the motivational style of the coach (Cruz & Kim, 2017).

Negative Coaches Behavior questionnaire (NCBQ) - The NCBQ is a 13-item inventory that assesses undesirable coach's behavior on three subscales, i.e. Insensitivity to Athletes' Wellbeing, Negative Feedback, and Results Orientation. Psychometric characteristics of NCBQ (factor structure, reliability, sensitivity, convergent and divergent validity) were tested on a sample of 181 kinesiology students. The results showed that NCBQ is valid and reliable measure useful for the assessment of negative coaching behaviors in various sport-related research (Jurakić Greblo, 2017).

Statistical analysis

For data analyses, descriptive statistics and Pearson correlation coefficients were used. The statistical analysis was performed using SPSS 20 and the level of significance was set at .05.

RESULTS

Table 2 shows the minimum and maximal results, means and standard deviations of dimensions of LSS and NCBQ. Mean and standard deviation scores for all variables were between 3.1 and 4.0. Results of Pearson's correlation test are shown in table 3. The results showed significant relationship between dimensions of LSS and NCBQ dimensions: Insensitivity to Athletes' Wellbeing showed negative relationship with Training and instruction (-.47), Democratic behavior (-.26), Social support (-.50) and Positive feedback (-.36). There is small negative relationship between Negative and Positive feedback (-.27).

Table 2. Descriptive Statistics for the dimensions of LSS and NCBQ

	Min	Max	Mean	SD
TRAINS	2.77	4.85	3.94	.50
DEMBEH	2.67	4.56	3.53	.52
AUTOCR	1.80	4.80	3.10	.73
SOCSUPP	2.25	4.63	3.48	.58
POFEED	2.60	5.00	4.03	.54
NOD	1.00	3.75	1.97	.58
NPI	1.00	4.60	1.98	.58
UNR	1.50	16.50	3.54	1.78

Table 3. Correlations between dimensions of LSS and NCBQ

	TRAINS	DEMBEH	AUTOCR	SOCSUPP	POFEED
NOD	**-.47****	**-.26***	-.05	**-.50****	**-.36****
NPI	-.13	.16	.19	.09	**-.27***
UNR	.03	.06	.09	-.07	-.18

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

DISCUSSION

The purpose of the present study was to determine relationship between perceptions of coaches' behavior measured by two questionnaires: Leadership scale for sport (LSS) and Negative coaches' behavior questionnaire (NCBQ). The atmosphere and the general relationship between the athletes in the team are associated with leadership by the coaches. They depend on whether the coach is focused on improving the performance of athletes in a variety of physical training segments, or focused solely on the result, that is, to win the contest (Jurko, Tomljanović, & Čular, 2013). We wanted to examine perception of coaches' behavior of male adolescent athletes from different team sports. Siekanska et al. (2013) reported that males, more often than females, indicated control and error correction as the coach's behavior was favouring more talented athletes. At the same time, individualization of training sessions was for male athletes the factor, which improved their athletic development.

The values of mean and standard deviations od examined dimensions of NCBQ are similar to results of study of Jurakić Greblo (2017), and only Results orientations was higher value in our study. They also reported that athletes from team sports reported a higher frequency of negative and a lower frequency of positive coaching behaviors.

Effective leadership behavior in sport can be explained according to interaction between athletes' characteristics and situational constraints, an approach called the multidimensional model of sport leadership. This model was developed by Chelladurai (2012) and claims that athletes' satisfaction and performance are predicated on three states of leader behaviors: required, actual, and preferred. All three states are directly influenced by various antecedent conditions such as the characteristics of the situation, leader, and member, as well as their interactions (Cruz & Kim, 2017).

Authors Cruz & Kim (2017) identified and compared young athletes' coaching leadership preferences based on gender, task dependency, playing experience, level of competition, and coach's gender, and determined any relationships between these selected variables and coaching behavior preferences of athletes. The findings indicated that athletes in this sample population prefer their coaches to demonstrate leadership behaviors of training and instruction "almost always", positive feedback "often", democratic behavior and social support "frequently", and autocratic "occasionally". Interestingly, while each independent variable did not show any significant differences between groups, an interaction was observed for athlete gender and coach gender on autocratic, democratic, and social support leadership preferences. This result provide valuable information on the dynamics of the sport leadership environment in young players and how crucial the role of coach's gender is for the athlete–coach dyad interaction and leadership style preference.

Many factors could affect the athlete's understanding of the coach's behaviors. It could result, for example, from the athletes' self-assessment, which in turn influenced their interpretation of messages, which the coach sent about him or her as a person. If self-assessment was low, even an error correction message could be interpreted by an athlete as an attack on their ego, and could automatically activate the defence mechanisms. In that case, even feedback, which was meant to be constructive, might be rejected and interpreted as groundless criticism (Siekanska et al., 2013).

CONCLUSION

Researches on the coach-athlete interactions from the perspective of an athlete needs to be continued. The measures designed to assess behaviors in the coach-athlete interactions used in the present study might become a useful tool in future research.

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SOCIAL COMPETENCIES, GENERIC SKILLS AND SPORTS SCIENCE

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SUMMARY

Modelling of domain specific competence development occurs over the life span and is confronted with at least two major challenges: (a) the stipulation of benchmarks for the judgment of competence development over the life span (for different requirements and standards) and (b) a coherent modelling of competence development over different educational stages allowing the description of cumulative developmental progress over time (scale anchoring). Social competence is defined as a set of positive social skills necessary to get along well with others and function constructively in groups, including, a) respecting and expressing appreciation for others; b) being able to work and communicate well with others and listen to others' ideas; c) demonstrating context-appropriate behaviour that is consistent with social norms; and) using a range of skills or processes aimed at resolving conflict. Any type of learning, especially in sports sciences, requires good social competencies and generic skills to be fully developed. Main reason for not having a wider acceptance of e-learning form of study programs curricula implementation can be contributed not only to technical but to cultural factors as well. Thus understanding of social aspects of e-learning can help realize optimal academic achievements and envisaged learning outcomes. Globalized spreading and popularity of sports sciences call for wider students' audience and participation. The competitive university has to appeal to a large number of the international students. Eastern Europe students want to obtain their education in sports for the knowledge sake but also for the license to work as coaches. Therefore, University of Nis and National Sports Academy as the leading educational institutions in their respective countries strive to establish distance learning centres for sports sciences students thus promoting e-learning and development of possible higher level diploma attainment. This paper presents attempts to establish, through IPA cross border cooperation project, joint distance learning centres in Serbia and Bulgaria for sport sciences curricula implementation and dissemination, having students' benefits as primary challenge and goal. The paper also strives to focus on the acquisition of relevant social competences and generic skills. We draw on the National Research Council Report, 2009, claiming that lack of interpersonal skills in middle childhood and adolescence–"poor social skills: impulsive, aggressive, passive, withdrawal" pose as a risk factor for possible failures at further schooling levels.

Keywords: Social competencies, generic skills, sports sciences, students

INTRODUCTION

Under the Instrument for Pre-accession Assistance (IPA) Bulgaria-Serbia Cross-Border Programme Faculty of Sport and Physical Education in Nis, Serbia and National Sports Academy in Sofia, Bulgaria have signed the contract to implement the project entitled "Establishment of E-learning centres on the basis of IT infrastructure for joint program implementation at Faculty of Sport and Physical Education in Nis, and National Sports Academy in Sofia". This project envisaged to last one year, gave rise to serious activities taken to enable distance learning mode introduction into the conventional modes of teaching. What are the real life facts showing? 80% of the PE students in Nis, Serbia are not home town dwellers. They come from nearby towns or even from remote places; therefore they present a grabbing audience for E-learning. The students' body in Sofia, Bulgaria is even more varied and would benefit from E-learning as well.

In terms of facilities, Faculty of Sport in Nis does not have a platform or modes for distance learning and all study cycles curricula are conventionally implemented. Students in Sofia have already started implementation of distance learning through the "Introducing a new educational system of quality distance learning in sports and sports-related programs " project of EU in the frame of human resources development”. As for the equipment Faculty of sport in Nis does not have any equipment or distance learning platform. Bulgarian students have found most benefits of distance learning mode through exams taking. The lecturers claim that they are highly motivated to embrace this mode of learning and exam taking because they can learn at their own pace, can consult the lecturers and can take progress tests showing them their aptitude and readiness to sit for an exam. But there is always indicators that something is missing or grasped wrong. Lecturers in Sofia complain that sometimes they do not gain what they asked for, that students could be more comprehensive and studious, that learning platform is not giving them freedom to communicate fully with students, that teaching materials could be more sophisticated, etc. Referring to the teaching staff in Nis the potential weaknesses could be that teachers are not yet familiar with distance learning platforms, that they are not so prone to changes, that they cling to convenient methods, that sport is sport and cannot be practiced at a distance. On the other hand, students would gladly accept the new teaching mode but they need to be trained for such a challenge and lastly, they need certain skills and competences to achieve curriculum set learning outcomes.

METHODS

Key Competency Definitions

1. Collecting, analyzing and organizing information

Implies the capacity to locate information, sift and sort information in order to select what is required and present it in a useful way; and to evaluate both the information itself and the sources and methods used to obtain it

2. Communicating ideas and information

Implies the capacity to communicate effectively with others using the range of spoken, written, graphic and other non-verbal means of expression

3. Planning and organising activities

Implies the capacity to plan and organize one’s own work activities, including making good use of time and resources, sorting out priorities and monitoring one’s own performance.

4. Working with others and in teams

Implies the capacity to interact effectively with other people both on a one-to-one basis and in groups, including understanding and responding to the needs of a client and working as member of a team to achieve a shared goal

5. Using mathematical ideas and techniques

Implies the capacity to use mathematical ideas, such as numbers and space, and techniques such as estimation and approximation, for practical purposes

6. Solving problems

Implies the capacity to apply problem-solving strategies in purposeful ways, both in situations where the problem and the desired solution are clearly evident and in situations requiring critical thinking and a creative approach to achieve an outcome

7. Using technology

Implies the capacity to apply technology, combining the physical and sensory skills needed to operate equipment with an understanding of scientific and technological principles needed to explore and adapt systems

(Source: Moy, P. The Impact of Generic Competencies on Workplace Performance, 1999)

Procedure

We used The eLearning Competency Framework for Teachers and Trainers which requires certain procedures observing main aspects of e-learning to be applied including the following:

Legal requirements

- relevant data protection legislation: and how to ensure that this is rigorously applied
- relevant legislation with regard to individual rights and equality of opportunity
- the law of copyright and how this may restrict the use of certain resources

Learning technologies

- the range of ways KILT (hardware, software and systems) may be used to facilitate the learning of others
- the ways in which KILT can help match learning opportunities to learners’ abilities, aspirations, needs and learning styles
- how to adapt KILT resources to the requirements and constraints of the learning environment
- how to provide learners with the KILT resources and facilities required to put into practice the learning objectives of the event, e.g., electronic white board, email, forum and discussion group virtual media or resources centre, tools (java applets, simulation, etc.)

Learning and development

- how to establish learning objectives
- how to evaluate the extent to which learning objectives have been achieved.

- the characteristics of formal, non-formal and informal learning
- ways of learning, learning styles and appropriate learning strategies in relation to the required outcomes of learning programs
- the importance of helping learners to identify their learning needs and select learning opportunities autonomously, and how to do so
- how to analyze the suitability of different learning opportunities with regard to the range of abilities, aspirations, needs and learning styles learners may have methods of assessing learners
- how to provide constructive feedback to learners, both formative and summative methods of assessing learning programs
- how to plan and promote application of learning
- Providing support, methods of giving information, advice and support in a manner that promotes individual autonomy and encourages self-development, general and specific sources of guidance
- the range of resources and tools for providing support to individual learners and groups of learners, e.g., email, computer mediated communication, telephone, journals, mailing lists, learning communities, communities of practice, colleagues, management, family, professional bodies and communities

At this point we have to emphasize the importance of having and showing **social competences** as the ability to understand the emotions of others as part of one's social awareness, to attain which one needs to demonstrate the following competencies:

Empathy - the ability to understand someone else's feelings and re-experience them. People with this competence: 1. Actively listen to what others say (both their words and non-verbal signals), 2.Show they understand and appreciate others' views or issues, 3. Focus on attaining the goal or task without conflict, 4. Understand where emotional boundaries start and end.

Organizational awareness - was defined by Goleman as 'the ability to read the current of emotions and political realities in groups.' People with this competence: 1. Understand the rationale behind their organization and its structure, 2. Know how to get things done within the organization - formally and informally, 3. Understand both client and vendor organizations, 4. Act with the client's best interest in mind.

Service orientation - builds on the empathy you have with others by helping you assist their personal development and satisfaction. People with this competence: 1. Are able through careful questioning to identify issues that are affecting an individual's performance, 2. Identify or adapt situations so that they provide an opportunity to improve their productivity and satisfaction.

The eLearning Competency Framework for Teachers and Trainers has its own limits in terms of giving advice and guidance, sources of referral how to communicate and interact with learners in a manner that fosters learners' confidence, self-esteem and self-image. Thus it incorporates monitoring and evaluation of the e-learning process reflects on managing resources and it also incorporates the value of the social competencies.

Monitoring and evaluation

- how to evaluate whether the outcomes of learning indicate that learning opportunities are suitable to learners' particular abilities, aspirations, needs and learning styles
- the importance of evaluating the effectiveness of activities, and how to make valid evaluations
- the importance of maintaining complete, accurate and up-to-date records and how to do so using KILT.
- how to analyze information to identify trends and common and emerging problems
- the importance of involving users in evaluating the quality of the support they receive, and how to do so
- Managing resources
- how to provide individual learners and groups of learners with the resources required to achieve their learning objectives
- how to adapt resources to the requirements of the learning environment
- Communication, how to ensure that all those involved in the learning event recognize their responsibility for ensuring an optimal learning environment
- Continual improvement, how to use information and experience to improve systems and personal performance
- Accessibility, the importance of providing access to learning to all, regardless of physical or intellectual disabilities or environmental disadvantages, basic principles of ensuring accessibility in the learning environment

- the range of KILT tools available for identifying preferred learning styles and needs of learners with a diverse range of abilities, how to exploit the possibilities offered by KILT to ensure accessibility
- Professional ethics, the attitudes and behavior expected of professional teachers/trainers.

RESULTS

The development, implementation, and maintenance of online courses and whole study programs analyses showed at the Faculty of sport in Nis to be expensive and time consuming. IPA cross border cooperation project resulted in the establishment of the joint distance learning centres in Serbia and Bulgaria for sport sciences curricula implementation and dissemination. However, as Boettcher claims and we confirmed through our assessment analyses, it takes time to design and develop online instruction model. Upon the implementation of this project the Faculty has accredited master study program distance learning mode, and is now recruiting successfully half the students' body as the conventional mode of studies. Obviously, judging by the students satisfaction surveys distance learning mode turned to be promising for the Faculty but teaching staff satisfaction is definitely one of the five pillars of quality assurance, and it seems to be equally important as the students' satisfaction with the courses, the study program as a whole, and the university as a desired qualifications provider. The Faculty of Sport and Physical Education in Nis, Serbia therefore always conducts surveys after academic year completion to make a SWOT analysis on the online teaching results concerning both academic and educational impacts.

DISCUSSION

All the triad teacher-student-institution related elements need to be continuously assessed, to assure quality online educational experiences both for the teaching staff and the students as well. No matter how cutting-edge technology your online teaching platform belongs to, there will always be students eager to ask face-to face questions, to praise or to criticize teachers lectures, teaching materials or propose new or additional exams criteria. That is actually how we swap the roles, and the students become the teachers, and vice versa. That is how we see our students become the autonomous learners, responsible for their own learning styles, learning outcomes and learning experiences. The way we teach them will definitely define the way they are going to shape their prospective working settings and hopefully their leadership styles, and bright careers prospects [25].

CONCLUSION

The knowledge-workers of the twenty-first century require the ability to jump between fields of technical specialization and capture the key issues quickly. A base-level of familiarity with scientific concepts and processes reduces the time taken to master new areas where emerging tasks and work processes occur. Generic skills are not just restricted to their usefulness in the workplace but are equally required across the spectrum of living experience in today's world. Emerging work place described above demands a set of new generic skills for maintaining employability. In addition to job-specific technical competencies, there is a requirement of a set of generic skills, which are generic to a cluster of occupations in order to perform competently as knowledge worker.

Generic skills are required by all workers. However, the extent by which these skills need to be possessed varies from one occupational grouping to another. The varying levels of generic skills use needs to be determined, to further guide in developing educational content rich in job-specific and generic skills formation.

The good amount of research studies undertaken in studying generic skills are guideposts in formulating educational policies and initiating pedagogical reforms that can bridge positive consequences to the learning outcomes and achievements of the future workforce. While no single list of generic skills can be concluded as conclusive to one job or sector in this constantly changing economic and social landscape, the dominating skills sets and competencies required in 21st century occupations must be consigned to the learner. Doing this needs to utilize appropriate teaching and learning methodologies, integration models and skills formation adapted by educational systems and institutions, at all educational levels. The possession of generic skills, then, will be a flexible passport of the workforce to move from one job to another, and ticket to enter any given condition and environment within 21st century requirements.

Over and above the assessment of cognitive competencies, we have suggested broadening the perspective systematically, and including additional competence areas—specifically social competencies. Learning processes subsequent to compulsory education need to be regulated by individuals rather than educational institutions. Learning becomes more and more dependent on the initiative of individual people (or families, unions, employers). The farther away from formal education, the higher the necessity to initiate and regulate one's own learning as well as to form decisions about the contents of learning. To cover these meta-competencies, which are regarded as central for middle- aged groups, one usually broadens the set of indicators and includes indicators of meta-cognition and self regulation. Especially for the middle-aged and aged groups, aspects of social behaviour and cooperation as reflected in interpersonal skills may be of high impact (i.e., cooperation with others, working together in a team, perspective taking).

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SOURCES OF STRESS AND COPING STRATEGIES OF FOOTBALL REFEREES

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SUMMARY

Based on the assumption that the role of a football referee is extremely stressful and that referees make efforts to overcome the stressors, the main objectives of this research were to determine which stressors are the most prominent among football referees, which strategies are primarily used for overcoming stress, and what are the relationships between the prominence of individual coping strategies and the intensity of certain stressors. The research sample consisted of thirty-three male football referees aged between 18 and 28 years old who have been refereeing in official football matches for over a year. By constructing adequate hypotheses and applying appropriate instruments and statistical techniques, certain results have emerged, the most important of which being those that indicate that the most significant stresses in football referees are the ones related to the judicial activity during the game, and that individual stressors are often related to individual coping strategies.

Keywords: football referees, stress, coping strategies

INTRODUCTION

Football referees are significant and vital participants in official football matches. Their responsibility for the success of the entire sporting event is of great importance, and therefore it is logical to assume that stress is an integral part of a referee's role. Speaking of stress, one needs to know what the main sources of stress among referees are, but also how they struggle against stress, that is, how they overcome it. Physical challenges are enormous. Football referees, on average, run about 10 kilometers in the course of the match, 47% of which includes jogging, 23% walking, 12% sprint and 18% going backwards, with an average heart rate of 165 heartbeats per minute (Krusturp & Bangsbo, 2001). At the same time, some authors like Milojević (Milojević, 2004) state that the presence of referees and the perception of their fair or dishonest work is one of the main sources of anticipation stress among athletes.

In this paper, we start from a transactional stress model that has the following components (Zotović, 2002):

1. a particular event or situation in the external environment;
2. characteristic subjective assessment of the event;
3. changes in psychological functioning;
4. physiological changes and
5. the experience of the entire process.

Stressors are stimuli (physical, chemical and psychological) that impose excessive burden on the organism, leading to a series of changes in both organism and personality. They can cause physiological, psychological, cognitive, emotional and behavioral reactions of the organism (Obrenović, 2005).

Regarding the sources of stress in a sports context, the most commonly considered ones are: physical or mental error, the anticipation of criticism or warning by a trainer, observing the opponent's cheating, experiencing pain or injury, poor decision by officials, perceiving that the opponent performs well, poor performance due to bad weather or poor playing conditions and distracting spectators (Anshel & Kassidis, 1997). Some authors (Noblet & Gifford, 2002, according to Mitic, 2016) talk about the division of stress in professional athletes into six categories.

The term *coping* with stress implies everything that a person does, either on a cognitive or behavioral plan, in order to solve the problem and / or reduce the intensity of a psychophysiological reaction within the process of stress (Lazarus & Folkman, 1984). Zotović (2004) states that one should always take into consideration that overcoming does not have to be a completed or a successful act, and that it is not necessarily visible on the behavioral level, but only on the cognitive one (by changing the perception of the stressful situation).

In this paper, we begin with the transactional approach of Endler and Parker (Endler & Parker, 1990) who claim that there are three dimensions of coping: problem oriented coping, emotion oriented coping, and avoidance oriented coping. Avoidance oriented coping can be divided into two subcategories: human-focused avoidance (social diversion) and a focus on a new task that is not related to a stressful situation or event (distraction).

On a sample of forty-two referees, the authors (Wolfson & Neave, 2007) note that the respondents stated the following as the most frequent and greatest stressors in their career:

1) Refereeing badly during the match

2) The protests of people who do not understand the basic rules of football

3) Possibility to be transferred to a lower level referee rank

4) Verbal harassment by trainers, managers and spectators

By applying different methods of factor analysis on the sample of 721 basketball referees, the author divided the stressors in referees into five groups (Rainey & Hardy, 1999):

1) Concerns about the refereeing (making mistakes, critical decisions and critical matches, losing concentration)

2) Fear of being physically attacked (attacks and threats by trainers, spectators or players)

3) Lack of recognition (or complete dismissal by officials and delegates, non-appointment for important matches)

4) The pressure of time (conflicts related to the absence of family and friends, conflicts between judicial duties and permanent work, others expect to devote more time to them)

5) Interpersonal conflicts (verbal criticism coming from players and trainers, hostile spectators who insult, protests by people who do not know the rules at all)

Lack of recognition is the lowest source of stress, but other factors, especially in interaction with the age of referees, lead to an intense burnout syndrome due to the stress, resulting in resigning from refereeing. Such data were also obtained by authors of similar research on the sample of rugby referees (Rainey & Hardy, 1999).

On the other hand, some authors, point to the four-factor structure of the stressors in handball referees (Tsorbatzoudis, Kaissidis-Rodafinos, Partemian, & Grouios, 2005).

The results of individual studies indicate that there are no significant differences in psychological stress between the main arbitrators at the borders and their assistants, and that the level of stress among referees is not too great (Gencay, 2009).

METHODS

The main **objectives** of this research are to determine which stressors are the most prominent in football referees and what are the relationships between the prominence of particular coping strategies and the intensity of particular stressors.

The research sample consisted of thirty-three male football referees aged from 18 to 28 (an average of 20.2 years) who have been refereeing in official football matches for over a year. Respondents had to assess the intensity of each of the following stressors on the scale from 1 to 10. The list of stressors was partly made on the basis of previous research (Wolfson & Neave, 2007, Rainey, 1999). The list contains the following stressors:

1. Making a wrong decision, 2. Decreasing concentration during a match, 3. A verbal attack and insult by a spectator or trainer, 4. Threats and verbal attacks by a player 5. A physical attack by a player or trainer, 6. Non-appointment for important matches 7. Failure to recognize a good refereeing by officials, 8. Physically exhausting matches, 9. Refereeing is time-consuming, 10. Criticism by the people who do not understand the rules at all. In addition, The Coping Inventory for Stressful Situations - CISS (Endler & Parker, 1990), or its adapted version prepared by Sorić and Proroković (Sorić & Proroković, 2002), were also used in the research.

RESULTS

In relation to the minimum and maximum values of the prominence of individual stressors in the referees, it was found that the empirically obtained average values are below the theoretically expected average values, and that the average values are closer to the minimum than the maximum values (Table 1.1 and Table 1.2).

The results shown in Table 3 show that stressors 2 (Decreasing concentration during a match) and 10 (Criticism by people who do not understand the rules at all) are positively correlated with the *Emotion oriented* stress coping strategy. The obtained correlation is statistically significant at the level of 0.01. On the other hand, there is a negative correlation of stressor 9 (Refereeing is time-consuming) and *Confrontation oriented* stress coping strategy and the obtained correlation is statistically significant at the level of 0.01. *Avoidance oriented* stress coping strategy is positively correlated with the stressor 2 (Decreasing concentration during a match) and stressor 8 (Physically exhausting matches), whereas it is, on the other hand, negatively correlated with the stressor 9 (Refereeing is time-consuming).

Table 1. 1. Prominence of different stressors on the sample of referees

	Stressor 1	Stressor 2	Stressor 3	Stressor 4	Stressor 5
Mean	4.21	3.67	2.73	2.55	3.09
Std. Deviation	1.816	2.231	2.081	1.872	1.926
Minimum	1	1	1	1	1
Maximum	9	10	9	10	10

Table 1. 2. Prominence of different stressors on the sample of referees

	Stressor 6	Stressor 7	Stressor 8	Stressor 9	Stressor 10
Mean	3.67	4.45	2.18	1.36	1.73
Std. Deviation	2.665	2.451	1.261	.653	1.859
Minimum	1	1	1	1	1
Maximum	10	10	5	3	9

Table 3. Correlations between different types of stressors and stress coping strategies

		Problem focused	Emotion focused	Avoidance focused	Distraction	Social diversion
Stressor 1	Pearson Correlation	.142	-.026	-.107	-.025	-.136
	Sig. (2-tailed)	.429	.887	.554	.892	.450
	N	33	33	33	33	33
Stressor 2	Pearson Correlation	.301	**.547(**)**	**.374(*)**	**.358(*)**	.334
	Sig. (2-tailed)	.089	.001	.032	.041	.058
	N	33	33	33	33	33
Stressor 3	Pearson Correlation	-.130	.257	.009	.168	-.125
	Sig. (2-tailed)	.471	.150	.961	.349	.487
	N	33	33	33	33	33
Stressor 4	Pearson Correlation	-.248	.302	-.107	.100	-.247
	Sig. (2-tailed)	.164	.088	.555	.580	.166
	N	33	33	33	33	33
Stressor 5	Pearson Correlation	-.212	.309	-.036	.132	-.099
	Sig. (2-tailed)	.237	.080	.844	.464	.582
	N	33	33	33	33	33
Stressor 6	Pearson Correlation	-.017	.261	.239	.235	.149
	Sig. (2-tailed)	.924	.142	.181	.188	.406
	N	33	33	33	33	33
Stressor 7	Pearson Correlation	.202	.294	.224	.172	.335
	Sig. (2-tailed)	.259	.097	.209	.338	.056
	N	33	33	33	33	33
Stressor 8	Pearson Correlation	-.106	.304	.200	**.407(*)**	.046
	Sig. (2-tailed)	.557	.086	.265	.019	.797
	N	33	33	33	33	33
Stressor 9	Pearson Correlation	**-.615(**)**	-.137	**-.541(**)**	**-.390(*)**	**-.496(**)**
	Sig. (2-tailed)	.000	.447	.001	.025	.003
	N	33	33	33	33	33
Stressor 10	Pearson Correlation	.221	**.387(*)**	.230	.201	.225
	Sig. (2-tailed)	.216	.026	.198	.261	.208
	N	33	33	33	33	33

Stressor 9 (Refereeing is time-consuming) is in a negative correlation with the Social Diversion stress coping strategy. All of the above correlations are statistically significant at the level of 0.05. On the basis of the obtained results, it is evident that there are correlations between certain types of stressors experienced by referees and the predominant stress coping strategies that referees use to overcome them. Thus, according to the type of stressors, referees display adaptive behavior (in case of *task/problem-oriented confrontation*) or maladaptive responses (in the case of *emotion oriented confrontation* and *avoidance oriented confrontation*, i.e., by *distraction* and *social diversion*).

DISCUSSION

When confronted with a decrease in concentration during the match (stressor 2), referees apply all long-term non-adapting strategies, primarily those emotion and avoidance oriented (particularly on distraction). They, therefore, in situations when they notice that they begin to lose control due to the lack of concentration give vent to their emotions, but also ignore the problem while the game is running. In reality, the referees do not have time to seriously deal with the causes of decreasing concentration while the game lasts (problem oriented strategies), nor to talk about it or something else to other people (social distraction), so these are also the only possible temporary strategies. Certainly, after the end of the match, they should deal with the explanations, the causes as well as the prevention of such situations in the future.

When they experience the feeling that the match they referee becomes physically burdensome (stressor 8), football referees use distraction as the dominant strategy, that is, they try to focus on the refereeing and simply redirect their attention from the feeling of exhaustion. That seems to be the best solution they have. As in the previous case, after the end of the match, they need to find a solution for the given problem (e.g. to increase the level of physical fitness) using problem-solving oriented strategies.

In situations when they encounter the criticism of their refereeing by the people who do not understand the rules of football game at all (stressor 10), referees predominantly use emotion oriented coping strategies. They feel and / or express anger, dissatisfaction and frustration, and this is a way to deal with these situations. Applying problem-oriented strategies (eg educating all the observers, which would lead to the solution to the problem) seems impossible, but surprisingly, that there are no statistically significant correlations with avoidance strategies that would imply ignoring the problem by being occupied with other things or by intensifying socializing with other people.

The most intriguing results were obtained in the ways of being confronted with the feeling that refereeing is time-consuming (stressor 9) and hence, the referees cannot probably be engaged in their primal job or with close people to the extent they want to. This situation is negatively correlated with the problem oriented strategies, but also with the strategies that are aimed at both types of avoidance - ignoring through other activities or intensifying socializing with other people. Therefore, football referees cannot solve this problem, but at the same time, they cannot even avoid it, which presents an extremely difficult situation.

The results obtained in order to check the hypothesis of this study that refers to the existence of statistically significant correlations between individual stressors and certain coping strategies are, although not entirely, on the trail of the claims of some researchers (Anshel, Sutarso & Jubenville, 2009; Gould, Finch & Jackson, 1993) that, in a sports context, certain types of coping are in the service of certain stressors.

CONCLUSION

The hypothesis of the research that refers to the existence of statistically significant correlations between the intensity of individual stressors and the various stress coping strategies in the sample of football referees is partially accepted since statistically significant correlation with certain stress coping strategies was found.in four out of ten given stressors The results indicate that when they encounter the feeling that the match being refereed is becoming physically burdensome, football referees use distraction as a predominant strategy, i.e. they try to concentrate on the refereeing and simply redirect their attention from the exhaustion they feel.

In situations when they encounter criticism of their refereeing by people who do not know the rules of the game at all, referees apply predominately emotion-oriented coping strategies. The obtained results related to the way of confronting the feeling that refereeing is time-consuming, show that this situation is negatively related to the problem oriented strategies, but also to the strategies that are oriented to both ways of avoidance - ignoring through other activities or intensifying socializing with other people. The basic limitation of the conducted research is reflected in the fact that the obtained results must be interpreted cautiously due to a relatively small number of respondents (33), but also to a small diversion in terms of age (all respondents are aged between 18 and 28) and refereeing seniority (from 1 to 11 years) within the tested sample.

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THE RELATIONSHIP BETWEEN PERFECTIONISM AND PERCEPTION OF COACHES' BEHAVIOR IN MALE ATHLETES

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UDC 796.015:159.9

SUMMARY

The aim of our study was to determine the relationship between perfectionism and perception of coaches' behavior in male adolescence athletes. The final sample of respondents (67 athletes, mean age 20.28±.92 years) is selected from the initial sample of 130 subjects, students at the Faculty of Sport and Physical Education in Nis. They completed the two questionnaires: Leadership scale for sport (LSS) and Competitive perfectionism Scale (CPS). The results showed a significant relationship between striving for perfection and training instructions (.47), social support (.44), and positive feedback (.46), and also negative striving for perfection and autocratic behavior (.40). This study provides valuable insight into understanding the dynamics of sports leadership and perfectionism in athletes. Research on the coach-athlete interactions, and also perfectionism from the perspective of an athlete need to be continued.

Keywords: team sports, democratic behavior, positive feedback

INTRODUCTION

Perfectionism is commonly conceived of as a personality style characterized by striving for flawlessness and setting of excessively high standards for performance accompanied by tendencies for overly critical evaluations of one’s behavior (Hamidi & Besharat, 2010). Two major dimensions of perfectionism were differentiated (Stoeber, Otto, Pescheck, Becker, & Stoll, 2007). The first dimension has been described as positive striving perfectionism and captures those facets of perfectionism that relate to perfectionistic striving, having perfectionistic personal standards, and setting exacting standards for one’s performance (Hamidi & Besharat, 2010). Earlier studies had shown that this dimension had positive correlations with indicators of good psychological adjustment such as positive affect, endurance, academic achievement, and test performance (Dunn, Dunn, & Syrotuik, 2002; Ghahramani, Besharat, & Naghipour, 2011; Stoeber, 2011).

The second dimension has been described as self-critical perfectionism and captures those facets of perfectionism that relate to critical self- evaluations of one’s performance, feelings of discrepancy between expectations and results, perfectionistic concern over mistakes and other high expectations, and fears that the others’ acceptance is conditional on one’s being perfect (J. G. H. Dunn, Dunn, & Syrotuik, 2002; Hamidi & Besharat, 2010; Stoeber et al., 2007). This dimension has shown positive correlations with indicators of maladjustment such as negative affect, low self- esteem, and low self-efficacy (Stoeber, 2011; Stoeber et al., 2007). However, perfectionism is multidimensional and multifaceted, and only some dimensions and facets are clearly negative, harmful, and maladaptive whereas others are positive, benign, and possibly adaptive (Hamidi & Besharat, 2010; Stoeber et al., 2007).

The relationship between coach and athlete is a very complex phenomenon which is affected by many variables. Also, this relationship influences the development of athletes and their sports career. The way athletes notice their coaches’ behavior affects all included, as well as the sports achievement, and it is influenced by many psychological variables (attitudes, emotions, goals). The aim of this study was to determine relationship between perception of coaches' behavior and perfectionism in male collage athletes.

METHODS

Subjects

The population of this study included 67 college athletes engaged in different team sports (basketball, football, and volleyball). Participants were asked to fill Competitive Perfectionism Scale (CPS; Besharat, 2009) and Leadership scale for sport (LSS). Total mean score for the athletes' ages was 20.28±.92 ranging from 19 to 25.

Table 1. Descriptive statistics for general data of athletes

	Min	Max	Mean	SD
Age	19.00	25.00	20.28	.92
Sports experience	2.00	15.00	8.82	3.69
Beginning of sports activity	5.00	17.00	9.22	2.88
Time with coach (per week)	1.00	12.00	3.97	3.39
Hours of training (per week)	1.00	35.00	9.43	6.15

Procedure

Competitive perfectionism Scale (CPS) - The CPS is a 10-item test designed and standardized by Besharat (2009) to assess the positive and negative dimensions of competitive perfectionism. Items tap the two dimensions of perfectionism, i.e. striving for perfection and negative reaction to imperfection on a 5- point Likert Scale ranging from 1(very low) to 5 (very high). The psychometric properties of CPS have been confirmed across several studies (Dunn et al., 2006; Martinent & Ferrand, 2006; Stoeber et al., 2007). According to preliminary findings, Cronbach alpha levels of each of the subscales, for a sample consisting of 133 athletes of different athletic levels and different sport majors, were estimated at .93 and .90 for items of the subscales respectively, which indicate a high internal consistency for the test (Hamidi & Besharat, 2010).

Leadership Scale for Sport (LSS) – The LSS is commonly used questionnaire to examine sport specific coaching behaviors (Chelladurai & Saleh, 1980; Cruz & Kim, 2017; Loughead & Hardy, 2005). The LSS is one of the most commonly used questionnaires for assessing sport leadership, which comprises five subscales representing different features of coaching behavior: (1) training and instruction behavior, which describes the sport skill and tactical instructional style of the coach, which are aimed at improving athletes' performance; (2) democratic and (3) autocratic behaviors, which refer to the decision-making style of the coach; and (4) social support and (5) positive feedback, which characterize the motivational style of the coach (Cruz & Kim, 2017).

Statistical analysis

For data analyses, descriptive statistics and Pearson correlation coefficients were used. The statistical analysis was performed using SPSS 20 and the level of significance was set at .05.

RESULTS

Table 1 shows the means and standard deviations of positive and negative dimensions of competitive perfectionism and athletes' coaching behavior preferences. Mean and standard deviation scores for perfectionism and dimensions of coaching behaviors were as follows, respectively: 25.12 & 4.14 for striving for perfection; 18.45 & 5.87 for negative reaction to imperfection; 3.94±.50 for training and instruction behavior; 3.53±.52 for democratic behavior; 3.10±.72 for autocratic behaviors, 3.48±.58 for social support and 4.03±.54 for positive feedback. Results of Pearson's correlation test are shown in table 3. The results showed significant relationship between striving for perfection and training instructions (.47), social support (.44), and positive feedback (.46), and also negative striving for perfection and autocratic behavior (.40).

Table 2. Descriptive Statistics for CPS and LPS dimensions

	Min	Max	Mean	SD
TRAINS	2.77	4.85	3.94	.50
DEMBEH	2.67	4.56	3.53	.52
AUTOCR	1.80	4.80	3.10	.72
SOCSUPP	2.25	4.63	3.48	.58
POFEED	2.60	5.00	4.03	.54
PERF	10.00	30.00	25.12	4.14
NEGPERF	5.00	30.00	18.45	5.87

Table 3. Correlations of variables

	TRAINS	DEMBEH	AUTOCR	SOCSUPP	POFEED
PERF	**.45****	.17	.04	**.44****	**.46****
NEGPERF	-.12	.05	**.40****	.02	-.03

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

DISCUSSION

The purpose of the present study was to determine the relationship between perfectionism and perception of coaches' behavior in male athletes. The results showed significant relationship between striving for perfection and training instructions, social support, and positive feedback, and also negative striving for perfection and autocratic behavior in male athletes. There are no previous studies on this topic, and also behaviors limited strictly to the emotional side of the coach-athlete interactions were appreciated to a greater extent by females than by males in earlier studies.

The earlier studies in athletes investigated the relationship between perfectionism and different behaviors in athletes such as goal orientations (Dunn et al., 2002), fear of failure (Sagar & Stoeber, 2009), anxiety and disordered eating (Haase, Prapavessis, & Glynn Owens, 2002), self-esteem (Gotwals, Dunn, & Wayment, 2003), motivational climate (Nordin-Bates, Hill, Cumming, Aujla, & Redding, 2014) etc.

When examining perfectionism in sport it is important to differentiate perfectionistic strivings and perfectionistic concerns because of that the perils of perfectionism in sport are mainly restricted to perfectionistic concerns. In contrast, perfectionistic strivings are often associated with positive characteristics, processes, and outcomes, particularly when the overlap between perfectionistic strivings and perfectionistic concerns is controlled. Perfectionism is a “double-edged sword” that may have benefits (perfectionistic strivings) but may also carry significant costs and risks (perfectionistic concerns) for athletes (Stoeber et al., 2007). Our investigation showed that coaches' behavior can be connected with perfectionism in their athletes.

Striving for perfection, as a positive aspect of perfectionism, allows a perfectionist to enjoy and take pleasure in their onerous and tiresome efforts. The athletes' experience of satisfaction at and pleasure in their personal performance, help them perform sport skills and techniques with a higher concentration and accuracy and hence increase the likelihood of their success. This condition will both enhance the self-confidence of the athlete, and lower the usual anxieties and worries inherent in a competitive situation down to a controllable point (Dunn et al., 2002).

Unlike positive aspects of perfectionism, negative reaction to imperfection which is one negative dimension or aspect of perfectionism increases one's worries over failure to meet their high standards, for its highly maladaptive and abnormal characteristics (Koivula, Hassme, & Fallby, 2002). The main product and result of such condition is the athletes' helplessness and inability to appropriately utilize their athletic skills and techniques. Such feelings of helplessness and inability not only increases competitive anxiety (cognitive and somatic), but also has a debilitating effect on the athletes' self-confidence (Hamidi & Besharat, 2010).

The dissatisfaction distracts the athletes' concentration and lowers their accuracy which, in turn, increases the likelihoods of failure and frustration for them. Under such circumstances, anxieties and worries within the competitive situation increase, which will damage both the athletes' self-confidence and their feelings of self-competence (Hamidi & Besharat, 2010).

Many factors could affect the athlete's understanding of the coach's behaviors. It could result, for example, from the athletes' self-assessment, which in turn influenced their interpretation of messages, which the coach sent about him or her as a person. Males, more often than females, indicated control and error correction as the coach favoured more talented athletes. At the same time, individualization of training sessions was for male athletes the factor, which improved their athletic development. Furthermore, contrary to Konter's results (2007) it was found that male athletes paid more attention to expert's competence than female athletes (Siekanska, Blecharz, & Wojtowicz, 2013).

Siekanska et al. (2013) concluded that high-expectancy athletes may perceive the coaching behavior as inhibiting (rather than enhancing) their athletic progress. It is commonly known that false assumptions on the athlete's performance potential may bring negative effects on the actual performance outcomes. It could mainly concern exerting too great pressure and demands on athletes. The behavior from the category of leniency and favouring, which works on the assumption of reducing pressure and facilitating development, has been assessed by the competitors as a developmental inhibitor. Clearly, research on the coach-athlete interactions from the perspective of an athlete needs to be continued.

CONCLUSION

Recommendation for further research is to provide longitudinal studies about perfectionism and coaching behavior during the competitive season considering the differences between types of sports, for example aesthetic, combat or power sports.

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THE ROLE OF PERSONALITY TRAITS IN STRESS AND COMPETITION STRESS COPING

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UDC 159.9:022

SUMMARY

The context of sport undoubtedly involves stressors, defeats in competitions, the perception of opponents' quality, audience behavior, judging criterion and the perception of competition conditions. The way the level of training and competition stress will affect a certain athlete is primarily determined by the athlete's personality traits (e.g. emotional stability, conscientiousness and extraversion), cognitive appraisal and the event interpretation. In the process of sport training and competition, sport and/or clinical psychologists and coaches assess an athlete's coping with training and competition stress in order to select and choose athletes in elite sport. The athletes differ according to expression level of basic and specific personality traits and at the same time according to coping efficiency in training and competition stress. Combinations/interactions of basic personality traits predict more appropriately than individual dispositions. Finally, further researches should reveal whether the efficacy level of training and competition stress coping changes compared to certain biological development periods (e.g. adolescence or early adulthood) or these relations remain unchanged.

Key words: personality, cope, training and competition stress.

INTRODUCTION

Coaches in team and individual sports have their own implicit personality theory while researchers studying personality psychology define personality depending on starting theoretical approach. For example, Larsen and Buss (2014, p. 4) define personality as „the set of psychological traits and mechanisms within the individual that are organized and relative enduring and that influence his or her interactions with, and adaptations to, the intrapsychic, physical, and social environments". With regard to this, personality traits are broad constructs involving "various aspects: physiological arousal, reticular formation, emotional component, limbic system and the interpretation of the stimulus itself (associative areas of cortex)" (Vukasović, 2013, p. 60). The author states that the implementation of meta-analysis revealed that "39 percent of individual differences in personality is the result of genetic contribution, and 61 percent refers to environment contribution" (p. 67). For example, Vukasović (2013) indicates that the assessment of the effect proportion of genetic contribution for certain personality traits within the five-factor personality model .41 for neuroticism, .37 for extraversion, .45 for openness, .36 for agreeableness and .34 for conscientiousness. Thus, personality characteristics or traits are moderately heritable (ranging from 30 to 50 percent), which indicates the importance of the environment factors influence (e.g. regular exercise, different life experiences) which can affect from 50 to 70 percent (Larsen & Buss, 2014) system changes in personality traits levels. These results are multiply scientifically and practically significant since they suggest a possible influence of the long-term process of sport preparation on personality trait expression level. For example, the empirical findings suggest that expressing personality traits can change during growing up – in adolescence (Pervin, Cervone, & John, 2008; Cervone & Pervin, 2008). Further on, the research findings reveal that many children change their temperament from the inhibited into an uninhibited one and vice versa (Kagan, 1994) which indicates that personality traits and temperament depend on the influence of environmental factors.

Within the domain of different kinds of personality models, Vukasović (2013, p. 11) states that "facet describing psychosomatic reactions to stress with somewhat different operationalization can be found in Cattell's model of personality (sensitivity), Tellegen's personality model (reaction to stress) and five-factor model (vulnerability)".

Quite certainly, in the context of sport, the biggest stressor is losing a competition, but even the opponent, the audience behaviour, the judging criterion, the perception of inadequate conditions at a competition and changes of the result during a competition can also be stressful (Horga, 2009). Wooden and Jamison (1997) indicate that situations with high competition pressure enable to recognize an athlete and a team with competitive greatness. Trninić, Papić and Trninić (2011, p.11) stated that "high training and competition stress will affect a certain athlete, which is primarily conditioned by cognitive appraisal and the interpretation of the event, by the athlete's personality traits (e.g. emotional stability and extraversion), by mood state and previous competition experiences in addition to his or her motivation variables as mediators affecting the regulation of experiencing and behaviour.

In the process of sport training and competition, the coaches assess (observe in situation conditions) an athlete's coping with training and competition stress with the purpose of selecting and choosing athletes in elite sport. At the same time, they assess the ability to cope with stress, pain, effort or frustration as well as resistance to injuries at the training or competition. It is assumed that the intensity of stressful reaction depends not only on the cognitive appraisal and interpretation, in addition to personality traits, but also on the preparedness state in athletes and on strategies an athlete applies in coping with training and competition stress. In relation to this, situation system of learning and exercising (the queen method of training") must be formed with the purpose of stimulating specific adaptation changes of the organism which enable to stimulate resistance and efficacy in training and competition stress coping.

THE INFLUENCE OF PERSONALITY TRAITS ON COPING AND REACTING TO TRAINING AND COMPETITION STRESS

Personality traits influence internal and interpersonal functioning of an individual. At the same time, personality traits an individual owns and environmental factors leave an impact on an athlete's behaviour. The findings show that personality traits (in addition to abilities, tendencies and intelligence) mutually distinguish athletes, as they are the result of the interaction between genetic and environmental factors and help predict adaptive functioning and future behavior of individual athletes (e.g. who is going to cope with training and competition stress more efficiently). Further on, besides stated features, the parts of the adaptive process are cognitive appraisal, emotions, mood state, motivation and self-concept or the way a person sees, understands or defines himself/herself (Larsen and Buss, 2014). Equally, the authors state that "personality is influenced by personal traits (dispositional domain), biological factors (biological domain), conflicts within the nervous system (intrapsychic domain), personal thoughts, feelings, wishes, beliefs and other subjective experiences (cognitive experimental domain), social, cultural and gender position in society (social and cultural domain) as well as by adjustment to problems that life inevitably brings (adjustment domain) (p.14). According to dimensional view, athletes mutually differ according to the expression level of basic and specific or personality traits, and also by the way they react and adapt in different environment factors which is evident from the efficacy in training and competition stress coping. The implementation of athletes' selection must set as a goal to choose athletes who can perform tasks on the upper potential boundary in different stressing situations. Recent meta-analyses have shown that athletes, compared to non-athletes, have a higher level of extraversion and conscientiousness as well as a higher level of neuroticism (Filho et al. 2005; Tayabee et al. 2013). Further on, research results reveal that athletes have a higher level of agreeableness and openness or intellect as well (Dutton and Lynn, 2015). Probably the least preferable combination in athletes is low conscientiousness and high neuroticism (Trninić, 2015; Trninić 2016).

The findings reveal that some of the basic and specific personality traits are connected to training and competition stress resistance (Cox, 2012). With regard to this, the researchers are getting more interested in combined/interactive effects of personality traits as well as in possible roles of positive emotions and positive assessment of events in coping with stress efficiently. For example, "happiness and experiencing positive affects in everyday life can best be predicted by high extraversion and low neuroticism" (Steel & Ones, 2002). Combinations/interactions of basic personality traits most likely predict more appropriately than individual dispositions which can be relevant for approaching emotions and behavior and efficient stress coping (e.g. low neuroticism, high conscientiousness and extraversion) as well as for understanding of personality functioning and predicting behaviour in different situations (Trninić, 2015; Trninić, 2016), At the same time, the stated combination of personality traits predicts less stressor subjection, less physical diseases and less stressed dissatisfaction with job, while high neuroticism and low conscientiousness predict higher stressor subjection, dysfunctional coping, physical diseases, dissatisfaction with job and less problem-focused coping (Grant & Langan-Fox, 2006). The authors indicate there are findings showing that the interaction of high neuroticism and low agreeableness is efficient in predicting dissatisfaction with work. It is assumed that adaptation is primarily influenced by personality traits e.g. neuroticism and extraversion, age, religion and cultural background, coping style and the exerciser's preparedness state.

In addition to this, specific personality traits responsible for efficient reaction to stress are hardiness, optimism and attribution style as well as active stress coping strategies (Trninić, Kardum, & Mlačić, 2010). The authors state that hardiness consists of three mutually related components: control (an individual's confidence degree on his/her own ability to influence the outcomes of life events), commitment (the degree of involvement in life activities and the perception of these as interesting and important) and challenges (experiencing life changes as an opportunity for personal development). It is assumed hardiness may serve as a protection factor in encountering stressing and demanding competition events. Further on, athletes with more expressed hardiness are more likely to apply active, problem-focused stress coping strategies in situations which can be controlled. Optimists are characterized by expecting positive outcomes in most of their lives' domains (Larsen & Buss, 2014). Additionally, specific personality traits such as optimism and attributive style, hardiness, active stress-coping strategies and the perception of one's own efficiency are related to stress resistance, good health and good functioning of immune system. The findings show that personality is related to the individuals' health and life outcomes (Pervin, Cervone, & John, 2008; Cervone & Pervin, 2008; Larsen & Buss, 2014). It is assumed that negative emotions (e.g. anxiety, sadness) increase stress and diseases while pleasant or positive emotions (e.g. happiness, joy, enthusiasm) facilitate efficient stress coping and stress adjustment (Frederickson, 1998; 2000). The research findings show that „before the mindfulness training, subjects tended toward a slightly right-sided asymmetry, suggesting chronic stess. After the training, these subjects, compared to the control group, showed a significant shift toward left-sided asymmetry. They also reported less stress, feeling more energized, more engaged in their work and less anxiety" (Larsen & Buss, 2014, p. 221).

Finally, it is presumed that emotional intelligence is particularly important in thinking and in stress-situation coping. Particular importance has specific abilities to manage and regulate emotions, especially negative emotions, to manage stress, and specific ability to control impulses. It seems that training psychological skills change these two specific abilities that belong to emotional intelligence. Thus, it is crucial to state that "emotional intelligence is an adaptive form of intelligence consisting of abilities to: know one's own emotions, regulate these emotions, motivate oneself, recognize the way others feel and influence the way others feel" (Larsen & Buss, 2014, p. 643).

CONCLUSION

Training and competition coping are influenced by: cognitive appraisal and interpretation, personality traits, mood state, motivation and competition experience. At the same time, expressing certain basic personality traits (e.g. high neuroticism, low conscientiousness, low agreeableness and low extraversion) specific personality traits (e.g. hardiness, optimism and attribution style, stress coping active strategies and the perceived self-efficacy) in addition to efficient and inefficient experience are related to training and competition stress resistance. Frustration tolerance and efficient training and competition stress coping may be acquired in the process of applying intervention programmes of psychological preparation and in situation training as the most important method of the integral sport preparation. Situation training involves improving individual and team performance under the pressure of time, result as well as the intensity of training and competition straining and different tasks in sport activity.

Recent findings suggest that personality expressing can change, particularly in children and adolescents when regular exercising has a central role in peer relations. Future studies should answer the questions which combinations of basic personality traits (e.g. expressed conscientiousness, extraversion and emotional stability) and specific ones (e.g. expressed hardiness, high optimism and attributive style) in addition to active stress coping strategies and a high level of perceived self-efficacy are related to approaching behavior as well as to the coping style through positive emotions. It is most likely that in future, psychology which studies approaching behavior, i.e. avoiding behavior, will have its say (Carver, Sutton, & Scheier, 2000). The authors of this study considers that the stated directions must have a special status in kinesiology of sport. With regard to this, we can stress the tendency to feel positive emotions and approaching and the tendency to feel negative emotions and avoiding (Davidson, 2000) which serve as a basis to human (athletic) sensation experience and behaviour, and which should have a privileged position in future researches.

In future, we may search for more researches to be focused on finding a genetic profile in elite athletes (Eynon et al. 2011) which will raise the level of understanding neural mechanism which basically make a difference between elite and average athletes. Such approach may be a precondition for rational management of the development of relevant characteristics in athletes, as well as for scientifically-based selection of players for top sport achievements (Yarrow, Brown, & Krakauer, 2009). With relation to this, recent studies suggest there are differences in the functioning of cortical and subcortical brain structures in beginners and elite athletes, where elite athletes display more activity in certain areas, but less total activity, which reveals the ability to filter irrelevant information (Yarrow, Brown, & Krakauer, 2009). Elite players, unlike beginners, are more likely to use brain more functionally (Yarrow, Brown, & Krakauer, 2009) which asks for further sophisticated neuroscientific researches.

Another challenge in further studies should be the question whether the efficacy level of training and competition stress coping changes in relation to certain biological developing periods (e.g. adolescence or early adulthood) or these relations remain unchanged. However, "the interpretation of findings in developmental researches as actual developmental changes is not simple in longitudinal research designs" (Bratko, 2002, p. 604). Problems may be of methodological character and they may involve difficulties in separating maturational effects from all other effects in longitudinal researches and in applying personality questionnaire (Tatalović & Vorkapić, 2014).

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WHETHER FAMILY RELATIONSHIPS ARE A SIGNIFICANT PREREQUISITE FOR DEVIANT BEHAVIOUR ON VISITORS (FANS OR SUPPORTERS) OF THE SPORT EVENTS

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UDC 316:796.01

SUMMARY

In this research work we explore whether family relationships are a significant prerequisite for deviant behaviour on visitors (fans or supporters) of the sport events in Republic of Macedonia. From which emerges the goal of labour for determinate the influence of family relationship as a risk factor for a deviant behaviour on funs of sport events in Republic of Macedonia. In this research work we surveyed 409 randomly selected respondents' visitors (funs and supporters) on public sports events in our country. Results in this research work are based on answers of visitors (fans or supporters) who are going on public sport events, whereby is analyzed influence of family relations as a risk factor for deviant behaviour on the sport events. The questionnaire was a consisted with 79 variables who has a related with main problem under investigation on this research work. While the comparative method has particular significance for sociological research and some others consider it a substitute for experiment. The research by this method was compared connection among deviant behaviour in different types of public sport events, to see "whether" and how much it has an influence of family relationships for deviant behaviour on visitors (fans or supporters) on sport clubs. As a conclusion, therefore, when creating a strategy for preventing and reducing deviant behaviour at sport events without exception should be taken into account the family environment and family relations, which is the basic cell of every society and a primary agent of socialization.

Keywords: Family/Deviant behaviour/Sport events/Visitors/ Fans or Supporters

INTRODUCTION

In this research work we explore whether family relationships are a significant prerequisite for deviant behaviour on visitors (fans or supporters) of the sport events in Republic of Macedonia. From which emerges the goal of labour for determinate the influence of family relationship as a risk factor for a deviant behaviour on funs of sport events in Republic of Macedonia. In this research work we surveyed 409 randomly selected respondents' visitors (fans and supporters) on sport events in our country. Results in this research work are based on answers to visitors (funs or supporters) who are going on sport events, whereby is analyzed influence of family relations as a risk factor for deviant behaviour on the sport events. The questionnaire was a consisted with 79 variables who has a related with main problem under investigation on this research work. While the comparative method has particular significance for sociological research and some others consider it a substitute for experiment. The research by this method was compared connection among deviant behaviour in different types of sport events, to see "whether" and how much it has an influence of family relationships for deviant behaviour on fans or supporters on sport clubs. When we thing about visitors (fans of supporters) on sport events, trough me experience in all my expert of scientific work, I conclude the difference between fans who is direct represent for fan's group.

Example 1: "Fans" are one or more represents of one fan's groups as Delije or Bad Blue Boys or other, they have his symbols, tradition, rituals and they have activities all the time for his sports clubs for whom they cheer. This category is always ready for deviant behavior (violence, fights, destroys and warns)

Example 2: "Supporters" are one or more persons who have strong support to one sports club of national sport representation, and they give him support every game not only with cheering but they support club financially (buy ticket, souvenirs, sports wardrobe and any object that has to do with the club. This category always manifests positive behavior not only for sport club but for other supporters.

METHODS

Subjects

The subject or dilemma in this research work is whether family relationships are a significant prerequisite for deviant behaviour on funs or supporters of the sport events in Republic of Macedonia.

Research Hypothesis

H^0 – The influence of family relationships aren't significant prerequisite for deviant behaviour on funs or supporters of the sport events, and

H^1– The influence of family relationships are significant prerequisite for deviant behaviour on funs or supporters of the sport events

Procedure

Sample of respondents

The subject of this research has been analyzed through a set of questions in the survey questionnaire distributed to fans in the many football clubs in all region of Republic of Macedonia.

Total number in this research work is 409 respondents who were a visitor (fans and supporters) on deferent sport events as National league competition and European cup qualification.

Time and place of the research

The research was realized in the period from beginning of October 2015 to the end of May 2016 year. One of part of respondents was a surveyed on field through personal contacts, while a part of them were surveyed by questionnaires submitted to them through social networks and internet.

Statistical analysis

For the purpose of statistical data processing we have applied χ^2 - test in two forms. The tables were construed by crossing on one side the variables for assessment of the social-demographic factors (ethnicity), in figures by frequency (f) and in percentage (%), and on the other side are the variables gender, residential status and current social status, also by frequency (f) and in percentage (%). The data are presented both in tables and in pictures.

The data have been processed with IBM SPSS Statistics for Windows Version 20,0.

RESULTS

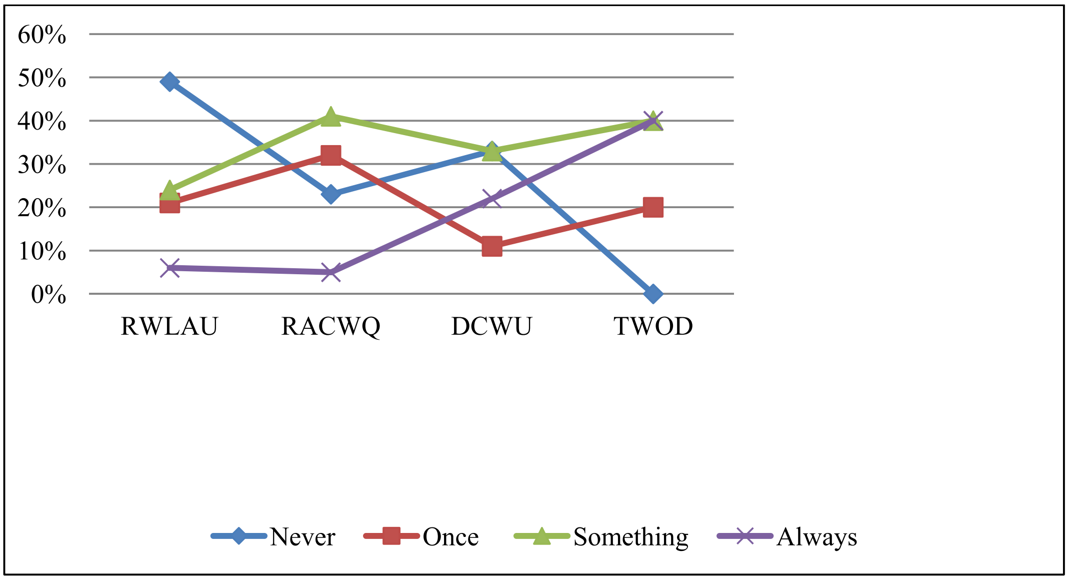
The influence of family and relationships in it on the deviant behaviour of visitors (fans or supporters) to sport events is investigated by establishing differences between the types of relationships between family members and reaction in an argument with a member of family participation in an incident during sport events and mode of response during the incident. The analysis took into account four types inter family relations: relaxed, with love and understanding, relaxed and correct, without argument, careless and cold, without understanding, and tense, with occasional disputes. Significance obtained are shown in the tables that follow. From Table and picture 1 (see below), notes that there is a statistically significant difference at the level 0.01 ($p < 0.01$) among persons living in families with a relaxed relationship, filled with love and understanding and those who live in families that are present arguments and/or cold and indifferent attitude. The largest percentage of **49.41 percent** of those who have relaxed and warm inter family relations filed with love and understanding, said they never participated in incidents during sports events. In contrast, **40 percent** of those who are tense with occasional bickering inter family relations, said they are frequent participants in incidents during sport events.

Table 1: Percentages of the attitude of family members in comparison with that if visitors were involved in some incidents during sport events

Relations between members of the family	Have you been participating in an incident during a sports event ?				df	p
	Never	Once	Something	Always	5	.000**
Relaxed, whit love and understanding	**49.41%**	21.17%	23.52%	5.88%		
Relaxed and correct without quarrels	22.72%	31.81%	40.90%	4,54%		
Disinterested, cold without understanding	33.33%	11.11%	33.33%	22.22%		
Thrown with occasional quarrels	0%	20%	40%	**40%**		

Note: df - degrees of freedom; ** p <0.01 ***Source: Research 2015/2016***

Picture 1: Percentages of the attitude of family members in comparison with that if visitors were involved in some incidents during sport events



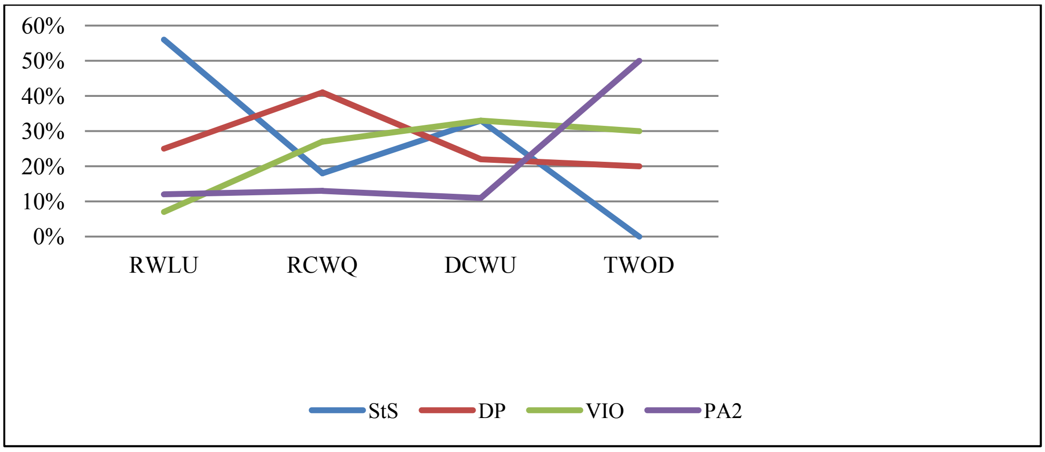
Statistically significant difference at the level 0.01 (p <0.01) was found in relation to the different reaction of the visitors who took part in an incident of sport events depending on the type of inter family relations. From Table and picture 2 (see below), shows that the largest **56.47 percent** of those persons who have relaxed and warm inter family relations were on hand in the incident. In contrast, **50 percent** of those who live in families where relationships are strained and the occasional bickering physically attacked during the sports event. It is interesting to note that **40.90 percent** of respondents who reported that family relations are relaxed and correct, no arguments were direct participants in incidents during sport events, while **33.33 percent** of respondents who have a disinterested and cold relations with occasional family disputes verbally insulted other visitors.

Table 2*:* Percentages of the attitude of family members compared with the way that responded during the incident on sport events

Relations between members of the family	Method of reacting during the incident at a sports event ?				df	p
	Standing on the side	Direct participant	Verbally insulted other	Physically attacked	5	.000**
Relaxed, whit love and understanding	**56.47%**	24.70%	7.05%	11.76%		
Relaxed and correct without quarrels	18.18%	40.90%	27.27%	13.63%		
Disinterested, cold without understanding	33.33%	22.22%	***33.33%***	11.11%		
Thrown with occasional quarrels	0%	20%	30%	**50%**		

Note: df - degrees of freedom; ** p <0.01 ***Source: Research 2015/2016***

Pictue 2: Percentages of the attitude of family members compared with the way that responded during the incident on sport events



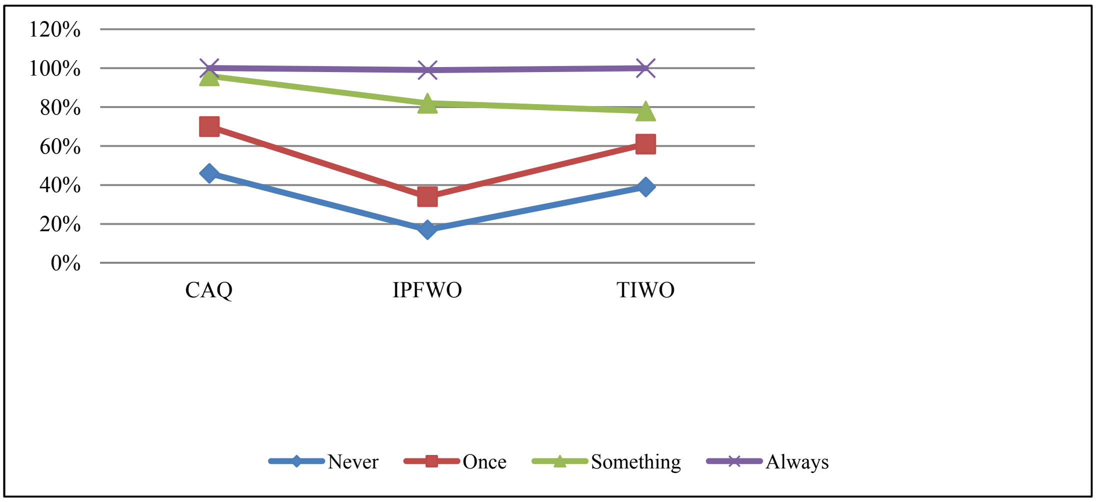
The analysis of how to react in an argument with a family member were taken into account three types of reactions: calmly, avoiding quarrels, impulsively, in a fight with offensive words. Results in Table and picture 3 (see below), indicate that no statistically significant difference at the level 0.01 ($p < 0.01$) on terms of participation in an incident on sport events and how to react in an argument with family member. Persons who respond calmly and try to avoid quarrels in the largest *46.25 percent* never participated in an incident at a sport event. Unlike them, *47.82 percent* of those who are physically calculated in a dispute with a family member is sometimes included in the incidents on sport events.

Table 3: Percentage ratio argument with a family member compared with the participation of some incidents during the sport events

How to react whit the members of family	Have you been a participant in some incident during the sports events ?				df	p
	Never	Once	Something	Always	5	.000**
Calm, I'm avoiding quarrels	**46.25%**	23.75%	26.25%	3.75%		
Impressively, physically I fight with others	17.39%	17.39%	**47.82%**	17.39%		
Tread, insults words to others	39.13%	21.73%	17.39%	21.73%		

Note: df - degrees of freedom; ** p <0.01 ***Source: Research 2015/2016***

Picture 3: Percentage ratio argument with a family member compared with the participation of some incidents during the sport events



DISCUSSION

This is what we can ascertain that the hypotheses that were tested using the survey for visitors (fans of supporters) during the sport events that first hypothesis is not confirmed and he is completed reject. Analogous of this, second hypothesis is completely confirmed about families relationships a s risk factor for produced deviant of visitors (fans or supporters) to sport events in Republic of Macedonia. The intention was to see whether inter-families relationships are basic factor for produced deviant behavior, between family members affect the manifestation of deviant behaviour at public sport events. The assumption is that if young people live and socialize in family where relations are with great understanding and harmony and where disagreements are rare and are resolved by peaceful means, then family members (young) who are fans of supporters on sport clubs and have attend on sport events or are members of fan groups, not cause nor, to participate in deviant behaviour the same. The obtained results confirmed the research hypothesis under which the particular family relationships in it affect on deviant behaviour at sport events.

The issues with which to confirm the second hypothesis, formulated in a way that will help you realize the type of family where the child lives. Initially we put emphasis on the type of family relationships is important sociologically because whether they are based on love, understanding, tolerance, but not to some negative values who is reality today. Questions pertaining to family relationships among members primarily sought answer to the size of the family. Quantification is important because it is assumed that families with more children or those living in more generations are more prone to tension and conflicts. Furthermore, specifically highlight the relations between members that are defined by categories: relaxed with love and understanding, relaxed and correct, without argument, careless and cold, without understanding, and tense, with occasional disputes. In terms of this categorization of relations put and frequency of each type of relationship she and generalized as follows: never, once, sometimes, and often. The research results are in line with theoretical findings and show that the largest percentage of those living in families where relationships between members are relaxed, with love and understanding, never participated in an incident during sports events. In contrast, individuals who come from families where relationships between members are tense, with occasional disputes, sometimes, even often, were involved in the incident.

CONCLUSION

On our basic dilemma, who we have set and the paper title whether family relationships are a significant prerequisite for deviant behaviour on visitors (funs or supporters) of the sport events in Republic of Macedonia, especially term “WHETER” – are simply answer is “YES”. Conclusions regarding the second hypothesis regarding the influence as a risk factor for deviant behaviour of visitors to sport events speak in favour of it. Also found that the general atmosphere that reigns in family, relations between family members and how to resolve mutual conflicts significantly affect an individual's behaviour during public sport events. The assumption that if young people live and socialize in a family where understanding and harmony reigns and where disagreements are rare and are resolved by peaceful means, then family members who are lovers of sports and attending sport events (such as supporters or members of fan groups) will not cause or participate in deviant behaviour, have been confirmed with high confidence interval. Results of this research shows that the largest percentage of those living in families where relationships between members are relaxed, with love and understanding, never involved in an incident during sport events. In contrast, individuals who come from families where relationships between members are tense, with occasional disputes, sometimes, even often, are participants in the incident. We can perform an general conclusion according to which family relations it are an important factor for predicting for deviant behaviour by visitors (fans or supporters) to the public sport events. If there are warm family relationships among members, whose main feature is the care, safety, love, mutual respect and respect for the opinion of each member. The likelihood that these individuals will manifest deviant behaviour in sport events is very small. On the contrary, when the relations in family are present tension, hostility, cold and indifferent attitude towards the basic needs for love, security and attention of its members, the likelihood that anger and stress as possibilities for deviant behaviour will be expressed during an sport events. Therefore, when creating a strategy for preventing and reducing deviant behaviour at sport events without exception should be taken into account the family environment and family relations, which is the basic cell of every society and a primary agent of socialization.

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THE SCIENCE OF MANAGEMENT CONNECTED TO THE SPORT LEARNING PROCESS IN ALBANIA

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UDC 005.796

SUMMARY

This study's goal is to highlight the importance of the science of management in the learning process in sport educational institutions and to connect in a practice way management and marketing to the sport activities in the ex-communist countries like Albania.

We face every day different realities which have recognized and have worked strategically for many years to invest in human resources and capabilities across the sport sector. The term "Resources" means not only sport people but also managers in sport. Sports managers handle the basic organization and scheduling of their clients. Both individual athletes and entire organizations hire sports managers to see that everything off the field goes smoothly. To become a sports manager it's helpful to have a bachelor's degree, a related internship, or experience within the sport. Graduate level degrees in sports management might enhance job prospects in this career.

Sports revenue managers are given the responsibility of analyzing key market trends in the entertainment industry to provide important figures for their organization's annual budget. Most sports revenue managers help drive their sports club's business plan by making sure ticket prices and merchandise costs are right on target to draw in maximum revenue. Sports revenue management duties can include tracking price patterns, monitoring the sales of competitors, initiating promotions to generate more revenue, forecasting future revenue performance, and finding effective yield management strategies. Sports revenue managers often will act as liaisons connecting the sales and marketing teams with the general manager and other execs.

Before jumping into the lucrative field of sports revenue management, you'll need to pay your dues by earning at least a bachelor's degree from an accredited post-secondary school. Most aspiring sports revenue managers will earn an undergraduate degree in business administration, sports management, finance, accounting, marketing, management, or economics. Regardless of your chosen major, it's essential that you take courses specifically related to sales, marketing, finance, and revenue management in the sports industry because it can vary from other industries. Many revenue managers will boost their professional capacity by returning to graduate school for a Master of Business Administration (MBA) or a specialized Master of Science in Sports Management. Actually we have a Department of Sport management and organization in and a Professional master in Management in Sport and Tourism connected with sport activity.

Overall, having a good bottom line is critical for all sports organizations, looking to win both games and profit in today's competitive industry. That's why sports revenue management is an important specialty area for making certain organizations to receive the maximum revenue available per sale and per seat at the game. If you choose to work as a sports revenue manager, you'll have the unique opportunity to help sport's clubs thrive off the field. The role of the academic institution in these field become very important in order to give to the market not only sport people but also sport managers.

Keywords: Management, Marketing, Sport, Educational institutions

Physical Activity and Health

EATING HABITS, PHYSICAL ACTIVITY AND LIFESTYLE, HEALTHY AND UNHEALTHY DIETARY HABITS AND FOOD IN AN ALBANIANS STUDENTS GROUP OF SPORTS UNIVERSITY OF TIRANA

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UDC 796_051:613(496.5)

SUMMARY

The present study evaluates eating habits, physical activity, lifestyle and healthy and unhealthy dietary habits and food in a group of Albanians students.

A dietary questionnaire previously constructed and tested was self-administered during school time. Each section was evaluated using a separate score.

The study was carried out as a part of a nutritional surveillance project in the Sports University of Tirana

148 student subjects (45 female – 103 male), aged 18.2- 19.4 years, attending the first year of Bachelor, participated in the study.

We evaluated eating habits, physical activity, meaning of healthy and unhealthy dietary habits and food, weight, height, Body Mass Index (BMI).

Only 35.14% of the sample have satisfactory eating habits; 35.81% have a very active lifestyle; only 47.30% have quite good nutritional knowledge.

The results point out unhealthy behaviors influencing students' eating habits and suggest which of these must be considered in order to develop tailored nutrition interventions, improving students' consciousness aimed at adopting a healthy lifestyle.

Key words: eating habits, dietary questionnaire, educational programs, students

INTRODUCTION

Healthy eating patterns in childhood and adolescence promote optimal childhood health, growth, and intellectual development; prevent immediate health problems, such as iron deficiency anemia, obesity, eating disorders, and dental caries; and may prevent long-term health problems, such as coronary heart disease, cancer, and stroke.

School health programs can help children, adolescents and students attain full educational potential and good health by providing them with the skills, social support, and environmental reinforcement they need to adopt long-term, healthy eating behaviors.

The principles contained in the Dietary Guidelines for Americans should be the primary focus of school-based nutrition education. By enabling young persons to adopt practices consistent with the guidelines, schools can help the nation meet its health objectives. During adolescence, young people are assuming responsibility for their own eating habits, health attitudes and behaviors. In fact, attitudes play an important role in the adoption and maintenance of a variety of health and nutritional habits.

Although adolescents' growing independence is often associated with unconventional eating patterns [18,10] and dietary behavior during adolescence might be transitory in some individuals, health-related behaviors show tracking through adolescence [9] and there is clear evidence of their early consolidation.

Factors influencing eating behaviors need to be better understood to develop effective nutrition interventions tailored to individuals to improve their healthy eating [16]. Therefore, determinants such as habits, and the meaning of "healthy" and "unhealthy" diet and food must be considered.

In the present study we evaluated eating habits, physical activity, meaning of healthy and unhealthy dietary habits and food, in a selected group of students of Sports University of Tirana, Albania. In addition, students' weight and height were measured to compute BMI to investigate the possible relationship between BMI and the above mentioned variables.

METHODS

Sampling

All the students of both gender attending the first year of Bachelor (n = 148) were informed about the study. The overall students attending university were equal to 148 subjects (69.59% males and 30.41% females). We decided to select only the first year Bachelor students (148 subjects) as we intend to follow-up a nutrition education intervention.

The study was carried out as part of a wider nutritional surveillance project that also included several nutritional assessment measurements, such as anthropometric (body weight, body height, skin folds and body circumferences).

All students were surveyed over the course in May 2017. 148 subjects, 103 males (69.59%) and 45 females (30.41%), participated in the study. This was a cross-sectional study, aware of the limitations included in such kind of study, in that it may not always be possible to distinguish whether the exposure preceded or followed the diseases. Informed written consent was obtained from each student.

Data Collection

1. Questionnaire

A dietary questionnaire previously constructed and tested with regard to its reliability [34] was self-administered during school time. It is divided into 3 main sections. Appendix 1 shows the questionnaire, which contains various topics as described below.

Section 2 - Eating habits: consisting of 14 questions. This section was designed to investigate the food habits of the adolescents, especially regarding breakfast contents, number of meals a day, daily consumption of fruit and vegetables as well as of both soft and alcoholic beverages.

Eight of the questions had the following response categories: always, often, sometimes, never; the other 5 have instead 4 response categories structured in different ways.

The score assigned to each response ranged from 0 to 3, with the maximum score assigned to the healthiest one and the minimum score to the least healthy one. The total score of this section was 42.

Section 3 - Physical activity: it contained 6 questions aimed at investigating physical activity levels. All responses were structured in different ways according to each question, each score ranging from 0 to 3, with the maximum score assigned to the healthiest habit. The total score of this section was 18.

Section 4 - Healthy and unhealthy dietary habits and food: consisting of 5 questions aimed at investigating the students' beliefs about healthy and unhealthy diet and food. Each question had 4 different responses, with the score ranging from 0 to 3. The total score of this section was 15.

As a measure of internal consistency of each questionnaire section, in a previous study [17] we computed Cronbach's alphas, while Pearson's correlation was used as a measure of temporal stability. Pearson's correlation, used to assess test-retest reliability for each of the sections, was very high: Pearson's correlation coefficients ranged from a minimum of 0.78 to a maximum of 0.88, indicating a very good temporal stability of the questionnaire.

All Pearson's correlation coefficients were statistically significant with $p < 0.01$.

The total score of each section was divided into tertiles, with the lowest tertile assigned to the worst evaluation and the highest to the best evaluation.

Before starting the study, we have organized many meetings with pedagogues and students to explain the aim of the research and to request their participation.

The questionnaire was self-administered during university study time under the supervision of the pedagogues and of a dietitian. In order to minimize the possibility of bias, all supervisors (students of scientific master) had received *8 hours of instruction about the questionnaire* and were standardized in answering any of the students' questions if explanations were needed.

We chose to self-administer the questionnaire as this makes it possible to collect simultaneously a large quantity of information from many subjects in a short period of time, costs less to administer than personal interview and requires fewer trained personnel. On the other hand, a self-administered questionnaire makes it more difficult to verify response truthfulness [1].

Since the questionnaire was completed under the pedagogue's and dietitian's supervision, checking that the students completed all the answers, non-response rate was equal to zero.

Completing the questionnaire took about 50 minutes.

Data Collection

2. Weight and Height Measurements for BMI Calculation Students' weight and height were measured by health personnel of our laboratory according to standard conditions. Body weight was

measured on subjects wearing only underwear and without shoes by means of a steelyard scale (precision ±100 g); body height was measured on subjects without shoes by means of a stadiometer (precision ±1 mm).

BMI was calculated as a ratio between weight and height squared with weight in kilograms and height in meters.

Data Analyses

The scores obtained in each section are expressed as mean ± standard deviation. The percentage distribution of students in each tertile score was calculated by using the statistical Package for the Social Sciences [30]. T-Student test was calculated to investigate differences in scores obtained by males and females, normal and overweight plus obese subjects; Pearson's correlation coefficients were computed to analyze the relationship between BMI and the investigated variables.

Reference Standards

Eating habits, physical activity, meaning of healthy and unhealthy dietary habits and food, were evaluated by comparing them with the Dietary Guidelines for Italians' Healthy Diet [12].

According to the International Obesity Task Force (IOTF) [5,3], Cole's age-specific cut-off points reference standard for BMI [4] was used to identify overweight and obesity in young age. Cole's centile curves were drawn so that at age 18-19 years they passed through the widely used cut off points of 25 and 30 kg/m^2 for overweight and obese adult.

The resulting curves were averaged to provide age and sex specific cut off points from 2–18 years [4]. The IOTF suggests [5,3] that Cole's cut off points are less arbitrary and more internationally based than current alternatives (they were developed by measuring 97.876 males and 94.851 females, respectively, from birth to 18 years of age living in Brazil, Great Britain, Hong Kong, the Netherlands, Singapore and the United States) and will help to provide internationally comparable prevalence rates of overweight and obesity in children and adolescents.

RESULTS

Sample

Characteristics of the sample are shown in Table 1. Group mean age is 18.51 years and BMI mean value is 23.31kg/m^2 for males and 21.42 kg/m^2 for females. According to Cole's cut-off points reference standard for BMI [28], 19.3% of males and 7.7% of females are overweight, and 4.1% of males and 3.38% of females are obese. As far as underweight is concerned, Cole does not give any suggestion, and we decided to judge underweight subjects as those under the 3rd centile, therefore 2.63% of males and 9.17 of females are underweight.

67.2% of the students live by rent, while the others (22.30%) live in a traditional family and 10.50% either with the mother or with the father or with grandparents. Most of the students' parents have a junior high school license or a high school license while 29% have graduated. Regarding parents' occupations, office-worker is the most represented (21.5% of the fathers and 28.5% of the mothers).

Table 1

Characteristics of the participants

Variable	Total	Males	Females
Number of Students	N=148	N = 103	N = 45
Age (years)	18.51	18.84	18.18
Weight (kg)	66.13	74.65	57.61
Height (cm)	1.74	1.79	1.68
BMI	21.84	23.31	20.36

Table 2						
Prevalence of obesity among students based on BMI by gender						
	Males		**Females**		**Total**	
Weight Status	***N=***	***Percentage***	***N=***	***Percentage***	***N=***	***Percentage***
Underweight*	**2.7**	**2.63 %**	**4.13**	**9.17 %**	**6.83**	**5.90 %**
Normal**	**73.3**	**71.2 %**	**36.17**	**80.38 %**	**109.47**	**75.79 %**
Overweight***	**19.8**	**19.3 %**	**3.18**	**7.7 %**	**22.98**	**13.50 %**
Obese****	**4.2**	**4.1 %**	**1.52**	**3.38 %**	**5.72**	**3.74 %**

Underweight (BMI ≤ 18.5), ** Normal (BMI between 18.5 – 24.9), * Overweight (BMI between 25–29.9), **** Obese (BMI ≥ 30).**

Dietary Questionnaire

Eating Habits. The total score (42) was divided into tertiles, where the lowest one referred to "inadequate eating habits", the medium one referred to "partially satisfactory eating habits" and the highest one referred to "satisfactory eating habits". The mean score obtained is 29 ± 5, without any statistically significant differences between males and females.

10.97% of the students show "inadequate eating habits", 22.59% have "partially satisfactory eating habits", while (66.44%) show "satisfactory eating habits". The worst eating habits are skipping breakfast (about 29.74% of the sample); 49.52% of males and 31% of females do not drink milk or yogurt at breakfast; 54.06% of the subjects do not eat at least two portions of fruit and vegetables every day. With about 36,49% of the sample, consumption of cakes and sweets is too high, in that a dessert or cake is always consumed at each meal.

Section 2. Eating Habits

Questions	Levels	*Total* N=148	MALES N=103	MALES %	FEMALES N=45	FEMALES %	*TOTAL* %
2.1 Do you eat breakfast?	always	64	56	54.37	8	17.78	43.25
	often	40	29	28.16	11	24.45	27.03
	sometimes	25	10	9.71	15	33.34	16.90
	never	19	8	7.77	11	24.45	12.84
2.2 Which beverage do you consume at breakfast?	milk/milk and coffee/cappuccino/yogurt	82	51	49.52	31	68.89	55.41
	fruit juice	27	11	10.68	16	35.56	18.25
	tea/coffee	22	16	15.54	6	13.34	14.87
	chocolate	17	5	4.86	12	26.67	11.49
2.3 At breakfast you eat:	biscuits/cakes/crackers/ breakfast cereals/bread	80	66	64.08	14	31.12	54.06
	fruit	42	22	21.36	20	44.45	28.38
	sausages and cheese	17	11	10.68	6	13.34	11.49
	pizza/focaccia/toast	9	4	3.89	5	11.12	6.09
2.4 Do you eat at least 2 portions (g 200) of fruit every day?	always	72	48	46.61	24	53.34	48.65
	often	30	22	21.36	8	17.78	20.27
	sometimes	33	23	22.33	10	22.23	22.30
	never	13	10	9.71	3	6.67	8.79

2.5 Do you eat at least 2 portions (g 200) of vegetables	always	64	42	40.78	22	48.89	43.25
	often	36	24	23.30	12	26.67	24.33
	sometimes	37	27	26.22	10	22.23	25.00
	never	11	10	9.71	1	2.23	7.44
2.6 Do you usually eat a cake or a dessert at meals?	always	54	41	39.81	13	28.89	36.49
	often	37	23	22.33	14	31.12	25.00
	sometimes	51	36	34.96	15	33.34	34.46
	never	6	3	2.92	3	6.67	4.06
2.7 Do you usually drink wine or beer at meals?	always	25	22	21.36	3	6.67	16.90
	often	27	19	18.45	8	17.78	18.25
	sometimes	54	39	37.87	15	33.34	36.49
	never	42	23	22.33	19	42.23	28.38
2.8 Do you usually eat breakfast, lunch and dinner every day?	always	74	54	52.43	20	44.45	50.00
	often	36	24	23.30	12	26.67	24.33
	sometimes	27	19	18.45	8	17.78	18.25
	never	11	6	5.83	5	11.12	7.44
2.9 Your diet:	is different every day	52	30	29.13	22	48.89	35.14
	is different only sometimes during a week	39	27	26.22	12	26.67	26.36
	is different only during the weekend days	34	26	25.25	8	17.78	22.98
	is very monotonous	23	20	19.42	3	6.67	15.54
2.10 Your diet is based mainly on:	high protein content foods (meat, fish, eggs, cheese, dried legumes)	63	49	47.58	14	31.12	42.57
	high fat content foods (sausages, focaccia, fried potatoes, cakes with butter and cream)	42	31	30.10	11	24.45	28.38
	high carbohydrate content foods (bread, pasta, rice, potatoes, biscuits)	30	18	17.48	12	26.67	20.27
	different foods every day	13	5	4.86	8	17.78	8.79
2.11 Your snacks are based mainly on:	fruit/fruit juice/fruit and milk shakes/yogurt	68	47	45.64	21	46.67	45.95
	biscuits/crackers/bread/stick bread	37	26	25.25	11	24.45	25.00
	fried potatoes/pop corn /krapfen/peanuts/soft drinks	27	21	20.39	6	13.34	18.25
	sweets/chocolate/ice cream/cakes	16	9	8.74	7	15.56	10.81
2.12 Which beverages do you usually drink between meals?	mineral/natural water	66	42	40.78	24	53.34	44.60
	soft drinks (cola, orange, soda, iced tea, tonic water, etc.)	47	36	34.96	11	10.68	31.76
	wine/beer	15	12	11.65	3	6.67	10.14
	fruit/fruit juice/fruit and milk shakes	20	13	12.63	7	15.56	13.52
2.13 Do you drink at least 1 glass of milk or do you eat	always	70	54	52.43	16	35.56	47.30
	often	37	22	21.36	15	33.34	25.00
	sometimes	27	17	16.51	10	22.23	18.25

at least 1 cup of yogurt every day?	never	14	10	9.71	4	8.89	9.46
2.14 Do you drink at least 1–1,5 L of mineral/natural water every day?	always	80	57	55.34	23	51.12	54.06
	often	41	26	25.25	15	33.34	27.71
	sometimes	19	14	13.60	5	11.12	12.84
	never	8	6	5.83	2	4.45	5.41

***Section 3 Physical Activity and Lifestyle*.**

The total score (18) was divided into tertiles, where the lowest one referred to "sedentary physical level", the medium one referred to "partially moderate physical level" and the highest one referred to "active physical level". The mean score obtained is 11 ± 3, without any statistically significant differences between males and females.

A statistically significant difference was found between normal and overweight plus obese boys, with the highest score obtained by normal weight boys (12 ± 3 vs. 11 ± 3) (p = 0.03). Only 18.5% of the students have a very active lifestyle, while about one third (29.7%) show a sedentary physical level, not consistent with a healthy lifestyle.

In response to the question ***"What do you prefer to do during free time?"***

27.71% of the sample answered watching television, using the computer or mobile, listening to music, reading a book, while only 36.49% reported practicing a sport and 22.98% going for a walk. In general, males are more active than females: 38.84% versus 31.12%;

In response to the question **"Do you usually practice a physical activity?"**

64.08% and 60.00% respectively of males and females answered "always", (because they are students of sport university). It's very important that nobody answer "never".

Questions	Levels	*Total* N=148	MALES N=103	MALES %	FEMALES N=45	FEMALES %	*TOTAL* %
3.1 Do you usually practice a physical activity?	always during the entire year	93	66	64.08	27	60.00	62.84
	only in some seasons	39	26	25.25	13	28.89	26.36
	sometimes	16	11	10.68	5	11.12	10.80
	never	0	0	0	0	0	0
3.2 How many hours do you practice it?	1h–2h in a week	30	18	17.48	12	26.67	20.27
	3h–4h in a week	51	33	32.04	18	40.00	34.46
	more than 4h in a week	67	52	50.49	15	33.34	45.27
	no hour	0	0	0	0	0	0
3.3 What do you prefer to do during free time?	walking	34	24	23.30	10	22.23	22.98
	watching TV/listening to music /using the computer/ reading a book	41	29	28.16	12	26.67	27.71
	shopping	19	10	9.71	9	20.00	12.84
	practicing a sport	54	40	38.84	14	31.12	36.49
3.4 How many hours do you spend on the computer or Watching TV?	1h–2h a day	20	12	11.65	8	17.78	13.52
	3h–4h a day	58	43	41.75	15	33.34	39.19
	5h–6h a day	43	29	28.16	14	31.12	29.06
	more than 6h a day	27	19	18.45	8	17.78	18.25
3.5 The physical activity that you practice at school:	is tiring	19	12	11.65	7	15.56	12.84
	is boring	17	11	10.68	6	13.34	11.49
	stimulates you to practice sports even out of school	71	47	45.64	24	53.34	47.98
	makes you feel well	41	33	32.04	8	17.78	27.71
3.6 Your lifestyle is:	very sedentary	15	11	10.68	4	8.89	10.14
	sedentary	19	12	11.65	7	15.56	12.84
	moderately active	61	46	44.66	15	33.34	41.22
	very active	53	34	33.01	19	42.23	35.81

In response to the question *"How many hours do you spend on the computer or Watching TV?"*

47.31% of the sample answered "5h–6h a day or more than 6h a day" and this statistic is too high. Technology is "killing" the active time of our generations. In general, males and females are in the same level.

Healthy and Unhealthy Dietary Habits and Food.

The total score (15) was divided into tertiles, where the lowest one referred to "little comprehension of the meaning of healthy and unhealthy dietary habits and food", the medium one referred to "sufficient comprehension of the meaning of healthy and unhealthy dietary habits and food" and the highest one referred to "good comprehension of the meaning of healthy and unhealthy dietary habits and food". The mean score obtained is 11 ± 2, without any statistically significant differences between males and females. Slightly more than half of the sample (33.79%) have sufficient comprehension of the meaning of healthy and unhealthy diet and food, while (47.30%) have a good comprehension, with a higher proportion among males (51.46% v. 37.78%). In response to the question:" According to you, which is a healthy diet?", 47.30% of the sample answered correctly (a healthy diet is a diet rich in different foods), nevertheless only 33.79% of the subjects reported eating a varied diet every day, as section 2 (eating habits) indicates. Regarding the question "According to you, which is a healthy food?", 38.52% reported that "a food rich in protein" is the healthiest one, 28.38% chose "a food rich in calories", 16.22% "a microbiologically tested food" and 16.90% "a food without preservatives and additives".

Section 4. Healthy and Unhealthy Dietary Habits and Food

Questions	Levels	*Total* N=148	MALES N=103	MALES %	FEMALES N=45	FEMALES %	*TOTAL* %
4.1 According to you, which is a healthy diet?	a diet rich in different foods	70	53	51.46	17	37.78	47.30
	a diet whose foods are rich in protein (meat, fish, eggs, cheese, dried legumes)	50	31	30.10	13	28.89	33.79
	a diet without any fats	21	10	9.71	11	24.45	14.19
	eating fish very often	13	9	8.74	4	8.89	8.79
4.2 According to you, which is the healthiest eating behaviors?	drinking 2 glasses of milk/eating 2 cups of yogurt every day	56	38	36.90	18	40.00	37.84
	preferring cooked vegetables to uncooked vegetables	35	23	22.33	12	26.67	23.65
	eating always cheese instead of meat	38	29	28.16	9	20.00	25.68
	when you eat snacks, preferring fruit/fruit juice/ biscuits and crackers	19	13	12.63	6	13.34	12.84
4.3 According to you, which is a healthy food?	a food rich in protein	57	42	40.78	15	33.34	38.52
	a food rich in calories	42	33	32.04	9	20.00	28.38
	a microbiologically tested food	24	18	17.48	6	13.34	16.22
	a food without preservatives and additives	25	10	9.71	15	33.34	16.90
4.4 According to you, which is the	washed vegetables ready to eat	84	58	56.31	26	57.78	56.76

healthiest food?	a canned food	26	21	20.39	5	11.12	17.57
	a food very rich in dressing	24	14	13.60	10	22.23	16.22
	a fried food	14	10	9.71	4	8.89	9.46
4.5 According to you, which is the healthiest cooking method?	cooking on a grill/in boiled water	58	42	42.22	16	35.56	39.19
	frying/braising	32	23	22.33	9	20.00	11.49
	cooking in the oven without fats	35	21	20.39	14	31.12	23.65
	cooking in a pan with fats	23	17	16.51	6	13.34	15.54

Dietary Questionnaire and BMI

Dietary questionnaire scores were analyzed in relation to students' BMI, considering two groups: normal weight subjects versus overweight plus obese subjects. No statistically significant differences emerged between the two groups for any sections of the dietary questionnaire except for section 3 relating to physical activity, for which normal weight boys obtained higher score (12 ± 3 score) than overweight plus obese ones (11 ± 3 score) ($p = 0.03$). In addition, no significant correlation (p = N.S.) emerged between scores obtained in each section and BMI values, except for section 4 (healthy and unhealthy dietary habits and food) where a negative correlation was found for the total sample ($p < 0.001$; $R = -0.71$).

DISCUSSION

The present study of 148 18-year-old students provided results with implications for designing programs for health promotion and improvement in nutritional habits for adolescents and students age.

The sample contains a slightly higher percentage of males than females, which reflects gender distribution in Sport University of Tirana. Most of the students live by rent houses. Parents' educational level is not high, as most of the fathers have a junior high school license and most of the mothers have a high school license.

As far as BMI is concerned, most of the students are in the normal range of values according to Cole's reference standards [4], while prevalence of overweight subjects in both sexes is high, but higher in males. On the other hand, the prevalence rate of obese students is low. Nevertheless, the high percentage of overweight subjects is worrying, and preventive and corrective strategies need to be undertaken in school programs aimed at weight control and therefore at reducing this risk condition. A few subjects are underweight under the 3rd centile, including just 2 male and 4 females. Our data are high in overweight students with 19.3% in boys and 7.7% in girls and a prevalence of obesity equal to 4.1% in boys and 3.38% in girls, respectively. Our results can be explained by the fact that, even though our subjects are students of Sport University, they mostly have a active lifestyle as shown from the results of section 3 of the questionnaire.

In addition, foods such as cheese rich in fats, sausages, butter and lard are traditional components of traditional meals in Tirana.

Overweight and obesity were not related to scores obtained in the dietary questionnaire, except for physical activity level in males as well as for beliefs about healthy and unhealthy diet and food in both sexes, which influence overweight and obese adolescents in making unhealthy food choices.

Data on eating habits show a good intake of milk and yogurt at breakfast as well as of fruit and vegetables and low consumption of cakes and sweets. In addition, about 56.77% of the students do not have breakfast every day. These results are inconsistent with the Dietary Guidelines for Italians' healthy diet [12].

As far as physical activity and lifestyle are concerned, though most students, 41.22% have moderate physical levels, about 10.14% of the students show a sedentary lifestyle, with a little bit higher proportion among males. This result represents a typical adolescent and student habit consisting in spending many hours in sedentary activities (watching television, using the computer, listening to music, reading a book) [14]. Watching television has been linked with an unhealthy diet, high cholesterol levels [20] and overweight and obesity [6,8]. This may be influenced by unhealthy nutrition messages in commercials [11], eating snack foods and decreased physical activity [14].

The meaning of healthy and unhealthy dietary habits is sufficiently known by the students, while the meaning of healthy food is less clear: in fact, 38.52% of the subjects report that a food rich in protein is the healthiest one. Our results are similar to those of Croll et al. [21] who found, in a sample of 203 American adolescents attending senior high schools, that adolescents have a significant amount of knowledge regarding healthy habits as they believe that healthy eating involves moderation, balance and variety.

Our results suggest that lay understanding of healthy eating does generally conform to dietary guidelines, and therefore health promotion priorities should focus on physical and psychological constraints to healthy eating, rather than attempting to increase the adolescents' knowledge as a whole.

CONCLUSION

In conclusion, different aspects of students' eating behavior may be influenced by different factors, which need to be considered in designing nutrition promotion programs. Nutrition and health professionals should tailor educational and treatment strategies according to the specific desired dietary outcomes. Interventions should help to make healthy eating easy for adolescents and students to apply and explain the consequences of unhealthy eating in terms that they value, stressing meaningful short and long-term benefits for human health, providing knowledge, increasing consciousness of healthy eating and, lastly, supporting the adolescents ans students in the adoption of healthy lifestyle.

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PHYSICAL ACTIVITY OF MIDDLE-AGED PEOPLE: A COMPARATIVE STUDY

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UDC 796.012.1-053

SUMMARY

The aim of this research was determining the level of physical activity in the population of men and women aged 50-60, so as to recognise whether there are differences between men and women in the level of physical activity and also if there is a difference among the participants of various age. The sample was consisted of 24 participants (11 men, mean age 55.4±3.01 and 13 women, mean age 54.8±08) from urban background. The level of physicalal activity was measured in pedometers (HJ-152, OMRON Japan) during seven days. Total number of steps was also measured as well as the distance passed expressed in km. For the purpose of determining the differences between men and women, as well as among certain age groups, a t-test was applied. All the collected data were processed via a statistical package Statistica 8.0 intended for data processing. After the implemented survey, the results showed that there are no significant differences in the level of physical activity of men and women ($p > .05$) but on the other hand, it was shown that men are more physically active when compared to women. Significant differences among the participants of various age ($p < .05$) were identified. It was concluded that the level of physical activity decreases with the aging both in men and women.

Keywords: Physical activity, pedometer, age 50-60

INTRODUCTION

What dominates the modern society is a sedentary lifestyle causing cosequences in the form of various health issues. According to the report of the World Health Organisation, insufficient physical activity (hypokinesis) has been declared as an independent risk factor and currently, it is ranked fourth in the world list of risk factors. General mortality rate in persons performing no physical activity is 2.5 higher, mortality rate is even 3.5 times higher in cardio-vascular dieseases, and in some forms of cancer mortality rate is 3 times higher (World Health Organization, 2003). A sedentary lifestyle and reduced physical activity lead to endangered health and normal functioning of organs and human organ systems (Hollmann, 1992; Hollmann & Hettinger, 2000; Weineck, 2000). Physical activity is defined as any body movement of skeletal muscles leading to energy consumption higher than while resting (Thompson et al., 2003). Practically, it encompasses all forms of activity, such as every day walking or bike riding, activities related to work, active playing and active resting time (such as exercising in the gym), dancing, gardening, as well as recreational and competitive sport activities. Level of physical activity is frequently used as a parameter of monitoring and health assessment of population and it is almost always associated with the health condition. Regular, properly portioned physical activity is a significant factor of a healthy lifestyle. Everyday, indvidual and optimally dosed physical activity increases physical fitness and working ailities (Mitić, 2001). With regard to physical activity, activities of moderate intensity such as hiking, take the central position, as it has been shown that such activities can be performed by significantly larger number of people since they are physically less demanding and are easier to include in a daily routine of individuals (Ostojić, 2009).

When it comes to the physical activity of persons aged between 50 and 60, what needs to be cosidered are the characteristics of the respective period of life. Namely, it is the period when the aging process begins and when these persons face a number of physical changes. Such changes which commence with the process of aging are the following: difficulties in functioning of certain systems in the organism, blood vessel damages, problems with heart functioning, raised blood pressure, diabetes, changes and damages to the muscle and bone tissue, weakening of eyesight and hearing, loss of elasticity, joint wear, deteriorated sleep quality, etc. Physical activity in this period can affect the improvement of the health status and provide various benefits such as: energy increase, improvemet of physical fitness and strengthening of the working capacity, maintenance of muscle mass, reduction of the fat component, improvement of strength and intermuscular coordination, and thus affect the prevention of falling and injuries. Aside from the effects on the mucle tone and cardiovascular fitness, it also affects the improvement of cognition and memory, leads to the release of a large amount of neurochemicals and growth factors, which significantly decelerate the aging process (Ratey & Hagerman 2008). It is notable to point out that persons in the respective age period (between 50 and 60), despite various biopsychosocial changes still represent part of the economically active population.

The aim of the research was determining the level of physical activity with respect to the population of men and women aged 50-60 as well as to determine whether there are differences between men and women and if there is a difference among the participants of various age.

METHODS

Subjects

The sample of participants was composed of persons aged 50 to 60 coming from urban settlements of the City of Niš. The research included the total of 24 participants (11 men, mean age 55.4±3.01 and 13 women, mean average 54.8±08). For the purpose of determining the differences between the sexes, the participants were divided into two groups, and for the purpose of determining differences among certain age groups, the participants were divided into two groups: a group aged 50 to 55 and an age group aged 56 to 60, composed of men and women of all of the aforementioned age references.

Procedure

Assessment of the level of physical activity was conducted by the means of digital pedometers HJ-152 (OMRON, Japan). Participants were supposed to wear pedometers for seven days ceaselessly, after which data were taken from the pedometers. Data obtained for the purpose of statistical processing were the following: number of steps made every day, average number of steps, total number of steps during the week. Aside from these parameters, what was also monitored was the total distance passed during a single day (km), average distance passed (km) and total distance during seven days (km).

Statistical analysis

Basic descriptive parameters were calculated for the purpose of each of the parameters used for assessing the level of physical ability (mean value – mean and standard deviation - Std.Dev). Determining of the differences between the groups was performed via the t-test. All the data were processed via statistical package Statistica 8.0, and the level of statistical significance was .05.

RESULTS

Results of descriptive statistics are presented in Table 1. Table 1 shows the values indicating that men on average pass 50.71 km per day, which is more compared to the walking distance women pass daily (43.17km). In case the average walking distance is also observed (km/day) it can be stated that men are physically more active than women (7.17km compared to 6.17km). The obtained values in men and women indicate the existence of major individual differences since the standard deviation goes between 22.03km in men and up to 18.30km in women. If the groups are observed with respect to their age, it can be stated that a group of participants aged 50 to 55 on average passes 54.88km during a week, which is higher when compared to the group aged 56 to 60 (34.48km). Mean values of the distance passed are higher in participants aged 50 to 55 as opposed to the participants aged 56 to 60 (7.84km/day compared to 4.92km/dan). Level of physical activity measured by the number of steps made during seven days (SUM step) shows similar results. Men on average make 40080.73 steps during a week, whereas the measured values in women reach 34592.23 during a week. By observing the total number of steps led by the criterion of age, it can be stated that the respondens aged 50 to 55 in total make 43911.93 steps weekly and have higher values compared to the participants aged 56 to 60 (27582.00 steps weekly). Based on the results presented in Table 1. it can be stated that men on average pass 5725.82 steps a day, whereas in women lower values were maeasured - 4941.75 steps/day. By observing the results among certain age groups it can be stated that the younger group participants (50-55) on average make 6273 steps, whereas the participants from the older group (56-60) make much less (3940.29 steps daily).

Table 1. Basic descriptive statistics parameters

	Men (n=11)		Women (n=13)		Total (n=24)		50-55 (n=14)		56-60 (n=10)	
	Mean	Std.Dev	Mean	Std.Dev	Mean	Std.Dev	Mean	Std.Dev	Mean	Std.Dev
km/day 1	6.83	3.46	6.59	4,54	6.70	4.00	8.03	4.47	4.84	2.30
km/day 2	7.05	4.67	7.68	5.54	7.39	5.06	9.24	5.91	4.81	1.48
km/day 3	10.39	5.52	5.53	3.09	7.76	4.93	9.53	5.48	5.27	2.66
km/day 4	6.62	3.75	5.28	3.33	5.89	3.52	5.76	3.64	6.08	3.52
km/day 5	7.20	5.02	6.93	4.05	7.06	4.42	8,72	4.91	4.72	2.15
km/day 6	5.02	2.31	.96	3.51	5.53	3.00	6.38	3.19	4.33	2.34
km/day 7	7.06	4.65	5.20	2.14	6.05	3.56	7.22	3.83	4.42	2.48
km/day	7.17	4.20	6.17	3.74	6.63	4.07	7.84	4.49	4.92	2.42
SUM km	50.17	22.03	43.17	18.30	46.38	19.96	54.88	21.19	34.48	9.99
step/day 1	5465.64	2764.33	5272.23	3632.77	5360.88	3196.48	6422.14	3579.07	3875.10	1844.86
step/day 2	5637.55	3737.91	6146,92	4431.55	5913.46	4048.24	7389.36	4731.71	3847.20	1187.01
step/day 3	8254.09	4297.47	4459.31	2431.65	6198.58	3852.95	7612.71	4238.39	4218.80	212698
step/day 4	5293.91	2997.33	4245.46	2650.52	4726.00	2802.89	4624.79	2893.22	4867.70	2819.15
step/day 5	5763.36	4014.61	5543.69	3239.92	5644.38	3535.06	6978.36	3930.35	3776.80	1726.04
step/day 6	4014.36	1847.79	4764.46	2807.20	4420.67	2396.20	5105.50	2553.22	346.10	1872.48
step/day 7	5651.82	3720.92	4160.15	1715.96	4843.83	2851.73	5779.07	3063.02	3534.50	1991.32
step/day	5725.82	3340.05	4941.75	2987.08	5301.11	3240.51	6273.13	3569.85	3940.29	1938.26
SUM step	40080.73	17513.14	34592.23	14636.81	37107.79	15903.82	43911.93	16839.75	27582.00	7995.60

Legend: n-number of participants; Mean value; SD- standard deviation; km/day – kilometers per day; step/day – steps per day

Differences between groups are shown in Table 2. Based on the obtained results via t-test it can be stated that there are no statistically significant differences between men and women concerning the level of physical activity if all the gauged paramaters are considered, except in the parameter of the total km on the third day and the total steps on the third day (.013). Such values indicate that there are no differences concerning the level of physical activity in men and women aged 50 to 60.

Results showed that there are statistically significant differences in the level of physical activity when comparing the younger with the older group of participants (Table 2). Significant differences were identified concerning the number of steps made in certain days (km/day 2 p= .031; km/day 3 p= .033 and km/day 5 p=.025), as well as with respect to the mean km passed per day and the total passed km during the week (km/day p= .000; SUM km p= .010). Similar results were obtained when observing the number of steps made during certain days, average number of steps made and total number of steps made during the week.

Table 2. Differences between groups

	Men vs Women		50-55 vs 56-60	
	t	p	t	p
km/day 1	0.02	.887	4.22	.051
km/day 2	0.09	.766	5.29	.031*
km/day 3	7.36	.013*	5.13	.033*
km/day 4	0.86	.364	0.04	.827
km/day 5	0.02	.884	5.77	.025*
km/day 6	0.57	.457	2.98	.097
km/day 7	1.67	.209	4.10	.055
km/day	2.35	.162	9.39	.000**
SUM km	0.72	.404	7.93	.010**
step/day 1	0.02	.886	4.22	.051
step/day 2	0.09	.766	5.30	.031*
step/day 3	7.38	.013*	5.39	.029*
step/day 4	0.83	.373	0.04	.839
step/day 5	0.02	.883	5.77	.025*
step/day 6	0.57	.457	2.98	.098
step/day 7	1.68	.209	4.10	.055
step/day	2.35	.163	9.40	.000**
SUM step	0.70	.412	8.02	.009**

*Legend: p – level of significance * - .05 ** - .01*

DISCUSSION

Average value of the level of physical activity in men measured by steps made per day is 5725.82 steps per day and compared to the previously realised surveys, such value is marked as low. Results of earlier studies examining the level of physical activity of men indicate that adult males in average make: 8053±3695 steps (Zhang et al. 2003); 7065 ±3079 and 7094 ±3106 (Tudor-Locke et al. 2001), 7661 ±2474 (Chan, Ryan & Tudor-Locke 2004) and 8543 ±2466 (Miller & Brown 2004) steps during a day. Likewise, by comparing the obtained results with very high mean values of men from Japan making 8053 ±3695 steps (Zhang et al. 2003); Afro-Americans 7654 ±3079 and Caucas Americans 7948 ±3106 (Tudor-Locke et al. 2001), Americans 7661 ±2474 (Chan, Ryan & Tudor-Locke 2004) and Australians 8543 ±2466 (Miller & Brown 2004), A deficit of about 2000-3000 steps per day can be noted. Received values indicate that the examined group of men belongs to the group of very inactive individuals. Female group of participants obtained a mean result of 4941.75 steps, which is far better than the mean values of senior female participants. However, compared to the group of men of the same age, the resukts were considerably poorer. It is neccesary to stress that the obtained results showed lower values when compared to the results obtained by foreign authors in their surveys. Zhang et al. (2003), determined that the number of steps goes between 6603±2938. Similar results were obtained by Tudor-Locke et al. (2001) (6198±2735 steps and 7494±3167 steps), Chan, Ryan & Tudor-Locke (2004). Deficit in the level of physical activity (number of steps) in the female group participants, goes between 1200 and 2500 steps compared to the results from other studies. Based on everything aforementioned, it can be concluded that the level of physical activity of women is on the low level. According ot the categorisation composed by Tudor-Locke et al. (2004) based on the number of steps made per day: sedentary (<5000 step/day); low activity (5000-7499 step/day); moderate activity (7500-9999 step/day); active (10000-124999 step/day); very active (>12,500 step/day), it is noticeable that mean values of groups included in this research match the persons with low physical activity (5000-7499 step/day) and sedentary (<5000 step/day). Similar categorisation was emphasised by Krumm (2004) - sedentary (<5.500 step/day), low activity (5,500-7,500 step/day) and active individuals (> 7,500 step/day). Moreover, based on such categorisation, the obtained results of groups would be included in sedentary and the groups showing low activity. According to certain studies (Pišot & Fras, 2005) around 35.5% of adult population is performs minimum physical activity, whereas 15.3% are engaged on the very limit value of efficency of motor/sport activities serving them for health preservation (Pišot & Fras, 2005). Comparative analysis of the male and female results was used to discern that men on average have higher level of physical activity than women. Men show higher level of physical activity than women, and the activity reduction value followed by aging is very similar in both sexes (Boudreault, Delisle, Dugal & Laberge, 2000). The obtained results are in congruence with the results obtained by Muntner et al. (2005) who examined the level of physical activity of men and women in China. If physical activity is observed with respect to sex, Chinese results also indicate that men are physically more active than women in their free time. Resulst fo the performed survey showed that, as in earlier researches, men are physically more active compared to women. The analysis shows that 16% of women and 13% of men never do exercises (European Commission, 2005).

Based on the obtained results and identified differences with respect to age, it can be stated that the level of physical activity decreases with aging. After conducted t-test comparing the groups fomred based on their age (groups of 50-55 and 56-60 years old participants), it was noted that there is a statistically significant difference between the groups with respect to the level of physical activity. Generally, the obtained results, if compared according to the categorisation of Tudor-Locke et al. (2004), indicate insufficient physical activity in both groups. In the study made by Hagströmer, Oja & Sjöström (2007) it was established that the amount of physicala activity in Swedish adult individuals decreases with aging. Available data from 2009, indicate that in the USA there is 49.4% insufficiently active adult individuals (51.7 % of women and 46.7 % of men) (Center for Disease Control and Prevention CDC, 2012), and that depending on the age, prevalence of insufficent physical activity almost lieary increases with aging. Moreover, similar resukts were obtained in the study conducted by the European Commission (2005) gde where it was established that the increase in the level of physical activity is measured as proportionate to aging. As in other parts of the world, in Canada as well, the trend of changes in the level of physical activity depends on the respective age. Based on data collected in 2008 (Canadian Community Health Survey, 2008) it was stated that respective years of age are followed by a decrease in the number of individuals doing any physical activity.

CONCLUSION

Insufficient physical activity conditioned by a sedentary lifestyle, has been declared as an independent risk factor and currently it is ranked fourth in the world list of risk factors and it holds responsibility for many diseases. Due to significant changes occurring in the body that are conditioned by the aging process, physical activity can represent the key factor in prevention and health retention, and thus it is needed to be objectively determined. The obtained results indicated that men on average show higher level of physical activity compared to women. However, generally speaking, the obtained results indicate insufficient physical activity in both groups of men and women. For further analysis of the level of physical activity of persons aged between 50 and 60 in the territory of the City of Niš, testing should be performed which would include a larger group of participants. Moreover, it was also observed that the level of physical activity decreases with aging, and/or that the participants categorised as belonging to the younger group were physically more active than the participants from the older group. The obtained results are in accordance with the surveys conducted so far.

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RELATIONSHIPS BETWEEN OVERWEIGHT, OBESITY AND PHYSICAL FITNESS OF NINE- TO TEN-YEAR-OLD MACEDONIAN CHILDREN

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UDC 796.015.055.1(459.6)

SUMMARY

Background: Macedonian children show the same tendencies in overweight and obesity as children in developed countries a decade ago. Childhood overweight is associated with chronic diseases, early mortality in adulthood and psycho-social effects with lifelong consequences. This study aimed to determine relationships between overweight, obesity and physical fitness of nine- to ten-year-old Macedonian children. Methods: Anthropometric (body-mass index [BMI], fat percentage) and physical fitness (body composition, muscle strength, muscle endurance, flexibility) measurements were obtained from 2218 children aged nine to ten years (1149 boys, 1069 girls) using the Eurofit fitness testing battery. International cut-off points were used to categorize children into normal-weight, overweight or obese categories. Data were analyzed using descriptive statistics, Spearman rank order correlation and variance of analysis. Results: The percentage of the overweight and obese children, classified according to the BMI (Cole et al.), is equal to 36% of the Macedonian children of the same age. Both male and female respondents with a high or an increased BMI have lower muscle mass percentage and show poor test results in the evaluation of the body strength, explosive power, speed, agility and coordination. Conclusions: Health-enhancing physical fitness of young children is negatively affected by overweight and obesity, and intervention strategies are recommended to improve the quality of life of such children but also to prevent early mortality during adulthood.Keywords: Dis autat quis utassum ipidebis et perio maio omnimus

Key Words: Body Mass Index, Macedonian children, EUROFIT, body composition

INTRODUCTION

Obesity, generally is defined as an excessive accumulation of body fat in the body that is in clinical practice, usually expressed through body mass index (BMI), where the values are equal to or more than 95-th percentile value for children of the same age and sex, while overweight when the values in the range of 85th and 95th percentile (Barlow, & Expert Committee, 2007). Obesity is a chronic non-communicable disease which occurs as a consequence of several factors, divided into two main groups: genotype and environmental conditions. There is no general consensus about the exact causes of this disease; it is believed that occurs as the integration of social behavioral, cultural, physiologic, metabolic and genetic factors (National Institutes of Health of USA, 2000).

Overweight and obesity are responsible for 80% of the cases with diabetes type, 2,35% for ischemic cardiac disease and 55% for high blood pressure in adults in the area of Europe causing over one million deaths annually (Tsigos et al., 2008; National Institutes of Health of USA, 1998; Vukovic et al., 2012; Kisic- Tepavchevic et al., 2008). Obesity in early ages is a reason for shortened life expectancy, contributes to great burden of diseases in adulthood (Freedman, et al., 2001) and jeopardize the health protection and security system.

Obese children have a great prevalence to remain fat in the adulthood (Biro, & Wien, 2010; Whitaker, et al.,1997; Serdula, et al., 1993). Apart from the genetic predisposition and other biologic factors (birth weight, intrauterine growth) it is considered that a child behavior plays one of the key roles in development of the obesity (Burke, 2006). This group of factors presumes first of all the nutrition and the level of physical activity. Lack of physical activity and increased food intake are some of the dominant factors in development of obesity in the recent twenty years (Lobstein, Baur, & Uauy, 2004; Roberts, Lucas, & Hirsch, 2000; Lustig, 2006).

Large research studies have shown a steady upward trend in the prevalence of overweight and obesity in the last 20 years or as at the global level, with an increase between 10 and 40% in developed and in developing countries (Ford, & Mokdad, 2008).

Prevention and education of children of preschool and school-age children, is of great importance. The most sensitive period in children in development of overweight and obesity coincides with the period of the puberty and rapid growth and development, and this is a period in which it is possible to make preventive action.

Apart from regular physical activity, it is necessary to inform children about the importance of proper nutrition and a healthy lifestyle.

Pursuant to the foregoing, the aim of the research is to determine the connectivity of the fitness with the different body weight status, categorized by the BMI and percent of body fats in children at the age of 9 and 10 years

METHODS

Subjects

The research was realized on a sample of 2238 children of Macedonian nationality, from 19 primary schools from the central and east part of the Republic, out of which 8 are in rural and 11 in urban environment. The sample has been divided into two sub-samples by gender – 1157 of the respondents are boys and 1081 respondents are girls. The average age of the respondents of both genders was 9,48±0,5 years.

The study included students for whom their parents had given consent to take part in the research, who were psychically and physically healthy and who regularly attended the classes of physical and health education. The respondents were treated in accordance with the Helsinki Declaration. Measurements were realized in March, April and May 2012, in standard school conditions at regular classes of physical and health education. The measurement was realized by experts from the area of kinesiology and medicine, previously trained to perform functional tests and to take anthropometric measurements.

Anthropometric measures and body composition

Measuring of the anthropometric measurements was realized upon the recommendations given by IBP-International Biology Program, (Lohman et al., 1988). For estimation of the morphological characteristics the following anthropometric measures have been applied: body height in standing position (cm), body weight (kg), circumference of the upper arm and circumference of the calf (cm), as well as the body mass index (BMI).

Components of the body composition have been determined by the method of bioelectrical impedance (measuring of the electric conductivity – Bioelectrical Impedance Analysis - BIA). The measuring was realized by a Body Composition Monitor, model "OMRON - BF511", by means of which we have measured the body weight, fat tissue percent and muscular mass percent. Prior to commencing the measurement we had entered the parameters of gender, years and body height of the respondent in the Body Composition Monitor. In order to provide better precision of the results obtained from the estimation of the body composition, prior to each measuring, we ensured that the preconditions recommended by ACSM (2005) and Heyward (2006) had been fulfilled.

Evaluation of Physical Fitness

Prior to starting the study, the researchers involved in the project undertook training sessions in order to guarantee the standardization, validation, and reliability of the measurements (Moreno et al., 2003). Seven tests, forming part of the EUROFIT battery, validated and standardized by the European Council, were applied in the following order: Sit and Reach test. With the subject seated on the floor and using a standardized support, the maximum distance reached with the tip of the fingers by forward flexion of the trunk is measured. Test indicative of amplitude of movement or flexibility. Hand Grip test. With the use of a digital Takei TKK 5101 dynamometer (range, 1-100 kg), the maximum grip strength was measured for both hands. Standing broad jump test. The maximum horizontal distance attained, with feet together, was measured. This test evaluates lower limb explosive-strength. Bent Arm Hang test. A standardized test was used to measure the maximum time hanging from a fixed bar. This test estimates the upper limb endurance- strength. Sit-ups 30 sec. Maximum number of sit ups achieved in 30 seconds. This test measures the endurance of the abdominal muscles Shuttle run: 4×10 meters. This test provides an integral evaluation of the speed of movement, agility and coordination. The subject does four shuttle runs as fast as possible between 2 lines 10 meters apart. At each end the subject places or picks up an object (a sponge) beside the line on the floor.

Definition of weight status

Four weight status groups were established in this study: underweight, normal weight, overweight and obesity. Participants were categorized according to the international gender and age-specific BMI (kg/m2) cut-off points (Cole et al., 2000,2007). These points have been particularly established for children and adolescents aged from 2 to18 years, separately for males and females and for 0.5 year age groups. These cut-off values are based on percentiles passing at age 18 years through BMI 18.5 kg/m2 for underweight, 25 kg/m2 for overweight and 30 kg/m2 for obesity (Cole et al., 2000, 2007).

Statistical analysis

The data are presented as frequencies (percentage) for categorical variables and mean (SD) for continuous variables. Gender differences in fitness and anthropometric characteristics were analyzed by one-way analysis of variance (ANOVA). Categorical data (weight status) were analyzed using the $\chi 2$ - test. Relationships between the variables were determined by Spearman correlation matrices. Adjustment for age was performed using analysis of covariance (ANCOVA) to examine differences in fitness level among weight status groups. Because a significant interaction was found for weight status and gender in relation to all fitness tests ($p < 0.05$), all the analyses were performed separately for boys and girls. Bonferroni's adjustments were used for pair wise comparisons. All the analyses were performed using the Statistical Package for Social Sciences software (SPSS, v. 20.0 for Windows; SPSS Inc., Chicago, IL, USA), and values of $p < 0.05$ were considered statistically significant.

RESULTS

Table 1 shows characteristics of the sample applied in this research. Results from analyses of variance show that in the variables of average age, arm circumference, thigh circumference, height, body fat and fat mass (kg) there is no statistically significant difference between boys and girls, while in other variables there are statistically significant differences by gender ($p < 0.00$). Distribution of statement into normal weight, overweight and obesity, assessed by BMI, by age and by gender are also shown in Table 1. $\chi 2$. Values of the test ($\chi 2$ = 5,33; p = . ,070) indicate that there is no statistically significant differences in the level of nutrition between boys and girls at this age.

Tables 2 and 3 show Correlation quotients of BMI and body fat percentage with anthropometrical measures, measures for assessment of body composition and test for assessment of fitness abilities in respondents of both genders. It is evident from the tables that all anthropometrical measures and measures for assessment of body composition (except for muscle mass) in both genders show statistically significant positive correlation (in range from .404 to .972) with the body mass index and the body fat percentage. Statistically significant negative correlation (in range from .-159 to .-650) has been found of the BMI and the body fat percentage in the „Standing long jump" fitness test, „Sit-ups 30 sec.", „Bent arm hang", „Shuttle run 4x10 m". Positive correlation with BMI was shown only in the „Handgrip" test, while statistically significant correlation between the BMI and the body fat percentage was not found in the „Seat and reach" test. Slightly higher are correlation quotients of body fats and variables for assessment of anthropometrical measures, body composition and fitness tests in terms of BMI therewith. In both genders the highest negative correlations of BMI and the body fat percentage are shown in the „Bent arm hang" and „Standing long jump" fitness tests.

Tables 4 and 5 show the mean value of the parameters for assesment of the anthropometrical measures, body composition and physical fitness, after partialization by age. In both genders, we have determined statistically significant differences in all parameters for assesment of anthropometrical measures, body composition and fitness tests in the groups of respondents formed under MBI classification, except for the „Seat and reach" fitness test in the female respondents.

Table 1. Characteristics of the study sample by gender

	Total		Boys		Girls		P*
	(n=2238)		(n=1157)		(n=1081)		
Age (years)	9,48	0,50	9,48	0,50	9,48	0,50	,983
Arm circumference (cm)	21,51	3,44	21,53	3,55	21,50	3,31	,847
Thigh circumference (cm)	44,46	6,58	44,34	6,78	44,59	6,36	,368
Height (cm)	140,52	7,68	140,53	7,44	140,51	7,93	,944
Weight (kg)	38,35	10,20	38,83	10,33	37,83	10,04	**,020**
Body fat (%)	23,25	8,36	23,41	8,07	23,09	8,66	,362
Fat mass (kg)	9,61	5,69	9,75	5,64	9,45	5,74	,219
Fat-free mass (kg)	28,83	5,36	29,17	5,59	28,48	5,07	**,002**
BMI (kg/m^2)	19,22	3,76	19,43	3,76	18,98	3,76	**,005**
Muscular mass (%)	32,02	2,47	32,51	2,44	31,49	2,39	**,000**
Standing long jump (cm)	125,82	22,46	133,14	22,31	118,01	19,84	**,000**
Sit-ups 30 sek. (n)	13,51	5,24	14,75	4,96	12,18	5,19	**,000**
Bent arm hang (s)	4,18	5,57	5,40	6,57	2,88	3,85	**,000**
Handgrip (kg)	16,80	7,55	18,37	7,79	15,09	6,89	**,000**
Sit and reach (cm)	15,05	6,01	14,26	5,84	15,88	6,07	**,000**
Shuttle run 4x10 (s)	14,64	1,80	14,21	1,75	15,10	1,73	**,000**
Normal weight**	599	60,60%	299	57,70%	300	63,80%	
Overweight	243	24,60%	131	25,30%	112	23,80%	
Obese	146	14,80%	88	17,00%	58	12,30%	,070

*P < 0.010 for difference between boys and girls (ANOVA); ns, non-significant.
**P < 0.010 for difference between boys and girls (Chi-Square Tests); ns, non-significant.

Table 2. Correlation quotients of BMI and body fat percentage with anthropometrical and physical parameters (boys)

	BMI				Body fat percentage			
	T	N	O	OB	T	N	O	OB
Anthropometrical parameters								
Arm circumference (cm)	,927**	,863**	,735**	,726**	,866**	,715**	,333**	,406**
Thigh circumference (cm)	,901**	,842**	,720**	,730**	,834**	,650**	,346**	,344**
Height (cm)	,457**	,359**	,223*	,424**	,288**	,035	-,208*	-,094
Weight (kg)	,923**	,779**	,644**	,765**	,821**	,504**	,131	,247*
Muscular mass (%)	-,194**	,206**	-,225**	-,240*	-,400**	-,180**	-,780**	-,799**
Fat mass (kg)	,987**	,967**	,884**	,880**	,971**	,922**	,683**	,639**
Fat-free mass (kg)	,737**	,529**	,401**	,584**	,572**	,177**	-,192*	-,048
Physical parameters								
Standing long jump (cm)	-,341**	-,130*	-,090	,163	-,400**	-,261**	-,322**	-,150
Sit-ups 30 sek. (n)	-,223**	-,053	,014	-,036	-,266**	-,107	-,287**	-,332**
Bent arm hang (s)	-,643**	-,325**	-,302**	-,049	-,646**	-,357**	-,396**	-,286**
Handgrip (kg)	,243**	,309**	,149	,367**	,133**	,079	-,327**	-,146
Sit and reach (cm)	-,077	,023	-,015	,166	-,069	,047	-,031	,050
Shuttle run 4x10 m	,274**	,024	-,047	-,005	,313**	,127*	,168	,368**

T = Total; N = Normal weight; O = Overweight; OB = Obese; * = p < 0.05; ** = p < 0.01;

Table 3. Correlation quotients of BMI and body fat percentage with anthropometrical and physical parameters (girls)

	BMI				Body fat percentage			
	T	N	O	OB	T	N	O	OB
Anthropometrical parameters								
Arm circumference (cm)	,915**	,802**	,615**	,623**	,869**	,727**	,193*	,167
Thigh circumference (cm)	,908**	,808**	,646**	,665**	,863**	,741**	,186	,150
Height (cm)	,404**	,261**	,171	,242	,266**	,045	-,290**	-,258
Weight (kg)	,899**	,706**	,557**	,671**	,813**	,536**	,022	,068
Muscular mass (%)	-,474**	-,062	-,254**	-,332*	-,655**	-,423)**	-,837**	-,900**
Fat mass (kg)	,973**	,905**	,815**	,827**	,972**	,934**	,692**	,525**
Fat-free mass (kg)	,688**	,434**	,288**	,478**	,531**	,170**	-,339**	-,215
Physical parameters								
Standing long jump (cm)	-,267**	,024	-,104	-,096	-,344**	-,164**	-,419**	-,332*
Sit-ups 30 sek. (n)	-,159**	-,020	-,120	-,047	-,200**	-,102	-,191*	-,446**
Bent arm hang (s)	-,614**	-,293**	-,304**	-,178	-,650**	-,401**	-,358**	-,226
Handgrip (kg)	,272**	,317**	,181	,249	,163**	,083	-,172	-,125
Sit and reach (cm)	-,003	,146	,234	,312	-,037	,092	,020	,194
Shuttle run 4x10 m	,169**	-,073	,150	,003	,245**	,088	,351**	,148
T = Total; N = Normal weight; O = Overweight; OB = Obese; * = p < 0.05; ** = p < 0.01;								

Table 4: Significance of differences in physical fitness components in the various BMI categories in the boys

	Normal weight		Overweight		Obese		F	Sig.	Post hoc pairwaise comparisons
	M	SD	M	SD	M	SD			
Arm circumference (cm)	19,33	2,18	23,84	1,71	26,81	2,06	1131,8	,000	1 & 2; 1 & 3; 2 & 3
Thigh circumference (cm)	40,31	4,26	48,56	3,93	54,23	4,37	919,5	,000	1 & 2; 1 & 3; 2 & 3
Height (cm)	138,31	6,89	143,22	6,51	145,22	7,59	96,1	,000	1 & 2; 1 & 3; 2 & 3
Weight (kg)	32,51	5,07	44,85	5,62	55,11	8,91	1177,3	,000	1 & 2; 1 & 3; 2 & 3
Fat mass (%)	18,13	4,91	29,30	3,45	35,44	2,94	1409,8	,000	1 & 2; 1 & 3; 2 & 3
Muscular mass (%)	32,95	2,62	32,37	1,87	30,90	1,69	52,1	,000	1 & 2; 1 & 3; 2 & 3
Standing long jump (cm)	139,49	21,40	127,21	19,54	117,15	18,72	93,9	,000	1 & 2; 1 & 3; 2 & 3
Sit-ups 30 sek. (n)	15,76	4,45	14,13	4,84	11,69	5,66	52,5	,000	1 & 2; 1 & 3; 2 & 3
Bent arm hang (s)	7,98	7,12	2,20	3,08	0,42	1,21	174,9	,000	1 & 2; 1 & 3; 2 & 3
Handgrip (kg)	17,61	7,60	19,25	7,65	20,34	8,37	10,3	,000	1 & 2; 1 & 3
Sit and reach (cm)	14,64	5,72	13,80	6,02	13,58	5,89	3,4	,034	1 & 2; 1 & 3
Shuttle run 4x10 m	13,86	1,62	14,42	1,60	15,26	1,92	50,4	,000	1 & 2; 1 & 3; 2 & 3
1 = Normal weight; 2 = Overweight; 3 = Obese									

From values of the aritmetic means and the level of statistical significance in Tables 4 and 5 one can see that students from both genders with overweight and with obesity achieve better results in the „Handgrip" test compared to respondents with normal weight ($p < 0.00$) (tables 4 and 5), and poor results in the other fitness tests. In the female respondents one can see that there are no statistical differences found in the „Seat and reach" test in the children classified with normal, moderate and increased BMI.

Male respondents classified with normal MBI reach better results in the „Seat and reach" test versus the respondents with moderate and increased BMI. No statistical differences are determined in the male respondents with moderate and increased MBI in the „Handgrip" fitness test. There are no statistical differences determined in the female respondents with moderate and increased MBI in the „Bent arm hang" and „Handgrip" fitness tests.

Table 5: Significance of differences in physical fitness components in the various BMI categories in the girls

	Normal weight		Overweight		Obese		F	Sig.	Post hoc pairwaise comparisons
	M	SD	M	SD	M	SD			
Arm circumference (cm)	19,71	1,98	24,14	1,83	27,07	2,01	1001,9	,000	1 & 2; 1 & 3; 2 & 3
Thigh circumference (cm)	41,24	3,91	49,53	3,62	55,17	4,16	892,7	,000	1 & 2; 1 & 3; 2 & 3
Height (cm)	138,79	7,56	143,77	7,20	144,64	7,40	60,2	,000	1 & 2; 1 & 3
Weight (kg)	32,57	5,69	45,10	6,03	55,09	8,21	908,5	,000	1 & 2; 1 & 3; 2 & 3
Fat mass (%)	18,17	5,56	30,37	3,74	37,14	3,74	1059,2	,000	1 & 2; 1 & 3; 2 & 3
Muscular mass (%)	32,28	2,21	30,59	1,69	28,70	1,88	181,3	,000	1 & 2; 1 & 3; 2 & 3
Standing long jump (cm)	122,17	19,75	111,87	16,45	106,06	17,51	53,6	,000	1 & 2; 1 & 3; 2 & 3
Sit-ups 30 sek. (n)	12,95	4,78	11,30	5,55	9,76	5,66	24,9	,000	1 & 2; 1 & 3; 2 & 3
Bent arm hang (s)	4,06	4,08	0,77	1,59	0,09	0,60	128,8	,000	1 & 2; 1 & 3
Handgrip (kg)	14,33	6,34	16,49	7,58	17,15	7,31	14,8	,000	1 & 2; 1 & 3
Sit and reach (cm)	16,05	6,04	15,73	5,78	15,21	6,81	1,1	,348	ns
Shuttle run 4x10 m	14,86	1,68	15,37	1,69	15,91	1,79	23,1	,000	1 & 2; 1 & 3; 2 & 3
1 = Normal weight; 2 = Overweight; 3 = Obese									

DISCUSSION

Obesity in childhood and youth has become a global epidemic and is threatening to become an epidemic in Macedonia. Percentage of overweight and obese children in 13-year and 14-year old children, classified by the BMI criterion in this research is 39%. In previous researches realized for Macedonian adolescents at the age from 11 to 14 years the percentage of overweight and obese children at the age of 11 and 12 years classified by BMI was 35%, while for children at the age of 13 and 14 years it was 31%. (Gontarev, S., & Ruzdija, K. 2014; Živkovic et al. 2014). Similar results for overweight and obesity were obtained in several international studies. (Jehn et al., 2006; Ortega, 2007; Al-Nakeeb et al., 2007; Ostojic et. al., 2011).

Results from our research also show that boys have a tendency for bigger prevalence of overweight and obesity versus girls (42,3% in boys and 36,1% in girls).

Over 24% of the respondents have a percentage body fats higher than 30%. Such a high percentage of body fats is connected with increase risk of acute and chronic diseases, such as osteoarthritis, increased blood pressure, diabetes mellitus and cardiovascular diseases, which may lead to worse quality of life, increased personal and financial burden for the individual, for the family and for the society and to shortening the life time (Williams et al., 1992; Aristimino et al., 1984; Berenson et al., 1980; 1982; Dugan, 2008) .

Results from this research clearly indicate that the overweight and obesity have negative impact on the health related fitness in pupils from the 4th and 5th grade, who are at the age of nine and ten years. The negative impact is mostly expressed in tests for assessment of the relative strength, explosive power, speed, agility and coordination. For most of these tests the success depends on locomotion of the body in space or mastering the resistance of own body or a part of the body whereas the component of fat is a bulk mass. These are motor manifestations that are under influence of the mechanisms for regulation of the intensity and duration of the excitation (Kurelić et al., 1975). Obviously, these mechanisms are significantly more efficient in young respondents with balanced proportion of the weight and height, i.e. lower values of BMI and body fats, which is in accordance with more international researches realized for children at the age of 5 to 17 years (Baine et al., 2009; Malina et al., 1995; Minck et al., 2000; Deforche et al., 2003; Prista et al., 2003; Graf et al., 2004; Kim et al., 2005a, b; Brunet et al., 2007; Casajus et al., 2007; Haerens et al., 2007; Huang and Malina, 2007; Fogelholm et al., 2008).

In terms of flexibility, our research indicates that overweight or obese girls achieve similar results as the respondents with normal weight, which was also shown in two Thaiwanese researches. However, results obtained from researches in some western countries indicate that obese girls achieve better results than girls with normal weight, which is not concluded for the boys (Prista et al., 2003).

All motor tests (except for the test for assessment of flexibility) are in lower or higher correlation with BMI and the body fat percentage. Correlation quotients of BMI, body fat percentage and fitness abilities are a little bit higher in boys than in girls.

Regular physical activity and the great intake of indigestible polysaccharides decrease the risk from occurrence of obesity, while the sedentary lifestyle and intake of food with high energetic value, and poor with micronutrient increases the risk of obesity in children. The choice of healthy food for children in school and at home decreases the risk, while the sweetened drinks and advertisements for fast food increase the risk of obesity. There are many evidences indicating that the food with a low glycemic index and rich with proteins lowers the risk, and the great number of meals prepared out of home and the monotonous nutrition habits increase the risk. In any case, the nutrition should be based on food with low energetic value (fruit and vegetable) and integral cereals (which are a good choice of dietary fibers).

The results obtained can be, to a certain point, explained with the lack of basic motor movements in the classes of physical education, as well as professionalism of persons educating children as from the period when they begin to go to preschool institutions up to the sixth grade in the elementary school. One of the reasons connected with insufficient or inadequate physical activity and improper habits connected with nutrition can be sought in the quantity and quality of teaching the physical education in the preschool institutions and during the young school age. Certainly, the „sportification" and the entire concept of teaching physical education which is exclusively aimed to development of motor skills, needs thorough reexamination and change.

The data obtained imply a scientific planning and programming curriculum in order to achieve optimization of the proportion of the quantity of subcutaneous fat tissue and muscle mass, which will create a possibility for maximization of the motor functioning in a wide range of abilities, particularly in the dimensions of strength and endurance. (Katic, 2003). The purpose of teaching the subject of physical and health education in this period of life, among the other, should be directed towards reduction of the fat tissue and increasing the muscle mass, first of all of the major muscle groups.

CONCLUSION

The study means an actual research of the prevalence of obesity and overweight in children from the central and eastern part of the Republic of Macedonia based on population approach, putting accent on the prevention. The results indicate that more than two children out of ten are overweight and 1 out of ten is obese. It affects the obesity prevalence in the later period of life. The obesity and overweight prevalence by the BMI in Macedonian adolescents is 39%. In terms of gender, Macedonian boys show higher percentage of obesity and overweight.

Macedonian children of both genders with moderately increased or high BMI have: lower percentage of muscle mass, higher percentage of body fat and achieve poorer results in the tests assessing the fitness. Children from both genders with moderate overweight or obesity show poorer results in the „Standing long jump", „Bent arm hang", „Jumping 4 x 10 meters" and „Sit-ups 30 sec." tests, show similar results in terms of flexibility of the respondents having normal weight and better results in the „Handgrip" test.

The Correlation quotients of the percentage of body fats and fitness abilities are slightly higher in boys in terms of the girls. On the other side, the Correlation quotients of BMI and fitness abilities are slightly higher in girls in terms of the boys.

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SELF-PERCEIVED HEALTH STATUS, HEALTH-RELATED LIFESTYLE HABITS AND LIFE SATISFACTION AMONG STUDENTS OF FSPE (WITH THE FOCUS ON THE YEAR OF STUDYING AND GENDER DIFFERENCE)

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UDC 796.61.012

SUMMARY

Health status is frequently analyzed variable in epidemiological research. Self-assessment is complex process that integrates components of self-perceived health and life satisfaction. We sought to analyze self-perceived psychological and somatic health, life satisfaction, physical activity level and lifestyle-related habits of Faculty of Sport and Physical Education (FSPE) students, University of Nis.Our investigation was conducted in December 2015, on a study sample of 201 FSPE students attending all study levels. Data were collected by means of a questionnaire of Sportello Salute Giovanni (Health Information Desk) wich was used in similar project conducted on a study population in Italy. We examined self-perceived health status, somatic and psychological health indicators, physical activity, and habits such as drinking and tobacco use. The results of our study shows that 52.75% all students declared their health as good. Average life satisfaction score on scale 1 to 10 was 8.16 and 43,92 % reported to have regular daily physical activities. Only 5% of students consumes alcohol on daily basis and 14.9% . reported binge drinking of more than 10 times a year. 9 % reported habitual smokking. In general females showed a better life satisfaction but on the other hand also reported more psychological and somatic symptoms. Statification by study levels demonstated that final year students had lower self-percieved health but were more inclined to consume alchocol. Third year showed more somatic symptoms compared to other study levels.In general FSPE students of University have very high life satisfaction as well as self-percieved heath. Our results can be explained by assuming the beneficial effect of physical activity on overall health and well being along with the study program suporting active life style during study .

Key words: self rated health, life satisfaction, health-related lifestyle habits, self assesment, students

INTRODUCTION

Health status is a frequently examined variable in epidemiological research where self-perceived health and life satisfaction are widely used indicators of overall health assessment. Self-assessment is a complex process that integrates a large variety of components related to psychological and somatic health (Jylhä, 2009). Recent literature data show that individuals with negative health perception tend to have a higher mortality and morbidity risk. (Idler & Benyamini, 1997; Larsson, Hemmingsson, Allebeck & Lundberg, 2002). On the other hand, health-related lifestyle habits and exercise have a great impact on overall health status and life satisfaction. Individuals who follow a proactive lifestyle are reported to have higher self-perceived health and life satisfaction score than those who do not. (Södergren, Sundquist, Johansson & Sundquist 2008; Harrington, Lutomski, Shiely, … Shelley, 2010; Tsai, Ford, Li, Zhao, Pearson & Balluz, 2010).

The aim of this study was to examine and analyze self-perceived psychological and somatic health, life satisfaction and lifestyle-related habits and physical activity in the Faculty of Sport and Physical Education students, stratified by gender and level.

METHODS

Our investigation was conducted in December, 2015. The questionnaire was filled in by 201 students of all four levels at the Faculty of Sport and Physical Education, University of Nis. There was a total of 52 first year students (12 female, 40 male, average age 19±0.5), 48 second year students (23 male and 25 female, average age 20±0.6), 54 in the third year (39 male, 8 female average age 21±1) 47 fourth year students(39 male gender, 8 female gender average age 22±0.8). The questionnaire examined several domains: self-perceived psychological and somatic health, life satisfaction, the amount of physical activity, smoking and drinking frequency.

Data were collected by fulfilling modified questionnaire form Sportello Salute Giovani (Youth Health Information Desk) which was used in similar investigation conducted on the population of students from different faculties in Italy (De Waure , Poscia , Virdis , Di Pietro & Ricciardi, 2015).

The dependent variable in our investigation was self-perceived health status rated on four level scale as very good, good, fair and poor. Subsequently, the answers of good and very good health perception were categorized ”good” SRH while the other answers were defined as negative health status perception and classified into category ’’poor’’ SRH.

Life satisfaction was assessed with an ascending scale from 1-10, 1 representing the lowest satisfaction with life, and 10 representing the highest satisfaction with life. Responses were categorized as positive (answers rated from 6-10) or negative (answers rated from 1-5).

For physical activity evaluation we used total activity performance in last seven days, duration in hours and exercise frequency during the week.

Our study takes into consideration the data coming from the following question:

- headache frequency in the last 12 months (question 66)
- stomach pain frequency in the last 12 months (question 67)
- back pain frequency in last 12 months (question 68)
- fatigue frequency (question 69)
- nervousness and irritability frequency (question 71)
- dizziness frequency (question 71)
- frequency of difficulty falling asleep (question 72)
- recovery sleep (question 73)
- self-perceived health (question 74)
- ability to cope with problems (question 75)
- life satisfaction (question 76)

Statistical analysis was done by means of descriptive statistics. Descriptive measures are presented as percentage values. Data were analyzed using the statistical program SPSS, version 19.0.(SPSS,Inc.Chicago, IL,USA).

RESULTS

The results show that 52.75% of all four levels marked their health as good, 41.15% students marked their health as very good, 4.11% marked their health as fair and only 1.99% students marked their health status as poor. Average life satisfaction score on the scale 1 to 10 is 8.16 (SD 1.49) and 86.50% marked their life satisfaction with 7-10.

Answering the question „How well do you think you are coping with your problems '' 55.4% replied „very well'' , 36.12% good, not very well replied 6.32%, 1.95% answered that are, totally unable“ to cope with problems.

43.92% of students reported every day physical activity, 25.1% of students are active 4 to 6 days a week, 18.72% of them reported physical activity every 2 or 3 days a week.

34.25% students of the Faculty of Sport and Physical Education reported physical activity of 5-7 hours a week.in, 32.77% of students are active more than 8 hours a week, 25.3% of students reported physical activity of 2-4 hours a week.

With regard to somatic and psychological symptoms FSPE students at all four levels rarely suffer from headache (2.45%) stomach ache (2.45%) and lower back pain (3%) during the week. Everyday dizziness and fatigue were felt by 1.85% of students, whereas 2.07% of them reported nervousness and irritability.

Survey results showed that during the week 86.70% of students have a good quality of sleep, while difficulty falling asleep was reported in 4.32% of them. 82.07% of students have never had those symptoms.

Most of the students never or rarely drink alchohol (61.7%) only 5% drink everyday. Cigarettes are consumed by only 9% of students.

Stratification by gender and study level

Regarding the differences in answers between gender, women 9.66 (SD 1.52)seem to be more satisfied with life than man 8.88 (SD 1.44). and have more somatic symptoms (headache, stomach ache and fatigue).Woman are also more physically active.

The highest average life satisfaction score was 9.65 (SD 1.32) reported by the second year FSPE students and the lowest 8.55 (SD 1.59) reported by the fourth year students.

Third year students had more hours of physical activity during the week than in other years and had more frequent somatic symptoms such as headache, lower back pain, fatigue and dizziness.

Results showed binge drinking is 2-3 times more frequent in last 12 months among fourth year students.

DISCUSSION

To the authors best knowledge, similar epidemiological studies on this research topic have not been conducted in our country. On the other hand, a similar study has been done in Italy, aiming to examine life satisfaction and self-percieved health among university students. Life satisfaction score was 7.46 in the Italian study (De Waure et al., 2015) compared to the students of FSPE whose life satisfaction score was 8.16.

Somatic and psychological indicators of self-perceived health in our study showed higher values in all analyzed aspects in comparison with the Italian study. Study program on compulsory and optional subjects lead to proactive lifestyle with all health advantages (Harrington et al., 2010; Tsai et al. 2010). FSPE students have increased physical activity because of the nature of studies. Interest in physical activity and sport among students provides them with positive life energy and at the same time requires certain physical capacity which is a precondition for success in sport.

Physical activity includes several adaptive physiological mechanisms and interplay of various hormones and humoral factors with benefits to overall health and wellbeing.

Literature data show that increased physical activity induces endorfin production. It is well known that endorfins minimize pain, boost life energy and improve mood (Grossman, 1985; Harber & Sutton,1984). Consequently, because of that aspect it would be interesting to conduct a similar study at faculties where different scientific fields are studied.

When we take gender differences into consideration, higher life satisfaction is shown in female students with the average score 9.66 (SD 1.52) compared to male students with average score 8.88 (SD 1.44). It was also demonstrated that females are slightly more physically active which can be a possible explanation for this finding.

Third level students had more somatic symptoms e.g headache, stomach ache, low back pain, fatigue and dizziness despite being the most physicaly active according to the number of active hours during the week. This information requires further investigation or explaination. We speculate that overtraining syndrome or the lack of motivation might be some of the possible causes of frequent somatic symptoms.

We noticed that the average life satisfaction score 8.55 (SD 1.59) on the fourth level is a little lower than on the other study levels, whereas drinking alcohol was more frequent (more than 2-3 times in last twelve months). Life satisfaction decline can be explained as repercussion of social conditions. The question of existence, uncertainityabout the future of final level students may be a likely explanation for frequent „binge drinking '' at this study level which also requires further investigation.

CONCLUSION

Students of the Faculty of Sport and Physical Education have a generally high life satisfaction score and self-perceived health status which can be explained by a positive effect of physical activity has on overall health. More frequent somatic symptoms among third level students require new research as well as the analysis of the relationship between study program difficulties and the organisation of practical and theoretical teaching. The reasons for life satisfaction score decline and frequent alchohol use can be the subject of further investigation with the aim of examining the relation between social conditions and life satisfacton as well as with self-perceived health status among FSPE students.

WHO defines health as the condition of complete physical and mental wellbeing and not only as the absence of illness and disability. In accordance with the definition, our study results show that FSPE students' psychological and somatic health is at high satisfactory level which emphasizes the importance of physical activity in maintaining and improving health.

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THE CONNECTION BETWEEN PHYSICAL ACTIVITY AND OBESITY

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SUMMARY

An analysis of the studies available in the journals published in the field of sport sciences was carried out, with the aim of determining the connection between physical activity and obesity. The problem was the collection of these studies, the analysis of the results, as well as the analysis of the conclusions that the authors reached. Collecting the relevant literature was carried out by an online key word search: physical activity, obesity, diet. The obtained data were processed by a descriptive method since various exercise programswere appliedin the collected studies, and the measuringswere carried out using various measuring instruments,so thatthat the possibility of comparison with results obtained using other methods was low to none. The results and conclusions that the authors reached have indicated a connection between physical activity programs and obesity. A positive energy balance of increased calorie intake and its inadequate burning due to inactivity is the basic cause of excess weight and obesity. The best way to prevent this is to partake in regular physical activity and moderate intensity exercises, which burn through fatty tissue and preserve muscle and other fat-free tissue.

Key words: physical activity, obesity, nutrition.

INTRODUCTION

The struggle for survival and frequent migrations of prehistoric humans forced them to be physically active. However, things have changed significantly since then. These changes occurred much slower in the beginning, while with the advancement in technological progress, the tempo of these changes in the last few decades hasincreased significantly. This has, unfortunately, turned us into a sedentary and obese population, which, as a result of this way of life, is increasingly suffering from chronic and other illnesses. As a result of an inappropriate diet and physical inactivity, excessive weight and obesity are constantly increasing and taking on the dimensions of an epidemic, which many studies can attest to (Fegal, Carroll, Ogden, & Johnson, 2002). This means that we must be more physically active, take more care about our choice of food, and eat less if we want to maintain our body weight within the normal limits and preserve our overall health.

Obesity, which emerged as a consequence of the modern way of life, is usually defined as excessive body weight which is the result of significant increase in fatty tissue in the body, beyond the limits of what is considered normal for the gender, age and body type of an individual. Obesity means that there is excess fat in the body, and not only in terms of extra kilograms, which means that the person can have a lower body weight than normal, but still be obese.

The obesity epidemic occurs due to an imbalance between intake of calories and calorie burning (Lakka& Bouchard, 2005), while unhealthy food and the resulting overweigh, like physical inactivity, significantly increase the risk of cardiovascular and other diseases.

METHODOLOGY

An analysis of the studies available in the journals published in the field of sport sciences was carried out, with the aim of determining the connection between physical activity and obesity. The problem was the collection of these studies, the analysis of the results, as well as the analysis of the conclusions that the authors reached. Collecting the relevant literature was carried out by an online key word search: physical activity, obesity, diet. The obtained data were processed by a descriptive method since various exercise programswere appliedin the collected studies, and the measuringswere carried out using various measuring instruments,so thatthat the possibility of comparison with results obtained using other methods was low to none.

THEORETICAL CONSIDERATION OF THE PROBLEM

People the world over are increasingly obese, warn researchers, and the reasons they cite, in addition to physical inactivity, are an abundance of food which makes the rich fat, and the intake of cheap fatty food which makes the poor fat. Whatever the reason, obesity represents a risk for cardiovascular and other illnesses, while moderate physical activity is the best way to reduce the metabolic activities of fat (Tichopoulou, Gnardellis, Laagiou, Benetou, & Tichopoulou, 2001) and is sufficient enough to achieve protection from hypertension, diabetes, depression, some malignant illnesses, osteoporosis, early onset old age and other conditions (Blair, 2000), which are all the consequence of excessive body weight.

Dietary habits are an important factor in the control of body weight. In America, according to the reports of the Centers for Disease Control and Prevention, almost 65% of adults are overweight, and the number of obese younger people over the last decades has more than doubled (Ogden, Carrol, Curtin, Lamb, & Flegel, 2010). Traditionally, a chubby child is considered a healthy child, but the excessive food that a child can be given during the first years of his life stimulates the development of larger and more numerous fat cells which can stimulate a greater appetite. Such an increase in fat cells can occur in puberty, a period critical for the development of obesity (Malina & Bouchard, 1991).According to research (Mc Dowell, Briefel, Alaimo, 1994) a single meal today contains14% more kcal than it did 30 years ago, and a great many children with a wide waist volume are at risk of contracting an illness (Fernandez, Redden, Pietrobelli, & Allison, 2004).

The constant decrease in daily calorie burning, which does not accompany an adequate reduction in calorie intake, is the main cause of the epidemic of obesity at a time of decreased movement, according to researchers. There is no balance between the intake of food and lower energy needs (Hili & Melanson, 1999), which refers both to children and adults. Children who have excessive body weight are less active than their peers involved in sports games, which means that when individuals decrease their activity, they usually get fatter. An individual who became obese later on in life, but was active in childhood, will be physically more active in old age than an individual who has been obese since childhood. In any case, physical inactivity, due to an excess of kilograms, brings with it greater physical inactivity, and so further increases body weight.

The best program for reducing body weight (Lakka & Bouchard, 2005) lasts for at least 60 minutes, or more likelyconsists of 80 to 90 minutes of daily moderate physical activity combined with a smaller intake of calories. In the long run, the best results are achieved when the weekly consumption of energy during moderate physical activity is at least 2.500 kcal.

Following the end of one's sports career, most athletes stop exercising completely. The volume of their activities decreases and their calorie intake remains the same, so the gain in weight is usually frequent and excessive, which leads to a decrease in physical fitness. The rate of decrease in fitness (aerobic abilities) among former athletes after the age of 50 is related to the decreased intensity of exercise and increase in body weight (Pimentel, Gentile, Tanaka, Seals, Gates, 2003).

Obesity and inactivity represent the two of the main economic problems of modern societies. Excessive weight has considerably increased the costs of medical examinations (Popkin, Kim, Rusev, Du, & Zizza, 2006), and so the treatment of obese individuals is on average 75% more expensive than that of people with normal body weight (Raebel, Malone, Conner, Xu, Porter, & Landy, 2004). The number of years of life which are lost due to excessive obesity (BMI in excess of 40) among men is 13, among women is eight (Fontaine, Redden, Wang, Westfall, & Allison, 2003). A man aged 40 has lost 3,1 years due to excessive weight and an additional 5,8 years to obesity (Peters, Barendregt, Willekens, Mackembach, Al Mamum, & Bonneux, 2003). The effects of the decrease in body weight cannot be achieved through dieting and starving of the body, but instead through long-term moderate intensity exercise, which burns fat and preserves muscle tissue and other fat-free tissue.

Numerous studies (Kriska, Saremi, Hanson, Bennett, Kobes, 2003; Sallis, Floyd, Rodriguez, Saelens, 2012)indicate that the risk of the occurrence of chronic illnesses is undoubtedly tied to the extent of moderate physical activity. Having and maintaining an active lifestyle plays and important part in preventing type 2 diabetes. This is why experts have recently increased moderate intensity activities from the minimum recommendation of 30 to 60 minutes. They increased their recommendation to increase the burning of calories and thus slow down the epidemic of obesity, which, as the results of numerous studies show, drastically increases the risk of cardiovascular disease (Brooks, Butte, Rand, Flatt & Cabellaro, 2004). Physical activity reduces the risk of the occurrence of pancreatic cancer, especially among obese individuals (Michaud,Giovannucci, Willett, Colditz, Stampfer, 2001),among whom, as it is well-known, there is an increased risk of malignancy.

The risk of obesity among children is significantly greater when the parents are obese because the genetic factor plays an important role in the development of obesity. That obesity had its roots in one's genetic make-up has been confirmed in studies on paternal and fraternal twins who grew up in different environments (Struncard, Foch, & Hrubec, 1986).However, in one study (Esparza, Fox, Harper, Schulz, Valencia, & Ravussirt, 2000) the researchers concluded that the level of physical activity played an important role in the prevention of the increase in obesity in the population with a genetic predisposition. They also noted a significant influence of fast food on the development of obesity in this population.

What can also contribute to the development of obesity are various fruit juices and soft drinks which contain fruit syrup rich in fructose. A high intake of such beverages is connected to obesity, due to the sugar and high calorie value (Schulze, Manson, Ludwig, Golditz, Stampfer, 2004). These are simple carbohydrates with a high glycemic index, which do contain energy, but not enough nutrients (vitamins and minerals), and thus should, in principle, be avoided, unless it is necessary to make up for spent energy as soon as possible under conditions of intense physical activity.

Untrained individuals, individuals with low physical fitness, get tired much sooner during physical activity, which as a consequence has the burning of fewer calories. However, considering that they increase their level of physical fitness, calorie burning is also on the rise since the activity lasts longer, is more frequent and more intense. This contributes to better weight control and higher energy consumption. Recent research has shown that exercise has a significant effect on the feelings of strain and fatigue among participants (Gaskill, Walker, Bouchard, Rankinen, 2005).By improving physical condition, more can be done without fatigue, without increasing heart frequency.Activities which had previously caused fatigue can be done with ease, and the participants can burn more calories, without experiencing excessive fatigue.

The effects of physical activity were also discussed in another study (Hays, Starling, Liu, Sullivan, & Evans, 2004) in which the participants were divided into two groups. One group took part in an exercise program and followed a low-fat diet, and the other only followed a low-fat diet. The participants in addition to a low-fat diet regularly exercised and lost 4,8 kgon average, while those on a low-fat diet lost 3,2 kg.

Sallis & Glanz (2006) found a link between physical activity, the living conditions of children and obesity. Obesity is lower and the level of physical activity of the children is significantly greater in urban environments with a well-developed network of sidewalks, bicycle paths and busy thoroughfares that have been removed from the pedestrian zones. By removing barriers of this kind, physical activity and a healthy lifestyle are promoted. The authors also cite that there is a large offer of fast food, a lack of fresh fruit and vegetables, as well as an increase in food portions, which contribute to the epidemic of obesity. Other studies as well (Ewing, Schmid, Killingsworth, Zlot, & Raudenbush, 2003; Sallis, et al., 2012) confirmed that there is a connection between obesity and the environment we live in, as well as the availability of sports content, even though studies of this kind are still only in their infancy.

CONCLUSION

The results and conclusions that the authors reached have indicated a connection between physical activity programs and obesity. A positive energy balance of increased calorie intake and its inadequate burning due to inactivity is the basic cause of excess weight and obesity. In addition, the causes of excess body weight have also been determined in other factors such as the environment one lives in, the abundance of fast food and a high-fat diet, as well as in the genetic predispositions of these characteristics. The effects of reduced body weight and fat percentage in the body cannot be achieved through dieting and starving of the body. The best way to prevent this is to partake in regular physical activity and moderate intensity exercises, which burn through fatty tissue and preserve muscle and other fat-free tissue. Physical activity of that type, by decreasing obesity, indirectly decrease the risk of contracting a chronic cardiovascular disease, diabetes and some malignancies such as colon cancer, pancreatic cancer and the like. Studies have also shown that physical activity played an important role in preventing obesity even in the population with a genetic predisposition.

In order to prevent the epidemic of obesity and fight for a healthy population, it is necessary to make a clear strategy for the increase of regular physical activity. In the struggle to achieve this goal, wide social support is needed, ranging from the family, schools, health institutions and other social organizations and institutions, to the media.

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THE EFFECTS OF PILATES ON LUMBAR SYNDROME: A SYSTEMATIC REVIEW STUDY

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UDC 796.012:61

SUMMARY

The objective of this study was to evaluate the effects of Pilates exercise on chronic lower back pain treatment based on a systematic review of previous studies. Seven electronic databases were searched, using the following terms as keywords: PILATES, PAIN, LOW BACK PAIN, and SPINE. Criteria for the inclusion of a study were as follows: the research had to have been published in the period between 2006 and 2016, it included both experimental and control groups, or at least two experimental groups, and it examined the impact of a Pilates program on pain relief and a reduction of functional disability caused by lumbar syndrome. Based on the established criteria, the final analysis included 13 journal articles which were classified into three groups for easier analysis. The first group comprised papers that compared the effect of the application of Pilates exercises compared to other exercise programs that are used in the treatment of chronic lower back pain. The second group included studies which compared the effects of the application of Pilates programs in relation to a control group. The third group consisted of research which compared the effects on the reduction of lower back pain between experimental groups which employed different Pilates exercise programs. Following a comprehensive analysis of the results it can be concluded that Pilates exercise programs have a positive effect on reducing the negative consequences of lumbar syndrome, especially pain in the lower back and functional limitation. The significance of this research lies in reviewing the possibilities of a practical application of Pilates programs applied in the analyzed studies in working with people who have LS according to their efficiency.

Keywords: Pilates, effects, back pain, functional disability

INTRODUCTION

Lumbar syndrome (LS) is defined as pain located in the spinal column, between the twelfth thoracic vertebra and the coccyx (Egle et al., 2008; Donelson, 2008; Pradhan, 2008). It can be described as pain occurring in the lumbar, sacral, or lumbar-sacral area (Posadzki, Lizis & Hanger–Derengowska, 2011). In terms of duration, it can manifest chronically, acutely, or sub-acutely (Vos et al., 2013). This type of pain occurs on average in 6.3% to 15.4% of the population every year, whereas the incidence of the pain recurring ranges between 1.5% and 36%. Furthermore, this condition can be classified on the basis of the factors which cause it to emerge, where on the one hand it is a consequence of other conditions, and on the other the cause of the pain's occurrence is unknown (Krismer & Van Tulder, 2007). Persons affected by this condition may experience limitations in relation to everyday activities, and may have difficulty adapting in order to maintain or preserve basic functions such as walking, running, or other activities (Hammill, Beazell & Hart, 2008). The syndrome may be linked to a dysfunction of internal abdominal muscles such as transversus abdominis, multifidus, pelvic muscles and diaphragm muscles, as well as to reduced coordination and stabilization of lumbar muscles, particularly the extensor muscles (Fonseca et al., 2009; Galdwell et al., 2006; La Touche et al., 2008). In addition to the dysfunction of these muscles, and impaired strength and endurance, changes can occur in other muscles that are responsible for maintaining the stability of the whole body (Rydeard, Leger & Smith, 2006). McGill recommends enhancing muscle endurance as well as muscle strength with the aim of LS prevention and rehabilitation (McGill, 2001).

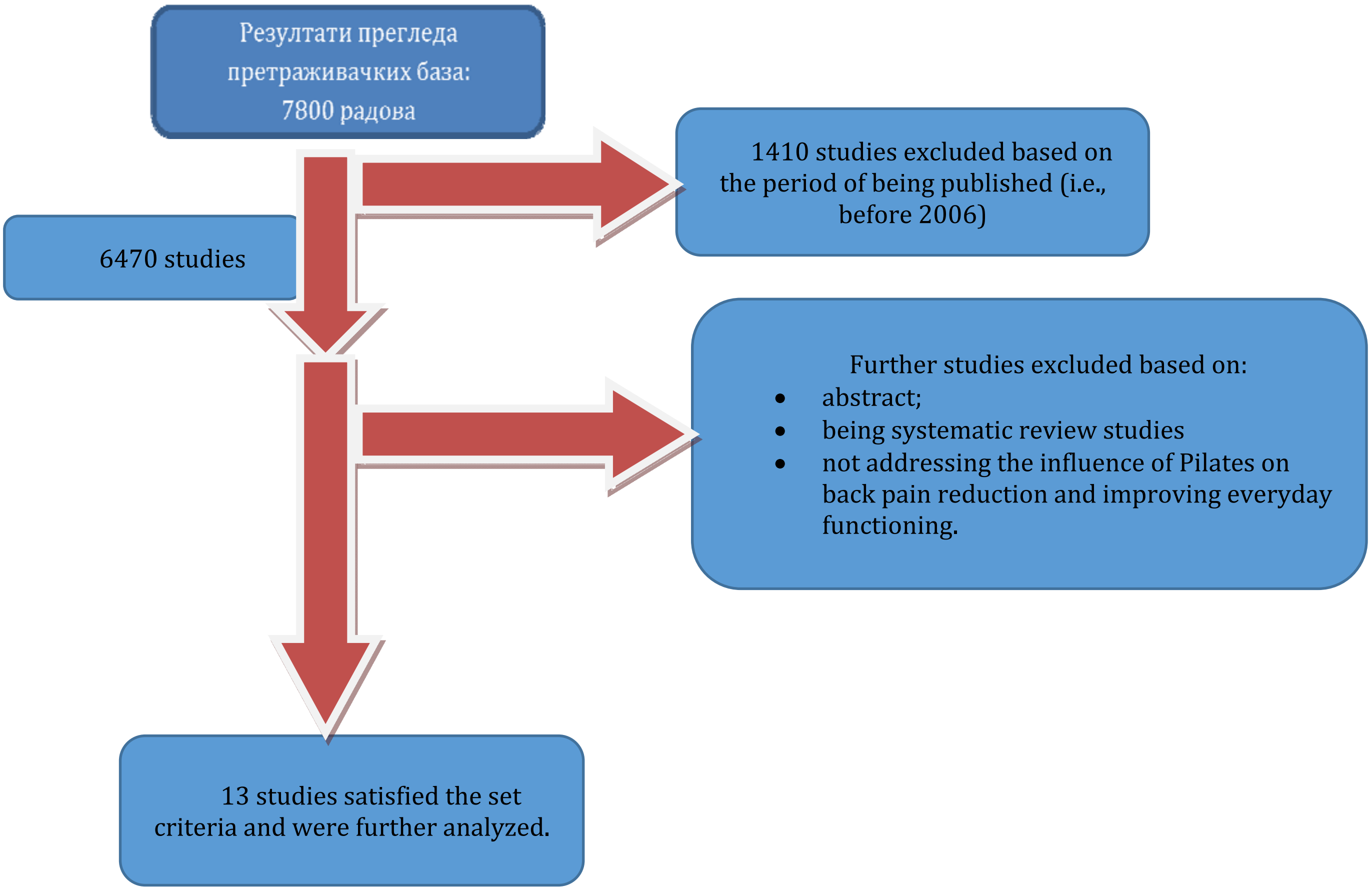
The Pilates exercise method, developed by Joseph Pilates (Di Lorenzo, 2011), is aimed at strengthening the muscles in charge of maintaining stability, such as abdominal muscles, back and gluteal muscles, as well as pelvic and hip muscles (Akuthota & Nadler, 2004). The effect of Pilates exercises consist of maintaining stability with a view to controlling movement and protecting the back (Muscolino, 2004; Latey, 2002). Akuthota and Nadler describe stability as a 'box', where the abdominal muscles comprise its front, the back and gluteal muscles comprise the back, the diaphragm is the top, and pelvic and hip muscles are the bottom (Akuthota & Nadler, 2004). Exercises include breathing control, which leads to the activation of transverse abdominal muscles, the diaphragm, and pelvic muscles. The activation of these muscles contributes to the stability of the lumbar region. In view of the above, the **objective** of this study was to conduct a systematic review of studies to date in order to determine the effects of the application of a Pilates exercise program on the treatment of lumbar syndrome.

METHODS

Studies conducted to date on the effects of Pilates exercise programs on lumbar syndrome were collected from the following electronic databases: SCIndeks, Google Scholar, PubMed, Web of Science, SPORT Discus, MEDLINE and CINAHL. The study search encompassed papers published between 2006 and 2016. Keywords used for database search included *Pilates, pain, low back pain, spine, lumbar syndrome.* Studies were included based on the following criteria: the study included at least two groups of participants, and it studied the effect of a Pilates exercise program on reducing the pain and functional disability caused by lumbar syndrome. Studies which met the criteria set were then analyzed and presented in terms of the following parameters: reference (first author's surname and year it was published), participant sample, age, total number, and sub-groups, the Pilates exercise program (frequency, duration, range, and exertion intensity), program duration and study results.

RESULTS

Figure 1. A representation of study collection, analysis and elimination



The process of collecting, analysis and elimination of retrieved papers is presented in Figure 1. Following the elimination process, 13 studies examining the effect of Pilates on reducing back pain and improving everyday functioning were included in the final analysis. Based on the data provided in Table 2 we can see that the participant samples in ten studies included both male and female subjects, whereas three studies included only female subjects in their participant sample (Lee, Hyun & Kim, 2014; Quinn, Barry & Barry, 2011; de Araujo, da Silva, Mello, Cader, Salgado & Dantas, 2012). The participant sample age range was between 18 and 70, with the youngest sample in the study by de Araujo et al., 18-25 years (de Araujo et al., 2012), and the oldest sample in the study by Wajswelner et al., 18–70 years (Wajswelner, Metcalf & Bennell, 2012). The largest participant sample, 87, was found in the study by Wajswelner et al. (Wajswelner et al, 2012), whereas the smallest participant sample, 22, was registered in the study by Borges et al. (Borges, Baptista, Santana, Souza, Kruschewsky, Galvão-Castro & Sá, 2014).

Further analysis reveals that the participant sample was divided into an experimental and a control group in seven of the thirteen studies, while six studies included two experimental groups. The participants in the control groups were asked to go on with their usual activities, including taking any medication there were already using and engaging in everyday activities with no additional exercise program. In the studies with two experimental groups, two of the studies compared different Pilates programs across groups (Lee et al, 2014; da Luz Jr, Costa, Fuhro, Manzoni, Oliveira & Cabral, 2014), whereas in the other four papers a Pilates exercise program is compared against other physical exercise programs (Wajswelner et al, 2012; Anand, Caroline, Arun & Gomathi, 2014; Donzelli, Di Domenica, Cova, Galletti & Giunta, 2006; Kuppusamy, Narayanasamy & Christopher, 2013). The longest experimental treatment duration was found in the study by Borges et al., namely 30 weeks (Borges et al., 2014), while the shortest experimental treatment duration, of 10 days, was that in the study by Donzelli et al. (Donzelli et al., 2006). The lowest weekly exercise frequency was once a week (Quinn et al, 2011; Donzelli et al., 2006; Gladwell, Head, Haggar & Beneke 2006), and the highest was three times a week (Patti, Bianco, Paoli, Messina, Montalto, Bellafiore, Battaglia, Iovane & Palma, 2016; Lee et al, 2014; Rydeard, Leger & Smith, 2006). Individual practice duration ranged between 50 and 60 minutes across all studies. Measure instruments employed in the studies included: the Quebec scale, Oswestry Disability Index, Visual analogue scale, Roland Morris pain rating visual analogue scale, Oswestry Low Back Pain Disability Questionnaire, Roland Morris Disability Questionnaire, 101-point numerical rating scale, and Borg CR 10- scale of perceived pain. All of the applied instruments were used for pain assessment, including lower back pain assessment, as well as for the assessment of disability or functional limitations due to lumbar syndrome.

Table 2. Detailed study analysis

Reference	Participant sample	Groups	Experimental program		Measure instruments and results
			Frequency and duration	Exercise program	
Donzelli et al. (2006)	A: 20 – 65 S: m, f n = 43	EG1 (n=22) EG2 (n=21)	TD – 10 days PD – 60 min WF – 1 time	EG1: "Back School" exercise program EG2: new Pilates CovaTech method	EG1 :VAS sig.↓; OLBPDQ sig.↓ EG2 :VAS sig.↓; OLBPDQ sig.↓ No difference between groups.
Gladwell et al. (2006)	A: 40.6±9.7 S: m, f n = 34	EG1 (n=20) CG1 (n=14)	TD – 6 weeks PD – 60 min WF – 1 time	EG1: modified Pilates exercise program with gradual progression; CG1: usual activity.	EG: OSWDQ no change; RMVAS sig.↓;. CG: OSWDQ sig.↓; RMVAS no change. No difference between groups.
Rydeard et al. (2006)	A: 20 – 55 S: m, f n = 39	EG1: (n=21) CG1: (n=18)	TD – 4 weeks PD – 60 min WF – 3 times + PD – 15 min WF – 6 times	EG1: Pilates exercises using mat and equipment (Pilates Reformer) CG1: usual activity.	EG: NRS-101 sig.↓; RMDQ-HK sig.↓. CG: no change.

Quinn et al. (2011)	A: EG1: 41.8±13.84 CG1: 44.07±12.5 S: f n = 29	EG1 (n=15) CG1 (n=14)	TD – 8 weeks PD – 60 min WF – 1 time	EG1: modified Pilates floor exercises CG1: usual activity.	EG1: VAS sig.↓, RMDQ no statistically significant changes compared to CG1
de Araujo et al. (2012)	A: 18 – 25 S: f n = 31	EG1 (n=20) CG1 (n=11)	TD – 3 months PD – 60 min WF – 2 times	EG1: 12 Pilates exercises using the Pilates ball and equipment. CG1: usual activity.	EG1: Borg CR 10 sig.↓
Wajswelner et al. (2012)	A: 18 – 70 S: m, f n = 87	EG1 (n=44) EG2 (n=43)	TD – 6 weeks PD – 60 min WF – 2 times	EG1: 6-12 Pilates exercises using props, plus 1-4 exercises at home; EG2: spinning, strength and stretching exercises.	EG1: QS sig.↓; EG2: QS sig.↓. No difference between groups.
Kuppusamy et al. (2013)	A: 20 – 65 S: m, f n = 30	EG1 (n=15) EG2 (n=15)	TD – 6 weeks PD – EG1:50-60 min EG2: 60 min WF – 2 times	EG1: McKenzie posture correction exercises; EG2: Pilates exercises on floor, 3 difficulty levels.	EG1: PNRS sig.↓, RMDQ sig.↓; EG2: PNRS sig.↓, RMDQ sig.↓; No difference between groups.
Anand et al. (2014)	A: 18 – 60 S: m, f n = 52	EG1 (n=26) EG2 (n=26)	TD – 8 weeks PD – 60 min WF – n/a	EG1: 10 modified Pilates exercises plus stretching exercises; EG2: spinning, strength and stretching exercises.	EG1: ODI sig↓; VAS sig↓. EG1 results better compared to EG2.
Borges et al. (2014)	A: 48.73±10.07 S: m, f n = 22	EG1-CG (n=11) CG1-EG (n=11)	TD – 30 weeks PD – 60 min WF – 2 times	EG1-CG: first 15 weeks Pilates exercises using equipment or floor, latter 15 weeks usual activity; CG1-EG: reverse order to EG1	EG1-CG: VAS sig.↓, CG1-EG: VAS sig.↓
da Luz Jr et al. (2014)	A: 18 – 60 S: m, f n = 86	EG1 (n=43) EG2 (n=43)	TD – 6 weeks PD – 60 min WF – 2 times	EG1: Pilates exercises on the floor, EG2: Pilates exercises using props.	EG1: PNRS sig.↓, RMDQ sig.↓; EG2: PNRS sig.↓, RMDQ sig.↓; No difference between groups after 6 weeks of program application.
Lee et al. (2014)	A: PME:34.0±3.3 PAE: 34.4±3.1 S: f n = 40	EG1 (n=20) EG2 (n=20)	TD – 8 weeks PD – 50 min WF – 3 times	EG1: 17 Pilates exercises on the mat, EG2: 9 Pilates exercises on the Cadillac Pilates Reformer	EG1: VAS sig.↓.; EG2: VAS sig.↓. sig.↓ in EG1 compared to EG2
Natour et al. (2015)	A: 18 – 50 S: m, f n = 60	EG1 (n=30) CG1 (n=30)	TD – 90 days PD – 50 min WF – 2 times	EG1: Pilates exercises and medication therapy; CG1: usual activity.	EG1: VAS sig.↓, RMDQ sig.↓, compared to control group.
Patt et al. (2016)	A: EG:41.31±11.24 CG:41.63±13.01 S: m, f n = 38	EG1 (n=19) CG1 (n=19)	TD – 14 weeks PD – 50 min WF – 3 times	EG1: 7 Pilates exercises, 4-20 repetitions, with 2-min. breaks in certain exercises; CG1: usual activity.	EG1: ODI sig.↓ CG1: ODI sig.↓ Greater improvement in EG1 compared to CG1.

M – male participant, F – female participant; EG1 – first experimental group; EG2 – second experimental group; CG1 – first control group; EG1-CG and CG1-EG – groups with role switching during the program's duration; sig.↓ - statistically significant result decrease in a particular test; TD – total program duration; WF – weekly frequency; PD – individual practice duration; QS-Quebec scale; ODI-Oswestry Disability Index; VAS-Visual analogue scale; RMVAS - Roland Morris pain rating visual analogue scale; OSWDQ-Oswestry Low-Back Pain Disability Questionnaire; RMDQ-Roland Morris Disability Questionnaire; 101 – NRS- 101-point numerical rating scale; OLBPDQ-Oswestry Low Back Pain Disability Scale; Borg CR 10- scale of perceived pain.

DISCUSSION

On the basis of the years in which the studies analyzed were published, it can be concluded that the question of the effects of applying Pilates exercise programs has been considered evenly over the last decade, that is, between 2006 and 2016. In terms of the sex of the participants in the studies considered, male and female subjects tended to be included equally in all but three studies, which only included female participants, which led us to conclude that lower back pain occurs equally in men and in women, but also that the same Pilates exercise programs are applicable in both demographics as therapy for lumbar syndrome. Based on the study participants' ages, lumbar syndrome appears to occur in the elderly as well as in the younger population, as evident from the study conducted by de Araujo et al., where participants were female students aged 18-25 (de Araujo et al., 2012), and the study by Wajswelner et al., where the upper age limit for the participants was 70 years (Wajswelner et al., 2012).

Considering program duration, even a treatment lasting ten days was shown to have a positive effect on reducing pain caused by lumbar syndrome, testifying to the efficiency of Pilates exercise programs as one of the methods for the prevention and treatment of this condition (Donzelli et al, 2006). Furthermore, positive effects of Pilates exercise programs were also evident when the program was applied once a week (Quinn et al, 2011; Gladwell et al, 2006). Individual practice duration was between 50 and 60 minutes in the majority of studies analyzed, identifying this as the optimal length of time needed for achieving positive effects of the Pilates exercise program for reducing lower back pain. Results obtained by Borges et al. indicate that Pilates exercise programs can be successfully implemented in the treatment of lumbar syndrome even in patients with a chronic condition or severe illness (Borges et al., 2014).

When analyzing the effects achieved by the application of Pilates exercise programs, the studies reviewed can be divided into three groups. The first group comprises studies that compared the effects of applying a Pilates exercise program against other exercise programs employed in the treatment of lumbar syndrome (Donzelli et al., 2006; Wajswelner et al, 2012; Kuppusamy et al, 2013; Anand et al, 2014). The alternative exercise programs included various activities such as: stationary bike exercise, back muscle exercises, exercise using the Pilates ball, stretching exercises, belt exercises, the „Back School" program, and the McKenzie exercises for postural status correction. The results obtained in these studies indicate that the Pilates programs employed had a positive effect on reducing lower back pain, as well as on reducing functional disability; however, there was no statistically significant advantage over the 'Back School' program or the McKenzie exercises for correcting postural status (Donzelli et al., 2006; Kuppusamy et al, 2013). The remaining two studies from this group applied very similar exercise programs, where the study by Anand et al. found better results with the Pilates program, and the study by Wajswelner et al. found the same positive effect for Pilates and the other exercise program examined. The results thus obtained indicate no advantage of Pilates programs over other exercise programs applied when treating LS.

The second group includes studies which analyzed the effects of applying Pilates programs in comparison with control groups, i.e., participants who continued with their usual activities and with any applicable medication for the duration of the experimental program (Gladwell et al., 2006; Rydeard et al, 2006; Quinn et al, 2011; de Araujo et al., 2012; Borges et al., 2014; Natour et al., 2015; Patti et al., 2016). In all the analyzed studies from this group there were statistically significant differences in favor of the experimental group employing the Pilates exercise program. The results obtained indicate that a Pilates exercise program ought to be added to everyday activities and therapy for people affected by LS, as it can aid in reducing the feeling of pain and the dysfunctionality which attends lower back pain.

Group three comprises studies that compared the effects of reducing lower back pain between experimental groups applying different Pilates exercise programs (Lee et al, 2014; da Luz Jr et al., 2014). In both studies one experimental group applied a Pilates exercise program on the floor, while the other experimental group applied Pilates exercises using specialized equipment. The results obtained in these two studies indicate that there is no difference in the effects of Pilates exercises based on the type of Pilates program applied; however, in terms of pain reduction, slightly better effects were achieved in the group employing floor Pilates exercises in the study by Lee et al. (2014).

CONCLUSION

Based on an analysis of the results of the reviewed studies it can be concluded that the Pilates exercise program has a positive influence on the reduction of negative effects caused by lumbar syndrome, primarily lower back pain and functional limitation. By comparing all the studies analyzed against factors such as: length of experimental program, its weekly frequency, and individual treatment duration, it emerges that Pilates programs of exercise have a positive effect regardless of any fluctuations in the above factors.

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THE INFLUENCE OF RESISTANCE TRAINING ON YOUNG WOMEN –REVIEW ARTICLE

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SUMMARY

When we take into acount that resistance training includes exercise with workout machines, weights, resistance bands or body weight exercises, with the aim of developing muscle force, strenght, and endurance, and that this type of exercise wasn't popular with women until recently, it is important to note that this mode of exercise rose in popularity in the last thirty years, but also that women have been employing it more intensively within the last decade. More and more women engage in this kind of training, and they respond to it better, and with improved success in all training areas when compared to men. Much research has been done to analyse the effects of resistance training on young women within the 20-25 age range. Methods, experiments, resulsts, and conclusions which have been analysed point to the fact that resistance training is an efficient way to develop explosive strengh, when used separately or in combination with other modes of training, and that evident improvements occur in response to this type of training.

Keywords: resistance training, influence, strenght, young women

INTRODUCTION

Numerous research have shown that regular physical activity strenghtens the body, improves motor skills, reduces the risk of cardio-vascular dieseases, encourages socialisation, improves our overal health condition, and has a positive influence on mental health. This leads to the hypothesis that exercise should be an integral part of our general education and living culture, which is a tendency employed almost everywhere in the world. However, advancements in technology, an increasingly more common sedentary lifestyle, and physical inactivity, threaten the psychosomatic condition of the 21st century individual. According to a lot of research regular physical activity not only strenghtens the body, and develops motor skills, but also helps with emotional stability and psychological health. In this modern age, being physically active, doing fitness, and going to the gym, all represent a unique "vent" for people, therefore making any kind of physical exercise a positive step forward.

Regular exercise also carries the posibility of developing positive moral traits like determination, boldness, stability, persistance, perseverance, discipline, initiative, honesty, modesty, optimisim in life, good behavior, patriotism, humanity, positive attitude towards one's community and so on. (Bungić and Baić 2009).

Resistance training includes exercise with machines, weights, resistance bands, or body weight exercises, with the aim of developing muscle force, strenght, and endurance (Ignjatović, Stanković, Radovanović, Marković and Cvećka, 2009). This kind of training has two basic adaptive effects on the body: efficient muscle activity (functional activity), and muscle hypertrophy (structural efficiency) (Jukić and Šimek, 2007). Resistance training with both profesional and recreational female athletes was much less present until recently due to the wrong asumptions about the effects of this kind of training. The misconception was that resistance training would reduce flexibility and increase brawniness with women. (Garhammer & Takano, 1992). A correctly designed training regiment has no negative effects on flexibility, while hypertrophy isn't overly present with women, despite the fears, due to the physical constitution of women – longer tendons in relation to their muscles (Darden, 1983), percentage of body fat, and a 100 times lower testosterone level. This type of training also brings about better competitive results. A resistance training programe should, however, take into account the specific way the female body funcions, in relation to the phases of the menstrual cycle (Šimek, and Sar. 2003). In cases where training is achieved through use of higher intensity exercises, this represents the classic muscle strenght training. Morphological differences between men and women can be seen in their respective body fat percentage, which is higher with women, muscle and bone tissue, general body mass, and furthermore, in their respective response to the forementioned type of training (Šimek, and Sar. 2003). It is important to note that the hormonal differences between men and women will seriously affect training results, including the results of resistance training as well. These differences are, above all, evident in the secretion of different hormones. With women estrogen is responsible for the increased percentage of body fat, while with men testosterone is directly responsible for their skeletal dimensionality and greater total muscle percentage. Research have shown that women with a genetically higher testosterone level have a predisposition to generate biger muscle force and strength (Hakkinen, Pakarinen & Kallinen, 1992).

Achievements and progress with resistance training represent a dynamic process which requires one to follow a properly designed training programme, constant evaluation of one's training process, as well as a carefully develeoped path towards the desired goals. The process starts by defining one's own individual needs and setting an end goal. This requires a plan which must include muscle training order, steps to avoid injury, knowledge of one's metabloic characeristics, etc. (Kraemer & Ratamess, 2004).

To determine whether the theoretical framework of resistance training has any foothold in practice and within the population of young women, provided here is a critical analysis and evaluation of materials which have been used in research on the effects of resistance training on explosive strength (with young women ages 20 to 25)

METHODS

In order to acquire the best possible material that will coincide with, and affirm the topic of this article, we have searched through an abundance of written work within a number of electronic data bases: KOBSON, EBSCO, PubMed, ScienceDirect, SCIndex, and Google Academic. The search included works which relate to the population of women between the ages of 20 to 25. The search was done through a combination of terms connected with the scope of resistance training, exertion of explosive strenght with young women, and was limited to the following key words: "resistance training", "young", "women", "girls", "effects", "explosive strenght", "benefits", ie. the combination of mentioned key words in the English language. Relevant studies were acquired after detailed overview and after fullfilling inclusion criteria. The analysis of proquired data was done through a descriptive method.

DISCUSSION

Based on the results aquired from the analysed research, it is clear that the observed strength training included various training modes, which managed to bring about, more or less, different changes in muscle potential. The focus of this analysis is, above all else, the efficiency of resistance training on the female gender. Most research were done while following original training programmes, which were aimed at finding the most adequate stimulus for increasing muscle potential with young women, and on their adaptive responses to the training, as well as determining and confirming the differences between the male and female population.

Improvements of muscle strength and endurance directly depend on physical resistance training, and not on genetic factors tied to neuro-muscular fibers found in muscle tissue (Hong, A., Hong, S., & Shin, 2014). The differences in physical performance between genders are lower when observing resistance training results by untrained women and untrained men (Mayhew & Salm, 1990), while strenght training improves physical performance and muscle potential with women after 6 months, and they become adapted to the strength and force (Kraemer, Mazzetti, Nindl, Gotshalk, Volek, et al., 2001), ie. women and men share a similar response to strength training starting from their untrained basics, and aside from their individual aproach to training, ie. adapting to the range and intensity for each person individually, there are no other recommendations or proof that strength training for women should be any different from the strength training of men (Holloway & Baechle, 1990), which emphasises the importance of such a training in physically demanding occupations. Research have pointed to the fact that even though there is no muscle hypertrophy there are still improvements in strenght with women, compared to men where we witness both hypertrophy and strength improvements (Lewis et al., 1986), and also that phases of the menstrual cycle have no influence on the muscle potential of women. While following the same resistance workout programme both men and women had shown similar results in relative strength improvements.

The development of physical performance cannot be achieved solely through tightly specialised training, which is where resistance training comes in and finds its place and usage, leaving behind the preconceptions where only strenght athletes employ it. This type of training wasn't overly popular with women due to the prejudice which women have towards exercising with weights and resistance. However, research results (Раденковић, 2016), recommend women engage in this mode of training for its physical, mental, and physiological gain. Women have had, in this research as well, a better response to training, and they have shown improvements in all research areas. Significant changes were noted in terms of increased explosive strength, reduction of body fat to muscle mass ratio, and another benefit this research pointed to is the social role of exercising in groups, which works as a motivational tool for achieving results.

Darden (1983) claimed that women are, when looking at absolute values, about 2/3 weaker than men due to their tendons being longer in relation to the muscles, fat tissue percentage (Wilmore, 1974; Drinkwater, 2000), a 100 times lower testosterone level, and their bodies are generally smaller than men's. Their muscle tissue area is smaller, and they carry a smaller number of muscle fibers. However, the female muscle tissue is of similar strength to that of males, and certain studies have shown that the proportional increase in muscle fiber, tone, and hypertrophy is similar for both genders in their pre-exercise state. Strength training affects beneficial change in bones (Snow-Harter, Bouxsein, Lewis, Carter& Marcus, 1992), since full bone mass with women is achieved only in their thirties, and strength training also reduces the percentage of subcutaneous fat with women.

In terms of motor skills the values differ with tests of absolute and relative strength. If the results on the bench press are expressed relative to body weight, women show 46% (37% repetition maximum) of the strenght of men, and on the leg press 92% (73% RM) of the strength of men (Wilmore i Costill, 1994). O'Hagan, Sale, MacDougall, & Garner, (1995) claim that the recorded changes in muscles are similar with men and women who have gone through the same training programme, but the difference is noticed in the acquisition of strength. On the other hand, authors note that the differences in physical performance between genders become less obvious after resistance workouts with untrained women compared to untrained men (Kraemer et al., 2001), but that there are also undeniable differences between men and women in the exhertion of maximum strength (Mayhew, Ball, Arnold & Bowen, 1992).

When looking at the general population, it appears that men have an advantage over women, which is the conclusion of the study done by Lewis, Kamon & Hodgson (1986). These advantages are obvious in specific responses or sizes of responses to different workout regiments. However, a very small difference can be seen in response to different forms of progressive resistance strength training workouts. Men and women show similar progression results in terms of relative strength within the same resistance training programme. The body changes which occur while doing resistance training are ambiguous at this moment. Some research point to the fact that there is a possibility for women, in spite of their lack in hypertrophy, to increase their strength, in comparison with men who experience both hyperthrophy and the increase of strength, due to the higher fat tissue percentage with women (Wilmore, 1974; Lewis, et al. 1986), while some studies don't deny hypertrophy (Chilibeck, Calder, Sale, & Webber, 1998) durring and after a workout.

Phases of the menstrual cycle don't create any change in terms of muscle potential with women, but the proof in inconclusive on the effects of resistance training in hot and cold conditions, where due to the increase in surounding temperature there is an increase in muscle temperature in conditions of normal muscle activity, and so the period of activation and relaxation of the muscles gets shortened (Lewis, et al. 1986).

Taking into acount the prevention and reduction of injury risk as one of the resistance training goals, studies have shown that women exhibit a significantly higher difference between eccentric and concetric movement with dynamic workouts with outer movement resistance than man do, which again points to a greater injury risk with women (Hollander, Kraemer, Kilpatrick, Radaman, Reeves, Fancois, et al. 2007). In the forementioned research (Hollander et al. 2007) women have achieved much lareger differences in terms of eccentric parts of movement while working out: leg press (w=66%, m=44%), bench press (w=146%, m=40%), military press (w=161%, m=49%), leg curl (w=82%, m=27%). This is precisely why strength training with women should be aimed at optimising the differences in strength between the eccentric and concentric parts of movement.

Mayhew & Salm (1990) did a research on the sedentary sample of men and women, whose differences they tried to explain based on the differences in body composition, strength, and neuromuscular function, and have determined higher values on all strength tests with men, while a difference in terms of response was almost non existant. Force and antropometric characteristics showed similar correlation with production of strength for both genders.

Estrogen with women causes the increased fat component of the total body mass, and testosterone in men is a significant factor which influences skeletal size, and the larger muscle component of the total body mass. Many studies have shown that women with genetically higher concentration of testosterone have a predisposition towards generating higher force and muscle strength (Hakkinen et al., 1992).

Šimunić и Barić (2011), researched the reasons why people work out, and to get the full picture it was necessary to question why some people "sometimes" or "rarely" engage in physical activity, and in what way are people motivated. The results they came by show that women who occasionally work out do it because of health reasons, mobility, and to maintain their body weight, and much less out of social pressure or competition. Men, occasionally work out to increase their strength and for health, much less out of recommendation or pressure.

Body weight workouts are key to normal development and maintaining a healthy skeletal structure. Activities which focus on increasing muscle mass can, also, be of use, especially with bones who suffer from no extra weight. Resent findings demonstrate that bones which are still in their growing phase respond better to mechanical pressure and physical activity compared to mature bones, and this fact suggests that regular activity in our youth may be an important factor which could help prevent osteoporosis later in life. Intensive training can lead to hormonal changes, menstural disorder, and have a negative effect on body structure (Остојић, 2007).

A group of researchers (Aarskog, Wisnes, Wilhelmsen, Skogen & Bjordal, 2012) which did a study on male and female students, came to a conclusion that there are improvements in maximum strenght with physically active and healthy young people, without significant differences between training programmes of both genders.

CONCLUSION

Resistance training represents an adequate kind of stimulus for increasing muscle potential, and it points to certain advantages over other types of work out. Resistance training is used not only as a method to develop strength with women, but also as a kind of motivator for functioning in modern, every day life. As physical inactivity presents a threat to our psychosomatic functions, we can safely say that, today, this type of workout should be used, not only as aditional exercise in all sport activities, but also in recreational purposes with non-professionals. In all studies to which it was applied, its efficiency was confirmed in terms of adaptive change in the muscles of women. While doing resistance training there is an appearance of muscle hypertrophy, which is most drastic with the untrained population, as well as people whose parameters for monitoring changes in muscle potential are on a low level. Hypertrophy and progress directly depend on the training itself, and not on genetic factors. Significant improvements in explosive strength are greater while exercising with higher resistances. Strength training positively influences changes in bones, considering that full bone bass is achieved only around the age of 30, and strength training reduces the percentage of fat tissue with women. Working out can also develop positive moral traits, and regular physical activity strengthens the body. Motor skills are also developed, and it has an effect on emotional stability and mental health in general. Aside from the individual aproach to training, ie. adjusting the range and intensity for each indvidual, there are no other recommendations or proof that strength training for women should be different compared to strength training for men.

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TREND OF CHANGES IN MORPHO-MOTORIC STATUS OF NORMAL WEIGHT GIRLS

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UDC 796.012.1

SUMMARY

The aim of this study was to determine the trend of changes in the morphological characteristics and motor abilities of normal weight girls of younger school age. The sample consisted of 264 normal weight girls, who were divided into 4 age groups. First group was consisted of 7-year-old (n = 47), second group of 8-year-old (n = 53), third group of 9-year-old (n = 58) and fourth group of 10-year-old girls (n = 106). Morphological status was determined by measuring 16 parameters of longitudinal, transversal and circular dimensionality, and subcutaneous fatty tissue by measuring skin fold thickness. For the assassment of motor abilities (explosive strength, coordination and speed), a battery of nine tests was applied. Trend of changes was determined on the basis of average values for the assessment of morpho-motoric status, shown by the graphic curves, while their statistical significance was determined by the univariant analysis of variance. Obteined results indicate that, relative to age, there are significant positive changes in morphological characteristics and motor abilities in normal weight girls. It is concluded that there is a harmonious growth and development of body characteristics and motor abilities in normal weight girls.

Keywords: morphological characteristics, motor abilitiess, nutrition, girls

INTRODUCTION

When it comes to studying the anthropological status of children, it is inevitable to look back at the processes of growth and development, their dynamics and regulations. The term "growth" implies quantitative body mass and size increase , as well as qualitative changes in the child's body shape. Development refers to physiological changes, inculing changes in the central nervous systemc, which reflect on the child's motor abilities (Malina, 1986). The most frequent growth is the so-called morphological maturation of the child, anatomical and physiological alterations, while the development implies functional maturation, which relates to the psychological and motor development (Bala, Jakšić, & Popović, 2009).

Biological growth and development of children must be measured, evaluated, monitored, controlled, and corrected through educational and training activities. By measuring and testing the relevant morphological characteristics and motor abilitis, we can obtain the necessary information about their growth and development. The most common methods of data collection are the transversal, longitudinal or combined logitudinal method. As the processes of growth and development interact with each other, it is necessary to know both the quantitative levels and the nature of the relationship that is most often manifested in the form of interactions between the morphological and functional maturation of children and is caused by their age and sex.

The biological development of children is manifested through changes in physical and motor development. One of the important aspects of the development, which is associated with physical and motor development, is nutritional status. The nutritional status of children and adolescents is one of the important indicators of their health, mental and physical potential for normal and healthy growth and development (Lobstein, Baur, & Uauy, 2004). Previous research has undoubtedly shown that any major deviations from the normal values of the body mass index have a negative impact on the overall anthropological status of children. Numerous studies have identified that anthropometric changes are associated with overweight and obesity in children, as well as stagnation in their motor development and the generation of motor habits (Bala, 2007; Cawley & Spiess, 2008; Graf et al., 2004a, 2004b; Wrotniak, Epstein, Dorn, Jones, & Kondilis, 2006).

Prepubescnt age is a very sensitive developmental period. Having in mind periodization of growth, the children of this school age fall into the first phase of slow growth, which is a certain preparation for a period of turbulent changes. Compared to the first two years of life, the annual increase in body height and weight is not so conspicuous, and although body proportions during this period change, children are in a relatively stable developmental stage (Medved et al., 1987). Rogol, Roemmich, & Clark (2002) point out that the first decade of children's life is characterized by linear growth, with the similar increase rate of muscle mass in boys and girls (Fomon, Haschke, Ziegler, & Nelson, 1982; Van der Sluis, De Ridder, Boot, Krenning, & De Muinck Keizer-Schram, 2002; Wells, 2007). However, girls show a tendency to a higher percentage of body fat (Wells, 2007; Arfai et al., 2002).

The problem of this study was to examine the trend of changes in morphological characteristics and motor abilities in normal weight girls aged 7 to 10. The aim of this study was to identify the progress of growth and development of normal weight girls by measuring and testing during four points in time, through information obtained by using a transversal measurement method.

METHODS

Subjects

The research was conducted on the sample of 264 normal weight girls, elementary school students attending "Ratko Vukićević," "Car Konstantin" and "Sveti Sava" elementary schools in Niš. After measuring body height and body weight and calculating body mass index (BMI), in accordance with the work of Cole, Bellizzi, Flegal & Dietz (2000), only girls with normal body weight were taken into consideration.

All the subjects were divided into 4 age groups. The first group was consisted of 47 girls aged 7 (BMI = 16.00 ± 1.2; ages = 7.2 ± 0.4), the second group had 53 girls aged 8 (BMI = 16.04 ± 1.69, ages = 8.07 ± 0.4), third group had 58 girls aged 9 (BMI = 16.68 ± 1.71; ages = 9.17 ± 0.32), while the fourth group was consisted of 106 girls aged 10 (BMI = 17.03 ± 1.87; ages = 10.08 ± 0.43).

The sample included those girls whose parents had given signed consent for their participation, and who were healthy on the day of the testing. The measuring took place in the school facilities which met the necessary requirements.

Procedure

Morphological characteristics were determined by measuring 16 parameters of longitudinal, transversal, circular dimensionality and body weight, and subcutaneous fatty tissue by measuring skin fold thickness. Within the longitudinal dimensionality of the skeleton the following parameters were determined: body height, leg length and arm length; within the transversal dimensionality: shoulder width, pelvic width, and hip width; within the body mass and circular dimensionality: thorax volume, upper arm volume, thigh volume and calf volume; within the subcutaneous fatty tissue: sub-scapular skin fold, abdominal skin folds, thigh skin folds and medial calf skin folds.

The measuring technique for the morphological characteristics followed the guidelines of the methodology recommended by the International Biological Program (Weiner & Lourie, 1969).

Basic parameters of the motor abilities were determined by using the battery of tests used in the study by Kostić et al. (2010): plyometric jump (Nazarenko, 2000), hyperextension, twist, and throw (Kostić et al., 2009), standing depth jump (Kurelić et al., 1975), 20 sidesteps with a baton (Kurelić et al., 1975), horizontal jump rope (Kurelić et al., 1975), running and rolling (Kostić et al., 2009), hand tapping (Kurelić et al., 1975), 5×10 meter run (Kurelić et al., 1975), and foot tapping against a wall (Kurelić et al., 1975).

Statistical analysis

For all the parameters of the morphological characteristics and motor abilities, mean arithmetic values and standard deviations were calculated. The trend of changes was determined on the basis of average values which graphically formed a curve, while their statistical significance was determined by the univariate analysis of variance. All of the analyses were carried out with help of the SPSS 16.0 program.

RESULTS

Table 1 shows the arithmetic mean values and standard deviation of all the variables of morphological characteristics and motor abilities in normal weight subjects aged 7-10.

Table 1. Basic descriptive statistical parameters

	Age of 7 (n=47)		Age of 8 (n=53)		Age of 9 (n=58)		Age of 10 (n=106)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Body height	125.41	5.86	133.12	6.80	139.40	5.84	144.60	7.11
Leg length	68.94	4.14	74.29	4.49	78.99	4.50	82.61	4.98
Arm length	52.70	2.70	55.83	3.32	58.90	3.66	61.95	4.28
Shoulder width	28.35	6.75	28.77	2.02	30.11	1.59	31.27	1.92
Pelvic width	19.60	1.72	20.60	1.40	20.92	1.43	21.99	1.67
Hip width	21.02	1.26	22.25	1.39	23.06	1.71	24.19	1.73
Body weight	25.27	3.00	28.50	4.60	32.53	4.68	35.78	5.79
Thorax volume	59.85	3.32	61.10	7.05	64.94	5.25	67.35	5.81
Upper arm volume	17.97	1.63	18.62	1.97	19.98	2.06	20.52	1.86
Thigh volume	37.07	3.30	37.74	4.18	41.44	4.63	42.40	3.85
Calf volume	26.07	1.85	26.94	2.23	28.32	2.28	29.19	2.26
Triceps SF	10.42	2.95	11.32	3.97	12.71	3.53	12.45	4.02
Sub-scapular SF	7.08	2.97	8.25	5.69	8.89	3.54	8.80	4.07
Abdominal SF	8.79	4.31	10.73	6.90	11.99	6.88	11.42	5.88
Thigh SF	16.24	5.64	14.09	4.76	16.85	5.20	17.26	5.07
Medial calf SF	11.89	5.11	12.66	3.88	11.80	4.33	14.55	5.03
Plyometric jump	12.74	4.99	14.57	5.64	19.01	5.78	19.48	6.34
Hyperextension, twist, and throw	38.74	16.69	48.77	15.08	69.88	18.08	76.54	22.53
Standing depth jump	106.17	16.66	108.44	31.54	121.07	21.25	131.84	22.85
Horizontal jump rope	2.91	3.54	4.91	3.72	6.33	5.07	8.30	4.94
20 sidesteps with a baton	31.13	7.99	24.17	6.86	23.47	8.88	19.07	5.53
Running and rolling	21.09	2.89	20.36	2.54	18.18	2.52	18.05	2.48
Hand tapping	27.09	4.04	28.42	5.45	32.84	4.41	33.58	6.49
Foot tapping against a wall	13.23	2.18	14.51	2.22	16.81	2.16	17.97	2.75
5×10 meter run	18.98	2.17	18.37	1.73	17.21	1.73	16.92	1.21

Legend: Mean - average value; SD - standard deviation; SF - skin fold; n – number

Results of univariate analysis of variance of morphological characteristics of normal weight subjects aged 7-10 are shown in Table 2. By analyzing the results, it can be noted that the intergroup differences are statistically significant in almost all morphological characteristics at the significance level of .01, and in the abdominal skin fold at the significance level of .05.

Univariate analysis of variance of motor abilities in normal weight subjects aged 7-10 is shown in Table 3. Analysis of the results leads to the conclusion that the intergroup differences are statistically significant in all motor abilities at the significance level of .01.

Table 2. Univariate analysis of variance of morphological characteristics

	F	Sig.
Body height	103.56	.000**
Leg length	106.52	.000**
Arm length	77.76	.000**
Shoulder width	11.57	.000**
Pelvic width	27.19	.000**
Hip width	48.01	.000**
Body weight	59.07	.000**
Thorax volume	26.21	.000**
Upper arm volume	25.38	.000**
Thigh volume	28.54	.000**
Calf volume	27.13	.000**
Triceps SF	5.54	.004**
Sub-scapular SF	2.17	.092
Abdominal SF	2.77	.042*
Thigh SF	4.70	.003**
Medial calf SF	6.05	.001**

Legend: F – Rao's F approximation; Sig. – significance level; statistical significance ** $p < .01$, * $p < .05$

Table 3. Univariate analysis of variance of motor abilities

	F	Sig.
Plyometric jump	19.801	.000**
Hyperextension, twist, and throw	54.338	.000**
Standing depth jump	18.518	.000**
Horizontal jump rope	17.346	.000**
20 sidesteps with a baton	31.893	.000**
Running and rolling	21.781	.000**
Hand tapping	21.794	.000**
Foot tapping against a wall	51.945	.000**
5×10 meter run	24.472	.000**

Legend: F – Rao's F approximation; Sig. – significance level; statistical significance ** $p < .01$

DISCUSSION

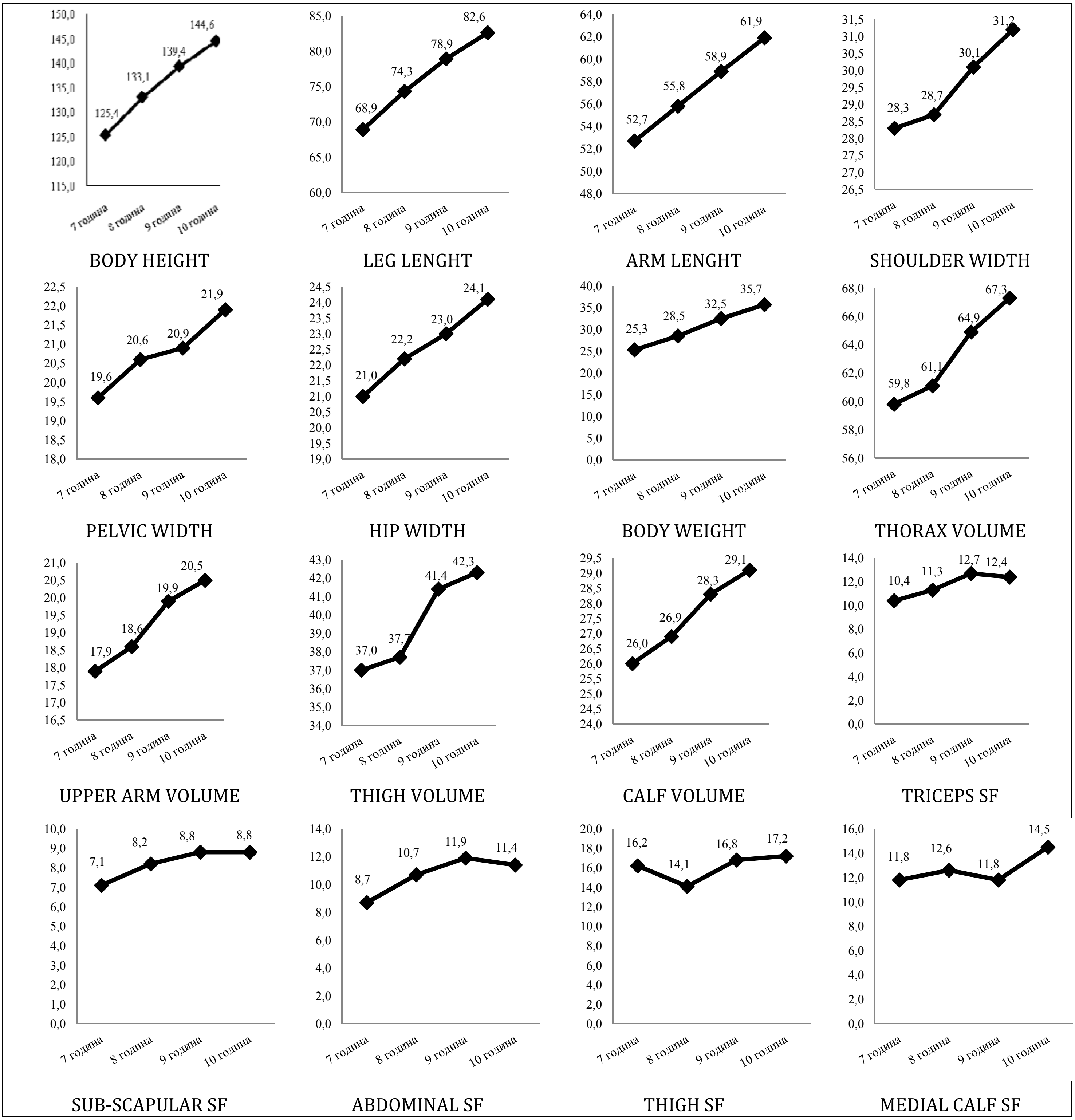
Graph 1 shows the mean values of morphological characteristics in normal weight subjects aged 7-10. The univariant analysis of variance (Table 2) indicate that the trend of changes shows a statistically significant difference in almost all morphological characteristics, except in the sub-scapular skin fold.

By analyzing the graph, it can be noted that measures of longitudinal dimensionality increase almost linearly with age, as well as measures of transversal dimensionality, voluminosity and body mass, which increase continuously. As for the variables used for the assessment of subcutaneous fatty tissue, a growth trend is noted, but in a discontinuous form. Curves of upper arm, sub-scapular and abdominal skin fold show continuous growth between the ages of seven and nine, followed by a decrease in upper arm and abdominal skin fold at the age of ten. No changes were noted in sub-scapular skin fold. A decrease regarding thigh skin fold was noted at the age of eight, that is at the age of ten regarding calf skin fold.

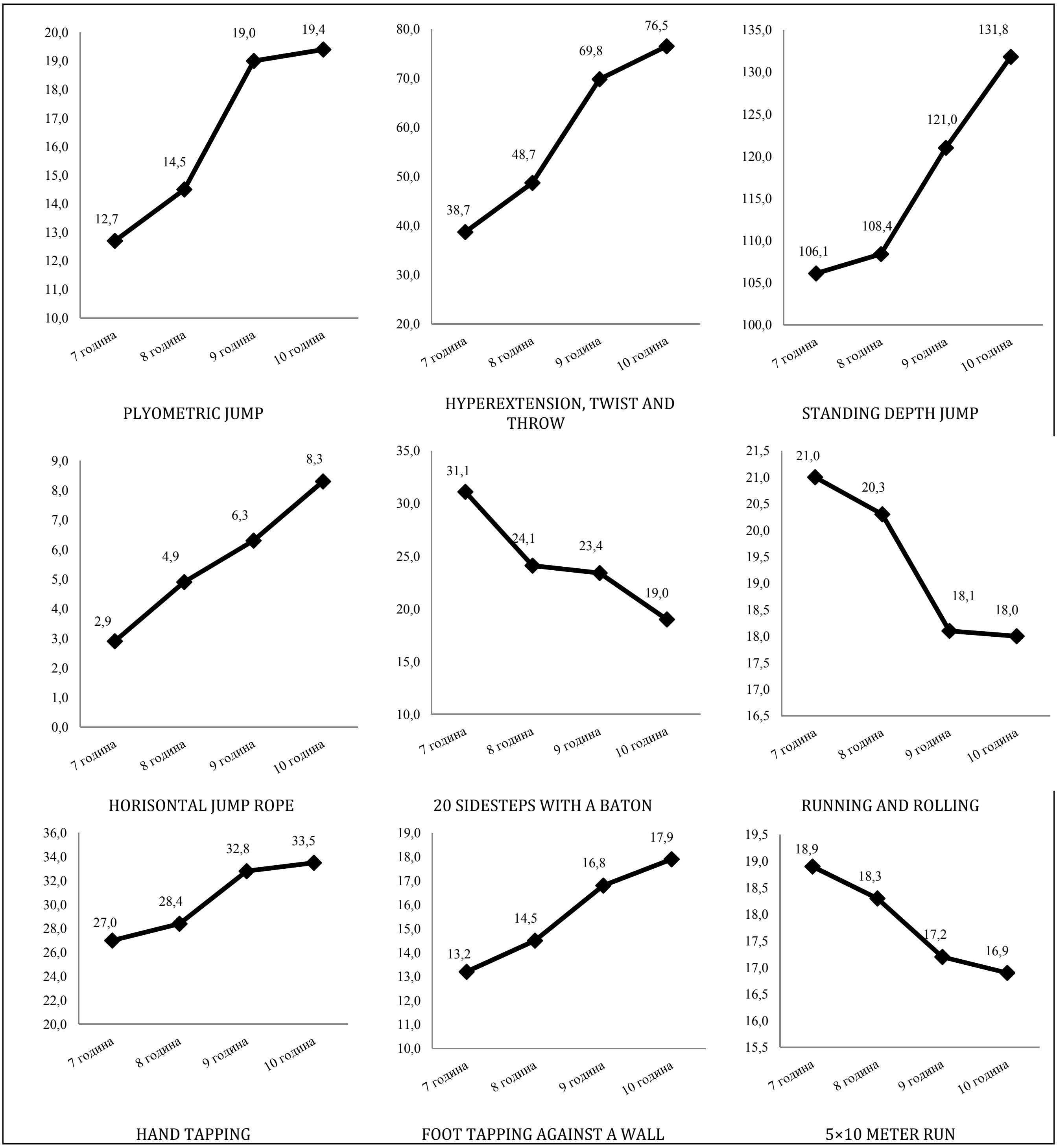
Increasing the measures of the longitudinal dimensionality takes place at the expense of the growth of bone tissue, while the increase in transversal dimensionality, voluminosity and body mass is partly due to the growth of bone tissue and muscle tissue. Based on the trend of changes in morphological characteristics, it can be concluded that the growth in bone and muscle tissues of normal weight subjects develops continuously, while the subcutaneous fat tissue shows a discontinuous form of growth. Popovic (2008) came to similar results on a sample of children aged 4 to 11 years. Study by Popovic (2008) points to a linear trend in the increase of height, voluminosity and weight, while the trend regarding subcutaneous fatty tissue, especially in prepubescent children, shows completely discontinuous growth.

By observing the values of height and weight in normal weight children aged 7 to 10, it can be noted that between the ages of seven and eight there was an increase in the height of the subjects by 7.7 cm and weight by 3.2 kg; between the ages of eight and nine increase of 6.3 cm and 4 kg, and between the ages of 9 and 10 increase of 5.2 cm and 3.2 kg. The results of previous research (Medved et al., 1987; Zdravković, 1978; Pavlović, 1999; Božić-Krstić, Rakić, & Pavlica, 2003), which were engaged in monitoring body height and weigh in children of different age groups, point out that the annual growth in body height is approximately 5 to 8 cm, and about 2-3 kg in weight. It can be concluded that the annual level of height increase in normal weight subjects is in accordance with the previous research, while the values of weight are slightly above the average.

Graph 2 shows the mean values of motor abilities in normal weight subjects aged 7, 8, 9 and 10. Univariant analysis of variance (Table 3) shows statistically significant differences in all motor abilities, at a significance level of .01. The results indicate that the trend of changes in the motor abilities of normal weight subjects shows statistically significant differences in explosive strength, coordination and speed. Graph analysis shows continuous increase with age in all motor abilities.



Graph 1. Trend of changes in morphological characteristics



Graph 2. Trend of changes in motor abilities

Motor abilities change with age, growth and maturation independently of physical activity (Malina & Katzmarzyk, 2006). The authors emphasize that basic movement skills (walking, running, jumping, throwing, etc.) develop during early childhood and reach their mature form by about 5 to 8 years of aget, which makes this age interval a crucial period for development of children's motor abilities. Curves of motor abilities development (standing long jump, vertical jump, shuttle run, dash, grip/arm strength and others) show more or less linear improvement from 6 to about 13 to 14 years, both in boys and girls (Malina, Bouchard, & Bar-Or, 2004). Authors point out that the trend in the development of motor abilities in boys is more intense and higher by one standard deviation than in girls.

Based on obtained results, it can be concluded that motor abilities of normal weight subjects aged 7-10 show continuous increase in explosive strength, coordination and speed, which corresponds to other studies (Leskošek, Strel, Kovač, 2007; Malina, Bouchard , & Bar-Or, 2004; Milanese, Bortolami, Bertucco, Verlato, & Zancanaro, 2010; Arceneaux, Hill, Chamberlin, & Dean, 1997; Davies & Rose, 2000).

CONCLUSION

Prepubescent age is a very sensitive developmental period. Although this is a period of slower growth, one calendar year in this ontogenesis period can be considered as developmental stage, when changes in child's body directly affect individual motor abilities (Turek, 2006). The results indicate that, relative to age, there are significant positive changes in morphological characteristics and motor abilities in normal weight girls. It is concluded that there is a harmonious growth and development of body characteristics and motor abilities in normal weight girls.

Results of this research offer a small contribution to illuminating the problem of growth and development in morphological characteristics and motor abilities of prepubescent children. These results are easily comparable with already established standards for healthy children of the same age and sex, as well as with the future studies. Also, one of the ideas for future research was to compare trends of changes in morpho-motoric status depending on the nutritional status of children.

ACKNOWLEDGMENT

In this study we used results obtained in doctorate dissertation by Đorđević, M. (2015). Trend of changes in morpho-motoric status of girls varying degrees of nutritional status. Unpublished doctorate dissertation, Niš: Faculty of Sport and Physical Education.

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DOES THE ADDITIONAL PHYSICAL ACTIVITY IN PRESCHOOL CHILDREN CAN REDUCE RISK FOR EARLY ONSET OBESITY ?

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UDC 796:613.25

SUMMARY

A research into the issues of overweight and obesity in preschool children was conducted as part of a project that spanned several years. The research included a sample of 391 children, ages 5-7 decimal years (221 boys and 170 girls) who attended preschool institutions regularly. The sample of children was divided into 4 age categories: 5-5.5 decimal years, 5.51-6.0 decimal years, 6.01-6.5 decimal years, and 6.51-7 decimal years. The experimental treatment, which included two hours of extra exercise on a weekly basis, was applied to 235 children, while the control treatment was applied to 156 children. Over four project cycles the following parameters were monitored: height, weight, abdominal and triceps skinfold. Based on the Body Mass Index (BMI) it was determined whether or not a child was overweight or obese, while the efficacy of the experimental treatment was determined by the changes in value of the subcutaneous body fat indicators. The results showed that long-term exposure of preschool children to increased physical activity did not lead to a decrease in their BMIs, but it did lead to a statistically meaningful reduction of fat tissue in the experimental group. These results once again highlighted the benefits of intense physical activity in regulating bodily mass, which is confirmed by the lower percentage of overweight and obese children in the experimental group of this research.t

Keywords: children, training, BMI, obesity

INTRODUCTION

The appearance of early onset obesity in contemporary society is becoming more of a problem each year. Adopting a sedentary way of life during early childhood can lead to hypokinesis which, coupled with an inadequate diet and a genetic predisposition, represents the most common factors in childhood obesity (Đorđić, 2007). Many countries have documented an evident increase in preschool children that are overweight and obese (Hassapidou at al., 2015; Davison at al., 2015; Milošević, & Obradović, 2007; Pavlović, 1999). Preschool children are highly susceptible to becoming overweight and obese. Recent rapid changes in body fat, fat distribution, and the prevalence of overweight and obese children among preschoolers indicates that the preschool population has undergone drastic changes in life-style in recent years.

Most studies dedicated to childhood obesity use the Body Mass Index (BMI) as an indicator for assessing excess weight and obesity, with the application of various criteria. The three references most frequently used are: a) the 2000 Centers for Disease Control and prevention (CDC) charts that classify children and adolescents as overweight at the 85th and 95th percentiles (≥85th to <95th percentile) and obese (≥95th percentile), which are mainly used in the USA (Kuczmarski, Ogden, & Grumeri-Strawn, 2000); b) the International Obesity Task Force (IOTF) which provided gender-specific values from 2 to 18 years of age, corresponding to BMI cut-off limits of adulthood, that is, 25 kg/m2 for overweight and 30 kg/m2 for obesity (Cole, Bellizzi, Flegal, & Dietz, 2000) ; and c) the 2007 World Health Organization (WHO) growth curves using BMI z scores +1 and +2 standard deviations (SD) for defining, respectively, overweight and obesity (James, & Lobstein, 2009). It was determined that the BMI decreases during early childhood, reaching its lowest values between the ages of 5 and 6, after which it increases in a linear manner. (Malina i sar., 2004). Alongside BMI it is important to monitor the percentage of fat tissue in the body for the sake of prevention, and for the sake of implementing adequate measures in the case that a child is overweight or obese (Widhalm, Schönegger, Huemer, & Auterith, 2001).

An excess of body fat in children represents a sort of ballast, and often a restricting factor when it comes to performing physical activities. That is why the reduction of excess body fat is essential when it comes to the prevention of early onset obesity.

Early onset obesity represents a hurdle in a child's development and growth process, and can impact their health in a significant manner. Studies have pointed out the correlation between early onset obesity in children and some health issue during adulthood (Safer, Agras, Bryson, & Hammer, 2001; Weiss et al., 2004; Viner, Segal, Lichtarowicz-Krynska, & Hindmarsh, 2005; Baker, Olsen, & Sorensen, 2007).

Most large studies that dealt with the problem of obesity in children have highlighted the importance of physical activities in obesity prevention (for example the APPLE project: Taylor, McAuley, Williams, Barbezat, Nielsen, & Mann, 2006). Additionally, multiple studies have determined that additional physical activates majorly contribute to the decrease of obesity prevalence in children (for example: Datar, & Sturm, 2004; Catenassi, Marques, Bastos, Basso, Ricardo, & Gerage, 2007; Brown, & Summerbell, 2009; Trajkovski, 2011).

During the several years of study of the effect of additional physical exercise on the anthropological dimensions of preschool children we followed the changes in BMI values and subcutaneous fat as well. We were interested in finding out whether additional institutionally organized exercise influences the changes of these indicators of bodily structure in preschool children. Having previous studies in mind we assumed that long-term physical exercise can indeed influence the reduction of BMI and subcutaneous fat values in preschool children, and by doing so help reduce the risks of obesity.

METHODS

Subjects

The sample of this retrospective study consisted of 391 children, age 5-7 decimal years (221 boys and 170 girls). The subsample of children that were exposed to the experimental treatment consisted of 235 children (153 boys and 82 girls), and the subsample of children that were exposed to the control treatment consisted of 156 children (68 boys and 88 girls). The total sample of children, regardless of gender, was divided into 4 age categories based on the distributional variable of *Decimal Years* for the purposes of this study: 5-5.5 decimal years (N=90), 5.51-6.0 decimal years (N=122), 6.01-6.5 decimal years (N=107), and 6.51-7 decimal years (N=72). All children attended preschool institutions regularly, and were a part of the same program for physical exercise during the school year.

Procedure

The regular program of physical exercise for preschool institutions represented the control treatment in this study. The control treatment included means of exercising, learning methods, and the exercises themselves, the purpose of which was to fulfill the requirements of the formal plan and program of preschool institutions, which is presented in the »Model of the Fundamentals of the Work Program with Preschool Children« part VII, under the title Physical Development and Physical Activities (Kamenov,1995). The control treatment was conducted in a small kindergarten gymnasium, typical of all gymnasiums in preschool institutions. The treatment was conducted by two kindergarten teachers, who were not experts in physical education. The gymnasium was modestly equipped with basic equipment.

The experimental treatment was conducted at the sports school as an additional exercise 2 times a week for 60 minutes, during the school year (about 9 months). The basic goals of the experimental training process were to develop and improve co-ordination, timing, agility, balance, speed, flexibility, strength, endurance, cardiovascular recovery, speed of solving complex motor problems, etc.: perceptual-motor activities, creative movements, rhythms and dances, stunts, tumbling, and apparatus activities, running, jumping, throwing, games and basic elements of team sports. This model contained many problem activities in which the children had to use mostly coordinative, balancing, and agility abilities and the activities that required the use of both arms, or both legs, or the whole body. The classes were held by educated, experienced coaches which focused on providing continuity, and retaining a moderate yet intensive level of difficulty.

The research relied on height and bodily mass results for the calculating of the Body Mass Index (BMI), which then served as an indicator of the level of nutrition, and overall growth and development of the children. The BMI was calculated in the following way: BMI [kg/m^2] = weight [kg] / [height (m)] ^{2}. Body height was measured with an anthropometer as per Martin, with .1cm accuracy. Body mass was measure with a decimal portable scale placed on a hard horizontal surface. The results were measured with .1 kg accuracy.

Subcutaneous body fat was measured using Abdominal skinfold and Triceps skinfold. They were measured using calipers (John Bull) adjusted so that the pressure of the tips on the skin was 10 gr/mm^2 according to International Biological Program (IBP) protocol.

Statistical analysis

For the purposes of this retrospective study, the fluctuations in values of BMI, Abdominal and Triceps skinfold were represented descriptively and graphically in the defined age categories of children. Based on BMI distribution, threshold values were defined as the 85th and 95th percentile, which used the CDC criteria to recognize overweight and obese subjects. For the purposes of testing the total difference between the experimental and control groups when it comes to analyzed variables a variance analysis was used. Differences in certain categories were tested with the t test for independent samples. All analyses were conducted with the p ≤ .05 of statistical conclusion. The actual effect size of the differences between the groups was determined with the application of Choen's d coefficient (Choen, 1988).

RESULTS

Considering that the sample of children was heterogeneous in terms of gender, we first tested the differences between boys and girls expressed through previously stated indicator values in order to establish further data processing. No significant differences were measured between boys and girls of the same age in terms of BMI variables, Abdominal Skinfold, and Triceps Skinfold (Table 1). Based on these finding further analyses were conducted on the whole sample regardless of gender.

Table 1. Results of t test for BMI, Abdominal skinfold and Triceps skinfold variables for children of different sexes and ages.

Age categories (decimal years)	BMI		Abdominal skinfold		Triceps skinfold	
	t	p	t	p	t	p
5.0 – 5.5	.52	.606	-1,10	.273	-1.09	.276
5.51 – 6.0	.59	.552	-.49	.627	-1.11	.269
6.01 – 6.5	1,80	.074	-1,65	.101	-.66	.509
6.51 – 7.0	-.09	.931	-.97	.058	-1.58	.123

Legend: t – t test value; p – signification of t test

The testing of BMI differences in certain age categories between the experimental and control groups (Table 2) showed that there were no statistically significant differences in any of the analyzed categories. However, it can be shown that the differences in arithmetic means in all categories showed negative signs which indicated that BMI mean values of the control group were higher than in the experimental group. The difference is particularly expressed in the last age category from 6.51 to 6.0 (.46 kg/m^2). Yet, low values of effect size determined based on Choen's d coefficient (Choen, 1988) confirm the presence of small differences in BMIs in the analyzed groups.

Table 2. Results of the t test for the variable Body Mass Index (BMI)

Age categories (decimal years)	t	sig	Mean differences (0,2mm)	Choen's d
5.0 – 5.5	-.87	.386	-.33	.18
5.51 – 6.0	-.27	.786	-.09	.05
6.01 – 6.5	-.13	.898	-.04	.03
6.51 – 7.0	-.65	.521	-.44	.24

Legend: t – value of t test; sig – statistical signification of t; Choen's d – effect size

The analysis of the distribution of overweigh and obese children by group (Table 3) showed that the control group had a higher percentage of children in both groups. Differences in individual categories and total percentage had no statistically meaningful level.

Table 3. Distribution of overweight and obese children by group

Percentage	Experimental	Control
Overweight (≥ 85 ≤ 95)	9.7 %	10.9 %
Obese (≥ 95)	4.1 %	5.8 %
Total	13.8%	16.7%

Testing of the total difference in both analyzed variables for determining subcutaneous fat (Table 4) showed a statistically meaningful difference between the experimental and control groups. When it comes to the Abdominal skinfold variable the difference was meaningful and high (F=11.9; p=.001).

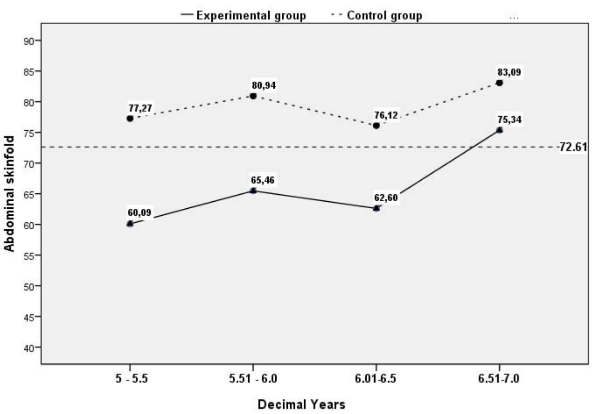
Table 4. Results of the t test for Abdominal skinfold (AS) and Triceps skinfold (TS).

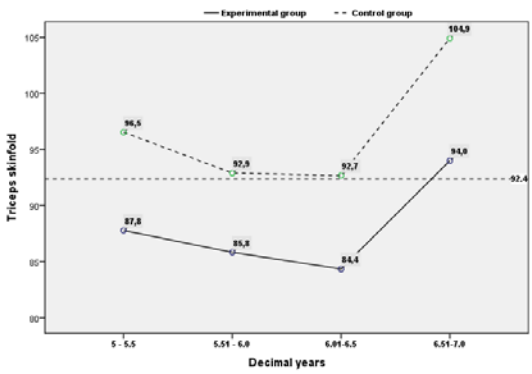
Age categories (decimal years)		t	sig	Mean differences (0,2mm)	Choen's d
5.0 – 5.5	AS	-2.47	.014	-17.19	.53
	TS	-1.31	.192	-7.07	.22
5.51 – 6.0	AS	-2.03	.047	-15.48	.37
	TS	-1.446	.152	-8.76	.27
6.01 – 6.5	AS	-1.98	.051	-13.52	.38
	TS	-1.70	.092	-8.33	.33
6.51 – 7.0	AS	-.47	.631	-7.54	.43
	TS	-1.01	.322	-10.91	.38

Within the first three age categories there was a statistically meaningful difference in the favor of the control group. The effect size was largest in the first age category and was statistically meaningful on a p=.014 assessment level, and belongs to the mid-high effects according to the Choen criteria (Choen, 1988). The second two age groups showed a low effect difference, but were statistically meaningful on a p ≤ .05 level. Only the last age group showed no statistically meaningful difference, yet even it's effect size was mid-high according to the Choen criteria.

The Triceps skinfold variable showed a significate, but obviously lower total difference (F=6.22; p=.012). No statistically meaningful differences were measured in singular groups when it comes to subcutaneous triceps fat.

Graphic 1 shows the movement trend of mean values of subcutaneous fat on the abdomen and triceps areas with both analyzed groups. Mean values for both categories are lower in the experimental group across all age categories, which can most probably be attributed to the effects of the experimental treatment.





Graphic 1. Side-by-side graphic of Abdominal and Triceps skinfold variable mean values in the experimental and control groups for children belonging to different age categories.

DISCUSSION

Retrospective analysis of children's indicators of bodily composition: BMI, Abdominal skinfold, and Triceps skinfold yielded useful information on the morphological status of preschool children of different ages. BMI is used as a standard for determining whether children and adults are overweight or obese, but it is also a good indicator of the development and growth of a child. The analysis showed that, regardless of the applied treatments, the children continued to grow and develop at a steady rate, and that there were no meaningful differences in mean values of BMIs between the two groups. No statistically meaningful difference was measured in certain age categories between the two groups. However, increase in BMI mean values was noted with children that had no additional physical activities across all age categories which is in accordance with many previous studies.

The results of the appearance of children with elevated BMIs inspection showed that the experimental group had less children that belonged to either the overweight or obese categories. The fact that the total percentage of children that are overweight or obese, according to this study (13.8% and 16.7%) is significantly lower that, for example 32.6% of children registered on the scale in Greece (Hassapidou et al, 2015), is encouraging.

The presence of a notably higher mean value in subcutaneous fat tissue around the abdomen and triceps that systematically showed up within all age categories points to the fact that additional physical activities applied over a long period of time can influence the reduction of subcutaneous fat tissue in preschool children. Children from the experimental group belonging to the first age category were exposed to additional physical activities over a period of school year, while the children from older age categories were exposed to at least 2 or 3 school years of additional physical activity. Such continuous exercise is probably the cause of the reduction in subcutaneous fat tissue around the abdomen and triceps, whose appearance is largely connected to environmental factors (sedentary habits, diet, lack of physical activity).

CONCLUSION

The conducted analysis showed that well organized, and long-term additional physical activity can positively influence the reduction of subcutaneous fat tissue appearance in preschool children. Such findings, coupled with the proven reduced percentage of obese children within the experimental group, confirms the presupposition that physical exercise influences the risk of early onset obesity in preschool children. However, we can agree with other authors that have pointed out the need for the activation of several other factors in this effort, primarily parents and the wider social community (Eisenmann et al.,2008; Brown, & Summerbell, 2009; Janssen, & LeBlanc, 2010).

ACKNOWLEDGEMENTS

This study was performed as a part of a project entitled „Possibilities of Improvement of Intellectual, Motor and Cardio-respiratory Abilities of Children by Means of Kinesiological Activities", conducted by the Faculty of Sport and Physical Education, University of Novi Sad, Novi Sad, Serbia, and financed by the Ministry of Education, Science and Technological Development of Republic of Serbia (No. 179011, Principal Investigator: Prof. G. Bala).

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OUTDOOR DYNAMIC GAMES DURING BULGARIAN LANGUAGE CLASSES (SECOND GRADE)

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UDC 796.1(497.2)

SUMMARY

The author of this article suggests several types of outdoor dynamic games during Bulgarian language classes which are highly effective in forming the linguistic concepts of noun, adjective and verb in 2nd grade in order to prove their importance in both developing the cognitive abilities in young students and in forming at a small age their motor skills and physical culture. The author shares experience from her cooperation with young teachers, active readers of "Pedagogicheski almanah" (Pedagogical Almanac) magazine, involved in incorporating innovative technologies in teaching Bulgarian language through active motor activity and healthy lifestyle.

Keywords: dynamic game, linguistic concepts, Bulgarian language, second grade, methods of teaching

INTRODUCTION

Studying the problem of the nature, role and functions of the game as part of the education and upbringing, which follows a serious and long tradition in the pedagogical literature, is one of the few upon which almost complete agreement has been reached. The reasons for this may be found in the rich folklore heritage, full of educational games as well as in the elaboration of powerful game theories and their pedagogical interpretations, long known in the practice. That is how at a certain time a relative balance between traditions, practices, science and reality has been established, which has provided a favourable basis for a constructive dialogue between all kinds of specialists. This dialogue is based on the search of the most effective approach to the problem of motivating young students to learn in a way that gives them pleasure, which finds its natural solution in the context of using games in their education and upbringing.

In the predominating part of the scholarly publications game is defined as "a peculiar type of activity typical mainly (but not only) for the early stages of development and characterized by a specific structure of activities" (Psychology Dictionary 1988,p. 158)

It is also important to point out that "the child's game originated historically as an activity in which children reenact the acts of grown up people and the relationships between them. While children play, they orientate themselves in the objective and social reality and get to know it in the same time."(Loginova, Samorukova, 1988, p. 94).

The Dutch historian Johan Huizinga studies game as a cultural phenomenon which appeared before the emergence of culture. "Game is a free activity or occupation, which is executed within conscious and defined time and space limits, following a set of accepted and compulsory rules and whose objective lies in the game itself and is accompanied by feelings of tension and joy, realization of the " other way of existence" compared to the "ordinary life". (Huizinga 1988)

V. Gyurorva defines game as "a way of discovering the world in a freely initiated and independent expression of experience without chasing a certain result" (Gyurova, 2000). While searching for the contemporary dimensions in forming the linguistic nucleus in an individual personality, V. Petrova finds out that during gaming interaction with adults, children in a preschool age not only show interest towards their native language but also towards other languages.

The author studies the pedagogical conditions in which the social interactions in the educational gaming process stimulate the partners to "… reproduce what they have learned in a familiar situation and adapt it to the bigger requirements in another situation" (Petrova 2012, 119). D.

Yordanova, P. Kaneva develop contemporary models for renovating the teaching of Bulgarian language in the 1st-4th grade, through which they upgrade the gaming experience for communicating in a native and foreign language, formed during the compulsory school preparation (for more details see Jordanova, Kaneva 2014, 521-541).

It can be concluded from the above mentioned definitions of the nature of game that it is a type of activity that is done with pleasure, has its own rules, is inherent in children and leads, orientatesand socializes them in the reality. A game can be also used with an educational purpose for developing of cognitive and motor skills but it should be students-oriented and giving them satisfaction.

Should we trust the studies, the only question that has provoked arguments is the one concerning the adult's part in the child's game. However, a consensus has been reached. A good decision is "to let children play freely but to provide them with a suitable location and atmosphere", because in the end game is a means of socialization and as such it alone reflects some ideals, viewpoints, aims and aspirations of the community of adults.

Game occupies a peculiar and proper place in the education of small and big children. Through it they affiliate themselves to the activities of adults, borrow their motives, follow a set of behaviour rules and form basic moral qualities. One of the major aspects of game, when it is suggested and controlled by adults, is its instructive role in guiding the individual development.

In the course of the game each child is related to other children in a way that raises inner changes in his/her abilities not only to build up and maintain the relationships with his/her partners but also to try to exert self-control. Relationships arise and form in the process of active communication whose most pronounced form is the collaborative activity.

Games as a method/technique, and more specifically motor games, used in a Bulgarian language lesson, have a lot of advantages. They are due to the fact that in games, the stages and peculiarities of the development which testify to the development of the cognitive and motor skills, are clearly emphasized.

While playing a game and through it, a young student satisfies some of their vital necessities, hence this strong aspiration for it. Games are played because of the pleasure they bring as a free and straightforward creative activity with a proper playing mood. Game as an activity is done with a feeling of joy and spiritual satisfaction. It is a means of self-fulfillment and expression. This is its greatest advantage compared to other human activities.

METHODS

The aim of this article is to present some active games, part of the Bulgarian language lesson in second grade, which can be done outside and activate both the cognitive and motor abilities in young children.

DISCUSSION

Outdoors active games, together with some interactive educational methods/techniques, can be used in all type of Bulgarian language lessons. For example:

- during the lesson for acquiring *newknowledge*, suitable active games for forming the concepts of noun, adjective and verb are: "Catch the nouns, adjectives and verbs". Students are outside forming three circles. Each circle is designated as noun, adjective or verb. The teacher says different words. When the children hear a word belonging to their circle, they hold each other's hands and start walking around. The winner is the circle which has gathered all words belonging to it without making a mistake. A similar game can be used for training the students' reflexes. A rule is set which words should be "caught" (nouns, adjectives, verbs). For example when the students hear verbs, they must squat. Whoever makes a mistake drops out.
- during the lesson for *exercise* a game entitled: "Moving target" can be played (finding the unknown letters in words) – a group of students is arranged in a line and they hold cards with letters on them. Where there is a missing letter, the students have left some space between them. The rest of the students hold mixed cards with letters. They must find the missing ones and stand between the students in the line with the correct letter. The game might have a competitive nature if there is a challenge for arranging the words correctly for the shortest time.
- In the *mixed* lesson a game entitled: "Chain" – the students stand in a row one behind the other, like a chain. The first student says a common noun. The next one says a proper noun beginning with the last syllable of the common noun said by the previous student. The third student - a common noun and that is how they alternate, common and proper nouns. The game is played until all students have taken part or until the chain "breaks".

When a student is not able to find a suitable noun, the chain gets broken and he/she goes at the back of the row.

- During the lesson for *summaryandrevision*some experimentation can be offered as there is a variety of dynamic outdoor games which can be combined together so that the linguistic concepts of noun, adjective and verb are formed: the game is called "Stop"- the class is divided in two teams. A child says the alphabet in his/her mind and another one says "stop". One of the teams writes on the ground using a chalk as many common nouns with the given letter as possible and the other team – proper nouns (or adjectives and verbs). The winner is the team with the most words (to make the game harder there might be an additional condition – the words should be spelled correctly); or "Guess what I am doing"- the students are outside. Choosing by lot or using another way suggested by the teacher, the students mimic activities and the others must guess them. If a student makes a mistake, he/she leaves the game (the game aims at checking students' knowledge on the appropriate usage of verbs and their correct pronunciation.)

CONCLUSION

All these games in Bulgarian language classesaim at helping students learn in a fun an leisurely way the abstract linguistic concepts and develop their motor skills. Combined with different language exercises or interactive methods/techniques, the games enrich and diversify the Bulgarian language syllabus in primary schools.

At the end several important **conclusions** might be pointed out:

1. Game is a basic activity in a child's life during preschool years and in primary school it accompanies the forming of the new activity – the educational one.
2. Gaming activities can be applied to all types of Bulgarian language lessons in the1st to 4th grade.
3. Dynamic games in Bulgarian language classes in the 1st-4th grade develop young students' critical thinking, their independence, correctness, responsiveness and motor skills. The desire to succeed is part of the game and it leads to successful results in mastering knowledge and competences.
4. Using outdoor dynamic games in Bulgarian language classes gives the students the possibility to be part of groups or teams which assures their concentrated cognitive participation during the lesson.
5. Depending on the aim of the lesson, the number of the students in class, their individual abilities, outdoor games might be combined with different kinds of exercises as well as with some interactive methods/techniques, which can bring better conditions for the realization of the standards in Bulgarian language education in the 1st-4th grade.
6. Games help students accommodate themselves more easily to the school community and are means of more successful mastering of the Bulgarian language syllabus when working with students in a bilingual environment.

To sum up it can be inferred that games in Bulgarian language education in primary school have an instructive and educational purpose and help reveal young students' potential and form their active motor skills. Through outdoor games children master imperceptibly and with ease the abstract linguistic material. One of the teacher's tasks is to make a competent selection and adaptation of the games, suitable for the age peculiarities in the 1st-4th, and more specifically in 2nd grade.

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PROMOTE ENVIRONMENT PROTECTION THROUGH RECREATION AND PHYSICAL ACTIVITY

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UDC 796.015:581.5

SUMMARY

The training needs and demands throughout the Physical Activity and Recreation industry, asking tourism guides and promoters for the ecotourism, is becoming a necessity for the Sport Tourism Industry. It also looks at ways for the Universities to respond to the industry’s needs. The Ecotourism field suggests that tourism operators need training in marketing and small business management and that employees in the industry need customer service training. Research in this field shows a strong consensus on the need for customer service training but the actual demand for the training turns out to be very low. The training demand in both these areas remains comparatively low. In order both to encourage and to serve the Physical Activity and Recreation training market, Universities would do well to become involved in providing training in the field of Ecotourism in order to promote the environment protection.

Physical Activity and Recreation as part of Sports Universities, by means of existing curricula provides to prepare tourist guides by offering students training in the activities which follow:

White tourism (skiing), Mountain guides, Alpinism, Biking, Kayaking, Hiking, Life-guarding, Etc.

All the above mentioned are outdoor activities which take place in different natural environments. Therefore the academic training shall provide the target group with necessary training in environment protection.

Main activities include:

- Training of academic staff with necessary knowledge in the field of environment protection
- Increasing awareness for environment monitoring and protection
- Methods to develop environmental protection techniques
- Promotion of eco friendly tourism among tourists participating in outdoor sports
- Preparation of guides in the field of environment protection, who will in turn transmit it to their clients

Ecotourism is about *uniting conservation, communities, and sustainable travel*. This means that those who implement and participate in and market Physical Activity and Recreation activities should adopt the following ecotourism principles:

Minimize physical, social, behavioral, and psychological impacts.

Build environmental and cultural awareness and respect.

Provide positive experiences for both visitors and hosts.

Provide direct financial benefits for conservation.

Generate financial benefits for both local people and private industry.

Deliver memorable interpretative experiences to visitors that help raise sensitivity to host countries' political, environmental, and social climates.

Design, construct and operate low-impact facilities.

The situation in the area indicated that training for ecotourism is an urgent necessity and that it cannot be undertaken randomly but should instead be developed according to a holistic approach and be part of Universities courses. To ensure effective training programme design that will meet the criteria required by the tourism trade as well as educational establishments, and to determine the various fields of knowledge and skills needed by candidates for a tourism qualification. It is envisaged that this project will emphasize the crucial role that ecotourism has in the sustainable utilization of Albanian's natural resources and, more importantly, that it will contribute to the professionalization of careers in Physical Activity and Recreation by applying accountable training in ecotourism.

Key words: Ecotourism,Physical Activity and Recreation, Professioanal Nature Guides

THE IMPACT OF CHANGES IN THE BODY DURING PHYSICAL ACTIVITY AMONG STUDENTS

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UDC 796.015(057.87)

SUMMARY

The purpose of the study was to assess the impact of physical activity and the level of flexibility among students with various physical levels. The study involved 69 physical education students and 44 recreation and health students (51 females and 62 males). The results provided information regarding their levels of physical activity. The data was taken with the use In Body Dial H20B. Their level of flexibility was assessed using the Sit Test. The results of the study demonstrated a significantly normal weight and muscle mass, lower fat percentage, lower value of the BMI index as well as a significantly higher level of flexibility ($p<0.001$) among students of physical education, compared to the students of recreation and health. The results indicate a positive impact of increased physical activity on the correct weight and muscle mass as well as a good level of flexibility.

Key words: students, physical activity, muscle mass, BMI index, flexibility.

THE RELATION BETWEEN TELEVISION VIEWING AND OVERWEIGHT AMONG ALBANIAN ADULTS PARTICIPATING IN DIFFERENT LEVELS OF PHYSICAL ACTIVITY IN LEISURE-TIME.

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UDC 796.01:613.25(496.5)

SUMMARY

To investigate the importance of physical activity on the relation between television viewing and overweight.

This study was based on completing the questionnaire in an elderly home in Tirana.

65 adults from a population sample in the capital of Albania. In the survey, 39 (60.00%) were males, and 26 (40.00%) were females.

Self-reported height and weight, two-week leisure-time physical activity retest, one-week average television viewing information.

Physical activity and body mass index patterns were both associated with hours of television watched. Compared to those participants who reported watching less than one hour of television per day, those watching 1 to 2.5 hours were 89% more likely to be overweight, those watching 2.5 to 4 hours were 177% more likely to be overweight, those watching more than 4 hours per day were 3.5 times more likely to be overweight. Physical activity was not directly associated with being overweight, but an interaction between activity and television watching was present. Respondents in the low, moderate and high physical activity categories who reported watching more than 4 hours of television per day were twice as likely to be overweight compared to those who watched less than one hour of television per day, irrespective of physical activity participation.

With approximately half the Albanian adult population overweight or obese, these findings indicate that public health strategies to reduce overweight and prevent weight gain may need to focus on reducing sedentary behaviours such as television viewing in addition to increasing physical activity.

Keywords: leisure-time; physical activity; television viewing; overweight; adults.

Physical Education

COMPARATIVE ANALYSIS OF THE NIS UNIVERSITY STUDENTS' INTERESTS, NEEDS AND ATTITUDES REGARDING THEIR ENGAGEMENT IN ORGANIZED PHYSICAL ACTIVITIES AND SPORTS

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UDC 313.213.3:796

SUMMARY

The aim of this paper was the examination of interests, needs and attitudes of the students regarding organized physical activity and sports, as well as their present engagement in them. Besides, the significance of the determined differences between the students of technical faculties and those who study social sciences and humanities is a better understanding of current problems and interests of the students as regards physical exercise in modern society. Namely, the students of technical sciences demonstrated a more positive attitude towards the importance of organized physical activities and sports for a better academic achievement in comparison to the students of social sciences and humanities. The research results may be understood as an adequate contribution to the widely-accepted idea that physical activities, especially sports, should be present in the education of young people with the purpose of developing, preserving and advancing their biological, psychological and social skills and abilities. Therefore, the concept of the students' physical education programs is to be clearly devised as a long-term project that will enhance the quality of living and studying at the University of Nis.

Keywords: Physical education, exercise, questionnaire.

INTRODUCTION

Physical exercises were not part of the regular curricula at universities during the period between 1918 and 1945. Physical education of university students had been long present at foreign universities when it was rather late introduced into Serbian universities. Serbian students did not have any classes of physical education for quite a long time. The turning point was the year of 1969 when the Council of the Belgrade University decided that "the University Center for the Physical Education of Students" be founded as one of the organizing units of the Faculty of Physical Education in Belgrade. The Center was employed to provide teaching staff, the appropriate space and to organize classes of physical education of students. This is how physical education was introduced into the curricula of the Serbian faculties (Савић, 2016).

Various sports were taught: swimming, water polo, diving, handball, basketball, volleyball, indoor football, ice-skating, athletics, rowing, judo, rhythmic gymnastics, gymnastics and skiing. Classes were taught as mandatory and elective twice a week, mainly to freshmen and sophomore students. The example of the Belgrade University was followed by other universities, i.e. those in Novi Sad, Nis and Pristina. The classes of physical education of students of the Nis University started during 1969/70 academic year. "Physical Education Center and Nis University Association for Physical Education" (USOFK) was in charge of the classes taught to 1,983 students at that time (Савић, 2016).

However, as the result of the political and social turbulences in 1998, the Ministry of Education and Sports decided to abolish the regular classes of physical education of university students. Physical education was continued as part of the regular curricula only at those faculties that had enough resources to finance the teaching staff. Few faculties in Serbia could do that. The Faculty of Medicine and the Faculty of Mechanical Engineering of the

University of Nis were among those that had enough resources. At present, it is indicated by the Ministry of Education and Sports that physical education will be reintroduced into the academic curricula of Serbian faculties (Савић, 2016).

Unfortunately, Serbian students still attend faculties whose academic curricula lack proper classes of physical education. Moreover, there are no official data regarding the health, content and needs of university students in relation to physical activities as part of university, i.e., faculty curricula. The available date are only those concerning primary and secondary-school pupils. They are distressing, though, since they show a high frequency of various deformities in the physical development of school children, such as spinal and feet deformities, cardiovascular and respiratory issues, an elevated level of blood lipids, large coronary risk factors, a more frequent presence of insulin-independent diabetes, obesity, larger lung volumes and capacity, smaller aerobic and anaerobic abilities, worsening of the immune system, lower levels of motor skills and generally lower levels of mental and social wellbeing.

Almost two-thirds of untimely deaths and one-third of all illnesses in adults are directly caused by the way of life in their youth. Life style is an issue that is inspiring a growing attention concerning the preservation of good health and prevention of chronic and degenerative diseases, so that a proper diet and physical activity are very significant (Macanović et al., 2013). A good diet, physical activity and an appropriate way of spending one's free time have an effect on health of people of all ages. However, at a younger age, their primary function is a proper psychological and physical development (Đorđić, 2004). University students represent the last age-group in which a successful prevention may be applied by changing some unwanted habits (Hardman, 2007). The studies conducted worldwide have confirmed that a change of life style may be beneficial in the prevention of chronic and degenerative diseases, which are proved to be the leading factor of untimely morbidity and mortality (Kazazović, Hadžikadunić, & Turković, 2008). It has been estimated that physical inactivity is the main cause of 1,9 million untimely deaths annually (Drljačić, Arsić, & Arsić, 2012). Moreover, physical activity has been found to be directly related to mental health, since physically active persons are less depressive and anxious (De Swaan, 1995). Therefore it is not surprising that strategies aimed at health improvement, based primarily on physical activity enhancement, have been developed worldwide (Arsić, Radovanović, & Arsić, 2011). Out of numerous strategies, the most exemplary ones are "Global Strategy of Diet, Physical Activity and Health" and "Healthy People 2010". This shows that regular physical activity has been recognized as crucial in health improvement. It will, therefore, help university students to accept such trends and transfer them to children and adults. A lack of physical activity in all social groups is the characteristic of modern times. Advancement in technology has resulted in people being less physically active, because their work has been replaced by machines. Insufficient physical activity is reflected in the state of health of modern people (Mišigoj-Duraković, 1999). Considering the particularities that characterize students' way of live, social and cultural surroundings in which they live, as well as the fact that no related studies have been conducted at the University of Nis so far, this research aims to identify certain relevant indicators regarding the interests, needs and attitudes of students and their habits that may govern students' decisions to participate in physical activities and sports at their faculties. This paper is also one of many attempts at highlighting this problem. Based on the aforementioned, the paper is focused on the comparison of differences in interests, needs and attitudes of the students of technical faculties and those who study social sciences and humanities. Therefore, the focus of the paper is the examination of interests, needs and attitudes of the students regarding organized physical activity and sports, as well as their present engagement in them. Besides, the significance of the determined differences between the students of technical faculties and those who study social sciences and humanities is a better understanding of current problems and interests of the students as regards physical exercise in modern society.

METHODS

Subjects

The total number of the respondents who took part in this research is 190 male and female students, aged from 20 to 27, characterized by different levels of physical activity and interests. The questionnaire was anonymously done by 50 students of the Faculty of Electronics, Faculty of Mechanical Engineering and Faculty of Law and by 40 students of the Faculty of Economics. The subjects were divided into two groups, those who were the students of technical faculties (Faculty of Electronics and Faculty of Mechanical Engineering) (N =100) and those who studied social sciences and humanities (N=90). The respondents were both bachelor students (from the first to the fourth year of study) and master students (one year of study). Prior to the research, students were asked to give their consent, which was necessary for a proper completion of the study.

Procedure

The results of the students' ideas regarding their interests, needs and attitudes towards an organized form of physical activity and sports at their faculties, i.e. at the Faculty of Law and Faculty of Economics, on one hand, and at the Faculty of Mechanical Engineering and Faculty of Electronics, on the other, were obtained by the application of a specially designed questionnaire. This questionnaire was done anonymously and contained relevant statements regarding interests, needs and attitudes of students concerning their engagement in physical and sports activities at their respective faculties. The questionnaire was composed of 22 statements (indicating the degree of agreeing), i.e., a three point agreement Likert scale and the following points of agreement: 1. Agree; 2. Neutral; 3. Disagree. Three variables, formed on the basis of the questionnaire statements (items), were applied in this research. They are defined as follows: THE FIRST is defined by the first 8 items and determined as the students' interests; THE SECOND is contained in the ensuing 7 items and determined as the students' needs; THE THIRD is defined by 6 items that determine the students' attitudes. Additionally, one particular variable was separated related to the frequency of physical activity weekly: **three or more times a week, once or twice a week** and **never**. It is important to emphasize that the questions were not ambiguous or personal. Questionnaires were done on faculty premises, during a previously estimated period of time lasting from 3 to 5 minutes, with additional information that respondents would be allowed more time if necessary. Prior to the procedure of answering the questions, the respondents were given detailed instructions on the way of filling in the questionnaire properly. Besides, students were allowed to address the interviewers in case of having any dilemmas. Incomplete questionnaires were not analyzed.

Statistical analysis

The obtained results are based on the methods of nonparametric statistics, which deals with the data grouped into categories, such as agreement scales, questionnaire answers, etc., i.e. the statistics in which the distribution does not deviate from what is regarded as normal. The frequency and percentages obtained from both subsamples were estimated by the statistical analysis of the data.

Owing to the particularities of the research, in which a three point agreement scale was used to analyze the answers of two separate subsamples (students of technical faculties and those who studied social sciences and humanities), as well as to the criteria concerning the respondents' engagement in physical and sports activities (active and inactive), the Mann-Whitney U test was used. The reason was the fact that the obtained data could be compared by the median which would give a more accurate comparison of the observed data.

The data were analyzed using the statistical package STATISTICA 8.0 for Windows (StatSoft, Inc., Tulsa, OK).

RESULTS

The overall analysis of the results presented in Table 1. of the first eight items answering the question of **interests** in physical activity and sports shows that the obtained answers are mainly positive (agree) and vary from 40,0% to 64,4%, while 15,6% to 33,3% of the respondents are neutral, and finally 11,1% to 35,6% express a negative attitude. It is though promising that as many as 64,4% of students agree with the statement "*I think that students of the University of Nis should have organized physical activities during the academic year*". Also, a large number of students chose organized physical activities for the statements 4 and 6 (63,3%). It is interesting that almost one-third of the respondents (35,6% and 32,2%) expressed negative attitude towards the following statements: "*I am personally interested in having physical education during two semesters (II) at my faculty*" and "*I am personally interested in having physical education during one semester (I) at my faculty*".

The analysis of the obtained results regarding the students' **needs** of physical activities and sports, which were presented in 7 items, shows that most of the respondents expressed agreement (agree), i.e. 34,4% to 70,0% of them, while 15,6% to 33,3% of the respondents were neutral, and 10,0% to 35,6% showed disagreement. More than half of the respondents (57,8%) agreed with the statement that "*It is necessary that the University has its own gymnasium for the purposes of physical exercises and sports*" as well as with the statement "*It is necessary that each faculty employs an expert in the field of physical education and sports*". Moreover, it is worth noting that more than two-thirds of the respondents (70,0%) were of the opinion that "Physical exercises and sports at faculties should be without charge for all students". It is though discouraging that almost a third of the respondents disagreed with the statements 10 and 11, i.e. the fact that physical education should be part of their regular academic curricula as both an obligatory and elective course (35,6% and 32,2%).

Table 1. Frequency and percentage of interests, needs and attitudes of the students who study social sciences and humanities (Faculty of Law and Faculty of Economics) regarding physical activity and sports

No.	ASSERTIONS	Agree	Neutral	Disagree
1.	I think that students of the University of Niš should have organized physical exercise during the studies	**58(64.4)**	16(17.8)	16(17.8)
2.	I am personally interested in having physical education during two semesters (II) at my faculty	37(41.1)	21 (23.3)	32 (35.6)
3.	I am personally interested in having physical education during one semester (I) at my faculty	36(40.0)	25(27.8)	29(32.2)
4.	I prefer collective sports (basketball, futsal, volleyball, handball, water polo ...)	**57(63.3)**	14(15.6)	19(21.1)
5.	I prefer individual sports (swimming, table tennis, dancing, shooting, tennis, fitness, bodybuilding ...)	49(54.4)	22(24.4)	19(21.1)
6.	I prefer occasional (once per month) activities in nature (excursions, hiking tours, mountaineering, orienteering) fishing ...) , риболов...)	**57(63.3)**	15(16.7)	18(20.0)
7.	I prefer sport of persons with disabilities	47(52.2)	18(20.0)	25(27.8)
8.	I am interested in going to organized student holidays, wintering and campings	**50(55.6)**	30(33.3)	10(11.1)
9.	It is necessary that the University has its own gymnasium for the purposes of physical exercises and sports	**52(57.8)**	25(27.8)	13(14.4)
10.	It is necessary to listen to the subject of PE as mandatory in the first year of studies	31(34.4)	27(30.0)	32(35.6)
11.	It is necessary that the subject of PE be listened to as an elective at any year of studies	37(41.1)	24(26.7)	29(32.2)
12.	It is necessary that each faculty employs an expert in the field of physical education and sports	**52(57.8)**	20(22.2)	18(20.0)
13.	Physical exercises and sports at faculties should be without charge for all students	**63(70.0)**	14(15.6)	13(14.4)
14.	It is necessary for the Faculty of Sport and Physical Education to coordinate physical exercises and sports at the University	43(47.8)	31(34.4)	16(17.8)
15.	Student physical exercise and sport should be of interest to the state	42(46.7)	39(43.3)	9(10.0)
16.	It is necessary for the University to actively participate in the restoration of regular physical exercise and sports at faculties	55(61.1)	18(20.0)	17(18.9)
17.	The current attitude of students towards physical exercise and sports is unsatisfactory	**70(77.8)**	15(16.7)	5(5.6)
18.	Regular and organized physical exercise and sport positively influence the health of students	**80(88.9)**	6(6.7)	4(4.4)
19.	Regular physical exercise and sport positively influence the increase in the level of motor and functional abilities of students	**72(80.0)**	14(15.6)	4(4.4)
20.	Regular and organized physical exercise and sport positively influence an academic achivement	52(57.8)	20(22.2)	18(20.0)
21.	University sport competitions promote healthy lifestyles	52(57.8)	20(22.2)	18(20.0)
	Frequency of exercising physical exercise during the week	≥3/ week	1- 2/week	non
22.	I practice physical exercise and sports in my free time	23(26.1)	48(54.5)	**17(19.3)**

Table 2. Frequency and percentage of interests, needs and attitudes of the students of technical faculties (Faculty of Mechanical Engineering and Faculty of Electronics) towards physical activities and sports

No.	ASSERTIONS	Agree	Neutral	Disagree
1.	I think that students of the University of Niš should have organized physical exercise during the studies	76(76.0)	21(21.0)	**3(3.0)**
2.	I am personally interested in having physical education during two semesters (II) at my faculty	57(57.0)	29(29.0)	**14(14.0)**
3.	I am personally interested in having physical education during one semester (I) at my faculty	55(55.0)	34(34.0)	11(11.0)
4.	I prefer collective sports (basketball, futsal, volleyball, handball, water polo ...)	63(63.0)	27(27.0)	10(10.0)
5.	I prefer individual sports (swimming, table tennis, dancing, shooting, tennis, fitness, bodybuilding ...)	57(57.0)	31(31.0)	12(12.0)
6.	I prefer occasional (once per month) activities in nature (excursions, hiking tours, mountaineering, orienteering) fishing ...) , риболов...)	64(64.0)	33(33.0)	3(3.0)
7.	I prefer sport of persons with disabilities	**53(53.0)**	38(38.0)	9(9.0)
8.	I am interested in going to organized student holidays, wintering and campings	**70(70.0)**	21(21.0)	9(9.0)
9.	It is necessary that the University has its own gymnasium for the purposes of physical exercises and sports	**73(73.0)**	19(19.0)	8(8.0)
10.	It is necessary to listen to the subject of PE as mandatory in the first year of studies	**59(59.0)**	28(28.0)	13(13.0)
11.	It is necessary that the subject of PE be listened to as an elective at any year of studies	60(60.0)	26(26.0)	14(14.0)
12.	It is necessary that each faculty employs an expert in the field of physical education and sports	65(65.0)	25(25.0)	10(10.0)
13.	Physical exercises and sports at faculties should be without charge for all students	75(75.0)	21(21.0)	4(4.0)
14.	It is necessary for the Faculty of Sport and Physical Education to coordinate physical exercises and sports at the University	65(65.0)	25(25.0)	10(10.0)
15.	Student physical exercise and sport should be of interest to the state	62(62.0)	32(32.0)	6(6.0)
16.	It is necessary for the University to actively participate in the restoration of regular physical exercise and sports at faculties	68(68.0)	26(26.0)	6(6.0)
17.	The current attitude of students towards physical exercise and sports is unsatisfactory	70(70.0)	21(21.0)	9(9.0)
18.	Regular and organized physical exercise and sport positively influence the health of students	**78(78.0)**	19(19.0)	**3(3.0)**
19.	Regular physical exercise and sport positively influence the increase in the level of motor and functional abilities of students	**72(72.0)**	23(23.0)	5(5.0)
20.	Regular and organized physical exercise and sport positively influence an academic achivement	71(71.0)	23(23.0)	6(6.0)
21.	University sport competitions promote healthy lifestyles	62(62.0)	32(32.0)	6(6.0)
	Frequency of exercising physical exercise during the week	≥3/ week	1- 2/week	non
22.	I practice physical exercise and sports in my free time	42(42.0)	37(37.0)	**21(21.0)**

The analysis of the obtained results concerning the students' **attitudes** towards physical activity and sports, contained in 6 items, shows that most of the respondents demonstrated a positive attitude, 57,8% to 88,9% of them, while 6,7% to 22,2% of the respondents were neutral and 4,4% to 20,0% of them had a negative attitude. The majority of the students agreed with the the statement that "Regular and organized physical activities and sports are beneficial for their health, motor and functional skills" (88,9% and 80,0%). It is also interesting that most of the students agreed with the statement that "Students' present attitude towards physical activities and sports is unsatisfactory" (77,8%).

The analysis of the results regarding the frequency of students' physical activities weekly shows that a large number of the respondents are physically active once or twice a week (54,5%), 26,1% are active three or more times a week and 19,3% are not physically active at all.

The overall analysis of the results presented in Table 1. of the first eight items answering the question of **interests** in physical activity and sports shows that the obtained answers are mainly positive (agree) and vary from 59,0% to 73,0%, while 19,0% to 32,0% of the respondents are neutral, and finally 3,0% to 14,0% express a negative attitude. It is though promising that as many as 76,0% of students agree with the statement "*I think that students of the University of Nis should have organized physical activities during the academic year".* Also, a large number of students chose organized physical activities for the statements 4 and 6 (63,0% and 64,0%). The analysis of the obtained results regarding the students' **needs** of physical activities and sports, which were presented in 7 items, shows that most of the respondents expressed agreement (agree), i.e. 34,4% to 70,0% of them, while 15,6% to 33,3% of the respondents were neutral, and 4,0% to 14,0% showed disagreement. More than two thirds of the respondents (73,0%) agreed with the statement that "*It is necessary that the University has its own gymnasium for the purposes of physical exercises and sports"* as well as with the statement "*It is necessary that each faculty employs an expert in the field of physical education and sports".* Moreover, it is worth noting that more than three-quarters of the respondents (75,0%) were of the opinion that "Physical exercises and sports at faculties should be without charge for all students". It is though encouraging that only a small percentage (13% and 14%) of the respondents disagreed with the statements 10 and 11, i.e. the fact that physical education should be part of their regular academic curricula as both an obligatory and elective course.

The analysis of the obtained results concerning the students' **attitudes** towards physical activity and sports, contained in 6 items, shows that most of the respondents demonstrated a positive attitude, 62,0% to 78,0% of them, while 19,0% to 32,0% of the respondents were neutral and 3,0% to 9,0% of them had a negative attitude. The majority of the students agreed with the the statement that "Regular and organized physical activities and sports are beneficial for their health, motor and functional skills" (78,0% and 72,0%). It is also interesting that most of the students agreed with the statement that "Students' present attitude towards physical activities and sports is unsatisfactory" (70,0%).

The analysis of the results regarding the frequency of students' physical activities weekly shows that a large number of the respondents are physically active once or twice a week (37,0%), 42,0% are active three or more times a week and 21,0% are not physically active at all.

The results related to the general **interests** of students in physical exercises and sports indicate a statistically significant difference regarding the statements 2 and 3, which are concerned with the students' attitudes towards the organization of one-semester or two-semester physical education classes at their respective faculties. The students of technical faculties expressed a more positive attitude compared to the students of social sciences and humanities and this difference is at the level of significance of 0.01.

Observed from the aspect of the students' **needs** of physical activities and sports, the obtained results show that this need is more evident among the students of technical faculties in comparison to the students of social sciences and humanities, concerning the classes of physical education during the entire period of studies, the difference being at the level of significance of 0.00 and 0.01. As regards the statement that "The Faculty of Sport should coordinate physical activities and sports at the University", this difference is at the level of significance of 0.05.

The obtained results regarding the students' **attitudes** towards physical exercises and sports indicate a significant difference related to the statement 22. Namely, the students of technical sciences demonstrated a more positive attitude towards the importance of organized physical activities and sports for a better academic achievement in comparison to the students of social sciences and humanities with the level of significance of 0.05.

Table 3. Differences in interests, needs and attitudes between the students of social sciences and humanities and those of technical sciences (Mann-Whitney U test).

	ASSERTIONS	Group 1 (sum)	Group2 (sum)	Z	P level
1.	I think that students of the University of Niš should have organized physical exercise during the studies	7931.00	10214.00	-1.75	0.08
2.	I am personally interested in having physical education during two semesters (II) at my faculty	7563.00	10582.00	-2.73	**0.01**
3.	I am personally interested in having physical education during one semester (I) at my faculty	7564.50	10580.50	-2.72	**0.01**
4.	I prefer collective sports (basketball, futsal, volleyball, handball, water polo ...)	8423.50	9721.50	-0.45	0.65
5.	I prefer individual sports (swimming, table tennis, dancing, shooting, tennis, fitness, bodybuilding ...)	8317.50	9827.50	-0.73	0.46
6.	I prefer occasional (once per month) activities in nature (excursions, hiking tours, mountaineering, orienteering) fishing ...) , риболов...)	8290.50	9854.50	-0.80	0.42
7.	I prefer sport of persons with disabilities	8166.00	9979.00	-1.13	0.26
8.	I am interested in going to organized student holidays, wintering and campings	7975.00	10170.00	-1.64	0.10
9.	It is necessary that the University has its own gymnasium for the purposes of physical exercises and sports	7886.50	10258.50	-1.87	0.06
10.	It is necessary to listen to the subject of PE as mandatory in the first year of studies	7217.50	10927.50	-3.64	**0.00**
11.	It is necessary that the subject of PE be listened to as an elective at any year of studies	7536.00	10609.00	-2.80	**0.01**
12.	It is necessary that each faculty employs an expert in the field of physical education and sports	8145.00	10000.00	-1.19	0.23
13.	Physical exercises and sports at faculties should be without charge for all students	8261.50	9883.50	-0.88	0.38
14.	It is necessary for the Faculty of Sport and Physical Education to coordinate physical exercises and sports at the University	7775.00	10370.00	-2.17	**0.03**
15.	Student physical exercise and sport should be of interest to the state	7878.00	10267.00	-1.89	0.06
16.	It is necessary for the University to actively participate in the restoration of regular physical exercise and sports at faculties	8118.00	10027.00	-1.26	0.21
17.	The current attitude of students towards physical exercise and sports is unsatisfactory	8960.00	9185.00	0.96	0.33
18.	Regular and organized physical exercise and sport positively influence the health of students	9056.00	9089.00	1.22	0.22
19.	Regular physical exercise and sport positively influence the increase in the level of motor and functional abilities of students	8944.00	9201.00	0.92	0.36
20.	Regular and organized physical exercise and sport positively influence an academic achivement	7853.00	10292.00	-1.96	**0.05**
21.	University sport competitions promote healthy lifestyles	8177.00	9968.00	-1.10	0.27
	Frequency of exercising physical exercise during the week				
22.	I practice physical exercise and sports in my free time	7807.50	9958.50	-1.37	0.17

DISCUSSION

Previous researches, which were conducted with students as respondents, were not so much focused on the identification of young people's habits that might influence significantly their engagement in physical activities, especially at their faculties. The first initiatives to deal with this issue are found in the pilot project conducted by the University Apeiron (Nešić, Lolić, Srdić, & Meholjić-Fetahović, 2011), which examined the effects of the students' body mass index on their attitudes towards sports and recreational activities at the university level. Hackney (2006) states that physical activities are beneficial for the adipose tissue reduction, muscle mass increase, metabolism boost and the hormone combination that prevents the weight gain. The present state and future perspectives of physical and health culture were studied at the University of Zagreb by Caput-Jagunica & Kučinić (2001). They discuss that a strikingly evident "sedentary" way of life on one hand and an insufficient number of classes of physical and health education, on the other, greatly contribute to the physical-inactivity-induced problems. Some other studies bear the evidence of the fact that university students are not sufficiently engaged in physical activities (Hraste, Srhoj, & Srhoj, 2000; Gošnik, Bunjevac, Sedar, Prot, & Bosnar, 2002; Andrijašević, Paušić, Bavčević, & Ciliga, 2005). Determining physical and health anamnesis and attitudes towards physical activities represents an important factor in planning, organizing and controlling both teaching and training processes. Some of the recent researches conducted in the neighboring regions (Nešić & Kovačević, 2011; Нешић и Кубуровић, 2011; Nešić, Fratrić, & Ilić, 2010) and focused on the detection of various aspects related to the reaffirmation of sports at the university level have in a way "opened the doors" to a more engaged approach to this issue. According to the results obtained in the research done by the Pan-European University Apeiron in Banja Luka, the majority of the examined students (more than 71%) expressed their wish to have classes of physical education regularly (Нићин, Лолић, Лолић, и Срдић, 2009), which is in accordance with the results of our research regarding the statement 1: "*I think that students of the University of Nis should have organized physical activities during the academic year*" (G1=64,4%;G2=76%). Besides, the aforementioned scholars state that 70% of the students would attend classes of physical education regularly if they were given ESPB points for attendance, which indicates that there is predominantly a positive attitude among students towards the introduction of sports activities into the academic curricula with the purpose of prevention of health-hazardous influences (Nićin et al., 2009). The research of the patterns of behavior of young people in their free time in the Republic of Serbia (Степановић, Виденовић, и Плут, 2009) detect some of the basic habits related to sports (watching sports on various media, visiting sports events and moderately significant tendency to playing sports). However, the results of the studies conducted by some foreign scholars (Aquatias, 2000; Dawson, Grant, Stinson, & Chou 2004; Orford, Krishna, Balaam, & Van Der Graf, 2004) emphasize that healthy habits are not so popular among the young, who are generally prone to risky behavior that has a very negative effect on their health. Vrčan, Pisačić, & Slačanac (2009) conducted a research with the purpose of determining students' attitudes towards physical exercises and interest in particular sports activities. 56 % of students stated that they were not actively involved in any kind of physical activities. 39% of them were physically active at times, i.e. from two to four times a week, while only 5% of students were physically active every day. The results of our research show a higher rate of physically active students: 42% of the students of technical faculties are physically active more than three times a week (G2) in comparison to 26,1% of the students of social sciences and humanities (G1). These data are certainly disconcerting since they are related to young people, who are expected to represent the future of one healthy society and thus aware of the significance of physical activity. The research of Macanović et al. (2013) indicates that 77,7% of the respondents are physically active. The majority of them, 55,5%, are physically active two to three times a week. The results of our research are similar regarding the respondents who are physically active once or twice a week (G1=54,5%; G2=37,0%). Lolić, Nešić, Fratrić, & Srdić (2012) emphasize the fact that most of their respondents play sports or do physical exercises in their free time and mainly at the weekends (46,1%), which is not enough since the generally required minimum of physical activity (as stated by the World Health Organization, 1948) which is beneficial for the transformation of psychological and physical characteristics is three times a week. These authors also state that the data which are particularly discouraging are those regarding the fact that almost one-third of the respondents are not physically active at any times, mainly female students. Our research did not focus on the differences regarding the gender of our respondents, which is the issue to be studied further since there are great differences that are gender-based. The aforementioned data obtained from various researches indicate that the sample of students participating in these studies reflect the average trends among students from Banja Luka and Republic Srpska, which is also the conclusion of our research. Čokorilo & Mikalački (2014) state that the question that they posed in their research, “Are you less physically active at the beginning of the exam term?” was answered with “Yes” by 22,1% of the respondents, “Yes, in part” by 49% and “No, not at all” by 26,9% of the respondents. These results indicate the trend of lowering physical activity during exam terms, which is dependent on students’ obligations during exam terms, which is detrimental to keeping the continuity in physical activities. The research conducted by Matković, Nedić, Meštrov, & Ivković (2010) shows that the students of medicine reflect the present state of average students in Croatia, but it also shows that almost half of the students do not take up any sports. Our research results, however, indicate a considerably lower percentage of physically inactive students (G1=19,3%; G2=21%). These data should be certainly taken with some reservations since the questionnaire used in our research did not include the kind, range and intensity of physical activities during the day, which might have an impact on the obtained results.

Statistically significant differences are present in the statements 2 and 3, which concern the students’ attitudes towards having one-semester or two-semester physical education classes at their respective faculties, since the students of technical faculties expressed a more positive attitude than the students of social sciences and humanities (Faculty of Law and Faculty of Economics). This difference may be explained by the fact that the students of social sciences and humanities have more studying materials to cover and thus less free time to dedicate to their physical activities. This assertion is to be taken with some reservations, as well, since the obtained results may be caused by various factors which we could not include in the research. However, what can be confirmed with certainty is the fact that physical inactivity of university students represents a serious problem, which is also confirmed by the results of similar studies. At this time a few research examined the relationship between physical fitness and academic achievement. One study that reported a consistent and significant relationship between fitness and achievement (Dwyer, Sallis, Blizzard, Lazarus, & Dean, 2001) had several threats to validity. First, there were validity concerns with the academic achievement indicator. Academic achievement was based on a non-standardized, subjective fivepoint rating scale. Therefore, the meaning of achievement could vary from site to site. Second, the reported correlations, although statistically significant (i.e., at 0.001, 0.01, & 0.05 levels of significance) were not impressive. That could explain one of the reasons why students of law and economics faculties changed and have lower attitudes towards organized one-semester and two-semester organized physical education.

Reason why students of technical faculties may have better relations according to the importance of organized physical activity and sports on academic achievement and significantly emphasize the need for organized physical education in the first and the other years of the study program can be explained by Grissom's research (2005) which confirms there was a consistent positive relationship between physical fitness and academic achievement in math, since math is one of the main courses in all technical and technological sciences. The difference in statement that the Faculty of Sports should coordinate physical exercises and sports at the University could be, in the opinion of the author, explained by the project " find a measure" which was held at the Faculty of Electronic Engineering by students of faculty of sport and physical education in Nis. In that project most students from technical faculties had the opportunity to meet the methods and coordination skills of students at faculty of sports.

CONCLUSION

When the results of this research are examined from the aspect of identifying the current life styles of the students of the University of Nis, i.e. their impact on certain attitudes towards the idea of “introducing” sports (physical exercises) into the university curricula, it can be ascertained that they are determined by certain everyday habits. The research results may be understood as an adequate contribution to the widely-accepted idea that physical activities, especially sports, should be present in the education of young people with the purpose of developing, preserving and advancing their biological, psychological and social skills and abilities. Therefore, the concept of the students’ physical education programs is to be clearly devised as a long-term project that will enhance the quality of living and studying at the University of Nis. The obtained results may be used as indicators of what sports and physical activities are to be proposed to students in accordance with their popularity, but also students’ desires and interests. These sports are expected to yield the best results in encouraging students to be physically active. These data should be taken into consideration when organizing and teaching physical education at faculties. Some students must accept their own share of responsibility and reconsider their priorities, as well as to develop the life style which includes healthier diet and regular physical activities on the daily basis. Moderate and proper physical activities are beneficial for an overall better state of health, suppleness, normal body mass index and bodily functions. Students' way of life represents an important turning point since it presupposes the change from the secondary-school surroundings to the university ones, which radically changes young people's habits. This might be also the period when some bad habits are adopted since the young are at their prime concerning their health. Thus, they start neglecting their health and accepting bad habits, which may be detrimental to their health. Although the results of this research show that there are certain differences regarding interests, needs and attitudes between the students of technical faculties and those that study social sciences and humanities, they are negligible in relation to the fact proven in this research that physical inactivity is a huge problem of modern time, especially when children and young people (students) are concerned. Promoting sports and healthy habits should play a key role in the fight against physical inactivity of students and adults in general, especially because physical activity greatly reduces the risk of developing some widely-spread diseases. The primary goal of this research is the preservation of students' health and prevention of its deterioration.

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DIFFERENCES IN ANTHROPOMETRIC, MOTORIC AND FUNCTIONAL ABILITIES AT THE STUDENTS IN THE PRIMARY SCHOOL, BETWEEN THE MALE AND FEMALE FROM THE SEVENTH GRADE

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UDC 796.012.1:727.11

SUMMARY

It has been performed a measurement of the anthropometric, motoric and functional Abilities at the students in the primary school from Skopje from seventh grade on male And female population. The goal of this study is to make an anaiyze of the changes that are developing in the children's organism, anthropometric , motoric and functional abilities, i.e. examining the differences of and development of the non-trained female and male population. The study shows that there are important statistical differences in the results of the anthropometric, motoric and functional space.

Keywords: anthropometric, motoric and functional space , ANOVA, MANOVA, factor

INTRODUCTION

The experiment is done on a sample of 100 male and female examines with age difference of +/- 6 months from 10-years-olds. The examines are from the primary school of "Vlado Tasevski" from Skopje. The main target is to determine the value of the differences of the manifestic anthropometric changing's, motoric and working tests between the examines from the both genders on a same age. To determine the differences of the factor structure of the anthropometric, motoric and working changings especially of male/female students on the same age. Because of that there was a total of 21 changings, which 11 of anthropometric, 6 of motoric and 4 of working stuff. All data from the measurements of the manifestic anthropometric measures, motoric and working tests are modificated by the basic statistic parametrics: arithmetic measurement – X, standard deviation – SD, minimal – MIN, and maximal – MAX result, test for asymetry of the results 'distribution – SKEW, test for results 'homogeneity – KURT and Kolmogorov-Smirnov test (K-S) test for normality testing of the distribution. For determination of the intergroup differences in the utilized manifestic unichanging and multichanging system of changings for every group is used in analysis of the variance MANOVA, and the partial differences of every changing are determined with the univariate analysis of the variance ANOVA, due to them it is made an orthogonal VARIMAX rotation of the intial coordinate system from 11 manfiestic variables, and due to that to get a result as simple as possible structure of the latent anthropometric, motoric and working stuff, it is made a comparative analysis as well of the arithmetic measures of the anthropometric, motoric and working changings between the males and females from fifth grade.

PRCEDUREE AND STATISTICAL ANALYSIS

Because of that there was a total of 21 changings, which 11 of anthropometric, 6 of motoric and 4 of working stuff. All data from the measurements of the manifestic anthropometric measures, motoric and working tests are modificated by the basic statistic parametrics: arithmetic measurement – X, standard deviation – SD, minimal – MIN, and maximal – MAX result, test for asymetry of the results'distribution – SKEW, test for results'homogeneity – KURT and Kolmogorov-Smirnov test (K-S) test for normality testing of the distribution. For determination of the intergroup differences in the utilized manifestic unichanging and multichanging system of changings for every group is used in analysis of the variance

MANOVA, and the partial differences of every changing are determined with the univariate analysis of the variance ANOVA, due to them it is made an orthogonal VARIMAX rotation of the intial coordinate system from 11 manfiestic variables, and due to that to get a result as simple as possible structure of the latent anthropometric, motoric and working stuff, it is made a comparative analysis as well of the arithmetic measures of the anthropometric, motoric and working changings between the males and females from fifth grade.

RESULTS AND DISCUSSION

The differences between the arithmetic measures of the athropometrics, motorics and workings of the examined sample from male and female gender from fifth grade are tested using T-test.

If the value of the test is 1.96 or bigger is statistic meaningful on the level of 0.05, and if it is 2.58 or bigger is statistic meaningful on the level of 0.01.

- Analyzing the arithmetic measures of the **anthropometric changing** and the given differences between them is noticable that the students from 5th grade have higher results for the changings of: ASHRA, ATEG, ATDP, AONLS, AKFNL and ASOG, except the changing of diameter per capta ATDK which shows higher results for the female examines. The given results are all statistic signatures of the level of 0.05.

  Almost the same results have: AVIS, ASHKA, AONLI and AOPL on the variables, where the taken differences are statistic insignificantly.
- Analyzing the arithmetic measures of the examined **motoric tests** and the taken differences between the arithmetic measure is noticable that the students from the sixth grade have made higher results in the motoric tests: MEST50, MESDM, MIVZ and MPTM. The differences in the taken results are statistic significant on the level of 0.05. It may be considered that the sixth-grade students have bigger *exlposive power, agility and fixed power*. Almost mutual results are taken on the tests for the students of fifth grade to the motoric tests: MFDPK and MISK, i.e in the tests for marking the *balance and flexibility.*
- The arithmetic measure for marking the ***working tests*** are statistic significant for the tests of inhaling frequency per minute and the blood pressure.

After performing the orthogonal varimax rotation from the ***anthropometric*** variables for ***females*** from fifth grade, the first factor took significant projection due to the changings for marking of the circular dimensionality, and according to the given dimension could be defined as a factor the *volume and weight of the body.* The second factor took significant projections due to the variables for marking the underskin fat tissue, so conditionaly could be defined as a factor of *underskin fat tissue.* After the varimax rotation of the sixth manifestic changings and likely to get as much as simple structure if the latentic ***motoric*** dimensions, there are two given latentic dimesnsions which don't give a clear definition of the factors. And the test which have very significant projections are impacted by the *mechanism for making the movements, i.e for sinergetic regulation of the muscular tone.* By the completed orthogonal varimax rotation for the four given **working** tests there are two latentic dimensions: factor of the pulse value and the vascular ability on calm mode and the factor of systolic and diastolic pressure on calm mode. (see below, all Tables 1, 2 and 3).

After completed orthogonal varimax rotation from the anthropometric variables for ***males*** from the fifth grade, due to giving more simple structure of the latentic anthropometrics, there are given three latentic dimensions: the first factor kept significant projections on the variables for marking of the longitudinal, transversional, circular dimensionality, accordingly there may be defined as a factor of the *sceletal complex.* Projections which are in the second and the third factor don't give clear definition because of their separated participation in the both factors. Because of that, the given dimension could be *defined as a general complex of volumes.* After completed orthogonal varimax rotation of the six manifestic changings due to getting two latentic dimensions: the first is *a factor of energetic regulation of the movements*, and the second one is *a factor for central regulation of the movements.* After competed varimax rotation of the manifestic changings from the workings due to getting as possible as simple structure of the latentic workings, there is also got 2 latentic dimensions, whereas the first factor basically on its structure could be defined as a factor of pulse value and vascular ventilation, the second one as a factor of systolic and diastolic pressure on calm mode.

Table 1: Main statistic signatures of the changings fot the females from 6th grade

	X	MIN	MAX	SD	Skewness	Kurtosis	KS
AVIS	1538.2	1480.0	1680.0	39.367	1.298	2.767	.14
ASHRA	32.4	25.0	40.0	2.787	.438	.872	.14
ASKA	25.5	22.2	27.5	1.199	-.797	.477	.13
ATEZ	40.5	35.2	58.1	4.496	1.478	3.301	.16
ATDL	72.1	62.0	90.0	6.496	.514	.206	.09
ATDK	97.7	84.0	111.0	6.163	-.058	-.247	.07
ASOG	74.8	65.5	87.0	5.317	.582	-.229	.14
AOMLI	21.7	19.0	25.0	1.635	.175	-1.162	.13
AONLS	22.6	20.0	25.7	1.752	.286	-1.232	.14
AOPL	19.7	17.0	22.0	1.121	-.339	-.164	.09
AKFNL	8.8	0.8	15.0	3.363	-.667	.49	.16
MEST50	8.3	5.5	11.9	1.634	.407	-.721	.09
MESDM	140.7	110.0	161.0	11.986	-.425	-.141	.08
MFDPK	26.1	22.0	34.0	2.246	1.226	3.131	.20
MIVZ	8.7	5.3	18.2	2.925	1.832	3.488	.17
MSIK	28.1	17.7	62.6	7.575	2.048	7.583	.12
MIPTM	24.0	8.0	35.0	5.812	-.232	-.115	.13
FSFDM	16.8	15.0	19.0	.941	.529	-.620	.26
FPVM	84.6	67.0	93.0	5.232	-1.153	3.080	.11
KPS	123.8	115.0	131.0	4.538	-.027	-1.232	.13
KPD	87.7	80.0	91.0	1.696	-1.854	7.542	.18

Table 2: Main statistic signatures of the changing's fot the males from 6th grade

	X	MIN	MAX	SD	Skewness	Kurtosis	KS
AVIS	1551.6	1480.0	1670.0	42.347	.6618	..127	.09
ASHRA	34.8	31.0	38.5	1.689	.3122	.192	.10
ASKA	25.3	21.0	29.5	1.712	.1149	-.045	.09
ATEZ	45.2	34.0	85.5	9.734	1.9411	4.862	.20
ATDL	79.0	62.0	100.0	7.348	.1371	.843	.12
ATDK	94.4	80.0	113.0	7.123	.4146	.409	.09
ASOG	77.7	66.0	93.9	6.835	.5365	-.389	.15
AOMLI	22.3	19.5	27.0	1.975	.7972	.015	.11
AONLS	24.1	21.0	28.5	1.995	.4200	-.532	.11
AOPL	19.9	17.0	22.7	1.402	.0945	-.299	.11
AKFNL	11.3	6.0	16.0	2.842	-.2752	-.526	.15
MEST50	7.5	5.2	11.8	1.503	.9746	.726	.11
MESDM	160.3	120.0	190.0	15.218	-.7829	.788	.15
MFDPK	25.4	20.0	32.0	2.251	.8310	1.980	.20
MIVZ	27.6	7.3	41.8	9.163	-.5810	-.182	.11
MSIK	29.8	14.4	92.3	10.550	4.3120	25.525	.19
MIPTM	30.8	10.0	47.0	7.540	-.5341	.881	.19
FSFDM	17.0	16.0	19.0	1.124	.7996	-.796	.28
FPVM	87.3	80.0	95.0	4.582	-.2243	-1.255	.11
KPS	124.6	116.0	133.0	4.603	-.1620	-1.150	.18
KPD	79.1	67.0	92.0	6.348	-.4919	-.415	.15

Table 3: Charts from the comparative analysis between the male and female students from the sixth grade

VARIJABLI	MALE	FEMALE	T-VALUE	P
AVIS	1551.600	1538.200	1.63877	.104468
ASHRA	34.758*	32.432*	5.04752*	.000002*
ASKA	25.262	25.542	.94731	.345809
ATEZ	45.210*	40.508*	3.10089*	.002520*
ATDL	78.960*	72.080*	4.96015*	.000003*
ATDK	94.380*	97.660*	-2.46242*	.015546*
ASOG	77.666*	74.782*	2.35486*	.020523*
AONLI	22.254	21.748	1.39551	.166017
AONLS	24.118*	22.580*	4.09573*	.000087*
AOPL	19.584	19.722	.51997	.604256
AKFNL	11.322*	8.822*	4.01530*	.000116*
MEST50	7.538*	8.319*	-2.48965*	.014471*
MESDM	160.260*	140.660*	7.15460*	.000000*
MFDPK	25.440	26.080	-1.42312	.157877
MIVZ	27.561*	8.686*	13.87591*	.000000*
MSIK	29.799	28.093	.92902	.355162
MIPTM	30.820*	24.020*	5.05106*	.000002*
FSFDM	16.960	16.820	.67530	.501075
FPVM	87.320*	84.640*	2.72463*	.007624*
KPS	124.580	123.760	.89703	.371902
KPD	79.060*	87.680*	-7605	.000000*

CONCLUSION

The differential kinesiology determines the differences of the motoric ontogenesis which are noticable on the male and female gender, the differences in the biological development in the different life phases between the both genders, the social qualification, characteristic fluctuations and the general influence of the kinesiologic activities of the systematic human.

The influence of the morphologic, motoric, working dimensions of the successful realized experiment of the partial physical activities and the taken differences of the completed manifestic and latentic anthropometric, motoric and working dimensions especially on male and female students, gives us that the need for differental approach for adding the contents on the subject of physical and health education which will be useful for the task and activity performance of the males and females of the tested period of age. These results may be used for programming and performing the tasks and activities which must be performed on the lessons of physical and health education on a higher level. All of this has its own influence for the healthy condition, gaining more quality working results, bigger assureness and security while working, and all of this makes the life better for living on a general level. This simplified syllabus for physical and health education could satisfy the needs of normal growth and psychobiological development of the person for the needs of a modern society which must have healthy generations in the future.

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EFFECTS OF MULTISPORT PROGRAM ON MOTOR FITNESS IN PRESCHOOL BOYS

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UDC 796.012.1-053.2

SUMMARY

The aim of this research was to determine the effects of multisport program on motor fitness in preschool boys. This study was performed on a sample of 120 healthy preschool boys that were divided into two groups, multisport training group and control group. Motor fitness tests were used from several test batteries: 20m dash, Standing broad jump, Arm plate tapping, sit and reach, Bent arm hang, Sit ups. The basic characteristics of multisport training process consisted of station and circuit work and obstacle courses two times a week lasting for 60 min with intensity around 160-180bpm. After the training intervention, the training group showed significant ($p < 0.05$) improvements in almost all the parameters analyzed (e.g., speed, Obstacle course backwards; Standing broad jump; Arm plate tapping; Bent arm hang and Sit ups) compared with pretest values. No significant changes were observed in the CG after the training intervention except for arm plate tapping ($p < 0.05$). This study provides evidence about the effectiveness of multisport programs for the optimal development of young children's motor fitness.

Keywords: Motor skill, physical activity, preschool, impact

INTRODUCTION

Nowadays, more and more children choose to specialize in one sport, hoping to achieve elite status (Wojtys, 2013). However, early specialization in young athletes leads to the risks of injury and burnout, while the degree of specialization is positively correlated with increased serious overuse injury risk (Myer, Jayanthi, Difiori, Faigenbaum, Kiefer, Logerstedt, & Micheli, 2015). Moreover, early specialization in sport could also reduce motor skill development and participation in games and sports as a lifestyle choice (Myer, Jayanthi, DiFiori, Faigenbaum, Kiefer, Logerstedt, & Micheli, 2016).

Consequently, there is a need for different high intensity programs in order to improve physical fitness in children, and consequently improve their health. Unfortunately, there are limited data on preschool-aged children. Physical activity in 3- to 5-year-olds is not a problem according to public and researcher has shown limited interest in studying the different effects of physical activity in preschool children. Furthermore, there is a limited scientific background about the relationship between physical activity and health indicators young children (Timmons et al., 2012).

Several publications have appeared in recent years documenting effect of different physical activity programs on motor fitness in preschool. Krneta et al. (2014) found significant effects of additional kinesiological treatment on explosive strength (Standing broad jump) and flexibility (Seated straddle stretch) in preschool boys. The focus of recent research has been documented that a 9-week ball skill intervention was effective in improving ball skills in preschool age girls. These skills as predictor of motor development were maintained overtime (Veldman, 2017). Therefore, early childhood interventions that focus on the development of ball skills in young girls might be a necessary. Great effort has been devoted to the study of Radanović et al., (2016). According to this study statistically significant impact of motor abilities on performance of all 3 gymnastic elements in primary school girls. Some previous studies have confirmed the effect of kinesiological activity on the children's motor abilities (Bala et al., 2010; Katić et al., 2002). Therefore, it is of great importance to constantly improve the motor abilities in preschool years. Accordingly, the aim of this research was to determine the effects of multisport program on motor fitness in preschool boys.

METHODS

Subjects

This study was performed on a sample of 120 healthy preschool boys that were divided into two groups. Experimental group (N=57) consisted of children attending kindergartens, and who volunteered for the experiment. The control group (N=63) was randomly chosen from the cluster of kindergartens. The average age of the children in the experimental group at the beginning of the treatment was 5.48 ± 0.29, whereas the children of the control group had 5.26 ± 0.64 years. Written informed consents were obtained from the parents of all children, who gave their assent to participate in the study. All measurements and treatments were performed in accordance with the ethical standards laid down in the Declaration of Helsinki.

Table 1. Body weight status in pre and post intervention

	Control group		Training group	
	Baseline	Post	Baseline	Post
Body height (cm)	113.9±8.3	115.92±8.2	116.3±7.3	119.6±7.3
Body mass (kg)	20.51±4.02	21.80±4.39	21.45±3.4	22.98±3.57
BMI	15.9±1.48	16.06±1.67	15.8±1.35	15.98±1.33

Note: All data are presented in mean ± SD

Testing procedures

The set of anthropometric variables and the set of motor variables obtained by the use of the following measurements and tests, were analyzed at the beginning of both treatments, and after 6 months. Body height was measured with a fixed measured using anthropometry according to Martin (GPMAnthropometer 100; DKSH Switzerland Ltd., Zurich, Switzerland; ± 0.1 cm;), and body mass with a digital balance (BC1000, Tanita, Japan;± 0.1 kg;), following the guidelines proposed by the International Biological Program (IBP). Motor fitness tests were used from several test batteries and reliability and factor validity was confirmed for this age group (Bala et al., 2011). The following test battery was used in motor fitness assessment:

1. 20 m dash. On command GO the child that stands behind the start line has to run 20 m as fast as he/she can to the end of the track (20 m). The children run in pairs. The score was the time of running, measured in tenths of second.
2. Arm plate tapping. For fifteen seconds the child has to tap alternately two plates on the tapping board with his/her dominant hand, while holding the other hand in between the two plates. The result is the number of alternate double hits.
3. Standing broad jump. The child jumps with both feet from the reversed side of Reuter bounce board onto a carpet, which is marked in cm. The result is the length of the jump in cm.
4. Sit and reach. This test involves sitting on the floor with legs stretched out straight ahead. Shoes should be removed. The soles of the feet are placed flat against the box. Both knees should be locked and pressed flat to the floor - the tester may assist by holding them down. With the palms facing downwards, and the hands on top of each other or side by side, the subject reaches forward along the measuring line as far as possible. Ensure that the hands remain at the same level, not one reaching further forward than the other. After some practice reaches, the subject reaches out and holds that position for at one-two seconds while the distance is recorded. Make sure there are no jerky movements. The score is recorded to the nearest centimeter or half inch as the distance reached by the hand.
5. Bent arm hang. The child under-grips the bar and holds the pull-up as long as he/she can (chin above the bar). The result is the time of the hold measured in tenths of a second.
6. Sit-ups. The child lies on his/her back with his/her knees bent and arms crossed on the opposite shoulders. He/she rises into a seated position and returns into the starting position. The instructor's assistant holds the child's feet. The result is the number of correctly executed raises to the seated position (no longer than 30 seconds).

The reliability of these motor tests, as composite tests with 3 items (replications), was previously analysed in a sample of 64 children aged 5–7 years by calculating the Cronbach a reliability coefficient. Good reliability coefficients were obtained for all these motor tests, as follows: Arm plate tapping a=0.90, sit ups a=0.97, standing broad jump a=0.88, sit and reach a=0.92, Bent arm hang a=0.9113.

Multisport program

The basic characteristics of experimental training process were the following: organization: work with stations, circuit work and obstacle courses; volume: 60 min, frequency: 2 times a week, intensity:

according to the usual external signs (sweat, blush, spontaneous breaks), and according to the heart rates (maximum between 170 and 180 in min).

Table 2. Multisport program

Duration	Organisation	Volume	Frequency	Intensity
6months	Frontal work, group work, work with stations, circuit work and obstacle courses	60 min per session	2 times a week	According to the External signs (sweat, blush, spontaneous breaks); Heart rates (maximum between 170 and 180 in min)

Structure of training: I) warm up – 15 min. various movement with changeable speed, exercises that correct and prevent flat-feet), stretching, corrective and preventive exercises from bad posture, proper sense of good performance; II) main part – 40 min. revision and practice of previous skills, teaching and practice new skills, competitive practice, conditioning; III) cool-down part – 5 min. stretching, coaching comments, conversation. Every part of the training lesson was run in positive and warm, friendly mood, with proper music (particularly in the introduction and preparation).

The control treatment included means of exercising, learning methods, and exercising itself, the purpose of which was to fulfil the requirements of the formal plan and program of preschool institutions. The control treatment was conducted in a small kindergarten gymnasium, typical of all gymnasiums in preschool institutions. The treatment was conducted by two kindergarten teachers, who were not experts in physical education. The gymnasium was modestly equipped with the most necessary props.

Statistical Analysis

Descriptive data were calculated for all variables. Shapiro-Wilk tests assessed the normality of distributions. A two-way repeated measure ANOVA (2 × 2) was used to test for interactions and main effects for time (initial vs. final) and group (training vs. control) on the dependent physical fitness variables. Statistical analyses were conducted in SPSS (SPSS, Version 18.0, Chicago; IL). Statistical significance was established a priori at $p < 0.05$ to test the hypothesis that experimental group would be more effective than control in improving physical fitness measures in children.

RESULTS

The Shapiro-Wilk test has shown that data was normally distributed. Values for all motor fitness tests at pre- and post intervention are presented in Table 3. After the training intervention, the training group showed significant ($p <0.05$) improvements in almost all the parameters analyzed (e.g., 20m dash, Standing broad jump; Arm plate tapping; Bent arm hang and Sit ups) compared with pretest values. No significant changes were observed in the CG after the training intervention except for arm plate tapping ($p< 0.05$).

Table 3: Mean ± SD results of different parameters before the experimental period (initial) and after the 24-week experimental period (final).

	Control group		Training group	
	Baseline (Mean ± SD)	Post (Mean ± SD)	Baseline (Mean ± SD)	Post (Mean ± SD)
20m dash	5.78± .70	5.57± 0.58	5.19± 0.72	4.96± 0.5*
Standing broad jump	99.39± 21.66	105.92± 20.50	112.97± 23.51	122.29± 20.38*†
Arm plate tapping (freq.)	16.23±3.11	18.14± 2.88*	15.84± 2.33	17.84± 2.47*
Sit and reach (cm)	29.49± 4.36	28.98±4.80	28.80± 4.25	32.07±4.58*
Bent arm hang	8.18±8.62	6.31±6.83	15.17±15.22	22.47±19.75*†
Sit ups	8.45±5.90	8.23±5.38	10.17±5.7	13.49±4.29*†

Note: * Significantly different from initial, p<.05; †Significantly different from control, p<.05.

DISCUSSION

The present study assessed the impact of a 6-month multisport program on motor fitness in boys aged 5-7 years. The major findings of this study were that 6 months of multisport training improved motor fitness, with positive training effects on strength, as well as on explosive power speed and speed of upper limp movement. In the case of control group, the changes were less pronounced, but speed of upper limp movement were improved. In contrast to the enhanced physical performance, the body composition remained nearly unchanged. Increases in height, weight and BMI are usual in this age group.

Early childhood is considered as an ideal age period for the development of fundamental movement skills (Gallahue et al., 2012; Krneta et al., 2015). Similarly to our study, Roth et al., (2015) have provided an evidence that motor skills performance in preschool children can be improved and maintained by an appropriate physical activity program in 4- to 5-year-old boys and girls. Previous studies in children concerning the impact of motor skills on cognitive development and academic performance were based on cross-sectional studies (Haapala, 2013). However, one study showed significant improvement in motor and intellectual functioning of 5-year old children following a preschool intervention program (Bala et al., 2013).

Children in our study showed significantly better improvements in speed, explosive leg strength, upper body strength and the strength and endurance of the abdominals while positive effects on flexibility did not persist. In that direction, training programs can play a significant role as it is considered to be an excellent means for improving and promoting motor and health related fitness (Coelho, 2010).

The control group showed improvement in speed of upper limp movement. Daily activities of young children consists of play that could have a positive impact on the motor development of young children. However, this impact is lower compared to the impact of purposefully organized exercise programs as the developmental program of the present study.

Some study limitations should be noticed. We didn't followed children's daily unorganized activities and inactivity that could have possible influence on mastering motor skills and development of abilities. Nevertheless, this study provides evidence about the effectiveness of developmental gymnastics programs for the optimal development of young children's motor fitness.

CONCLUSION

The major findings of this study were that 6 months of multisport training improved motor fitness, with positive training effects on strength, as well as on explosive power speed and speed of upper limp movement. Although the control group did not include the specialised athletes in a particular sport it is better to spend time playing a variety of sports to improve their motor skills that are similar in many sports rather than specialise at an early age. Moreover, multisport activities include more fun and less bored activities thereby attracting and retaining our kids interest in sport.

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EFFECTS OF PROGRAMMED PHYSICAL EXERCISE ON CHILDREN'S MOTOR SKILLS

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SUMMARY

The goal of this study was to show to what extent and what influence various forms of programmed physical activities can have on development of basic motor skills with children at preschool or younger primary school age.

Literature search was carried using the following bases: Google Scholar, Kobson, DOAJ. For a closer search and choice of research papers, authors used key words – children development, moving, physical exercise, which was at the same time the research issue. The study was limited to research papers published in the period of 1996 - 2015.

Physical activity beneficially influences not only improvement of motor skills, but overall growth and development of children in kindergarten and early school age. Early implementation of physical activity, from starting kindergarten, creates a sort of a habit and the implementation of the same in the later period of postnatal life.

Keywords: children development, moving, physical exercise

INTRODUCTION

New technological developments and the achievements changed the way of life, resulting in the growth of hypokinesis which has a negative influence on the psychophysical state of children and youth. De Onis, Blossner and Borghi (2010) came up with the information that around 43 million children under five years of age do not fulfill the daily dose of recommended physical activity. Children in Serbia mostly spend their free time practicing habits which are usually related to sitting – doing homework, watching television, listening to music, etc., whereas only one quarter is physically active. The fact that a large percentage of children avoids PE classes is also worrying. An additional problem is an insufficient and inadequate intensity and content of physical exercise in preschools and primary schools. (Bala, 1991).

Moving is considered one of the most important factors of mental and physical health of people and defined as moving the body using skeletal muscles which results in energy consumption (Caspersen, Powell & Christenson, 1985). We should start various physical activities from the earliest age in order to have an acquired habit of physical exercise during schooling. Due to a specific biopsychosocial status in the society and an excess of free time, compared to the older population, children need a programmed and adequately dosed activity, and all towards proper mental and physical development (Previšić, 1987). Certain researchers concluded that various forms of practice lead to development of different motor skills which are in high correlation with their proper growth and development (Gadžić and Vučkovič; Hennessy et al., 2010; Eathern, Morgan & Lubans, 2013).

The research of proper motor skills started as far back as 1902, and in 1930 a scientific research was carried on individual motor functions in children (Hicks, 1930). A large number of theorists claim that a larger part of basic motor skills develops in the preschool and young primary school period, which is characteristic for relatively slower height growth (Bala, 1991; Đurašković, 2002), while the deficit of physical activity in this period leads to a lower motorical and intellectual growth which cannot be recovered later (Kelly & Kelly, 1985; Humphrey, 1991).

The goal of this study was to show to what extent and what influence various forms of programmed physical activities can have on development of basic motor skills with children at preschool or younger primary school age.

METHODS

Literature search was carried using the following bases: Google Scholar, Kobson, DOAJ. For a closer search and choice of research papers, authors used key words – children development, moving, physical exercise, which was at the same time the research issue. The study was limited to research papers published in the period of 1996 -2015.

RESULTS WITH DISCUSSION

There are phases of intensive and slow development of basic motor skills (Planinšec, 2002), and a larger part of the above mentioned skills should be developed in the preschool and young primary school age period (Marković and Bradić, 2008). This is the period of slow growth and development of children, and represents an intensive phase of motor skills development. Madić, Popović and Kaličanin (2009) state that the age from seven to eleven belongs to a very sensitive phase of biological development when it is ideal to apply the sports gymnastics program, because it can influence development of all motricity very favorably. With the development of motor skills, cognitive abilities develop, too (McMahon, 2013; Hillman, Erickson, Kramer, 2008; Hillman et al., 2009).

A larger number of studies which research the level of motor skill development in children point out that a physical exercise program influences all motricity of boys and girls at preschool or younger primary school age very favorably (Iivonen, Nissinen, Sääkslahti & Liukkonen, 2007; Sabo, 2003; Hraški and Živčić, 1996; Videmšek, Karpljuk, Štihec & Kropej, 2003). In the research of Iivonen et al. (2007) the program of physical exercise led to an improvement of dynamic balance in boys, whereas in girls, significant differences were noticed in the tests for assessment of static balance and standing long jump. Also, examinees who have been physically active for a long time had better developed motor skills (Sabo, 2002). Other researchers (Sääkslahti et al., 2001) who researched the influence of a four-year program on the development of motor skills in 184 examinees (100 boys and 84 girls) of four years of age in average, agree with this conclusion. The authors state that the examinees from the experimental group had more developed locomotor skills, manipulation skill, better dynamic balance and were physically more active. When comparing examinees' sex, boys from both groups showed better results in manipulation skills, whereas girls had better developed perception and balance skills. The difference between sexes appears and can be seen around the fifth year of postnatal life, and Cvetković, Popović and Jakšić (2007) state in their study that in that period, boys were superior in tests of body coordination, running speed and explosive power of lower extremities. There is a noticeable difference between the group of examinees who exercised since early childhood and others who were active for only a year. Similar results were obtained from the Sabo research (2003) where girls who were included in the physical exercise system in kindergarten for a long period of time showed better results in terms of coordination, agility and balance then the ones who were not. It is proven that motor skills are in positive correlation with the physical activity frequency, as well as percentage of time in moderate and highly intensive physical activities, and inversely proportionate to the percentage of time in sedentary activities. Examinees with the highest level of motor skills were physically most active (Wrotniak et al.,2006). In Hraški and Živčić study (1996), examinees used the program of physical exercise in 45 to 60 minute intervals every day. The program itself included natural forms of moving and basic motor movement from various sports (rhythmic-sportive gymnastics, handball, judo, karate, basketball, athletics, cycling, alpinism and else). Research results showed a significant improvement in all motor tests, and the biggest improvement was noticeable in coordination, strength and flexibility. With the results gathered this way they can mostly identify with the results of De Privitellio et al research (2007) in which it is noticed that the sports program contributed to the improvement of motor skills. Boys had better results in terms of explosive power and coordination and girls in terms of balance, flexibility and repetitive strength. Unlike results obtained in the above mentioned studies, in Špelić and Božić paper (2002) the influence of a specific sports program on the development of some motor skills in children was checked, and no significant differences between the experimental and the control group were recorded, apart from flexibility and only with girls. To what level motor skills develop largely depends on the size and intensity of the program itself, which can be seen in the results of Videmšek et al study (2003) where their goal was to determine the influence of physical exercise on development of some motor skills with children aged five to six. One program of activities was carried out by nursery-governesses and the other by students of kinesiological sciences in collaboration with the nursery-governesses, and the results obtained showed that the program carried out by students in collaboration with the nursery-governesses gave better results. Also, different programs, training quality, genetic predisposition and physical activity in free time have an influence on development of certain motor functions which Nikolić and coworkers (2015) proved in their study when they compared children from the rural and urban areas. Students from urban areas had significantly better results in the test for assessment of upper extremities explosive power and the test for assessment of lower extremities flexibility, whereas students from rural areas had significantly better results in tests for assessment of frequent arm and leg movements, as well as repetitive trunk strength.

CONCLUSION

Results of certain researches point to a trend of reducing of motor skills from 1981 to 2006 (Brunet, Chmaput & Tremblay, 2007) which is more noticeable with girls compared to boys. Therefore, we should bring motrical development to a higher level during the sensitive period using various stimulants of proper intensity, extensity and range, namely adequate exercise program (Bala, Kiš and Popović, 1996). Data which is very useful is that early implementation of physical activity, from starting kindergarten, creates a sort of a habit and the implementation of the same in the later period of postnatal life (Špelić and Božić, 2002). If characteristics of sexes are taken into consideration, we can spot differences in certain motor functions, partly in boys' favor, concerning explosive strength, coordination and manipulation skills, whereas girls had significantly better results in test for assessment of balance, flexibility and perception (Sääkslahti et al., 2001; Bala, 2003; Zurc et al., 2005; De Privitellio et al., 2007). These differences in motor skills between the two sexes, in the period of slow growth and development from the fourth to eleventh year of a child's extrauterine life, are most noticeable around the age of five, where in most observed parameters boys had better results (Cvetković and coworkers, 2007), but the common existence of differences in motor skills, which appears in both male or female population, can be explained as the effect of genetics, training specificity and physical activity intensity (Nikolić and coworkers, 2015). Development of motor skills is in a positive correlation with cognitive characteristics as well (Planinšec, 2002), whereas sedentary way of life has a negative influence (Wrotniak et al., 2006). Parents have a significant role in preventing hypokinesia and encouraging child's activity, and mostly fathers whose physical activity affects children's activity, whereas correlation between a physically active mother and child has not been recorded (Lepeš, 2011).

Physical activity beneficially influences not only improvement of motor skills, but overall growth and development of children in kindergarten and early school age (De Privitellio et al., 2007).

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EXPLOSIVE STRENGTH OF BOYS IN YOUNGER SCHOOL AGE

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UDC 796.012.116

SUMMARY

Physical exercise in the younger school age is extremely important due to growth and development of organism as well as corrective treatment on various deformities. Physical education in this period of physical growth and development is very important. But in practice, this subject is not carried out regularly or is not performed by pedagogues of physical culture. The facts that each movement has on the organism are known, in terms of stimulating its development and maintaining capabilities at a certain level. Exercises in artistic gymnastics are very diverse and some of them are more demanding in terms of different forms of strength, some in terms of coordination, mobility, balance, and some sublimate more motor abilities. For this reason, the application of exercises on apparatus and floor indisputably affect the overall motor status of a person. Exercise on apparatus, as a wider concept of developmental gymnastics, is a motor activity rich in diversity of movements and positions. The richness of movement and position in exercise on apparatus allows to those who utilize them to create a huge fund of motor knowledge. Subject of this research was explosive strength. The problem and aim of research were related to determining the differences in explosive strength between EXP and the CON group of boys in younger school age. The sample of respondents for experimental group consisted of 54 boys and for control group 53 boys aged 9 to 11 years. To determine the level of explosive strength three tests were used. Data processing was performed by the statistical program SPSS v. 20. For all data, the parameters of descriptive statistics were calculated. To determine the differences between the groups, a t-test for independent samples was used with calculation of significance of the size of difference (Cohen's d). The research showed differences in the explosive strength of boys aged 9 to 11 years. Differences in explosive strength were identified in favor of the experimental group in two out of the three variables. The results obtained accurately indicate that respondents included in the developmental gymnastics program have a significantly higher level of explosive strength than respondents who only attended physical education.

Keywords: Developmental gymnastics, physical education, explosive strength, young school age.

INTRODUCTION

General problem is realization of physical education in the younger school age, and especially realization of gymnastic content within the class. It is assumed that the reason for this is the lack of space and gymnastic apparatus and equipment or insufficient professional competence of teachers (Badić, Živčić-Marković, Sporiš, Milanović & Trajković, 2012).

Physical exercise in younger school age is extremely important due to the growth and development of the organism, as well as corrective treatment on various deformities. At this age, it comes to development of the respiratory system, the cardiovascular system develops, the bones become more and more stiff, more firm and develops and fixes the physiological curves of the spinal column. The physical education class in this period of physical growth and development is very important. But in practice this teaching is not carried out regularly or is not practiced by the pedagogues of physical culture (Đurašković, 2002).

The facts that each movement have on organism are known in terms of stimulating its development and maintaining capabilities at certain level. Exercises in artistic gymnastics are very diverse and some of them are more demanding in terms of different forms of power, some in terms of coordination, flexibility, balance, and some sublimate few motor skills. For this reason, the application of exercises on apparatus and floor indisputably affect the overall motor status of a person. Under artistic gymnastics, the widest auditorium experiences sport, conceptually defined as competitive discipline, with polycrystalline content of acyclic type and strictly defined rules as a convention applied in practice (Petković, Veličković, Petković, Hadži – Ilić & Mekić, 2013).

Exercising on apparatus, as a wider concept of developmental gymnastics, is a motor activity rich with diversity of movements and positions. The richness of movement and position in exercise on apparatus allows to those who employ them to create a huge fund of motor knowledge that is a very good base and a predisposition for engaging with any sport (Madić & Popović, 2012).

There are a number of definitions of motor skills, so Findak (1999) and Prskalo (2004) similarly defined motor skills as latent motor structures that are responsible for infinite number of manifest reactions that can be measured and described. Milanović (2009) defines motor skills as an ability that enables the realization of all kinds of movements. Malacko and Popović (2001) state that motor skills are latent, they can not be directly measured, but indirectly, which means that only motor reactions, or manifestations of different measuring units, can be measured directly.

Many authors have tried to define the strength in the most adequate and best way using different starting basics. Thus, dr Pavle Opavski (1971) identifies strength with force and says that force is the ability to transform muscular strain in composition of motor units into a kinetic or potential form of mechanical energy. In anthropomotoric, term power is defined as the human trait, or its ability to overcome some external resistance or to resist it by means of muscular strains (Nićin, 2000).

Based on the character of muscular work, strength can be divided into:

- static (it is reflected in the ability to maintain the maximum muscular contraction, isometric type, for a long time, without movement, and with intention to prevent the disturbance of the occupied position), and
- dynamic (expressed in the form of explosive and repetitive strength), (Herodek, 2006).

Rubin (2015) defines explosive power as the ability to activate maximum number of muscle fibers in unit of time. Explosive strength is one of the determinants of success in all activities that requires expression of maximum muscle force in as short as possible time unit (Kreamer & Newton, 1994).

The subject of this research was explosive strength. Within the research problem, the answer to the basic question was given: are there differences in explosive strength with boys in younger school age. The aim of the research was to determine the differences in explosive strength between experimental (EXP) and control (CON) group of boys in younger school age. On the basis of the defined subject, problem and aim, tasks were set that are related to determining the differences in explosive strength of boys in younger school age.

METHODS

An experimental model was used for research purposes. Appropriate procedures have been applied in accordance with the subject, aim and tasks of the research.

Subjects

The sample of respondents for the EXP group was intentional (Miljanović & Vojvodić, 2008). It was made of 54 boys ages 9 to 11 years from four cities, who as members of clubs are included in the developmental gymnastics program for at least three months. Average height of respondents was 139.55 cm, average weight was 33.46 kg and average BMI value was 17.05 (Table 1).

Table 1. Anthropometry and BMI (EXP)

	Height	Weight	BMI
AVG	139,55	33,46	17,05
MIN	121,80	22,00	14,17
MAX	159,30	49,60	24,09
RANGE	37,50	27,60	9,91

Legend: *BMI – body mass index, AVG – mean value, MIN – minimum values, MAX – maximum values.*

A random stratified sample was formed for CON group (Miljanović & Vojvodić, 2008). It was made of 53 boys from two classes from third grade and two classes from fourth grade of primary school "Dušan Radović" in Niš, aged 9 to 11 years. Average height of respondents was 145.96 cm, average weight was 41.33 kg and average BMI value was 19.23 (Table 2).

Table 2. Anthropometry and BMI (CON)

	Height	Weight	BMI
AVG	145,96	41,33	19,23
MIN	132,50	25,40	14,37
MAX	163,00	70,00	26,43
RANGE	30,50	44,60	12,06

Legend: *BMI – body mass index, AVG – mean value, MIN – minimum values, MAX – maximum values.*

Procedure

CON group respondents visited regular classes of physical education, which according to the curriculum for 3rd and 4th grade are present with three classes within a week.

In addition of physical education, EXP group respondents were included in program of developmental gymnastics three times a week for an hour. The developmental gymnastics program involves the training of compulsories for first category on floor, pommel horse or parallel bars, rings or high bar and vault (Veličković, Dejanović & Drakuluić, 2013).

Anthropometric characteristics of the sample were determined only for a better description, and were not taken for further analysis. They were measured in accordance with the recommendations of the International Biological Program – IBP (Weiner & Lourie, 1969). Height was measured with a measuring tape with accuracy of 0.1 cm. Weight was estimated using a decimal scale with a precision of 0.1 kg. Body Mass Index (BMI) was also not taken into account for statistical processing, but was calculated (BMI = Weight in kilograms : Height^2 in meters) only to have an insight into state of nutrition of the respondents.

Three tests were used to assess explosive strength:

1. Counter movement jump – CMJ: **duration of the test:** assessment of the duration of the test for one respondent about 2 minutes; **number of testers:** one examiner and one assistant; **requisites:** *Optojump***,** the optical system for measurement; **assignment:** respondent stands upright, the feet are in width of the hip, and the arms are on the waist. From the starting position it quickly descends into squat with an angle of 90° in the knees. Without making a break, the respondent performs jump as high as possible without letting his hands off the waist and landing on the foot with both legs at the same time; **evaluation:** explosive strength parameter obtained by *Optojump*, and which is statistically processed, is height of the jump in cm (Bosco Ergojump System, 2013).

2. Squat jump – SQJ: **duration of the test:** assessment of the duration of the test for one respondent about 2 minutes; **number of testers:** one examiner and one assistant; **requisites:** *Optojump***,** the optical system for measurement; **assignment:** From the starting position, the subject performs the jump as high as possible and lands with both legs simultaneously. The athlete stands calmly on the surface in an upright position, in stockings or barefoot and in weight uniformly distributed on whole feet. When ready, athlete makes a squat to an angle of 90 ° between thigh and lower leg. After a few seconds in the initial position, on the mark of tester or measuring device, subject jumps as high as possible, and lands with both legs; **evaluation:** explosive strength parameter obtained by *Optojump*, and which is statistically processed, is height of the jump in cm (Bosco Ergojump System, 2013).

3. Throwing the medicine ball – TMB: **duration of the test:** assessment of the duration of the test for one respondent about 2 minutes; **number of testers:** one examiner and one assistant; **requisites:** medicine ball (1 kg), centimeter tape, adhesive tape for marking the starting line; d**escription of the place of performance:** parallel with wall of the hall at distance of 50 cm on the floor is marked starting line indicating the place from which the throwing is performed. From the starting line, we mark on the floor each 100 cm with adhesive tape**; assignment:** the task of respondent is to place the medicine ball in front of the chest. Then he stands behind the starting line with his back turned toward the wall. Followed by the throwing of the medicine ball by stretching arms forward, whereby a small swing of the body is allowed. The examiner demonstrates the task; **evaluation:** the throwing length is measured on a centimeter tape with an accuracy of 1 dm; **note:** if a throw is performed incorrectly, repetition is allowed. As error in performance is considered to be overrun over the starting line during throwing and raising the foot from the floor (Gojković, 2009).

In all three tests three trials were measured and the mean value was taken for further statistical processing (Paunović, Veličković, Aleksić-Veljković, Kurtev & Filipović, 2014).

Measurement of motor skills, was conducted in gymnastics halls in which respondents are trained and which are intended for implementation of this special program, with creating optimal conditions for performing measurements.

Statistical analysis

For the processing and analysis of raw data, the statistical data processing package SPSS v. 20 was used. For each applied variable, the basic parameters of descriptive statistics were calculated. The estimation of the distribution of the results and the estimation of the central and dispersion parameters was made in order to obtain data on whether the distribution of the results is normal or not. For this purpose, the following parameters were calculated: arithmetic mean (Mean), standard error of arithmetic mean (S.E M), arithmetic mean calculated when ignored 5% of extreme cases from left and right (5% T Mean), standard deviation (S.D.), coefficient of variation (CV%), Range, minimum value (Min), maximum value (Max), coefficient of curvature (Skew), coefficient of roundness (Kurt), Kolmogorov-Smirnov zet (K-S Z), significance of Komogorov-Smirnov zet (Sig K-S z).

For determining the differences between the groups, a t-test for independent samples was used, with a significance size difference calculation (Cohen's d).

RESULTS

The basic descriptive parameters for EXP group are shown in Table 3.

Table 3. Descriptive parameters for EXP group

Variable	Mean	S.E M	5% T Mean	SD	CV%	R	Min	Max	Skew	Kurt	K-S Z	Sig K-S z
CMJ	21,96	,61	21,80	4,50	21%	20,60	13,30	33,90	,57	,27	,66	,78
SQJ	20,93	,58	20,74	4,23	20%	18,30	13,80	32,10	,73	,33	,91	,38
TMB	4,40	,12	4,40	,85	19%	3,90	2,60	6,50	-,10	-,03	,82	,52

When the Mean and 5% T Mean values of boys from the EXP group are compared (Table 3), it can be noted that the values are quite similar, which indicates that extreme values do not greatly affect the value of the arithmetic mean and there is no need for additional correction of extreme values. After examining the CV% - coefficient of variation (Papić, 2008) it can be seen that all three variables have relatively low variability. Significance of Kolmogorov-Smirnov Z (Sig K-S z) is in all cases greater than 0.05, which indicates that the assumption of a significant deviation of observed distributions from normal distribution is not confirmed. Also, as a confirmation that the observed distributions do not significantly deviate from the normal distribution are all values of asymmetry (Skew) and roundness of distribution (Kurt) that do not extreme deviate from zero value.

The basic descriptive parameters for CON group are shown in Table 4.

Table 4. Descriptive parameters for CON group

Variable	Mean	S.E M	5% T Mean	SD	CV%	R	Min	Max	Skew	Kurt	K-S Z	Sig K-S z
CMJ	17,84	,51	17,81	3,71	21%	15,40	10,20	25,60	,13	-,44	,61	,85
SQJ	17,69	,46	17,64	3,33	19%	13,90	11,40	25,30	,24	-,33	,46	,98
TMB	4,30	,10	4,27	,72	17%	3,00	3,10	6,10	,53	-,25	,84	,49

As with the previous group of respondents, values of Mean and 5% T Mean indicates that extreme values do not affect value of the arithmetic mean and there is no need for additional correction of extreme values (Table 4). The coefficient of variation (CV%) indicates that all three variables have relatively low variability. Values of Kolmogorov-Smirnov Z (Sig K-S z) test indicates that there is no significant deviation from normal distribution, which is confirmed by values of asymmetry (Skew) and distribution roundness (Kurt).

Table 5 shows results of t-test.

Table 5. t-test between the EXP and CON group

Variable	t	df	Sig	Mean Diff (E-K)	Cohen's d
CMJ	5,16	105,00	,00**	4,12	1,01
SQJ	4,39	105,00	,00**	3,24	0,86
TMB	,66	105,00	,51	,10	0,13

Legend: *t – calculated t-test value, df – degrees of freedom, Sig – statistical significance of t-test * < 0.05, ** < 0.01, Mean Diff (E-K) – the differences that are obtained when the arithmetic mean of EXP group is subtracted from the arithmetic mean of CON group, Cohen's d – calculated Cohen's index of the size of differences.*

In all three applied variables, numerical difference between the arithmetic means in favor of better results of the EXP group is showen (Table 5). Reviewing the results of the t-test and its statistical significance it is noted that the differences between arithmetic means are in addition to numerical also statistical significant with tests CMJ and SQJ at level Sig= .00. With test TMB there were no statistically significant differences (Sig= .51), and numerical differences are almost negligible values.

Cohen proposed the following guidelines regarding the interpretation of the size of differences (Pallant, 2011): small – from 0,20, medium – from 0,50 i large – from 0,80. Review of the obtained coefficients on the size of the differences (Cohen's d) large differences in the benefits of better results of the EXP group can be noted for variables CMJ (1,01) and SQJ (0,86) while with variable TMB strength of the difference is small (0,13), but still in favor of the EXP group.

DISCUSSION

The obtained results indicate a higher quality of explosive strength of EXP group in relation to CON group. These differences in the variables CMJ and SQJ are attributed to the program of developmental gymnastics, which obviously has a greater influence on explosive strength of the lower extremities from current curriculum of physical education. Thus obtained results are consistent with previous researches (Gojković, 2009; Milenković, 2002, 2004), in which the authors examined differences in motor skills on a different sample of respondents.

The reason why the differences are small and statistically insignificant with variable TMB can be found in anthropometric characteristics of the respondents. By reviewing Table 1 and 2, it can be noticed that CON group respondents have higher height, weight and BMI values than respondents from EXP group. A few researchers (Rodić, 2012; Kondrič, Mišigoj – Duraković & Metikoš, 2002; Diane, Julie & Louise, 2006), in their researches came to conclusion that body weight and height positively affect on explosive strength of upper extremities.

CONCLUSION

The conducted research indicates that the teaching of physical education itself is not sufficient for the quality development of explosive strength. It should be further modified and adapted to give better results in the motor development of boys in younger school age. The results accurately indicate that respondents included in the developmental gymnastics program have a significantly higher level of explosive strength than respondents who attended only physical education classes. One of the problems is that the teaching of physical education at this age is performed by insufficiently trained persons. As a possible solution imposes introduction of extra-curricular activities that would not be carried out by teachers, but professors of physical education.

This research should encourage a series of researches that would include a larger population, on a larger number of tests covering more motor spaces. It should also awaken parents' awareness to more seriously address the problem of physical (in)activitie of children, because with development of technology play has completely changed the character and caused the development of various deformities. We hope that by using these and similar programs, children will be separated from computers, tablets and phones and that they will enable themselves healthy growth and development, and the best effect would be achieved by implementing the aforementioned programs into the curriculum and the physical education program.

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INFLUENCE OF THE SOCIAL STATUS ON THE MOTOR ABILITIES OF PRE-SCHOOL CHILDREN

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UDC 796.012.1

SUMMARY

Pre-school age is a very sensitive period of child growth. There is scientific evidence on the impact of socio-economic and socio-cultural status of the family on the development of a pre-school child. The aim of the paper was to determine whether socio-economic and socio-cultural status influences the motor skills of preschool children and whether there is a link between socio-economic and socio-cultural status with motor skills. Connectivity is to be seen through the differences that appear in this respect among children who come from families with different socio-economic and socio-cultural status. If these differences are significant, they are in favour of the assumption that social status influences motor skills. The survey was conducted on a sample of 147 children, aged six (± two months), both sexes, from kindergartens "Pčelica", "Mladost" and "Sloboda" from Preschool Institution "Naše dete" in Šabac. Stratification of the sample was done on three strata according to the social criterion (lower, middle and higher). Assessment of the socio-economic and socio-cultural status of children, and later the difference between them, was conducted using the "Questionnaire on the conditions of the family environment", with 29 items. The assessment of motor skills was carried out with a battery of eight moving tasks, on the unified scale of Mary Gutrich, ranked in five classes. The obtained data show that there is a statistically significant difference between groups of children belonging to the strata determined by social status in the system of variables of motor abilities. The results indicate that social status has significantly affected the motor skills of preschool children.

Keywords*:* socio-cultural and socio-economic status, strata, questionnaire, Mary Gutrich scale, motor behavior.

INTRODUCTION

Preschool period is the most turbulent in child development (Antropova, M.B. and Koljcova, M.M. 1986; Elkonjin, D. B. 1990. Ivić, I. 1979. Kamenov, E. 1983; Kundrat, V. 1979; Smiljanić, V. 1983). This period in domestic and world literature is designated as one of the most sensitive periods for the development of certain motor skills, but also for the appearance of harmful effects from the exogenous and endogenous environment, to the locomotor apparatus - physical development, seen in a wider context.

Given that this is the richest period of development and can be most affected at the time, this childhood life span is, from the point of view of science, particularly interesting for study.

The socio-economic status of the family and its impact on the development of the child was more intensively explored in the world during the fifties. Thus it has been proven that "The children whose parents belong to free professions or management circles are bigger in all physical dimensions than the children of skilled or semi-skilled workers. These differences become greater with age. "(Amos & Flory, 1944; Meredith, 1951 - interpretation by Herlok, E. 1970, 123).

Ponthieux, N.A. & Barker, D.G. (1965) found evidence that girls of lower social status are faster, have better coordination and better endurance, and that girls of higher status have greater strength of arms and shoulders, belly and muscles of the flexor of the hip. On the other hand, boys of lower social status are faster, have better coordination, while boys of higher status have shown a higher level of agility and speed, strength of abdominal muscles and flexor of the hip.

Correlation of social status and motor skills was also found by Božinović (1983). There was a significant difference in motor skills in favour of children whose fathers have a higher level of education. He also found that children whose mothers are employed show better results in motor tests.

Džinović-Kojić (2000) found that the educational level of mother and father is related to the power of lower extremities of pre-school children.

Ketelhut, Bittmann and Ketelhut (2003), on socio-economic basis, found that pre-school children (three years of age) of lower social status had lower motor skills.

Study by Freitas, D. Etal. (2007), on a sample of the school population, indicates significant variations in growth, physical activity and physical abilities, depending on socio-economic status. Statistically significant differences in growth and physical abilities were determined, depending on high, average and low socio-economic status. Namely, boys from low socio-economic status showed better results in terms of muscular and aerobic endurance. On the other hand, girls from the high socio-economic status were better in power.

It can be said that the socio-economic and socio-cultural status of the family has a great influence on the development of a pre-school child and that there is exact scientific evidence of its impact on general development. Pre-school age is a very sensitive period of child growth. On the other hand, for parents, this is the most critical period, outside the family, in a career when they should reach the highest level, zenith.

The aim of the paper was to determine whether socio-economic and socio-cultural status influences the motor skills of preschool children and whether there is a link between socio-economic and socio-cultural status with motor skills. Connectivity is to be seen through the differences that appear in this respect among children who come from families with different socio-economic and socio-cultural status. If these differences are significant, they are in favour of the assumption that motor skills are influenced by the social status.

The following hypotheses served as a starting point:

H-0 There are no statistically significant differences between groups by social status (lower middle and higher) in terms of state of motor skills;

H0-1 There are no statistically significant differences in the frequency between groups by social status (lower, higher and higher) in terms of state of motor skills;

H0-2 Groups are not discriminatory, i.e. there is no clearly defined boundary (in relation to frequency) between groups by social status (lower, middle and higher) in terms of state of motor skills;

H0-3 There is no statistically significant difference in frequency between groups by social status (lower, middle and higher) by individual characteristics (variables);

H0-4 There is no statistically significant difference in frequency between couples per groups by social status (lower, middle and higher) relating to individual characteristics (variables).

METHODS

Subjects

The sample of respondents included a total of 147 children, aged six (± two months), regardless of gender, from kindergartens "Pčelica", "Mladost" and "Sloboda" from Preschool Institution "Naše dete" in Šabac. It is represented by stratification, i.e. the sample is divided into three strata according to the social criterion (lower, middle and higher).

Procedure

The assessment of the socio-economic and socio-cultural status of pre-school children, and later the difference between them, was conducted by the "Questionnaire on the conditions of the family environment", with 29 items, which is designed to cover the examined area more complexly. The following group of family characteristics were assessed: a) socio-economic and socio-cultural status 1. Material conditions, 2. Employment of both parents, 3. Housing conditions, 4. Educational level of parents related to socio-cultural status with possession of computers, books, CD players, 5. Type of interest of the parents, 6. Possession of toys, 7. Departures to the sea, or winter holiday, 8. Self-assessment of the property status - below average, average, above average; b) Family structure 1. Number of the household members and number of children in the family. All questions were collected and a summary of responses received by each respondent was obtained. Based on the summary of responses of all respondents, the sample is divided into three groups, three strata defined by social status. In order to check (confirm) the characteristics of each stratum, a complete analysis of the differences between the strata on the basis of the questionnaire was performed. On the basis of the differences, the characteristics of each stratum were determined by the social structure.

A scaling technique was used to evaluate motor skills (efficiency of motor behavior) of pre-school children. Namely, the unified Mary Gutrich scale was applied (according to Watson 1973). The special scale contains 14 stages of motor skills development, in which Perić (1989, 87-89) assigned each assignment a score from 1 to 14. The test battery is composed of eight moving tasks, which are classified (conditionally, given pre-school age children) in five groups: a) strength tests. 1. standing long jump (long), 2. hand-pulling on a steep slope in a lying position on the stomach (steepslope) and 3.

throwing a medicine ball of one kilogram over the elastic rope in the distance (med); b) speed test: winding running with a sandbag (running); c) general coordination test: 1 roll forward (roll); d) balance test: 1. walking over the reverse Swedish bench with a turn (balance); e) precision and fine coordination tests: 1. throwing a tennis ball over the elastic band in the distance (ball) and 2. throwing the hoop on the rack (throwing). All assessments of respondents are classified into five classes. Based on the frequency of the assessments from 5 to 14, a classification was made - grouping on five levels - classes, in the following way:

1st class: 5-6 children with very low motor skills (insufficient)

2nd class: 7-8 children with low motor skills (sufficient)

3rd class: 9-10 children with moderate motor skills (good)

4th class: 11-12 children with high motor skills (very good)

5th class: 13-14 children with very high motor skills (excellent).

Statistical analysis

Data processing included in addition to basic statistical indicators, the following statistical procedures: multivariant analysis of variance (MANOVA), discriminatory analysis and coefficient of discrimination, Roy's test, Student's T-test on proportions.

RESULTS

Table 1. Significance of the difference between the strata determined by social status in relation to the assessments of the motor behavior of the respondents

	n	F	P
MANOVA	8	3.780	.000

Based on the fact that the high level of significance p =, 000 (Table 1) of multivariate variance analysis (MANOVA), H0-1 hypothesis is not accepted. "There are no statistically significant differences in frequency between groups by social status (lower, higher and higher) in terms of state of motor skills". Alternative is accepted - there is a statistically significant difference between the three strata defined by the social status based on the eight estimated variables of the motor abilities of pre-school children.

Table 2. Significance of the difference between the strata determined by social status in the assessment of motor behavior

	n	F	P
DISCRIMINATIVE	8	3,843	,000

Based on the fact that p = .000 (Table 2), for the eight synthesized features (variables) the assessment of the motor behavior of the respondents, the discriminatory analysis rejects the H0-2 hypothesis. "The groups are not discriminatory, i.e. there is no clearly defined boundary (in relation to the frequency) between groups by social status (lower, middle and higher) in terms of state of motor skills. An alternative hypothesis is accepted. So, there is a significant difference and a clearly defined boundary between some social groups - the strata in the grades, the eight motor variables, the motor skills of the respondents.

Table 3. Coefficient of discrimination between strata determined by social status in assessing the motor behavior of respondents

variables	Coefficient of discrimination
throwing	.136
roll	.113
med	.075
balance	.066
running	.045
steepslope	.026
ball	.021
long	.009

The analysis of the coefficient of discrimination shows that the greatest contribution to discrimination between different social groups - the strata in the assessment of the motor behavior of the respondents (i.e. the biggest difference) is in the case of " throwing the hoop on the rack " (throwing) (1.36), "roll" (roll) . 113). "Throwing a medicine ball" (med) (.075), "balance" (balance) (.066). "Running" (.045), "steep slope" (steepslope) (.026), "tennis ball (ball) (.021) and" long jump "(.009).

Table 4. Significance of difference between strata determined by social status in relation to individual variables of motor behavior of respondents (Roy's test)

	χ	R	F	p
running	.128	.126	1.160	.316
steepslope	.222	.179	2.379	.096
med	.240	.220	3.637	.029
long	.194	.166	2.019	.137
roll	.298	.291	6.633	.002
balance	.278	.222	3.724	.027
ball	.206	.164	1.972	.143
throwing	.351	.362	10.812	.000

By analyzing the results obtained by scaling the characteristics (variables) in relation to the criterion "social status" (socg), it is noted that for the variation of " throwing the hoop on the rack " (p = .000), the best possible discrimination between the three social groups - the stratum in motor abilities (Table 4) was achieved. H0-3 hypothesis was not confirmed - "There is no statistically significant difference in the frequency between groups by social status (lower, middle and higher) by individual characteristics (variables)", in variables: " throwing the hoop on the rack " (throwing) (p = .000)….. (P = .002), "walking over the reverse bench" (balance) (p = .027), "throwing a medicine ball of one kilogram" (med) (.029), "hand-pulling on a steep plane in the lying position on the stomach "(steepslope) (.096). The alternative was accepted. This means that there are statistically significant differences between the strata defined by the social status based on the five variables indicated.

Table 5. Significance of differences between stratum pairs determined by social status by individual variables of motor behavior

	groups			proportion		%			
T-test	Gr 1	Gr 2	Class	m1/n1	m2/n2	prop1	prop2	t	r
steepslope	lower	middle	excellent	8/38	28/70	21.05	40.00	-1.99	.049
med	lower	higher	excellent	7/38	2/39	18.42	5.13	1.82	.073
med	middle	higher	excellent	6/70	0/39	8.57	.00	1.88	.063
long	lower	higher	insufficient	3/38	0/39	7.89	.00	1.79	.077
long	middle	higher	insufficient	5/70	0/39	7.14	.00	1.71	.099
roll	lower	middle	insufficient	10/38	6/70	26.32	8.57	2.48	.015
roll	lower	middle	good	9/38	29/70	23.68	41.43	-1.84	.068
roll	middle	higher	sufficient	21/70	19/39	30.00	48/72	-1.94	.055
roll	middle	higher	good	29/70	7/39	41.43	17.95	2.50	.014
balance	lower	higher	very good	1/38	6/39	2.63	15.38	-1.95	.055
balance	middle	higher	sufficient	23/70	6/39	32.86	51.28	-1.89	.062
throwing	lower	higher	good	12/38	6/39	31.58	15.38	1.68	.097
throwing	lower	higher	insufficient	1/38	6/39	2.63	15.38	-1.95	.055
throwing	middle	higher	excellent	0/70	6/39	.00	15.38	-3.38	.001

Based on the obtained high values of the significance level of the t-test on the proportions, we estimate that the hypothesis is not accepted by H0-4. "There is no statistically significant difference in frequency between pairs per groups by social status (lower, middle and higher) by individual characteristics (variables) but alternative is accepted. It means that statistically significant differences were found between the mentioned pairs of strata determined by social status based on six variables.

DISCUSSION

Multivariate analysis (MANOVA) showed a significant distinction between the three strata defined by social status in the system of examined motor variables.

The Roy's test showed that in five of the eight motor variables there is a significant difference.

A discriminatory analysis has shown that there is a significant difference between the three strata determined by social status in all eight motor variables.

The analysis of the "proportions" (t-test on proportions), or proportional representation of the respondents in all three strata - social groups in certain movable tasks, i.e. variables show that there are statistically significant differences in six of the eight variables of motor skills of a pre-school child.

Thus, all levels of the statistical analysis indicate the existence of a significant distinction between strata determined by social status in relation to motor variables.

Research has shown that children of different social groups - strata achieved different results from motor assignments. The determined social strain had a significant impact on the results of all eight motor assignments.

The study showed that external factors had a certain impact on the motor space of the tested sample of children. The established social status had a significant impact on the results of motor skills, seen through eight motor tasks. There are statistically significant differences between groups of children belonging to strata determined by social status in motor behavior. Thus, favorable conditions for the life and raising of children have statistically significantly influenced the child as a whole, that is, his motor development. It is known that motor behavior is largely conditioned by motor skills, and then by the environment in which he/she lives.

Families who had better conditions for living and raising children were more likely to offer and provide various stimuli for improving motor skills, motor habits, as well as other psychosomatic characteristics, as a basis for children's motor behavior, and therefore the entire motor behavior of children of pre-school age. Those families had better material possibilities for performing motor activities, better informing of parents and their relationship to motor activities as well as their activity, to enable children to have better nutrition, rest (sleep), the habit of exercising motor activities more often, to consider movement as life necessity ... so that we assume that the children from these families were more motor active, which, as a whole, resulted in the existing differences in motor behavior.

Given that all applied statistical methods have confirmed statistically significant differences in motor skills between groups of children belonging to different strata defined by social status, it can be safely concluded that social status as an exogenous factor for the development of the child's organism statistically significantly influenced on the motor behavior of children of pre-school age.

CONCLUSION

Since none of the zero hypotheses has been statistically confirmed, alternatives are accepted. We can say that there is a statistically significant difference between the groups of children belonging to the strata with a certain social status in the system of variables of motor skills.

All eight variables contribute to the discrimination of groups of children belonging to different strata defined by social status and clearly define the boundary between them.

Differences have also been confirmed between groups of children belonging to different strata defined by social status in individual variables: "throwing the hoop on a rack" (throwing), "roll forward" (roll), "walking over the reverse bench" (balance), "throwing the medicine ball of one kilogram in the distance "(med) and hand-pulling on a steep slope in the lying position on the stomach" (steepslope).

Also, differences were found between pairs of strata determined by social status in individual variables of motor abilities of children.

The results of the research suggest that the development of motor skills is largely conditioned by favourable or unfavourable conditions for life and raising children.

It is known that the conditions for life and raising children affect the child as a whole and even the motor development. It is very possible that children from families with different socio-economic and socio-cultural status were also on different occasions to develop their motor skills, motor habits, as well as other psychosomatic characteristics, which also affected their motor behavior.

In this study, there is a very clear picture of the impact of social status on the motor behavior of preschool children.

This means that there are significant differences between the strata determined by social status based on all eight motor tasks in the examined children. The established social status had a significant effect on the motor behavior of preschool children.

In addition, children belonging to a stratum determined with a higher social status were highly positioned on the basis of the efficiency of motor behavior (considering all the examined movement tasks) in relation to children from the remaining two strata.

The results of the motor behavior of children in the stratum determined by a lower social status were, generally speaking, lower than the results of children from the other two strata.

Looking at the overall results, strata and class grades, all indicate that in motor behavior there is a certain similarity in terms of the hierarchical positioning of the stratum determined by the social status and the influence of the social status on the motor abilities of children of pre-school age.

Based on the results obtained in the research, it can be concluded with considerable certainty that the social status significantly influenced the motor status of children of pre-school age.

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THE DIFFERENCES IN POSTURAL STATUS BETWEEN FOOTBALL PLAYERS AND NON-ATHLETES

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UDC 796.3:61.71/.72

SUMMARY

In a young age category of football players, appropriately dosed football training has a positive effect on the learning and improvement of elements of the football technique and approach, as well as on the development of physical readiness. The muscles and other elements of the locomotor system get stronger during physical preparation which may have a positive effect on the prevention and modification of postural disorders. Therefore, the aim of the research was to establish the difference in the presence of kyphosis, lordosis and flat feet in children, football players and non-athletes. The sample of participants consisted of thirty football players and thirty boys who do not participate in any sport, between the ages of 10 to 12. The Spinal mouse was used to estimate the postural status of the spinal column in thesagittal plane,while plantography was used to estimate the reduction of the foot arch. The Chi-square test of independence was used to establish any statistically significant difference in the presence of a postural disorder. For one half of football players a statistically significant difference was identified in terms of the decreasedoccurrence of flat feet (p= 0.039). There was no significant difference in regard to the presence of kyphosis, lordosis and kypholordosis. The results indicate a connection between actively playing football and the presence of flat feet within the examined groups. One of the reasons why boys who play football have better foot arches is that they use their leg muscles when they run and perform elements of the football technique which play a part in maintaining a normal foot arch. Although the research was carried out on a small number of participants, based on the analysis of the given results and their comparison with contemporary research, it can be assumed that football training as a physical activity has a positive effect on maintaining and improving proper foot arches, whereas it does not have an effect on the postural status of the spinal column.

Keywords: Flat feet, kyphosis, lordosis, positive effect, postural spine

INTRODUCTION

Postural status represents a stance or the position of the body and its segments at rest or in an active state(Đorđić, 2007). Proper body posture is conditioned by the proper functioning of the active part of the locomotor apparatus. An excessive or unilateral load, inactivity and weakness of the muscle groups leads to postural disorders, that is, to the disruption in the principle of symmetricity and balance (Milenković, 2007). Poor posture is characterized by a weakness of the entire body, especially the joint-muscle apparatus. In these states, statistical insufficiency of the spinal column is the most pronounced, which is conditioned by the weakness of the other parts of the locomotor apparatus. (Živković, 2009). According to Milenković (2007), kyphosis, lordosis and scoliosis as well as flat feet, are the most frequent postural disorders among school-aged children. The causes of the occurrence and possible onset of postural disorders among children can vary: insufficient physical activity, obesity, malnourishment, early specialization in certain sports, etc. Bad posture is acquired early on and mostly during the school age period. This is why it is of the utmost importance to begin with exercises that mobilize the entire locomotor system at that age (Živković&Karaleić, 2014). This pointsto the need for children to take part in sports which involve large muscle groups so as to affect the prevention and restoration of postural disorders. It may be assumed that as a result of great exertion of the upper and lower extremities, the development of motor abilities, the involvement a large number of muscles especially of the legs, football can have a positive influence on the restoration of postural disorders. In relation to the aforementioned, the aim of this study is to determine the differences in the prevalence of kyphosis, lordosis and flat feet among younger aged football players and non-athletes.

METHODS

Participants

The sample of participants in this study consisted of 30 young boys who have actively taken part in football for more than two years in the football school "Red Star" from Nis, aged 10 to 12, and 30 boys from the elementary school "Ivan Goran Kovačić" from Niska Banja, of the same age, who did not take part in any sports activities.

Procedure

To evaluate kyphosis and lordosis, the "SpinalMouse" device can be used (Idiag, Fehraltdorf, Switzerland, www.idiag.ch). It belongs to the group of non-invasive measuring instruments used to evaluate the postural status of the spinal column. This instrument has already been used among children of a preschool and school age, as well as the population of students (Jorgić et al., 2015a; Jorgic et al., 2015б, Jorgić et al., 2016). The validity and reliability of this type of measuring of postural disorders were confirmed in various studies (Mannion, Knecht, Balaban, Dvorak, &Grob, 2004; Post &Leferink, 2004). The variables obtained by means of the Spinal Mouse are the following:

1. No postural disorder (BPP);
2. Kyphotic posture (KIFO);
3. Lordotic posture (LORD);
4. Kypholordosis(KILO).

To evaluate the existence of flat feet, we will use the plantographic method, and for analyzing the obtained results of the plantogram, we will use methods of Russian authors (Živković, 2000). Based on the analysis of the plantogram we obtained the following variables:

1. Normal feet (0);
2. Flat feet – Level one (I);
3. Flat feet – Level two(II);
4. Flat feet - Level three(III).

Statistical analysis

The results of the measuring will be represented as numerical values, as well as frequencies (%). In order to determine the statistical significance of the differences in the presence of postural disorders we will use the Chi square test. The data were processed using the statistical program of the IBM Corp. Released 2010. IBM SPSS Statistics for Windows, Version 19.0. Armonk, NY: IBM Corp.

RESULTS

Table 1. The prevalence of postural disorders in the sagittal plane among non-athletes

Non-athletes	Total	BPP	KIFO	LORD	KILO
Number of participants	30	21	4	5	0
%	100	70	13.33	16.67	0

Legend: BPP – no postural disorder, KIFO – kyphotic posture, LORD – lordotic posture, KILO – kypholordosis.

Table 2. The prevalence of postural disorders in the sagittal plane among the young football players

Football players	Total	BPP	KIFO	LORD	KILO
Number of participants	30	26	2	2	0
%	100	86.66	6.67	6.67	0

Legend: BPP – no postural disorder, KIFO – kyphotic posture, LORD – lordotic posture, KILO – kypholordosis.

Table 3. The results of the Chi square test for the difference in the prevalence of postural disorders in the sagittal plane.

Chi square test	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.455	1	.117
Continuity Correction	1.571	1	.210

Table 4. The prevalence of flat feet among young non-athletes

Level of flat feet	0	I	II	III	Total
Number of participants	11	16	1	2	30
%	36.67	53.33	3.33	6.67	100

Legend: 0 – normal foot, I – flat feet – level one, II – flat feet – level two, III – flat feet – level three.

Table 5. The prevalence of flat feet among non-athlete boys

The level of flat feet	0	I	II	III	Total
Number of participants	20	8	2	0	30
%	66.67	26.67	6.66	0	100

Legend: 0 – normal foot, I – flat feet – level one, II – flat feet – level two, III – flat feet – level three.

Table 6. The results of the Chi square test for the difference in the prevalence of the level of flat feet

Chi square test	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5.406	1	**.020**
Continuity Correction	4.271	1	**.039**

Based on the obtained results we can note that 30 % of the boys who are non-athletes have postural disorders on the sagittal plane, of which 13.33% have kyphotic and 16.67% have lordotic posture (table 1).

Among the young football players, 13.34% of them have postural disorders in the sagittal plane, where the same prevalence of the kyphotic and lordotic posture can be found (table 2).The results shown in table 3 indicate that there is no statistically significant change in the prevalence of postural disorders of the spinal column in the sagittal plane between non-athlete boys and football players.

The results in table 4 indicate that in the case of non-athlete boys only 11 of them (36.67%) have normal feet, that is, do not have flat feet, while 16 of them have flat feet of the first level (53.33%), one participant has flat feet of the second level(3.33%) and two have flat feet of the third level(6.67%).

In the case of young football players (table 5.) 20 football players or (66.67%) do not have flat feet, while 33.33% of them have flat feet,while none of them have the third level of flat feet.

The results shown in table 6 indicate that there is a statistically significant greater prevalence of postural disorders among boys who are non-athletes compared to boys who actively play football.

DISCUSSION

Based on the obtained results which indicate the state of the postural status and the extent of the fallen arch, it was determined that physical deformities are present both among boys who have participated in football practice for more than two years, as well as boys who are non-athletes. By studying the percentage of the prevalence of the deformity within each group, we can note a larger number of physical deformities among boys who do not take part in sport.

In the case of the postural disorder of flat feet, the results indicate that 63.33% of non-athletes suffer from some extent of fallen arches, while in the case of football players the prevalence is 33.33%. This difference is also statistically significant and indicates that there is a connection between active participation in football and the prevalence of flat feet among the analyzed group of boys aged 10 to 12. The overall number of children with flat feet for both groups is 48.33%,which is less than in previous studies (Grković, 2016) where the prevalence of flat feet among both groups of participants was 62.5%, as well as in relation to the study of (Radaković et al., 2015) where the percentage of flat feet was 74.4%. In the research of Grković(2016),the participants were basketball players and non-athletes aged 11 to 13, while in the study of Radaković et al.(2015),the participants were football players and non-athletes of an elementary school age. The results of this study are in accordance with the results of the study of Grković(2016),in the sense that among non-athlete boys there is a greater prevalence of flat feet which in the cited research had a value of 68.75%. Dačević&Jovović(2013) also determined a greater percentage of flat feet among non-athlete boys (66.6%) compared to judokas aged 12 to 13. The importance of preserving the normal arch was pointed out in the study of Jankowicz-Szymanska, Mikolajczyk, &Wardzala(2015). The authors determined that judokas aged from 9 to 13 have better balance compared to non-athletes of the same age, where one of the factors for such results is a higher arch among the studied group of judokas compared to non-athletes. One of the possible reasons for why boys who actively take part in football have better arches is the work of leg musclesduring running, constant changes in direction, running on uneven terrain and different surfaces, kicking the ball with the top of the foot, outside or inside part of the foot, which play a role in maintaining normal arches. When implementing exercises among children with flat feet, work is done on strengthening the muscles of short flexors of the toes, which through their contractions lead to the toning of muscles responsible for maintaining the normal arch of the feet, then the strengthening of the long flexors of the toes which are strengthened by using the effect of the lever of strength, with resistance against the distal third of the feet. In addition, it is also a case of strengthening the supinators of the feet which perform the lifting of the internal edges and thus contribute to establishing the normal arch of the feet. Some of these muscles are the m.tibialis anterior etposteriror, m. triceps surae, m. flexor digitorum longus и m. flexor hallucis longus (Živković, 2009). It is precisely most of these muscles that are engaged when running (Chan &Rudins, 1994; Terry &Jewison, 2012), as well as when playing football (Brophy, Backus, Pansy, Lyman, & Williams, 2007).

In the case of differences in the postural status of the spinal column in the sagittal plane also, a great number of non-athlete boys have a greater prevalence of kyphosis and lordosis. Of the overall number of non-athlete boys, 30% of them have postural disorders in the sagittal plane, while among the boys who play football the prevalence of these deformities is 13.34%. The obtained differences in percentages were not statistically significant. The obtained results for the prevalence of postural disorders match the results of obtained by Grković(2016), as well as the results of Radaković et al.(2015) who also did not determine a statistically significant greater difference in terms of the prevalence of postural disorders in the sagittal plane among young football players and non-athletes. Grabara (2012) in his study determined that among the young football players and non-athletes there is no statistically significant difference in the angle of the kyphotic disorder, while in the case of lordosis, a statistically significant difference can be determined among the population aged 11 and 14, while for those aged 12 to 13 no difference was determined. In terms of the prevalence of kyphosis and lordosis among young athletes and non-athletes, there is also no significant difference in the prevalence of these postural disorders according to Grabara&Hadzik(2009). Based on the results of the studies that have been carried out we can assume that football practice and competitions do not have a significant influence on the postural status of the spinal column in the sagittal plane, that is, the prevalence of kyphosis and lordosis. This is supported by the conclusion of Grabara (2012), according to whom there is no connection between sports training and postural status, as well as ofZeyland-Malawka(1989) who stated that sports training is only one of the multiple factors which influence the postural status of the spinal column in the sagittal plane.

CONCLUSION

The results obtained in this study indicate the positive influence of football as a selected sports activity on the maintenance of normal arches and the prevention of the development of the postural disorder of the fallen arch among boys aged from 10 to 12. In order for the assumed positive values of football training in the sense of the correction of flat feet to be implemented in practice, in full, it is necessary to carry out new studies with a greater number of participants, as well as female participants of various ages.

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THE INFLUENCE OF MOTOR SKILLS ON THE RESULTS OF THE HIGH JUMP STRADDLE TECHNIQUE ON A SAMPLE OF ELEMENTARY SCHOOL CHILDREN

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UDC 796.31:012.1

SUMMARY

The aim of this research was to determine the influence of motor skills on the results of the high jump straddle technique among elementary school students. The research was carried out on a sample of 39 sixth-graders by using 12 measuring instruments to evaluate motor skills (3 for the evaluation of power, 3 for the evaluation of speed, 3 for the evaluation of agility and 3 for the evaluation of balance) and the criterion variable – the high jump straddle technique. Based on the obtained results we can conclude that there is a significant influence of the system of motor skills on the results of the high jump straddle technique. By analyzing the individual regression coefficients it was determined that three variables statistically significantly influence the results of the high jump straddle technique – the wide angle seated forward fold and hyperextensions which are used to evaluate agility, as well as the power of the jump which is responsible for power evaluation. This means that students with greater agility and jumping ability will achieve better results for the high jump straddle technique.

Keywords: physical education classes, high jump, straddle technique

INTRODUCTION

Athletic movements such as walking, running, and throwing represent natural forms of movement, and as such make up the basis for any kind of student motor activity. Research results in the field of athletics can be the most realistic means for the evaluation of the development of students' individual abilities, such as: endurance, power and some of their forms. Athletics is the basis of physical education of students in most countries, including ours. (Tončev, 2001)

Being familiar with the anthropometric, motor and functional characteristics of students today is a necessity, since it enables proper dosing and intensification for students during physical education classes, and also can help professionals in this field for the selection of young athletes and for the proper programming of training. (Višnjić, 2007)

The realization of athletics classes in elementary schools takes up approximately 25%, or one quarter of the overall number of physical education classes. These data indicate the great significance which athletics has in the education process, especially in elementary schools, when students acquire habits of movement and learn basic sports-technical content. Through the realization of athletics content, students increase their level of motor skills and develop their bodies proportionally, so that exercises from athletic disciplines are an excellent means for physical education teachers to successfully realize basic in-class tasks. (Stanković, 2006)

The high jump straddle technique is a technique which is no longer used during official competitions, but is included in physical education classes for elementary and high schools, since acquiring the high jump straddle technique is much easier than the Fosbury Flop technique. The reason for this is that this technique consists of fewer technical elements which make up the entire jump.

Current studies related to the high jump straddle technique over the past twenty years have practically been non-existent. The ones which pertained to the high jump generally indicate the high level of the effect of motor skills on the high jump results (Milanović, 1980; Malacko et al., 1990; Gehri, 1998; Stanković, 2006; Ivković, 2008; Milenković, 2009; Radinović & Pavlović, 2013; Stanković et al., 2016)

The aim of this study is to determine the influence of motor skills on the results in the high jump straddle technique among elementary school children.

METHODS

Subjects

The sample of participants in this study consisted of 39 sixth-graders from the "Sveti Sava" Elementary School in Batočina. The average age of the students was 12 years +/- 6 months. All of the students regularly took part in their physical education classes and were not members in any sports club, but a certain number of the students took part in extracurricular activities at school (sports clubs and schools of sport). Their parents gave their consent for the students to participate in the study, which they confirmed to the homeroom teachers at parent-teacher conferences.

The measuring instruments

In this study we used the following tests to evaluate motor skills: to evaluate power we used the counter movement jump (CMJ) by means of the Myo test (Bubanj et al., 2010) with the following parameters: height (HIGH), power (POWER) and force (FORCE); the tests for the evaluation of speed (Đorđević, 1989) included the following: foot tapping (MTAP), the 20m run with a high start (M20V) the 40m run with a high start (M40V); to evaluate agility (Metikoš et al., 1989) the following tests were used: wide angle seated forward fold (PRRAS), forward bend with a resistance band (PRTRA) and hyperextensions (DPRKL); and the tests for the evaluation of balance (Đorđević, 1989) included: the support stand, shoulders parallel to the balance beam (UZSKR), support stand, shoulders perpendicular to the balance beam (POSKR) and support stand on the balance beam, eyes closed (SKRZO).

The criterion variable in the study was the variable of the high jump straddle technique (SKUV).

Statistical analysis

The statistical methods of analyses included:

Descriptive statistics comprised: number of participants (N), mean value (Mean), standard deviation (SD), minimum (Min) and maximum (Max) numerical results, range (Range) and standard error of the mean value (Error). Discriminative measurements were performed by two procedures: Skewness (Skew) pointing to the symmetry of substance layout around the arithmetic mean and Kurtosis (Kurt) designating peakedness or flatness of distribution.

The correlation of predictor and criterion variables (each with each) was shown in the matrix of intercorrelations and cross-correlations.

To determine the influence of the predicting variables on criterion variable, a regression analysis was used. It contains the following parameters: coefficient of correlation (r), coefficient of the partial correlation (Part–r), standardized regression coefficient (Beta), vector of the standardized regression coefficient (t), significance of beta coefficient (p-level), coefficient of the multiple correlations (R) coefficient of the determination (R2), and the level of the significance of regression connection on a multivariate level (p).

Raw data were processed by means of Statistica 10.0 software package. Statistical significance was determined at the level of $p<0.05$.

RESULTS

Table 1. The basic and central and dispersion parameters of the motor skills of the students

Variables	N	Mean	Min	Max	Range	SD	Error	Skew	Kurt
HEIGHT	39	28.28	15.10	39.00	23.90	5.576	0.893	-0.2564	-0.1133
POWER	39	42.10	19.40	84.50	65.10	12.386	1.983	0.9111	2.3058
FORCE	39	28.25	20.90	38.90	18.00	5.143	0.824	0.4482	-0.9999
MTAN	39	30.97	19.00	39.00	20.00	3.801	0.609	-0.9976	2.4692
M20V	39	4.32	3.56	5.27	1.71	0.346	0.055	0.3930	0.4422
M40V	39	8.06	6.34	10.59	4.25	0.997	0.160	0.6419	-0.1380
PRRAS	39	51.12	19.00	69.00	50.00	11.326	1.814	-1.1056	1.0125
PRTRA	39	29.23	15.30	47.00	31.70	5.836	0.934	0.3778	1.3746
DPRKL	39	18.46	0.00	29.00	29.00	6.988	1.119	-0.7024	-0.0041
UZSKR	39	22.45	2.87	60.00	57.13	13.950	2.234	1.0692	0.8261
POSKR	39	7.00	2.01	17.30	15.29	3.771	0.604	1.0232	0.5159
SKRZO	39	7.24	3.13	13.24	10.11	2.449	0.392	0.6570	0.0852
SKUV	39	112.82	80.00	160.00	80.00	15.886	2.544	0.2299	1.1963

By analyzing the data in Table 1, which shows the basic central and dispersion parameters of the motor skills of the students, it can be noted that all the applied tests have good discriminative value, since their standard deviation (SD) is always contained approximately 3 to 5 times within the range (Range). The skewness indicates a normal symmetric distribution of the data around the arithmetic means in almost all the tests, except for the test of the wide angle seated forward fold (PRRAS) with a slight orientation to the left, while a mild orientation to the right was present for the tests of the support stand, shoulders parallel to the balance beam (UZSKR) and support stand, shoulders perpendicular to the balance beam (POSKR). The kurtosis, however, indicates that the results for most of the variables are dispersed (platykurtic distribution of data) except for the power of the jump (POWER) and foot tapping (MTAN) where the distribution of the data is normal (mesokurtic). This can explained by the fact that the measurings were carried out on a sample of participants who were not selected, thus, we are dealing with students who only came in contact with athletics during their physical education classes, and at the same time were in a period of intense growth and development.

Table 2. The intercorrelation matrix of skills and results for the high jump of the students

Variables	HEIGHT	POWER	FORCE	MTAN	M20V	M40V	PRRAS	PRTRA	DPRKL	UZSKR	POSKR	SKRZO	SKUV
HEIGHT	1.00												
POWER	**0.32**	1.00											
FORCE	**0.37**	**0.52**	1.00										
MTAN	**0.45**	0.15	0.11	1.00									
M20V	**-0.58**	-0.08	-0.13	-0.29	1.00								
M40V	**-0.68**	-0.04	-0.20	**-0.41**	**0.81**	1.00							
PRRAS	0.18	0.15	0.27	0.18	0.18	0.08	1.00						
PRTRA	-0.06	-0.03	0.26	-0.29	-0.12	0.03	**-0.44**	1.00					
DPRKL	0.07	0.16	-0.02	**0.36**	0.08	0.05	**0.44**	**-0.50**	1.00				
UZSKR	**0.38**	0.08	0.19	**0.39**	-0.22	-0.28	0.27	-0.16	-0.07	1.00			
POSKR	0.22	0.02	0.27	**0.46**	-0.25	-0.15	0.14	-0.05	0.01	**0.60**	1.00		
SKRZO	0.22	0.29	**0.37**	0.30	0.04	-0.01	0.21	-0.11	0.19	**0.36**	**0.52**	1.00	
SKUV	**0.71**	**0.45**	**0.58**	**0.38**	**-0.42**	**-0.54**	0.29	0.11	-0.11	**0.41**	**0.32**	**0.34**	1.00

The indicated coefficients are at a significance level of $p < 0.05$

By analyzing the data in Table 6, which shows the intercorrelations of motor skills and the criterion variable of the students, we can note that a small number of the coefficients are statistically significant. The highest statistically significant coefficient was determined between the tests of the 20-meter run with a high start (M20V) and the 40 meter run with a high start (M40V), 0.81, which occurred due to the similarity in test performance. The following statistically significant coefficient was determined between the jump height (HEIGHT) and the 40-meter run with a high start (M40V), -0.68, and then for the support stand, shoulders parallel to the balance beam (UZSKR) support stand, shoulders perpendicular to the balance beam (POSKR), 0.60.

By analyzing the correlations between the motor skills and the criterion variable, we can conclude that statistically significant correlation coefficients exist for all the tests for the evaluation of power, speed and balance, while they were not determined for the tests for the evaluation of agility.

Table 3. A regression analysis of the influence of motor skills on the results of the high jump straddle technique among sixth-graders

Varijable	R	Part-R	Beta	Std.Err. of Beta	t(26)	p-level
HEIGHT	**0.7125**	0.3660	0.3101	0.1546	2.0056	0.0554
POWER	**0.4486**	0.3895	0.2823	0.1309	2.1561	**0.0405**
FORCE	**0.5759**	0.0204	0.0161	0.1552	0.1038	0.9181
MTAN	**0.3826**	0.1795	0.1291	0.1387	0.9304	0.3607
M20V	**-0.4218**	0.1165	0.1159	0.1938	0.5980	0.5550
M40V	**-0.5380**	-0.3171	-0.3721	0.2183	-1.7047	0.1002
PRRAS	0.2852	0.4747	0.3731	0.1357	2.7502	**0.0107**
PRTRA	0.1142	0.3124	0.2328	0.1389	1.6769	0.1055
DPRKL	-0.1128	-0.3973	-0.2892	0.1310	-2.2077	**0.0363**
UZSKR	**0.4063**	-0.0463	-0.0319	0.1349	-0.2361	0.8152
POSKR	**0.3180**	0.0986	0.0817	0.1617	0.5051	0.6177
SKRZO	**0.3393**	0.1619	0.1054	0.1259	0.8367	0.4104

R = 0.8786	**R² = 0.7719**	**F(12,26) = 7.3325**	**p < 0.00001**

By analyzing the data in Table 3, which shows the results for the influence of motor skills on the high jump straddle technique among this group of students, we can conclude that there is a statistically significant connection within the system at the multivariate level p<0.00001. This explanation and the high the multiple correlation coefficient R = 0.8786, as well as the determinant coefficient R^2=0.7719, which explains the connection of the entire system of motor skills and the criterion variable with approximately 71%. The remaining 29% of the explanation of the entire variability of the high jump straddle technique can be ascribed to other characteristics and abilities of the students, but which were not taken into consideration (the remaining motor skills, morphological characteristics, etc.), as well as the testing conditions.

By analyzing the individual regression coefficients we can note that three variables affect the results of the high jump straddle technique in a statistically significant manner – the wide angle seated forward fold (PRRAS) with a significance of 0.0107 and hyperextensions (DPRKL) with a significance of 0.0363, which are responsible for the evaluation of agility and the power of the jump (POWER) with a significance of 0.0405, which is responsible for the evaluation of power. The remaining coefficients individually do not have a statistically significant influence on the criterion variable, although it might be noted that the test for jump height (HIGH) was on the very borderline of significance.

DISCUSSION

A statistically significant influence of the set of motor skills on the result of the high jump straddle technique among this group of students was determined at the level of p<0.00001, with a joint variability of approximately 71%. By analyzing the individual regression coefficients it was noted that three variables have a statistically significant influence on the results of the high jump straddle technique – the wide angle seated forward fold and hyperextensions which are responsible for the evaluation of agility and the power of the jump, which is responsible for the evaluation of power. This means that the students with better agility and jumping ability will achieve better results in the high jump straddle technique. This can be explained by the fact that during this phase of development students are able to learn movement habits related to the technique of the high jump better and faster, and that those students who at the same time have better agility and explosive power of the legs achieve better results on the high jump (Milanović, 1980; Malacko et al., 1990; Gehri, 1998; Stanković, 2006; Ivković, 2008; Milenković, 2009; Radinović & Pavlović, 2013). These findings are in accordance with the study of Stanković et al. (2016), where it was determined that a high jumper should have an exceptionally high level of explosive power and speed, a very high level of maximum force of the attempted movements and general power, and a relatively high level of coordination. In addition, he must be in possession of a high level of explosivity of the relative type and flexibility, and what is also important is the presence of good muscle coordination. What is of special importance are both horizontal and vertical speed when performing a jump.

CONCLUSION

The straddle high jump technique is an athletic discipline which is a component of the physical education curriculum for both elementary and high school education, since acquiring this technique is much easier than acquiring the Fosbury Flop high jump technique. Considering that the high jump straddle technique is no longer performed at official competitions, current research related to this technique over the past twenty or so years practically does not exist.

Based on the obtained results in this study, we can conclude that there is a significance influence of the system of motor skills on the results for the high jump straddle technique. An analysis of the regression coefficients determined that three variables have a statistically significant effect on the results of the high jump straddle technique – the wide angle seated forward fold and hyperextensions which are responsible for the evaluation of agility, as well as the power of the jump, which is responsible for the evaluation of power. This means that students with greater agility and jumping ability will achieve better results for the high jump straddle technique.

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ANTHROPOMETRIC AND PHYSICAL TESTS TO 15 YEARS AGE IN TIRANA CITY

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UDC 796.012(496.5)

SUMMARY

The study aim is to determine the validity of body composition and age as direct measurement for physical exercise. In addition these study included the similar approach in both analytical and discussed worked out research the study included descriptive program by scanning method. The sample involves (153) pupils at intermediate level tested by gradient equal distribution then the data collected by body measurement. And the determination of physical fitness these direct measurement of (age) and the fat area measurement by skin fold (Triceps, subscapular, suprayliac.) these measurement were used to calculate the body density, and fat ratio and body weight. The body physical fitness the represented by long jump from stand, 30m running, 10x5m running, walking running 1609 m, push up, from body bent, flexibility Sit Test. The study analyzed statically using mathematical mean, standard deviation, simple correlation coefficient, linear regression multi linear regression, all linear regression the study reveal.

Keywords: physical exercise, pupils, tests, body composition.

PHYSICAL EDUCATION AND SPORT IN THE PEDAGOGICAL FACULTY OF THE “ST. CIRIL AND ST. METHOIUS” UNIVERSITY OF VELIKO TURNOVO, BULGARIA

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UDC 796.012(371.012)

SUMMARY

The Physical Education at the Faculty of Pedagogy in "St. Cyril and St. Methodius" University of Veliko Turnovo is realized in three directions - with the education of students at physical education and sport in the specialty" Pedagogy of Physical Education ", methods of teaching in the rest of pedagogical specialties and training of non-specialists in general physical training and sport. The specialty "Pedagogy of Physical Education" was opened in 1992/1993 academic year on a regular basis and since 2001/2002 academic year- extramural education. Since 2003, a Master's degree "Sports Pedagogy" has been opened, and since 2004 - a PhD educational program.

Keywords: physical education, theory and methods of teaching of the physical education, specialty “Pedagogy of the training of the physical education”, Pedagogical Faculty

INTRODUCTION

The Physical education and sport are presented at the Faculty of Pedagogy on a solid basis. At present, there are five departments: Pedagogy, Physical Education Theory and Methods of teaching, Pre-school Pedagogy, Primary School Pedagogy and Music.

The specialties are 8, in which over 2000 students are taught. They are the following: - Pedagogy of Physical Education; Pre-school and initial pedagogy; Pre-school pedagogy and foreign language; Primary school pedagogy and foreign language; Pedagogy of music education; Social Pedagogy; Pre-school pedagogy and music; Primary school pedagogy and special pedagogy. The existing since 2003 European Thematic Network AEHESIS (Aligning a European Higher Education Structure in Sport Science) is funded by the Erasmus program. The aim is to reach the requirements in sport education and science through thematic meetings and other events. According to E. Mileva (2006), the four areas in which AEHESIS is implemented are: Physical education, Sports training, Sports management, Health and fitness. The Physical Education at the Faculty of Pedagogy at " St. Cyril and St. Methodius " University of Veliko Turnovo is realized in three directions - through the training of students in physical education and sport in the specialty" Pedagogy of Physical Education ", methods of teaching in the other pedagogical specialties and training of non-specialists in general physical training and sport.

The specialty "Pedagogy of Physical Education" was opened in 1992/1993 academic year on a regular basis and since 2001/2002 academic year- extramural education. Since 2003, a master's degree in Sports Pedagogy has been opened. Until 1992 it existed only as "Second specialty in physical education and sport" in the program at "St. Cyril and St. Methodius "University of Veliko Turnovo.

METHODS

The aim of the specialty "Pedagogy of Physical Education" is to provide training in bachelor and master degree for highly qualified teachers at physical education and sport in the educational system of the Republic of Bulgaria. Besides the qualified characteristics "Teacher of Physical Education", the future teachers have the opportunity to receive specialized sports training in a number of sports such as: athletics, gymnastics, sports games, water and winter sports, etc. Medical, humanities and other sciences are also studied, allowing students to become specialists in sports clubs and other out-of-school sport activities (Official Gazette, issue 18 / 13.02.1998).

DISCUSSION

The professional qualification of the future sports teachers allows to carry out their pedagogical activities in the following directions:

1. Teachers at physical education in all types and grades of educational institutions.
2. Leaders of recreational groups (aerobics, fitness, etc.).
3. Sports animators in tourism.

The Department of Physical Education Theory and Methods of teaching (TMPE) in the specialty “Pedagogy of Physical Education” provides training in the Bachelor's and Master's degrees for highly qualified lecturers and researchers in physical education and sports in the educational system of the Republic of Bulgaria. Besides the qualification characteristics "Sports Pedagogue", the future teachers have the opportunity to deepen the knowledge gained in the Bachelor's degree in the field of school sports and recreation. (Annex - Higher Education Act, Article 42, Paragraph 8, Item 3, in conjunction with Article 42, paragraph 5, and Article 6, paragraph 3 of the Ordinance on State Requirements for Higher Education of the Bachelor, Master and Specialist degrees).

The new conditions for the development of physical education and sports - private clubs and colleges, sports centres in hotels and resorts also influence the rise in demand for sports experts.

Since 2004, there has been a teaching in the educational and scientific degree "Doctor" in the scientific specialty "Theory and methods of teaching of physical education and sports training".

There is conformity of the specialty with the requirements of the Higher Education Act and the other normative documents.

The specialty “Pedagogy of Physical Education” was established in 1992 in accordance with the Academic Autonomy Act, which was in force until 1995, and entitles the higher education institutions to determine themselves the specialties in which they are trained. The legality of the specialty has been confirmed also by the Ministry of Education and Science to award places at "St. Cyril and St. Methodius" University of Veliko Turnovo.

“Pedagogy of Physical Education” specialty is included in the nomenclature of the specialties in the "Pedagogy" section, with a Bachelor's and Master's degree and a professional qualification "teacher".

The training contents of the subject corresponds to the Unified State Requirements: a four-year training course with 2400 hours and 240 credits; name of the subjects studied and minimum workload requirements; study of obligatory, optional and facultative subjects. The 60-30-10 ratio that exists between obligatory, optional and facultative disciplines is kept.

The curricula are structured modularly in accordance with Decree № 316 / 01.08.1997 for the adoption of the Ordinance on the Unified State Requirements for Higher Education - additional provision - Art. 1, Art. 2 and Art. 3 (State Gazette No. 63 / 06.08.1997). The grounds on which the opening of the Master’s program "Sports Pedagogy", direction "School Sport and Recreation", is stated above.

The curriculum contents of the Master's program corresponds to the Unified State Requirements - 240 hours after the bachelor program in the same specialty and 60 credits, the name of the disciplines studied, the study of obligatory, optional and facultative subjects and requirements for minimum attendance for them.

At the Pedagogical Faculty in the above-mentioned specialties such as Pre-school and Primary Education, Primary or Pre-school Pedagogy with a foreign language and Primary School Pedagogy with a foreign language, the subject "Methods of teaching of Physical Education" is studied with 45 hours of lectures and 45 hours of exercises.

All subjects except Pedagogy of Physical Education have 75 hours of exercises in their chosen sport.

Insurance of the specialty with academic staff.

Specialty "Pedagogy of Physical Education" is led by Department TMPE, which has the necessary scientific and teaching staff for the purpose of training.

The lecturers in the specialty are selected and appointed in accordance with the legal order - through a competition.

The teaching process is provided mainly by 28 lecturers, who are on main contract at the Faculty of Pedagogy and other faculties of "St. Cyril and St. Methodius ".

University of Veliko Turnovo.

The obligatory courses are provided by 22 habilitated lecturers and by six PhD.

The habilitated lecturers - professors and associate professors provide 98% of lecture courses and 75% of all disciplines at state requirements of 70% for lecture courses.

Mobility and development of the academic staff.

In the period 1999/2016 the academic staff marks a progressive development - 4 professors, 7 lecturers have acquired the academic title "associate professor", 25 PhD students have been assigned to the department, 18 PhDs, 1 Ph.D., 8 - scientific-teaching degree "chief assistant".

Mobility takes place in the following directions:

- 8 our lecturers, who have been teaching in other specialties of VTU;
- 3 of our lecturers, leading lecture courses at other higher schools;
- 14 lecturers from other departments of VTU, conducting educational work in the specialty “Pedagogy of Physical Education”;
- 10 lecturers from other higher education institutions have held lectures in the specialty in the past years;
- International Activities - Conducting of international scientific conferences "Kinesiology", annual scientific conference of the Faculty of Pedagogy with section "Kinesiology". Participation in the European Socrates-Erasmus and Erasmus + programs for the exchange of lecturers and students with the universities of Kato-Renno - Belgium, Ostrava - Czech Republic, Pitesti - Romania, Warsaw, Byala Podlaska and Katowice - Poland, Klaipeda - Lithuania, Daugavpils - Latvia, Antakya - Turkey, Santarem - Portugal, Skopje and Tetovo - Republic of Macedonia, Elbasan - Albania, Nis and Novi Sad – Serbia, etc.
- The Pedagogical Almanac Magazine, edited by the Pedagogical Faculty, has two editions annually and an international editorial board, in which Bulgarian and foreign specialists participate with articles on the problems of Pedagogy, including Sports Pedagogy.

CONCLUSION

In conclusion, we can convince that the education of pedagogical staff in physical education and sports at the Pedagogical Faculty at "St. Cyril and St. Metodius " University of Veliko Turnovo is qualified, compliant with all contemporary requirements and has a future in the European Union in which our country has been a member since 2007.

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PHYSIOLOGICAL LOAD IN 14 YEAR OLD CHILDREN IN PHYSICAL EDUCATION

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UDC 796.012:612

SUMMARY

Insufficient intensity of physical education lessons in schools may be the cause of many health-related problems, and may also play a role in the process of growing obesity of children and youth. Twenty selected boys (mean weight 46 kg/ height 157.2 cm) and twenty girls (mean weight 43 kg/ height 153.4 cm) aged 14 from one school in Tirana were monitored heart rates on minute-by-minute with Polar Garmin ANT (Sensor Sport Heart Rate Monitor) observed for four weeks during all physical education lessons. In Tirana pupils at this stage of education have three 45-minute lessons of physical education a week. The data were analyzed using the ANOVA program. High proportion of moderate to vigorous and vigorous activity experienced in "game play dominated" lessons is higher as compared with "skill practice dominated" lessons. At "invasion game" (lessons such as basketball or football) are more effective in promoting fitness than other types of lessons, which was also proven in own research. Examined in Tirana 14 year old pupils did not have sufficient time of exercising with intensity supporting cardiorespiratory fitness during school lessons of physical education.

Key words: loads of intensity, heart rate, physical education lessons.

SYSTEM OF CAMING EXERCISES FOR PRE-SCHOOL CHILDREN AND PRE-PRIMARY SCHOOL PUPILS IN PRIMARY EDUCATION (THEORETICAL ASPECTS)

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UDC 796.371.3

SUMMARY

The article presents the theoretical aspects of correct speaking education for children in pre-school and pupils in primary education. A system of game exercises has been constructed that includes two main groups: language and communicative speech exercises. The questions of correct speaking training are presented as part of the publishing activity of the Pedagogical Almanac Magazine at the Pedagogical Faculty of Veliko Turnovo University "St. Cyril and St. Methodius ". The exercises for the formation of interpersonal skills are seen as part of the professional and practical training of student pedagogues in the context of an integrated approach.

Keywords: system, game exercises, training, correct speaking, pre-school and initial educational stage, Pedagogical Almanac magazine, pedagogy students.

INTRODUCTION

The interest in correct speaking education in Bulgaria is more than a century old. Due to its decisive role as a regulator for the uniform pronunciation of words and forms in accordance with the norms of the literary language and for achieving the necessary level of the culture of speech, a considerable number of methodological and specialized publications devote considerable attention to the training in correct speaking. One of the authoritative scientific journals in which articles on these issues are published is the Pedagogical Almanac, an edition of the Faculty of Pedagogy at Veliko Tarnovo University "St. Cyril and St. Methodius ". In this sense, the articles, studies, reviews, recommendations of books shared on the pages of the Pedagogical Almanac magazine are extremely useful for students, PhD students, scholars, pedagogical specialists. Modern theoretical concepts, specific didactic technologies, innovative pedagogical practices, research procedures devoted to the culture of speech are promoted from the pages of the journal.

Undoubtedly, the training in correct speaking is decisive for the preparation of the students in the pedagogical specialties, as it is of paramount importance how to educate and train children aged 4 to 10-11, how to develop and perfect their language under the influence of the speech environment in which they live and study. In developing a model for modern correct speaking education, national education strategies such as the National Strategy for Promotion and Improvement of Literacy 2014-2020 and the National Strategy for Development of Physical Education and Sport in the Republic of Bulgaria 2012-2022 are of crucial importance. In view of this, the model of correct speaking training is linked to the contemporary tendencies for the complex and harmonious development of children, which require the search for and application of synergy approaches and technologies in education and training. From this point of view, the exercises in harmony are combined with a child-preferred active motor activity. Mastering the rules of correct speaking is linked to mobile games, which improve the righteous and motor culture of children and pupils.

Pre-school and initial educational childhood education is fundamental to the implementation of the key competences defined by the European Qualifications Framework. Understanding and comprehending basic ethical norms by 4-10 years olds is to a great extent decisive both for their successful training on all subjects for the different educational stages and for the formation of skills that develop the ability of young children and students to serve language in a diverse social and cultural context.

The specificity of the normative norms, the age specificities and the cognitive needs of the 4-10-year-old children, as well as the main purpose of the pre-school and initial educational process in Bulgarian, determine the primary role of **the exercise** as a basic method of formation of interpersonal skills. Game training for correct speaking for these stages is part of a comprehensive system that includes the following parameters: purpose, tasks, learning content, methodological tools, forms and learning tools. Given the limited volume of content, the main purpose of the report is to present theoretically the technology of correct speaking training, commenting on the essence of individual types of exercises. The question of methods and exercises in correct speaking education for grades 1-4 in recent years has been elaborated in a comprehensive and detailed way by Prof. D. Yordanova (see Yordanova, 2013, 2016). An intensive experimentation in compulsory pre-school preparation groups is being carried out on the set-up system of gambling exercises. Students and graduates develop technological options to combine motor activity with the formation of interpersonal skills.

METHODS

In synthesized form, methods and exercises can be represented by a table.

Table 1. Methods and exercises in correct speaking studies in stages 1-4

Methods for knowledge formation	**Methods for forming skills according to students' activities**	**Methods for forming skills according to students' activities**
	Teaching and learning /related to the use of a literary pronunciation, corresponding to the norms passed in the Bulgarian language **-** for awareness of a particular correct speaking peculiarity/	**Communicative and Speaking** /through them various communicative tasks are completed/
1**. Explanation -** to assimilate the correct terms such as correct speech, syllable, unsuccessful syllable, emphasis	**Types of exercises**	**Types of exercises**
2. **Reporting of knowledge -** for the practical introduction of words that contain variable and other legal features	1 **Model exercises and algorithms -** for reception, reproduction, imitation and reflection of linguistic material at phonetic and lexical levels	1. **Working with texts through reading, perception, understanding and reasoning -** to improve the proficiency skills
3. **Monitoring -** auditory, visual, dynamic	2. **Modeling exercises -** to illustrate the sound composition of words that contain the same ethical features; to realize the difference or not between pronunciation and spelling	2. **Situational-speaking** about the application of the learned knowledge in various speech situations
4. **Reproductive talk -** to consolidate the knowledge of the norms of correct speaking	3. **Linguistic analysis** (sound analysis, sound and letter analysis, phonetic analysis, morphematic, morphological, syntactic, correct speaking analysis) - to develop thinking and evaluation of linguistic fact at different linguistic levels in view of a relevant interpersonal relation	3. **Preparation and editing of oral and written texts -** to prevent and correct mistakes in pronouncing

Game exercises are a sort of bridge between exercises for the formation of learning-cognitive and communicative narrative skills. The game enables children and pupils to interact appropriately with each other as well as with the teacher. Game exercises preserve the interest, self-sufficiency, resourcefulness, comprehensiveness and mutual help of 4-10-year-olds in the educational process. These exercises stimulate the activity of children, because through the play, albeit didactic, they improve their correct speaking skills. The main purpose of pre-school and initial correct speaking education is to increase the cognitive activity of children in an accessible and fascinating way by changing the type of exercise by interacting with different mechanisms - mental, speech, motor.

The game exercises through which methodological work on the right is realized can be divided into two subgroups:

1. Game exercises in didactic plan

2. Game exercises according to the language level

The first group differentiates the subgroups of linguistic and ***communicative*** exercises.

Linguistic exercises refer to the exercises in form and algorithms; linguistic analysis; constructive exercises; modeling. Through these exercises knowledge is acquired and skills for literary pronunciation are formed.

The subgroup of communicative exercises includes: situational-speaking; editing texts; reading, perceiving, understanding and comprehending texts.

Through these exercises the students consolidate the acquired knowledge about the norms in their speech activities, including unintentionally and deliberately in different social roles that are close to their interests; listen, read and speak with different texts.

In ***linguistic terms***, in the games for the formation of pre-school and pre-primary education, the group has several groups that are linguistic: phonetical, morphological, syntactical, and text-linguistical:

Phonetic level:

- propedeutics of literary pronunciation at pre-school age;
- speech of vocal and vocal combinations in different positions;
- a spoken word with consensus in different combinations and positions;
- a word of conspiracies;
- a word of speech with regard to the word of accent.

Morphological level:

- practical mastering of basic normative norms for parts of speech at pre-school age;
- correct speaking of prefixes, suffixes and endings;
- correct speaking of nouns;
- correct speaking of adjectives;
- verb correct speaking;
- correct speaking of prosecutions.

Syntax level:

- pre-school intonation propedeutics;
- aphony of phonetic words within the sentence;
- intonation of a communicative sentence;
- intonation of a question mark;
- intonation of exclamation sentence;
- intonation sentence intonation;
- correct speaking of the morphemy clause in nouns when they are the subject of the sentence.

Textualist level:

- targeting attention to hearing perception in pre-school age
- correct pronunciation of text;
- correct text diction;
- correct text intonation.

RESULTS

The division of the subgroups into a linguistic aspect is conditional. Although a particularity is learned at a certain linguistic level for the purpose of learning, the language units are implemented in a complex way. In this sense, the inclusion of texts of different functional styles in the educational process enhances the rightful vigilance and attention of children and young students and helps them to form skills for inadvertent and deliberate differentiation of non-literary and literary expressions. Through listening and subsequently by comparing correct and incorrect forms of correct speaking in texts that are of different functional styles and genres, children's mental activity is enhanced and they acquire skills to control foreign speech. The didactic expectations of this activity are related to the improvement of self-control skills in terms of their own speech.

DISCUSSION

From a methodological point of view, **the conclusion** that the literary pronunciation and the set of rules that establish a unified pronunciation encompass the long-term memory of the children through speech and repetition with the help of language and communicative exercises, which are applied in a certain didactic sequence in view of age specifics.

CONCLUSION

To conclude, game exercises improve the rights of young children and students and socialize them by including them in an age-appropriate way in active communication in regulated and unregulated learning situations. Game tutorial exercises are appropriate for achieving an integrated approach to learning across all subjects, given their versatility in achieving the necessary level of communication culture to form key core competencies. In the perspective, they can be represented in the structure of a dynamic model by constructing a conceptual framework with its structure, interrelations and functioning that we hope will be useful for social and pedagogical practice as well as for pre-school and primary school children age.

The Pedagogical Almanac magazine at the Pedagogical Faculty of the University of Veliko Tarnovo will still meet the standards of modern scientific periodicals, it will participate in significant national and international projects that will provide rich scientific and practical information and will promote shared experience and good practices.

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Sports Medicine and Physiology

PHYSICAL EDUCATION EFFECTS ON THE MOTOR ABILITIES OF ADOLESCENTS WITH MILD INTELLECTUAL DISABILITIES

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UDC 159.9:61

SUMMARY

The aim of this study was to determine the effects of one semester physical education program on the motor abilities of adolescents with mild intellectual disabilities. Participants were 20 adolescents aged 15-20 years (17.16±0.89 years) with mild disturbances in intellectual functioning attending a special school „October 14th" in Nis. The program consisted regular curriculum of physical education for school children and youth with intellectual disabilities prescribed in the Ministry of Education, Science and Technological Development of Republic of Serbia. The motor abilities were tested by 14 tasks of the BOT-2, Short Form (Bruininks-Oseretsky Test of Motor Proficiency). The results indicate that the applied exercise program contributed to the statistically significant increase in total score motor abilities for standardized ($p = .005$) and non-standardized results ($p = .005$). The physical education classes had a positive influence on the motor abilities of young people with mild intellectual disabilities. Additionally, the results can provide useful information in evaluation and monitoring motor abilities in this sensitive population.

Keywords: physical activity, BOT-2, young.

INTRODUCTION

Intellectual disability is characterized by significant limitation in intellectual functioning and adaptive behavior, as reflected in conceptual, social and practical adaptive skills. Disorder usually occurs before 18 years (Buntinx & Schalock, 2010).

The classification system by the American Association of Intellectual and Developmental Disabilities (AAIDD) from 2010 (Winnick, 2010) is multidimensional. It is based on five dimensions of human functioning and the type of support that is necessary to provide a person with intellectual disabilities to enable it to participate in everyday and social life (Schalock, Borthwick-Duffy, Bradley, Buntinx, Coulter, et al., 2010). Five dimensions measured are: intellectual abilities, adaptive behavior, health status, participation (roles and interaction in the areas of housework, work opportunities, education, leisure, spiritual and cultural activities) and the context (relationship in every days life).

People with intellectual disabilities have lower levels of motor skills (physical fitness) at all ages because of sedentary lifestyles, fewer opportunities for physical exercise and the nature of disability (Lotan, Isakov, Kessel, & Merrick, 2004; Frey, Stanish, & Temple, 2008).

The movement presents stimulator of normal growth and development of man. Physical activities carried out through physical education, recreation and sports, play an important role in the life of modern man (Eminović, Čanović, & Nikić, 2011).

For people with disabilities, adaptive physical education presents, primarily, secure forms of physical activity, personal satisfaction, as well as the acquisition of certain experiences related to physical activity (Haegi & Kozub, 2010)

The educational system of children and adolescents with disabilities in Serbia is organized in three different basic ways: special education in special schools for children with disabilities; special education in regular schools which is set up for students with the same type of disability; regular education in the same class with the rest of the students, but without systematic support and adjustment to the special needs of these students. The special schools is more adapted to the needs of children with disabilities than regular schools – in terms of the teachers' education, equipment and applying special methods in working with these students. Physical education classes in special schools is done by specially designed curriculum as the adaptive physical education (Radenkovic, Beric, & Kocic, 2014).

The development and monitoring of students motor abilities are the tasks of physical education, and it is necessary to constantly work on adequate evaluation of the results achieved. Although numerous authors investigated the influence of different exercise programs to intellectually disabled children and adolescents' motor abilities (Ninot, Bilard, & Delignieres, 2005; Young, Browne, & Pearce, 2010; Golubović, Maksimović, Golubović, & Glumbić, 2012; Top, 2015), there is a need to provide more information about effects of regular physical education curriculum on specific develop in this sensitive population. The aim of the present study is to determine the effects of physical education applied in special schools on the motor abilities of adolescents with mild intellectual disabilities using an adequate test. Children and young people with mild disabilities in intellectual functioning are mainly assessed using tests for the population without disabilities. In this study, evaluation of motor abilities was made using a specially adapted test BOT -2.

METHODS

Subjects

The participants comprised a total of 20 high school students- 15 boys and girls (mean age 17.16±0.89 years, height 170.37±12.95 cm, weight 62.79±15.05 kg, BMI 21.48±4.27 kg/m^2) from "14 October" special school in Nis. All of the participants and their parents or guardians gave their written informed consent before participation. The school psychologist recommended a list of students who should be involved in research, in order to balance sample by the level of intellectual disability, which was characterized as mild. Total mean scores for the students' ages, mass, high and body mass index (BMI) are described in Table 1.

Table1. Descriptive statistics for students' general data

	Min	Max	Mean	SD
Age (years)	15.38	18.55	17.16	0.89
Mass (kg)	35.30	91.10	62.79	15.05
High (cm)	149.00	198.00	170.37	12.95
BMI (kg/m^2)	14.90	34.00	21.48	4.27

Procedure

Subjects attended physical education classes at school in winter semester twice a week - regular curriculum of physical education for school children and youth with intellectual disabilities prescribed in the Ministry of Education, Science and Technological Development of Republic of Serbia. During the experimental treatment, subjects were not involved in any additional exercise program, except in physical education classes.

Physical education program was conducted at the sports hall of special school "October 14th" in Nis. Each class lasted 45 minutes and comprised three parts: introductory part – 10 minutes, main part – 30 minutes and the final part - 5 minutes.

Motor abilities was determined by fourteen tasks of Bruininks-Oseretsky Test of Motor Proficiency, Second Edition, Short Form (BOT-2). BOT-2-the Bruininks-Oseretsky Test of Motor Proficiency is a battery of tests for assessing the basic and fine motor skills development. It is used for identifying a person with mild to moderate motor coordination deficit. It is applicable to the age of 4-21 years (Bruininks & Bruininks, 2010).

The tasks were: drawing lines through paths-crooked, folding paper, copying a square, copying a star, transferring pennies, jumping in place-same side synchronized, tapping feet and fingers- same side synchronized, walking forward on a line, standing on one leg on a balance beam-eyes open, one-legged stationary hop, dropping and catching a ball-both hands, dribbling a ball-alternating hands, knee push-ups, sit-ups and total scores (standardized and non-standardized data).

Measurements were made in the sports hall of special school "October 14th" in Nis. Measuring was conducted in accordance with the standards of the 2008 Helsinki Declaration on the Ethical Principles for Medical Research Involving Human Subjects (WMA, 2011).

Statistical analysis

Obtained data were analyzed using statistical package SPSS 20.0. For all the variables obtained during the study, were calculated arithmetic means (Mean) and standard deviation (SD). Due to the small sample size, the Kolmogorov- Smirnov Test (with the significance level set at $p< .01$) was used to assess the normality of data. To determine the difference between initial and final measurements, we used the t-test for dependent samples (Pallant, 2011). The level of significance up to .05 ($p< .05$) is accepted as statistical significance for differences in the results of the variables between the two measurements.

RESULTS

The results of the descriptive statistical analysis for the variables obtained in motor abilities tests for initial and final measurements are presented in Table 2 and 3, respectively. Based on the results for the means, we find that the participants had better results at the final measurements comparing to initial measurements except for variables: FOP (Folding Paper), CST (Copying a Star) and DCB (Dropping and Caching a Ball-Both Hands).

The results for the Kolmogorov - Smirnov test indicated that the most variables have normal distribution. Variables TFPI (Transferring pennies), TOTI (Total score on initial measurement), STAI (Standardized total score on initial measurement), TOTF (Total score on final measurement) and STAF (Standardized total score on final measurement) was not established normal distribution.

Table 2 Descriptive statistics for motor abilities variables at the initial measurement

Variables	Mean	Std. Deviation	K-S (p)
DLPI	5.65	2.41	.000
FOPI	4.05	2.76	.001
CSQI	4.60	1.14	.000
CSTI	2.70	2.30	.000
TFPI	4.80	2.61	.200*
JPSI	1.75	1.37	.001
TFFI	2.20	1.85	.000
WFLI	3.65	0.88	.000
SOLI	2.65	1.53	.001
OSHI	6.05	2.69	.001
DCBI	4.90	0.31	.000
DBAI	4.45	2.01	.019
KPUI	3.45	2.09	.042
STUI	3.40	1.54	.032
TOTI	54.40	16.05	.200*
STAI	32.85	7.92	.200*

Legend: DLPI- drawing lines through paths-crooked initial; FOPI- folding paper initial; CSQI- copying a square initial; CSTI- copying a star initial; TFPI- transferring pennies initial; JPSI- jumping in place-same side synchronized initial; TFFI- tapping feet and fingers- same side synchronized initial; WFLI- walking forward on a line initial; SOLI- standing on one leg on a balance beam-eyes open initial; OSHI- one-legged stationary hop initial; DCBI- dropping and catching a ball-both hands initial; DBAI- dribbling a ball-alternating hands initial; KPUI- knee push-ups initial; STUI- sit-ups initial; TOTI- non-standardized total point initial; STAI- standardized total point initial .

Table 3 Descriptive statistics for motor abilities variables at the final measurement

Variables	Mean	Std. Deviation	K-S (p)
DLPF	5.80	2.31	.000
FOPF	4.05	2.37	.049
CSQF	4.75	0.45	.000
CSTF	1.45	2.06	.000
TFPF	5.80	2.55	.006
JPSF	2.25	1.02	.000
TFFF	2.75	1.41	.012
WFLF	3.95	0.22	.000
SOLF	2.95	1.47	.000
OSHF	6.90	2.69	.001
DCBF	4.80	0.52	.000
DBAF	5.60	1.82	.004
KPUF	4.95	2.04	.007
STUF	4.15	1.57	.025
TOTF	60.15	13.71	.200*
STAF	35.65	7.42	.200*

Legend: DLPF- drawing lines through paths-crooked final; FOPF- folding paper final; CSQF- copying a square final; CSTF- copying a star final; TFPF- transferring pennies final; JPSF- jumping in place-same side synchronized final; TFFF- tapping feet and fingers- same side synchronized final; WFLF- walking forward on a line final; SOLF- standing on one leg on a balance beam-eyes open final; OSHF- one-legged stationary hop final; DCBF- dropping and catching a ball-both hands final; DBAF- dribbling a ball-alternating hands final; KPUF- knee push-ups final; STUF- sit-ups final; TOTF- non-standardized total point final; STAF- standardized total point final .

Table 4 The difference in the results for motor abilities variables between the initial and final measurements (dependent t-test)

Variables	T	df	p
DLPI-DLPF	-.900	19	.379
FOPI-FOPF	.000	19	1.000
CSQI-CSQF	-.513	19	.614
CSTI-CSTF	2.107	19	.049*
TFPI-TFPF	-2.874	19	.010*
JPSI-JPSF	-2.939	19	.008*
TFFI-TFFF	-2.238	19	.037*
WFLI-WFLF	-1.674	19	.110
SOLI-SOLF	-1.031	19	.316
OSHI-OSHF	-1.686	19	.108
DCBI-DCBF	.809	19	.428
DBAI-DBAF	-3.520	19	.002*
KPUI-KPUF	-3.873	19	.001*
STUI-STUF	-1.637	19	.118
TOTI-TOTF	-3.171	19	.005*
STAI-STAF	-3.177	19	.005*

Table 4 presents the results of the t-test for dependent samples between the initial and final measurements.

The results from the last table indicate that there are statistically significant differences between the initial and final measurements in the variables: CSTI-CSTF, TFPI-TFPF, JPSI-JPSF, TFFI-TFFF, DBAI-DBAF, KPUI-KPUF, TOTI-TOTF and STAI-STAF at the significant level $p \leq .05$.

DISCUSSION

The purpose of this study was to determine effects of physical education classes, during the one semester, on motor abilities of mild intellectually disabled adolescents. The results showed significant improvement in non-standardized and standardized total scores, as well as the fine motor integration, manual dexterity, bilateral coordination, upper-limb coordination and arm strength. There are no significant improvement in balance, agility, fine motor precision and trunk strength.

There is little longitudinal research on this subject, although children with mild intellectual disabilities distinctly less involved in extracurricular sports activities. When compared to their typically developing peers, children with intellectual disability participated in fewer Active-Physical and Skill-Based activities and in more Recreational activities (King, Shield, Imms, Blacks, & Ardern, 2013). Physical education classes are often the only form of physical activity that this population is engaged in (Eminovic et al., 2011). Lotan, Henderson, & Marrick (2006) in their research highlights the importance of this form of exercise for adolescents with disabilities. New findings indicate that is an ongoing and increasing tendency for sedentary lifestyles across age groups and gender in many countries. In addition, there are many factors that work together to contribute to a sedentary lifestyle in individuals with intellectual and developmental disability. These findings are concerning, and indicate that people with intellectual disabilities are at relatively high risk for the development of multiple negative consequences of physical inactivity.

Shin & Park (2012) concluded that the most appropriate is to practice three or four times per week for persons with mild intellectual disability. The most effective length of session for exercise is 31–60 min (PE class duration is 45 minutes). This is another indicator of the importance of physical education effective teaching in special schools.

It is necessary to monitor the scientific trends in terms of applying adequate tests battery to determine the motor skills of children and young people with intellectual disabilities. This providing the necessary consistency and facilitate monitoring and comparing the results of different studies (Frey et al., 2008).

Scientists are increasingly concerned with examining the effects of different types of experimental exercise program on the motor skills of children and adolescents with ID in order to provide information to teachers.

The results obtained in this study are consistent with results obtained by the other researchers who have investigated a variety of exercise programs, according to motor abilities total scores results: six month long special designed physical education program (Golubovic et al., 2012); 20-weeks daily home occupational therapy (Wuang, Ho, & Su, 2012); 12-weeks everyday trampoline exercise (Giagozoglou, Kokaridis, Sidiropoulou, Patsiaouras, Karra et al., 2013); four-week basketball program (Radenkovic et al., 2014) and 12-week polygons and ball games program (Stojanovic, 2017).

On the other hand, the10-weeks occupational therapy (Wuang et al., 2012) and 10-weeks swimming program (Top, 2015) did not cause a statistically significant change in the motor abilities total score result in adolescents with mild intellectual disability.

The obtained results should be viewed in the context of detecting strengths and weaknesses of the physical education curriculum required for special schools, in order to work on its improvement.

CONCLUSION

Based on the data obtained it can be concluded that physical education has a positive effects on changes in adolescents with mild intellectual disabilities motor skills. Recommendation for further researches is to provide continuous evaluation of motor abilities promotion in order to ensure the best possible working with this sensitive population.

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PHYSIOLOGICAL, BIOCHEMICAL AND PSYCHOLOGICAL CHARACTERISTICS OF CHESS PLAYERS

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SUMMARY

Chess is a competitive sport in the classical meaning of the word. Because of the specific characteristics of a chess game the pesonality of chess players became the subject of psychological and physiological research. Specific characteristic of chess players are: mental stability, power of concentration, willpower, quality of judgment and mental endurance, while the dominant aspects of intelligence are: memory, visualization, organization and imagination. In chess and in classical sports, the brain, spinal cord, nerves and muscles cooperate in complete harmony. The brain commands everything: in chess the figures, in sport the cellular receptors (baro-, lactate-, gluco-, metabo-,chemo-, thermo-, respiratory-) "send" signals via eyes or metabolic changes to the brain. The brain then decides, what to do: in chess, the player moves a figure; in sports, muscles react according to demand. Research neurovegetative and cardiovascular activity of chess players are showed similarity with the contestants in athletic disciplines. There were established important changes in metabolic energy processes and hormone - biochemical status of chess players, and because of that physiological processes can be comparable with sports disciplines (athletics, tennis, motorcycling). Neurophysiological studies of the brain have shown the existence of specific differences in morphology of gray and white mass, as well as parts of the brain responsible for cognitive functions of chess players. Are these anatomic changes, cause or result of intense and protracted chess activities it will be examined in future studies. Intelligence, character, education and psycho-physical condition of chess players have a positive impact on dealing with chess and contrary, chess have a positively effect on the development characteristic (self-respect through self-realization and self-edification) and cognitive skills (reasoning, deduction, induction). **S**tudying of psychology, physiology and biochemistry chess players should be improve the practice and pedagogy of chess.

Key words: psychology, physiology, biohemistry, chess

INTRODUCTION

Chess is a competitive sport in the classical meaning of the word. Because of the specific characteristics of a chess game the pesonality of chess players became the subject of psychological and physiological research. Specific characteristic of chess players are: mental stability, power of concentration, willpower, quality of judgment and mental endurance, while the dominant aspects of intelligence are: memory, visualization, organization and imagination (Ferguson,1999, Gobet & Charness, 2006, Bilalic,2017). In chess and in classical sports, the brain, spinal cord, nerves and muscles cooperate in complete harmony. Research neurovegetative and cardiovascular activity of chess players are showed similarity with the contestants in athletic disciplines (Golf, 2015). There were established important changes in metabolic energy processes and hormone - biochemical status of chess players, and because of that physiological processes can be comparable with sports disciplines (athletics, tennis, motorcycling). Intelligence, character, education and psycho-physical condition of chess players have a positive impact on dealing with chess and contrary, chess have a positively effect on the development characteristic (self-respect through self-realization and self-edification) and cognitive skills (reasoning, deduction, induction)(Aciego,2012).

Mental processes of cognition usually expected in chess players have been studied in all sport specialities [Ali, 2011). The mental processes include intelligence, expertise, perception, memory, anticipation, attention, mental imaging, judgement and decision making [Bar & Raab, 2006)]. The most important factor for acquiring athletic skill in any sport discipline is the accumulated duration of special training [Dauvergne, 2000). The work analyzes the psychological, physiological and biochemical characteristics of chess players.

Physiology and Biochemistry of Chess

Brain energy sources are glycogen located in brain, liver and muscle and some other organs, and from adipose tissue located outside of the brain. Glycogen stores in brain are small compared to liver and, especially muscles. Brain glycogen turns over rapidly and contributes significantly to normal brain energy metabolism [Golf, 2015)]. Glycogen is located almost entirely in astrocytes, the multitudinous cells in brain, which are distributed throughout the brain and mostly concentrated in fiber bundles and white matter [Hanggi,2012]. The brain is an expensive tissue. Grey brain matter needs double the energy of the rest of the brain because of the high signalling-related energy demand in grey matter [Leone,2012], for which 75% of the energy is necessary. With this level of energy expenditure, brain uses more energy than the human leg muscle during a marathon. Although the human brain contributes only 2% to the body's weight, it accounts for 20% of its resting energy metabolism. Most of the brain's energy is used for signalling processes, particularly Na+ transport. The brain has small energy reserves, and the safety margin between energy that can be generated and energy required for maximum activity is small. The brain commands everything: in chess the figures, in sport the cellular receptors (baro-, lactate-, gluco-, metabo-,chemo-, thermo-, respiratory-) "send" signals via eyes or metabolic changes to the brain. The brain then decides, what to do: in chess, the player moves a figure; in sports, muscles react according to demand (Hänggi,2014). Neurophysiological studies of the brain have shown the existence of specific differences in morphology of gray and white mass, as well as parts of the brain responsible for cognitive functions of chess players. Are these anatomic changes, cause or result of intense and protracted chess activities it will be examined in future studies (Horgan & Morgan, 2010).The supply of energy from glycogen limits the activity of neurons. Since anaerobic energy from glycogen is obtained 100 times faster than aerobic energy, the brain is able to function in competitive chess at maximal performance only through anaerobic glycolysis. When lactate coming from anaerobic glycolysis is exhausted, the brain "talks" to adipose tissue and energy coming from ß-oxidationof fatty acids will be available [Golf,2015]. Three principal energy resources are available to humans for energy-dependent processes such as physical and mental stress situations: Creatine-phosphate and ATP present in cells, glycogen derived from blood glucose present in cells of muscle, liver and brain and some other organs [Hanggi,2012], and fatty acids from adipose tissue. Three principal energy resources are available to humans for energy-dependent processes such as physical and mental stress situations: Creatine-phosphate and ATP present in cells, glycogen derived from blood glucose present in cells of muscle, liver and brain and some other organs, and fatty acids from adipose tissue (Golf, 2015).

The first study of autonomic excitability and metabolic load of high-class chess players during an 18 day tournament was carried out in 1980. It was concluded, that the autonomic excitability and circulatory parameters (heart-rate, HR) during the competition of the chess players were completely comparable to other sportsmen of similar athletic performance. Later studies confirmed these observations on human circulatory parameters [Leone, 2012].

Spirometric analysis is applied in traditional sport, medical diagnosis and therapy [Gobet,2006] and in chess tournaments, where the respiratory exchange ratio is raised (>0.89) at the start of a chess competition and decreases during the game to 0.75, indicating that energy expenditure switched from carbohydrate to lipid oxidation [Golf,2015]. The changes in substrate oxidation are caused by high cognitive demands and bring new insight into adaptations to mental strain.

In chess as well as physical exercise, a series of metabolic, physicochemical and physical signals are on the way in order to move a hand. First of all, the activation pattern of motor cortex neurons does two things--it specifies for the peripheral motor system both what to do and how to do it (Gobet,2006]. The signals move from the brain cortex through the spinal cord to nerves to muscle cells.

Mental profile of professional chess players

Expertise in chess enables the player to perform as an expert in a cognitive domain [Jelovic, 2012], which taps many cognitive processes [Trinchero,2013], that are associated with intelligence, mental speed, spatial abilities, working memory [Barker, 2016], anticipation and transfer [Bart, 2014], perception [Markovic, 2009], motivation [Gobet,2006] attention and recognition [Frydman & Lynn, 2002]. Serious study alone is the strongest predictor of chess skill [Root, 2006]. Chess players at the highest skill level expended about 5000 hours on serious study alone during their first decade of serious chess play. A strong correlation exists between the number of hours, chess players have dedicated to chess and their current rating [Smith,2000]. Unrated players reported more than 8000; rated but untitled players reported close to 12000; Fidemasters reported almost 20000 and the International Masters reported 28000 hours of dedication to chess. Skilled players use their knowledge of chess configurations to recognize plausible moves for limited searching [Liptrap, 1998]. This result suggests that better players have a larger visual field on the chess board from which they can extract chess relationships and the experts are more likely to concentrate on relevant squares on the board [Golf, 2015].

Recently, the role of intelligence in chess was extended and specialized [Bilalic,2007]. Six variables were identified:

• The age entering the chess club
• The number of tournament games
• The emotion expression control
• the numerical intelligence
• The actual age and finally
• The chess-related performance motivation[Golf, 2015].

Mental processes of cognition usually expected in chess players have been studied in all sport specialities. The mental processes include intelligence , expertise, perception, memory , anticipation, attention, mental imaging, judgement and decision making (Bar & Raab,2006).

The benefits of regular, but moderate physical exercise are wellestablished. The American College of Sports Medicine states that physical exercise improves stress responses such as HR, blood pressure and release of stress hormones to physical and mental stress situations. Exercise training is effective in improving physical skills [Thompson,2003], and it is also effective in reducing reactivity to psychological stress in terms of cognitive and somatic anxiety, behavioural anxiety during the anticipation of the stressor, and speed of HR recovery after stress. Specific characteristic of chess players are: mental stability, power of concentration, willpower, quality of judgment and mental endurance, while the dominant aspects of intelligence are: memory, visualization, organization and imagination (Trinchero, 2013). Expert chess players display significantly higher selective intelligence than controls and their playing strength is related to the selective intelligence level. In addition, by using the extended expert–novice paradigm (comparing experts with novices of different intelligence levels) it has been found that both, expertise and intelligence have an impact on the performance in expertise-related tasks [Horgan,1990]. It is presumed, that expertise in chess play does not stand in isolation from selective intelligence. There exists no gender specific intellectual performance in humans for chess playing despite several different opinions. Intelligence, character, education and psycho-physical condition of chess players have a positive impact on dealing with chess and contrary, chess have a positively effect on the development characteristic (self-respect through self-realization and self-edification) and cognitive skills (reasoning, deduction, induction) (Velickovic,2016).

CONCLUSIONS

Competitive chess is equal to classical sport with regard to physical, mental and neuronal activity, effects on conservation and promotion of mental and physical health as well as on professional, educational and recreational human needs. **S**tudying of psychology, physiology and biochemistry chess players should be improve the practice and pedagogy of chess.

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POWER CHANGES IN FEMALE STUDENTS OF ACADEMY OF CRIMINALISTIC AND POLICE STUDIES[1]

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SUMMARY

In order to increase professional efficiency, it is necessary to define educational and training programs for developing general and specific motor abilities, as well as procedures for monitoring of their effects. Repetitive power is manifested in a large number of police tasks and implies an extended time interval in the expression of motor abilities. Explosive power is manifested in strikes, throws, levers, blocks and other self-defense techniques. The aim of the research was directed to determination of changes in different indicators of muscle power in female students of Academy of Criminalistic and Police Studies during all four years of study. The total sample consisted of 218 female participants divided in four groups: 83 students of the 1st (I YR), 53 students of the 2nd (II YR), 50 students of the 3rd (III YR) and 32 students of the 4th year (IV YR) of study. Power was determined by following tests: Push-ups in 10 seconds (PUSH), Pull-ups (PULL), Sit-ups in 30 seconds (SU) and Standing long jump (LJ). The statistically significant differences between students of different years of study were found both, on general and partial levels. It can be concluded that there is no general regularity in the increase of muscle power level between observed groups. A complex set of reasons stimulates motive for targeted way of partial exercise, not practical exercise based on a conscious professional motive.

Keywords: strength, police students, female.

INTRODUCTION

The initial phase of the police officers career represents the selection process, and then the period of professional education. One of the parameters in the police work selection process is testing the level of motor abilities in order to allocate the most capable candidates (Strating et al., 2010). After the selection, it is necessary to further develop and control motor abilities. Their inadequate level may be a limiting factor in the performance of professional duties and could lead to poor productivity, injuries and long-term disability, which results in the loss of human resources and economic costs (Lonsway, 2003).

According to recent researches conducted among police officers, muscular power and general aerobic endurance stand out as dominant physical abilities required for successful realization of professional duties such as chasing suspect on foot, climbing over fences, jumping across ditches or creek beds and wrestling with individuals who resist being subdued (Bonneau and Brown, 1995; Anderson et al., 2001). In order to increase professional efficiency, it is necessary to define educational and training programs for developing general and specific motor abilities, as well as procedures for monitoring of their effects (Dopsaj et al., 2002; Blagojević et al., 2006).

One of the segments in the education of the Academy of Criminalistic and Police Studies (ACPS) students is the subjects of Specialized physical education (SPE) aimed at achieving certain levels of general and specific motor abilities. Defining SPE educational and training process derives from the need to transform the student's motor abilities, with the aim of their development in accordance with the requirements for employees at the Ministry of Internal Affairs (Blagojević, 1996; Dopsaj et al., 2002). The specificity of professional duties requires that police officers, compared to the average citizen population, must have a higher level of the motor abilities. One of the ways to ensure the necessary motor abilities level is a criterion for the ACPS enrollment, and the realization of norms that are defined in accordance with the projected needs of effective coping with SPE subject. The enrollment

[1]This paper is the result of the research on project: "Management of police organization in preventing and mitigating threats to security in the Republic of Serbia", which is financed and carried out by the Academy of Criminalistic and Police Studies, Belgrade - the cycle of scientific projects 2015-2019.

criteria provides an initial applicant motor abilities level above the 33.33 percentile (‰) in relation to the average Republic of Serbia (RS) civil population. The standards for the basic-motor abilities assessment in the SPE subjects predict that after graduation, each evaluated motor ability is on a minimum level of 66.66‰ of the RS average civil population distribution, as the standard of the future professional working environment.

Repetitive power represents the ability to realize successive fast and powerful movements during the creatine phosphate energy phase, carried out in the zone of maximum and sub-maximal intensity (Dopsaj et al., 2002). As the ability to perform consecutive muscular contractions with maximum speed intensity, i.e. the strength and amplitude of the movement within a defined time interval, repetitive power is one of the characteristics that statistically significant describe the specific motor space (Dopsaj et al., 2002). Repetitive power is manifested by a great number of police tasks during interventions, which demands a longer time frame for the demonstration of physical abilities (Arvey et al., 1992).

Explosive power is defined by the dependence of strength and muscle shortening velocity, and as such can be described as the ability of muscles to move as fast as possible, with or without added resistance (Blagojević, 2003; Zatsiorsky and Kraemer, 2006). Explosive power is manifested in strikes, throws, levers, blocks and other self-defense techniques and as such, is one of the prerequisites for the effective functioning of the police during the use of force. It is important for the successful implementation of planned techniques on SPE subjects (Milošević et al., 2001; Blagojević et al., 2006), and correlate with the speed of execution of specific police motor activity in handling and use of firearm weapons (Blagojević et al., 2006; Vučković et al., 2011). The aim of the research was directed to determination of changes in different indicators of muscle power in female students of ACPS during all four years of study.

METHODS

Participants

The total sample consisted of 218 female participants divided in four groups: 83 students of the 1st (I YR), 53 students of the 2nd (II YR), 50 students of the 3rd (III YR) and 32 students of the 4th year (IV YR) of study. Basic anthropometric measures per group were as follows: body height (BH) = 169.25 ± 4.55cm, body weight (BW) = 62.91 ± 6.77kg and body mass index (BMI) = 21.59 ± 2.06kg/m^2 for the I YR, BH = 168.80 ± 5.46cm, BW = 63.38 ± 7.59kg and BMI = 22.22 ± 2.25 kg/m^2 for the II YR, BH = 169.84 ± 5.87cm, BW = 62.53 ± 6.60kg and BMI = 21.74 ± 2.19 kg/m^2 for the III YR and BH = 169.47 ± 5.60cm, BW = 61.37 ± 7.34kg and BMI = 21.36 ± 2.20 kg/m^2 for the IV YR. The research was conducted in accordance with the terms of "Declaration of Helsinki for recommendations guiding physicians and biomedical research involving human subjects" - (http://www.cirp.org/library/ethics/helsinki/), as well as with the permission of the Ethics Committee of the Faculty of sport and physical education, University of Belgrade.

Procedure

All tests were performed in the Laboratory for assessing the basic physical abilities within the subjects of SPE at ACPS in Belgrade. The testing of physical abilities was preceded by a standard 10-min running warm-up and 10-min active stretching. Following a detailed explanation and qualified demonstration of each test, all respondents performed one practice trial followed by two consecutive experimental trials and the best result was used for further analysis. The rest periods between the consecutive trials and between two consecutive tests were 2 and 15 min, respectively. Repetitive power of arms extensors was estimated with test of the maximum number of push-ups performed in a time interval of 10 seconds (PUSH), the number of correctly performed push-ups was evaluated (Kolarević et al., 2014). Repetitive power of arms flexors was estimated with test of the maximum number of pull-ups (PULL), the number of correctly performed pull-ups was evaluated (Dopsaj et al., 2010). Repetitive power of abdominal flexors was estimated as the number of sit-ups, in a time interval of 30 seconds (SU), the number of correctly performed sit-ups was evaluated (Dopsaj et al., 2010; Kolarević et al., 2014). Explosive power of leg extensors was assess by a standing long jump test (LJ), the length of the jump was measured in cm, and the measurement accuracy was 1 cm (Dopsaj et al., 2010; Dimitrijević et al., 2014).

Statistical analysis

All data were analyzed using the descriptive statistics to calculate the basic parameters of central tendency: arithmetic mean (MEAN), standard deviation (SD), coefficient of variation (cV%), minimum (Min) and maximum (Max) values. The existence of a general difference of variability between the groups was determined by multivariate analysis of variance (MANOVA), while for the determination of partial difference between pairs of variables the Bonferroni post-hoc test was used.

Statistical significance was defined at 95% probability, i.e., at $p < 0.05$ level (Hair et al., 1998). All statistical analysis was done by the application of software package SPSS Statistics 17.0.

RESULTS

The results of descriptive indicators for all groups of ACPS student are shown in Table 1.

Table 1. Results of descriptive statistics

Variable	MEAN	SD	cV%	Min	Max
I YR					
PUSH	4.06	2.97	72.68	0	12
PULL	0.13	0.49	366.13	0	3
SU	20.89	2.45	11.65	14	27
LJ	168.19	19.69	11.64	130	244
II YR					
PUSH	6.98	2.52	36.03	0	13
PULL	2.02	1.75	86.61	0	8
SU	23.51	3.38	14.39	17	34
LJ	180.75	19.84	10.98	130	228
III YR					
PUSH	7.70	1.59	20.70	5	11
PULL	1.64	2.01	122.42	0	10
SU	24.66	2.12	8.58	21	29
LJ	174.12	14.05	8.07	150	218
IV YR					
PUSH	7.28	1.71	23.46	3	11
PULL	1.63	1.95	119.81	0	8
SU	25.25	2.41	9.54	19	29
LJ	180.28	11.49	6.37	165	210

Table 2. Results of MANOVA

General level						
Effect		Value	F	Hypothesis df	Error df	Sig.
Year of study	Wilks' Lambda	.506	13.690	12.000	558.545	**.000**
Partial level						
Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Year of study	**PUSH**	559.026	3	186.342	31.482	**.000**
	PULL	145.154	3	48.385	20.980	**.000**
	SU	682.286	3	227.429	32.741	**.000**
	LJ	6448.923	3	2149.641	6.967	**.000**

The results of the differences in the indicators of muscular power between groups in a function of years of study are shown in Table 2. The results of the difference are shown in the general and partial level.

Table 3 presents the results of the Bonferroni post-hoc test, showing statistically significant differences of the observed muscular power between groups, defined at 95% probability ($p < 0.05$).

Table 3. Results of Bonferroni post-hoc test

Variable		II YR	III YR	IV YR
PUSH	I YR	**.000***	**.000***	**.000***
	II YR		.812	**.000***
	III YR			1.000
PULL	I YR	**.000***	**.000***	**.000***
	II YR		1.000	1.000
	III YR			1.000
SU	I YR	**.000***	**.000***	**.000***
	II YR		.167	**.021***
	III YR			1.000
LJ	I YR	**.000***	.365	**.007****
	II YR		.340	1.000
	III YR			.737

*$p < 0.05$, ** $p < 0.01$, *** $p < 0.001$*

DISCUSSION

The statistically significant differences between students of different years of study were found both, on general and partial levels (Table 2). Results of Bonfferoni test showed a great number of statistically significant differences between the groups, and especially between I YR and other groups (Table 3). For the I YR group, the difference was not obtained only in the test LJ in relation to the III YR group. The II YR group does not differ in the test of SU in relation to the III YR group, as well as in the tests PUSH, PULL and LJ in relation to III and IV YR groups. There were no statistically significant differences between the observed variables among III and IV YR groups. From the results of descriptive statistics (Table 1) it can be seen that a constant increase in power from I to IV YR exists only for the variable SU. For the variable PUSH, the power level increases from I to III YR, and then decreases in IV YR. For the variable LJ, the power level is lowest in I YR group, the highest in II YR group, then decreases in III YR and again increases in IV YR group. For the variable PULL, the level of power is lowest in I YR, the highest in II YR, and then decreases in III and IV YR groups.

From previously stated, it can be concluded that there is no general trend in power level increasing between the observed groups. These findings could be largely attributable to the concept of the SPE subject and a total fund of teaching classes during studies. In fact, Dimitrijević et al. (2014) found that on the levels of motor abilities expression statistically significant influences the total amount of SPE subjects classes, which were reduced from the initial 1085 on current 180. The first modified SPE curriculum was realized in the period from 2000. until 2006., when the Police Academy started to attend female students, with a total fund of 999 classes. Both, the initial and the modified SPE programs, was implemented during all four years of study while the current SPE program is implemented only in three out of eight semesters: in the summer semester of the first, the winter semester of the second, and finally in the summer semester of the third year of study. Additionally, it should be noted that student have the possibility of partial motor abilities level examination on the SPE colloquium, which gives them possibility to reach the prescribed norms for different motor abilities more times during the year. More specifically, students have the possibility not to meet the standards for all tests at once, but to pass "only what is left" on the next colloquium. It is evident that the current SPE teaching program, with a small number of classes and the long-time gaps, has an undesirable effect on the motor abilities expression, i.e. the period of classes and testing's are not a requirement for the continuous physical workout, why there is no permanent adaptation and stabilization in levels of muscle power.

In general, levels of power are the lowest for all observed variables in I YR group and then increase. From the descriptive and Bonferroni test results, it can be concluded that the IV YR group had significantly higher levels of power compared to I YR for all monitored variables. However, the more complete picture can be obtained if the results of this research are compared with the results of previous studies in similar populations. Specifically, observed for the whole sample and according to the standards of Dopsaj et al. (2010), ACPS students can be classified into the following groups: PUSH – average power level, PULL - under average power level, SU - average power level and LJ - average power level. In relation to research of Vučković (2007), the power levels observed in this study are for the all variables, except for the variable SU, on a lower level compared to female students who have attended SPE classes according to the modified program.

It can be concluded that the current teaching fund on SPE subjects is not sufficient for students to achieve stable state of motor abilities. Therefore, it is necessary to suggest an increase in SPE total fund classes, which would be implemented during all eight semesters of study. This would provide continuous, planned and systematic educational and training impact throughout the whole period of schooling. There is also a need for the implementation of teaching/training programs in swimming, snow skiing, morning exercise, etc., which were an integral parts of initial and modified SPE curriculums, as well as other exercise contents within the obligatory extracurricular activities.

CONCLUSION

The aim of this research was focused on changes in the levels of different indicators of muscle power in ACPS female students during all four years of schooling. The research was conducted on a sample of 218 students divided into four groups. A large number of statistically significant differences, in the general and partial level, was found between groups for all of the observed variables. It can be concluded that the levels of strenght are lowest on the I YR and then increase to the highest years of study, but their level does not meet stabile states. The reasons are various: SPE subjects are implemented in only three out of eight semesters during the four-year study; the current number of SPE teaching classes does not provide continuous, systematic physical activities with the desired intensity and scope of exercises; the actual method of SPE colloquiums allows students the partial examinations with long intervals between testings. The above reasons stimulates motive for targeted way of partial exercise, not practical exercise based on a conscious professional motive.

Based on these results, it can be concluded that there is a need for new researches that will determine the status and trends of changes in other motor abilities of ACPS students during their education. Thus obtained results, can be used for a more detailed analysis of the effectiveness of the current SPE programs. The final goal of further researches should be related to the improvement of educational and training processes in the field of basic motor abilities, as well as the basis for the setting of a long-term strategy for the development and improvement of teaching programs on SPE subjects.

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RAT MODELS IN EXERCISE PHYSIOLOGY RESEARCH: OVERVIEW AND FUTURE DIRECTIONS

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UDC 796.012:612

SUMMARY

The use of rat models in experimental research from the XIX century to this day has provided better understanding of various physiological processes and adaptive mechanisms in acute or chronic exposure to a type of exercise, especially in the cases when studies on humans cannot be done for ethical reasons. Moreover, rat models have been used in experimental work by almost all most important researchers in the field of exercise physiology. In this paper, we shall try to give a historical overview of the research turning points in exercise physiology in which rat models have been used and to present similar research efforts in our laboratories.

Keywords: exercise physiology, rat model, experimental research.

INTRODUCTION

Exercise physiology and physiology of sport are narrowly specialized branches of human physiology. Exercise physiology studies the functioning of human organism as it changes and adapts under the influence of exercise. Physiology of sport applies the knowledge acquired in exercise physiology to the training of athletes in order to improve their achievement. Both of them employ observation and experiments in the follow-up and elucidation of all the functions and phenomena related to exercise, and they thus belong to the group of experimental scientific disciplines (Radovanović, 2015).

Experimental protocols involving the use of animal models have been developed for the purpose of study of the effects of exercise in the situations in which human subjects cannot be used in scientific research because of ethical considerations. Rodents, rats above all, are the most commonly used animal models in scientific research since they share with humans some of the physiological characteristics. Moreover, their small size facilitates their biological reproduction and provides successful survival in the laboratory settings, while their relatively short life span facilitates the observation of age-related phenomena or chronic degenerative diseases (De Angelis, Rodrigues, Zanesco, Oliveira, Evangelista, Coelho Junior, et al., 2017).

In this paper, we shall try to give a historical overview of the research turning points in exercise physiology in which rat models have been used and to present similar research efforts in our laboratories.

HISTORICAL OVERVIEW

Its experimental character and use of animal models marked the onset of exercise physiology in the USA near the end of the XIX century (Buskirk, 1981). William T. Porter (1862–1949), physiologist and editor of the *American Journal of Physiology*, included in the first issue of the journal three papers in the field of exercise physiology in which animal models had been used: “Spontaneous physical activity in rodents and the influence of diet”, “Neural control of muscular movement in dogs” and “Perception of muscular fatigue and physical activity” (Appel, 1987). The original trend continued in the next four issues of the journal with six more published studies in the field of exercise physiology using animal models (McArdle, Katch, Katch, 2010). The beginning of the XX century brought about the first insights into the anaerobic metabolism after a series of *in vivo* experiments on frog muscles performed by Walter M. Fletcher (1873–1933), an

English physiologist (Fletcher, 1907). After that, August Krogh (1874–1949), a Danish physiologist, published his study of the regulation of blood flow in resting and contracting skeletal muscles of the frog (Krogh, 1919), being awarded the Nobel Prize for his work in 1920. Another physiologist and the Nobel Prize winner (in 1922), Archibald V. Hill (1886–1977) used frogs as an animal model in his experimental work (Hill, 1926). Francis G. Benedict (1870–1957) published in 1938 the formula for basal energy expenditure calculation after a series of experiments on different animal models (Benedict, 1938). A series of experiments on rabbits as animal models resulted in milestone discoveries in the field of energy metabolism (Krebs, Salvin, & Johnson, 1938), and Hans A. Krebs (1900–1981) was awarded the Nobel Prize in 1953 for his contribution.

In the second half of the XX century rat models became predominant in the field of exercise physiology. Kennedy and Lehninger (1950) discovered that mitochondria are the place where the oxidation of fatty acids occurs. Subsequently, rat models were used in the experiments resulting in the knowledge of the role of adenosine triphosphate in the skeletal muscle tissue and processes in the nuclei of skeletal muscle cells (Padykula & Gauthier, 1963; Edelman, Edelman, Kniggee & Schwartz, 1965). Furthermore, Charles M. Tipton and John O. Holloszy conducted a series of experiments on rats as an animal model in different studies of the effects of exercise (Tipton, 1965; Holloszy, 1967; Tipton & Sebastian, 1997). During the last two decades of the XX century, rat models were used in a number of studies of the mechanisms of glycogen deposition in the skeletal muscle (Sherman, Plyley, Sharp, Van Handel, McAllister, Fink, & Costill, 1982; Kuipers, Costill, Porter, Fink, & Morse, 1986; Kirwan, Costill, Flynn, Neufer, Fink, & Morse, 1990). Moreover, rat models were used in the studies examining the effects of training on bone tissue and on muscle regeneration (Westerlind, Fluckey, Gordon, Kraemer, Farrell & Turner, 1998; Devor & Faulkner, 1999).

EXPERIMENTAL RESEARCH WITH RAT MODELS IN SERBIA

The beginning of research in the field of exercise physiology and organization of experimental settings with rat models are associated with the work of the physiologist Dragoljub P. Jovanović (1939–2013) at the Faculty of Medicine University of Niš during the 1970s. These series of experiments resulted in a number of successfully defended doctoral dissertations and master's theses, which, regretfully, did not translate into scientific papers to be published in prestigious journals and entered into electronic data bases. After an almost complete shut-down of all experimental research in the last decade of the XX century (as the consequence of social circumstances and poor socioeconomic situation during the decade), after 2000 a new start in the research of exercise physiology on rat models could be witnessed. In addition, the research teams of the University of Niš and the University of Kragujevac started to collaborate directly, which resulted in a series of experimental researches contributing to the current knowledge in the field.

One of our researches showed that higher doses of anabolic steroids had the strongest adverse effect on the function of myocardium and cardiac perfusion (Nikolic, Živkovic, Srejović, Radovanović, Jeremić, Jevdjević, Đurić & Jakovljević, 2016). Before that, it was established that anabolic steroids caused serious damage to the liver, in the nuclei and cytoplasm of hepatocytes (Radovanović, Jovanović, Mihailović, Ranković, Stojiljković & Dimitrov, 2003). Another series of our experiments on rat models provided some new evidence of the beneficial effects of moderate intensity training on the redox balance in the systemic and coronary circulation (Stojanović-Tošić, Jakovljević, Živković, Srejović, Valdevit, Radovanović et al., 2015). After that, it was shown that more frequent physical exercise as well, if the intensity was maintained at a moderate level, did not produce adverse effects on cardiodynamic (Stanojević, Jakovljević, Barudžić, Živković, Srejović, Parezanović-Ilić et al., 2016).

DIRECTIONS FOR FUTURE STUDIES

The rat model is undoubtedly the predominant element in experimental research in the area of exercise physiology. The principal advantage of rat model compared to mouse model is a larger quantity of tissue to be sampled and a larger blood volume, allowing for a greater number of analyses. Further, a significant advantage of the rat model in experimental research in the area of exercise physiology and physiology of sport is the fact that such models can be used in extremely controlled environments and settings enabling the isolation of selected variables responsible for organ or organ-system functioning, which is not possible with human subjects. In such experimental protocols low sample sizes are sufficient for reliable research results (Booth, Laye, & Spangenburg, 2010; Goutianos, Tzioura, Kyparos, Paschalis, Margaritelis, Veskoukis, et al., 2015).

The use of rat models in experimental research from the XIX century to this day has provided better understanding of various physiological processes and adaptive mechanisms in acute or chronic exposure to a type of exercise, especially in the cases when studies on humans cannot be done for ethical reasons. Rat models have been used in experimental work by almost all most important researchers in the field of exercise physiology. Future experimental research should be designed to compare directly human with rat model responses during acute or chronic exposure to a type of physical exercise, with different examined variables and sampling sites.

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SPORT AS A PROTECTIVE OR RISK FACTOR IN ALCOHOL AND TOBACCO PRODUCTS CONSUMPTION

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UDC 796.615.015.6

SUMMARY

The aim of the study was to establish differences in alcohol consumption among the athletes and the non-athletes, as well as to explore the situation in Croatian within the global context. A questionnaire on alcohol consumption habits (Alcohol Use Disorders Identification Test - AUDIT) was given to a sample of 80 subjects (50 athletes and 30 non-athletes). The questionnaire was reliable for both groups (Cronbach's alpha 0.73 for the athletes group; Cronbach's alpha 0.70 for the non-athletes group). Anamnestic data and the data on tobacco products consumption habits were also collected. The results showed that the athletes consume alcohol more than the non-athletes (almost significant statistical difference, p=0.08). Such trends have been registered before in the world, in particular among the athletes. Thus, the athletes represent a target group on which programmes for decreasing alcohol consumption are carried out. Similar programmes should be carried out in Croatian, as well, in order to monitor the issue. On the contrary, sport stands as a protective factor from the smoking consumption. The athletes consume significantly less tobacco products than the non-athletes (p=0.02). To conclude, the study reveals alcohol consumption problemme among the athletes and, as such, should be dealt with in an appropriate and immediate way following the examples of other countries that have been dealing with the same problemme successfully.

Keywords: substance, health, non-athletes

INTRODUCTION

There are many perceptions on the issue of sport as a protective factor regarding alcohol consumption. While some studies see sport as a protective factor regarding alcohol consumption (Straus and Bacon, 1953), others see no correlation between the two (Kopp et. al., 2015a). Even more, latest studies report on perceiving alcohol as a risk factor (Hildebrand et. al., 2001; Lisha and Sussman, 2010; Turrisi et. al., 2006). Generally speaking, the higher one advances in sport achievement, the more often he consumes alcohol (Leichliter et. al., 1998).

Since various sample group classifications (athlete/non-athlete, recreation/heavier physical activity, team/individual sport) are present in the aforementioned studies, it is very difficult to compare them (Lipowski et. al. 2016). Nevertheless the diversity in group classification can influence the result. Namely, subsamples, in general, are: athletes/non-athletes (Martens, Dams-O'Connor, & Beck, 2006); recreational sport, i.e. high intensity physical activity (Cych, Kosendiak, Kalwa, & Kosendiak, 2013); team or individual sports (Martens, Watson, Poynald, & Beck. 2005); age groups (Diehl, Thiel, Zipfel, Mayer, & Schneider, 2014); gender groups (Lipowski, Lipowska, Jochimek, & Krokosz, 2016); high and low intensity sport (Baumert, Henderson, & Thompson, 1998); various ethnic groups (Green, Uryasz, Petr, & Bray, 2001; Martens et. al., 2006); athlete's sociological status, commonly whether an athlete or a team leader.

Furthermore, there are neither studies that report on a sample evolved in sport out of fun or 'love' for the game, nor studies that report on a sample forced to do sport. In other words, pupils have PE classes at schools, police officers do sport in order to maintain their physical readiness, and figherfighters need to be in shape so as to answer their duty etc. In addition, all the aforementioned groups have to fulfill certain physical criterion together with permanent motor and ability testing (Adams et. al., 2014; Fielitz, Coelho, Horne, & Brechue, 2016; Knapik & East, 2014).

For centuries, people have been making alcohol drinks in many different ways from many different substances (grapes, rice, honey, etc.). Today, unfortunately, alcohol consumption has become an urgent matter of concern not only among adults but among the youth population as well. Consequently, alcohol addiction has become an alarming issue within medical and public health spheres. Many factors influence it – genetics, psychological, cultural and other – and the frequency of its consumption varies (more common among the female than among the male). Since the roots of alcohol consumption are neurophysiologic, they can cause damage to the whole human organ system. Problemmes caused by the alcohol consumption appear prior to clinical results. Most often alcohol addicts die due to cardio-nervous diseases. Additionally, alcohol consumption can be found within the workplace domain where it causes many alcohol-related negative health problems: from decreases in productivity and various injuries. Developing strategies and educational programmes would help prevent and reduce alcohol consumption problemmmes.

The aim of the study is to establish differences in alcohol consumption among athletes and non-athletes, as well as to explore whether the 'trend' in drinking is present only in Croatia or in global context as well.

METHODS

Subjects

The sample consisted of 80 subjects (all male). For the purpose of the study, we divided the sample into two subcategories: the athletes (n=50) and the non-athletes (n=30). In addition, the sample consisted of senior athletes competitors (age ≥18) from different individual and team sports, as well as of the non-athletes of the same age. In order to choose the non-athletes, we used the random sample method, while in choosing the athletes we were guided by three criteria. The first criterion was that they compete; the second criterion was that they have, at least, five years experience in training; the third criterion was that they train at least five times a week. The questionnaire was subject to their own will. Time length was 10 minutes.

Procedure

The variable sample consisted of two variables: alcohol consumption score (measure by the AUDIT test) and smoking (tobacco products consumption). In order to confirm their athlete status, the subject had to answer several anamnestic questions: age, sport, years of training experience and number of weekly trainings.

We tested the tobacco products consumption among the subjects with one question. The subjects had to circle one particle from 1 to 6 (from 'I have never smoked' to 'I smoke over 20 cigarettes daily) regarding smoking frequency. Alcohol Use Disorders Identification Test (AUDIT) was used in establishing subjects' habits regarding alcohol drinks consumption. The questionnaire is based on the results obtained by the World Health Organization (WHO) used in early detection of heavy alcohol consumption subjects (Saunders & Aasland, 1983). The questionnaire has fulfilled the reliability criterion in many prior studies on the issue (Bell & Britton, 2015; Lundin, Hallgren, Balliu, & Forsell, 2015; Yee, Adlan, Rashid, Habil, & Kamali, 2015). The questionnaire consisted of 10 particles and the obtained result of each particle varies from 0 to 40 (0 being the minimum score the subject can obtain; 40 being the maximum score the subject can obtain). We also used several categories regarding subjects' results. With one group we tested consumption score, i.e. the addiction score (Sekulić, Ostojić, Ostojić, Hajdarević, & Ostojić, 2012); two categories that refer to heavy consumption score ≥11 and light consumption score <11 (Claussen & Aasland, 1993); five categories (total abstinence- score 0, low level of drinking, score 1-7, risky drinking, score 8-15, heavy drinking, score 16-19, and alcohol addiction, score 20-40) (Luchters et. al., 2011). The first option regarding consumption score, i.e. the addiction score was used.

Statistical analysis

All the data were analyzed using Statistics v. 7.0. (Statsoft, USA). The Inter-Item Correlation and the Cronbach's alpha coefficient were calculated. All variables were analyzed using descriptive statistics (mean, standard deviation, minimum and maximum score). The KS Test was used to determine normality distribution, while the ANOVA and the non-parametric Mann-Whitney U test were used to determine differences among groups.

RESULTS

Table 1 shows parametric reliability of the questionnaire (Cronbach's alpha and average Inter-Item correlation)

	Cronbach's alpha	Average Inter-Item correlation
All groups	0,73	0,24
Athletes	0,73	0,23
Non - athletes	0,70	0,25

As shown in Table 1, ADUIT questionnaire fulfills the reliability criterion on the tested sample although low Cronbach's alpha, in all groups, is above 0.70 that results to be acceptable value (DeVellis, 2016).

Table 2 shows descriptive statistics parameters: mean, standard deviation, minimum and maximum score for all the variables

	Athletes(n=50)		Non-athletes(n=30)		ANOVA		MWU-test	
	AS ± SD	MIN / MAX	AS ± SD	MIN / MAX	F	p	U	P
Age	22.4 ± 4.5*	16.0 / 38.0	25.5 ± 3.7	18.0 / 30.0	9,7	0.02		
Years of training experience	11.3 ± 4.9	5.0 / 26.0	±	/				
Weekly trainings	7.1 ± 2.7	5.0 / 12.0	±	/				
Smoking	1.5 ± 0.9**	1.0 / 4.0	5.0 ± 1.6	1.0 / 5.0			327.0	<0.001
AUDIT	17.5 ± 4.9	9.0 / 26.0	15.6 ± 3.9	11.0 / 26.0	3.2	0.08		

Table 2 shows that the non-athletes are statistically significant older from the athlete group (p=consume more alcohol drinks than the non-athletes but the difference between them is not statistically significant) but is very close to it (p=0.08)); the non-athletes consume statistically significantly more tobacco products than the athletes (p<0.001).

DISCUSSION

If we take into consideration years of training experience and the number of weekly trainings, we notice that the athletes have had 11 years of training experience, in average. Based on the obtained results, we confirm their athlete status. Additionally, all the athletes are younger (age 2.4±4.5) than the non-athletes (25.5±3.7). Saying this, it has been established that age and sex are two variables that influence alcohol consumption (Boyle et. al., 2016; Karam et. al., 2007; Jackson et. al., 2012). Since the study sample consisted of only male subjects, sex did not influence the results.

Additionally, the study reported on the adolescence group as one being the most troubled regarding the alcohol consumption. In other words, interest in alcohol consumption increases around the age 18 onwards and decreases around the age of 25. The non-athletes fall into the alcohol consumption risk group. Despite the age difference between the groups, both groups are part of age-risk group.

Since the athletes drink statistically more than the non-athletes (p<0.08), it puts the sample group within global alcohol consumption trends (Kopp et. at., 2015b, Kroll et. al., 2016). There are two hypotheses that may explain the aforementioned. The first hypothesis relates to rewarding system (dopamine and endogenous opioids). Namely, it has been stated that sports achievements increase the hormone of happiness and that, accordingly, the athletes are used to a certain level of the hormone. In case the level of the hormone drops due to insufficient sports achievement, athletes turn to other available sources that may substitute the hormone; for instance, turn to alcohol consumption. The second hypothesis relates to stress issue (stress-related drinking). As stated, sport tends to be a very stressful activity, whether physical or mental (Geva et. al., 2017). Fatigue trainings, self-denial, pressure, coach's, parent's and public's expectations increase the level of stress among the athletes. Accordingly, athletes consume alcohol in order to deal with accumulated stress easier. Earlier hypothesis channeled sport into protective factors regarding alcohol consumption. The results of this study proof the opposite. Not only is sport not a protective factor, but it is rather a risk factor. Some countries have developed strategies (for instance, organized round tables, discussions among athletes and athlete staff etc.) to prevent and reduce alcohol consumption among athletes. We believe it is necessary to raise athletes' awareness regarding all alcohol-related problemmes that may influence their athletic achievement.

The study results have confirmed that non-athletes smoke more than the athletes. In this case, sport stands as a protective factor regarding the tobacco production consumption. Although history tells us there have been athletes who consumed tobacco products, awareness on negative influence of smoking on athlete's fitness proofs the opposite. Smoking influences athlete's respiratory capacity. Thus, we may assume that the athletes relate easier to the bad influence smoking has on their performance rather than to the bad influence alcohol has on their performance. Therefore, we believe further research on the topic should be done within the Croatian context, as well as to establish strategies to reduce alcohol –related problemmes among the athletes.

CONCLUSION

To conclude, the study has indicated that there is statistically significant difference among the athletes and the non-athletes alcohol consumption. Accordingly, the non-athletes tend to smoke more than the athletes. Therefore, we may conclude that alcohol consumption 'trends' in Croatia do follow the same global 'trends' and, as such, require strategy development to prevent and reduce alcohol-related problemmes among athletes.

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THE DIFFERENCES IN THE RELATIVE STRENGTH OF THE HANDGRIP BETWEEN GENDERS

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SUMMARY

The aim of this study was to determine the differences in the grip of the hand between different young and healthy people of different genders. Twenty eight students (n=10 female, n= 18 female) from the Faculty of Sport and Physical Education, with a mean ± SD body mass 61,5±8,7 for female and 80,2±9,8, for male respectively were involved in this study. In the implemented study all of the examinees have declared to be right handed. The measurement of the maximum strength of the hand grip was implemented by a Vernier Hand Dynamometer and Logger Pro data-collection and analysis software for Windows. The following variable were measured, for both hand: hand grip, index finger grip, middle finger grip, ring finger grip and pinky finger grip. Data analyses were performed using statistical package SPSS (v 19.0, SPSS Inc., Chicago, IL). Based on gathered results it is concluded that a statistically significant difference does exists, but only in the Right HandGrip and Right IndexfingerGrip variables, while non-significant differences were observed in other variables.

Keywords: Handgrip, strength, dominant hand, gender.

INTRODUCTION

The hand represents a structure of the distal part of the arm which consists of bone and ligament muscles, nerve and capillary vein structures. This part of the arm is a vital segment of the body during the performance of various coordinated, precise movements, manipulative movements, as well as movement during the act of catching and palpation (Tyldesley & Grieve, 2000; Ilic, 2008). The hand represents the segment of the body, whose function invokes the synchronized functioning of all of its segments, which is under stipulation of the central nerves system that sends electric impulses through the bronchial chord plexus (Boškovic, 2003).

The expression of the maximum muscle strength of the hand presents the parameter which has found its use in various fields throughout the course of the assessment of parameters in medical use: as help in foreseeing complications in the post operational process (Klidjian et al., 1980), in the assessment of the effects of aging (Kerr et al., 2006; Rantanen et al., 1999), as well as in the studies concerning the development of children during the growth process (Sartorio et al., 2002), the level of muscle density (Foo et al., 2007), level of proteins (Windsor & Hill, 1988), but also as insight into social parameters , above all aggression during the adolescence period (Gallup et al., 2010).

Also the maximum muscle force, as a physiologic parameter, is affected by many factors such as gender, age, physical fitness and anthropometric parameters (Dopsaj et al., 2009a; Dopsaj et al., 2009b).

Muscle force expressed with the help of maximum contraction of the flexor of the hand reaches its height during the period between thirty and forty years of age in both males and females, and after that it is in a constant decline until the end of a persons life (Massy-Westropp et al., 2011; Hogrel, 2015).

Maximum muscle strength of the flexor of the hand can be determined with the help of measuring instruments such as different types of dynamometers and systems such as the „ForceMap system" (Dopsaj, Koropanovski, Vučković, Blagojević, Marinković, & Miljuš, 2007; De Beliso et al., 2009; Taekema, Gussekloo, Maier, Westendorp, & de Craen, 2010).

The hand with the help of the flexor muscle is capable of making certain types of grabs such as the cylindrical or the grab of strength, the sphere and hook grab. The power grab apropos the power of motor muscles is the maximum grip of the fingers fixated around a certain object. The expression of the maximum strength of the handgrip (Fmax), which is expressed in Newtons (N), is also affected by the position of the shoulders as well as the upper arm i.e. in the lower end and the position of the joint of the hand which due to the increase of the angle leads to the decrease of the maximum expressed force (Stošljevic et al., 1999; Kattel al., 1996; Hallbeck & McMullin, 1993). Aside from the maximum muscle force, muscle force can also be expressed as explosive muscle, repetitive and combined (Kukolj, 2006; Ivanovic et al., 2010).

METHODS

Subjects

Twenty eight students (n=10 female, n= 18 female) from the Faculty of Sport and Physical Education, with a mean ± SD body mass 61,5±8,7 for female and 80,2±9,8, for male respectively were involved in this study. In the implemented study all of the examinees have declared to be right handed. All the participants have been made aware of the methods of testing and have volunteered to participate in this study. The study was implemented according to the rules of the Helsinki declaration.

Procedure

The measurement of the maximum strength of the handgrip was implemented by a Vernier Hand Dynamometer and Logger Pro data-collection and analysis software for Windows. Maximum values for each attempt in Newtons were loaded from a graph which were then converted into kilograms and adjusted with regards to body mass. The following variable were measured, for both hand: handgrip, index finger grip, middle finger grip, ring finger grip and pinky finger grip.

Statistical analysis

Data analyses were performed using statistical package SPSS (v 19.0, SPSS Inc., Chicago, IL). Mean, standard deviation, minimum and maximum were calculated for each trial of the flexor tests. The normality of the data distribution was checked using the Shapiro-Wilk test of normality, whereas the homogeneity of variance was tested by the Levene´s test. Student's t-test was used to determine the differences between the groups.

RESULTS

Descriptive Statistics for right hand

	RhandG		RindexG		RmiddleG		RringG		RpinkieG	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Male
Valid	18	10	18	10	18	10	18	10	18	10
Mean	53.84	42.30	12.98	9.940	10.94	9.600	7.894	6.640	5.717	4.250
Std. Deviation	7.660	6.723	2.142	1.911	1.873	1.468	2.001	1.512	1.706	0.8436
Minimum	41.90	35.80	8.500	7.600	7.300	6.900	4.600	5.200	3.200	2.700
Maximum	65.20	55.30	16.20	13.70	13.90	11.80	11.80	9.600	8.900	5.600

Descriptive Statistics for left hand

	LhandG		LindexG		LmiddleG		LringG		LpinkieG	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Valid	18	10	18	10	18	10	18	10	18	10
Mean	41.33	34.80	11.93	11.74	10.22	9.380	7.072	6.680	4.844	4.010
Std. Deviation	10.46	8.004	3.236	2.487	2.333	2.211	1.674	0.8011	1.322	1.203
Minimum	23.30	26.30	6.800	6.400	5.700	6.800	4.200	5.900	3.000	2.400
Maximum	61.40	48.30	17.70	14.50	15.10	14.00	10.30	8.500	7.700	6.200

Independent Samples T-Test				
	t	df	p	Mean Difference
LhandG	1.709	26.00	0.099	6.528
LindexfingerG	0.163	26.00	0.871	0.193
LmiddglefingerG	0.932	26.00	0.360	0.842
LringfingerG	0.694	26.00	0.494	0.392
LpinkiefingerG	1.650	26.00	0.111	0.834
RhandG	3.983	26.00	< .001	11.544
RinexfingerG	3.729	26.00	< .001	3.038
RmiddglefingerG	1.955	26.00	0.061	1.344
RringfingerG	1.723	26.00	0.097	1.254
RpinkiefingerG	2.536	26.00	0.018	1.467

DISCUSSION

The aim of this study was to determine the differences in the grip of the hand between different young and healthy people of different genders. Object manipulation is above all a manual ability which is quite present in everyday life. Precise manipulation of a certain objects is not possible if the muscle strength of the hand flexor is not developed. The intensity of control consists of many mechanisms, whose influence is based on visual and somatosensory feedback. (Cole, 2008). The necessary strength of the hand flexor varies from maximum to minimum and adapts itself to the object and the act which is supposed to be done. The assessment of specific abilities of hand flexor is applied in different fields of scientific activity, over and above they have a great influence in predicting functional limitations as well as motor disorders. In the field of anthropometric measurements the characteristics of the strength of the hand flexor correlates with body height, the BMI index, gender, as well as the age of the examinee.

Based on gathered results it is concluded that a statistically significant difference does exists, but only in the DHandR and DIndexfingerR variables , while there are difference in other variables in the strength of the hand flexor they are not statistically significant. With regards to the fact that a person always has one dominant hand, motor asymmetry is present. The dominant hand of healthy adults has a tendency to be fast and precise. (Elliot et al., 1999; Roy et al., 1994). Every examinee whether it be male or female who has taken part in this study has a dominant right hand. The mentioned variables D HandR and D Index finger represent Mean value of the strength the muscle of the hand and the muscle of the index finger of the dominant right hand. Similar results were gathered in the research of the group of authors (Trajkov et al., 2015). They have also confirmed the statistically significant difference in the strength of the hand flexor between the genders. Many reasons that have led to the difference in expressing strength may be body weight, body height, current physical fitness as well as motivation of the examinee. The authors conclude that possible reasons for the lack of statistically significant differences in other variables between the genders might be due to the decreased use of the middle, ring and pinky finger during the process of manipulation of most of the objects.

CONCLUSION

In the available literature the most common information that can be found is that the dominant had is about 10% stronger than the non dominant hand (Petersen et al., 1989; Hager-Ross & Rosblad, 2002; Kljajić et al., 2012) . However in the study done by Ertema and associates (Ertem et al., 2005) it was established that the dominant hand was stronger than the non dominant hand by only 0,31%. Our study has shown that a statistically significant difference in the strength of the hand between genders does exist, but only in the RhandG and RindexG variables which represent the force of the handgrip and the force of the grip of the index finger. The difference in force in other variables between genders does exist and it is in the favor of the male gender, however it is not statistically relevant. This aim of this study was to determine the differences in the relative strength of the handgrip between genders. As for the restriction of the study, the following study should consist of a large number of examinees, of a different age, different abilities and different levels of training as well as a certain number of examinees with a dominant left hand of both genders.

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USE OF NUTRITIONAL SUPPLEMENTS AMONG ALBANIAN PEOPLE EXERCISING IN GYMS AND IMPACT FACTORS

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SUMMARY

To assess suplement use in people who exercise regularly in gyms in city of Tirana, and discuss the factors influencing on this use. This study aims to understand which is the trend in those who practice exercising in gyms, because there is no comprehensive information among albanian people gym participants.

: A total of 103 subjects who exercised in ten gyms in Tirana were part of this cross sectional study. Participants were asked to complete written questionnaires about their reasons and what kind of nutritional supplements they have used. The people asked were over 15 years old; 58 men (56.3%) and 45 women (43.7%). The dependent variable was supplement use and the explanatory variable were motivation of physical exercises, duration, educational attainment self-perception of body weight and self-perception of diet. Most participants 76% had been exercising between 6-9 months. The descriptive statistical has been applied.

The most users of nutritional supplements were 20-29 years old, 27 women and 34 men in this age. Has been observed that in this range of age, 55.2% were men and 62% were women. The majority of men use nutritional supplements rich in protein and aminoacids, aiming the growth of muscular mass and force, while women use nutritional supplements such as proteins, vitamins and minerals of natural origin, aiming mainly weight loss. In our study the majority of individuals who consumed supplements were: young, healthy, who categorized their nutrition as good, exercised three to five times a week, for one to two hours a day and avoid sedentary life and were more men then women 38%: Consequently, we can conclude that the use of supplements was related to individuals who had less need for them

The use of supplements lacks proper professional guidance, being motivated by individual unsatisfied with their low body weight and who perceive workout as intense, which raises the need for monitoring this population. Our results showthat supplement use in gyms is moderate high and is usually self-prescribed. We emphasize that the use of dietary supplements must be done always under the supervision of a specialist.

Key words: Gyms, Education, nutritional supplements

THE ANALYSIS OF ANATOMICAL CHARACTERISTICS OF THE COMMON PERONEAL (FIBULAR) NERVE AND THEIR CONNECTION WITH SPORTS-RELATED KNEE IJURIES

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UDC 616_001.8

SUMMARY

Peroneal palsy is a serious complication of sports- related knee injuries, the most common to football players and skiers. Nearly half of sports-related knee injuries are followed by incomplete or complete injury of the peroneal nerve manifesting with foot drop due to weakness of dorsiflexion muscles of the foot. The most frequently, mechanism for injury is traction of nerve which occurs in cases with knee dislocations, proximal fibula fractures, as well as, injury of the structures of the posterolateral region of knee. The aim of our work was to present anatomical features of the common peroneal nerve, which according to our results and literature data might be responsible for its predisposition to damage in latter cited conditions. Common peroneal nerve is lateral terminal branch of the sciatic nerve. It travels inferolaterally from superior angle of the popliteal fossa to the neck of fibula where it is located in so-called fibular tunnel. There it is superficial, attached to the fibular neck and relatively immobile, divides into superficial and deep peroneal nerve. This is in a immediate proximity to distal attachment of the biceps femoris muscles and the posterolateral region of the knee joint. Fascicular structure of the common peroneal nerve consists of a small number of the larger fasciculi and a small amount of epineurial connective tissue. Segmental blood supply of its popliteal portion often originates from a single superficial blood vessel. It can be concluded that anatomical characteristics, histological structure and pattern of a blood supply, make common peroneal nerve significantly vulnerable to stretch or compression induced injuries, which should be taken into the consideration during the processing of the knee injuries, in order to prevent serious consequences.

Keywords: peroneal nerve, sports injuries, knee, foot drop

INTRODUCTION

Peroneal neuropathy is the most common mononeuropathy of lower extremity which manifests as a functional impairment of either the common peroneal (fibular) nerve (CPN), or its terminal branches (Iwamoto et al., 2016). Clinical signs of the peroneal neuropathy are followed by motoric and the sensitive deficits of the leg. Patient suffers from weakness of the muscles of the anterior and lateral compartment of the leg with consequent difficulties of dorsal flexion and eversion of the foot (foot drop). While walking the patients bend their knees to lift their foot higher than usual to avoid the dragging stepping first on their toes then onto the heel producing in such way a specific noise called “slapping” (slapping gait). In cases with bilateral lesion of the common peroneal nerve “rooster gait” is present.

Peroneal palsy appears in more than 50% of the cases with sports - related knee injuries and this percentage increases (Cho et al., 2011). According to their origin peroneal neuropathies can be traumatic (stretching, contusion or penetrating injuries), compressive, iatrogenic lesions or due to other causes like sudden weight loss, longer squats or longer wearing of the plaster cast. The most common mechanisms of the CPN injuries are stretching and contusion (Van der Bergh et al., 2013). The severity of injury depends on circumstances in which it occurred and on the strength of the active force, varying from the transitory nerve conduction block to incomplete or the complete interruption of the nerve.

The traction (stretching) of the CPN can happen in cases of dislocation of the knee (rotational, external, front, back), proximal fractures of the fibula as well as the injuries of the posterolateral region of the knee (PLR). The structures of the PLR include tendon of the biceps femoris muscle, tendon of the popliteus muscle, external part of the knee joint capsule, collateral fibular, popliteofibular and the arcuate ligament. Traction lesions can accompany dislocations of the lateral compartment of the knee, and are most likely to occur in cases with avulsion of distal attachments of the biceps femoris and the ligaments attached for the fibular head and in some cases a small part of the fibular head. This causes the nerve which is tethered to the bicipital tendon by dense fascia to be pulled proximally (Stranding 2008). Traction injury of the peroneal nerve also happens during forced varus position or hyperextension of the knee joint followed by avulsion of the biceps femoris or other muscles, as well as other ligaments. (Niall et al., 2005; Oshima et al., 2015). The chances for the CPN injuries are higher if the dislocation of the knee is associated with damage of the ligaments (cruciate and colateral ligaments) or fracture of the bones (Cho et al., 2011).

The complete rupture of the nerve is present in cases where dislocation of the knee joint is followed by both rupture of the cruciate ligament and /or structures of the posterolateral region (Niall et al., 2005; Gruber et al., 2005). Opposite to the traction, contusion of the nerve is almost always a consequence of a direct blow that can happen during football or some other contact sport because of the nerve pressured against the fibula. The form and frequency of the peroneal neropathy depends on the sport. Cho et al. (2011) in their extensive research of 84 cases of sport-related knee injuries, concluded that the highest percentage of the peroneal nerve lesion is present in skiers (50%), then football players (27%), soccer (10%), basketball (7%), ice hockey (2%), track (2%) and volleyball (1%) players. They assumed that reasons for an increase of this type of injury in skiers and football players are extreme biomechanical requirements and a higher possibility for a direct blow of the knee. In other sports such as basketball, running and volleyball, the reasons for such injuries can be excessive load of muscles and ligaments, frequent and rapid changes of body position and sometimes sudden movements of the knee.

The peroneal palsy appears in 5-40% of cases with knee dislocation caused by traffic traumatism and sport-related injuries (Niall et al., 2005; Cho et al., 2011; Sánchez et al., 2014; Woodmass et al., 2016). It can be incomplete or complete with a different outcome. Woodmass et al. (2016) stated in their work for those who suffered an incomplete CPN injury to achieve in 87% full motor recovery, in contrast to those suffering a complete CPN palsy with only 38% of the patients to completely recover dorsiflexion against gravity. Peskun et al. (2012) analyzed the risk factors in knee dislocation for the occurrence of the peroneal palsy and its recovery. They found out that significant predictors are gender (more often in men), body mass index (more often in obese) and the presence of fracture of the fibula, while age, the mechanism of the injury and damage of the cruciate ligaments are insignificant factors. Injuries of the tibial nerve as a second terminal branch of the sciatic nerve, also located in the popliteal fossa are cited in only a few cases in the literature. Those cases are almost always presented as a subsequent complication of the common peroneal nerve paralysis (Williams et al., 2009; Reddy et al., 2015).

METHODS

In this mini review, we used available literature data and the results of our studies to evaluate morphological characteristics of the common peroneal nerve which can underpin more often occurrence of the peroneal neuropathy in relation to other peripheral nerves.

RESULTS AND DISCUSSION

Textbook data about anatomy of the tibial and the common peroneal nerve

The tibial nerve is formed by the anterior branches of L4-L5 and S1-S3, and the common peroneal nerve by the anterior branches of L4-L5 and S1-S2 spinal nerves (Stranding 2008; Stefanović et al., 2011). Covered by common epineurial sheath they form the sciatic nerve which leaves the pelvis through the infrapiriform foramen, travels through the gluteal, then posterior femoral region up to the apex of the popliteal fossa where tibial and peroneal split. Terminal division of the sciatic nerve can occur high in the posterior femoral, gluteal region or even inside pelvic cavity (Sunderland 1964). Further, CPN continues to travel inferiorly and laterally form the popliteal fossa apex along the medial side of the distal tendon of the biceps femoris muscle to the head of the fibula. Then it bends forward over the fibular neck piercing the long peroneal muscle and immediately dividing into the superficial and the deep peroneal nerves. The deep peroneal nerve continues to travel anteriorly and inferiorly through the anterior compartment of the leg up to the dorsal region of the foot. Its branches supply the muscles of the anterior compartment of the lower leg and the dorsal side of the foot, as well as the part of the skin of the facing surfaces of the thumb and the second toe. The superficial peroneal nerve travels from the fibular neck down to the lateral compartment of the leg (Stranding 2008). In the inferior half of the leg it pierces the fascia and becomes superficial supplying the skin of the lateral and anterior side of the lower leg, as well as the skin of the dorsum of the foot and lateral three and half toes with its terminal branches. Also, it innervates the long and the short peroneal muscles with its motor branches.

Tibial nerve continues to extends down up to the tendon arch of the soleus muscle, goes underneath and continues through the posterior region of the leg to the medial side of the calcaneus where it divides into its two terminal branches: medial and lateral plantar nerves. Tibial nerve supplies hamstring muscles (semitendinosus muscle, semimembranosus muscle, biceps femoris muscle –long head), part of the adductor magnus muscle, all the muscles of the posterior compartment of the leg (gastrocnemius muscle, popliteus muscle, flexor hallucis longus muscle, flexor digitorum longus muscle and the posterior tibial muscle), while in the plantar region it innervates all muscles. Sensitive fibers of the tibial nerve innervates the major parts of the skin of the posterior crural region and the inferior aspect of the foot and the toes. (Stefanović et al., 2011; Stranding 2008).

A comparative analysis of predisposition factors for the injury of the peroneal and the tibial nerve in the area of the knee

As it is described above, the most common mechanisms that underpin peroneal nerve injuries in the knee are stretching and compression. Some of following CPN anatomical features can explain the posttraumatic occurrence of the peroneal neuropathy.

The superficial position of the peroneal nerve from the apex of the popliteal fossa to the fibular neck makes it more vulnerable to injuries, particularly direct blows (Fig 1a). Tibial nerve is superficially localized in the upper half of the popliteal fossa, posterior to the popliteal artery and the vein. However, unlike peroneal nerve, it travels directly downwards, where it is covered by the lateral and medial head of the gastrocnemius muscle.

Lateral and oblique position of the peroneal part of the sciatic nerve followed by its fixation at the level of the neck of the fibula reduce the capacity for stretching of the nerve. In opposition to the latter, the tibial nerve continues to travel vertically downwards without significant fixation for the structures of the lower leg and the foot ending in the plantar region of the foot. It is considered that the capacity for stretching of the peroneal nerve is reduced because of its direction and its fixation in the area of the neck of the fibula.

Musculoaponeurotic tunnel between the short head of the biceps femoris muscle and the lateral head of the gastrocnemius muscle adds up pressure on the peroneal nerve (Fig 1a). Mostly it is the common peroneal nerve that travels inferiorly from the apex of the popliteal fossa, obliquely and laterally, between the distal end of the biceps femoris tendon and the lateral head of the gastrocnemius muscle, surrounded by the fat tissue as a protective pad. However, in the cases of strain of the attachment of the short (less frequently long) head of the biceps femoris, the muscle tunnel is without fat tissue. Accessory attachments of the biceps femoris for the lateral femoral and tibia condyles, crural fascia, the tendon of the popliteal muscle or the arcuate popliteal ligaments, can also compress the peroneal nerve into the popliteal fossa. (Vieira et al., 2007; Kaplan et al., 2008).

The close proximity of the neck of the fibula and the formation of so called fibular tunnel is mostly concerned as a risk factor for the injury and compression of the peroneal nerve (Van den Bergh et al., 2013). Narrow fibular tunnel is formed by the musculoaponeurotic arch of the long peroneal muscle, the tendon of the soleus muscle and the bone of the neck of the fibula (Fig 1b) (Stranding 2008). In cases with narrow fibular tunnel (forced inversion of the foot, the ossification of the proximal part of the long peroneal muscle, presence of hematomas), compression of the nerves and so called fibular compression syndrome can occur. On the other hand, although seldom, there is a possibility of tibial compression syndrome due to the pressure of the arc of the soleus muscle (Johnson et al., 2008; Reddy et al., 2015). However, the tibial nerve goes underneath soleus muscle arch with the popliteal artery and vein reducing possibility of a direct compression of the arch on the nerve.

It is clear that there are distinct differences between the anatomical features of the peroneal and the tibial nerve. However, they represent only the basic reasons for the common occurrence of the peroneal neuropathy in cases of sport and traumatic injuries of the knee. It is known that the fascicular structure of the nerves affects its biomechanical resistance, too. The common peroneal nerve is of the polifascicular type, so its fascicular group is separated from the fascicular group of the tibial nerve with a connective fatty barrier. In regard to the tibial nerve, the CPN is characterized by a lesser number of larger fascicules and a scarce epineurial sheath. Such fascicular organization reduces the nerves biochemical resistance properties (Baima et al., 2008; Ugrenovic et al., 2014).

Figure 1. Right popliteal fossa, superficial (a) and deep (b) layer; SSM (semimembranosus muscle), STM (semitendinosus muscle), BFM (biceps femoris muscle), TN (tibial nerve), CPN (common peroneal nerve), PV (popliteal vein), SSV (small saphenous vein), GM-MH (gastrocnemius muscle- medial head), GM-LH (gastrocnemius muscle- medial head), PLM (long peroneal muscle), SM (soleus muscle), PM (popliteal muscle), LFL (lateral fibular ligament), LM (lateral meniscus).

The external and internal nerve vascular network is formed by the nerve arteries which are different in number, caliber, length, and the size of the nerve segments which they supply. The sciatic and the tibial nerves are vascularized by a large number of the arteries which come from the arteries such as perforating branches of the fermoral, popliteal, tibial and peroneal arteries. The common peroneal nerve in the popliteal fossa is mostly vascularized by a single arterial vessel, in most of the cases the branch of the popliteal artery from which it travels up to the nerve trunk. (Kadiyala et al., 2005; Ugrenovic et al., 2013). This type of arterial supply makes difficult for the collateral circulation to develop in case of comparison or forced stretching of the nerve. Hematomas may also develop during the damage of the superficially localized blood vessel and that makes the peroneal nerve additionally sensitive to the compression and stretching.

CONCLUSION

Common appearance of the peroneal neuropathy as a complication of the sport related and other injuries of the knee can be explained by its anatomical features, relationships with its adjacent structures, fascicular structure and vascularization. So, the superficial localization in the popliteal fossa, the change of the direction with a significant fixation in the area of the fibular neck, as well as a close relationship with the structures of the posterolateral region of the knee joint make the peroneal nerve significantly sensitive to stretching and contusion. Additionally, a small number of the larger fascicules with a scarce connective tissue sheaths reduce its biochemical resistance. Also, the superficial localization of single nerve artery reduces the possibility for the development of collateral circulation in the popliteal part of the nerve. The peroneal palsy is a severe complication of the knee injury which can lead to serious disability. Health practitioners should be aware that an early diagnosis, the proper assessment of the severity of the injury and a proper therapy can influence a better prognosis.

ACKNOWLEDGMENTS

Contract grant sponsor: Ministry of Science and Technological

Development of Republic of Serbia; Contract grant number: 175092.

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THE IMPACT OF PAIN IN DESIGNING A PROGRAM OF PHYSICAL ACTIVITY WITH OLD ALBANIAN ADULTS.

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UDC 796:616.8-009.7(496.5)

SUMMARY

Activity theory developed by Robert Havighurst supports the maintenance of regular activities, roles and social pursuits and is clear that persons who achieve optimal age are those who stay active. This study evaluates the relationship between the variables of the level and type of physical activity and the degree of pain, with a series of socio-demographic variables, such as age, gender, civil status and occupation.

The final selection of the sample, composed of 62 (35 female and 27 male) participants, with an average age of 62.03 years and an age range between 48 and 72 years from Tirana, Capital of Albania, was made by a sampling technique intended to provide a natural composition with a criterion of inclusion, that is to say, people aged 40 or older. Various measuring instruments were chosen (pain scale and questionnaire) to collect the variables selected.

The results indicated that 30.65% of the participants presented with a moderate degree of pain, the cervical area and knees being the structures most affected. On the other hand, 66.13% of the sample population habitually carried out physical and sporting tasks, with no differences according to gender, but showing differences according to age and occupation. The most common activities were walking (62.34%) and keep fit (37.66%). There was no correlation between physical activity and the degree of pain.

The main conclusions highlight the need to create in our gyms exercise and health protocols and programs with a multidisciplinary approach, adapted to the individual needs of each person and the promotion of the construction of new, modern sporting facilities in urban areas so that people may enjoy better sporting opportunities.

Key words: Old age, pain, physical activity, old people, keep fit.

SOMATOTYPE OF ELITE RHYTHMICS GYMNASTS: A SYSTEMATIC REVIEW

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UDC 796.412:688.751

SUMMARY

The somatotyping method has an essential importance in sports where the body constitution can directly affect the biomechanics of movement as well as the results of performance. Belonging to group of aestethics sports, for rhythmics gymnastics this method is very important. The aim of this study was to systematicly investigate the adequate literature to determine the type of somatotipe of elite rhythmics gymnasts junior and senior categories. Inclusion criteria were studies that were assesing anthropometrics caracteristics of elite rhythmics gymnasts (body height, body weight, body mass, body mass index) , as well as the studies that were determining somatotypes of elite rhythmics gymnasts based on anthropometrics characteristics. Nine studies completed the criteria for inclusion in this systematic review. Based on the results it can be concluded that overwhelming somatotype in rhythmics gymnastics is meso-ectomorph. Further evidence is necessary in order to confirm the results completely.

Keywords: somatotype, anthropometric characteristics, rhythymics gymnastics, elite athletes

INTRODUCTION

Athletes are mostly viewed by combination of body composition - body size components which are believed to have an influence to succeed in any given sport. Therefore, it is suggested that the measurement of kinanthropometry is a very important tool in the search for information that would assist coaches and athletes in their journey to accomplish their goal at the highest level in sport, as well as to identify talent in a specific sport (Sánchez-Muñoz et al., 2012). Literature describes desirable model characteristics of the elite athletes in the form of basic anthropometric dimensions, their interrelations, body composition components, and somatotypes. Many authors find that body size and body build have great influence to performance in many sports, particularly in aesthetic sports (Misigoj-Durakovic, 2012). Within the so-called women's aesthetic sports, rhythmic gymnastics (RG) is one of the most demanding in terms of biomechanics. Anthropometric characteristics, somatotype, body composition and biological maturation characteristics are predictors for success in gymnastic competitions in general, and especially in rhythmic gymnastics (Bakter-Jones & Helms, 1996, Massidda et al., 2013). During the initial stage of talent identification as well as in monitoring of the training process in rhythmic gymnastics many authors find these characteristics very important (Massidda et al., 2013).

By reasrching the adequate literature it is found that there are not many studies that involve elite female gymnasts, especially the researches done on elite rhythmics gymnasts in various stages of their national or international careers (Pool et al., 1969). The available data usually contains somatic profiles (Bester and Coetzee, 2010; Claessens et al., 1991), often in combination with biological maturation (Claessens et al., 1991, 2006; Georgopoulos et al., 2004; Peeters and Claessens, 2012), somatotype (Claessens et al., 1991; Massidda et al., 2013; Thorland et al., 1981) and body composition (Deutz et al., 2000; Theintz et al., 1981, 1989).

Rhythmics gymnastics, in another words called art of body movement, is a sport where the body is primary and determining element to achieve high performance scores within the artistic and tehnical judges panel where we can see that somatotyping method is especially helpful (Claessens et al.,1999). Striving for perfection, tehnical demands in rhythmics gymnastics are very high. The gymnasts's body type could influence the judges's evaluation

(Baxter-Jones et al., 2002) as well as the biomechanics of the technical movements (Ackland et al., 2003).

In general, somatotypes of athletes are quite different from each other and several trends characterizing competitive gymnasts from reference samples are obvious. Whilst ratings in each of the somatotype components may vary from one sample to another, in many studies it was found that the relative dominance of components are constant. Further research shows that the mesomorphy is usually dominant component between female gymnasts, and on the other hand that the ectomorphy is greater than the endomorphy (Carter, Heath, 1990).

The definition of what constitutes an elite athlete is not definied untill today. This depends partly on difference of sports demands (Coutinho et al., 2016), as well as ethnic and cultural specifics. However, studies conducted on elite athletes somehow managed to define their general physical profiles according to both tehnical and biomechanical demands of specific sport. While searhing the data it is found that there is insufficient quantity of data that clearly show differentiations between gymnasts considering different competitive and performance levels. This review's main purpose is to to provide an overview of available data from 1960's to the present to educate researchers and trainers about how to identify rhythmics gymnasts´ body size and shape as well as linking these characteristics to performance.

This paper contributes to the literature by critically reviewing available reports that characterize the body physique of elite gymnasts, identifying possible gaps and hence, providing suggestions for future research. The first section reviews research timelines and the number and origin of the studies, and provides a general view of the available literature. The second section offers a summary of available data, with a critical analysis, as well as an identification of gaps that should be considered in future research.

METHODS

An online search using Scopus, Web of owledge, Pubmed, Ebsco Sportdiscus, and Bon databases was conducted. All of the cited paer works in this systematic review were published in period from january the 1st 1969. until the end of august 2017. The following key words were used to locate studies: rhythmics gymnastics, anthropometric characteristics, somatotype, elite athletes, maturation, body composition and body constitution, as well as their combinations. Inclusion criteria were as follows:

(1) International academic texts that explore the field of rhythmic gymnastics written in Serbian and English language, including literature reviews;

(2)International academic texts having samples solely composed of elite female rhythmics gymnasts, and

(3) International academic texts having anthropometry, somatotype, body composition and biological maturation related data.

Additionally, the following screening steps were taken:

(1) The article title and abstract were read to verify the inclusion criteria were met;

(2) If so, then the full paper was read in its entirety to extract information on the country, author and publication year, sample size, measurement instruments, and main descriptive results.

From a putative number of 110 scientific papers, excluding duplication, following title and abstract screening, our search was narrowed down to 23 scientific papers. From these, 14 were excluded, and only 9 fulfilled all criteria and were retrieved as full-texts.

RESULTS

In this paper the results are presented in two steps. During the first step we addressed the number of available papers as well as their publication years. In second step the main data was reviewed, i.e. body size and other body dimensions, somatotype, body composition and biological maturation. Chronologically, the number of publications increased very little between 1969. and 1999. as well as between 2000. and 2015.; 7 publications were found between 1969. to 1999. and 10 between 2000. to 2015. In the first time period (1969-1999), studies reported data from Olympic, European and World Championships participants, mostly aiming to extensively characterize elite gymnasts (Claessens et al., 1990; Malina et al., 1984; Pool et al., 1969). During the period of time from 2000. to 2015., it was noticed that a small number of articles were carried out on athletes participating in large competitions and therefore it is necessary to investigate this field more.

Basic anthropometric data was found in all 9 articles; 3 had somatotype and anthropometry data. Body composition was presented in 4 articles, whilst biological maturation together with anthropometric data was considered only in 2 papers (Table 1). From the 9 selected papers, 3 of them originated from data collected during international competitions: 1 during the Olympic Games, 2 during World Championships. In the other papers data was collected during the national competitions or in the clubs themselves on the sample of gymnastics of the A level programme. Furthermore, information regarding performance in competition was only present in 5 reports. Studies from the second analyzed period did not consider Olympic or world-class level gymnasts, and they consisted only of research from specific countries. Thus, we are in need of greater sample sizes of Olympic and world-class gymnasts to verify possible trends; furthermore, this novel data will provide new insights into elite gymnasts since the available data are outdated.

Table 1. the origin of the data used in this review article: Sample, origin, age, somatotype, anthropometrics characteristics, body composition

Study	Sample	Origin	Age	Somatotype	Anthropometrics characteristics	Body composition
Di Cagnno et al., (2008)	63	Olimpic games iin Athens	14,6+/-2,3		Stature and sitting height, body mass, hamstring lenght, skinfolds of relaxed and flexed upper arm	BMI Relative body mass
Klentrou et al., (2012)	84	World championship Portimao 2009 and 2010	18,59+/-2,44		Body mass and height, hip, arm, tigh and waits and calf circumferencies, waist/hip ratio	BMI BF LM LBM
Di Cagno et al., (2009)	22	University championship in RG	22+/-4		Stature and sitting height, body mass, thigh length, and skinfolds thickness at three body sites (triceps, subscapula, suprailiac)	BMI SHSR FFM FM
Poliszczuk et al., (2010)	19		8-11	Endomorph Ectomorph Mesomorph	Body height	BMI
Massida et al., (2013)	42	National championship of Italy – level A	13,4+/-2,5	Ectomorph-mesomorph Balanced mesomorph	Stature height, body weight, humerus and femur widths, arm (flexed) and calf girths and the biceps, triceps, subscapular, supraspinale, and medial calf skinfolds	
Purenović-Ivanović et al., (2014)	40	National championship of Serbia – level A	13,04+/-2,79	Endomorph Mesomorph Ectomorph	Body height (in cm), body mass (in kg), four skinfolds (over triceps, subscapular, supraspinale, and calf; in mm), and biceps girth (flexed 90° and tensed; in cm), standing calf girth (in cm), humerus breadth (in cm) and femur breadth (in cm)	
Vicente-Rodriguez et al., (2009)	13					BM FM BMD
Douda et al., (2008)	15		13,41+/-1,62		Height, body mass, arm span, skinfold thickness over the triceps and calf regions, 14 circumferences (shoulder, chest, waist, abdominal, buttocks, proximal thigh, midthigh, distal thigh, calf, ankle, arm, forearm, and wrist), and 8 diameters (biacromial, chest, biliac, bitrochanteric, knee, ankle, elbow, and wrist)	height 152.05 ± 8.38 cm, body mass 37.14 ± 5.74 kg, and body fat 14.01% ± 1.05%

In all papers where the somatotype was examined, it was perceived that the Heat-Carter method was used.

In the three studies that spoke directly about somatotypes, the results are very similar. In the first study, the results indicate that the values of the first endomorphic component (body component), the other mesomorphic component (stockiness) and the third ectomorphic component (slimness) among the gymnastics were 2.65 +/- 1.29, 2.45 +/- 0, 37 and 3.95 +/- 0.64, respectively. Considering the fact that this study compares rhythmic gymnasts and female population of the same age who do not deal with physical activity, it has been concluded that this result in determining somatotype is contributed to early selection as well as the engaging in systematic and planned training procces of rhythmic gymnastics in the regime of A program. In the second study, the results show that the main somatotype in girls engaged in rhythmic gymnastics is ectomorphic-mesomorph. Considering that the tests were performed out on girls aged 9-22, the three sub-groups were made: senior, junior and cadet gymnasts. The controling of differencies between age groups was done by statistical analysis of ANCOVA. The analysis showed that senior gymnasts have grater body mass values than junior and cadet gymnasts, as well as cadet gymnasts had smaller body height and body mass values. A further analysis of these three subgroups suggests that the distribution of results in somatotypes is very similar to the competition category. The mean values between also didnt show any significant difference, so the study showed that the main somatotype was ectomorfic-mesomorph in propotions of 70% for cadet, 50% for junior and 44% for senior group. The following somatotype that accompanies this classification is the mesomorphic-ectomorph in proportion of 13% for cadet, 30% for junior and 22% for senior group. In the third study, on the basis of the analysis of the obtained somatoplots, the authors came to the conclusion that the ectomorphic somatotype prevails in relation to the endomorphic and mesomorphic. It was noted that with the increase in the number of years the values of the endomorphic somatotype increase, while the other two components are observed in the stable distribution. Considering that in this paper research was carried out on 5 age categories, a statistical analysis of ANOVA was made in order to determine the possible differences between them. In addition to age, body height and weight, the discriminatory factor was one of the components of the endomorphic somatotype, and on this basis the authors came to the conclusion that the range of the somatotype components in the rhythmic gymnastics is moderate.

All three somatotypes are shown on somatoplots, while the method by which the data was processed was the Heat and Carter method.

The great majority of authors (Lapiez et al., 1993; Menezes et Filho, 2006; Amigo et al., 2009; Poliszczuk and Brod, 2010; Kuintero et al., 2011) proposed one, the most common somatotype model for rhythmic gymnasts (RG) - a balanced ectomorph - which implies that the ectomorphic component is dominant, and the remaining two have the same prevalence. However, there are other models that should not be ignored, such as mesoectomorph (Lopez-Benedicto et al., 1991; Amigo et al., 2009), mezomorf-ectomorph (Vernetta et al., 2011) as central somatotypes (Kuintero et al., 2011; Vernetta et al., 2011), and even a balanced endomorph (Kuintero et al., 2011).

DISCUSSION

In addition to talent, an adequate body composition is a prerequisite for achieving success in sports. Body structure is largely determined by human genotype, but it is also susceptible to environmental effects within defined limit.

The influence of the training process of every sport influences the biological and physiological functions of the organism of the athlete, and consequently on the formation of a body composition that will contribute to the performances of athletes in competitions. Therefore, there comes to a formation of an athlete's model in every sport discipline. Determination of somatotype is another important heading in the series for a better provision of athletes. The body of elite athletes is characterized by the small values of the diameter of the body composition with very low body weight, with the prevalence of ecto-mesomorphism, low values of fat mass and late maturation. However, there still does not exist a general consensus on whether these characteristics explain competitive performance, and whether they differentiate athletes at different competitive levels.

Rhythmic Gymnastics as one of the disciplines of gymnastics imposes high demands on athletes, both in technical preparation and in the appearance of the body, physical structure and composition, especially elite rhythmic gymnastics.

CONCLUSION

Based on the analyzed literature, we find that most studies indicate that the ecto-mesomorphic somatotype predominates in rhythmic gymnastics, as a combination of three isolated somatotypes: endomorphic, ectomorphic, and mesomorphic. With the increase in the number of years of age, the values of the endomorphic somatotype increase, while the values of the other two components show a stable value.

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THE INCIDENCE OF POOR POSTURE IN PRESCHOOL CHILDERN

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SUMMARY

Postural disorders and spinal deformities are among most common diseases in preschool children ages. Early detection, correct diagnosis, adequate treatment and rehabilitation, prevention, appropriate active routine, all can prevent adverse effects of the postural disorders and spinal deformities and ensure smooth functioning of child organism. In order to determine the incidence of poor posture among preschool children was realized a research on a sample of 80 male children aged 6 and 7. In order to evaluate the state of the postural status of the spinal column in both planes (sagittal and frontal), the device “Spinal Mouse” (IDIAG, Fehraltdorf, Switzerland) was used. The results showed that the percent of postural disorders in preschool children population in Republic of Serbia is very high. Based on the results, in sagittal plane 30,00% boys have thoracic spine bad posture, 26.25% boys have lumbar spine bad posture and 20,00% boys have inclination bad posture. In frontal plane 3,75% boys have thoracic bad posture, 8,75% boys have lumbar spine bad posture and 5,00% boys have inclination bad posture.

Keywords: postural disorders, preschool children, poor posture…

INTRODUCTION

The postural alignment starts its development from early period of life with development of the spine and its curvature. Physical development is correlated with their physical growth regime. Children build their posture by development of movements and by muscles growth. When the body is in correct balance, all its parts, including the internal organs, are held in good position and function normally (Markovska, 2012). Postural disorders and spinal deformities are among most common diseases in preschool children ages.

Early detection, correct diagnosis, adequate treatment and rehabilitation, prevention, appropriate active routine, all can prevent adverse effects of the postural disorders and spinal deformities and ensure smooth functioning of child organism.

Poor posture is a position resulting from any deviation from ideally aligned erect posture (Shimaa, 2012). Poor posture may cause one or more of the following dysfunctions:

1. Defects in bones, joints, muscles;
2. Bad habits: either from early childhood or from occupational positions;
3. Pain, fatigue or bad psychological state;
4. Secondary deformities and compensatory postural defects.

Bad posture puts strain on your body. Bad posture can limit range of movements, cause headaches, muscle aches and joint aches, affect circulation and breathing, and even inhibit your inner organs functioning optimally. You may never have noticed these effects or imagined that you could, or needed to change them (Gibson, 2013).

METHODS

Subjects

The sample consisted of 80 male children aged 6 and 7 (Age=6.30±0.46, Body height=115.77±8.45, Body weight=21.54±5.69). All of the participants were members of the children’s sports school in the City of Belgrade.

Procedure

The X-ray scan is the most objective method for evaluating the postural status, but is not recommended for mass testing purposes, especially in early childhood (particularly for its potential harm to the organism). That is the reason why alternative tests and techniques were used. In this research in order to evaluate the state of the postural status of the spinal column in both planes (sagittal and frontal), we used the device "Spinal Mouse" (IDIAG, Fehraltdorf, Switzerland), a non-invasive method of measuring postural status, along with appropriate software, whose work is based on the technology of ultrasound (Bubanj, S. et al. 2010; Zsidai and Koscis, 2001; Bićanin et al., 2017).

Statistical analysis

The data about level, frequency and structure of postural disorders were processed through basic statistical analysis. The research results are shown in tables, expressed in numbers and percentages. All statistical methods were implemented using software package SPSS for Windows Release 20.0 (Copyright © SPSS Inc., 1989-2011).

RESULTS

The results are shown in Table 1 (the values of measurement in the sagittal plane) and Table 2 (the values of measurement in the frontal plane).

Table 1. The results of measurement in sagittal plane

Sagittal plane	
Thoracic spine Normal (%)	70.00
Thoracic spine Bad Posture (%)	30.00
Lumbar spine Normal (%)	73.75
Lumbar spine Bad Posture (%)	26.25
Incination Normal (%)	80.00
Inclination Bad Posture (%)	20.00

Based on the results the incidence of postural disorders in sagittal plane (Table 1) we have concluded that 30,00% boys have thoracic spine bad posture (kyphotic poor posture); 26,25% boys have lumbar spine bad posture (lordotic poor posture) and 20,00% boys have inclination bad posture.

Table 2. The results of measurement in frontal plane

Frontal plane	
Thoracic spine Normal (%)	96.25
Thoracic spine Bad Posture (%)	3.75
Lumbar spine Normal (%)	91.25
Lumbar spine Bad Posture (%)	8.75
Incination Normal (%)	95.00
Inclination Bad Posture (%)	5.00

Based on the results in frontal plane (Table 2) incidence of scoliotic poor posture is 3,75% boys (thoracic spine bad posture), 8,75% boys (lumbar spine bad posture). Inclination bad posture is represented with 5,00% boys.

DISCUSSION

The percent of postural disorders in preschool children population in Republic of Serbia is very high. Based on the results on whole sample we can conclude that in sagittal plane more than 30% boys have kyphotic poor posture; more than 26% boys have lordotic poor posture; and 20% boys have inclination bad posture. In frontal plane incidence of scoliotic poor posture is 12,50% boys (summary in lumbar and thoracic spine region). Inclination bad posture is represented with 5% in preschoolers in frontal plane.

The postural disorders incidence and their frequency percentage in preschool children significantly varies with different authors, and it depends on samples, age, environment, methodology of disorder detection etc.

According with some investigations of different authors from the field of physical culture (Kosorić, 1983; Tomašević i Gavrilović, 1985; Đorđević i Nikolić, 1987; Dragić, 1987; Dragaš, Živković i Ćirić, 1987, Živković, Milenković, 1996) bad lordotic posture is present among preschoolers within 3-13%, kyphotic bad posture 13-26%, scoliotic bad posture 8-20%. The same authors also adducing 3-

24% of changes on the chests and 31-65% of flat feet. Some of these results suggest that in this age boys are more susceptible on this unwanted posture changes.

The study of Đorđić (2007) analyzed postural status in 1192 children (618 boys and 574 girls) aged 4 to 7 from territory of Vojvodina. In accordion to better age trend analyzing, the whole sample was divided into three subsamples: children aged 4 to 5, 5 to 6 and 6 to 7 years old. The results of postural examination in frontal plane showed that almost 80% of children haven't any of lateral spinal deviation. In 21% of examined children are present scoliosis poor posture and in 0,3% of children exist scoliosis with markedly level of deviation.

Results from longitudinal investigation Basarić et al. (2006) indicate that every third child at East Serbia have bad spine posture before 1st grade of elementary school. They also noticed that the postural disorders have a growing trend and suggesting establishing active influence of physical activity with aim to create balanced musculoskeletal system, which would be preventive action to avoid structural deformities in later period of life.

CONCLUSION

It is obvious that the postural status in Serbian preschool children is harmed more than expected. General conclusion is that poor posture is present in all segments of the spinal column in Serbian preschool children. Determined situation suggest a more serious approach from all the responsible subjects at all levels of society. Postural deformities are not common subject of interest among the researches, especially in preschool children. Bigger interest on this field exists only in the last few years, and it was initiate by increasing level of this phenomenon. Positive can be fact that in last years more and more researches examine these problems on regional level, which gives a more reliable and more complete insight into the real situation. The results of this study will provide an opportunity of their comparing with the results of other researches in this field.

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Team Sports

ANALYSIS OF THE DIFFERENCES BETWEEN THE VOLLEYBALL TEAMS AND VOLLEYBALL PLAYERS BY POSITIONS AT THE OLYMPIC QUALIFICATION TOURNAMENT

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SUMMARY

The research was conducted in eight volleyball teams of the senior Olympic qualification tournament, divided into two groups of four teams. The main goal of the research was to determine whether there are statistically significant differences between groups, volleyball teams of the Olympic Qualifying Tournament and players in the playing positions (shooter, corrector, lift, middle blocker, libero) in basic morphological characteristics (body height, body weight) and situational parameters (smash, block). In order to determine the differences between groups and players in player positions (shooter, corrector, lift, middle blocker, libero) in the basic morphological characteristics (body height, body weight) and situational parameters (smash, block), a series of t- a variance analysis as well as a Tukey test to determine which variables there are statistically significant differences. The results of t-tests show that players of group 1 and group 2 do not statistically significantly differ in body height or in the result of sputum, but a statistically significant difference in body weight and in the result of the block is established. The results of the t-test analysis also indicate that there is no statistically significant difference between the volleyball teams of different play positions in morphological characteristics and situational parameters. However, the results of the variance analysis suggest that players of almost all different playing positions inter differ statistically significantly in morphological characteristics and partly statistically significantly differ in the results of the situational parameters (spam, block).

Key words: morphological characteristics, situational parameters, volleyball, t-test, variance analysis

INTRODUCTION

For the proper and high-quality process of specialization, it is necessary to have complete insight into the anthropological status of young male and female volleyball players (morphological characteristics, motor skills, cognitive abilities, conative abilities, health status, etc.). Marelić et al. (2010) carried out a study with the aim of determining the anthropological profile of players aged 15 – 18, and at the same time analyzed the differences between beginners and players of the same age who had participated in the training process for at least three years. Achieving maximum results requires that a player aspire to an “elite anthropological model” of player positions in volleyball (Janković, 2009). Đurković et al. (2012) carried out a study with the aim of determining the differences in the morphological characteristics of premiere league volleyball players based on their playing positions, and their results confirm the hypothesis that there are significant differences in morphological characteristics between volleyball players of various playing positions. By analyzing the parameters which make up the content of the game volleyball, they attempted to determine the parameters or groups of parameters which lead to a qualitative difference between the winning team and the losing team (Eom H. J, et al. 1992; Marelić, N et al. 2004; Palo, J. M. et al. 2006). In this study, the data were collected from eight teams of senior volleyball players, all members of the national teams which participated in the Olympic Qualification Tournament, with the aim of determining any statistically significant differences between two groups of national teams and their players in various playing positions (outside hitter, opposite hitter, setter, middle blocker, libero) based on their basic morphological characteristics (body height, body weight) and situational parameters (spike, block).

THE METHOD

The sample of participants

The data were collected during the Olympic Qualification Tournament held in 2014. The sample included 8 volleyball national teams: France, Germany, Russia, Poland, Belgium, Bulgaria, Finland and Serbia. The teams were divided into two groups. The first group (G-1) was made up of the following national teams: France, Germany, Russia and Poland. The second group (G-2) was made up of the following national teams: Belgium, Bulgaria, Finland and Serbia. Group 1 numbered 107 volleyball players, and group 2 numbered 119 volleyball players.

The sample of variables

The sample of variables consisted of variables for the evaluation of morphological characteristics (body height, body weight) and situational parameters (spike, block), based on the playing positions.

Methods of data processing

The data processing was carried out using SPSS, while the methods used during data collection included methods of analysis and description. The following basic descriptive parameters were calculated: arithmetic means, standard deviation, minimum and maximum value of the results. In order to test the differences between the arithmetic means, we used the t-test and analysis of variance. The student t-test represents one of the most frequently used parametric tests to determine the existence of any statistically significant difference between two arithmetic means, while the analysis of variance was used to determine the differences between several variables. For the post hoc analysis, calculated after the analysis of variance, the Tukey test was used to determine whether there were any statistically significant differences between the variables.

RESULTS AND DISCUSSION

Based on the compiled data, the participants of the Olympic Qualification Tournament were divided into two groups. Group 1 consisted of the players of the national teams of France, Germany, Russia and Poland, while group 2 consisted of the players of the national teams of Belgium, Bulgaria, Finland and Serbia. In order to determine whether there is a statistically significant difference in the morphological characteristics of the volleyball players from the first and second group, based on playing positions, a series of t-tests for dependent samples were calculated. The results are shown in table 1.

Table 1. The results of the t-test for the two groups of participants based on morphological characteristics (body height and body weight)

Group	N	M	SD	t	ss	p	Min	Max
Height G-1	107	198,05	8,28	,257	224	,787	180	218
Height G-2	119	197,79	6,71				183	211
Weight G-1	107	92,15	10,38	2,38	224	,018	64	116
Weight G-2	119	89,24	7,89				71	112

Legend: body height and body weight for group 1, body height and body weight for group 2, N = the number of participants, M = arithmetic means, SD = standard deviation, t = results of the t-test, ss- degrees of freedom, p = statistical significance, Min = minimum value, Max = maximum value

The results of the t-test shown in table 1 indicate that there is no statistically significant difference in the morphological characteristic of body height *(t=,257; p>,05)* calculated for the two groups of volleyball players, that is, that there is no statistically significant difference in the body height of the players from group 1 or from France, Germany, Poland and Russia and the players from group 2 or from Belgium, Bulgaria, Finland and Serbia. However, the results indicate that there is a statistically significant difference the in body weight *(t=2,38; p<,05)* of the players from group 1 consisting of France, Germany, Poland and Russia, and the players from group 2 consisting of Belgium, Bulgaria, Finland and Serbia.

To determine the differences between the two groups of volleyball based on situational parameters (the results for the spike and block), an analysis of the results of the t-test was also carried out. The results of the analysis of the t-test are shown in table 2.

Table 2. The results of the t-test for the two groups of volleyball players based on situational parameters (the spike and block)

Group	N	M	SD	t	ss	p	Min	Max
Spike G-1	107	342,47	16,51	,237	224	,813	243	375
Spike G-2	119	342,03	11,27				313	365
Block G-1	107	325,03	11,36	3,09	224	,002	300	345
Block G-2	119	319,06	16,81				219	350

Legend: body height and body weight for group 1, body height and body weight for group 2, N = the number of participants, M = arithmetic means, SD = standard deviation, t = results of the t-test, ss- degrees of freedom, p = statistical significance, Min = minimum value, Max = maximum value

The results shown in table 2 indicate that there is no statistically significant difference in the results for the situational parameter spike (t=,237, p>,05), but that there is a statistically significant difference between the two groups in terms of the result for the situational parameter block (t=3,09, p<,05). The obtained results indicate that the players from group 1 and group 2 do not differ in a statistically significant manner either in terms of body height or the results of the spike, but that there is a statistically significant difference between them in terms of the results of physical weight and the results of the block, indicating that the players from group 1 achieved statistically significant higher results compared to the players from group 2.

The next step was to calculate the t-test for small independent samples of volleyball players of various playing positions from the two groups of teams based on their morphological characteristics (body height and body weight). The results of the t-tests are shown in tables 3. and 4.

Table 3. The results of the t-test for the two groups of volleyball players of various playing positions based on body height

Group	N	M	SD	t	ss	p	Min	Max
Outside hitter G-1	29	198,48	4,61	1,168	64	,247	192	212
Outside hitter G-2	37	197,03	5,33				183	206
Opposite hitter G-1	17	200,94	4,60	-,006	35	,996	193	207
Opposite hitter G-2	20	200.95	4,85				193	210
Setter G-1	18	191,83	6,75	-1,71	36	,095	180	203
Setter G-2	21	195,14	5,13				185	204
Middle blocker G-1	30	205,40	5,08	1,577	55	,121	198	218
Middle blocker G-2	27	203,41	4,38				194	211
Libero G-1	13	184,92	3,09	-2,149	25	,071	180	190
Libero G-2	14	188,43	5,06				180	196

Legend: body height and body weight for group 1, body height and body weight for group 2, N = the number of participants, M = arithmetic means, SD = standard deviation, t = results of the t-test, ss- degrees of freedom, p = statistical significance, Min = minimum value, Max = maximum value

Table 4. The results of the t- test for the two groups of volleyball players of various playing positions based on body weight

Group	N	M	SD	t	ss	p	Min	Max
Outside hitter G-1	29	91,55	5,96	1,641	64	,106	80	107
Outside hitter G-2	37	88,95	6,73				76	103
Opposite hitter G-1	17	96,88	9,51	1,663	35	,105	84	107
Opposite hitter G-2	20	92,15	7,81				72	105
Setter G-1	18	86,50	8,37	,272	36	,787	72	97
Setter G-2	21	85,86	6,37				75	100
Middle blocker G-1	30	99,47	8,70	2,363	55	,022	77	116
Middle blocker G-2	27	94,63	6,45				83	112
Libero G-1	13	78,23	6,49	-1,003	25	,252	64	85
Libero G-2	14	80,57	5,63				71	90

Legend: The results for body weight for group 1 (France, Germany, Poland and Russia), the body weight of group 2 (Belgium, Bulgaria, Finland and Serbia), N = the number of participants, M = arithmetic means, SD = standard deviation, t = results of the t-test, ss- degrees of freedom, p = statistical significance, Min = minimum value, Max = maximum value

Based on the results shown in table 3. we can see that there is no statistically significant difference in body height between the players from group 1 and group 2, based on playing positions. The result of the difference between the players in the outside hitter position has a value of t= 1,168; p>,05, the difference between the players in the opposite hitter position has a value of t= -,006; p>,05, the difference between the players in the setter position has a value of t= - 1,7; p>,05, the difference between the players in the middle blocker position has a value of t= 1,577; p>,05, and finally, the difference between the players in the libero position has a value of t= -2,149; p>,05. These results indicate that the playing positions of opposite hitter, setters and libero players of group 2 did not score statistically significant higher results than the players from group 1, while for the remaining two playing positions the situation was reverse.

Based on the results shown in table 4. we can see that there is no statistically significant difference in the weight between the players from group 1 and group 2, based on playing positions, with the exception of the position of the middle blocker. Thus the result for the difference between the players in the outside hitter position has a value of *t= 1,641; p>,05*, the difference between the players in the opposite hitter position has a value of *t= 1,663; p>,05*, the difference between the players in the setter position has a value of *t= ,272; p>,05*, the difference between the players in the middle blocker position has a value of *t= 2,636; p<,05,* and finally the difference between the players in the libero position has a value of *t=-1,003; p>,05.* These results indicate that the players group 1 do not differ in a statistically significant manner from the players of group 2 based on playing positions, with the exception of the players in the middle blocker position where a statistically significant difference was determined in favor of group 1. In addition to the aforementioned t-test, an analysis of variance was used to evaluate whether the players in various playing positions differ amongst themselves in terms of weight and height. The obtained results are shown in tables 5 and 6.

Table 5 The results of the analysis of variance between the players in various playing positions based on body height

Scales	Variable of comparison	F
Outside hitter height in kg	opposite hitter	-3,29*
	setter	4,05*
	middle blocker	-6,79*
	libero	10,93*
Opposite hitter height in kg	opposite hitter	3,29*
	setter	7,33*
	middle blocker	-3,51*
	libero	14,21*
Setter height in kg	opposite hitter	-4,05*
	setter	-7,33*
	middle blocker	-10,84*
	libero	6,88*
Middle blocker height in kg	opposite hitter	6,79*
	setter	3,51*
	middle blocker	10,84*
	libero	17,72*
Libero height in kg	opposite hitter	-10,93*
	setter	-14,21*
	middle blocker	-6,88*
	libero	-17,72*

Legend: Playing position – Outside hitter/Opposite hitter/Setter/Middle blocker, Libero, spike results, F – result of the analysis of variance, Sig. – the significance of the differences between the groups based on Tukey's test of multiple comparisons, *p<,05

Based on the data shown in table 5 we can conclude that all the players in various playing positions differ in a statistically significant manner in terms of height. Thus the player in the outside hitter position is higher in a statistically significant manner than the player in the setter position (*F=4,05, p<,05*) and the player in the libero position (*F=10,39, p<,05*), the player in the opposite hitter position is higher in a statistically significant manner than the player in the setter position (*F=7,33, p<,05*) and thus the libero position (*F=14,21, p<,05*); players in the setter position are higher in a statistically significant manner than the players in the libero position (*F=6,88, p<,05*), while the players in the middle blocker position are the tallest, that is are higher in a statistically significant manner than the players in all the other playing positions. The players in the position of libero are the shortest, in a statistically significant manner.

Table 6. The results of the analysis of variance between the players of various playing positions based on body weight

Scales	Variable of comparison	F
Outside hitter weight in kg	opposite hitter	-4,23*
	setter	3,94
	middle blocker	-7,09*
	libero	10,65*
Opposite hitter weight in kg	opposite hitter	4,23*
	setter	8,17*
	middle blocker	-2,85
	libero	14,88*
Setter weight in kg	opposite hitter	--3,94
	setter	-8,17*
	middle blocker	-11,02*
	libero	6,71*
Middle blocker weight in kg	opposite hitter	7,09*
	setter	2,85
	middle blocker	11,02*
	libero	17,73*
Libero weight in kg	opposite hitter	-10,65*
	setter	-14,88*
	middle blocker	-6,71*
	libero	-17,73*

Legend: Player position – Outside hitter/Opposite hitter/Setter/Middle blocker, Libero, spike results, F – result of the analysis of variance, Sig. – the significance of the differences between the groups based on Tukey's test of multiple comparisons, *p<,05

Based on the results shown in table 6 we can conclude that the players of almost all the playing positions differ in a statistically significant manner in terms of weight. Thus the player in the outside hitter position is heavier in a statistically significant manner than the player in the libero position (F=10,65, p<,05), the player in the opposite hitter position is heavier than the outside hitter in a statistically significant manner (F=4,23, p<,05), than the player in the setter position (F=8,17, p<,05) and the position of libero (F=14,88, p<,05); the players of the setter position are heavier than the players in the position of libero in a statistically significant manner (F=6,71, p<,05), while the players in the middle blocker position are the heaviest, that is, are heavier than the players in the outside hitter position in a statistically significant manner (F=7,09, p<,05), as well as the setter (F=11,02, p<,05) and also the libero position (F=17,73, p<,05). The players in the position of libero weigh the least, in a statistically significant manner.

Table 7. The results of the t-test between the two groups of players in various playing positions based on the results of the situational parameter of the spike

Variables	N	M	SD	t	ss	P	Min	Max
Outside hitter G-1, Spike	29	343	7,55	-1,06	64	,293	338	360
Outside hitter G-2, Spike	37	345	7,64				330	365
Opposite hitter G-1, Spike	17	352,88	11,93	1,49	35	,144	334	375
Opposite hitter G-2, Spike	20	348	7,81				335	362
Setter G-1, Spike	18	334,89	9,82	,433	36	,677	315	352
Setter G-2, Spike	21	333,48	10,43				313	355
Middle blocker G-1, Spike	30	348,20	21,67	-,116	55	,908	243	375
Middle blocker G-2, Spike	27	348,70		6,62			338	365
Libero G-1, Spike	13	324,92	12,51	-,161	25	,873	310	345
Libero G-2, Spike	14	325,57	8,05				315	336

Legend: The spike result for group 1, and the spike result for group 2, N = the number of participants, M = arithmetic means, SD = standard deviation, t = results of the t-test, ss - degrees of freedom, p = statistical significance, Min = minimum value, Max = maximum value

Based on the presented results we can conclude that there are statistically significant differences in the space of morphological characteristics (body height and body weight) between the teams of volleyball players based on various playing positions.

With the aim of determining the statistically significant differences in the space of situational parameters (spike, block) between the groups of volleyball players of various playing positions, that is, in order to compare the players based on their playing positions and based on whether they belong to group 1 or group 2, two t-tests were calculated for small independent samples, one for each playing position. The obtained results of the t-test are shown in tables 7. and 8.

Based on the analysis of the results shown in table 7 we can note that there are no statistically significant differences in terms of the result of the spike and playing position for the two groups. Thus the result of the difference between the players in the outside hitter position has a value of $t= -1{,}06$, $p>{,}05$, the difference between the players in the opposite hitter position has a value of $t=-1{,}49$, $p>{,}05$, the difference between the players in the setter position has a value of $t=-{,}433$, $p>{,}05$, the difference between the players in the middle blocker position has a value of $t=--{,}116$, $p>{,}05$, and finally the difference between the players in the position of libero has a value of $t=- -{,}166$, $p>{,}05$. These results indicate that the outside hitter, middle blocker and libero players in group 2 do not achieve statistically significant better results for the spike than the players in group 1, while for the remaining two playing positions the situation is reverse.

Table 8. The results of the t-test between the two groups of players of various playing positions based on the results of the situational parameter of the block

Variables	N	M	SD	t	ss	P	Min	Max
Outside hitter G-1, Block	29	343	7,55	1,30	64	,197	314	345
Outside hitter G-2, Block	37	345	7,64				219	345
Opposite hitter G-1, Block	17	352,88	11,93	2,68	35	,011*	314	345
Opposite hitter G-2, Block	20	348	7,81				310	340
Setter G-1, Block	18	334,89	9,82	,543	36	,596	303	332
Setter G-2, Block	21	333,48	10,43				290	335
Middle blocker G-1, Block	30	348,20	21,67	2,08	55	,042	310	347
Middle blocker G-2, Block	27	348,70	6,62				225	350
Libero G-1, Block	13	324,92	12,51	1,76	25	,090	300	330
Libero G-2, Block	14	325,57	8,05				296	320

Legend: The results of the block of group 1, and the block of group 2, N = the number of participants, M = arithmetic means, SD = standard deviation, t = results of the t-test, ss- degrees of freedom, p = statistical significance, Min = minimum value, Max = maximum value

The analysis of the results in table 8 indicates that there are no statistically significant differences in terms of the block and playing position based on group membership, with the exception of the results for the playing position of opposite hitter. Thus the result of the difference between players in the outside hitter position has a value of $t= 1{,}30$, $p>{,}05$, the difference between the opposite hitter position has a value of $t= 2{,}68$ $p<{,}05$, the difference between the setter position has a value of $t= {,}543$, $p>{,}05$, the difference between players in the middle blocker position has a value of $t= 2{,}08$, $p>{,}05$, and finally the difference between the players in the position of libero has a value of $t= 1{,}76$, $p>{,}05$. These results indicate how the players of group 1 in all the playing positions do not achieve statistically significant higher results for the block than the players in group 2, with the exception of the players in the opposite hitter position, where the difference in favor of the players in group 1 is statistically significant.

In addition to the t-test, an analysis of variance was performed which was meant to evaluate whether the players in various playing position mutually differ in terms of their scores for the spike and block. The results of the analysis of variance are shown in tables 9. and 10.

Table 9. The results of the analysis of variance between the players of various playing positions for the spike

Scales	Variable of comparison	F
Outside hitter block result	opposite hitter setter middle blocker libero	-6,12 9,99* -4,32 18,86*
Opposite hitter block result	opposite hitter setter middle blocker libero	6,12 16,12* 1,81 24,98*
Setter block result	opposite hitter setter middle blocker libero	4,32 -16,12* -14,31* 8,87*
Middle blocker block result	opposite hitter setter middle blocker libero	4,32 -1,81 14,31* 23,18*
Libero block result	opposite hitter setter middle blocker libero	-18,86* -24,98* -8,87* -23,18*

Legend: Player position – Outside hitter/Opposite hitter/Setter/Middle blocker, Libero, spike results, F – result of the analysis of variance, Sig. – the significance of the differences between the groups based on Tukey's test of multiple comparisons, *p<,05

Based on the analysis of the data in table 9 we can conclude that the players differ only partly in a statistically significant manner when it comes to the spike. Thus the players in the outside hitter position achieve statistically significant better results for the spike than the players in the setter position (F=9,99, p<,05) and the players in the position of libero (F=18,86, p<,05), the players in the opposite hitter position achieve statistically significant better results for the spike than the players in the setter position (F=16,21, p<,05) and the players in the position of libero (F=24,98, p<,05); the players in the setter position achieve statistically significant better results for the spike than the players in the position of libero (F=8,87, p<,05), the players in the middle blocker position achieve statistically significant better results for the spike than the players in the setter position (F=14,31, p<,05) and also libero (F=23,18, p<,05). The players in the position of libero achieve the lowest results for the spike, which are statistically significant.

Table 10. The results of the analysis of variance between the players in various playing positions for the block

Scales	Variable of comparison	F
Outside hitter block result	opposite hitter setter middle blocker libero	-6,36 6,11 -5,33 14,51*
Opposite hitter block result	opposite hitter setter middle blocker libero	6,36 12,47* 1,04 20,87*
Setter block result	opposite hitter setter middle blocker libero	-6,11 -12,47* -11,44* 8,40
Middle blocker block result	opposite hitter setter middle blocker libero	5,33 -1,04 11,44* 19,84*
Libero block result	opposite hitter setter middle blocker libero	-14,51* -20,87* -8,40 -19,84*

Legend: Player position – Outside hitter/Opposite hitter/Setter/Middle blocker, Libero, block results, F – result of the analysis of variance, Sig. – the significance of the differences between the groups based on Tukey's test of multiple comparisons, *p<,05

The analysis of the results in table 10 indicates that there is a partial statistically significant difference between the players based on the results for the block. Thus the players in the outside hitter position achieve statistically significant better results than the players in the position of libero ($F=14{,}51$, $p<{,}05$), the players in the opposite hitter position achieve statistically significant better results than the players in the setter position ($F=12{,}47$, $p<{,}05$) as well as the players in the position of libero ($F=20{,}87$, $p<{,}05$); the players in the middle blocker position achieve statistically significant better results than the players in the setter position ($F=11{,}44$, $p<{,}05$) as well as the position of libero ($F=19{,}84$, $p<{,}05$). The players in the position of libero achieve statistically significantly the lowest results for the block, while the players in the setter position do not achieve statistically significant better results than any of the players in the other playing positions.

CONCLUSION

The research was carried out on eight senior member volleyball teams which were divided into two groups. All of the teams participated in the Olympic Qualification Tournament. The aim was to determine whether there are statistically significant differences between the groups and players based on player positions (outside hitter, opposite hitter, setter, middle blocker, libero), based on basic morphological characteristics (body height, body weight) and situational parameters (spike, block). By using a series of t-tests and an analysis of variance, was well as the Tukey test which was used to determine the existence of any statistically significant differences between the applied variables, results were obtained which represent a significant contribution to the continued shaping of content and evaluation of the training process of elite volleyball players, as well as an important source of information in the process of final selection of future volleyball players and the specialization of playing positions. The results of the series of t-tests indicate that there are no statistically significant differences in terms of body height and the spike for volleyball players who belong to various national teams, but a statistically significant difference was determined for body weight and the block. An analysis of variance determined that there is a statistically significant difference between the players based on their playing positions. The obtained results for body height indicate that the players in the opposite hitter position score values which are statistically significantly higher than those of the players in the outside hitter position, setter position or libero position, while the players in the position of libero scored the statistically significant lowest results. Based on the obtained results for body height we can conclude that a player in the opposite hitter position is statistically significantly heavier than a player in the outside hitter position, setter position or libero position, and that the player in the libero position is statistically significantly the lightest.

In the case of situational parameters (spike, block), it can be concluded that the players in the outside hitter and opposite hitter positions achieve statistically significant better results for the spike than the players in the setter and libero positions, that the players in the setter and middle blocker position achieve statistically significantly better results for the spike than the players in the libero and the setter positions, that the players in the libero position achieve statistically significantly the lowest results for the spike, that the players in the outside hitter and opposite hitter achieve statistically significantly better results for the block than the players in the libero and setter position, and that the players in the position of libero achieve statistically significantly the lowest results for the block.

Based on the obtained results it can be concluded that certain characteristics of the players and their positions affect the overall model of the volleyball player. Most playing positions have a similar player model, with the exception of the libero who in his characteristics deviates from the remaining playing positions. Based on group membership, the teams do not differ in terms of height and spike, but they do differ significantly based on their weight and block, which is one of the more important segments of the game, creating an important distinction in its quality. Thus we can conclude that the teams which achieved higher values for the block during the training process at the same time ended up higher ranking teams in the pre-Olympic tournament.

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BODY COMPOSITION OF YOUNG ACADEMY SOCCER PLAYERS IN UNITED ARAB EMIRATES

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SUMMARY

Talent identification and early selection into a professional soccer academy has been reported to be very important for the long term development of footballing expertise. Through soccer-specific research, a number of anthropometric and physical parameters have been linked to successful performance in soccer. The objective of the research study was to explore anthropometric characteristics of U15 and U16 academy soccer players, which can be used to predict their future success in soccer. All results have been analyzed in the statistical program Statistics 7.0 for Windows. Height and weight are important on allocating positional roles, but cannot discriminate successful from less successful performers.

Keywords: body composition, academy soccer players

INTRODUCTION

Soccer is one of the most widely played and complex sports in the world, where players need technical, tactical, and physical skills to succeed (Joksimović et al., 2009). Talent identification and early selection into a professional soccer academy has been reported to be very important for the long term development of footballing expertise (Le Gall *et al*., 2010). This awareness of the need for early identification of gifted youngsters has led to an increased number of soccer centers of excellence and academies throughout the world. Traditionally, identification and selection of promising individuals into youth soccer academies has been linked to a coach's subjectivity and preconceived image of the player. Once this method is used in isolation it can result in tedious misjudgments in talent identification - hence the emphasis on science-based approaches. Through soccer-specific research, a number of anthropometric and physical parameters have been linked to successful performance in soccer (Le Gall *et al*., 2010). Ostojic (2002) indicated that a relationship exists between an athlete's body composition and functional fitness characteristics and pointed out that body composition and somatotype variables can greatly influence the attainment of functional characteristics such as strength, speed, power and flexibility by an athlete. These variables are thus used by exercise physiologists and coaches during talent scouting. They measure both anthropometric characteristics and functional fitness in an effort to determine factors that indicate future talent. This was substantiated by Le Gall *et al*. (2010) who studied players at France's elite soccer academy (Clairefontaine) and found that, youth players with significantly greater height, weight, jumping ability and maximal anaerobic power, were more likely to be selected for France's senior men national team game.

Researchers in modern sport share the same notion that elite sporting performance is achieved once an athlete possesses some appropriate structural and functional characteristics fundamental to that particular sporting event (Singh *et al*., 2010; Gravina *et al*., 2008; Gil *et al*., 2007; Ostojic, 2003; Carter and Heath, 1990) and stressed the need to develop young soccer players' technical and physical capacities at a period before adolescence, as this is the decisive stage where appropriate training and motor skill acquisition determine the future progress of young players.

Body composition has been known to influence success in sport performance (Maud and Cortez-Cooper (1995). Similarly demands for certain sporting events can also determine the body composition an athlete should possess – a process known as 'morphological optimization' (Bloomfield *et al*., 1995). In events such as discus, shot put, hammer throw, wrestling, rowing and boxing, high levels of fat free mass are a determinant of success. In track athletics, gymnastics, jumps as well as other sports which require carrying weight over a distance, leanness influences the possibility of success (Singh *et al*., 2010). Carter (1984) reported that athletes who possess sport-specific body shapes have better chances of being successful in the sport once they receive appropriate training. Thus sport specific training has an influence in determining success in a sport. Toriola *et al*. (1985) also stressed that body size; shape and proportion of athletes are important considerations in sport performance.

According to Sinning (1996), body composition measures are widely used to prescribe desirable body weights, optimize competitive performance and assess the effects of training. Most studies in kinanthropometry have generally agreed that a minimum relative body fat is desirable for successful sporting performance (Abraham, 2010; Singh *et al*., 2010; Carter and Heath, 1990). Excess body fat adds more weight to the athlete's body with no contribution to energy. Sinning (1996) also stresses the fact that a high quantity of fat mass is disadvantageous in sports where the body is moved against gravity such as in high jump, basketball (shooting), pole vaulting and gymnastics. Abraham (2010) points out that the oxygen requirement of an athlete is directly related to his/her body weight when running at a sub maximal speed. Thus the demand for oxygen increases when the body weight is high. Large bodies also require more energy to initiate and sustain movement.

Changes in height and weight. The pattern of body composition changes is similar for all children, however, body size attained at certain age and the timing of the adolescence growth spurt vary from child to child (Malina *et al*., 2004). From the time of birth up to early adulthood, weight and height assume a certain sequence, i.e. accelerated growth at infancy and early childhood; steady growth at middle childhood; accelerated growth during adolescence and a slow increase till growth stops at adulthood height (Malina *et al*., 2004). According to Bouchard *et al*. (1997) growth in sitting height and leg length determine the total stature. Gender variations in these two variables are negligible during childhood. At early adolescence leg length for girls is slightly longer compared to that of boys but only for a short time, while sitting height for girls remain higher for a longer period. Boys surpass girls in leg length at around the age of 12 years but they do not catch up with girls on sitting height until approximately 14 years (Malina *et al*., 2004; Bouchard *et al*., 1997). The early adolescents' growth spurt is characterized by rapid growth of the lower extremities thus increasing leg length more than sitting height, a factor assumed to result in poor flexibility scores in adolescent boys (Wells *et al*., 2000; Bouchard *et al*., 1997). Growth in leg length ends earlier than sitting height and sitting height continues to increase into late adolescence up to about 20-22 years (Malina *et al*., 2004). Thus sitting height contributes more to adolescents' growth spurt in height.

Changes in fat mass (FM) and percentage body fat (%BF). Total body fat increases during the first 2-3 years from birth and slightly changes up to 5-6 years. Gender variations are negligible at this stage. FM increases more rapidly in girls than in boys through adolescence, and reaches a plateau at adolescence growth spurt in boys (13-15 years). Total percentage body fat increases rapidly in both genders at infancy and then decreases gradually from early childhood. From age 5-6 years to adolescence, girls tend to have greater %BF compared to boys (Bouchard *et al*., 1997). In boys %BF increases gradually until around 11-12 years (before growth spurt) and steadily decreases to reach its lowest at adolescence (16-17years), after which it rises at early adulthood. Malina *et al*. (2004) tracked European athletes and non-athletes to compare the relative fatness from late childhood to adolescence. They reported a decline in relative fatness but athletes had lower relative fatness at all ages. They noted a wider difference between boys and girls as the subjects approached adolescence age.

The objective of the research study was to explore anthropometric characteristics of U15 and U16 academy soccer players, which can be used to predict their future success in soccer. It is assumed that by realizing this objective, this study could subsequently add value to talent identification and in monitoring players' physical performance.

METHODS

Subjects

The sample of research were 60 soccer players from academy in UAE (31 players age U15 and 29 players age U16), conferred by the position in the football field at the 4 sub samples: goalkeepers (8), defenders (16), midfielders (20) and forwards (16).

Procedure

Each participant will have to meet pre-defined conditions, to enter the sample: to regularly attend training sessions, that the respondents voluntarily attended training in the football academy. All the players had more than 3 years of experience that the participants are healthy, participants do not have physical defects, morphological aberrations damaged locomotor apparatus, and they do not possess greater pathophysiological abnormalities. The players were fully-informed of all the experimental procedures. All tests were performed on an indoor artificial grass pitch. It was assumed that players will not consume either excessive or very minimal amounts of water at least two hours before the anthropometric tests. It was also assumed that the players will not train or partake in any vigorous exercises at least 24 hours before the testing day. The testing process started early in the morning until midday and were conducted at the academy's training fields. According to the recommendations of Gore (2000), the following testing order was observed: Body mass; Height; Skinfolds – (triceps, subscapular, biceps, iliac crest, supraspinale, abdominal, front thigh, and medial calf.); Body density; Percentage body fat; Body mass index; Waist-hip ratio.

All anthropometric variables were measured using the standard procedures of the International Society of the Advancement of Kinanthropometry (ISAK) (Marfell-Jones *et al.*, 2006). The anthropometric sites and descriptions that were used in this study were based on those propounded by Ross and Marfell-Jones (1991) and Norton and Olds (1996), ratified by the International Society for the Advancement of Kinanthropometry (ISAK) and revised by Marfell-Jones *et al.*, (2006).

Mass is the quantity of matter in a body and is calculated through the measurement of weight. Body mass was measured using a digital scal). Body mass was recorded to the nearest 0.1kg. Values for height and weight measurements were used to compute body mass index (BMI).

A total of eight skinfolds were measured using skinfold Slimguide callipers (Rosscraft®-Canada) and a demographic pen for the landmarks. The following skinfolds measurements were taken according to the methods of Marfell-Jones *et al.* (2006): triceps, subscupular, biceps, iliac crest, supraspinale, abdominal, front thigh and medial calf.

Two measurements were taken and the average was recorded as the final score.

The following body composition variables were computed:

- Body mass index (BMI): BMI = BM/height2
- Fat mass: body weight (kg) × percentage body fat/100.
- Fat-free mass: body weight (kg) - fat mass (kg).
- Fat mass index: fat mass/height2
- Fat-free mass index: FFM/height2.

Body Density (BD) was computed using the equation of Withers et al (1987) and the percentage body fat (%BF) was computed from body density using the Brozek and Keys (1963) equation.

- Body Density = 1.0988 – 0.0004 (Xi).
- %BF = (4.570/Bd – 4.142) x 100.

Where Xi = Σ7 skf (triceps, biceps, abdominal, supraspinale, subscapular, front thigh and medial calf in mm).

Statistical analysis

All results have been analyzed in the statistical program Statistics 7.0 for Windows. For all variables basic parameters of the descriptive statistics were calculated: the minimum score (Min), maximum score (Max), mean (Mean), standard deviation (Std. deviation). To determine a statistically significant difference between the groups for each variable was used a T - test, where for the statistical significant difference the value of the significance level to 0.05 ($p \leq 0.05$) was taken.

RESULTS

Anthropometry: U15 according to positions of play. No significant difference in age was observed among the U15 players across playing positions ($p>0.05$). Goalkeepers and defenders were of similar age, while midfielders and forwards were slightly younger (Table 1.). Goalkeepers were the heaviest of all the other groups, also goalkeepers were the tallest and forwards were the lightest and shortest. A statistically significant difference was observed in height of the players across playing positions ($p = 0.05$), with a greater difference existing between forwards and defenders. No significant differences were seen in all other variables across playing positions.

Table 1. Anthropometric scores for U15 players according to playing positions (values are mean + SD)

Characteristics	Goalkeepers (n=4)	Defenders (n=9)	Midfielders (n=10)	Forwards (n=8)	P-value
Age (years)	15.0±.070	15.0±0.67	14.9±0.79	14.9±0.73	> 0.05
Height (cm)	169.5±5.95	164.4±5.90	166.7±7.27	163.9±4.90	= 0.05
Body mass (kg)	62.7±7.26	57.1±12.5	57.5±9.14	53.8±7.1	> 0.05
Sum of 8 skinfolds (mm)	79.8±42.68	62.1±23.20	63.2±10.46	49.4±9.94	>0.05
Body density	1.06±0.013	1.07±0.009	1.07±0.004	1.07±0.005	> 0.05
Percentage body fat	13.0± 6.09	10.7± 4.07	11.0± 1.74	8.6± 2.40	> 0.05
Body mass index	21.4± 2.81	20.4± 3.34	20.4± 1.85	20.5± 1.97	> 0.05
Waist-hip ratio	0.8±0.04	0.8±0.04	0.8±0.11	0.8±0.03	> 0.05

Table 2. Anthropometric scores for U16 according to playing positions (values are mean + SD)

Characteristics	Goalkeepers (n=4)	Defenders (n=7)	Midfielders (n=9)	Forwards (n=9)	P - value
Age (years)	15.6±1.34	15.5±0.97	16.3±0.80	16.1±0.73	>0.05
Height (cm)	174.6±4.79	168.8±3.32	170.1±6.46	168.7±3.51	> 0.05
Body mass (kg)	64.5±5.03	60.6±4.54	62.5±4.94	60.9±5.31	> 0.05
Sum of 8 skinfolds (mm)	46.4±5.22	42.1±6.28	48.5±7.94	49.5±6.85	> 0.05
Body density	1.07±0.001	1.08±0.003	1.07±0.039	1.07±0.003	> 0.05
Percentage body fat	9.3±0.78	7.9 ±1.45	9.4±1.69	9.4±1.70	> 0.05
Body mass index	21.5±0.58	21.2±0.97	21.5±1.77	21.4±1.61)	> 0.05
Waist-hip ratio	0.79±0.04	0.80±0.04	0.79±0.04	0.81±0.79	> 0.05

Anthropometry: U16 according to positions of play. There was no significant difference across playing positions for any anthropometric variables (p > 0.05). Goalkeepers were the tallest and heaviest compared to other players, while defenders and forwards were the shortest and lightest in the group. Goalkeepers, midfielders and forwards had the highest %BF, while defenders had the lowest (Table 2).

DISCUSSION

Height and weight are reportedly determined more by heredity (Malina *et al*., 2004; Bouchard *et al*., 1997) and to some extent by environmental factors and life style. The use of height and weight in talent selection in soccer is limited as soccer players are known to have varying heights and weights, however, it was reported that height and weight of players have a positional advantage (Reilly *et al*., 2000a). Tall and heavy players were noted to feature as goalkeepers and central defenders, while short and light players play as midfielders and forwards (Reilly *et al*., 2000a; Bangsbo, 1994a).

In the current study, there was no statistically significant difference in height and weight between U15and U16 players (p > 0.05). Goalkeepers and defenders were found to be the tallest and heaviest while forwards and midfielders were the shortest in the team. This shows a common tendency in many soccer teams to allocate positional roles to players based on anthropometric characteristics.

The mean height and weight for U15and U16 teams combined together was 168.3±5.89 and 59.9±8.47, respectively. When mean height and weight scores found in this study is compared to data of young soccer players of similar age groups from the literature in other studies, they reflect that players from U15 and U16 compared well with players from China elite under 17 soccer team studied by Wong and Wong (2009); the Brazilian under 16 soccer team reported by Pittoli *et al*. (2010) and the Canadian under 16 team reported by Leatt *et al*. (1987). However, it was noted that the height and weight results of young soccer players in this study are significantly lower to those of young soccer players from Tunisia and Senegal studied by Chamari (2004) and those of young players from Finland reported by Rahkila and Luthanen (1989), as well as those from Europe reported by Hegerud *et al*. (2001). It was noted that young players from these countries are taller and heavier than those in the current study.

Body composition

There were significant differences between the U15 and U16 players in terms of the sum of 8 skinfolds (p = 0.01), %BF (p = 0.03) and body density (p = 0.03). No significant differences were noted for BMI (p = 0.08). There were no data on waist-hip ratio, fat mass index and sum of 8 skinfolds in the literature to compare the findings of the current study with.

Percentage body fat of U15 players was 10.5 ± 3.61% and for U16 players was 9.0 ± 1.6%.. Due to higher competition demands in U16 league, they can present with less fat mass which could have contributed to lower averages for the whole team on these variables. This assumption is consistent with the findings of Koutedakis (1995) who noted that players at a higher level of competition have less %BF compared to players at lower levels of competition.

The study found out that of all the body composition assessed, the most discriminatory ones were: %BF and fat mass.

CONCLUSION

The study found out that of all the body composition assessed, the most discriminatory ones were: %bf and fat mass. Height and weight are important on allocating positional roles, but cannot discriminate successful from less successful performers. the mean weight and height for youth soccer players (14-19 years) as reported by various authors range from 49.9±0.4 - 71.3±6.8 kg and 163.9±0.3 - 178.6±6.3 cm, respectively and for adult players range from 72.1±8.0 – 78.4±7.4kg and 177.2±4.5 – 190±6.0 (Pittoli *et al.*, 2010; stolen *et al.*, 2005; Chamari *et al.*, 2004; Rahkila and Luthanen, 1989; Leatt, *et al.*, 1987). According to Malina *et al.* (2004), the weight and height of a soccer player are important contributors to functional test performance such as speed, vertical jump, and to soccer specific skill performance such as heading, shooting, passing and goalkeeping.

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BRIEF REVIEW OF THE AGILITY AND CHANGE OF DIRECTION SPEED TESTING IN HANDBALL

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UDC 796.322

SUMMARY

The aim of this review was to detail the reliability, validity and sensitivity of current change of direction speed (CODS) and agility tests in handball players.

Relevant peer-reviewed journal articles were identified from Google Scholar, CORE, and PubMed (Public Medline run by the National Center of Biotechnology Information (NCBL) of the National Library of Medicine and of Bethesda (USA)) prior 20. September 2017. The following word terms were used separately or in combination: ´reliability´, ´validity´, ´sensitivity´, ´usefulness´, ´handball´, ´agility´, ´change of direction speed test´, ´construct validity´, ´criterion validity´, ´concurrent validity´, ´measurement error´, ´reactive agility´, ´non-planned´ and ´planned agility´.

Six CODS tests (´T – Test´, ´Illionis Agility Test´, ´Time for the 2 x 2.5 m turn-around´, ´Handball CODS Specific Test´, ´CODS Test´, ´Modified Zig Zag Test´) and one agility test were evaluated across five studies .

Findings of the reliability analysis strongly support the use of the investigated CODS tests and agility test it the routine assessment of pre-planned and non-planned maneuvers in handball players. On the other hand, the construct validity and sensitivity of the CODS and agility tests has yet to be full elucidated. ´T-Test´ and ´Illionis Test´ are highly sensitive to detect small changes in performance, and should be used by coaches and practitioners for monitoring athlete´s progression in the response to training interventions.

Keywords: reliability, validity, usefulness, sensitivity

INTRODUCTION

Handball is complex and multifactorial sport game (Wagner, Finkenzeller, Würth, & von Duvillard, 2014) characterized as being high intermittent in nature (Michalsik, Aagaard, & Madsen, 2013; Póvoas et al., 2012). High intermittent nature of handball match require frequently transition between brief bouts of high-intensity efforts (comprising turns, jumps, throws, changes of direction, one-on-one situation in the attack) and longer periods of low-intensity demands (Póvoas et al., 2012). The results suggest that the most frequently high intensity activities were stops and changes of direction (60% of the 103 playing actions registered) (Póvoas et al., 2012). Therefore, the improving change of direction sped (CODS) and agility performance is one of the most important aspects of the off-season strength and conditioning programs of handball players.

CODS and agility are used interchangeably in the sport literature. CODS ability can be described as a pre-planned path (Sheppard & Young, 2006), and this phrase has become increasingly common to distinguish this ability from agility involving reactive component (Young, Dawson, & Henry, 2015). Although, disparities may exist, agility has been defined as “a rapid whole-body movement with change of velocity or direction in response to a stimulus”. Therefore, agility comprises a perceptual decision-making process and its outcome, a change of direction or velocity (Sheppard & Young, 2006). Based on that, it is suggested that these abilities should evaluate independently.

Given the increasing recognition of the importance of agility (Paul, Gabbett, & Nassis, 2016) and CODS in handball, it would be valuable to establish whether current CODS and agility tests possess appropriate test reliability, validity and sensitivity. To our knowledge, no review has investigated the reliability, validity and sensitivity of field-specific CODS and agility tests in handball players. Therefore, the aim of this review was to detail the reliability, validity and sensitivity of current CODS and agility tests.

METHODS

Search strategy

Relevant peer-reviewed journal articles were identified from Google Scholar, CORE, and PubMed (Public Medline run by the National Center of Biotechnology Information (NCBL) of the National Library of Medicine and of Bethesda (USA)) prior 20. September 2017. The following word terms were used separately or in combination: ´reliability´, ´validity´, ´sensitivity´, ´usefulness´, ´handball´, ´agility´, ´change of direction speed test´, ´construct validity´, ´criterion validity´, ´concurrent validity´, ´measurement error´, ´reactive agility´, ´non-planned´ and ´planned agility´. The reference list from each included article and review articles was also scanned to identify additional relevant studies. Although no restriction were made on the study design, eligibility criteria for study inclusion consisted of one of the following: 1) tests comparing results on two separate occasions under similar conditions (reliability); 2) comparison between different levels or playing ability (construct validity); 3) correlation with another test set as a criterion of measure (concurrent validity) 4) participant were actively involved in handball. Only full text articles published in English were included, therefore, conference abstracts and studies written in languages other than English were not included in the analysis.

Data extraction and analysis

The data extrapolated from the reviewed studies were collected in Table 1 for comparisons among them; in particular for each study the author and year of publication, number of participants, sample size, sex, age, playing level, name and type of test (agility test or CODS test), reliability and validity values. This was undertaken by one author, while a second author checked the extracted data for accuracy and completeness. Disagreements were resolved by consensus between investigators. Reviewers were not blinded to authors, institutions or manuscript journals.

RESULTS

Search results

The initial search procedure yielded 72 records through the electronic databases, and additional 3 articles identified through reference lists (Figure 1). Following the removal of duplicates and the elimination of articles based on title and abstract screening, 20 studies remained. A total of 5 articles were identified for inclusion in the present review.

Study characteristics

In total, 335 handball players were studied (range 18 – 104). Participant age ranged from 12.5 to 26.9, mostly members of the national league from young to senior category. The studies included only males (n = 4), and both males and females (n = 1). Six CODS tests (´T – Test´, ´Illionis Agility Test´, ´Time for the 2 x 2.5 m turn-around´, ´Handball CODS Specific Test´, ´CODS Test´, ´Modified Zig Zag Test´) and one agility test were evaluated across five studies (Hermassi, 2015; Iacono, Ardigò, Meckel, & Padulo, 2016; Negra et al., 2017; Spasic, Krolo, Zenic, Delextrat, & Sekulic, 2015; Vieira, Veiga, Carita, & Petroski, 2013).

Change of direction speed test designs

´T-Test´ was administered using the protocol outlined by Munro and Herrington (2011). Four cones were arranged in a T shape, with a cone placed 9.14 m from the starting cone and two further cones placed 4.57 m on either side of the second cone (Figure 2). Subject sprinted forwards 9.14 m from the start line to the first cone and touch the tip with their right hand, shuffle 4.57 m left to the second cone and touch with their left hand, then shuffle 9.14 m to the right to the third cone and touch with their right hand, shuffle 4.57 m back left to the middle cone and touch with their left hand before finally back pedaling to the start line. The time needed to complete the test was used as performance outcome and it was assessed an electronic timing system (Microgate SARL, Bolzano, Italy).

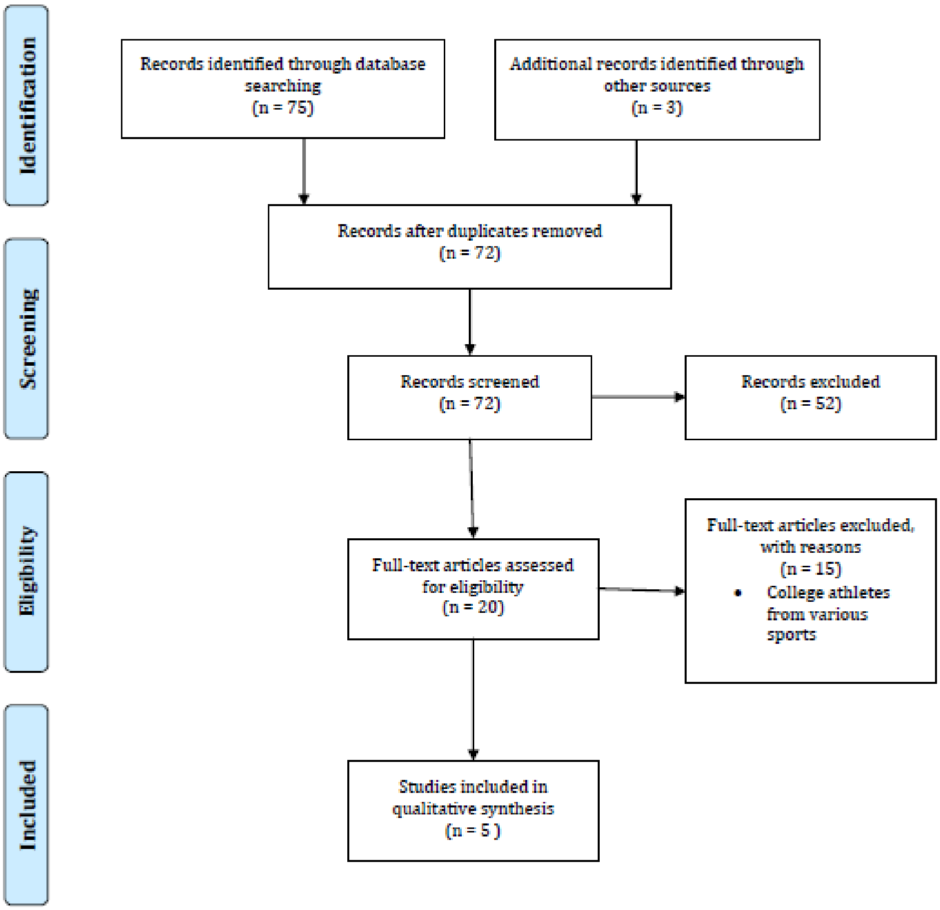

Figure 1. A PRISMA flow diagram displaying the identification, screening, and selection of relevant studies in this review.

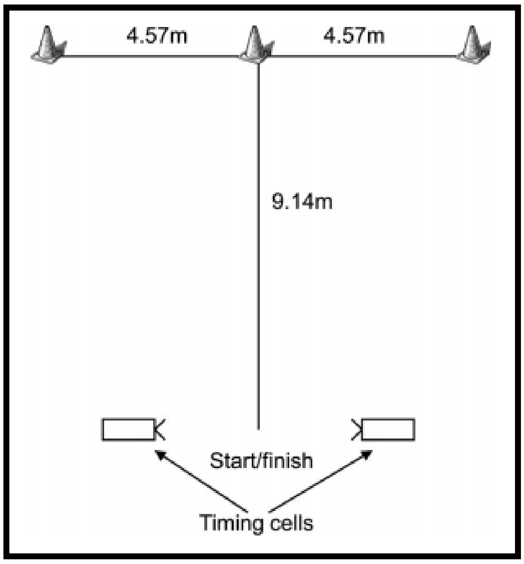

Figure 2. Layout of the T-Test (Pauole, Madole, & Garhammer, 2000)

´Illionis Agility Test´ – The length of the Illionis Agility course is 10 m and the width is 5 m (Amiri-Khorasani, Sahebozamani, Tabrizi, & Yusof, 2010)(Figure 3). Four cones are used to mark the start, finish and the two turning points. Another four cones are placed down the center an equal distance

apart. Each cone in the center is spaced 3.3 meters apart. Subjects should lie on their front (head to the start line) and hands by their shoulders. The athlete were instructed to gets up as quickly as possible and runs around the course in the direction indicated, without knocking the cones over, to the finish line, at which the timing is stopped. The Illionis Agility performance was recorded using electronic timing system (Microgate SARL, Bolzano, Italy).

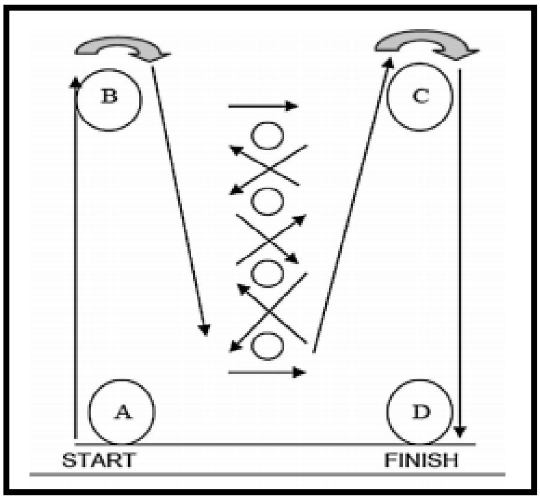

Figure 3. Layout of the Illionis Agility Test (Amiri-Khorasani et al., 2010)

´Handball CODS Specific Test´ – This test included forward – backward running and diagonal sliding movements that resemble specific handball movements (Iacono et al., 2016; Vieira et al., 2013). The setup test is illustrated in Figure 4. Specifically, the player ran forward in a straight line until he reached a marking cone, 2.5 m from the starting position, then he slid diagonally and backward to cone 3, which was positioned 3.5 m to the right of the starting position (cone 1). After the player slid diagonally and forward to cone 4, he ran backward in a straight line until he reached cone 5, placed 5 m from cone 4. Finally, he slid diagonally and forward to cone 3 and then slid diagonally and backward to cone 1. For time measurement, this test was conducted using photocell gates (Timing – Radio Controlled; TT Sport, San Marino, CA, USA).

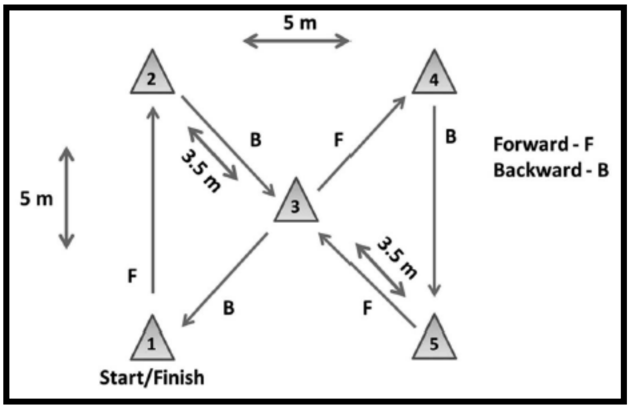

Figure 4. Layout of the Handball CODS Test (Iacono, Eliakim, & Meckel, 2015)

´

CODS Test´ – The CODS test was performed on the testing field presented in Figure 5 (Spasic et al., 2015). Athletes began running from the start line when ready. Timing began as participants crossed the infrared (IR) beam. The athletes shuffle to the cone ´A´, touch the top of the cone with their hand, shuffle back (from cone ´A´ to point ´X´), and run backward (from point ´X´ to start line). They then had to cross or step on the start line with their preferred leg, and run again over the next course. A single test trial consisted in three courses and was completed when the participant crossed the IR beam after returning from the third course. The testing scenario followed an A-B-A pattern, which the participants knew in advance.

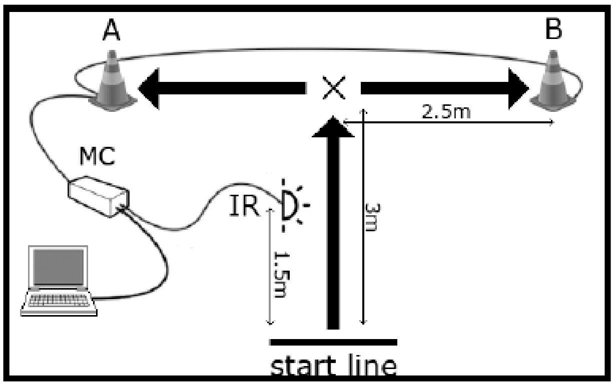

Figure 5. Layout of the CODS test and Reactive Agility Test (MC – microcontroller, IR – infrared sensor)(Spasic et al., 2015)

´Modified Zig Zag Test´ was performed using a short course 5 m sections set out at 100° angles because it required acceleration, deceleration and balance control facets of CODS and also a dribbling a ball (Hermassi, 2015). The setup test is illustrated in Figure 5. Electronic timing gates were placed at the start and finish line (Microgate Race time 2 Light Radio, Bolzano, Italy).

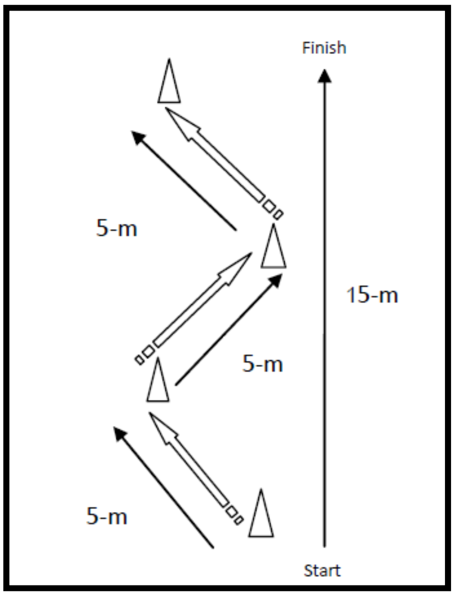

Figure 6. Layout of the Modified Zig Zag Test. Each straight sprint is 5-m and each turn at a flag is 100°

Agility test design

´Reactive Agility Test´ was performed on the testing field presented in Figure 5 (Spasic et al., 2015). Athletes began running from the start line when ready. Timing began as participants crossed the infrared (IR) beam. As they did so, a hardware module (microcontroller - MC) initiated one of the two light-emitting diodes (LED) that were placed within 30-cm-high cones (A & B). The athlete had to assess which cone was lit, shuffle to that particular cone, touch the top of the cone with their hand, shuffle back (from cone to point “X”), and run backward (from point “X” to start line) as quickly as possible. They then had to cross or step on the start line with their preferred leg, and run again over the next course. Every time athletes crossed the IR, the MC initiated one of the LED lights. A single test trial consisted in three courses and was completed when the participant crossed the IR beam after returning from the third course. All athletes were tested using three identical scenarios (i.e., identical sequences of LED lighting), though they had no knowledge of it in advance. The scenarios were A-A-B, B-A-A, and B-B-

B. The CODS test was performed on the same testing field as the reactive-agility test (Figure 5).

Study outcomes

The reliability analysis included calculation of the intra-class correlation coefficient (ICC), coefficient of variation (CV) and typical error of measurement (TEM). ICC ranged from 0.85 to 0.99 across all (agility and CODS) tests (Table 1). In addition acceptable within-subject reliability were reported in all tests (CV = 1.9 % - 4.8 %). TEM ranged from 0.50 % to 2.3%. The construct validity for the ´CODS Test´ (Spasic et al., 2015) was presented by the comparison of defensive and offensive handball players. Male defensive players achieved better results than offensive handball players in ´CODS Test´ (ES = - 0.97 moderate difference; p = 0.04) (Spasic et al., 2015). Small difference was observed between these groups in females (ES = - 40; p = 0.24) for the same test (Spasic et al., 2015). There were no significant differences between these two groups for ´Reactive Agility Test´ in both genders (male: ES = 0.07 trivial difference; female: ES = - 0.49 small difference) (Spasic et al., 2015). The concurrent validity of ´Modified Zig Zag Test´ was determined by examining relationship between the ´Modified Zig Zag´ performance and two popular CODS tests performance (´T-half Test´ and the ´Illionis Test´) (Hermassi, 2015). A ´Modified Zig Zag Test´ was closely related to both ´T-half Test´ and the ´Illionis Test´ (r = 0.52; r = 0.68; p < 0.05). Based on the sensitivity analysis, the ability of the ´T-Test´ and ´Illionis Test´ to detect small performance change can be rated as ´good´ in young handball players (smallest worthwhile change [SWC] > TEM)

Table 1 Study characteristics regarding the reliability and validity of the investigated agility and change of direction speed tests in handball players

Study	Population			Playing level	Name and type of test	Reliability data	Validity data
	Sample size (n)	Sex	Age (years)				
Negra et al. (2017)	92	M	12.5 ± 1.7	National first division for young athletes	Illionis Agility Test; CODS	ICC = 0.99; TEM = 0.50 %	
Negra et al. (2017)	92	M	12.5 ± 1.7	National first division for young athletes	T – test; CODS	ICC = 0.98; TEM = 0.99 %	
Iacono et al. (2016)	18	M	24.8 ± 4.4	Members of a top team of the national league	Time for the 2 x 2.5m turnaround; CODS	ICC = 0.97; CV = 1.9 %	
Vieira et al. (2013)	104	M	U16	National and regional league	Hand ball agility specific test; CODS	ICC = 0.92; TEM = 2.3%	
Spasic et al. (2015)	49	M and F	F: 25.1 ± 3.7 M: 26.9 ± 4.2	National Championship first division	Handball agility specific test; CODS	M: ICC = 0.91; CV = 4.8 % F: ICC = 0.93; CV = 3.6 %	Construct validity M: OP 6.4% faster than DP (moderate difference ES = - 0.97) F: OP 2 % faster than DP (small difference ES = - 0.40)
Spasic et al. (2015)	49	M and F	F: 25.1 ± 3.7 M: 26.9 ± 4.2	National Championship first division	Handball agility specific test; AT	M: ICC = 0.85; CV = 3 % F: ICC = 0.90; CV = 2.4 %	Construct validity M: OP 1.8% faster than DP (trivial difference ES = 0.07) F: OP 4.55% faster than DP (small differences ES = - 0.49)
Hermassi (2015)	72	M	15.6 ± 0.4	NR	Modified Zig Zag course; CODS	ICC = 0.92; CV = 2.7 %	Concurrent validity T – half test : r = 0.52; p < 0.05 Illionis test: r = 0.68; p < 0.05

M – male; F – female; CODS – change of direction speed test; AT – agility test; ICC – interclass coefficient of correlation; TEM – typical error of measurement; CV – coefficient of variation; U – under; NR – not reported; OP – offensive players; DP – defensive players,

DISCUSSION

This study provides an overview of current CODS tests and agility test evaluated across handball players. The results from this review undoubtedly represent that ´T-Test´, ´Illionis Test´, ´Time for the 2 x 2.5 m turn-around´, ´Handball CODS Specific Test´, ´CODS Test´, ´Modified Zig Zag Test´ are reliable tests as a measuring tool of CODS, while ´Reactive Agility Test´ represent a reliable method to assess agility performance in handball players. CODS tests had a sligthly stronger reliability than the agility test (ICC = 0.90 – 0.99 vs ICC = 0.85), however, it was expected given the relative complexity of the agility test (response to a stimulus which could directly alter reliability).

In addition, of practical importance for coaches is the ability of test to discriminate higher and lower playing ability. For this purpose, Spasic et al. (2015) assessed the construct validity of ´CODS Test´ and ´Reactive Agility Test´ by testing offensive and defensive handball players. The authors hypothesized that those athletes who are regularly involved in defensive duties will be faster than offensive players in ´Reactive Agility Test´. Contrary to their initial hypothesis, the aglity performance of defensive player was not superior. However, the absence of significant difference in ´Reactive Agility Test´ performance can be explained first by the advantage in terms of body dimensions of offensive players (they are lighter), and second, offensive players achieved better results in ´CODS Test´ (Spasic et al., 2015). Witin this context, Sekulic, Krolo, Spasic, Uljevic, and Peric (2014) suggested calculating the index of perceptual-reactive-capacity which is the ratio between CODS and agility done over the same course (P&RC index). In support of this notion, handball players who are involved in defensive duties had better P&RC index (Spasic et al., 2015). Therefore, it appears that P&RC index derived from the ratio between ´CODS Test´ and ´Reactive Agility Test´ is a valid indicator of defensive-specific agility performance in handball. In addition to construct validity, a high correlation was reported between ´Modified Zig Zag Test´ and two popular CODS tests performance (´T-half Test´ and the ´Illionis Test´) demonstrating acceptable concurrent validity of the test (Hermassi, 2015). Therefore, ´Modified Zig Zag Test´ should be consider as a valid measure of the pre-planned skill.

Furthermore, ´T-Test´ and ´Illionis Test´ may provide valuable data for monitoring athlete´s progression in the response to training interventions. Namely, the TE of measurement in mentioned tests is consistently below the SWC indicating high sensitivity of the tests to detect small performance changes (Negra et al., 2017). Based on that, ´T-Test´ and ´Illionis Test´ should be used by coaches and practitioners to quantify changes in performance targeted as a measure of CODS in handball players.

CONCLUSION

Findings of the reliability analysis strongly support the use of the investigated CODS tests and agility test it the routine assessment of pre-planned and non-planned maneuvers in handball players. On the other hand, the construct validity and sensitivity of the CODS and agility tests has yet to be full elucidated. ´T-Test´ and ´Illionis Test´ are highly sensitive to detect small changes in performance, and should be used by coaches and practitioners for monitoring athlete´s progression in the response to training interventions.

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CORRELATION BETWEEN MORPHOLOGICAL CHARACTERISTICS AND SITUATIONAL – MOTOR ABILITIES OF YOUNG FEMALE HANDBALL PLAYERS

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UDC 796.322.012.1

SUMMARY

A morphological-motor profile of a player has a vital role in achieving success in modern handball. The aim of this research was to establish the correlation between morphological characteristics and specific- motor abilities of female handball players at the age of 13 to 14. The sample was comprised of 30 examinees, female handball players from the school of handball of the female handball club 'Naisa', Serbia. A set of 22 measuring instruments was applied for estimating and evaluating morphological characteristics, whereas a set of 8 tests was used for situational-motor abilities (Shooting from a 7meter-distant high stand [n/4 shots], Shooting from an 8meter-distant step [n/4 shots], Jump shot from 9 meters [n/4 shots], Starting speed with the ball in a 20meter run [sec.], Throwing and catching the ball rebounded off the wall with onehand [n/30 sec.], Dribbling in 'eights' [sec.], Dribbling along a 3meter-long line of a square [sec.] and Players' movements with and without the ball with shooting ongoal [sec.]). Canonical-correlation analysis was used for obtaining a high statistically significant canonical correlation (R=0,90; p=0,01) between the morphological characteristics (the body volume) and the situational and motor variables (shooting precision).

Keywords: Morphological characteristics, situational-motor abilities, correlation, female handball.

INTRODUCTION

Over the past decade, handball has seen a rise in popularity not just in Europe but in Brazil, China, South Korea and Japan too. A large number of girls have taken up handball for its dynamics, attractiveness, the positive influence it has on the development of the anthropological characteristics, socialization and for many other benefits for young people.

Handball is a dynamic game comprised of the natural ways of moving, running, jumping as well as different types of landing. Technical and tactical elements with or without the ball to a large extent influence the development of many basic and situational and motor abilities of young female handball players. In the process of selection, special attention is paid to those characteristics and abilities which are required for achieving success. The most important is genetic predisposition, followed by the morphological, motor and psychological profile of the player. Demanding technical and tactical elements of the game dictate that female handball players need to be higher, need to have longer arms and bigger hands, optimal body weight and relationship between the components of the body composition. Speed, explosive power, agility, coordination and precision are some of the most important motor abilities of handball players. They represent the prerequisite for acquiring and realizing technical and tactical elements indispensable for handball (feinting, making different passes, shooting, realizing the defensive tasks, etc.). The period of growth by the age of 14 is considered to be the most suitable on (the sensible phase) for the development of almost all motor abilities (Petković, 2008). It is, at the same time, the period of maturation which has a significant influence on anthropometric characteristics but not on physical performance of young female handball players
(Mohamed, Vaeyens, Matthys, Multael, Lefevre, Lenoi r&Philppaerts, 2009). Therefore, it is important for the training process at that age to be focused on acquiring and perfecting all the abilities and skills as

well as on learning basic and more specific handball movements.

The changes in the official handball rules that were introduced in 1999, together with the 2014 and 2015 amendments, have led to the increase in the attractiveness of the game itself and in its dynamics but have also reduced the possibility of rough contacts in mutual duels of the players. The new characteristics of the game have also led to adopting a different approach to the training process in the parts related to the physical, technical and tactical as well as psychological preparation of both male and female handball players. Much more time within the training process is allocated to a specific conditioning preparation. All the exercises and movements for the development of speed, strength, coordination and agility are realized with the ball, as specific (competitive) exercises, the aim of which is enabling the players to efficiently deal with the tasks in the game itself.

The specific relationships and connections between different anthropological features of female handball players have been the focal issues of much research (Srhoj, 2002; Mohamed et al, 2009;Milanese, Piscitelli, Lampis & Zancanaro, 2011; Vila et al, 2012; Xhemaili, 2012; Pori, Šibila, Justin, Kajtna & Pori, 2012; Stanković, Malacko, Bojić & Ilić, 2013;Bojić & Pavlović, 2014). Morphological and motor, as well as psychological profiles of the players will differ depending on the player's position in the team.

The aim of this research was to establish the correlation between morphological characteristics and specific- motor abilities of female handball players at the age of 13 to 14.

METHODS

Subjects

30 female handball players, aged 13 to 14, members of the school of handball of the female handball club 'Naisa' from Niš, Serbia participated in the research. All the examinees had been playing handball for at least three years at the time the research took place. The frequency of their training sessions was 4 to 5 a week, lasting from 90 to 120 minutes.

Procedure

A set of 30 variables was used in the research. The set covered both morphological characteristics and situational and motor abilities.

Morphological characteristics were evaluated by 22 measuring instruments including:

- longitudinal skeleton dimensionality (4 variables), transversal skeleton dimensionality (3 variables), volume and body mass (8 variables) and subcutaneous fatty tissue (6 variables)

Situational and motor abilities were evaluated by a set of 8 variables (Pavlin, Šimenc i Delija, 1982):

- Shooting from a 7meter-distant high stand [n/4 shots], Shooting from an 8meter-distant step [n/4 shots], Jump shot from 9 meters [n/4 shots], Starting speed with the ball in a 20meter run [sec.], Throwing and catching the ball rebounded off the wall with onehand [n/30 sec.], Dribbling in 'eights' [sec.], Dribbling along a 3meter-long line of a square [sec.] and Players' movements with and without the ball with shooting ongoal [sec.].

Statistical analysis

A statistical data analysis preconditioned by the aim of the research was used in this research. Basic parameters of descriptive statistics were calculated: mean value (Mean), standard deviation (St. Dev), minimum results (Min) and maximum results (Max), range (Range). Canonic correlation analysis was used for determining relations between the variables of the morphological characteristics and the system of situational and motor abilities. All the data were processed by the statistical package Statistica 7.0.

RESULTS

The analysis of the results of the basic descriptive parameters of the morphological characteristics given in Table 1 shows that almost all the tests have good discrimination since their standard deviation (St Dev) is always up to six times within the range (Range). It can also be noticed that there is a significant deviation in the following variables: chest volume (Range 67.90), hip volume (Range 40.00), upper arm volume (Range 69.40), stomach skin crease (Range 56.40), shin skin crease (Range 52.50) and body mass (48.30), with the greater range pointing to the smaller number of the examinees with the maximum or minimum results.

Table 1 Basic descriptive parameters of the morphological characteristics and situational and motor abilities

		Mean	St.Dev.	Min	Max	Range
Morphological characteristics	Body height	167,55	6,70	151,50	181,60	30,10
	Leg length	94,79	4,70	86,00	105,50	19,50
	Height when sitting	89,73	3,91	77,00	98,30	21,30
	Arm length	72,31	3,64	64,80	78,80	14,00
	Shoulder width	36,30	3,47	16,50	40,50	24,00
	Pelvis width	26,44	2,42	22,60	37,70	15,10
	Hip width	30,38	2,49	24,80	38,50	13,70
	Chest volume	80,66	9,58	30,30	98,20	67,90
	Waist volume	68,26	5,29	55,60	82,00	26,40
	Stomach volume	75,33	6,79	62,20	97,80	35,60
	Hip volume	90,14	7,86	68,20	108,20	40,00
	Upper arm volume	25,20	9,21	19,20	88,60	69,40
	Forearm volume	22,46	1,47	18,60	25,30	6,70
	Thigh volume	51,50	6,17	21,30	61,50	40,20
	Shin volume	35,85	3,46	29,20	52,20	23,00
	Upper arm skin crease	11,97	3,61	6,20	19,00	12,80
	Back skin crease	10,60	4,42	4,60	26,00	21,40
	Forearm skin crease	7,02	2,61	3,80	18,00	14,20
	Stomach skin crease	17,72	8,80	5,00	61,40	56,40
	Thigh skin crease	22,94	5,08	13,20	35,80	22,60
	Shin skin crease	18,79	7,41	9,20	61,70	52,50
	Body mass	58,77	9,87	36,90	85,20	48,30
Situational and motor abilities	Shooting from a 7meter-distant high stand [n/4 shots]	1,53	1,35	0,00	6,00	6,00
	Shooting from an 8meter-distant step [n/4 shots]	1,72	1,52	0,00	6,00	6,00
	Jump shot from 9 meters [n/4 shots]	1,40	1,29	0,00	6,00	6,00
	Starting speed with the ball in a 20meter run [sec.]	3,87	0,50	2,80	5,10	2,30
	Throwing and catching the ball rebounded off the wall with onehand[n/30sec.]	22,38	5,16	12,00	34,00	22,00
	Dribbling in 'eights' [sec.]	6,59	0,95	3,50	8,50	5,00
	Dribbling along a 3meter-long line of a square [sec.]	9,19	1,73	6,10	14,30	8,20
	Players' movements with and without the ball with shooting ongoal [sec.]	26,36	2,63	21,80	33,40	11,60

The results of the basic statistical parameters of the situational and motor abilities (Table 1) show that the range between the minimum and maximum results is mostly constant and that there is no significant deviation from the mean values of the results, except for a slight one in throwing and catching the ball rebounded of the wall with one hand variable (Range 22.00).

Canonic correlation analysis was used for determining the connection between the variables which describe morphological characteristics and situational and motor abilities in young female handball players.

Table 2 shows the matrix of cross-correlation of the morphological characteristics and situational and motor variables and table 4 shows the isolated canonic function.

The analysis of the matrix of cross-correlation between the system of the criterion variables (situational and motor abilities) and the system of predictorial morphological variables (table 2) shows relatively high and statistically significant correlations between the pairs of variables of both anthropological areas. The following predictorial variables: leg length (0.26), stomach volume (0.27) and body mass (0.25) have statistically significant connection with the jump shot from 9 meters variable. The highest degree of connectedness is between the criterion variable players' movements with and without the ball with shooting on goal and most of the predictorial variables (shoulder width **-0.33**; chest volume **-0.31**; hip volume **-0.29**; upper arm volume **0.37**; thigh volume **-0.27**; shin volume **0.31**; shin skin crease **0.27**).

Table 2 Correlations between morphological characteristics and situational and motor abilities

	Shooting from a 7meter-distant high stand [n/4 shots]	Shooting from an 8meter-distant step [n/4 shots]	Jump shot from 9 meters [n/4 shots]	Starting speed with the ball in a 20meter run [sec.]	Throwing and catching the ball rebounded off the wall with onehand[n/30sec.]	Dribbling in 'eights' [sec.]	Dribbling along a 3meter-long line of a square [sec.]	Players' movements with and without the ball with shooting ongoal [sec.]
Body height	0,04	0,12	0,23	-0,20	-0,02	-0,14	-0,01	-0,06
Leg length	0,10	0,17	0,26	-0,32	0,16	-0,21	-0,05	-0,18
Height when sitting	-0,08	-0,04	0,17	-0,15	-0,10	-0,04	-0,11	0,02
Arm length	0,08	0,13	0,21	-0,19	0,06	-0,15	-0,02	-0,07
Shoulder width	0,11	0,09	0,20	-0,31	0,24	0,01	-0,21	-0,33
Pelvis width	-0,15	-0,10	0,05	0,09	-0,12	0,02	0,17	0,23
Hip width	-0,01	-0,09	0,20	-0,06	0,09	0,04	-0,05	-0,12
Chest volume	0,03	-0,03	0,23	-0,22	0,18	0,05	-0,09	-0,31
Waist volume	-0,07	-0,19	0,08	0,07	-0,08	0,19	0,13	0,18
Stomach volume	-0,05	-0,02	0,27	-0,11	0,12	-0,00	-0,03	-0,08
Hip volume	-0,03	-0,04	0,19	-0,24	0,19	0,00	-0,08	-0,29
Upper arm volume	-0,06	-0,13	-0,09	0,16	-0,27	0,03	0,12	0,37
Forearm volume	-0,04	-0,24	0,14	-0,01	-0,04	0,04	0,05	0,01
Thigh volume	0,01	-0,07	0,23	-0,20	0,17	0,07	-0,13	-0,27
Shin volume	-0,02	-0,16	-0,01	0,07	-0,21	0,08	0,06	0,31
Upper arm skin crease	0,19	-0,02	0,16	-0,03	0,08	-0,04	-0,03	-0,03
Back skin crease	-0,14	-0,20	0,04	0,07	-0,18	0,14	0,10	0,20
Forearm skin crease	-0,21	-0,13	0,14	0,24	-0,18	-0,14	0,03	0,11
Stomach skin crease	-0,02	-0,08	0,01	-0,10	-0,11	-0,01	0,10	0,16
Thigh skin crease	-0,04	0,03	0,27	-0,01	0,15	0,00	0,30	-0,04
Shin skin crease	-0,09	-0,14	-0,07	0,06	-0,16	-0,01	0,17	0,27
Body mass	0,02	-0,08	0,25	-0,17	0,08	0,03	-0,06	-0,12

After a characteristic equation of the cross-correlation matrix had been solved, a specific factor (as shown in table 3) was isolated. While determining relations between the predictorial system of morphological characteristics and criterion situational and motor variables using Bertlett $\chi 2$ test, a high canonic correlation of 0.09 (R= 0,09) was obtained which is statistically significant at 0.005 level (p= 0,01). R^2 of the canonic correlation, which explains the mutual variance of the variables of the two sets of the total variability of all analyzed systems of variables, is R= 0.81, which means that the isolated function is explained by 81% of the total variability.

Table 3 The number of significant factors

	Canonical R	Canonical R-sqr.	Chi-sqr.	df	p
0	0,90	0,81	222,15	176	**0,010**
1	0,85	0,72	163,26	147	0,170
2	0,77	0,59	118,59	120	0,519
3	0,76	0,58	86,90	95	0,710
4	0,66	0,44	55,77	72	0,921
5	0,61	0,37	35,27	51	0,954
6	0,53	0,28	18,99	32	0,966
7	0,43	0,18	7,10	15	0,954

By analyzing the matrix of the structure of the canonic factor of the morphological characteristics (table 4) it can be concluded that the range of the statistically significant coefficients is from 0.00 to 0.49. The canonic factor within this range is best defined by the following variables: shoulder width (0.41), upper arm volume (-0.41), hip volume (0.47), chest volume (0.48) and thigh volume (0.49). Therefore, the canonic factor is defined by those variables of the morphological set which estimate the voluminosity of the body. Having this in mind, it should be emphasized that in this matrix the variables with good results can be both positive and negative integers.

The canonic factor within the set of situational and motor abilities of young female handball players is defined by high values of the statistically significant canonic coefficients of the correlations of the following variables: shooting from a 7meter-distant high stand [n/4 shots] (-0.28), shooting from an 8meter-distant step [n/4 shots] (-0.38) and players' movements with and without the ball with shooting ongoal [sec.] (-0.51). This canonic factor is well defined in the applied situational tests so it can be described as the precision factor of the ongoal shooting.

Table 4 Factor structure of the isolated factor

Morphological canonic factors		**Situational and motor canonic factors**	
Body height	-0,10	Shooting from a 7meter-distant high stand [n/4 shots]	-0,28
Leg length	-0,00	Shooting from an 8meter-distant step [n/4 shots]	-0,38
Height when sitting	0,00	Jump shot from 9 meters [n/4 shots]	-0,01
Arm length	-0,10	Starting speed with the ball in a 20meter run [sec.]	-0,20
Shoulder width	0,41	Throwing and catching the ball rebounded off the wall with onehand[n/30sec.]	0,10
Pelvis width	-0,18	Dribbling in 'eights' [sec.]	0,16
Hip width	0,29	Dribbling along a 3meter-long line of a square [sec.]	-0,18
Chest volume	0,48	Players' movements with and without the ball with shooting ongoal [sec.]	-0,51
Waist volume	0,04		
Stomach volume	0,20		
Hip volume	0,47		
Upper arm volume	-0,41		
Forearm volume	0,18		
Thigh volume	0,49		
Shin volume	-0,26		
Upper arm skin crease	-0,02		
Back skin crease	-0,02		
Forearm skin crease	-0,10		
Stomach skin crease	-0,18		
Thigh skin crease	0,08		
Shin skin crease	-0,27		
Body mass	0,26		

DISCUSSION

Achieving success in all sports is attributed to the adequate morphological profile of an athlete. From 11 to 15 years of age, in girls who are included in regular training sessions a positive influence of physical activity on morphological characteristics can be observed, except for the longitudinal dimensionality of the skeleton, which is under a strong influence of the biological growth factor and maturation (Đurašković, 2009; Mohamed et al, 2009).

Some of the important abilities determining the successfulness of a handball team are explosive power, coordination and precision. These abilities are manifested in shooting and they have a direct influence on the result of a game since scoring goals is the only way to evaluate how successful a team is in various competitions (Gorostiaga et al., 2005; Bulava, Rodić i Gruić, 2011). Research has shown that the speed of the ball in handball depends on the physical ability of an athlete, their power and strength before all other abilities. The muscle strength is a very important parameter responsible for the successfulness in performing high-speed movements with maximum effort which, when it comes to handball, implies throwing the ball and shooting (Newton & Kraemer, 1994; Van den Tillaar & Ettema, 2004).

The given canonic analysis has proven that there is a statistically significant correlation between the morphological characteristics and situational and motor abilities of the young female handball players. The high values of the correlation can be observed between the criterion variables estimating the speed of movements and precision and the predictorial set of variables estimating body voluminosity. The results can be explained by the fact that the successful realization of specific technical and tactical tasks in handball largely depends on the possibility of generating muscle power. Taking into account the fact that the muscle power stems from the muscle cross section, which, in turn, leads to the enhanced volume of that same muscle, it is presupposed that the parameters of voluminosity in young female handball players work in the favour of the muscle mass.

CONCLUSION

The statistically significant correlation between the morphological characteristics (the predictorial system) and situational and motor abilities (the criterion system) in young female handball players was obtained. The results of canonic correlation analysis and the factor structure of the isolated factors indicate that there is a significant correlation between the body voluminosity and the speed of movements and precision in young female handball players. Presupposing that the bigger volumes of the measured body parts of the examinees work in favour of the muscle mass, the obtained results lead to the conclusion that young female handball players who have bigger body voluminosity are more successful in realizing those situational and motor tasks which are dominated by shooting precision.

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DIFERENCE IN KINEMATIC PARAMETER OF MADE JUP SHOT IN YOUNG BASKETBALL PALYERS

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UDC 796.3.012:612.766

SUMMARY

The aim of this study was to determine the difference in kinematic parameters of made jump shot in young basketball players. Participants were 61 basketball players, divided in two subsamples. Experimental subsamples of 31 players (age 15.32 ± 0.65 years), trained according to specific training program for 10 weeks and control subsample of 30 players (age 16.3 ± 0.71 years) who trained according to the plan of their coaches. The obtained data from the initial and final measurement were processed by nonparametric statistics with the aim to determine the differences between the experimental and the control subsample, both on the initial and the final measurement. The results showed that there are differences in nine out of 10 kinematic parameters at initial measurement and that there are also differences in nine out of 10 kinematic parameters at final measurement but not in the same one.

Keywords: Kinematic, Jump shot, Basketball, Smart Ball.

INTRODUCTION

The good biomechanics of jump shot in basketball represents the correct movement of the upper extremities while the lower extremities should provide well-balanced and powerful vertical jump (Krause, Meyer, & Meyer, 2008; Chen, Lo, Lee, Wang, & Shiang, 2005). For player to perform an effective jump shot, important role are playing biomechanical parameters and balance of the body (Millslagle, 2002; Button et al., 2003; Okubo & Hubbard, 2006; Fontanella, 2007; Lam et al., 2009).

Shooting at the basket is the most known basic basketball technique (Chen, Lo, Lee, Wang, & Shiang, 2005). However, jump shot stands out as the most important and most common shot of all shots in the game (Hess, 1980; Çetin & Muratl, 2014). Importance of it lies in fact that it's the basis of any attack (Taborda, Dorst, & Leite, 2007). For that reason, most of the coaches defined jump shot or any kind of shot as the most important basketball skills (Kant, 2014). A proper shot is the most important technique that needs to be mastered in basketball (Varghesea & Shelvam, 2014).

The main factors that determine the flight of a ball during the jump shot are: the speed of the release, the angle of the release and the height in which the ball is release and of course the distance from where the shot was taken (Hay, 1994; Miller & Bartlett, 1996; Rojas, Cepero, Ona, & Gutierrez, 2000; Chen, Lo, Lee, Wang, & Shiang, 2005). Although, the technique of jump shot may look similar in all basketball players, every player have a different style because of biomechanical parameters (Erčulj & Supej, 2006).

According to some authors (Miller & Bartlett, 1993; 1996; Rojas, Cepero, Oña, & Gutierrez, 2000) the release angle from closer range is usually 52° - 55°, while from a greater distance is usually 48° - 50°. The release angle is in a positive relation with the ball entry angle into the basket (Miller & Bartlett, 1996). There are many factors that can have influence on release angle: distance from the basket and shooter's height (Satern, 1993; Miller & Bartlett, 1996), angle in shoulder join (Satern, 1988), as well as the defender and his presence. What needs to be noted is that there is on one angle that will make the shot ideal, but that there is a right combination of the release speed and the angle of the release. It can simply be said that all factors are interdependent (Erčulj & Supej, 2006).

The shooter's height, height of the jump and the position of the body can have influence on the height from which the ball is release (Miller & Bartlett, 1996; Struzik, Pietraszewski, & Zawadzki, 2014). Height from which the ball is release is important because, as the higher the release point is the easier will be to shot the ball over his defender.

All kind of shooting trainings and shooting exercises can help to improve the jump shot and his precision. Main thing is such shooting trainings is that they need to be brought as close as you get to realistic conditions (for a certain time to made a shot, shoot over the players, make a position for a shot with the defense). But as we sad, when performing a jump shot a powerful vertical jump is needed and the best way to improve the explosive strength according to some authors (Wilson, Murphy, & Giorgi, 1996; Fatouros et al., 2000; Matavulj, Kukolj, Ugarkovic, Tihanyi, & Jaric, 2001; Tricoli, Lamas, Carnevale, & Ugrinowitsch, 2005; Lehance, Croisier, & Bury, 2005; Kotzamanidis, 2006; Markovic, 2007; Markovic, Jukic, Milanovic, & Metikos, 2007) is plyometric exercises. Therefore, the combination of shooting exercises and plyometric exercises should be helpful in improving the jump shot in basketball

METHODS

Subjects

The sample of participants consisted of 61 healthy mail basketball players was divided in two subsamples. One of the subsample was experimental with 31 basketball players, average age of 15.32 ± 0.65 years, trained according to specific training program for 10 weeks. Second subsample was control with 30 basketball players, average age of 16.3 ± 0.71 years. All participants had a training status for more than a year.

Procedure

The Initial measurement was done one week before experimental subsample started with program and the final measurement was done week after the program ended.

For measuring kinematic parameters such as release speed of ball (RSB) and angle of release (AOR) smart basketball "94 fifty" was used. For measuring angle in the elbow joint at the moment of ball release (AEJR), height of the body center of gravity at the moment of ball release (HCGR) and height of release point (HRP), high-speed camera Casio Exillim F1 was used for recording jump shot and software for motion kinematics analysis "Kinovea" 0.8.25 was used for analyzing video with jump shot and determining mentioned parameters.

Each player performs a jump shots from the left and right wing and from position against the basket. After making three shots player moved to the next position. Shooting positions were set at distance of five meters (two point) and 6.75 m (thee point). There were two players who, after rebounding, passed the ball directly to the shooter.

Specific Training Program

The specific training program of 10 weeks had three practices per week, in duration of 90 min each and a pause between practices of one to two days. The program consisted of combination of polymeric and shooting exercise, dosed with 50%:50% at one practice.

The plyometric program (table 1) had six levels of exercise load intensity, depending on the week. The first week was with low intensity. Second, third and fourth week was with low - medium intensity. The fifth and sixth week was with medium - high intensity of exercises. Seventh week was a pause. Eighth and ninth was with the highest intensity and last week, tenth one, was with high mid-intensity of plyometric program.

The shooting part of the program (table 2) consisted of shooting exercises, shooting tasks as well as mutual competitions. From week to week, the shooting program was made more difficult in terms of bringing tasks closer to real situations on the court during one game. That means that time for scoring was decreasing, distance was increasing, the defender was bring in to guard the shooter and other similar tasks where added.

Table 1: Plyometric program per week with load intensity, series, repetitions and exercises.

WEEK	LOAD INTENSITY	SERIES AND REPETITIONS	POLYGON EXERCISES
I	Low	1 x 4-8	Deer jumps (with and without ball); Forward Bounds; Side jumps from one leg to the other (with and without a ball); Catching and passing medicine ball; Throwing the medicine ball over the head with jumps.
II	Low/Medium	1-2 x 4-8	Lateral Bounds; Plyo Lunges; Up and overs; Take-off up with one foot from the bench (with and without a ball); Pulling a rubber band; Pushups with a basketball as a footrest.
III	Low/Medium	2 x 4-8	Running in pairs with rubber belt resistance; Stance Jumps; Backboard Touches; Toss & Catch; "Stroller" (half length); Throwing the medicine ball above head from the squat.
IV	Low/Medium	2 x 4-8	Box Jumps (with and without a ball); Touch & Finish; push-ups on basketball ball; Jump from a push-up; Throwing the medicine ball above the head, side and chest to the chest (in pairs).
V	Medium/High	2 x 5-10	Matrix Jump (with and without a ball); Matrix Jump with one leg (with and without a ball); Stepbeck shot; Push-ups between the bench (Dips); Six pack work out with throwing the medicine ball above the head (in pairs).
VI	Medium/High	2 x 5-10	Power zone Jumps; Box Jumps (with a medicine ball/with load on ankles); Passing medicine ball in pairs; Depth jumps; Push-ups between the bench (Dips); Walking push-ups.
VIII	High	3 x 5-10	Stance Jumps (with medicine ball); Box Jumps (with medicine ball); Depth jumps (with and without medicine ball); Passing medicine ball form lying position on the stomach; Throwing the medicine ball from lying position (over the head, imitate the jump shot movement); Push-ups over chest.
IX	High	3 x 5-10	Power zone Jumps with medicine ball; Matrix jumps with medicine ball; Touch & Finish exercise with a medicine ball; Walking push-ups; Push-ups with lifting of palms from the ground; Different variants of passing the medicine ball.
X	High/Medium	2 x 5-10	With loading around the ankle joint: a) Low skip over the hurdle, b) a high skip over a hurdle, c) jump with a left leg over the hurdle, d) jumps with the right leg over the hurdle, e) jumping jumps over the hurdle (with and without medicine ball; Matrix Jump with one leg (with and without a ball); Push-ups on basketball ball; Push-ups over the chest; Six pack work with medicine ball and passing it.

Table 2: Shooting program per week with purpose of exercise on each training

WEEK	PURPOSE OF EXERCISE	TRAINING 1	TRAINING 2	TRAINING 3
I	Number of made shots	Five in a row; Jump Shot from dribbling; Jump shot with a fake movement; 21 points.	7 of 7 shots; 70 shots; Rotate the cones to the basket; 3 x 3 shots; 21 points.	4 - 3 - 2 - 1 shots; Shot from running in; Jump shot after slalom; 0.5, 1, 2 points.
II- IV	II and III - Number of made shots; IV - On time	7 of 7 shots; 70 shots; Rotate the cones to the basket; 3 x 3 shots.	4 - 3 - 2 - 1 shots; Shot from running in; Jump shot after slalom; 0.5, 1, 2 points.	Five in a row; Jump Shot from dribbling; Jump shot with a fake movement; 21 points.
V-VI	V - On time; VI - on time with passive defense	4 - 3 - 2 - 1 shots; Shot from running in; Jump shot after slalom; 0.5, 1, 2 points.	Five in a row; Jump Shot from dribbling; Rotate the cones to the basket; 21 points.	7 of 7 shots; 70 shots; Jump shot with a fake movement; 3 x 3 shots.
VIII- IX	On time with active defense	Five in a row; 7 of 7 shots; Jump shot after slalom; 21 points.	Rotate the cones to the basket; 0.5, 1, 2 points; Shot from dribbling; 3 x 3 shots.	Shot from running in; 70 shots; Jump shot with a fake movement; 4 - 3 - 2 - 1 shots.
X	On time with passive and active defense	7 of 7 shots; Five in a row; Jump shot with a fake movement; 3 x 3 shots.	4 - 3 - 2 - 1 shots; Shot from running in; 0.5, 1, 2 points; Jump shot after slalom.	70 shots; Shot from dribbling; Rotate the cones to the basket; 21 points.

Statistical analysis

Statistical analysis was carried out using statistical software package IBM SPSS. The difference between subsamples on initial and on final measurement was determined using the Kruskall-Wallis test.

RESULTS

Table 3: Difference between subsamples on initial measurement in kinematic parameters of made jump shots.

INITIAL	Mean Con.	Mean Exp.	Chi-Squ.	df	Sig.
RSB2p (S)	1.10	1.18	11.34	1	**0.00**
RSB3p (S)	1.22	1.19	0.01	1	0.90
AOR2p (DEG)	47.41	48.99	8.55	1	**0.00**
AOR3p (DEG)	49.46	49.12	3.95	1	**0.05**
AEJR2p (DEG)	156.59	160.04	8.09	1	**0.00**
AEJR3p (DEG)	157.87	161.66	12.22	1	**0.00**
HCGR2p (CM)	129.22	126.76	9.39	1	**0.00**
HCGR3p (CM)	131.29	127.81	28.81	1	**0.00**
HRP2p (CM)	241.08	232.48	37.4	1	**0.00**
HRP3p (CM)	242.01	229.01	88.72	1	**0.00**

Table 3 shows the results of the differences between the control and the experimental subsample in kinematic parameters of made jump shots at the initial measurement obtained by the Kruskal-Volis test.

According to the values shown in the column Sig. it was concluded that there is a difference in nine kinematic parameters between the two subunits at the initial measurement. Of these nine parameters, even eight of them (RSB2p, AOR2p, AEJR2p, AEJR3p, HCGR2p, HCGR3p, HRP2p and HRP3p) have the highest level of significance ($p \leq 0.00$). The angle of release for three-point shot (AOR3p), also have a level of significance, but this level is at the lower limit and its value is $p = 0.05$.

Based on values obtained in the hi-squared (Chi-Squ) column, it was found that the parameters with the highest level of significance difference also have a high level of the value of the hi-quadrate (RSB2p $\chi2 = 11.34$; AOR2p $\chi2 = 8.55$; AEJR2p $\chi2 = 8.09$; AEJR3p $\chi2 = 12.22$; HCGR2p $\chi2 = 9.39$; HCGR3p $\chi2 = 28.81$; HRP2p $\chi2 = 37.4$ and HRP3p $\chi2 = 88.72$). The lowest value of the hi-quadrate has the angle of release for three-point shot (AOR3p $\chi2 = 3.95$) and therefore, since the level of significance of the difference was the lowest, it can be said that these kind of hi-square values are expected.

Table 4: Difference between subsamples on final measurement in kinematic parameters of made jump shots.

FINAL	Mean Con.	Mean Exp.	Chi-Squ.	df	Sig.
RSB2p (S)	1.10	0.93	65.13	1	**0.00**
RSB3p (S)	1.21	1.01	65.12	1	**0.00**
AOR2p (DEG)	46.90	50.24	49.41	1	**0.00**
AOR3p (DEG)	48.69	50.29	10.28	1	**0.00**
AEJR2p (DEG)	156.47	160.35	9.06	1	**0.00**
AEJR3p (DEG)	157.64	162.06	16.61	1	**0.00**
HCGR2p (CM)	129.49	131.73	6.45	1	**0.01**
HCGR3p (CM)	130.99	134.52	13.9	1	**0.00**
HRP2p (CM)	239.90	239.18	2.99	1	0.08
HRP3p (CM)	241.20	239.45	5.05	1	**0.02**

Table 4 shows the results of the differences between the control and the experimental subsample in kinematic parameters of made jump shots at the final measurement obtained by the Kruskal-Volis test.

Observing the column Sig. and the values of the significance difference, it was concluded that there is a difference in nine out of 10 kinematic parameters between the two subunits at the final measurement. Of these nine parameters, seven parameters (RSB2p, RSB3p, AOR2p, AOR3p, AEJR2p, AEJR3p and HCGR3p,) have the highest level of significance ($p \leq 0.00$). A slightly lower level of significance is found at the height of the body center of gravity at the moment of ball release (HCGR2p) which was $p = 0.01$ and at the height of release point (HRP3p) which was $p = 0.02$. The only kinematic parameter in which there was no significant difference is the height of release point (HRP2p $p = 0.08$).

What can be further concluded by observing Table 4 is that, based on value in the hi-square (Chi-Squ) column, parameters that have a high level of hi-square values are actually parameters with the highest level of significance difference (RSB2p $\chi2 = 65.13$; RSB3p $\chi2 = 65.12$; AOR2p $\chi2 = 49.41$; AOR3p $\chi2 = 10.28$; AEJR2p $\chi2 = 9.06$; AEJR3p $\chi2 = 16.61$; HCGR3p $\chi2 = 13.9$). For the remaining two parameters with a slightly lower level of significance, the value of the hi-quadrate is HCGR2p $\chi2 = 6.45$ and HRP3p $\chi2 = 5.05$.

DISCUSSION

The aim of this study was to determine the difference in kinematic parameters (release speed of ball, angle of release, angle in the elbow joint at the moment of ball release, height of the body center of gravity at the moment of ball release and height of release point) of made jump shot in young basketball players. Observing the results, it can be concluded that there are differences between subsamples on initial and also on final measurement.

As is interpreted in some researches (Walters, Hudson, & Bird, 1990; Satern, 1993; Okazaki & Rodacki, 2012) with further distance target visualization becomes smaller and therefore reduces the success of the jump shot. The only way of decreasing the distance between shot position and rim is to increase the height of ball release or to increase vertical jump during the performance of jump shot. Ideal height for releasing the ball during jump shot is when the ball is in horizontal level with the rim because, with that position ball have the shortest way to cross.

During jump shot body position should provide the shooter best stability and balance. That is the reason for decrease of jump height and height of ball release at long distance shoots (Miller & Bartlett, 1993, 1996; Rojas, Cepero, Oña, & Gutierrez, 2000; Okazaki & Rodacki, 2012; Tapera, Gundani, Makaza, Amusa, & Goon, 2014a, 2014б). However, results of this research cannot completely confirm this fact. Observing mean values (columns mean con./exp.) of height of the body center of gravity at the moment of ball release (HCGR) and height of release point (HRP) for three-point shot are not less than values for two-point shot, as was the case in mentioned studies. On the other hand, there is not a big numeric difference between mean values of three-point shot and two-point shot both on the initial and the final measurement. However, such results may be justified by other authors (Kant, 2014; Tapera, Gundani, Makaza, Amusa, & Goon, 2014a) who concluded in their researches that for a successful jump shot ball release need to be made from higher point. Therefore, if the shooters goal is to release the ball in the higher point, one of the goals of a specific training program was to make such a release jurying jump shot from any distance. On the initial measurement there was difference in height of the body center of gravity at the moment of ball release (HCGR) and height of release point (HRP) for bout shots but on the final measurement there wasn't only at height of release point for two-point shot (HRP2p). However, although there is no difference, comparing numerical values from the initial and final measurement, an increase in value can be noticed and that was the purpose of specific training program.

Jump shot from longer distance requires from the shooter to adjust his movements in order to increase his precision. That means that except the change in height of ball release (release point), a change in angle of release and release speed of ball needs to occur (Miller & Bartlett, 1996; Okazaki & Rodacki, 2012). Results of this research indicate on higher release speed of ball (RSB) from longer distance (three-point shoot) among both subsamples, which was the case in previous studies (Satern, 1993; Miller & Bartlett, 1996; Okazaki & Rodacki, 2012) with similar problem.

Angle in which ball will enter through the rim is closely connected with angle of release and angle in joints of the shooting arm. So, the bigger the release angle - the bigger ball entry angle. When increasing the distance, the angles of the shooting arm are also increasing (Ryan & Holt, 1989; Elliott & White, 1989; Satern, 1993; Miller & Bartlett, 1996; Taborda, Dorst, & Leite, 2007; Okazaki & Rodacki, 2012) which can be confirmed with this research when it comes to angle of ball release and angle in the elbow joint at the moment of ball release. Results from initial and final measurement, indicate that both subsamples have bigger angle values in elbow joint as the distance increases (three point shot). Also, the mean values of the angle of ball release, obtained in this study, indicate that with increasing the distance there is a slight increase of its values.

CONCLUSION

The obtained results of this research may seem confusing, because although there are two different subsamples, the differences in the kinematical parameters exist at the initial measurement and at the final measurements after a specific training program. However, it has been said about the technique (style) performing a jump shot, and how may look the same in all players but again quite different. With this, the obtained results can be explained. At this age there is still no formed jump shot and comes easily to changes in kinematic parameters. What is important to mention is that after the implementation of the ten-week specific training program, there have been numerical improvements in kinematic parameters of the experimental subsample.

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FLEXIBILITY OF YOUNG ACADEMY SOCCER PLAYERS IN UNITED ARAB EMIRATES

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UDC 796.332.012.1(620)

SUMMARY

Flexibility is defined as the range of motion at a single joint or series of joints. Flexibility is important in all sport; it affects performance in individual sports more than in team sport. There is also a distinction between static and dynamic flexibility. The objective of the research study was to explore flexibility of U15 and U16 academy soccer players, which can be used to predict their future success in soccer. All results have been analyzed in the statistical program Statistics 7.0 for Windows. It can be concluded that level of play may not influence flexibility and that age-related increases in flexibility occur from late adolescence to early adulthood; thereafter there is an age-related decline in flexibility.

Keywords: flexibility, academy soccer players, playing positions

INTRODUCTION

Flexibility, according to Eston and Reilly (1996), is defined as the range of motion (ROM) at a single joint or series of joints. Gleim and McHugh (1997) considered flexibility as a component of physical fitness and defined it as the amount of movement of a joint through its normal plane of motion. There is also a distinction between static and dynamic flexibility. Static flexibility is defined as the range of motion available to a joint or series of joints (Gleim and McHugh, 1997). Dynamic flexibility refers to the ease of movement within the obtainable range of motion (Maud and Cortez-Cooper, 1995). Sub optimal flexibility increases the risk of injuries. Therefore testing for flexibility can be important in soccer as it can possibly identify players at risk (Ostojic and Stojanovic, 2007; Reilly, 1996). Arnason *et al.* (2004) analyzed the frequency and severity of injury and its relation to performance in top English soccer teams and found that teams who sustain fewer injuries occupied better positions on the log standings and had greater chances of success at the end of season. This observation may relate to the findings of Gleim and McHugh (1997) who reported that non-injured groups of players tend to be more flexible than injured groups.

Several studies have shown that soccer players have poorer flexibility than non-athletes (Signorelli *et al*., 2012; Ostojic and Stojanovic, 2007; Malina *et al*., 2004) which could be associated to the little attention given to flexibility during training sessions as most coaches would rather focus on skills training and game strategies. Ostojic and Stojanovic (2007) compared the flexibility of thirty (30) elite (national league players) and thirty (30) non-elite (Division 3 players) Serbian soccer players. The purpose of the study was to examine the relationship between flexibility and level of play. They found no significant differences between elite and non-elite players in passive hip flexion and ankle flexibility ($p > 0.05$). A significant difference was noted in sit and reach results, non-players had superior scores compared to elite players (10.7±6.4 and 7.9±3.2), ($p < 0.05$). Young and Pryor (2007) examined the flexibility scores of 485 young elite and non-elite Australian soccer players using the sit and reach method. They observed that elite players had higher scores compared to non-elite players (8.8± 7.5 and 7.1 ±7.3 cm), ($p = 0.039$), and this higher score cannot be interpreted to mean the best suitable score.

Varying flexibility scores have been reported by different authors. Young and Pryor (2007) and Ostojic and Stojanovic (2007) reported higher scores for Australian and Serbian elite than non-elite youth players. Generally it is expected that players at higher levels of play should have better fitness characteristics and should perform better than those at lower levels of play. This is true for most fitness characteristics, but not for flexibility; in this case higher level players do not necessarily have better flexibility and in fact, many studies actually show they have poorer flexibility than lower level players. This suggests that level of flexibility should have little effect on talent selection, since it cannot discriminate between elite, professional and selected players from non-elite, non-professional and non-selected players. Although flexibility is important in all sport, it affects performance in individual sports more than in team sport.

Flexibility has been shown to decrease with increased age in boys from 5-11 years and then rapidly increases at adolescence growth spurt until the age of 18 (Malina *et al.*, 2000). Adolescence growth spurt is characterized by increases in leg length and shorter trunk length and this leads to less flexibility. In girls the trunk is generally longer than the legs; hence the better flexibility in girls than in boys. Signorelli *et al.* (2012) compared the flexibility of young (17-22 years) and older (27-36 years) players from elite soccer clubs in Brazil to investigate the effect of age and maturity on pre-season flexibility. They found that flexibility has an age-related decrease, although the difference was not statistically significant between the two groups (14.3±3.2 versus 13.1±4.4 cm; p = 0.11). They attributed the difference to age-related loss of muscular elasticity.

The objective of the research study was to explore flexibility of U15 and U16 academy soccer players, which can be used to predict their future success in soccer.

METHODS

Subjects

The sample of research were 60 soccer players from academy in UAE (31 players age U15 and 29 players age U16), conferred by the position in the football field at the 4 sub samples: goalkeepers (8), defenders (16), midfielders (20) and forwards (16).

Procedure

Each participant will have to meet pre-defined conditions, to enter the sample: to regularly attend training sessions, that the respondents voluntarily attended training in the football academy. All the players had more than 3 years of experience that the participants are healthy, participants do not have physical defects, morphological aberrations damaged locomotor apparatus, and they do not possess greater pathophysiological abnormalities. The players were fully-informed of all the experimental procedures. All tests were performed on an indoor artificial grass pitch. It was assumed that players will not consume either excessive or very minimal amounts of water at least two hours before the tests. It was also assumed that the players will not train or partake in any vigorous exercises at least 24 hours before the testing day. The testing process started early in the morning until midday and were conducted at the academy's training fields. Each player performed a standardized 15-minute warm-up consisting of general movements and dynamic and static stretching. After the general warm-up, the players performed all required test.

The sample of the variables represented eighteen tests of specific motoric devided in six groups:

- Sit and reach

Purpose of test: The purpose of the sit and reach test was to measure flexibility of the lower back and the hamstring muscles. These muscles are particularly active during soccer play. The test has a reliability of 0.89 (Jackson and Langford, 1989).

Equipment used: standard sit and reach box with a sliding ruler.

Test Procedure: The player assumed a sitting position, barefooted, with legs extended and feet placed against the box with a sliding ruler on the measuring chart. The subject extended arms and hands, with middle fingers aligned on top of each other. Knees were kept locked in a straight position as the arms reach as far forward as possible. The subject held the position for at least 3 seconds and a reading was taken for the distance moved by the fingers along the measuring chart.

Trials: The best reading from two trials was taken as the final score.

- Shoulder flexibility test

Purpose of test: The purpose of the shoulder flexibility test was to measure the flexibility and mobility of the shoulder joint. Adequate range of motion in the shoulder is important for injury prevention and sporting performance in soccer and other sport which require throwing or catching skills.

Equipment used: flexible tape

Test Procedure: The subject assumed a standing position, with feet shoulder width apart. The right arm was raised straight up overhead for testing the left shoulder flexibility. The subject then bent the right elbow and let the right palm slide at the back of the neck and down the back between the shoulder blades to meet the left palm. The right hand moved down while the left moved up such that the fingers overlap. The distance between the fingertips of the right and left hand was recorded as the test score to the nearest centimeter. The subject then switched hands and performed the test on the opposite shoulder.

Trials: The best score from two trials was taken as the final score.

Statistical analysis

All results have been analyzed in the statistical program Statistics 7.0 for Windows. For all variables basic parameters of the descriptive statistics were calculated: the minimum score (Min), maximum score (Max), mean (Mean), standard deviation (Std. deviation). To determine a statistically significant difference between the groups for each variable was used a T - test, where for the statistical significant difference the value of the significance level to 0.05 ($p \leq 0.05$) was taken.

RESULTS

Table 1. Flexibility scores for U15 (n = 31) and U16 (n = 29) players (values are mean + SD)

Test	Total	U15	U16	P-value
Sit and Reach (cm)	9.6±7.75	9.2±7.20	10.1±8.47	> 0.05
Right shoulder flexibility (cm)	9.4±6.65	10.2±7.82	8.3±4.70	> 0.05
Left shoulder flexibility(cm)	4.7±7.49	6.6±7.26	2.4±7.24	= 0.01

Table 2. Flexibility of U15 and U16 players (combined) according to playing positions (values are mean + SD)

Test	Goalkeepers (n=8)	Defenders (n=16)	Midfielders (n=19)	Forwards (n=17)	P- value
Sit and Reach	15.0±6.06	5.6±8.49	11.3±5.90	9.2±7.78	= 0.01
Right shoulder flexibility	10.4±2.74	10.0±7.95	9.5±6.61	8.0±6.80	> 0.05
Left shoulder flexibility	6.2±3.32	4.7±10.1	4.3±6.91	4.5±6.80	> 0.05

Table 3. Flexibility of U15 players according to playing positions (values are mean + SD)

Test	Goalkeepers (n=4)	Defenders (n=9)	Midfielders n=10)	Forwards (n=8)	P – value
Sit and Reach (cm)	14.2±4.51	6.4±6.11	9.7±7.06	10.1±8.89	>0.05
Right shoulder flexibility (cm)	10.6±3.22	11.9±8.63	10.3±8.01	7.7±8.34	> 0.05
Left shoulder flexibility (m)	7.0±4.26	8.1±9.30	4.6±7.78	6.6±4.38	> 0.05

Table 4. Flexibility of U16 according to playing positions (values are mean + SD)

Test	Goalkeepers (n=4)	Defenders (n=7)	Midfielders (n=9)	Forwards (n=9)	P – value
Sit and Reach	15.8±7.79	4.0±12.45	13.1±3.87	8.4±6.86)	= 0.05
Right shoulder flexibility	10.1±2.51	-6.2±4.86	8.7±4.91	8.4±5.27	> 0.05
Left shoulder flexibility	5.3±2.18	-1.9±8.66	4.0±6.17	2.4±8.28	> 0.05

Table 1. shows that the U16 players were more flexible than the U15 players in the sit and reach tests. However, only the shoulder flexibility to the left resulted in statistically significantly better scores by the U15 players ($p = 0.01$), while there were no statistically differences in sit and reach as well as right shoulder flexibility .

From Table 2. the U15 and U16 players (combined) showed statistically significant differences in sit and reach test according to playing positions ($p = 0.01$), while there was no significant difference in both right and left shoulder flexibility across playing positions.

Goalkeepers had the most flexible lower back muscles compared to other players, whereas defenders had the least flexible lower back muscles (Table 3.). Defenders had higher scores for both right and left shoulder flexibility, whilst forwards and midfielders had the lowest scores in these tests. However, overall there were no statistically significant differences in flexibility of players in different playing positions ($p > 0.05$).

Similarly to the U15 players, the U16 goalkeepers were the most flexible group in all the flexibility tests, followed by midfielders and forwards (Table 6.16).

DISCUSSION

Although flexibility can be considered important in soccer, several studies reported that it is very weak in determining future performance in young players (Signorelli *et al*., 2012; Ostojic and Stojanovic, 2007; Malina *et al*., 2004). The most common flexibility method used in soccer is the sit and reach test, however the current study incorporated sit and reach and the left and right shoulder flexibility tests. No literature was found where the shoulder flexibility test has been used in young soccer players; hence there are no reference score for this test. However, considering the rapid movements of the upper body during dribbling and turning and the explosive throwing actions during throw-ins during a soccer match, this test should actually be considered for young soccer players.

In the shoulder flexibility tests, the U15 players showed better performance over their U16 counterparts. They recorded 10.2 ± 7.82cm on the right shoulder and 6.6 ± 7.26 on the left shoulder, against U16 scores of 8.3 ± 4.70 and 2.4 ± 7.24. No statistically significant differences were observed in all the flexibility tests between the U15 and U16 players, except in left shoulder flexibility ($p < 0.01$). U15 players showed superior performance over U16 players in both right and left elsewhere. They had worse scores compared to Greek under 12 and 16 players studied by Nikolaïdis (2012); to Brazilian elite and non-elite junior players studied by Signorelli *et al*. (2012) and probably due to some of the reasons prior stated. Flexibility is regarded as an unreliable test to distinguish players of different performance abilities because it uses a non-qualitative ranking system ranging from low to high (Malina *et al*., 2000)), whereby hyper-flexibility cannot be said to be optimal and neither can high flexibility scores be classified as excellent.

CONCLUSION

It can be concluded that level of play may not influence flexibility and that age-related increases in flexibility occur from late adolescence to early adulthood; thereafter there is an age-related decline in flexibility.

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FUNCTIONAL BASKETBALL ANALYSIS (OVERVIEW)

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SUMMARY

The modern basketball game is characterized by high intensity of activity for all forty minutes of its duration. Requires players to undergo their own abilities to the collective as well as a wide range of basic and specific functional and motor skills. It is almost impossible to isolate some skill that does not partially participate in the success of the game. Examination of basic and specific functional and motor skills provides an insight into the qualitative and quantitative characteristics of basketball players of different positions in the team, as well as the different ranking of the competition. The aim of this study was the analysis of the research in which parameters of functional capabilities were evaluated and their impact on success in the basketball game.The research included 21 papers published in the period from 2000 to 2015. The descriptive method and theoretical analysis were used to collect, classify and analyze the targeted research, and the research that they came across were: Google, Google Scholar, PubMed and Kobson. The results showed that the use of diagnostic tools is necessary especially in professional basketball, because without them the exact condition of the training of a basketball player regarding the parameters of functional abilities can not be reached. The choice of tests to assess them depends on many factors, such as age, level of training, availability, number of respondents, etc.

Keywords: aerobic and anaerobic capacity, male basketball players, female basketball players, effects.

INTRODUCTION

Basketball is a collective sport game played by two teams, each with five players, and the goal of the game is to score a goal in the opponent's basket and prevent the players of the opposing team from scoring a goal or reaching the ball, respecting and applying the rules of the game (Kocic and Beric , 2015, 49). The functional ability of basketball players is the adaptation of the organism as a whole or of certain parts of the subsystem and the capacity to execute the training or match demand. The functional ability of an athlete is better if the ability to adapt to external conditions is greater. Intensive physical activity has the effect of slowing down the decline in the functional capacity of an individual (Kocić and Berić, 2015, 13).The explosive-type strength for the needs of the start, the fast and the short sprint, and the maximum leap in defense and attack, energy dominates during the activity itself, then coordination in the performance of specific motor tasks and space, the speed of the neuromuscular reaction and the speed of the movements themselves, high aerobic ability ensures slower fatigue and quick recovery in short breaks throughout the game, and anaerobic energy ability is responsible for endurance in repetitive activities of high intensity. The values of the maximum reception and consumption of oxygen, as well as the size of the maximum oxygen debt, differ significantly in high class basketball players from the lower class ones.

The maximum VO_2 (VO_2 max) is different in centers and guards, with the relevant size in favor of the latter, while the maximum length has higher values in the centers and forwards than in the guards. This is exactly the reflection of the characteristics of the activity during the game itself (Karalejić, Jakovljević, 2001). Under the training load, a certain amount of action of the training tools is assumed, primarily on the functional structure of the organism of the athlete (Malacko, 1991). By size criteria, the loads are divided into: small, medium, large and maximum, and determined by the extent and intensity of work (Koprivica, 2013). The load intensity implies the degree of effort involved in training work, ie the strength of the work, and is expressed by the frequency of the repetition of a work in the unit of time, the amount of work in the unit of time, the speed of movement, the percentage of exercise performed with relatively high loads, (Malacko, 1991). Aerobic capacity represents aerobic power, aerobic capacity and aerobic efficiency. It takes place in the body in order to provide and satisfy the energy needs of muscular contraction in the presence of O_2 (oxygen), and when this process takes place without the presence of oxygen, it is anaerobic processes (Đurašković, 2009). Maximum Oxygen Consumption (VO_2 max) is the highest amount of oxygen the body can absorb during physical activity and is most correlated with working ability (Astrand, Rodahl, 1970). The lactate threshold is defined as the turning point when blood lactates suddenly begin to accumulate to a greater extent (http://www.ognjenstojanovic.com/diagnostika-u-sportu/). Basketball is basically anaerobic sport and consists of about 30% aerobic and about 70% of anaerobic activity (Kocić and Berić, 2015), and numerous factors influence the individual distribution of their share. For example, certain players are constantly moving to take the ball, while others struggling for a better position, some players throw the ball in, while others sprint on the court. We can also confirm this by saying that if we follow a player playing for 10 minutes, we will see that the ratio of activity and rest is about 1: 1 or lower. If we were to follow this same player through the whole game, assuming full minutes of playing, we would see that the ratio of activity and rest between 1: 1 and 1: 3 because the game is composed of short intense activities followed by inactive periodes such as timing- out and halftime. While the energy for high-intensity activities is taken primarily from anaerobic compositions, the recovery takes place during rest, using the aerobic composition (Brittenham, 2005). The aim of this paper is the analysis of the research in which the parameters of functional capabilities were evaluated and their impact on success in the basketball game in the period from 2000 to 2016.

METHOD OF RESEARCH

The descriptive method and theoretical analysis were used to collect, classify and analyze the targeted research, and the research that they came across were: Google, Google Scholar, PubMed and Kobson. Additional literature in the form of textbooks was also used. Search is limited to works published in the period from 2000 to 2016. Analyzed scientific research was published in journals that have a significant impact factor. The keywords used during the search are: aerobic and anaerobic capacity, basketball players. References from all papers were reviewed in order to have more studies that dealt with this topic.

THEORETICAL REVIEW OF PROBLEMS

Each work is presented according to the following parameters: sample of respondents (total number of respondents, age and sex) and estimated parameters (aerobic or anaerobic capacity, number of groups during the survey, parameters measured and results). In 19 out of 21 researches, respondents were male basketball players, while in one research there were also male basketball players and female basketball players (Pupis, M., Rakovic, A., Savanovic, V., Stankovic, D., Kocic, M., & Beric, D (2010). The number of researchers ranged from research to research. The smallest number of respondents were in works of Hoffman, JR, Epstein, S., Einbinder, M., & Weinstein, Y. (2000) and amounted to nine respondents, and the largest in the research of Sporis, G., Vučetić, V., L., Milanović, Z., Krespi, M., & Krakan, I. (2014) and amounted to 150 respondents.

Table No. 1 - Sample of respondents (**N**-total number, **Y/A**-years of age and **S**-sex of respondents) and **tracked parameters** (**Ng -** number of groups, measured parameters, results)

Reference	Sample of respondents			Estimated parameters		
	N	Y/A	S	Ng	measured parameters	results
Hoffman, J. R., Epstein, S., Einbinder, M., & Weinstein, Y. (2000)	9	15	M	1	anaerobic power of basketball players	running drill test (line drill) and jumps can be acceptable as measurement tests for anaerobic power specific to basketball players
Apostolidis, N., Nassis, G. P., Bolatoglou, T., & Geladas, N. D. (2004)	13	18	M	1	VO_2 max	the players presented moderate VO_2 max and anaerobic strength; also, a significant correlation between Pmean and certain outdoor tests suggests that tests can be used to assess the anaerobic capacity of young basketball players
Granić, I., &Krstić, T.	80	15	M	2	functional and	the development of TZK children is not sufficient, given

(2006)					motor skills	that a statistically significant difference in functional and motor skills has been achieved, in the interest of children who train basketball
Prahović, M., & Protić, J. (2007)	98	17	M	2	aerobic endurance	there are differences in functional and motor skills between boys non-sportsers and those who have been training for two years
Balčiūnas, M., Stonkus, S., Abrantes, C., & Sampaio, J. (2006).	35	16	M	2	anaerobic capacity	the PE group training model showed an improvement in the shuttle ball dribbling test. Both training modalities are able to maintain the initial speed and power values, however, anaerobic capacity and skill level have only been increased with the RE group
Litkowycz, R., Mikołajec, K., Zając, A., & Góralczyk, R. (2008)	16	17	M	1	anaerobic capacity	the starting and absolute speeds were not significantly improved (5, 15, 20, 30m), while anaerobic endurance (10 × 30m) showed significant changes. High level of training load in the aerobic zone and inadequate level of alactate anaerobic metabolism was the main reason for the lack of improvement in the level of speed
Castagna, C., Chaouachi, A., Rampinini, E., Chamari, K., & Impellizzeri, F. (2009)	22	20	M	2	aerobic endurance	50 mL · kg-1 · min-1 sufficient value of maximum oxygen consumption for such competitions
Tsimahidis, K., Galazoulas, C., Skoufas, D., Papaiakovou, G., Bassa, E., Patikas, D., & Kotzamanidis, C. (2010)	26	17	M	2	aerobic endurance	the positive effects of this type of training for young basketball players to improve power, speed, and ability to jump
Pupiš, M., Raković, A., Savanović, V., Stanković, D., Kocić, M., & Berić, D. (2010)	48	20	M-F	2	aerobic endurance	inhalation does not have a positive impact on basketball shooting, and 99.5% inhalation of the oxygen has a positive effect during anaerobic loading in basketball
Filipović, I., & Filipović, Đ. (2011)	22	20	M	1	functional abilities	Preparations represent exceptional physical stress for the body, especially for the cardiovascular system, for this reason it is very important to regularly control the health condition of professional athletes. Determining functional abilities is recommended 3 times, and the ECG is analyzed at least once a year
Mačković, S., Pojskić, H., &Užičanin, E. (2012)	34	20	M	4	functional abilities	the differences between internal and external positions of players in aerobic power and relative anaerobic capacities, while there was no difference in the height of the vertical jump. The external players had better aerobic power and higher relative anaerobic power and capacity values, while internal players had better absolute anaerobic power
Santos, E. J., &Janeira, M. A. (2012)	25	14	M	2	aerobic endurance	a durability program can improve results in vertical jumping and arm strength during adolescence. It should be noted that this type of training made for young basketball players increases the explosiveness, which is important for the results in the game without additional burden on the development of skeletal muscle
Štrumbelj, B., Jakovljević, S., & Erčulj, F. (2012)	13	19	F	1	aerobic endurance	The "30-15IFT" intermittent conditioning test proved to be appropriate for assessing the current functional abilities of famele basketball players as well as for identifying variations in their readiness during the various training periods
Andrejić, O. (2012)	21	12	M	2	aerobic endurance	increasing the ability of young male basketball players by applying a pliometric training combined with strength training
Šekeljić, G., Marković, Ž., & Stamatović, M. (2012)	64	15 - 17	M	1	functional abilities	working on the step bench in relation to the bicycle ergometer, it differs in relation to the engaged muscles and their masses, so the burden on the cardiovascular system is different
Stojanovic, M., Ostojic,	24	22	M	1	functional	the reverse relationship between CMJ and RSAtot was

S., Calleja-González, J., Milosevic, Z., &Mikic, M. (2012)					abilities	established, while there was no significant connection between VO_2max and RSA, nor between the CMJ RSAFI
Marinković, D., & Pavlović, S. (2013)	30	16-20	M	1	aerobic capacity	there is a difference in the aerobic capacity of the basketball player compared to the toy position, the backs had the highest value (VO_2 max) while the centers had the lowest values
Sporiš, G., Vučetić, V., Milanović, L., Milanović, Z., Krespi, M., &Krakan, I. (2014)	150	23	M	3	aerobic endurance	the requirements of a specific sport can affect the anaerobic capacity of athletes
Станковић, А. (2014)	16	17	M	1	aerobic endurance	the training process influenced the improvement of all observed variables
арић, И. (2014)	13	17	F	1	aerobic endurance	after the treatment there is a positive transformation of the tested capabilities
Borović, I., Rupčić, T., Matković, B. R., Garafolić, H., &Dadić, M. (2016)	16	15	M	1	functional abilities	aerobic and anaerobic capacity are well developed by all players and meet the high demands of modern, basketball games

DISCUSSION

Hoffman, J. R., Epstein, S., Einbinder, M., & Weinstein, Y. (2000) compared two sport-specific tests when assessing the anaerobic strength of basketball players on a sample of nine basketball players of the young Israel national team aged 17 years. The results obtained in this paper show that the line drill and jump tests – countermovement jump (CMJ) and 15-second anaerobic jump test (APJT) may be acceptable as measurement tests of anaerobic power specific for basketball players.

Balčiūnas, M., Stonkus, S., Abrantes, C., & Sampaio, J. (2006) aimed to determine the effect of four-month different training modalities on strength, speed and anaerobic capacity on a sample of 35 young Lithuanian basketball players . The conclusion is that strength training (occasional exercise with high intensity) can be more useful for preparing young players for the cardiovascular and metabolic specific determinants of the game.

Granić, I., & Krstić, T. (2006) found out possible differences between those who have extracurricular physical activity and students with only TZK, in the exercise of 80 students of the 8th grade, 10 tests were applied. Based on the obtained results of this paper, it is evident that there are noticeable differences in abilities between young basketball players and eight-grade students in favor of the first.

Prahović, M., & Protić, J. (2007) aimed to determine the differences in aerobic endurance and some motor skills on a sample of 98 students using nine tests. There are differences in functional and motor skills between non-sportsmen and those who have been training for two years, and it can be noted that non-sportsmen have achieved poorer performance compared to the prescribed norms, and especially in comparison with the mentioned athletes.

Litkowycz, R., Mikołajec, K., Zając, A., & Góralczyk, R. (2008) investigated the effect of six-week pre-contest mesocycles on speed and anaerobic abilities in 16 basketball juniors of the Polish national team up to 20 years. The efficiency of basketball depends on the ability to undertake short, intense efforts, performed with high frequency, followed by longer periods of low intensity activity (standing, walking, running-slow). The obtained results also show that milk anaerobic metabolism is dominant during the analyzed period in the preparatory and pre-competition phase.

Castagna, C., Chaouachi, A., Rampinini, E., Chamari, K., & Impellizzeri, F. (2009) aimed to determine the aerobic abilities and explosive power of lower extremities in Italian basketball players (regional amateur amateurs) on the sample of seniors (S, n = 11) and junior (J, n = 11). They estimated their maximum oxygen consumption at the time they carried a small gas analyzer (K4b2, COSMED, Rome, Italy) during the yo-yo endurance test. The results showed that 50 mL · kg-1 · min-1 is a sufficient value of maximum oxygen

Pupis, M., Raković, A., Savanović, V., Stanković, D., Kocić, M., & Berić, D. (2010) conducted a survey where the physical reactions of basketball players to the oxygen inhalation of the concentration were 99.5%. The study found that no significant evidence was found that inhalation had a positive impact on basketball shooting, while it can be said that 99.5% inhalation of oxygen has positive effects during anaerobic loading in basketball.

Filipović, I., & Filipović, Đ. (2011) had the goal of analyzing functional abilities and ECG changes in basketball before and after preparation for the next season on a sample of 22 basketball players, the first-division of Serbia. A twelve-channel ECG was created in peace. The results showed that there was a correlation between these two variables both in the pre-preparation period and in the period after preparation, while the ECG parameters were not changed. For this reason it can be noted that it is important to regularly check the health status of professional athletes.

Mačković, S., Pojskić, H., & Užičanin, E. (2012) wanted to discover the differences between basketball players playing on the outside and those who play on the inside positions in some aerobic and anaerobic indicators, on a sample of 34 basketball players from four the Bosnian team, divided into two subunits: I = 17 external players and II = 17 internal. The same is measured body composition, aerobic power (VO2 prediction based on multiple levels of shuttle run test), anaerobic capacities (based on parameters of anaerobic repeating sprint test) and anaerobic power (maximum and relative power output produced during a vertical jump with the preparatory phase). The results of the study show that external players had better aerobic power and higher relative anaerobic strength and capacity values, while internal players had better absolute anaerobic strength.

Santos, E. J., & Janeira, M. A. (2012) conducted a survey to determine the effect of a 10-week training program on the development of explosive power of 25 young basketball players. The results showed that this durability program can improve results in vertical jumps and throwing medicine from a sitting position with young basketball players during adolescence. It should be noted that this type of training made for young basketball players increases the explosiveness, which is important for the results in the game without additional burden on the development of skeletal musculature.

Štrumbelj, B., Jakovljević, S., & Erčulj, F. (2012) presented the applicability of the modified "30-15IFT" test on the sample of the senior basketball team of Serbia, as well as the level of development of certain indices of the special endurance of basketball players and the differences between individual types of players . The "30-15IFT" intermittent conditioning test proved to be appropriate for assessing the current functional abilities of basketball players and for identifying variations in their readiness during the various training periods.

Šekeljić, G., Marković, Ž., & Stamatović, M. (2012) have determined whether the results for estimating the maximum aerobic power will be significantly different if they were obtained using two different ergometers, and two different procedures on a sample of 64 basketball players. The results indicate that the values obtained through these two tests differ significantly. In 77% of respondents, a higher maximum oxygen consumption by step-test was estimated. These differences can be explained that the physiological response of an organism to a step-test operation is different in relation to the work on the cycling process.

Marinković, D., & Pavlović, S. (2013) had to find out whether there is a difference between university basketball players of different playing positions (bek = 11, wing = 11, center = 8) in terms of aerobic capacity. Laboratory system "breath-by-breath" found that there is a difference in the aerobic capacity of the basketball player compared to the toy position. The bulls had the highest value (VO2 max) while the centers had the lowest. This can be said that we were expected with a sense of it if we take the constitution of the players themselves and their tasks in the game itself.

Sporiš, G., Vučetić, V., Milanović, L., Milanović, Z., Krespi, M., & Krakan, I. (2014) have determined whether there are differences in anaerobic endurance between basketball players, football players and handball players on a total of 150 players (each 50). Athletes performed a "300 yard shuttle run" (300Y) and measured the maximum values of lactate in the blood. The results showed that there are significant differences in the results of both tests in tested athletes. Basketball players achieved the best results, then football players and then handball players.

Stankovic, A. (2014) determined the effects of systemic training in the first stage of the preparation period on the energy-motor skills of a player on a sample of 16 basketball players (juniors). The training process influenced the improvement of all tracking variables, the least with running 20 m, and the most with functional abilities.

Zarić, I. (2014) aimed to determine the changes in the motor and functional abilities of the junior 13 female basketball players of the Serbian national team created by the impact of the six-week training process. The selected tests evaluated the speed, strength, agility, flexibility and durability. The results of the research show that between the initial and final testing, there is almost always a difference. The biggest change was obtained in the endurance test (YO YO intermittent test).

This paper analyzed the anthropological profile of cadet male basketball players (U16) of Croatian national team in order to define the model values that will be used in the future in the purpose of directing and developing basketball players of the selected age on a sample of 11 potential cadet players. Basketball players in the U16 category achieved poorer performance in functional tests compared to older players and U18 players, which can be explained by the fact that these players are still in the process of intensive functional and motor development.

CONCLUSION

This paper tells us about aerobic and anaerobic endurance tests as indicators of energy capacity, where a requirement is required for high criteria of functional capabilities in terms of oxygen supply and recovery rate after high anaerobic loading. Therefore, the main goal of fitness preparation in basketball is to achieve an optimal form, and it represents a period when athletes (basketball players) achieve the best results. This means that the coach (or other professional) is asked to make top athletes out of his teammates. In order to achieve this, it is necessary to know the characteristics of the character, because when dealing with younger ages, the wrong choice of methods can have negative effects, and besides this, with older players, the position itself (the task) on the field is also important. The use of diagnostic tools is necessary especially in professional sports, because without it the exact condition of the training of a basketball player in terms of anaerobic and aerobic energy capacities can not be reached. The choice of these tests depends on many factors, such as age, level of training, availability, number of respondents. Finally, when choosing, you need to select those tests that will do the best evaluate the functional state of the examined basketball players, so based on that, they can be precisely planned and programmed trainings of anaerobic and aerobic energy capacities, and the above presented and analyzed works will surely help in that.

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INFLUENCE OF ANTHROPOMETRIC CHARACTERISTICS ON THE SPEED OF SHOTS IN GOALBALL

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UDC 796.3:012.13

SUMMARY

The aim of the research was to determine the influence of anthropometric characteristics on the speed of shot in goalball. The sample of respondents consisted of 13 goalball players aged 18 to 38, with at least 5 years of sports experiance.The predicate set of variables consisted of 13 anthropometric measures, and the criterion variable represented the speed of the shot. A regression analysis was used to analyse the group effects of predictor variables on a criterion variable. Due to the small number of respondents, it was not possible to perform a regression analysis in which the predicate set would consist of 13 variables. Therefore, each dimensionality was presented through a special predicate set, and with it a total of four regression analyzes were performed. The results showed that the transversal dimensionality of the skeleton statistically significantly influenced on the speed of shot in goalball.

Keywords: anthropometric characteristics, speed of shot, goalball.

INTRODUCTION

People with visual impairment (PVI) are lagging behind in the development of certain abilities (Aslan et al., 2012), but it is possible that the ultimate level of them is approximate to the abilities of people without visual impairment, and this helps a well-designed plan and training program (Ćosić & Koprivica, 2010; Houwen et al., 2007). Members of this population have different needs, desires and goals, and involvement in sports (Ćosić & Koprivica, 2010). Goalball is a team sport that is involved in the program of Paralympic Games, and was created for the purpose of rehabilitating veterans with visual impairment (Грлица et al., 2016). This sport is a dynamic sport according to the amount and variability of muscular contraction made during the performance of technical actions. Specifically, some studies have shown that in over 40% of the time to play, the athlete's pulse is high (above 85% of the maximum pulse rate - FCM) and 35% in the aerobic zone (between 50 and 75% FCM) (David & Tosim, 2016). The morphological profile of goalball player is increasingly observed due to the specificity of the sport. Goalball requires a combination of high, powerful and swift athletes to achieve a better impact in attack and defence, in wich the height and range of the body is essential for better perfomance in defence and attack. (Scherer et al., 2012). The expert assessment concluded that the speed of the shot is one of the main indicators for the selection of goalball players. On the other hand, there are no studies that gave the answer how to anticipate this velocity in relation to the morphology of the goalball player.Therefore, the aim of this pilot study is to determine the impact of anthropometric characteristics on the speed of shots in goalball.

METHODS

Subjects

The sample of respondents consisted of 13 goalball players aged 18 to 38, with at least 5 years of sports experiance on the national level.

Procedure

The sample of the variables was divided into two subunits: anthropometric measurements (predictor set of variables), and speed of shot (criterion variable). The testing of 13 anthropometric measures was carried out as follows: longitudinal dimensionality of the skeleton (body height, arm length, leg length), transversal dimensionality of the skeleton (sholder width, hip width, width of the pelvis), body circumference and body mass (,body mass, circumference of the upper arm, chest circumference, volume of the abdomen), adiposity (leather belly set, leather upper arm, leather back set). The speed of the shot was measured using the RADAR[1] During the training session, the speed of the shot was read, and the highest value was takein for futher statistical processing.

Statistical analysis

Statistical data processing was performed in the statistical package SPSS.22. Descriptive statistics have been used-describes the pattern currently in use, and the correlation in which parametric technique (Pirson's correlation) will be used in order to determine the correlation between the two variables. A regression analysis was used to analyze the group effects of the predictor variables on the criterion variable.

RESULTS

Table 1. Descriptives statistics of the predictor (anthropometric characteristics) and criterion variables (the speed of shot).

Variable	MEAN	MIN	MAX	RANGE	SD	SKEW	KURT
BH	178,88	164,9	188,40	23,50	7,62	-0,75	-0,33
LA	77,72	70,90	82,00	11,10	3,57	-1,01	-0,19
LL	97,15	90,00	106,00	16,00	3,84	0,55	1,92
WL	31,65	25,90	40,50	14,60	4,61	0,50	-0,52
HL	34,14	29,70	40,00	10,30	3,07	0,26	-0,50
SL	42,78	37,50	52,10	14,60	3,87	1,16	1,64
BM	81,18	51,20	116,00	64,80	21,01	0,17	-1,28
CC	89,46	67,00	108,50	41,50	14,69	-0,14	-1,44
SC	81,29	65,50	108,90	43,40	14,38	0,63	-0,65
UAC	21,25	13,30	28,70	15,40	5,49	0,01	-1,44
SFUA	25,26	11,40	37,00	25,60	9,83	-0,29	-1,57
SFS	21,65	11,00	35,00	24,00	7,24	0,22	-0,79
SFB	20,76	8,30	34,00	25,70	9,46	0,11	-1,65
SVEL	51,23	40,10	68,19	28,09	7,97	1,02	0,75

Legend: BH - Body height, AL - Arms length, LL - Leg length, WL - Width of the pelvis, HL - Hips width, SL - Shoulder width, BM - Body weight, CC - Breast circumference, SC - Volume of the abdomen, UAC - Circumference of the upper arm, SFUA - Leather upper arm, SC - Leather abdomen, SFB - Leather backbone, SVEL - Shutter speed, MEAN - Arithmetic mean, MIN - Minimum value, MAX - Maximum value, RANGE - Range, SD - Standard deviation, SKEW - Skewness, KURT - Kurtosis

Table 1. shows the the values of descriptive statistics of all predictor and criterion variables .The value of the distribution asymetry is estimated by SKEWNESS, and in the largest number of variables there is a good symmetry and ranges from 0 to ± 0.5 (WL, HL, BM, CC, UAC, SFUA, SFS, SFB). Also, there are values with acceptable symmetry and ranges in the range of ± 0.5 to± 1.0 (BH, LL, SC). The values of asymmetricity of distribution indicating significant asymmetry and moving slightly above ± 1.0 value are present in the three investigated variables (LA, SL, SVEL). The value of the distribution homogeneity evaluated by KURTOSIS indicates a large inhomogenity of the examined sample in as many as 11 of 14 variables (BH, LA, WL, HL, BM, CC, SC, UAC, SFUA, SFS, SFB), because the values are negative. The sample is homogeneous only in the estimated values of three variables (LL, SL, SVEL).

[1]Pro-Level Speed Training Tool & Radar Gun, Pocket Radar, Inc., 3535 Industrial Dr. Suite A4, Santa Rosa, CA 95403

Table 2. Matrix of individual intercorrelations of predictors (anthropometric characteristics) and criterion variables (the speed of shot).

Variable	BH	LL	LL	WL	HL	SL	BM	CC	SC	UAC	SFUA	SFS	SFB	SVEL
BH														
LL	0,18													
LL	0,49	0,11												
WL	0,08	-0,35	0,02											
HL	-0,02	**-0,68**	-0,12	**0,82**										
SL	0,49	-0,17	0,39	0,11	0,26									
BM	0,28	-0,18	0,37	**0,89**	**0,66**	0,30								
CC	0,35	-0,43	0,20	**0,90**	**0,80**	0,39	**0,89**							
SC	0,20	-0,32	0,09	**0,95**	**0,73**	0,16	**0,88**	**0,93**						
UAC	0,22	-0,39	0,13	**0,94**	**0,83**	0,29	**0,92**	**0,97**	**0,96**					
SFUA	0,41	-0,14	0,11	**0,76**	**0,66**	0,47	**0,82**	**0,79**	**0,76**	**0,81**				
SFS	0,47	-0,27	0,26	**0,74**	**0,59**	0,32	**0,78**	**0,92**	**0,86**	**0,85**	**0,70**			
SFB	0,19	-0,24	-0,03	**0,89**	**0,79**	0,18	**0,80**	**0,89**	**0,92**	**0,92**	**0,79**	**0,85**		
SVEL	0,49	-0,08	**0,66**	0,11	0,09	**0,89**	0,38	0,34	0,16	0,24	0,38	0,30	0,04	

Legend: BH - Body height, AL - Arms length, LL - Leg length, WL - Width of the pelvis, HL - Hips width, SL -Shoulder width, BM - Body weight, CC - Breast circumference, SC - Volume of the abdomen, UAC - Circumference of the upper arm, SFUA - Leather upper arm, SC - Leather abdomen, SFB - Leather backbone, SVEL - shutter speed

Table 2. shows the matrix of individual intercorrelations of predicitive and criterion variables. Among the variables that represent anthropometric characteristics there are 38 connections that we can consider as statistically significant. Given the fact that the goal of this paper is the influence of anthropometric characteristics on the speed of shots in goalball, the analysis of results will only be directed to the fulfillment of this goal. This matrix shows that only two of the 13 predictor variables have a significant intercorrelation relationship with the criterion variable-the speed of shot. The high correlation (0.89) with SVEL has a variable SL, and the moderate correlation (0.66) has a variable LL. Due to the small number of subjects, only 13, it was not possible to perform regression analysis. Therefore, each dimensionality (longitudinal dimensionality of the skeleton, transversal dimensionality of skeleton, volume and volume of the body, adiposity) was presented through a special predictive set, so it was performed by a total of four regression analyzes.

Table 3 shows the results of the regression analysis of the effect of predictor variables (longitudinal dimensionality) on the criterion variable (the speed of shot). Based on the significance of the correlation set- criterion (p=0.08) it can be concluded that there is no statistical correlation between the predictor variables of the longitudinal dimensionality of the skeleton (BH, AL, LL) on the criterion variable (SVEL).

Table 3. Regression analysis of influence of predictive variables (longitudinal dimensionality of the skeleton) on the criterion variable (the speed of shot).

Variable	BETA	PART R	R	P
BH	0,25	0,29	0,49	0,38
AL	-0,19	-0,26	-0,08	0,45
LL	0,56	0,57	0,66	0,07
RS= 0,71 R^2= 0,51 p=0,08				

Legend: BH - Body height, AL - Arms length, LL - Leg length, BETA – standardized coefficient, PART R - value of partial correlation, R – correlation value, P - the significance of correlation with the criterion variable, RS – The value of the correlation set-criterion variable, R^2 - Determination coefficient , p – The significance of the correlation set-criterion

Table 4. Regression analysis of influence of predictive variables(transversal dimensionality of the skeleton) on the criterion variable (the speed of shot).

Variable	BETA	PART R	R	P
WL	0,40	0,52	0,11	0,10
HL	-0,50	-0,59	0,09	0,06
SL	0,97	0,93	0,89	**0,00**
RS= 0,93 R^2= 0,86 **p=0,00**				

Legend: WL - Width of the pelvic, HL - Hips width, SL - Shoulder width, BETA – standardized coefficient, PART R - value of partial correlation, R – correlation value, P - the significance of correlation with the criterion variable , RS – The value of the correlation set-criterion variable, R^2- Determination coefficient , p – The significance of the correlation set-criterion

Table 4. shows the results of the regression analysis of the influence of predictive variables (transversal dimensionality of the skeleton) on the criterion variable (the speed of shot). Based on the significance of correlation set-criterion (p=0.00), it can be concluded that there is a statistically significant correlation between the set of predictive variables of the transversal dimensionality of the skeleton on the kriterion variable (SVEL).A set of predictive variables of the transversal dimensionality of the skeleton is determined with the criterion variable 86% of the variance (R2 =0.086). The correlation of the selected predictive variables of the transversal dimensionality of the skeleton (WL,HL,SL) with the criterion variable (SVEL) is high (RS=0.93). Specificaly, only the SL (Shoulder width) variable has a statistically significant correlation (p=0.00) with the criterion variable values (SVEL).

Table 5. Regression analyses of ifluence of predictive variables (volume and volume of the body) on the criterion variable (the speed of shot)

Variable	BETA	PART R	R	P
BM	1,00	0,46	0,38	0,18
CC	1,50	0,47	0,34	0,17
SC	-1,10	-0,38	0,16	0,27
UAC	-1,00	-0,26	0,24	0,47
RS= 0,67 R^2= 0, 45 p=0,25				

Legend: BM - Body weight, CC - Breast circumference, SC - Leather abdomen, UAS – Circumference of the upper arm, BETA – standardized coefficient, PART R - value of partial correlation, R – correlation value, P - the significance of correlation with the criterion variable, RS – The value of the correlation set-criterion variable, R^2 - Determination coefficient, p – The significance of the correlation set-criterion

Table 5 shows the results of the regression analysis of the influence of the predictor variables (volume and volume of the body) on the criterion variable (speed of shot). Based on the significance of correlation set- criterion (p=0.25), it can be concluded that there is no statistical correlation between the predictive variables volume and body volume (BM, CC,SC,UAS) on the criterion variable (SVEL).

Table 6. Regression analysis of influence of predictive variables(adiposity) on the criterion variable(speed of shot).

Variable	BETA	PART R	R	t(9)	P
SFUA	0,90	0,61	0,38	2,30	0,04
SFS	0,90	0,56	0,30	2,00	0,08
SFB	-1,40	-0,67	0,04	-2,7	0,02
RS= 0,73 R^2= 0,53 p=0,07					

Legend: SFUA - Leather upper arm, SC - Leather abdomen, SFB - Leather backbone, BETA – standardized coefficient, PART R - value of partial correlation, R – correlation value, P - the significance of correlation with the criterion variable RS – The value of the correlation set-criterion variable, R^2 - Determination coefficient, p The significance of the correlation set-criterion

Table 6 shows the results of the regression analysis of the influence of predictor variables (adiposity) on the criterion variable (speed of shot). Based on the significance of correlation set-criterion (p=0.25) it can be concluded that there is no statistical correlation between predictive variability variables (SFUA, SC, SFB) on the criterion variable (SVEL).

DISCUSSION

The values of descriptive statistics of predictive variables (anthropometric characteristics) and criterion variables (speed of shot) show that the sample of non-homogeneous subjekt. (Table 1.). Considering the fact that the respondents were of different age, the sporting experience (especially in goalball), and the frequency of training, unification and homogeneity of the values in anthropometric measures as well as in the value of the speed of the shot could not and would not be expected. Othervise, the values of the BH variables are higher in this study than Brazil's top goalball players (Scherer et al., 2012; Lemos et al., 2016) and Turkey (Temur et al., 2014). Given the fact that the purpose of this paper is the influence of anthropometric characteristics on the speed of shot in goalball, there must be a specific review of the value of the shots, which is one of the main indicators of the game in goalball (Owen, 2014). The value of the arithmetic mean SVEL variable is 51.23 km/h more than modest for the top goalball. Even the highest measured value (68.19 km/h) is not competitive for the top goalball. The matrix of individual intercorrelation of predictive (anthropometric characteristics) and criterion variables (speed of shot), has shown that the two variables have an individual connection with the speed of shot-sholder width and leg length (Table 2.). How is this research so called a pilot study, and a sample of subjects small, inhomogeneous according to the criterion of the competition level, conclusions should be takein with caution. The reason for the impact of the mentioned variables on the criterion should be sought in the kinetic chain for the shot in goalball (Bowerman et al., 2011). Stability of this kinetic chain starts at the lower extremities, and the stability and strength of the arm and the shoulder, can be manifested through the bi-diametric diameter (shoulder width), and it can provide techically correct shot as well as its speed.

A total of four regression analyzes were performed, because fewer respondents were compared to the number needed to include all 13 anthropometric measurements in the predictive set. Only one set had a statistically significant correlation with the speed of shot, which is the set of transversal dimensionality of the skeleton containing three variables - Width of the spine, Hips width, Shoulder width. Specifically, the shoulder width variable has a statistically significant correlation with the values of the speed of shot in goalball. Similary, motorized manifestations of the shoulder girdle, which are primaily seen in mobility, in previous studies have shown that they can be a significant factor in the distinction of goalball players, and people with visual impairment who do not have any participation in sport(Colak et al., 2004; Karakaya et al., 2009).

CONCLUSION

The aim of the research was to determine the influence of anthropometric characteristics on the speed of shot in goalball. The sample of respondents consisted of 13 goalball players aged 18 to 38, with at least 5 years of sports experiance.The predicate set of variables consisted of 13 anthropometric measures, and the criterion variable represented the speed of the shot. A regression analysis was used to analyse the group effects of predictor variables on a criterion variable. Due to the small number of respondents, it was not possible to perform a regression analysis in which the predicate set would consist of 13 variables. Therefore, each dimensionality was presented through a special predicate set, and with it a total of four regression analyzes were performed. The results showed that the transversal dimensionality of the skeleton statistically significantly influenced on the speed of shot in goalball.

Due to the low number of examinees and the inhomogeneity of the examined sample, it can not be said with certainty that the results obtained and the observed correlations can be accepted as an axiom. In future research it is necessary to examine the influence of other anthropological dimensions on the speed of the shot. In order to explain from the anthropological side determinants of success in goalball, it is necessary to consult (in addition to a modest number of studies) a goalball experts (Tosim et al., 2008).

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SPEED, CHANGE OF DIRECTION SPEED AND REACTIVE AGILITY IN ADOLESCENT SOCCER PLAYERS: A COMPARATIVE STUDY

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UDC 796.332:313.213.3

SUMMARY

We investigated age-related differences in speed, change of direction speed and reactive agility in a group of highly trained adolescent soccer players. A total of 75 adolescent male soccer players (aged 14– 19 years) were recruited. The players were grouped on the basis of chronological age into 2-year age categories: under 15 (U15: 12.0–13.9 years), under 17 (U17: 14.0–15.9 years), and under 19 (U19: 16.0–17.9 years). Players were tested for 5, 10-m sprint, and 20-m sprint, and agility performance (COD, Illinois test and reactive agility test). Under 19 players had faster ($p \leq 0.01$) 20-m and illinois ($p \leq 0.01$) times than U15 players, while U17 players were faster ($P \leq 0.05$) than U15 players in 20 sprint, COD right and illinois test performances. The main finding of this study was that no significant differences were found among the players in different age categories for most of the variables.

Keywords: differences, youth, performance, football

INTRODUCTION

Soccer is characterized as a prolonged, high-intensity, intermittent team sport that places an emphasis on explosive movements such as repeatedly jumping, sprinting, and kicking (Marques, Izquierdo, Gabbett, Travassos, Branquinho, & van den Tillaar, 2016). High-speed actions in soccer consist of acceleration, maximal speed or agility skills (Gambetta, 1996). Accordingly, Chapman et al., (2008) described speed in soccer as running speed, reaction speed and acceleration speed during the first steps (quickness). Agility has also been shown to be an important component of soccer play (Jovanovic et al., 2011). Currently, agility is considered an open skill and was recently defined as a change in velocity or direction in response to a stimulus that cannot be pre-planned (Sheppard et al., 2006). It is well known that in soccer, athletes who have anticipatory expertise are able to recognize and attend to different stimuli faster after the presentation of a stimulus (Williams and Davids, 1998), compared to novice players, who may require the entire skill to be executed by the opponent (e.g., cross-over, step and direction change) before making the correct decision and responding to the stimulus. However, we don't know if there is difference between different age categories in reactive agility. Mendez-Villanueva, Buchheit, Kuitunen, Douglas, Peltola, & Bourdon, (2011) found no betweengroup differences in acceleration, maximum running speed, and repeated-sprint performance when adjusted for estimated biological maturity, and suggest that these physical qualities in young highly trained soccer players might be considered as a general quality, which is likely to be related to qualitative adaptations that accompany maturation.

In youth sport competitions, children are divided according to their chronological age. The main goal when imposing this selection criterion is to ensure that children's development is age-related and that there is fair competition and an equal chance of success for all (Helsen, Van Winckel, & Williams, 2005). Although an age difference of less than 12 months may have little relevance for adults, it may be significant in children (Helsen, Van Winckel, & Williams, 2005). One important question that arises in this regard is what criteria coaches use to select youth players. Moreover, little is known, about the possible effects of maturation on reactive agility. Thus, the purpose of this study was to investigate possible age-related variations in speed, change of direction speed and reactive agility in a group of highly trained adolescent soccer players.

METHODS

Subjects

A total of 75 young male soccer players (aged 14–19 years) were recruited. Only field players were tested with goalkeepers excluded. Written informed consent was obtained from the players and their parents. All participants were from a professional soccer club and completed on average 10 h of combined soccer training and competitive play per week. The players were grouped on the basis of chronological age into 2-year age categories: under 15 (U15: 12.0–13.9 years), under 17 (U17: 14.0–15.9 years), and under 19 (U19: 16.0–17.9 years). The experimental protocol received approval from the institutional ethics committee from the faculty of sport and physical education, University of Novi Sad.

Table 1. Physical characteristics for U15, U17, and U19 soccer players (mean+sd).

	U 15 (n=25)	U 17 (n=27)	U 19 (n=23)
Age	14.4±0.6	16.2±0.7	18.3±0.7
Height	176.06 ±5.82	180.49±6.56	179.12±5.45
Weight	66.06±12.82	72.89±8.48	70.70±6.22
Experience (years)	6.1±2.7	6.5±2.9	9.2±3.4
Training (min·week-1)	387±126	425±167	464±170

Procedure

Testing was conducted at the beginning of the annual training season to limit differences in training status between players. All players followed a similar training programme under the supervision of their respective coaches. All performance tests were conducted on the same day. Test sessions were undertaken between 09:00 and 13:00 h at least 8 h after the last training session. All performance tests were performed on an outdoor facility maintained at standard environmental conditions. Speed testing followed 20 min of standardized warm-up, which consisted of low-intensity running, acceleration runs, skipping and hopping exercises. Players were familiar with all test procedures.

Height and weight measurements were taken in the morning. Height was measured with a fixed stadiometer (+0.1 cm, Holtain Ltd., Crosswell, UK), and body mass with a digital balance (+0.1 kg, ADE Electronic Column Scales, Hamburg, Germany). The same researcher conducted all the measurements.

Acceleration and maximum running speed. The running speed of players was determined using a 20-m sprint effort with photocell gates (Microgate, Polifemo Radio Light, Italy) placed 0.4 m above the ground, with an accuracy of 0.001 ms. The timer was automatically activated as participants crossed the first gate at the starting line with split times at 5 m, and 10 m. Players were instructed to run as quickly as possible over the 20- m distance from a standing start (crouched start positioned 0.5 m behind the timing lights). Acceleration was evaluated using the time to cover the first 5 m of the 20-m test. Participants performed two trials with at least 3 min of rest between them. The best performance of the two tests was used for analysis.

Change of direction Test (CODS). The pre-planned agility test (Dellal et al., 2010) is used to evaluate CODS. Participants were asked to sprint as fast as possible for 5 m through a triggered timing gate (start gate), make a 45° cut and sprint 5 m to the left or right through a target gate. In this test, participants knew the cut direction. Running time was recorded using photocell gates (Microgate, Polifemo Radio Light, Italy) placed 0.4 m above the ground, with an accuracy of 0.001 ms at the start and finish gates. The best time of three attempts was considered for further analysis.

The reactive agility test (RAT) was performed according to the protocol described previously by Chaouachi et al. (2014). During RAT, the tester had 4 options for each condition: preplanned and randomly ordered (i.e., 8 trials). All these conditions were provided to each player in 2 series (5–8 minutes between sets rest) in a random order. Players were instructed to recognize the cues as soon as possible. Running time was recorded using photocell gates (Microgate, Polifemo Radio Light, Italy) placed 0.4 m above the ground, with an accuracy of 0.001 ms. The same conditions were used for another reactive agility test but this time the Witty SEM lights were used instead the testers. When the participants past the first gate the signal shows right or left direction. The participants must react to visual signal, change direction and past the third gate.

Illinois agility test: The length of the field is 10m, while the width (distance between the start and finish points) is 5m. Four cones were placed in the center of the testing area at a distance of 3.3m from one another. Four cones were used to mark the start, finish and two turning points. The subjects started the test lying face down, with their hands at shoulder level. The trial started on the "go" command, and the subjects began to run as fast as possible. The trial was completed when the players crossed the finish line without having knocked any cones over. Three trials were performed by every subject with the best score used for analysis (Daneshjoo, Mokhtar, Rahnama and Yusof 2013).

Statistical analysis

The analysis of the data obtained from the study was saved in SPSS version 16.0. Descriptive statistics (means+ standard deviations) are reported. All analyses of variance (ANOVA) were performed on log-transformed data; for the sake of clarity, however, they are reported non-transformed. Age-group-based comparisons of anthropometry were made with one-way between-groups ANOVA (with three levels: U14, U16, and U18). When ANOVA showed a significant group effect, betweengroup differences were allocated by using post hoc Bonferroni tests. The level of significance was set at $p<0.05$.

RESULTS

Table 1 shows the physical characteristics of the players according to age group. All anthropometric variables, showed no significant age differences (U15, U17, U19; $P \geq 0.05$).

Table 2. Times for 5, 10-m sprint, and 20-m sprint, and agility performance for the U15, U17, and U19 soccer players (mean+sd)

	U 15 (n=25)	U 17 (n=27)	U 19 (n=23)
Speed 5	1.178± .106	1.113± .090	1.118± .121
Speed 10	1.959± .144	1.860± .103	1.855± .213
Speed 20	3.389± .243	3.211± .131$_a$	3.173± .216$_b$
COD left	2.235± .116	2.150± .091	2.139± .124
COD right	2.24± .127	2.077± .278$_a$	2.113± .147
RAT witty	2.696± .130	2.609± .158	2.60 ±.194
RAT live	2.584± .108	2.488± .064	2.585± .104
Illinois	15.796± .795	15.137± .537$_a$	14.981±.479$_b$

$_a$ difference between U 15 and U 17; $_b$ difference between U 15 and U 19;

COD left-change of direction left; COD right-change of direction right; RAT witty- reactive agility test with witty SEM visual signals; RAT live- reactive agility test with testers.

Under 19 players had faster ($p \leq 0.01$) 20-m and illinois ($p \leq 0.01$) times than U15 players (Table 2), while U17 players were faster ($P \leq 0.05$) than U15 players in 20 sprint, COD right and illinois test performances (Table 2).

DISCUSSION

Physical performance in adolescents depends on several factors mediated by growth and maturation. The main aim of the present study was to determine the difference in several performance indicators relevant for soccer performance in adolescent players of different age categories. The main finding of this study was that no significant differences were found among the players in different age categories for most of the variables. Possible explanation for these results could be found in the fact that modern soccer training, with frequent changes in tactics, based on the characteristics of the opponent, has led to an increased adaptability of player roles especially in young players (Fiorilli, et al., 2017). Moreover, it is not so uncommon in youth training, to change a player position in response to different game situations, developing a large range of technical solutions useful for his future playing soccer carrier (Deprez et al., 2015).

In the literature, sprinting ability over short (5 m) and longer distances (20 m) is considered to require separate and specific biomechanical and neuromuscular qualities and therefore training techniques (Harris et al., 2008; Little & Williams, 2005). When considering the U15, U17 and U19 groups, we found difference between groups only for 20 m distance which is in line with abovementioned fact.

In the last decades, change of direction speed and reactive agility were considered to be the same skill (Fiorilli, et al., 2016). However, nowadays, pre-planned agility may be defined as sprints with change of direction, while the reactive agility is classified as sprints with directional changes in response to a stimulus. (Brughelli, Cronin, Levin, Chaouachi, 2008; Salaj, Markovic, 2011).

A remarkable observation from the present study was that male adolescent players had similar scores, despite their age category, sport experience and systematic training. It has been stated recently that intervention programs may have to be different for different age stage (Yanci et al, 2015). According to our results, we could speculate that modern training is similar for all age categories in adolescent soccer players. Nowadays, training contain sport-specific stimuli, rather than generic, and high intensity training for physical skills.

A main limitation of this study is that the attribution of a physical ability could be whether to talent or previous training. In our study, the players were interviewed about their current training load (weekly time) and previous experience (years engaged in soccer). Moreover, they were from the same squad, with the same programs conducted in all categories. Therefore, we could speculate if different approaches to training could contribute to differences in other variables. Future studies should examine the players from different teams and academies.

CONCLUSION

Reactive agility and change of direction speed are key skills required for soccer success, based on greater levels of motor control, however this study does not recommend to use reactive agility and CODS as indicators to assign the players age differences in adolescents. Further studies are needed to confirm these results.

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CIP - Каталогизација у публикацији - Народна библиотека Србије, Београд

796/799(082)(0.034.2)

SCIENTIFIC Conference "FIS Communications 2017" in physical education, sport and recreation (20 ; 2017 ; Niš)
Book of Proceedings [Elektronski izvor] / XX Scientific Conference "FIS Communications 2017" in physical education, sport and recreation, (Niš, Serbia, october 19-21st, 2017) ; [editor in chief Saša Pantelić]. - Niš : Faculty of sport and physical education, 2017 (Niš : Medivest). - 1 elektronski optički disk (CD-ROM) ; 12 cm

Sistemski zahtevi: Nisu navedeni. - Nasl. sa naslovne strane dokumenta. - Tiraž 200. - Na vrhu nasl. str.: University of Niš. - Bibliografija uz svaki rad.

ISBN 978-86-87249-85-1

a) Спорт - Зборници b) Физичка култура - Зборници
COBISS.SR-ID 247497740