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Dear students,

Continuing our efforts towards progress, we are proud to introduce the new issue of our magazine "Sport Science". In this issue, we offer you a wide range of high-quality and interesting scientific works, not only from Bosnia and Herzegovina but also from some other countries in the region. As in the past, the work of young academics is not excluded and we offer them a means to promote their knowledge and quality through our magazine. With regard to the topics handled (transformation processes, sports management, sports games, basic sports, physical education and sport at school, recreational sports), the magazine has become a go-to source for authors interested in presenting and introducing their research in these areas.

Your commitment gives us more strength to continue our efforts and to publish and make better and more interesting magazines. Our efforts towards progress can be seen in this issue, which contains interesting and high-quality scientific publications.

We can observe that the magazine "Sports Science" can stand shoulder to shoulder with some of the highest ranking publications because of the proposals and criticism, but certainly well-intentioned article reviews of our associates and many scientists who enjoy prestige and respect of the scientific community.

We would like to thank the authors who have pleasantly surprised us with a great number of articles, and with their serious approach, the quality of ideas and their elaboration, as well as their scientific attempt to clarify some issues handled in this magazine issue.

We should work as a team and use our ideas and suggestions to make a successful magazine that would be firmly planted among the best.

Editor in Chief:

Prof. Osmo Bajric, PhD

THE EFFECT OF HYPOTHETICAL PREDICTORS ON THE REPRESENTATION OF CHARACTERISTICAL MODALITY SERVES IN VOLLEYBALL

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Original scientific paper

Abstract

The aim of this research is to present the analysis of the transversal study of certain legalities of services as elements of volleyball game based on the example of the Russian volleyball team that played 28 games against 14 different national teams during the World League and World Championship in Japan in 2006. In the paper we operated by the pattern of matches, and not as it is usual, by the pattern of respondents. Data collection was carried out by the method of observation. Program called "DATA-volley", has been used. Each of the 6 modalities is firstly discussed descriptively, and then we examined the impact of the hypothetical predictors on the representation of specific modality services in the 102 analyzed sets. The results of this research, generally when considered in relation to the course and ultimate outcome of the set of all six studied modalities, we may say that the Russian national team had more modalities that were closer to the negative side of the assessment scale and that the positive modes were closely associated with the result in the set. As the victory in the set is convincing the number of the positive serves is increasing and vice versa, as the defeat is convincing, the number of successful service is thereby decreased. Low value of the coefficient variation indicates high homogeneity of the statistical series. In the two examined competitions, the Russian national team did not show the highest technical level in the area of serve. Obtained data clearly show, that certain reserves for improving the game of the Russian national team lie in the area of serve. The average representation of serve modalities depended on all three applied criteria.

Key words: volleyball, data – volley, serve, situational efficiency, national team

Introduction

The main idea for realisation of this work is the rapid development of sport. To follow the process of training we need to use scientific and technical knowledge. That is why a modern volleyball trainer has to be

well educated. Technical and technological innovative solutions are very often used in volleyball of 21st century. Moreover it is almost impossible to find a team from one of the best European and world leagues, as well with national teams, that doesn't have a special group of people (as a part of

coaching staff), with special responsibilities (for the collection and processing of information, the medical team, psychological team, a team of fitness and conditioning training). Each of these teams is responsible for its narrow specialist field and constantly collecting and processing data which gives the exact results that are immediately applicable in the training process and competitions.

The main purpose of this research is to analyse the transversal study analyzing the legality of serves as an element of volleyball game on the example of Russian Volleyball Team which had played 28 matches against 14 different national teams during the 2006 Volleyball World League and 2006 Volleyball World Championship in Japan.

Methodology of research

The research represents a transversal study which was used to analyze a certain rules in volleyball game on the example of Russian Volleyball team's serve. The team had played 28 games during the 2006 World League and 2006 World Championship, with 102 sets played as well. Since we have operated with data bases formed independently from observer, it could be attached an attribute of ex post facto experiment to this research. For the realisation of the experiment it has been used a sophisticated technology of the last generation (4 laptops, 2 printers, 3 cameras, 2 projectors and etc.) for reaching the highest standards in scouting. Data collection was performed by applying the method of observation with respect that the monitoring of treated activities (games) was done during play while recording of events with familiar and prepared the program. A program which was used from expert for

capturing game, gives an output data – frequency of appearing characteristics for particular volleyball element and its percentage value used for following data easier and for possible faster usage in the organisation of game. For this research we used “DATA VOLLEY” program. Program among others, provides the information "online" while entering the data obtained and results achieved by the action of the observed technical and tactical elements that played a set. We have analyzed game data for every set in function of accepting or rejecting addressed tasks and to reflect the given results (conclusions). The purpose is to have a better view on serve as a volleyball element through efficiency of serve modality from three criteria: the quality of opponent, the end result and the trend (hardness) of the set. In the paper we have operated by the pattern of matches, and not as it is usual, by the pattern of respondents. Each of the 6 modalities is firstly discussed descriptively, and then we examined the impact of the hypothetical predictors on the representation of specific modality services in the 102 analyzed sets.

We have defined the serve variable through 6 modalities:

- Service error
- Serve that resulted a perfect reception for the opponent
- Serve that resulted a reception near the 3m line
- Serve that resulted a reception away from 3m line
- Serve that resulted a reception over the net on the server's side
- Service winner

Results and discussion

Representation of the serve is always formulated in relation to one set. Firstly,

representative descriptive parameters are assigned, what is followed by analysis of variance which tested the difference between the average numbers of serves made in different sets defined by the criteria: the quality of opponent, the end result and the trend (hardness) of the set. In the first subsection we carried out an analysis of the total number of registered serves, regardless of the different value modalities, and then we applied the same procedure partially in each modality. As with all monitored elements, modalities of serves were analyzed by ascending order, starting with errors, which represent directly lost points, up to the ideal serves which represent directly points scored. Finally, the cumulative data analysis of serve is given in order to explain the structure of the serve in relation to the end result and the trend (hardness) of the set.

The total representation of serve

Descriptive statistics show that the Russian team in the 102 sets analyzed (total serve) performed an average of 23.14 serves, with a range of minimum 7 and maximum of 32 serves per set. The low coefficient of variation ($V = 0.17$) indicates a high homogeneity of statistical series, so that the mode of 24 services per set can be taken as a typical value of this element of the game. Comparing the average number of sets performed against 14 teams included in this analysis (the criteria of the quality of opponent), there were no statistically significant differences as evidenced by the very high value of the realized level of significance ($p = .742$). The absence of significant difference is probably caused by the high quality of the Russian team that has not only dominated against weaker opponents, but against better teams also (like Brazil, Italy, France, Poland and

Serbia). Russian team had won a large number of points and performed a large number of serves in each set. When we tested the representation of serve compared to the final outcome of the set, there was statistically significantly higher number of serves in sets in which victory is achieved. Meaningly greater difference in winning sets (on average by as much as four serves) is expected and logical result of which should not be given greater importance to research. It is interesting that in some sets it was enough to win 14 serves, which is the minimum value in the winning sets, and in some cases even 28 serves (maximum value in the lost sets) was not enough to avoid defeat. A statistically significant difference in the prevalence of serves, is expected in relation to the hardness of sets played (by a landslide defeat to victory), and was confirmed by analysis of variance. We obtained a very low value of the realized level of significance that statistically confirmed greater number of services per set in all cases of victory. Maximum values were obtained in the cases referred to as tight victory. These were mostly sets in which both opponents won more than 25 points.

The representation of service error

The first analyzed, mode of serve, was the initial value on the negative end of the scale and was related to an obvious error in serve which is directly lost point (service to the net or out). The average number of such mistakes in the Russian team was 3.43 while a variation width was very large, ranging from 0 (minimum value) to 8 (maximum value), which was obtained and a relatively high coefficient of variation ($V = 0.478$). Mode of this modality poor serve was 4 (Table1).

The results of analysis of variance test of significance for the quality of opponents and the trend of the set, or T-test for testing the difference in sets with different outcome, with significant predictor proved out only the quality of opponents, while the remaining two criteria (trend of the set and the end result) left out the differences. Significant differences were, in fact, determined only in relation to the opponent. It turned out that the largest number of server error against the Russian team had the strongest teams (Brazil 4.78 and Italy 4.17) which, probably, can be explained by the high psychological pressure in the toughest matches. This data fits in an earlier statement regarding the negative score of "tie-breaks" (2:5) and supports the assumption about the lack of psychological stability of the Russians in decisive moments in the match. This fact may have even thwarted the Russian national team on the road winning to the World League and World Championship, despite the obvious superior technical and tactical qualities.

Among the average number of worst serve errors in lost and obtained sets (Table 2), and between hard and easy sets of negative and positive outcomes (Table 2) – there was not found any statistically significant differences. These facts indicate a very high value of the realized level of significance that far exceeded the theoretical limit of 0.05 ($p > .05$).

The representation of the serve that resulted with perfect reception for the opponent

The average number of serves that allowed easy reception for the opponent was around 12 per set ($M = 11.49$ and mode = 12), with a rather large range between the minimum

(Min = 2) and maximum (Max = 18) values. The relatively low coefficient of variation (0.293) indicated a high homogeneity of the data (Table 1).

The results of analysis of variance and t-test (Table 2) showed that the average representation of this modality of serve depended on the applied three criteria - the opponent, the end result and the hardness of sets. In all three cases were obtained by very low levels of significance (p). It is interesting that the Russian team registered the smallest number of serves that allowed easy reception for the opponent against three teams with whom they only had a negative score (Brazil, Poland and Italy). Against Brazil, that number was on average less than 10, and even against Poland under the 9. These numerical values are in conflict with those relating to the most severe form of server errors since it shows that Russians were better serving against stronger opponents. Here is probably a regular fluctuation of results, and if there is some legitimacy perhaps it shows that the serve in matches against the strongest opponents was the deciding factor of victory or defeat. Possible assumption is that a feature of the best teams analyzed at the two competitions (the World League and World Championship 2006.) was the ability to organize a quality attack even when reception of the serve was not perfectly executed. It could look as an absurd that the significantly higher number of serves that enabled an ideal reception for the opponent the Russian team had in sets which won, then in those which lost (Table 2). The same was found when comparing hard and easy sets from the result perspective (Table 2). This data supports the further assumption that serve was not a decisive factor in the game of the Russian national team.

The representation of the serve that allowed a reception near the 3m line

This mode of serve is located on the negative pole of the scale because the opponent can receive the serve near the attack line (3 m) and provides favourable conditions for organizing the attack easily. Such serves (conditional third-level) were not too much on average at the Russian national team matches ($M=3.71$, $Mode=3$). The heterogeneity of the data that made up the statistical series indicated a relatively high coefficient of variation ($V = 0.47$) in what fits the great variational width - $Min=0$ $Max=8$ (Table 1).

The results in Table 2 showed that none of the three hypothetical predictors (the opponent, the end result and the trend) were not statistically significant for the different representation of serves received around the line of attack. Against all teams, regardless of quality, the Russian national team had served approximately the same number of serves in the area around the line of attack. The same is true for won and lost sets, and that with a different result uncertainty. Even with double number of representation of these serves in convincing victories (4.69) versus convincing defeats (2) showed no statistically significant. Due to the high value of the realized level of significance ($p = .179$) observed difference is explained as unsystematic, or as a result of chance.

The representation of the serve that allowed a reception away from 3m line

The first mode of being in the positive pole of the scale for assessing the quality of serve was the serves that significantly shifted the reception from the opponents attack line (line 3 m). The average representation of the modalities per set by

the Russian national team has been very low with the arithmetic mean of only 2.2 and the mode of 2 (Table 1). Another characteristic of raw data was high heterogeneity of the results on what indicated the high value of the coefficient of variation ($V = 0.754$) and a very wide range ($Max-Min=7$). The analysis results (Table 2), which tells us the average distribution of serves that significantly shifted a reception of opponent did not differ in respect of matches against different opponents. On the other hand, the presence of this serve modality was significantly different from the end result and the trend of the set. These serves were systematically represented more in won sets than in lost sets, where the mean were constantly growing with the winning convincingly.

The representation of the serve that resulted with reception over the net on the server's side

How is the serve element technically difficult and how well are the top teams trained in its reception, can be shown by very low average representation of serve that was so powerful that it forced the opponent to the ball right back to the receiving party server!!!. The average representation of this modality of serve, in fact, moved around one ($M = 1.19$, $Mode = 1$), with a maximum value which did not exceed 4 per set (Table 1). Although the calculated arithmetic mean shows that most (2 on average) strong serves were served against inferior teams (Tunisia, Canada and Puerto Rico), analysis of variance ($F = 1.114$, $p = .334$) showed that this is not a statistically significant differences (Table 2).

Significant differences were lacking, and when compared to averages of won and lost

sets (Table 2).

The only statistically significant differences in the prevalence of serves that forced the ball from the reception to return to the server are found in terms of varying difficulty in losing or gaining sets (Table 2). The perceived legitimacy indicates that the number of such services grows in proportion to convincingly achieved victory in the set.

Representation of serve from which the points were scored directly

The serve is a difficult technical element and top teams are well trained in his admission, which is confirmed by the very low average representation of the serve from which the points were scored directly, whether it was a classic ace or the elusive serve for opponents. The average representation of this modality, in fact, moved around one, with nearly equal arithmetic mean and mode of statistical series ($M = 1.09$, $Mode = 1$) and a maximum value of 3 per set (Table 1).

Analysis of variance showed that the proportion of serves from which it gains a point was not directly dependent on the quality of opponent (Table 2). Statistically significant differences between the average representations of serves that directly score a point were found only between sets of completed as victory and defeat, as well as a results of the various uncertainties of result (Table 2). Higher average values of the winning sets indicate the assumption that this technical detail can sometimes be crucial to the outcome and the trend of volleyball set.

Table 1. Descriptive statistical parameters derived from 102 analyzed sets

Statistical parameter	The calculated value						
	Serve- Total	Service error	Serve that resulted a perfect reception for the opponent	Serve that resulted a reception near	Serve that resulted a reception away	Serve that resulted a reception over the net	Service winner
Arithmetic mean (M)	23.14	3.43	11.49	3.71	2.20	1.19	1.09
Mode (Mod)	24	4	12	3	2	1	1

Standard deviation (SD)	3.93	1.638	3.362	1.744	1.659	1.06	0.869
Standard error of the mean (S _M)	0.389	0.162	0.333	0.173	0.164	0.105	0.086
Minimum value (Min)	7	0	2	0	0	0	0
Maximum value (Max)	32	8	18	8	7	4	3
Coefficient of variation (V)	0.17	0.478	0.293	0.47	0.754	0.89	0.797

Table 2. Analysis of the presence of characteristical modes of serve in volleyball in relation to the hypothetical predictors

modalities	Differences in the prevalence of serves in relation to the quality of opponent		Differences in the prevalence of serves in relation to the hardness of sets played		The differences shown by the set criteria of the end result???	
	F	p	t	p	F	P
Serve- Total	.717	.742	5.909	.000*	24.00	.000*
<i>Service error</i>	2.211	.015*	0.426	.671	1.658	.152
<i>Serve that resulted a perfect reception for the opponent</i>	2.602	.004*	3.103	.002*	6.117	.000*
<i>Serve that resulted a reception near the 3m line</i>	1.16	.322	1.085	.281	1.559	.179
<i>Serve that resulted a reception away from 3m line</i>	1.55	.116	2.696	.008*	2.64	.028*
<i>Serve that resulted a reception over</i>	1.144	.334	1.666	.099	3.02	.014

<i>the net to the server's side</i>						
<i>Service winner</i>	.582	.862	3.87	.000*	4.57	.001*

In Table 3 we can observe a statistically significant difference between the representation of service that would allow an ideal reception for the opponent in the received and lost sets. Special attention is focused only on this modality since it was dominant in the overall structure of all registered services. It is interesting to note that the number of these, for the Russian national team unfavorable service, was more in case of victories than losses (by up to two serves per set). This absurd fact clearly indicates an assumption that the Russian team its initial disadvantage, made by poorer serve, succeed to compensate with some other technical elements (possibly by block, attack or something else) later in the match. To obtain a clearer and more comprehensive picture of the serve's impact

on the outcome of set, we carried out comparative analysis of modes that are treated as typical empirical frequency of conditionally average set, since they are obtained by counting serves during each set of 102 observed (Table 4). Modes are designed so that contingency analysis can be applied to them (χ^2 -test). This analysis yielded a very high value of the realized level of significance ($p = .639$) and thus showed that despite slightly lower performance of the serve, the Russian team was not losing because of that, but not winning sets too. In other words, the Russian serve was not so weak technical element to be declared as a sure cause of the defeat and it was obviously compensated by increasing quality of other technical and tactical elements of the game.

Table 3. *The structure of average number of serves determined in relation to the end result of the set*

<i>The end result of the set</i>	Service error	Perfect reception	Easy reception	Moved reception	Returned ball	Service winner
Win	3.38	12.19	3.84	2.50	1.31	1.31
Loss	3.53	10.09	3.44	1.59	0.94	0.65

t	.426	3.103	1.085	2.696	1.666	3.870
p	.671	.002*	.281	.008*	.099	.000*

Table 4. The structure shown by mode of serve, compared to the end result of the set

<i>The end result of the set</i>	Service error	Perfect reception	Easy reception	Moved reception	Returned ball	Service winner
Win	4	12	4	2	1	1
Loss	4	11	3	0	0	0

$$\chi^2 = 3.399 \quad p = .639$$

The analysis of results in Table 5, conducted on data relating to the representation of different serves in different hardness of sets (from convincing defeats to convincing victories) showed the most obvious representation of the serve that allowed opponents an ideal reception. In addition, in this, as with all three modalities with positive half-scale value, we obtained statistically significant differences between the empirically determined average values. Using modes (the same analogy applied in analyzing the average values won and lost serves) this time also we implemented χ^2 -test (Table 6) which gave even greater value of the realized level of significance ($p = .947$). This is supported by previous conclusion about the quality of serve of the Russian national team and its small technical disadvantage that could be compensated by increasing the quality of other technical and tactical elements of the game

Table 5. *The structure of average number of serves determined in relation to the trend of the set*

<i>The trend of the set</i>	Service error	Perfect reception	Easy reception	Moved reception	Returned ball	Service winner
Convincing defeat	1.33	6.33	2.00	1.00	0.00	0.00
Easy defeat	3.94	8.88	3.65	1.47	0.88	0.59
Tight defeat	3.50	12.94	3.44	1.61	1.17	0.89
Tight win	3.64	13.18	3.82	2.27	1.73	1.73
Easy win	3.45	11.98	3.63	2.58	1.05	1.20
Convincing win	2.92	11.15	4.69	3.00	1.85	1.38
F	1.658	6.117	1.559	2.64	3.02	4.75
p	0.152	.000*	0.179	.028*	.014*	.001*

Table 6. *The structure shown by mode of serve, in relation to the trend of the set*

<i>The trend of the set</i>	Service error	Perfect reception	Easy reception	Moved reception	Returned ball	Service winner
Convincing defeat	2	3	3	0	0	0
Easy defeat	3	8	3	0	1	0
Tight defeat	4	11	2	0	1	1
Tight win	3	12	6	4	1	2
Easy win	4	13	3	1	0	1
Convincing win	3	9	5	2	1	1

 $\chi^2 = 14.768$ **p = .947**

Conclusion

For the purpose of identifying more general principles concerning the role of serve in the Russian national team game in 102 sets

observed, we made simultaneously monitored analysis of all six modes (quality levels) of serve. Thus we obtained a clearer picture, not only in a relation to the total

number of different modalities of serve, but in relation to three criteria - quality of opponents, the end result of the set and its trend (hardness, a score uncertainty). A review of six previously analyzed modalities of serve, we can see that within the Russian team the most represented serve was the one that has allowed opponents an ideal reception. The obtained arithmetic means and modes are most strongly indicated the presence of this modality that is theoretically located at the negative pole of the scale of assessment. If we add the fact that after this modality of serve, the other two modalities which were the most represented are also closer to the negative pole of the scale value, it nevertheless

suggests that the Russian team in two followed world competitions didn't show the highest technical level in the serve element area. Thus, some other previously identified weaknesses of the Russian servers within individual analysis reinforced the general impression of lower quality of serve that was apparently lagging behind the other elements of the game. The data clearly show that certain reserves for the improvement of the Russian national team games lie in the area of serve. Improving and training the serve would make more difficulties for opponent or at least shift the place of reception and thereby reduce the potential for easily and quickly organizing attacks.

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UTICAJ HIPOTETSKIH PREDIKTORA NA ZASTUPLJENOST KARAKTERISTIČNIH MODALITETA SERVISA U ODBOJCI

Sažetak

Cilj ovog istraživanja predstavlja analizu transferzalne studije izvjesne zakonitosti servisa kao elementa odbojkaške igre na primjeru Ruske odbojkaške reprezentacije koja je odigrala 28 utakmica protiv 14 različitih nacionalnih selekcija tokom svjetske lige i svjetskog prvenstva u Japanu 2006. godine. U radu se operiralo uzorkom utakmica, a ne kako je uobičajeno uzorkom ispitanika. Prikupljanje podataka izvršeno je metodom opservacije. Korišten je program pod imenom "DATA-VOLLEY". Svaki od 6 modaliteta razmatran je najprije sa čisto deskriptivnog, a potom je razmatran uticaj hipotetskih prediktora na zastupljenost pojedinih modaliteta servisa u 102 analizirana seta. Rezultati ovog istraživanja generalno kada ih posmatramo u odnosu na konačan tok i ishod seta svih šest posmatranih modaliteta možemo kazati da je reprezentacija Rusije imala više modaliteta bližih negativnom polu skale procjene a da su pozitivni modaliteti bili usko povezani sa rezultatom u setu. Kako je ubedljivija pobjeda u setu tako i raste broj pozitivnih servisa i obrnuto što je poraz ubjedljiviji tako se smanjuje i broj

uspešnih servisa. Ruska reprezentacija na dva praćena svjetska takmičenja nije pokazala najviši tehnički nivo u prostoru servisa. Dobijeni podaci nedvosmisleno pokazuju da se izvjesna rezerva za unapređenje igre Ruske reprezentacije nalazi u prostoru servisa. Prosječna zastupljenost modaliteta servis, ovisi o sva tri primijenjena kriterija.

Ključne riječi: odbojka, data – volley, servis, situacijska efikasnost, reprezentacija

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TRANSFORMATIONAL EFFECTS OF PHYSICAL AND HEALTH EDUCATION ON BASIC MOTOR SKILLS OF PUPILS

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Abstract

The objective of conducted longitudinal-experimental study was to determine the effects of physical and health education curriculum on the basic motor skills in the third grade pupils of elementary school. The sample of respondents is defined as a group of 128 pupils from certain elementary schools from Tuzla, male, aged 8 ± 6 months. Subjects were divided into three groups (two experimental and one control). The study applied 9 tests for basic motor skill assessment. Multivariate analysis of covariance was applied for analysis of progress, i.e. the effects of an experimental treatment in the domain of assessment of basic motor skills variables within applied groups. The results obtained indicate that groups differ significantly in all of nine basic motor variables applied. The first experimental group (E1) achieved better effects in variable for segment speed of arms and shoulders assessment. The second experimental group (E2) achieved better effects under the influence of program curriculum and the third additional hour in the remaining eight variables, while the control group (K) didn't have better results in any of the applied variables.

Key words: *changes, motor skills, boys, multivariate analysis of covariance*

Introduction

Pupils of junior school age are considered to be the most active part of the population. However, there is a reasonable fear that in the context of modern lifestyle, level of children's physical activity is not

satisfactory. All this could adversely affect the physical growth and development of children, as with irregular eating habits, prolonged retention in forced position, along with other factors, creates a good basis for the deterioration of health. The present state of physical health education in

school is unsatisfactory as well as the results achieved there. This statement specifically refers to the lower grades of elementary school (Dzibric et al., 2011). The cause of insufficient efficiency is commonly referred to: insufficient number of hours, inadequate program, poor material conditions, as well as insufficient involvement of elementary school teachers who are entrusted with teaching physical and health education in lower grades. Without final positive effects, physical and health education loses its meaning. Effects of physical and health education are reflected primarily in a positive impact on the growth and development of young organism, on the one hand and the increase of motor skills on the other hand (Visnjic et al., 2004, Markova, 2008). Physical activity at schools has, as one of its primary goals, positive impact on all basic motor skills. Additional physical activity, according to most previous studies (Nicin, 2000, Petkovic, 2007) increases positive effects of physical development and basic motor skills as well. We studied the effects of regular classes and additional physical activity on transformation of anthropological status of students whether it was organized, monitored by professor of physical and health education or as an extracurricular activity (Jurak et al., 2007; Males et al., 2007; Jakovljevic and Batričević, 2008; Selmanovic et al., 2008; Nikolic et al., 2008; Dzibric et al., 2009). The study conducted had longitudinal and experimental character with an objective to determine the effects of physical and health education curriculum on basic motor skills in pupils of the third grade of elementary school.

Methods

The sample

The population we chose 128 respondents from was defined as a population of certain third grade students of elementary schools in Tuzla, male, age of 8 ± 6 months. From such defined population three samples are formed. Subsample of 42 subjects who participate in regular physical and health education where teachers work with them two classes per week (the first experimental group – E1). Subsample of 41 subjects who participate in regular physical and health education where teachers work with them two hours, plus a third extra hour a week (second experimental group – E2). Subsample of 45 subjects who participate in regular physical and health education where teachers work with them two classes per week (control group – K). All subjects had a stable health condition and were able to actively participate in the research. All subjects voluntarily agreed to participate in the study with the consent of parents.

Sample of variables

In order to assess factors of basic motor skills variables were applied according to Eurofit test battery (Hadzikadunic et al., 2000) as follows: flamingo balance test (MBAFLA), hand tapping (MBFTAP), sit and reach (MFLDSJ), standing long jump (MFESDM), handgrip (MSADIN), sit ups (MRCLES), bent arm hang (MSAVIS), 10x5m shuttle test (MA10X5) and polygon backwards (MREPOL).

Applied programs

The experimental program of physical and health education was implemented by experimental groups (E1 and E2) with professors of physical and health education. Program lasted one semester (18 weeks), two hours a week. The second experimental group (E2) in addition to two hours per week had an extra hour. The program didn't

include testing and measuring, so it was conducted before and after program implementation. The experimental program was implemented during the first semester (Sep/Dec, 2008/09th).

Additional program of physical and health education lasted 15 hours. The program content included such kinesiology activities that are represented in regular program, but expanded and planned during the same months as the regular program. Contents that we applied during an extra hour were mostly familiar to pupils because they were usually repeated and developed exercises that were performed in the previous two regular hours. These are the contents from programs of walking and running, contents of the games, jumping, gymnastics, throwing catching and shooting, rhythm and dance, climbing crawling and pulling through, corrective gymnastics. In realization of mentioned contents first we applied simple and later more complex methodical organizational forms of work. Program requirements were raised to a higher level, and thus increased work motivation, while various methodical and organizational forms of work through additional exercise increased the class density. Besides, the engagement and independence of pupils, better use of space, equipment and props was increased. Such working method with emphasis on contents offered, better work organization during the introductory, preliminary and final part of the class, as well as the application of complex methodical and organizational working forms in the main part of the class, as it will be shown, gave a statistically significant effect on the increase of the tested basic motor skills of pupils.

Results and discussion

Multivariate analysis of covariance (MANCOVA) was applied to analyze the progress, i.e. the effects of an experimental treatment in domain of variables for basic motor skills assessment within tested groups. Based on the result review we obtained in Table 1, it can be noticed that at the global level, there is a statistically significant difference in overall motor space among the three groups of tested boys (the first experimental, the second experimental and control group), at statistically significant level ($p = 0.00$)

according to most previous studies (Nicin, 2000, Petkovic, 2007) increases positive effects of physical development and basic motor skills as well. We studied the effects of regular classes and additional physical activity on transformation of anthropological status of students whether it was organized, monitored by professor of physical and health education or as an extracurricular activity (Jurak et al., 2007; Males et al., 2007; Jakovljevic and Batričević, 2008; Selmanovic et al., 2008; Table 1. Statistical significance of the effect differences of multivariate level

MAIN EFFECT: GRUPA (dječaci.sta)		
	Value	p-level
Wilks' Lambda	0,350657	
Rao R Form 3 (18,216)	8,264706	0,000
Pillai-Bartlett Trace	0,70336	
V (18,218)	6,569646	0,000

Results in Table 2 show us in which of the applied motor variables the groups mostly differ, i.e. in which variables we observe statistically significant differences between groups. Based on the results obtained, we notice that the groups differ significantly in all nine of motor variables.

Table 2. Statistical significance of the effect differences of univariate level

MAIN EFFECT: GRUPA (dječaci.sta)				
	Mean sqr	Mean sqr	F(df1,2)	
varijable	Effect	Error	2,116	p-level
MBAFLA_F	47,705	2,667	17,883	0,00*
MBFTAP_F	13,264	1,230	10,778	0,00*
MFLDSJ_F	12,685	3,311	3,830	0,02*
MFESDM_F	365,01	29,864	12,222	0,00*
MSADIN_F	64,324	3,070	20,948	0,00*
MRCLES_F	56,892	3,671	15,497	0,00*
MSAVIS_F	63,390	4,641	13,656	0,00*
MA10X5_F	17,681	2,398	7,371	0,00*
MREPOL_F	33,456	1,149	29,108	0,00*

Table 3 presents the values of arithmetic mean of the initial and final measuring of the applied variables for assessment of motor skills of the tested boys. Based on these indicators it is accurately visible whether the values of arithmetic means are higher or lower in tested groups (the first experimental, the second experimental and control group).

Table 3. Arithmetic means of control and experimental groups

Means (dječaci.sta)				
Rao R (18,216)=8,26; p<.0000				
	varijable	exp -1	exp -2	control
	MBAFLA_I	4,991	5,9	6,3
	MBFTAP_I	20,0	21,1	20,7
	MFLDSJ_I	19,5	17,8	19,4
	MFESDM_I	121,8	114,6	117,8
	MSADIN_I	12,0	15,0	16,9
	MRCLES_I	16,0	14,7	18,2
	MSAVIS_I	7,5	7,1	4,6
	MA10X5_I	23,5	25,2	23,9
	MREPOL_I	21,5	22,3	23,5
Covar.	MBAFLA_F	7,2	8,1	6,3
Covar.	MBFTAP_F	18,6	19,7	20,6
Covar.	MFLDSJ_F	20,4	19,2	19,6
Covar.	MFESDM_F	129,6	124,3	119,4
Covar.	MSADIN_F	13,2	17,2	16,6
Covar.	MRCLES_F	19,5	19,3	18,4
Covar.	MSAVIS_F	8,4	9,0	4,5
Covar.	MA10X5_F	22,2	22,5	23,5
Covar.	MREPOL_F	20,4	21,0	23,6

Table 4 shows the results of the corrected arithmetic means which indicate the significance of the effects between the tested groups in final measuring, where the results of initial measuring are neutralized (equalized), it is clear that significant differences exist in all nine motor variables. The second experimental group (E2)

achieved better effects under the influence of program content and the third extra hour in eight variables as follows: MBAFLA – flamingo balance test, MFLDSJ – sit and reach, MFESDM – standing long jump, MSADIN – handgrip, MRCLES – sit ups, MSAVIS – bent arm hang, MA10X5 – 10x5m shuttle test and MREPOL – polygon backwards. The first experimental group (E1) achieved better effects in variables for segmental speed of arms and shoulders MBFTAP – hand tapping. The third control group (K) didn't have better results in any of the applied variables, which is visible from the corrected arithmetic means. It can be concluded that the program activities managed to improve the effect results of motor skills in both experimental groups.

The results indicate that implementation of program contents of the second experimental group, led by professor of physical and health education with an additional third hour of physical and health education, produced better effects in motor skills than the first experimental group led by a professor of physical and health education without additional hour. We can also notice that both groups produced greater effects than the control group led by elementary school teachers. Based on the results obtained, we can point out a few important facts. Positive effects in motor dimensions of mechanism for movement structuring (variables MBFTAP – hand tapping and MREPOL – polygon backwards) it is necessary to highlight that the most of the motor tasks, in this mechanism for structuring movement variable, consists of a movements where in their performance the essential role have already formed motor programs acquired in physical and health education, the applied test although motor complex, is not significantly associated with intellectual

processes, because motor problem in the sense of information is almost nonexistent. Mostly energy component prevails so for the speed of movement performance sub-cortical (motor) and regulatory mechanisms are essential, and cortical activity is reduced to possible corrections according to the requirements of specific motor activity.

It is necessary to mention that the positive effects in motor dimension of synergistic regulation mechanism and tonus regulation (variable MBAFLA – flamingo balance test and MFLDSJ – sit and reach) are achieved, among other things, with application of physical exercises in physical and health education and that have had a positive impact on changes of structural muscle and ligament features and their resilience, although essentially, the level of this dimension depends on the structure and the shape of the joints in which the movement is performed.

It is necessary to mention that positive effects in motor dimension of the mechanism of regulation of excitation intensity (variable MFESDM – standing long jump), contributed the means of physical exercise in physical and health education, i.e. program tasks were good predictors for expressing high activity of the nerve muscle system, resilience and ability to relax muscles. Besides, for this dimension, the energy supplies in the muscles are extremely important, as well as increased intake of energetic substances. Applied instruments of physical exercise in physical and health education have contributed to the achievement of positive effects in motor dimensions of the duration of excitation mechanism (variables MRCLES – sit ups, MSAVIS - bent arm hang) probably due to the greater frequency of activating motor units in time localized in abdominal wall and shoulder belt.

In these tests, mainly dominates general repetitive strength which represents the ability of long term operation, which is the time needed to master the appropriate external load from 75% to maximum.

The results obtained are compatible with previous studies (Bonacin et al. 2002; Bilic, et al. 2007).

Table 4. Corrected arithmetic means of control and experimental group

Adjusted means (dječaci.sta)			
Rao R (18,216)=8,26; p<.0000			
variable	exp -1	exp -2	control.
MBAFLA_F	7,993969	8,030116	5,708206
MBFTAP_F	19,18126	19,36465	20,47536
MFLDSJ_F	19,9862	20,37124	19,05588
MFESDM_F	125,8123	127,2868	120,3545
MSADIN_F	16,02909	17,0389	14,05904
MRCLES_F	19,59996	20,28359	17,52257
MSAVIS_F	7,552676	8,705663	5,73895
MA10X5_F	22,66954	22,096	23,66155
MREPOL_F	21,18792	20,98518	23,00459

Conclusion

Therefore, this study represented a longitudinal study with objective to determine whether the implemented program activities will cause significant effects on the increase of the tested basic motor skills in pupils of the third grade of elementary school. It turned out that the most dynamic growth within the study domain (basic motor skills) achieved a group of subjects led by professor of physical and health education with additional class of physical and health education. In relation to overall problem of physical and health education realization in lower grades of elementary school, especially from the aspect of certain basic motor skills development, this, and future studies should complement the picture about the necessity to engage professors of physical and health education for this

specified age, and also to add an additional class from this subject.

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TRANSFORMACIONI EFEKTI NASTAVE TJELESNOG I ZDRAVSTVENOG ODGOJA NA BAZIČNO-MOTORIČKE SPOSOBNOSTI UČENIKA

Sažetak

Provedeno istraživanje longitudinalno-eksperimentalnog karaktera imalo je cilj da utvrdi efekte programskih sadržaja nastave tjelesnog i zdravstvenog odgoja na bazično-motoričke sposobnosti kod učenika trećeg razreda osnovnih škola. Uzorak ispitanika definisan je kao skup od 128 učenika određenih osnovnih škola iz Tuzle, muškog spola, starih 8 godina $\pm$ 6 mjeseci. Ispitanici su podijeljeni u tri grupe (dvije eksperimentalne i jedna kontrolna). U istraživanju je korišteno 9 testova za procjenu bazično-motoričkih sposobnosti. Multivarijatna analiza kovarijanse primijenjena je za analizu napretka, odnosno efekata u eksperimentalnom tretmanu u prostoru varijabli za procjenu bazično-motoričkih sposobnosti unutar primijenjenih grupa. Dobiveni rezultati pokazali su da se grupe statistički značajno razlikuju u svih devet primijenjenih bazično-motoričkih varijabli. Prva eksperimentalna grupa (E_1) ostvarila je bolje efekte kod varijable za procjenu segmentarne brzine ruku i ramenog pojasa. Druga eksperimentalna grupa (E_2) ostvarila je bolje efekte pod utjecajem programskih sadržaja i trećeg dodatnog sata u preostalih osam varijabli, dok kontrolna grupa (K) nije imala bolje rezultate ni u jednoj primijenjenoj varijabli.

Ključne riječi: *promjene, motorika, dječaci, multivarijatna analiza kovarijanse.*

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THE INFLUENCE OF MORPHOLOGICAL CHARACTERISTICS ON SITUATIONAL-MOTOR EFFICIENCY OF SWIMMERS

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ABSTRACT

The main goal of this research was to determine the influence of morphological characteristics on situational-motor efficiency of swimmers aged 13-15. The research was conducted on a sample of 70 swimmers aged 13-15 who are in a continuous training process in their clubs. In this study, we used a set of 12 variables, 10 variables for the assessment of morphological characteristics, and 2 variables for the assessment of situational-motor efficiency. Regression analysis was used within the multivariate level in order to determine how strong is the influence of the system of predictor variables, in other words morphological characteristics on the criterion system of variables which is represented by situational-motor skills in swimming. Displayed predictive values of used variables, as well as the ability to predict the results proved to be significant in this research, in all used criterion variables.

Keywords: swimming, examinees, morphology, influence, efficiency.

Introduction

Swimming is a mono-structural cyclic movement in specific environment, therefore learning swimming is influenced by the characteristics of water. A swimmer performs physical activity in the water environment, where the body is in unstable position, which means it has no firm support. In such circumstances a large number of different moves is used, so we can say that water ignites movement in some joints and of some parts of body which are usually less active, which makes a positive influence on the development of

certain systems in human body and the parts of body as well. Body of a swimmer becomes seemingly weightless, because weight is neutralized by the water thrust force. "Weightless" state of body in the water allows the locomotor system to perform actions and moves of different intensity without big burdening and static exertion, which contributes to proper and harmonic physical development. Body of a swimmer, under the influence of gravitational force creates pressure on water surface. This force is opposed to the force of thrust by water particles, which is equally strong as the thrust but opposite in direction.

Because of that, the gravity center of a body and the volume center of ousted liquid, in other words thrust center, are not in the same vertical (Rađo, 1998). During the inactive state of body, formation of reverse force momentum occurs, allowing immersion of legs, and therefore body changes its position from horizontal into vertical (Mikić et al., 2004).

Body of a swimmer, whether in inactive or active state in the water, behaves differently because there is a huge difference of force powers in the water and on the ground. Depending on the specific weight of human body and water (specific weight of regular water is 1 gr/cm^3 , sea water $1.15 - 1.25\text{ gr/cm}^3$ – with higher concentration of salt and minerals, and the average specific weight of human body is $0.93 - 1.06\text{ gr/cm}^3$), 4-6% of body weight is in static position above the water. The ability of people to maintain their body on the surface and in the water is based on the principles of specific body weight, propulsion and balance in the water (Mikić et al., 2004). The specific weight of people and its value depends on the specific weight of osseous, muscle and subcutaneous adipose tissue.

Specific weight of human body changes and is not a constant value. During inhalation this value is around $0.93\text{--}0.98\text{ gr/cm}^3$, and during exhalation it increases and its value is $1.03\text{--}1.08\text{ gr/cm}^3$.

Besides anthropometric characteristics (height, weight, length of extremities, disposition of muscular mass), vital capacity, many other factors which also have an influence but which are not that easy to measure, influence and determine the success in swimming. Because of limitations in the skills dominant for performing a swimming task, it is necessary

to have knowledge about the differences in anthropological characteristics of swimmers (Petrič, 1996).

The main **goal** of this research was to determine the influence of morphological characteristics on situational-motor efficiency of swimmers aged 13-15.

Research methodology

Sample of examinees

Sample of examinees in this research includes swimmers from swimming teams “11. April” and “OLIMP”, both from Banja Luka.

This sample of examinees can be considered to be representative, since the most of medals and records were achieved by swimmers from this population.

Research included 70 swimmers aged 13-15, and testing included only examinees who were completely healthy during measurements. Examinees who didn't go through complete measurements were not taken into consideration.

Variables for the assessment of morphological characteristics

For the set of variables in the space of morphological characteristics in this research we used measuring instruments described by the method recommended by the International biological program (IBP). For easier procedure during data processing variables were encoded in a way that the first letter (A) marks anthropometric space, while other letters mark alternate characteristics of a measuring instrument.

1. Body height.....(AVISTL)
2. Arm length.....(ADUŽRU)
3. Leg length.....(ADUŽNO)
4. Foot length.....(ADUŽST)
5. Shoulder width.....(AŠIRRA)

6. Body mass.....(ATLMAS)
7. Upper arm skin fold.....(ANABNA)
8. Stomach skin fold.....(ANABTR)
9. Back skin fold.....(ANABLE)
10. Body mass index.....(BMI)

Variables for the assessment of situational-motor efficiency in swimming

1. Start off the blocks (parallel)...(SMSTPA)
2. Time of 50m crawl swimming (SMVPLK)

Statistical data processing

In order to determine the influence of morphological characteristics (predictor variable) on situational-motor efficiency of swimmers (criterion variables) we used regression analysis.

Results and discussion

Regression analysis of morphological characteristics and criterion variable start off the blocks - parallel (SMSTPA).

On the basis of data presented in added tables one can see that between the systems

of predictor variables, which are in this paper represented by ten morphological variables, there are statistically significant relations and influence on criterion (Sig. = .012). Criterion is represented by parallel start off the blocks (SMSTPA), while multiple correlation coefficient is $R = .615$ (table 1) which explains joint variability of about 40% ($R^2 = .394$) while other 60% in overall variability can be explained by other anthropological dimensions, which were not included in this research (conative, cognitive, sociological, and other environmental factors).

Based on the analysis of the influence individual predictor variables have on given criterion one can see that variables showing statistically significant influence on given variables are : body mass (ATLMAS), back skin fold (ANABLE) and foot length (ADUŽST).

The reason why the above mentioned variables have the biggest influence on given criterion is that dynamic propulsion measured by time on 10m distance occurs in the structure of performing a situational element.

Table 1

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.615 ^a	.388	.214	.56778

Model Summary

a. Predictors: (Constant): ANABTR, ADUŽNO, AŠIRRA, ATLMAS, ANABNA, ADUŽRU, ANABLE, BMI, AVISTL, ADUŽST.

Table 2 Anova^b

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	11,123	10	1,114	3,496	,012^a
Residual	17,171	55	,324		
Total	28,488	69			

a. Predictors: (Constant): ANABTR, ADUŽNO, AŠIRRA, ATLMAS, ANABNA, ADUŽRU, ANABLE, BMI, AVISTL, ADUŽST

b. Dependent Variable: SMSTPA

Table 3 Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	2,491	2,719		,893	,341
AVISTL	,005	,004	,365	,898	,348
ADUŽRU	-,004	,003	-,268	-1,161	,239
ADUŽNO	,004	,004	,291	,875	,394
ADUŽST	,008	,011	-,616	2,245	,009
AŠIRRA	,007	,005	,216	1,596	,114
ATLMAS	-,007	,004	-,744	-3,294	,008
ANABNA	,121	,028	-,225	-1,222	,206
ANABLE	,116	,029	,621	2,638	,009
ANABTR	-,035	,024	-,255	-1,322	,276
BMI	,107	,031	,233	1,224	,232

a. Dependent Variable: SMSTPA

Regression analysis of morphological characteristics and criterion variable time of 50 crawl swimming (SMVPLK)

On the basis of data presented in added tables one can see that between the systems of predictor variables, which are in this paper represented by ten morphological variables, there are statistically significant relations and influence on criterion (Sig. = .006). Criterion is represented by variable time of 50m crawl swimming (SMVPLK), while multiple correlation coefficient is $R = .692$ (table 4) which explains joint variability of about 50% ($R^2 = .472$) while other 50% in overall variability can be explained by other anthropological dimensions, which were not included in this

research (conative, cognitive, sociological, and other environmental factors).

Based on the analysis of the influence individual predictor variables have on given criterion one can see that variables showing statistically significant influence on given variables are: back skin fold (ANABLE), foot length (ADUŽST) and arm length (ADUŽRU).

The reason why the above mentioned variables have the biggest influence on given criterion is that dynamic propulsion measured by time on 10m distance, as well as propulsion of movements in water occur in the structure of performing a situational element.

Table 4 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,692 ^a	,472	,216	,55066

a. Predictors: (Constant), ANABTR, ADUŽNO, AŠIRRA, ATLMAS, ANABNA, ADUŽRU, ANABLE, BMI, AVISTL, ADUŽST

Table 5 Anova^b

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	11,126	10	1,066	3,622	,006 ^a
Residual	17,322	55	,308		
Total	29,133	69			

a. Predictors: (Constant), ANABTR, ADUŽNO, AŠIRRA, ATLMAS, ANABNA, ADUŽRU, ANABLE, BMI, AVISTL, ADUŽST

b. Dependent Variable: SMVPLK

Table 6 Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	2,611	2,694		,917	,346
AVISTL	,005	,004	,365	,948	,347
ADUŽRU	-,006	,002	-,611	-2,456	,011
ADUŽNO	,005	,004	,291	,866	,372
ADUŽST	,016	,022	,522	3,132	,006
AŠIRRA	,008	,007	,206	1,533	,122
ATLMAS	-,001	,002	-,313	-,366	,701
ANABNA	,102	,022	,333	1,422	,115
ANABLE	,102	,026	,511	2,633	,009
ANABTR	-,036	,028	-,244	-1,155	,206
BMI	-,022	,016	-,245	-1,133	,166

a. Dependent Variable: SMVPLK

Conclusion

Morphology studies the constitution and structure of certain parts of human body, anatomy of organ systems and their functioning, technique of anthropometric and somatotypical procedures, as well as main regularities of human genetics,

biological growth and development. During body growth and development, certain parts of body follow a different growth curve, reaching their maximum at different points of time. These facts are the reason why morphological body structure which is based on mutual interactions of all anthropological measures at different development stages can be different, or in

other words certain morphological characteristics can at different points of time participate with different coefficients of participation in certain morphological body structure and have different statistical significance of influence on situational-motor efficiency of swimmers from that age group.

Regression analysis was used within the multivariate level in order to determine how

strong is the influence of the system of predictor variables, in other words morphological characteristics on the criterion system which is represented by situational-motor skills in swimming.

Displayed predictive values of used variables, as well as the ability to predict the results proved to be significant in this research in both criterion variables.

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UTICAJ MORFOLOŠKIH KARAKTERISTIKA NA SITUACIONO-MOTORIČKU EFIKASNOST PLIVAČA

Sažetak

Osnovni cilj istraživanja bio je utvrđivanje uticaja morfoloških karakteristika na situaciono-motoričku efikasnost plivača uzrasta 13-15 godina. Istraživanje je provedeno na uzorku od 70

plivača uzrasta od 13-15 godina koji se nalaze u kontinuiranom trenažnom procesu u svojim klubovima. U ovom istraživanju je primjenjen skup od 12 varijabli, i to: 10 varijabli za procjenu morfoloških karakteristika i 2 varijable za procjenu situaciono-motoričke efikasnosti. Regresiona analiza primjenjena je u okviru multivarijantnog nivoa s ciljem utvrđivanja veličine uticaja sistema prediktorskih varijabli, odnosno morfoloških karakteristika na kriterijski sistem varijabli koji je predstavljen situaciono-motoričkim sposobnostima u plivanju. Iskazane prediktivne vrijednosti primjenjenih varijabli, kao i mogućnost predikcije rezultata pokazala se značajnom u ovom istraživanju u svim primjenjenim kriterijskim varijablama.

Ključne riječi: plivanje, ispitanici, morfologija, uticaj, efikasnost

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THE ROLE AND THE IMPORTANCE OF SPORT AS A FUNCTION OF HEALTH

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Original scientific paper

Abstract

The health is the most important element of human life, which leads to a numerous investigations of that area. Healthy people have the will to live, are vital and experience a sense of well-being. A healthy person can be called only person with the established physical and mental balance. Sport as physical activity is important because of the positive impact it has on the development of individual physical strength, making it attractive for the entire population, especially for young people. Sport is part of free time and makes people happy and joyful in those moments of games and entertainment. Tension and negative energy as a consequence of modern life can be successfully channeled through sport. Studies have confirmed that sport and physical activity reduces stress and depression symptoms in children and adults. Regular physical activity is essential for proper physical, mental, psychological and social development. Sports include physical activity that develops and maintains the health of muscles, bones, joints and ligaments. Sport has a positive effect on the body weight, fat and blood pressure. Regular athletic activity has a significant impact in the prevention of chronic diseases. Besides the positive effects on the heart muscle, regular physical activity has a positive impact on the reduction of the degree of atherosclerosis through increased fat metabolism and increasing the elasticity of large arteries. The basic steps are the dietary treatment of obesity procedures and movement therapy. For the reduction of body fat, suitable aerobic activities: walking, running, swimming, etc., which involve large muscle groups. Physical activity can be seen as an effective tool in the prevention and treatment of anxiety and depression. When people live an active lifestyle, there is a sense of self-esteem and a sense of control of its own life. Regular physical activity has a positive effect in terms of stimulating and protecting brain function. It is necessary to systematically approach and to solve problems according to preferences and interests of students, to offer an appropriate program of activities. The first steps of a systematic approach must be based on research that will provide enough valuable information necessary for the proper planning and setting goals and objectives.

Keywords: sport, healthy, physical activity,

Introduction

The Health

The health is the first and greatest value in life. People who are healthy have the will to live, are vital and experience a sense of well-being. A healthy person can be called only person with the established physical and mental balance. Healthy people are exempt from the pressure of everyday life, anxiety and depression. The old Latin proverb says, "*Mens sana in corpore sano*". It is the result of long experience of previous generations, as an expression of knowledge and awareness about the sources and foundations of human life and health, but also enduring determinant of life and development of all generations.

Every generation in history has put the life and the health in the foreground as core social and individual values. In developing, enriching and protecting these values in all generations, in all social systems, in all social circumstances, the indispensable role of sport had. Systems, rulers, economic and social order, social values, customs and way of life have changed through the history, but no ruler, no order, did not dispute the importance of sport and sports competitions. On the contrary, they were all aware of the social, ethical, driving force of sport and sports competitions, and tried to use it, some in favor, some to the detriment of their own people and humanity as a whole. For these reasons, the sport has been and still is one of the enduring, essential determinants of the human civilization.

Today, as for centuries, we cannot imagine a society without sports and recreational activities. This fact has now become apparent only at the global level and social demands, new, different, more meaningful and responsible social engagement in the

development of sport, health and education in the sport.

The sport

We could say the sport is as old as humankind is. Sports activities have existed in all times and cultures and had different forms of expression and different meaning. Beginning in prehistoric times, people have organized various forms of entertainment and the cult games with elements of sport that we could recognize even today. Sports at the time of Sparta were the main method of physical and mental preparation of boys and young men in military skills and military campaigns. In modern times, sport has become a means of quality use of leisure time in order to maintain and develop the mental and physical strength of the individual. Sport has evolved from the game as the oldest form of education. The original meaning of the word sport comes from the Latin verb "*dis - porto*" which means *to blow, to scatter, scatter it, keep minds off*.

Sport as physical activity is important because of the positive impact it has on the development of individual physical strength, making it attractive for the entire population, especially for young people. Sport is a part of leisure and makes people happy providing joyful moments in these games and entertainment moments. The importance of sport can be observed in the domain of integration and socialization of individuals in society, and this is achieved by voluntary and unforced socializing through sports.

The role of sports activities to maintain and improve the health

Sport, helps people becomes better, stronger, skilled, and healthier and constantly strives to mental and physical improvement. Sport is a very important factor in the manifestation of man's intense mental and physical resources. In that way, sport influences the maturing, self-knowledge and self-realization (Čokorilo, 1998). Playing sports provides an opportunity for the individual to experience success in a relatively short period of time. This ability influence the development and strengthening of self-confidence, and this role of sport in the development of adolescents as a vulnerable population is very significant. Sporting activity has beneficial effects on emotional health. Tension and negative energy as a consequence of modern life can be successfully channeled through sport. Studies have confirmed that sport and physical activity reduces symptoms of stress and depression in adults. One of the more recent researches, including boys and girls ages 8 to 12 years at three schools in the United States, revealed that inactive children are more depressed than active children who regularly go in for sports (Thompson, LM, et al., 2003). Many professions of modern society are exposed to stress and the managerial profession is at the top of the scale of the most stressful occupations. Maintenance of health and prevention of "management disease" is one of the most common diseases of modern society; it is possible only with the implementation of sports activities and recreation of managers (Radosavljevic, 2005).

Sports can be placed in the field of education and in this sense it can provide

great influence in life values, such as, for example, the competitive spirit. It binds us to that principles of honorable and fair game in sports arenas, transmit in all other areas of social life and work, in particular presenting the sport as a good way to combat sex based discrimination or disability, and to combat racism.

Technological developments in terms of the informational achievements have significantly responsible for weakening of the physical activity of children and youth. Young people increasingly realize their social needs through the Internet. In this way, they become "dependent" of that kind of communication and social communication. Reduced physical activity and interest in playing sports are visible in each age category and represent a serious problem of youth development. The form of physical activity, which corresponds to a certain standard program, exists in schools. Sports are represented in the scope of planned curriculum as well as a varsity sport in the third class of physical education. Curriculum covers only certain sports (handball, basketball, volleyball, football, athletics and gymnastics), which significantly limits the choice of students. This is one of the limiting factors in terms of motivation and commitment of students for a particular sport. That is one reason why students are engaged in active sports and opt for one of these sports. Material conditions also determine what will be included in the plan of actions to implement. Schools that have rooms, equipment and props can fully implement all the activities and provide students with adequate contact with popular sports.

"European Year of Education through Sport" project is created to develop a sport through new trends in sports, a wider community, which eliminates the risk of

sitting lifestyle, social isolation caused by the application of new technologies, all kinds of discrimination and respect for the true values of sport embodied through the ideals of Olympic Charter emerged from *kalokagathia*.

The link between the sport and beneficial effects on health is not questioned for long time. Many studies have shown that water sports activities leads to high quality physical condition. Another aspect of these studies shows that inactivity becomes a risk factor for many diseases and a major health problem for society. Regular physical activity is essential for proper physical, mental, psychological and social development. Habit of exercising should be developed within children at the earliest age. In this way, the likelihood that children will go in for sport when they become older and more aware of the importance when they grow up increase. Sports include physical activity that develops and maintains the health of muscles, bones, joints and ligaments. A large number of schoolchildren have postural disorders (flat feet, X/O legs, kyphosis, lordosis, scoliosis). Researchers conducted in nineties have suggested there are about 60% of schoolchildren with these shortcomings. Today, there is an increasing number of studies including schoolchildren where 90% of them have some sort of postural disorders. The number of obese children in the population of schoolchildren is constantly increasing. The level of development of motor abilities of today's children is very low. Children do not know the right way to move, to walk, to run or to jump. Of course, this situation has a direct impact on the health status of children, children's resilience and ability of an organism to resist disease, the development of organ systems and body functions.

Conditions of life in the modern era are the direct culprits for the appearance of hypokinesia, as the most important factors that influence the abnormal physical development in children. The diet has a significant factor affecting these problems. All these findings clearly indicate to us that it is necessary to create necessary conditions for proper physical growth and development of motor skills in children. Habit of physical education should be created from early childhood as a necessity of modern man living in urban areas. The habit of regular sports that can be made in youth is easy to maintain in times of middle and older age. Active sporting habits youth is the best prevention of potential disease of modern society that can occur in the elderly.

Although schools use physical education classes, the body's curricula are physically under stimulated, in relation to the needs of the developing child. Many schools in Serbia have no gym. Few schools have outdoor sports facilities. Many schools have a problem with a lack of equipment and devices necessary for the implementation of quality physical education and sports activities in the various sections. So even physical education teachers may not realize all the movement activities that would prevent the diseases we were talking about. A moment of becoming a schoolchild is critical in terms of physical strain in children caused by many factors: mostly sitting in classes, carrying heavy school bags, feeble and poorly formed body, and inadequate nutrition. These are factors that generally lead to bad posture and postural disorders, which often lead to deformity. Analyzing posture status of children and muscle weakness shows it is easy to conclude that the apparatus exercises (swinging, strongholds, attitudes,

endurance) are necessary for the proper formation of the child's body. It is noteworthy exercise combined with athletic activities (walking, running, jumping, throwing), followed by swimming, basics of the martial arts (falls, pulling, tug, pushing) and sports games (football, handball, basketball, volleyball, tennis). When children undergo such a comprehensive program of training, success in the proper formation of the child's body and their motor skills are guaranteed.

Sport has a positive effect on the body weight, fat and blood pressure. Regular athletic activity has a significant impact in the prevention of chronic diseases. Heart rate is the best indicator of heart muscle as well as general health. Average resting heart rate is 60-80 beats per minute. While the heart rate of athletes drops to 40 beats per minute, the sedentary person can reach 100 beats per minute. With regular exercise, heart weight increase, so it can respond to efforts that are more intensive. At the same time, the heart rate decreases, so use less energy and oxygen, generating more work. For this reason, it is important to measure heart rate and based on that determine the type of exercise, duration, and the ultimate goal to be achieved. Monitoring of heart rate, using heart rate monitor, exercising become more efficient and safer, as the reaction of organism to physical activity is shown moment-to-moment. Heart rate at rest is the number of heartbeats per minute, in the morning, shortly after waking up. In trained people is always lower, and in elite athletes can go up to 30 beats per minute. Decrease in heart rate at rest suggests improved fitness, while increased heart rate at rest suggests overtraining, possible dehydration, emotional stress, poor sleep

habits, disease, poor nutrition or a combination of two or more factors. A lower heart rate is a physiological advantage, because the heart works more efficiently and uses less energy than a heart with a higher frequency for the same amount of blood flow (Djordjevic, 2003). Heart attack and cardiovascular disease take about one million lives per year, which is significantly more than the total number of U.S. casualties in the four major wars in the previous century (636 282). American Heart Association in 1993, aligned lack of physical activity in a group of primary risk factors along with smoking, high cholesterol and high blood pressure (hypertension, and so recognized and emphasized the importance of physical activity. Inactive people are as much as 56 times more vulnerable to heart attack due to the exhaustion in relation to people who exercise regularly and among which the rate risk increases only five times under the heavy load (Sharkey, JB and Gaskill, ES, 2008). Physical activity has multiple effects on the health of the human body. Besides the positive effects on the heart muscle, regular physical activity has a positive impact on reduction of the degree of atherosclerosis through increased fat metabolism and increasing the elasticity of large arteries.

Obesity

Overweight (obesity) is one of the major health problems of the developed world. One study shows that in most developed countries over 50% of the adult population is overweight, and the number of obese people is increasing. Only in some cases, the cause of obesity is a metabolic disorder, while the majority has the energy imbalance problem. A person's metabolism is adjusted

in that way that, when food intake exceeds caloric needs, placing deposits of the excess energy as fat. Obesity threatens mostly people older than 30 years, though; there are plenty of younger people, mostly females, with a significant increase in body weight. Proportion of fat in the body weight is 15% up to 18% for men and from 20% up to 25% for women with normal body weight status. In cases of obesity, up to 35kg of fat (fat) can be present in the human body, which makes up more than 65% of total body weight. As a rule, the excess fat deposition is performed in women in the area of the pelvis and the thighs, and in case of men, in the stomach area. If the fat content exceeds 20% in men and 30% in women, such a person is considered obese. Obesity causes shortness of breath and fatigue during physical exertion. Although obesity is a health problem, it is often associated with various diseases of cardiovascular system, musculoskeletal system and metabolism, such as hypertension, diabetes, and elevated cholesterol, osteoarthritis of the knee or hip. Physical inactivity caused in 2000 around 1.9 million deaths worldwide. On the general level obesity was in 10-16% the cause of breast cancer, colon cancer and diabetes, and in about 20% of cases the cause of ischemic heart disease (*World Health Report*, 2002). In case of the obesity, the heart beat rate is extremely uneconomical, and manifest a strong increase in heart rate during physical exertion. Weakness, fatigue and shortness of breath are symptoms that are often noticeable in obese patients not initially result in heart disease, but the disparity between the capabilities of the heart and the increased demands of the body. Severe obesity increases the workload of the heart, and the result of chronic heavy load is a

heart enlargement. Respiratory disorders occur because of changes in respiratory mechanics. The high position of the diaphragm, the increased curvature of the thoracic spine, reduce respiratory motion due to the deposit of fat in the thorax and respiratory muscles, causing interference, leading to a reduction of lung capacity and lower values of respiratory parameters. The consequence of this is an increased need for oxygen, which hardly can be met because it is contrary to the above mentioned. Obese people are predisposed to many diseases: diabetes, increase levels of cholesterol and triglycerides in the blood, hypertension, atherosclerosis and the development of myocardial infarction. There are noticeable and pronounced degenerative changes of the locomotor system, especially the joints of the lower extremities and the spine. Flat feet and varicose veins of the lower extremities are common. The biggest mistake parents make in cases of obesity in their children and the appearance of flat feet due to excessive obesity is paying the attention to the purchase of orthopedic devices in the form of inserts or orthopedic shoes instead direct their energies to forming habits of proper nutrition and sports activities of their children.

The basic steps of obesity treatment are the dietary procedures and movement therapy. The program for the reduction of body weight is an attempt to show that it is not difficult to change your eating habits formed and general human activities. Although we do not know all the causes and mechanisms of obesity, we know that our knowledge is sufficient for taking concrete steps towards mitigation or curing of inherited obesity. These steps involve radical changes in diet and sporting activities. Reduction of body mass implies movement therapy, which is recommended

with the combination of weight loss diets. The load should be gradual, depending on age, sex, state of physical fitness and obesity. It is wrong to think that the purpose of the movement is that increasing the burning energetic materials, directly reduces weight. The usual intensity of exercise is generally not high enough to significantly reduce the impact of increased mass. Just every day, hard physical work lasting several hours can lead to a significant increase in metabolic processes, in order to have the effect on the reduction of body weight. Physical exercise and physical activity affect the restructuring of the distribution of body fat, keep the skin tone and subcutaneous tissue, and it has a psychological effect. For the reduction of body fat, aerobic activities: walking, running, swimming, etc. are suitable, which involve large muscle groups. The essence of sport and movement therapy is determined by the rate at which energy is provided solely from aerobic sources. The intensity at which obese people generally consume fat, as an energy source, is up to 50% of the maximal intensity, i.e., at 120 to 150 heart bitrates per minute, which will serve to consume carbohydrate and proteins partially. Studies have shown that the best results in the reduction of body weight could be achieved by a combination of exercise and diet. It has been proven that there is no statistically significant difference between continuous and interval training methods when the volume and intensity of exercise is equal to (). To include the fat in the process of providing energy for muscular work, you need a hormonal response. This answer requires about 20 minutes, so the scope of practice should be half an hour or more. Such exercising will not lead to a heavy fatigue (low intensity), so that the frequency of

training can be on an everyday basis. The most effective activity in the reduction of body weight is brisk walking and running. Calories are not only consumed during exercise. Studies have shown that the metabolism is accelerated for several hours after a workout, so almost the same amount of calories is consumed during the recovery period as during exercise. It is important these calories come mostly from fat. Therefore, the best thing is to practice in the morning or before noon so the metabolism is accelerated during most of the day. It is important not to eat before, during and after exercise for some time, as in that case the energy would be used from food, not from body fat. It is a good to practice in the morning and do not eat three hours after that, because then the metabolism is accelerated and thus burning fat. It is advisable to drink plenty of fluids, especially water. Physical activity helps to expel waste products of metabolism. It is necessary to drink at least 2-3 liters of fluid per day. You need to drink water before you feel thirsty because thirst is often a sign of partial dehydration.

The influence of sport on mental health

The first association regarding the positive effects of sport on the human body is the physical health, although the sport has equal effects on mental health. Physical exercise can produce a variety of physiological and biochemical changes in the body, then a change in ways of thinking and experiencing ourselves and the environment, contributing in that way to better mental functioning and mental health (Durakovic et al., 1999). Data collected in epidemiological studies indicate a positive correlation of physical activity and mental health. Physical activity can be seen as an

effective tool in the prevention and treatment of anxiety and depression. Anxiety is defined as a feeling of constant threats of unknown origin, accompanied by the characteristic feelings of uncertainty and helplessness. Physical activity reduces the level of anxiety and is recommended as an effective tool in situations of tension and concern about the everyday problems and responsibilities. Numerous studies have shown a positive effect of physical activity on reducing the level of anxiety. Tests conducted at the police officers, firefighters, athletes and patients, have shown that training and improved physical fitness repressed anxiety as a personality trait (Sharkey and Gaskill, 2008, according to Landers and Petruzzi, 1994).

Physical activity has a positive effect on reducing depression and its prevention. Depression is a specific mental condition that involves sadness, decreased self-esteem, pessimism and despair. Symptoms of depression are different - pain, irritability, lack of criticism, withdrawal, and thinking about suicide. Regular physical activity provides an excellent means of combating stress and tension of everyday life. Physical activity occupies the mind with nice thoughts that automatically decreases the tension characteristic of thinking about everyday problems of different types. Physical activity can be seen as a vent that allows a man to expel negative energy and negative thoughts and focus on relieving feelings of comfort. Physical activity is also a form of meditation with full positive effect. In active lifestyle, there is a sense of confidence and a sense of control of its own life. Regular physical activity has a positive effect in terms of stimulating and protecting brain function. Experimental research conducted on animals that were forced to

physical activity in terms of running the hamster wheel, showed that physical activity had effect on gene expression changes in the formation of the nervous system that have emerged. In these animals was observed an increase in molecular neurotropic factors that prolong the survival of neurons, support the learning process and protect against cognitive decline (Sharkey and Gaskill, 2008, according to Cotman and Engesser-Cesar, 2002). The studies that included physically active people have shown that older people who exercise three or more times a week, rarely suffer from Alzheimer's disease and old age dementia.

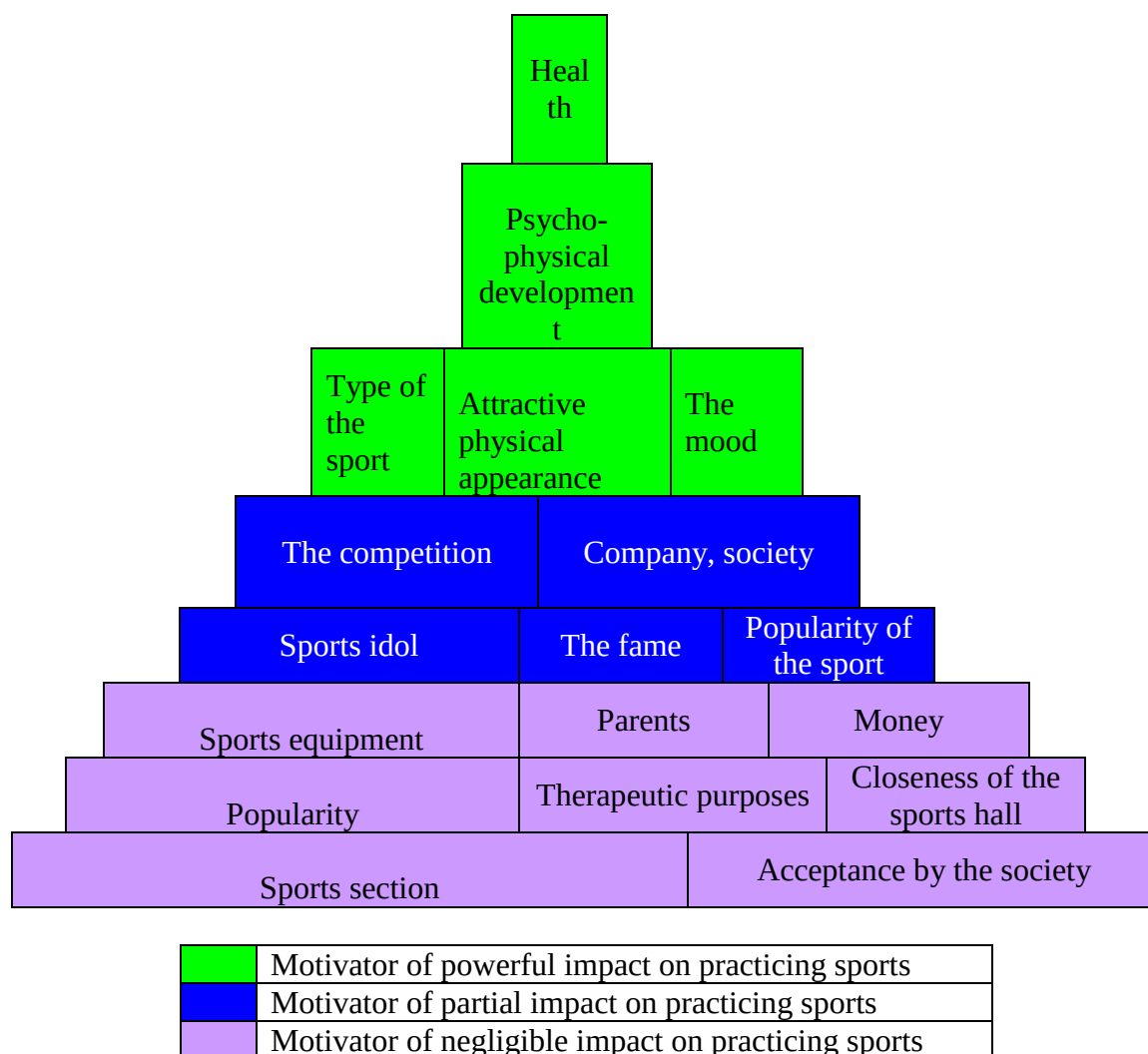
Motivacion in sports

A large number of people, of different ages, gender, social engagement, political beliefs, and religion deal with sport. People deal with sports of different beliefs, attitudes and interests, so the difference in the motives of sports can be seen as a completely natural thing.

Motives are very important in the sport and they are a significant factor in sports efficiency and strongest support in the process of keeping the sport, Tomić (Tomić, 2001). The school population is aware of the importance of sport for their health. The results of research in sports motif in primary and secondary schools shows that. The survey was conducted in four primary and eight secondary schools in Zrenjanin in the period 10.03.2010 - 20.05.2010, and 794 subjects were included. The research results indicate that health, mental and physical development and the impact of sport on mood are strong incentives for the school population. These results are quite logical given the fact that the sport in this region is identified with health. Starting from parents, through

teachers, professors, to literature and media, children learn about the importance of sport and its role in the maintenance of health.

Figure 3: The pyramid of motivators



The research results indicate that primary and secondary students seen sport as a factor directly affecting the health. They perceive health as the most powerful motivator for sports.

The role of parents, schools, government and media in promoting sports and healthy

First contact of children with knowledge about the health and its importance in daily life is related to the first year of life. Parents are the first and most important source of information about health and that is why it is necessary for parents to devote their full attention to the ways and methods of directing children towards health habits.

Health habits acquired in early childhood are the basic foundation of health.

Educational institutions have a major impact on health behaviors and attitudes about health development of children and youth. The educational process must include health as a field of education of children and youth, from preschools through elementary and secondary schools, to vocational school in the field of medical and sport science (secondary vocational

schools, colleges, universities). The school system has an educational role and is necessary to make a greater impact on the widening of youth activities in the direction of health education. Apart from cases dealing health areas and active impact on youth through formal learning, it is necessary to affect the implementation of creative actions, promotions, sports and health programs, etc.

Given the values that sport is embedded in society, a sport has become a factor that contributes to human education. UNESCO on many occasions stressed in its documents the need for associating sport, curriculum, and activities that contribute to the overall development of the personality in relation him/her, physical development and cultivated social habits.

At the European level, several experiments that have been set as a test of educational programs related to sports organizations were conducted. For example:

- "Sport-school" pilot activity, which also included three European Olympic Committee with provisions to use the Olympic values and principles in school activities
- Activities within the Socrates program to promote academic exchanges, and others

Europe has always been committed to the educational values of sport and in this way gained a reasonable opportunity to raise awareness on co-operation of educational and sport organizations, building their wider partnership in order to use the sports activities in education more appropriately.

Conclusion

We are witnessing the emergence of new diseases that are the product of modern technological processes and relations of production, such as cancer, cardiovascular, respiratory diseases, allergies, stroke, AIDS, etc. Through the media and permanent reminding of positive effect of physical exercise on reduction of these diseases today, we came to the categories of citizens who became truly aware of and committed to make room and places for recreation in everyday life.

The physical activity in schools is represented the form that corresponds to a certain standard program. Sports are represented in the planned curriculum as well as a varsity sport during the third class of physical education. Curriculum covers only certain sports (handball, basketball, volleyball, football, athletics and gymnastics), which significantly limits the choice of students. This is one of the limiting factors in terms of motivation and commitment of students for a particular sport. That is one reason why students are engaged in active sports and opt for one of these sports. Material conditions also determine what will be included in the plan of actions to implement. Schools that have rooms, equipment and props can fully implement all the activities and provide students with adequate contact with popular sports. For the reduction of sports activities, schools are also to blame. Increasingly smaller number of schools organizes sports section to support physical activity in the curriculum. The greatest number students the first contacts with organized physical activity and sports activities experience in schools. This is the right place and time to motivate children to become involved in sport and making sport habits.

It is necessary to systematically approach and solve problems according to

preferences and interests of students, to offer an appropriate program of activities. The first steps of a systematic approach must be based on research that will provide enough valuable information necessary for the proper planning and setting goals and objectives.

Besides the parents, the educational institutions must provide important influences on students' interest towards the sport, not individually, but in combination with sports organizations. Sports organizations should be seriously involved in the sense of observation of students as a population to whom sport and sporting activities are necessary, as well as a population that can be a serious and targeted market group. Kastratović states that one of

the basic and most important steps in the process of strategic marketing planning is a skill to recognize target market. Market research must recognize the cause of dissatisfaction or partial satisfaction (Kastratović, 2012). Only cooperation between the Ministry of Sports, Ministry of Health, sports organizations and associations and media organizations can contribute to the promotion of sport and its importance for the health of individuals and society as a whole. Sports colleges should be involved in projects to promote sports and implementation of sports action, which would also constitute an excellent practice and provide experience for the students as future employees in the field of sports.

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Sažetak

Zdravlje predstavlja najvažniji element ljudskoga života što je uslovalo mnogobrojna istraživanja upravo te oblasti. Osobe koje su zdrave imaju volju za životom, vitalne su i doživljavaju osećaj blagostanja. Zdravim osobama mogu se nazivati samo osobe kod kojih je uspostavljena fizičko-mentalna ravnoteža. Sport kao fizička aktivnost je značajan zbog pozitivnog uticaja koji ima na razvoj individualnih fizičkih snaga, što ga čini privlačnim za celokupnu populaciju, posebno za mlade ljude. Sport ispunjava slobodno vreme mnogih i čini ih zadovoljnim i radosnim u tim trenucima igre i zabave. Napetost i negativna energija kao posledice modernog načina života mogu se uspešno kanalisati kroz sport. Istraživanja su potvrdila da sport i fizička aktivnost smanjuju simptome stresa i depresije kod dece i odraslih. Redovna fizička aktivnost neophodna je za pravilan fizički, mentalni, psihološki i socijalni razvoj. Sport podrazumeva fizičku aktivnost koja razvija i održava zdravlje mišića, kostiju, zglobova i ligamenata. Sport pozitivno utiče na kontrolu telesne mase, masti i krvnog pritiska. Redovna sportska aktivnost ima značajan uticaj u sprečavanju pojave hroničnih bolesti. Osim pozitivnog dejstva na srčani mišić, redovna fizička aktivnost ima pozitivan uticaj i na smanjenje stepena arteroskleroze kroz pojačan metabolizam masti i kroz povećanje elastičnosti velikih arterija. Osnovni koraci lečenja gojaznosti su dijetetski postupci i terapija kretanjem. Za redukciju telesne masti, pogodne su aerobne aktivnosti: hodanje, trčanje, plivanje, itd., gde učestvuju velike grupe mišića. Fizička aktivnost se može posmatrati kao efikasno sredstvo u prevenciji i lečenju anksioznosti i depresije. Pri aktivnom načinu života javlja se osećaj samopouzdanja i osećaj upravljanja sopstvenim životom. Redovna fizička aktivnost ima pozitivno dejstvo u pogledu stimulisanja i zaštite funkcije mozga. Neophodno je sistemski pristupiti rešavanju problema i shodno sklonostima i interesovanjima učenika, ponuditi adekvatan program aktivnosti. Prvi koraci sistematskog pristupa moraju se bazirati na istraživanjima koja će dati dovoljno vrednih informacija neophodnih za pravilno planiranje i postavljanje dugoročnih i kratkoročnih ciljeva.

Ključne riječi: sport, zdravlje, fizička aktivnost.

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ASSESSMENT OF NUTRITIONAL STATUS AND PERCEPTION OF ONE'S OWN WEIGHT FOR FEMALE ADOLESCENTS FROM TRAVNIK MUNICIPALITY

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Original scientific paper

Abstract

Nutritional status is an indicator of the health status of an individual, even of an entire population, as well as their physical abilities, that is the level of motor skills. Assessment of nutritional status is determined through the Body Mass Index (BMI), which is the product of height values and body mass. The aim of this paper is to analyze the nutritional status of students from Travnik who attend secondary commercial school and to assess their subjective satisfaction with their current body weight. The analysis was conducted on whether male and female teenagers have different perception regarding their weight and whether they have different personal criteria regarding desired and ideal body weight in relation to their current body weight. Research included anthropometric measurements of body weight and height. There was also an anonymous questionnaire for 442 students among which 267 were girls and 176 boys. We analyzed their responses to questions about satisfaction with their current body weight , desired "ideal" body weight in relation to the current weight, and answers about the implementation of diet as a way to control current body weight. Ideal weight is shown by deviation ($\pm$ kg) from the measured body weight.

Keywords: *nutritional status, body image, adolescents, BMI, diet, body weight , body height.*

Introduction

Nowadays, when the imperative for slenderness as an ideal for good and attractive appearance is so strong, many children and young people have unjustified fear of „fatness“ and a wish to have an appearance which resembles as much as possible the appearance of people from the covers of magazines and TV screens. On the other hand, reduced physical activity,

many hours in front of TV and monitor, bad eating habits increase the risk of obesity. Body image is a subjective picture of one's own physical appearance and an important aspect of psychological and interpersonal development in adolescence. In many developed western countries 50-80% of girls want to be thinner, and 20-60% of girls are on a diet (Levine and Smlak, 2002).

Sample which included Croatian high school students showed that 50.4% of girls and 24% of boys have been on a diet at some point of their lives (Rukavina, 2002). Excessive slenderness, together with negative stereotyping of obese people can result in the noticeable feeling of unhappiness regarding one's own physical appearance and concern with one's own weight, which is especially the case for young girls. Unhappiness with one's own body leads to negative attitude towards nutrition, concern regarding weight and diet, and it can eventually lead to eating disorder. Eating disorders such as anorexia, nervousness etc., are usually problems of young adolescent girls, although attempts to lose weight can occur even in prepuberty (Halvars, Lunner and Sjoden, 2000). Although there are different explanations offered by etiology of eating disorders it is considered that social messages which put emphasis on the importance of being thin and slender have the most important role in the occurrence of these disorders. That is why these disorders are related more to the western, more developed and industrialized countries where these messages are widespread.

The results of the research are in accordance with the above mentioned assumptions. It is estimated that in Spain, 0,1 - 3% of young people who are between 14 and 24 years old suffer from some kind of eating disorders (Rodriguez-Cano, Beato-Fernandez and Bemonte-Llario, 2005). Al- Subaie (2000) finds out that 40 % of girls in Saudi Arabia is concerned with their body weight, which is in accordance with the data which show that Asian women are less unhappy with their weight and are less on a diet in comparison to American women. Eating disorders are typically related to females, with 9:1 relation in favor of women

(Rastam, Gillberg and Garton, 1989, Fairburn and Beglin, Wolf, 1991.) Researches conducted on adolescents from Croatia suggest that concern regarding body weight and appearance is more important for young women than for young men (Pokrajac-Bulian, 2000).

Adolescence marks the end of overall physical, psychological, emotional and social development and growing up which starts from the end of childhood and lasts all the way to the start of adulthood. According to the World Health Organization it starts at the age of 10 and lasts until the age of 19. It is divided in three stages: early adolescence (10-13), middle adolescence (14-16) and late adolescence (17-19). Due to faster growth, during adolescence young people gain 20% of their height and about 50% of their body mass in adulthood, which causes huge energy needs for teenagers at that period of life. For girls, faster growth starts with the first signs of puberty (usually at the age of 11) and lasts until menarche and for boys it starts around the age of 13 and lasts through the second half of puberty. Overall body fat tends to gradually increase for girls during puberty and decrease for boys. Under the influence of testosterone boys have dominant growth of muscles and the increase of minerals in bones. Physical changes at the start of adolescence are the strongest sign that a child steps into the second period of overall development. Adolescents react emotionally on changes of their bodies.

Concern with one's own body becomes even more important part of a complete personal picture for adolescents at this period of life and is a crucial factor of self-assessment. Damage and impulses related to self- assessment and one's own body from this period of life can also be seen in

adulthood (Tomori, 1990). Perception on one's own body can be satisfactory or not. Which feeling would prevail depends on reactions from close family circle and all people who are important for one adolescent. An individual who is not satisfied with his or her own physical appearance assumes that other people share his or her opinion. This is related to one's own perception and triggers the idea that other people also have negative opinion about him or her. Negative picture and self-assessment easily become parts of negative self-assessment with signs of depression (Kuhar, 2004).

There are numerous anthropometric parameters used for the assessment of nutrition status. The most suitable parameters for use are the measurement of body height and mass and determining Body Mass Index. Calculating Body Mass Index (BMI) is becoming more and more popular in the whole world. Body Mass Index is the individual's body mass divided by the square of their height – with the value universally being given in units of kg/m^2 - $\text{TM (kg)} / \text{TV (m)}^2$. The advantage of BMI is an easy calculation and strong correlation with body mass percentage, and insufficiency is the fact that it does not show position of fatty tissue. Because of this, measurement of waist and upper arm can be used for overweight adolescents, and skin-fold measurements using 4 spot formula can be used for thinner adolescents. Nutrition status of examinees is assessed by registering calculated BMI into the chart of Body Mass Index increase, specific for the gender of examinees (CDC BMI-for-age growth charts). The chart shows limiting values of percentiles based on which we make diagnosis on undernourishment or obesity according to European and American criteria.

Nutrition categories expressed in percentile of Body Mass Index

Nutrition category	European countries	USA
Undernourishment	<P3	<P5
Normal nutrition	P3 –P90	P5 – P85
Overnourishment	>P90	>P85
Obesity	>P97	>P95
Morbid obesity	> P99 (≥ 3 SD)	

Charts of height and weight growth are designed on the basis of statistically managed data for many healthy children, in coordinate system in which age of child is marked on the abscissa, and weight or height for that age is marked on the ordinate. Such graphs besides curves connecting points of average height or weight for children of a certain age, contain curves marking statistically variational width of height of growth for the appropriate age. These are so called weight-for-age centile curves or height-for-age centile curves. A child whose weight or height is below 5. or above 95. in centiles for his or her age, is marked with significant deviation (95% or 5 %) from children of the same age. For assessment of physical constitution and level of nutrition, body weight is compared to body height. For this purpose, centile curves of body weight for certain height (weight-for-height centile curves) are used. Current height is marked on the abscissa in coordinate system, while current weight is marked on the ordinate. Children with values over 95. centiles are overweight in comparison to children of the same height, and they are considered obese, while children with values below 5. centiles are thin in in comparison to most of the children sharing the same height. Certain clinical signs can point to eating disorder, so during medical examination attention should be paid on colour and quality of skin, hair, nails and mucous membrane of oral cavity. Numerous laboratory analyses can provide an insight into the state of nutrition. Values of haemoglobin, hematorcrit, proteins and albumin in the serum are used as screening. Diet as a way to control body weight is widespread and accepted way of behaviour. According to some authors it is popular with adolescents, especially girls, so much that it can be considered to be a

standard (Crouter and Birch, 2001). Research on the sample of Croatian high school students showed that 50.4 % of girls and 24 % of boys at least have an experience with diet (Rukavina, 2002). According to these data, the majority of people who go through a diet belong to normal weight category, while some even belong to underweight category. Going through a diet is a reason for concern at the age when growth and development is in full stride. These diets are often completely unacceptable from a medical point of view. Young people unfortunately go on diets which include skipping meals, especially breakfast, hunger periods that lead to vomiting, and sometimes even use of laxatives and diuretics as a way to attempt controlling their weight. Since children and adolescents have increased needs for energy and nutritive substances, going through a diet at that age can lead to many negative consequences. Diets cause physiological changes of numerous body systems, as well as to cognitive dysfunctions. For some individuals excessive diets can lead to psychological disorders such as anxiety and depression (Patton, Carlin and Shao, 1997), and moreover they can eventually lead to clinical eating disorders (anorexia, bulimia). Range of eating disorders is directly proportional to the frequency of diets (Shisslak, Crago and Mc Knight, 1997). Range of eating disorders and the concern of adolescents with their body weight and appearance should require attention and should not be neglected. Obsession with food and diet can lead to eating disorders.

Problem and aim

Defining the problem of this paper is a very simple task, because numerous researches on the nutrition of adolescents and their

perception of their own body and the importance of maintaining ideal body weight, failed to give specific results which would be used as matrix in maintaining ideal BMI values for the most sensitive population, adolescents. Aims of the paper are:

1. Determining nutrition status of adolescents (15-20 year-old) from Travnik municipality.
2. Assessing how pleased adolescents from Travnik are with their current body weight.
3. Analysis of the differences between male and female adolescents, and between adolescents from urban and rural area regarding their perception of their own body weight as well as their perception of their desired ideal
4. Determine whether and if yes to what extent adolescents from Travnik go on a diet as a way to control their body weight.

Work methods

Research was conducted in Mixed Secondary School of Economy and Catering in Travnik. This secondary school educates 474 students, and our research included 442 students (93.45 %) among

which 266 students were girls (60.2 %). Body weight (kg) and height (cm) were measured for all students on the lesson of Physical Education. They all had full sports equipment. Measurements of body weight was performed by *Soehnle Quattrotronic* portable digital scale with graduation of 100 gr and capacity of 150 kg. For height measurement we used static height gauge *Secca V 91/2m*, with graduation of 0.1, *CMS Weighing Equipment LTD*, model 1A25. Body Mass Index (BMI) calculation was based on the following formula: $ITM = TT \text{ (kg)} / TV^2 \text{ (m}^2\text{)}$. Desired ITM (kg/m^2) was calculated from the ratio of desired TT (body weight) and current body height (TV). “Ideal“ desired TT (body weight) was shown by deviation of desired ($\pm \text{kg}$) from measured TT (body weight). Examinees took the anonymous questionnaire about their satisfaction with their current body weight (YES/NO). They also gave answers on questions about what would be their desired weight and whether they are currently on a diet (YES/NO). The obtained data were processed by descriptive statistical methods of description, correlation of variables, factor analysis and regression analysis.

Results and discussion

Examinees were female students

Table 1. Main descriptive parameters

	Valid N	Mean	-95.000 %	95.000	Minimum	Maximum	Variance	Std.Dev	St.Error	Skewness	Kurtosis
TEZI	266	59.04	58.00	60.09	37.90	99.50	74.93	8.66	0.53	1.04	2.27
VISI	266	1.66	1.65	1.66	1.50	1.85	0.00	0.06	0.00	0.23	0.05

BMI	266	21.56	21.21	21.91	15.03	38.14	8.46	2.91	0.18	1.52	4.47
ZELT	266	57.26	56.61	57.91	40.00	70.00	28.91	5.38	0.33	0.05	0.00
ZELI	266	20.93	20.74	21.12	14.92	24.56	2.51	1.59	0.10	-0.15	0.50
RAZL	266	1.78	0.97	2.59	-19.20	39.50	44.63	6.68	0.41	1.10	4.25
ZAD O	266	0.33	0.27	0.39	0.00	1.00	0.22	0.47	0.03	--	--
DIJE	266	0.05	0.02	0.07	0.00	1.00	0.05	0.22	0.01	--	--

According to indicators from table 1, it can be determined that results for high school girls when it comes to BMI are within the limits of ideal body weight. Insignificant number of girls shows signs of undernourishment and obesity. Analysis of nutrition status according to criteria of the World Health Organization (WHO) shows that 2.5 % of girls is very undernourished, 3.5. undernourished, 77% have a normal nutrition status while 9.2 % are overnourished and 7.7 % obese. By looking at WHO statistics we come to a conclusion

that parameters for the analyzed sample are within limits of world average, and that there are no deviations in relation to parameters of similar researches in the region (Rakić R. Božić-Krstić V. Pavlica T. 2008, Puharić Z., Đermanović Lj. 2009,) where researches have shown that distribution of Body Mass Index is mostly within the limits of normal nutrition status, and that number of undernourished and obese adolescents is statistically insignificant.

Table 2. Correlation of variables

	TEZI	VISI	BMI	ZELT	ZELI	RAZL	ZADO	DIJE
TEZI	1.00	0.42	0.86	0.64	0.37	0.78	-0.19	0.27
VISI		1.00	-0.09	0.62	-0.22	0.05	-0.07	0.05
BMI			1.00	0.35	0.53	0.83	-0.17	0.27
ZELT				1.00	0.62	0.02	-0.14	0.03
ZELI					1.00	-0.02	-0.10	-0.01
RAZL						1.00	-0.14	0.33
ZADO							1.00	-0.12
DIJE								1.00

According to results in table 2. one can see the results of mutual connection of all 8 variables. The obvious fact is that correlation of variables TEZI (Weight), VISI (Height), BMI, ZELT and ZELI (desired weight) are in average and high connections and in most cases are positive (the exception is correlation of variables VISI and BMI which has negative relation). Such results of mutual connection of variables are not surprising, because their

correlation is the result of mutual bases which eventually produce BMI. Variable ZADO (Satisfaction) expectedly produced negative correlation as the result of the lack of satisfaction because these adolescents are unhappy with their current weight, which can also be seen through positive correlation with variable DIJE (diet) which although having small values still shows tendency of adolescents to control their own body weight using this method.

Table 3. Factor structure in varimax position

	Factor	Factor	Factor
	1	2	3
TEZI	0.79	0.44	0.39
VISI	0.06	0.98	-0.18
BMI	0.83	-0.06	0.53
ZELT	0.08	0.75	0.65
ZELI	0.04	-0.05	0.98
RAZL	0.96	-0.03	-0.01
ZADO	-0.24	-0.14	-0.10
DIJE	0.57	0.03	-0.19
Expl.Var	2.63	1.73	1.89
Prp.Totl	0.33	0.22	0.24

Table 3 shows us that there are three mechanisms of phenomenon formation in analyzed model. The first one is directly related to body mass, which results in well structured factor. The best way to describe it is overall mass together with dissatisfaction with weight and diet. The second factor is described by two variables,

height and desired weight, so we can mark it as aspiration for elegant appearance. It is obvious that we have clear indication that girls have different perception of their mass (the first factor) and overall constitution defined by height (the second factor) which generally can be the indication of excessive body weight they aspired to or they are

afraid of. The third factor is a single-factor with variable Desired BMI together with significant projections BMI and ZELT, so we are definitely talking about a comparison factor in accordance with some universally accepted phenomena in social surroundings. All of these facts show us that girls do not experience morphological,

social and aesthetic model of women in an integrated manner. On the contrary, they divide it into multiple composite segments, which is a topic for a more serious discussion about medical, kinesiological and anthropological general education at a younger age.

Table 4. Discriminative analysis of urban/rural area

	Wilks'	Partial	F- remove			1- Toler.
	Lambda	Lambda	(1,257)	p- level	Toler.	(R- Sqr.)
TEZI	0.99	1.00	0.23	0.63	0.00	1.00
VISI	1.00	1.00	0.64	0.42	0.01	0.99
BMI	0.99	1.00	0.08	0.78	0.00	1.00
ZELT	0.99	1.00	0.12	0.73	0.00	1.00
ZELI	0.99	1.00	0.23	0.63	0.01	0.99
RAZL	0.99	1.00	0.20	0.65	0.00	1.00
ZADO	1.00	1.00	0.40	0.53	0.95	0.05
DIJE	0.99	1.00	0.10	0.75	0.88	0.12

	G_1:1	G_2:2
G_1:1	--	0.99
G_2:2	0.99	--

According to Table 4 indicators, for girls there are no differences, neither globally (P) nor according to certain variables, between indicators in urban and rural areas. Reason for these results can certainly be equal life conditions in urban and rural areas, presence of mass media which is one of the basic causes of phenomena known as eating disorders, whether it is imposed by beauty

and health ideal, or on the other by a sedentary lifestyle as a desired option for the same population. Moreover, physical activity of adolescents is significantly reduced, especially in rural areas, which can be key fact in analyzing these phenomena, so there are no significant differences, neither in weight (TEZI) nor in desired weight (ZELI) which tells us that activities

and ideals are equal for female adolescents
from rural and urban areas.

Table 5. Regression of criterion Satisfaction

		St. Err.		St.Err.		
	BETA	of BETA	B	of B	t(259)	p-level
Intercpt			10.71	8.61	1.24	0.21
TEZI	2.97	8.30	0.16	0.45	0.36	0.72
VISI	-0.77	0.69	-5.80	5.21	-1.11	0.27
BMI	0.41	0.99	0.07	0.16	0.41	0.68
ZELT	-1.00	5.23	-0.09	0.46	-0.19	0.85
ZELI	-1.02	0.80	-0.30	0.24	-1.28	0.20
RAZL	-2.77	6.38	-0.20	0.45	-0.44	0.66
Analysis of Variance; DV: ZADO (basinzz.sta)						
	Sums of		Mean			
	Squares	df	Squares	F	p-level	
Regress.	2.63	6.00	0.44	2.02	0.06	
Residual	56.25	259.00	0.22			
Total	58.89					

According to table 5 indicators, we see no global connection and the influence of used variables on criterion Satisfaction with current body weight. This means that there is no group of relations within Satisfaction

with body weight which can have significant statistical connection with body mass. Obviously there are other social, genetic and other influences which play much more important role.

Table 6. Regression of criterion Diet

		St. Err.		St. Err.		
	BETA	of BETA	B	of B	t(259)	p-level
Intercpt			-4.34	3.79	-1.15	0.25
TEZI	-8.26	7.97	-0.21	0.20	-1.04	0.30
VISI	0.77	0.66	2.66	2.29	1.16	0.25
BMI	0.30	0.95	0.02	0.07	0.32	0.75
ZELT	4.21	5.03	0.17	0.20	0.84	0.40
ZELI	0.56	0.77	0.08	0.10	0.73	0.46
RAZL	6.45	6.13	0.21	0.20	1.05	0.29
Analysis of Variance; DV: DIJE (basinzz.sta)						
	Sums of		Mean			
	Squares	df	Squares	F	p-level	
Regress.	1.47	6.00	0.24	5.81	0.00	
Residual	10.90	259.00	0.04			
Total	12.36					

Indicators from table 6 confirm that tested sample of female adolescents generally perceive body mass and appearance within other values and socially marked parameters, which are slightly more difficult to connect with body mass, and often go on a diet, not from health reasons but on the contrary for aesthetic reasons, although there is no need for that decision.

Conclusion

Generally, big percentage of analyzed girls shows normal nutrition status, with very small percentage of undernourished or obese girls. We described three mechanisms on which phenomena in this sample depend. Those three phenomena are not integrated, with a clear influence of numerous social values. Under the influence of mass media ideal of beauty has changed, and media use aggressive campaign to impose lifestyle, clothing style, and nutrition on adolescent and by

that have a direct influence on their eating habits and an indirect influence on their health. Although health institutions and organizations are against imposition of the above mentioned standards, we can still see on the results of this paper that girls of this age are not satisfied with their weight although indicators of body weight index distribution are within the limits of normal weight status.

When it comes to urban-rural area differences, they have no statistical significance. The reason for this first of all is the lifestyle in urban and rural areas which is almost the same according to physical activities of community members, and this can especially be seen in population which is influenced by media the most. BMI

indicators for female members of both groups are almost equal and they have equal indicators of satisfaction with body weight, which also implies the influence of media, because all indicators are within the limits of normal nutrition status for female members of both population. Satisfaction with one's own weight can not be explained by morphological indicators, while in the case of parameter Diet (be on a diet) explanation of results is very possible, but shown variables do not offer enough information, so we can conclude that other influences such as culturological status and the influence of media and social environment prevail and have stronger influence than them.

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PROCJENA STANJA UHRANJENOSTI I PERCEPCIJA ADOLESCENTICA OPĆINE TRAVNIK O VLASTITOJ TJELESNOJ TEŽINI

Sažetak

Stanje uhranjenosti je pokazatelj zdravstvenog stanja pojedinca, čak i cijele jedne populacije, te njihovih tjelesnih sposobnosti, tj. nivoa motoričkih sposobnosti. Procjenu stanja uhranjenosti određujemo putem indexa tjelesne mase (BMI), koji je produkt vrijednosti visine i mase tijela. Cilj ovog rada je analiza stanja uhranjenosti učenika Srednje ekonomsko-ugostiteljske škole u Travniku te procijena subjektivnog zadovoljstva postojećom tjelesnom težinom. Istraženo je da li se mladići i djevojke međusobno razlikuju po percepciji vlastite tjelesne težine, te po vrijednosti željene težine koju sebi postavljaju kao idealnu u odnosu na postojeću. Prilikom istraživanja korištena su antropometrijska mjerenja tjelesne težine i tjelesne

visine, a anonimno je provedeno anketiranje 443 učenika, od kojih 267 djevojaka i 176 mladića. Analizirani su odgovori na pitanja o zadovoljstvu postojećom tjelesnom težinom, željenoj „idealnoj“ tjelesnoj težini u odnosu na postojeću, te odgovori o provođenju ili neprovođenju dijete, kao načina kontrole postojeće težine. Idealna „željena“ tjelesna težina prikazana je odstupanjem ($\pm$ kg) od izmjerene tjelesne težine

Ključne riječi: *uhranjenost, body image, adolescenti, BMI, dijeta, tjelesna težina, tjelesna visina.*

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STATISTICAL ANALYSIS OF THE USE OF FREE TIME FOR SPORTING ACTIVITIES IN SERBIA

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Abstract

The topic of this paper pertains to the identification of ways in which men and women in Serbia spend their free time, and how much of that time is set aside for sporting activities. Playing sports in one's free time, i.e., recreational sports, represents the engagement of individuals during their free time for non-profit purposes. Generally, the male population has more free time than the female population. Research conducted in the United States and Europe has shown that adult men have between 1 and 9 hours of free time more than women who work every week. The results of the present study, conducted by the Sports Institute of the Republic of Serbia by interviewing people on the territory of the Republic of Serbia, reveal that a quarter of the time during the day is spent on leisure activities, while on the weekends 1 additional hour is devoted to leisure activities than on the weekdays. Almost half an hour a day is spent on sports and recreation, while men spend slightly more time on it than women. Out of the half hour, most time is spent on walking, and the difference between the sexes in this area is small. The aim of this study is to use statistical analysis to process the existing data in order to highlight the importance of playing sports during spare time.

Keywords: recreation, spare time, sports

Introduction

Free time is time spent away from doing business, house chores, or working. It also excludes time spent on necessary activities such as eating, sleeping, and where mandatory, education.

The distinction between leisure and unavoidable activities is not clearly defined. People sometimes do certain business-related activities for pleasure, or for the long-term benefit of the company. Also,

there is a difference between free time and rest. According to some beliefs, free time is an illusion and is rarely detached from the economic and social strengths of an individual.

Recreational activities are not entirely a matter of choice as they may be limited by social pressure. For instance, a person may be forced into gardening due to the need to keep up with the standards set by the neighboring gardens.

Time available for leisure varies from one society to the next. Anthropologists have discovered that the hunter-gatherers of the African tribes have much more free time than people in more complex societies.

Results of a large number of studies have suggested that men in general have more spare time than women. In the United States and Europe, adult men have between 1 and 9 hours of free time more than women who work every week.

The lack of physical activity in modern life is a reality and an undisputable fact. As physical activity is a biological need of all humans, the greater involvement from our society as a whole is required on all levels, as well as from each individual who needs to take care of his own health status. Physical activity has an irreplaceable instrumental value as it represents the best way for achieving and maintaining good health. In addition, it enables the realization and development of an individual's motor skills and achievements.

Just as an athlete is considered to be an incomplete person if s/he does not receive an education at the same time, so is the person who has been receiving an education throughout his whole life required to take care of his physical stamina and health, and the means through which s/he can achieve exactly that is physical activity.

Today's findings clearly show that the level of people's health, aside from the hereditary factors and environmental influences, is largely a reflection of different aspects of their lifestyle associated with family traditions, cultural, and socio-economic environments. A series of discoveries and research findings link a high-quality way of life with the lifestyle which implies not

smoking, no alcohol or drug addiction, healthy nutrition, resistance to stress and infection, and physical activity as an important part in creating a healthy human body. Hence, it is understood that under the current conditions these factors are an integral part of the culture of living of every individual. In the past, people moved much more because in order to meet their basic needs they worked physically to a far greater extent, so they did not have to exercise. Today's life is inconceivable without modern technological recourses, whose use has replaced physical work from the past that was used for survival, which led to the situation in which there is a lack of physical activities. In contemporary society, such deficiencies can be compensated for by exercising in groups or on one's own, and this has become an unavoidable necessity and an integral part of a quality lifestyle and good health for each modern person.

Playing sports during free time, or recreational sports, is a time engagement for non-profit purposes, in other words, it refers to the refreshment of one's body or mind. The reaction is a refreshing activity and it differs from person to person. It includes economic and social factors, i.e., our standard of living can determine the type of recreation and other partakers.

Playing sports is a great source of relaxation in a day in which we have more and more working hours. Today's pace of life is very fast and we therefore have more baggage and business responsibilities imposed on us. Refreshing the mind from the new ways of life is also the health benefit of playing sports. Furthermore, sports today are also a form of entertainment.

The Use Of Free Time To Play Sports In Serbia

A publication of the Institute of Sports called *The Use Of Time In Serbia, 2010/2011* was created on the basis of data obtained from studies on the use of time. The survey was carried out on the territory of the Republic of Serbia during the period of 1 year, from 15 February 2010, to the end of February 2011. The object of this study was to determine the ways women and men in Serbia spend their time. The research on the use of time provides information about how the residents of Serbia use their time day or night, on the weekdays or the weekends.

The main objective of this study was to gain insight into how the residents of Serbia spend their time during the 24 hours. In order to obtain the data on the use of time, the basic research instrument was a diary in which the members of a household noted their daily activities. Each participant was to fill out two logs for two selected days in advance, with the diary entries being recorded for each ten-minute interval over a period of 24 hours. Based on these data it was possible to calculate how long each episode lasted and who carried it out.

The survey was conducted in 2340 households, out of which 780 households were in Belgrade, 1040 were in central Serbia excluding Belgrade, and 520 households were in Vojvodina.

The results of the conducted research yielded the following indicators:

- The main difference in the way men and women spend time,
- How persons in different age groups spend their time,
- How persons in the urban and other settlements spend their time,
- How persons of different education levels spend their time,
- How persons of different employment status spend their time,
- How time is spent on the weekdays vs. the weekends

The ways in which the population of the Republic of Serbia aged 15 or over, or men and women spend their time can be divided into 6 groups: paid work, unpaid work, studying, personal needs, free time, and other activities.

The activities related to leisure, including playing sports, accounted for almost a quarter of the time spent during the day, i.e., almost 6 hours. This time is spent for socializing with friends, on cultural and sports activities, watching TV, or reading books and newspapers. Women spend more than 5 hours a day on leisure activities while men spend 1 hour more.

- The main differences in the way men and women spend time

Table 1. The average time spent on activities by sex

Hours									
Activities	Women			Men			Total		
	Work day	Weekend	All days	Work day	Weekend	All days	Work day	Weekend	All days
Paid	2:34	1:05	2:09	4:23	2:16	3:47	3:26	1:38	2:55
Non paid	4:50	4:54	4:51	2:17	2:14	2:16	3:37	3:38	3:38

Studying	0:31	0:11	0:25	0:23	0:07	0:19	0:27	0:09	0:22
Personal	11:01	11:44	11:13	10:50	11:45	11:05	10:56	11:44	11:10
Free	5:00	6:03	5:18	6:03	7:33	6:29	5:30	6:46	5:52
Other	0:01	0:01	0:01	0:01	0:01	0:01	0:01	0:01	0:01

As for the leisure activities, women on average spend 5 hours and 18 minutes during the week, while men spend more than 1 hour more - 6 hours and 29

minutes. Women devote 1 additional hour to free time during the weekend, while men set aside an additional hour and a half more.

Table 2. The participation of the population in the engagement in activities by sex

Percentages									
Activities	Women			Men			Total		
	Work day	Weekend	All days	Work day	Weekend	All days	Work day	Weekend	All days
Paid	36	19	31	53	33	47	44	26	39
Non paid	95	94	95	76	78	77	86	86	86
Studying	8	6	8	6	4	5	7	5	7
Personal	100	100	100	100	100	100	100	100	100
Free	98	99	99	100	100	100	99	100	99
Other	5	4	4	5	5	5	5	5	5

A certain number of women did not report their leisure activities for all days from Monday to Sunday, while 2 percent of women did not report such activities on

a work day. The men have all recorded some sort of free time activity during the day.

Table 3. The average time for those who have engaged in activities by sex

Hours									
Activities	Women			Men			Total		
	Work day	Weekend	All days	Work day	Weekend	All days	Work day	Weekend	All days
Paid	07:12	05:34	06:55	08:15	06:59	08:00	07:48	06:25	07:32
Non paid	05:05	05:12	05:07	02:59	02:53	02:57	04:12	04:13	04:12
Studying	06:18	03:16	05:37	06:43	03:10	06:00	06:28	03:14	05:46
Personal	11:01	11:44	11:13	10:50	11:45	11:05	10:56	11:44	11:10
Free	05:05	06:05	05:22	06:05	07:35	06:30	05:33	06:47	05:55
Other	00:24	00:27	00:24	00:30	00:34	00:31	00:27	00:31	00:28

The population of Serbia spends a quarter of the day on leisure activities. On the weekends, they spend 1 additional hour on the leisure activities compared to the work

days. On average, women spend almost 5.5 hours on such activities, while men spend 1 hour more. On the weekends, women spend 1 additional hour on leisure activities

compared to the work days, while men have 1.5 more time.

- The main differences in the use of time among the persons of different age groups

Table 4. The participation of the population in the engagement in activities by age and sex

Activities	Percentages							
	15-29		30-64		65+		15-64	
	F	M	F	M	F	M	F	M
Paid	21	42	41	58	13	22	36	54
Non paid	84	55	98	80	94	86	95	74
Studying	38	28	..	..	..	..	10	7
Personal	100	100	100	100	100	100	100	100
Free	99	100	99	100	99	100	99	100
Other	4	5	5	5	2	6	5	5

The population aged between 30-64 has the least free time, among which women have 1 hour less than men. The young people of 15-29 years of age and the persons older than 65 years spend about

the same amount of time on leisure activities. The difference between men and women is just over an hour for both age groups in favor of men.

- The main differences in the use of time between persons in urban and other settlements

Table 5. The participation of the population in the engagement in activities by the type of settlement and sex

Activities	Percentnages			
	Urban Settlements		Other settlements	
	F	M	F	M
Paid	28	41	36	55
Non paid	95	76	94	77
Studying	9	7	6	3
Personal	100	100	100	100
Free	99	100	99	100
Other	5	4	4	6

The difference in engagement of women and men from both types of settlements in leisure activities is almost nonexistent.

- The main differences in the use of time between persons with different levels of education

Table 6. The participation of the population in the engagement in activities by the highest level of education and sex

Activities	Percentages					
	Primary education or less		Secondary education		Post-secondary education	
	F	M	F	M	F	M
Paid	25	41	32	51	45	45
Non paid	93	76	96	76	97	81
Studying	8	9	8	4	..	..
Personal	100	100	100	100	100	100
Free	98	100	99	100	100	99
Other	4	6	5	4	5	7

Men with the highest level of education spend the most time on leisure activities, and have almost 1 additional hour more than other men. The differences between women are lesser when it comes to education, although those with higher education levels have more time for leisure activities. The difference between the sexes is the greatest among those with the highest educational degrees - more and 1.5 hours,

and it is the least among the lowest-educated - less than 1 hour. Regardless of education, on average, about half an hour is spent on sporting activities. The more the person is educated, the more s/he engages in sporting activities, while men, on average, spend 10 minutes more than women across all education categories.

- The main differences in the use of time between persons of different employment status

Table 7. The participation of the population in the engagement in activities by employment status as per their own statement and sex

Activities	Percentages			
	Employed persons		Unemployed persons	
	F	M	F	M
Paid	74	81	10	17
Non paid	96	70	94	82
Studying	..	..	11	9

Personal	100	100	100	100
Free	97	99	100	100
Other	5	6	4	4

Employed women have the least amount of free time – almost 4 hours, while the unemployed men have the most free time – almost 8 hours.

Playing Sports in One's Spare Time

Although sports nowadays are very popular because millions of people follow sporting events, the barricades that stand in the way of the personal engagement in regular physical activities are frequent. A purely rational insight is not enough to change the lifestyle that is massively affecting the modern human being. This way of life has emerged as a consequence of the development of modern technological means, and the visible consequence is the smaller volume of physical activities. Regardless of the fact that there is new insight on the negative consequences of the lack of physical activities on a daily basis on human health, such finding will mean nothing to an individual if s/he has a negative attitude toward exercising. Therefore, the solution to the problem should involve a change in attitude, and turning the mind toward creating new habits in order to take preventative measures for the health of an individual.

Free time is part of everyday life. The amount of free time largely depends on the sex, age, education level, employment status, as well as the number of available

days for recreation during the week.

Women on average have more than 5 hours of free time per day, while men have almost 6.5 hours. Women have less spare time on the weekdays, or from Monday through Friday, and on the weekends compared to men. On the weekdays, the difference between the sexes is 1 hour, while on the weekends the difference is 1.5 hours. Thus, it is evident that on the weekends women use that same time on leisure activities that the men have on the weekdays.

On the road to changing the static way of life, people very often, although they have a positive attitude about exercising, fail to implement it in the act. The reason for this situation probably lies in the fact that although many people know the consequences of very little moving, at the same time they want to live a more casual life. Achieving the goal requires certain sacrifices, and when it comes to exercising the data on not engaging in physical activities indicate that a large part of the population is simply not ready for this kind of sacrifice.

Both sexes spend almost half an hour a day on sporting and recreational activities, while men spend a little more time than women. Out of this time, they spend the most time on walking.

Table 8. Participating in the engagement and average time spent on leisure activities for those who engaged in such activities by sex

Percentages and hours				
Activities	Participation of the population in the engagement in activities		The average time for those who have engaged in those activities	
	F	M	F	M
TV and radio program	91	92	2:45	3:12
Social life and entertainment	79	78	1:48	2:03
Outdoor sporting activities	24	29	1:25	1:43
Reading	23	27	1:06	1:05
Hobbies and working on the computer	16	23	1:27	1:47
Volunteer work and meetings	9	9	1:59	2:30
Travelling related to free time	42	50	0:50	0:54

One in four women (24 percent) recorded sporting activities in which she spent 1.5 hours. The participation of men in sporting activities was slightly higher (29 percent) and they spent more time on it, almost 2 hours.

Conclusion

Educating the population, among other things, presupposes the understanding of the essence of exercising. The modern way of life has imposed another model as a priority in creating the criteria of a good life, and engaging in sporting activities in order to stay healthy is considered to be one of the less important factors. Therefore, the lack of physical activity is often justified by the lack of time. Although it is mostly related to spare time, recreation today is increasingly encountered in specific programs as an important element in contemporary scientific organization of work and rest periods. Sporting activities are chosen freely, are not imposed, and are

usually carried out during spare time. The essence and purpose of sports is to provide optimal conditions and options to the modern persons to satisfy their needs for movement and to creatively spend their free time through a variety of sports and recreation activities. Playing sports maintains and improves health, maintains the working optimism, and improves overall skills. Partakers in sports and recreational activities constitute a very broad subcategory of the population, i.e., a very inhomogeneous subcategory by age, gender, social, and psychological characteristics, whose needs can be met only by using the sports and recreation programs. Sports and recreation, as part of a cultured and physical lifestyle, involve the application of appropriate sports and recreation programs on all aspects of human life (education, work, and spare time), so it is no surprise that certain programs of sports and recreational activities have become an integral part of the scientific organization of work and rest periods, as well as of

meaningful and enlightened spending of spare time. Interpreted results of this study should influence the awareness of the population in the Republic of Serbia as to

the increased volume of engaging in sporting and recreational activities.

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STATISTIČKA ANALIZA KORIŠĆENJA SLOBODNOG VREMENA ZA BAVLJENJE SPORTOM U SRBIJI

Sažetak

Predmet ovog rada se odnosi na utvrđivanje načina na koji muškarci i žene u Srbiji provode svoje slobodno vreme i koliko tog vremena izdvajaju za bavljenje sportom. Bavljenje sportom u slobodno vreme, odnosno rekreativni sport predstavlja angažovanje pojedinaca u svom slobodnom vremenu u neprofitabilne svrhe. Muška populacija generalno ima više slobodnog vremena nego ženska populacija. Rezultati istraživanja u Evropi i Sjedinjenim Američkim Državama su pokazali da odrasli muškarci imaju između jednog i devet sati više slobodnog vremena nego žene koje rade svake nedelje. Rezultati ovog istraživanja koje sproveo Republički zavod za sport anketirajući ljude na teritoriji Republike Srbije pokazuju da četvrtina vremena tokom dana provede se u slobodnim aktivnostima, s tim što se danima vikenda više od jednog sata posvećuje slobodnim aktivnostima nego radnim danima. U sportu i rekreaciji provode skoro pola sata dnevno i to nešto malo više muškarci nego žene. Od toga, najviše vremena provodi se u šetnji i tu je razlika u aktivnosti među polovima mala. Cilj rada je da se statističkom analizom obrade postojeći podaci da bi se ukazalo na značaj bavljenja sportom u slobodno vreme.

Ključne reči: rekreacija, slobodno vreme, sport.

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TECHNIQUE OF SHOTS IN A HANDBALL GAME IN SELECTED HANDBALL PLAYERS

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Original scientific paper

Abstract

Technical issues in handball as a sport has not been studied enough so as to give positive results for practical application, especially due to the fact that technique assumes computer technology and that research team must have good understanding of functional anatomy and mathematical modeling. Research methodology applied to analysis of shot techniques, i.e. swings, is fully applicable to biomechanical analysis in all sports in which swing is included as a momentum. Apart from unavoidable external forces in any complex movement generated by man, there are lots of muscles whose ideal simultaneous-successive synchronization enables relative and ideal performance of complex movements. Each synchronization misbalance of muscular effects decreases effects of a complex movement too. Assuming there are no significant kinematic and goniometric differences between male and female handball players in handball as a sport, then the training program should focus on the development of musculature which is operative and simple for throwing activities in handball. Goniometric variables and techniques of ball shots are as follows: absolute angle of bottom elbow, relative angle of elbow articulation, moment just before the ball throw off, slow-down stage of the ball. Video recording is digitalized on PC by means of camcorder, after which each recording is played in succession. Coordinates of relevant figurative points are written with special software to the computer where a special program calculates further the following: fields, time and goniometric values for each figurative and representative point for each position of any throw of a ball. Handball belongs to acyclic polystructural sports in which acyclic movements are predominant. Handball is characterized by diversity and multiple technical elements, tactics, overall body movements, changeable strength, and changeable tempo. Theoretical significance of this research is that it provides a base for research in other anthropological spaces, for establishing mutual relations, as well as for determining effects and significance of these spaces.

Key words: technique, shot, handball

Introduction

Shootings are essential moves in handball sport, hence they are paid highest attention in the process of learning – training –

practicing. Three factors are important for the technical element of shooting: 1) which muscles are involved, how and when, 2) trajectory traveled by particular body spots

and velocity of the sport movements, and 3) which angles are formed by biomechanical levers during a certain form of shooting in handball.

Jump-shot is one of the oldest shooting techniques. Directing the ball to the goal using this technique is very attractive and highly efficient as a high score percentage is realized. The technique of shooting itself in this case may be divided in four stages: pounce, takeoff, fly and ball throw, and landing.

In the field of handball technique, research done so far is insufficient for deriving positive results in practical application. It is predominantly due to the fact that technique requires computer technology, provided that a research team must be well acquainted by the theory of functional anatomy.

Research methodology applied in this research has also been used in other sports, however, owing to the fact that it uses a similar form of movement (throw-off), it is fully applicable for biomechanical analysis for all sports where throw-off is applied as a moment of movement quantity.

Research

Hamil and Lapoint (1994) points to the significance of ball throw in handball or the contents of a unique whole of handball sport (technique, strategy, and training).

J. Wayne & T. McFarland (2001) give an understandable illustration of techniques of handball sport with a special emphasis on throwing without pretensions in terms of high professionalism.

J. Page (2000) stresses that all ball games include similar technical elements which may be transferred positively, such as

throws in handball, water polo, javelin throw, etc.

Kovač, Djukić & Hajnal (1990) used a sample of female handball players of cadet age to determine morphological and motor characteristics depending on the play position. On this occasion, they have determined that there are differences in motor spaces, more specifically in the variable of body height. Within the basic motor abilities, significant differences were determined in terms of coordination, explosive power of upper extremities and precision.

B. Pokrajac (1982) carried out comparative analysis of motor status between top competitors in handball sport and competitors in other sports games. On this occasion, correlations were determined between throwing in handball sport and throwing in other sports games, in which throws represent one of important motor characteristics for a particular sport.

I. A. Baylos et al (2001) did research with a goal to study the relationship between isokinetic power of internal and external rotators of shoulders and ball velocity in handball players of different levels. The experiment included three groups of young and healthy males: I group of 15 handball players – best goal-getters in A1 league; II group of 12 handball players of the best goal-getters in the A2 league; and III group representing a random sample of 15 students of the Faculty of Physical Education.

N. Zvonarek et al (2002) performed kinematic analysis of two different techniques of jump-shot execution in handball from external positions by two top handball players. By comparing them, they determined that there was a significant

difference between them. Jump of the first player was slightly lower, whereas the ball throw-off took the maximum trajectory. Jump of the other subject was extremely high, as well as the ball throw-off.

Stanković et al. (2006) drew the following conclusions in their research: there were no qualitative differences between ankle angles depending on the kind of shot in handball, during jump-off; there were no qualitative differences in angles of knee joint, depending on the type of jump-shot in handball, during jump-off, and there are no qualitative differences in angles of hip joint, depending on the type of jump-shot in handball, during jump-off.

Wit, J. Elasz (2000) in their research “Three-dimension kinematic analysis of handball throws”, explain the following: throw success in a match of team handball often depends on throwing velocity. One of the most important factors affecting the velocity of ball is the technique of movement.

J. Elliasz (2000) made the study of “Relations of throwing velocity and parameters of motor abilities of top handball players”, and he says that throwing is one of the most important skills in team handball. Two basic factors are important for efficiency of throwing: accuracy (precision) and velocity of throwing. Naturally, the faster the ball throw to the goal, the shorter is the time of defending players and goal keeper for defense against the shot.

I. A. Baylos & K. Boudolos (2001) did a study of “Precision and velocity of throwing in handball”, in which these parameters were considered as the basic parameters during competition. Several examiners studied the relations between the

velocity of movememnts of upper extremities and precision of throwing from the standing position, which led to developing interesting theories. The purpose of this study was to make a comparative analysis of precision in combination with ball velocity during throwing in handball, between sportsmen of different levels and non-sportsmen subjects.

R. van den Tiller & G. Ettema (2003) did analysis on the topic “Effects of instructions on the velocity and precision of over-arm ball throw”. Nine experienced Norwegian handball players performed the task of throwing by random technique, 7 times according to 5 instructions ranging from stressed velocity to focused precision. When instructions focused significantly on precision, velocity declined. However, precision did not improve when the subjects were instructed to do the task again.

R. van den Tiller & G. Ettema (2003) did a similar study again “Instructions stressing the velocity, precision of execution, or both, this time in kinematics of over-arm ball throw-off in handball by experienced handball players”. In motor tasks such as over-arm ball throw, velocity and precision are the two significant parameters of execution of a motor task. The purpose was to analyze the effects of instructions stressing velocity, precision, or both on kinematics of throw-off with hands. Results of 9 experienced handball players were 24 ± 2.2 , at average age.

Problem and subject

Starting with an assumption that morphological-motor characteristics of male and female handball players are different, the basic problem of this research

is technique of ball shots in selected male and female handball players.

According to a specially recorded kinograms, kinematic and goniometric values were determined for each shot, by means of which an answer is given in relation to eventual differences in shot realization by selected female and male handball players, which is the main subject of this research.

Purpose

The primary purpose of this research is focused on the need to determine relations between selected male and female handball players in technique of shot realization.

Basic methods

Basic methods applied in this study are kinematic and goniometric method.

Subject sample

Subjects were taken from a group of selected male and female handball players of cadet national team, whose technique of ball throw was qualified as potentially acceptable based on expert observation.

Sample

Each kinogram represents a movement i.e. throw of ball in handball – shooting. Accordingly the following values are monitored on each kinogram:

Kinematic variables

Kinematic variables are expressed in the values of m/s (meter per second).

- Total movement velocity of the center of gravity of the ball;

- Horizontal movement velocity of the center of gravity of the ball;
- Vertical movement velocity of the center of gravity of the ball;
- Total movement velocity of the center of wrist;
- Horizontal movement velocity of the center of wrist;
- Vertical movement velocity of the center of wrist;
- Total velocity of movement of the center of elbow joint;
- Horizontal movement velocity of the center of elbow joint;
- Vertical movement velocity of the center of elbow joint;
- Total movement velocity of the center of shoulder joint;
- Horizontal movement velocity of the center of shoulder joint;
- Vertical movement velocity of the center of shoulder joint;

Goniometric variables

Goniometric variables are expressed in units ° (grades).

- Absolute angle of lower arm;
- Absolute angle of upper arm;
- Relative angle in elbow joint.

Method of data processing

For processing a video recording, a program for kinematic analysis in 2D space is used. In this research, a two-dimensional kinematic analysis is applied. The subject technique is recorded with a single video camera, at the velocity of 50 shots per second. Data processing is carried out by means of HUMAN program for kinematic analysis. Then the video recording is processed and prepared for further processing, which assumes determination of referent spots at 14-model system.

Results

In order to get relevant data in this research, the analysis included total shots to the goal by 17 selected male handball players and 17 female ones. Analysis of shot technique included calculation of 15 subject variables from kinematic and goniometric space at 6 significant moments before and after the ball throw. Total number of obtained parameters was $2 \times 17 \times 15 \times 6 = 3060$. As for the statistical processing, three significant moments were singled out, i.e. input data matrix was $(2 \times 17 \times 3) \times 15 = 102 \times 15 = 1530$.

Descriptive statistics of kinematic and goniometric variables in male handball players

The moment before ball throw

The Table 7.1.1-1 presents values of central and dispersion measures of the resultant velocity of the current points at the moment before ball throw. It may be observed that maximum value of ball velocity in some male handball players reached the value up to 18.1 m/s, whereas the mid-value amounted to 13.91 m/s.

Table 7.1.1-1 *Descriptive parameters of the resultant component of total velocity*

	Valid N	Mean	Minimum	Maximum	Std.Dev.	Skewness	Kurtosis
VrBall	17.00	13.91	11.19	18.10	1.95	0.70	0.12
VrHand	17.00	11.86	9.80	13.67	1.18	-0.06	-1.00
VrElbow	17.00	8.37	5.61	10.44	1.05	-0.69	2.46
VrShoulder	17.00	4.63	3.50	6.34	0.70	1.36	2.52

Horizontal component of movement velocity of all relevant points is shown in Table 7.1.1-2 had the following values of the center of gravity of: ball, hand, elbow, and shoulder (-13.64, -11.58, -8.32, -4.50 respectively). These values are similar to

resultant values, due to the fact that significantly greater amount of movement in shot in handball takes place in the horizontal direction.

Table 7.1.1-2 *Descriptive parameters of the horizontal component of total velocity*

	Valid N	Mean	Minimum	Maximum	Std.Dev.	Skewness	Kurtosis
VxBall	17.00	-13.64	-17.75	-11.01	1.89	-0.66	0.11
VxHand	17.00	-11.58	-13.39	-9.72	1.13	-0.03	-1.18

VxElbow	17.00	-8.32	-10.31	-5.45	1.06	0.83	2.80
VxShoulder	17.00	-4.50	-6.05	-3.47	0.68	-1.04	1.44

DESCRIPTIVE STATISTICS OF KINEMATIC AND GONIOMETRIC VARIABLES IN MALE HANDBALL PLAYERS

The moment before ball throw

The Table 7.1.1-1 presents values of central and dispersion measures of the resultant

velocity of the current points at the moment before ball throw. It may be observed that maximum value of ball velocity in some male handball players reached the value up to 18.1 m/s, whereas the mid-value amounted to 13.91 m/s.

Table 7.2.1-1 *Descriptive parameters of the resultant component of total velocity*

	Valid N	Mean	Minimum	Maximum	Std.Dev.	Skewness	Kurtosis
VrBall	17.00	13.24	11.47	15.80	1.35	0.44	-0.82
VrHand	17.00	10.41	9.19	12.03	0.84	0.53	-0.67
VrElbow	17.00	6.62	4.26	8.57	1.32	-0.26	-0.76
VrShoulder	17.00	2.83	1.39	4.25	0.82	0.02	-1.04

Horizontal component of movement velocity of all referent points shown in Table 7.2.1-2 had the following mid-values for centers of gravity of: ball, hand, elbow, and shoulder (-12.74, -10.17, -6.44, -2.70

respectively). Here gain, it could be noticed that these values are similar to the resultant values, with regard to the fact that major portion of movement with a handball shot takes place in horizontal direction.

Table 7.2.1-2 *Descriptive parameters of the horizontal component of total velocity*

	Valid N	Mean	Minimum	Maximum	Std.Dev.	Skewness	Kurtosis
VxBall	17.00	-12.74	-15.48	-10.49	1.40	-0.54	-0.64
VxHand	17.00	-10.17	-11.83	-8.87	0.87	-0.58	-0.65

VxElbow	17.00	-6.44	-8.48	-4.13	1.35	0.09	-0.99
VxShoulder	17.00	-2.70	-3.79	-1.38	0.73	0.14	-1.08

Conclusion

There are certain differences between selected male and female handball players in relation to the kinematic and goniometric characteristics of ball shooting technique. Velocity of the center of gravity of a ball, with its horizontal component, does not statistically differ in selected male and female handball players in the first and second phase, whereas in the phase of ball throw off, this difference is statistically

significant. Absolute angle of lower arm is not statistically significant with selected male and female handball players. This research should encourage researchers in the field of handball sport to accept a scientific approach for work with the youngest selections, so that such research results might be used for planned and programmed selection, which is highly important for all age categories.

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TEHNIKE ŠUTIRANJA U ODBOJKAŠKOJ UTAKMICI ODABRANIH IGRAČA

Sažetak

Tehnički problemi u rukometu kao sportskoj igru nisu dovoljno izučeni da bi dali pozitivne rezultate za praktičnu primjenu, naročito iz razloga što tehnika podrazumjeva kompjutersku tehnologiju i da istraživački tim mora dobro razumjeti funkcionalnu anatomiju i matematičko modeliranje. Metodologija istraživanja primjenjena na analizu tehnike šuta, odnosno zamasi, potpuno je primjenjiva na biomehaničku analizu u svim sportovima gdje se primjenjuje zamah.

Pored neizbježnog uticaja vanjskih sila u bilo kojem kompleksnom ljudskom pokretu, mnogo je mišića čija idealna simultavno-sukcesivna sinhronizacija omogućava relativnu i idealnu izvedbu kompleksnih pokreta. Svaki debalans sinhronizacije mišićnih uticaja umanjuje efekte kompleksnog pokreta takođe.

Ako pretpostavimo da nema značajnih kinematskih i goniometrijskih razlika između rukometaša i rukometašica, onda bi program treninga trebalo fokusirati na razvoj muskulature što je operativno i jednostavno za aktivnosti hvatanja u rukometu.

Goniometrijske varijable i tehnike šutiranja su sljedeće: apsolutni ugao donjeg dijela lakta, relativan ugao atrikulacije lakta, momenat prije samog bacanja lopte, faza usporavanja lopte. Video zapis je digitaliziran na računarima pomoću kamera, nakon čega se svaki zapis pušta jedan iza drugog. Koordinate relevantnih figurativnih tačaka su zapisane sa posebnim softverom na računar gdje poseban program dalje izračunava: polja, vrijeme i goniometrijske vrijednost za svaki figurativnu i reprezentativnu tačku svake pozicije bilo kog bacanja lopte.

Rukomet pripada acikličnim polistrukturalnim sportovima gdje dominiraju aciklični pokreti. Rukomet je karakteriziran raznolikošću i višestrukim tehničkim elementima, taktici, sveukupnim pokretima tijela, promjenjivoj snazi i promjenjivim tempom. Teoretski značaj ovog istraživanja je da omogućava osnovu za dalje istraživanje u ostalim antropološkim prostorima, za ostvarivanje obostranih veza, kao i određivanje uticaja i značaja ovih prostora.

Ključne riječi: tehnika, šut, rukomet.

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ANALYSIS OF SITUATIONAL EFFICIENCY FOR WINNING AND LOSING TEAMS IN 2010 VOLLEYBALL WORLD CHAMPIONSHIP

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Abstract

Main goal of this study is to determine differences in situational efficiency between winning and losing teams. For the needs of this research we analyzed 53 games played in 2010 FIVB Volleyball Men's World Championship in Italy. First group of entities was defined as "THREE" and this group includes winning and losing national teams which played in games finished in 3 sets. Within group "THREE", 29 games were analyzed. The other group of entities was defined as "FOUR" and that group included winning and losing national teams which played in games finished in four sets. Within this group, 24 games were analyzed. For the needs of this research we used twelve variables evaluating situational efficiency of teams within the games. Median test was used to determine differences between winning and losing national teams. The results of our study indicate that within group "THREE" as well as within group "FOUR" there are statistically significant differences in certain parameters of situational efficiency between winning and losing teams. On the basis of presented results we can see that the structure of competitive demands changes in relation to number of played sets within a game. In games played in three sets, differences in high number of used variables were determined in relation to games played in four sets where the difference was expressed in lower number of variables.

Key words: volleyball, efficiency, differences, median test.

Introduction

Monitoring parameters of situational efficiency within the game of volleyball is very important for the improvement of volleyball. Team efficiency in certain parameters of situational efficiency, which are used in a game, determines efficiency of a winning and a losing team (Durković et al., 2009; Costa et al., 2012). It should be emphasized that there is no defensive tactics in volleyball, because rules require

teams to look for success by winning points (Janković and Marelić, 1995). In accordance with that, technical elements used in Complex I and Complex II of volleyball are equally important for winning against the opposing team (Eom and Schuttz, 1992). Therefore, efficiency in the use of technical elements in the following stage of the game depends on the same efficiency in the previous stage of the game (Bergeles et al., 2010). Large number of researches is concerned mostly with the

use of certain technical and tactical elements in order to better understand dynamics of volleyball Araujo et al., 2009; Costa et al., 2012; Hayrinen et al., 2004; Giatsis and Tzetzis, 2003; Bergeles et al., 2009). The game of volleyball consists of various specific skills such as serve, reception, set, attack, block and defense (Palao et al., 2004). Volleyball is characterized by various competitive demands in relation to age, gender and level of competition (Virpi et al., 2013; Silva et al., 2013; Palao et al., 2009; Zetou et al., 2007; Rabaz et al., 2013). Efficiency in the use of all technical and tactical elements depends on individual and team performances of players on one team (Hayrinen et al., 2004; Silva et al., 2013; Bergeles et al., 2009). We have to emphasize that regardless of the competition level, differences between winning and losing teams in terms of their playing style are evident. It is very easy to notice differences in the use of technical elements as well as in efficiency of tactical variations (Marcelino et al., 2010; Davila-Romero et al., 2012; Grgantov et al., 2006). Therefore, in order to improve how one team plays it is necessary to know the models of success for a team, each individual, phase of the game, players' positions and each set (Hayrinen et al., 2004; Silva et al., 2013; Marcelino et al., 2010). For establishing model of success it is necessary to conduct analyses of the games played on the highest level of competition. In accordance with the above mentioned, our study contains analyses of the games played in 2010 FIVB Volleyball Men's World Championship in Italy. In volleyball as well as in other sports connection between technique and tactics is necessary (Janković and Marelić, 1995). Connection between technique and tactics

is mainly reflected in the use of technical elements within tactical set plays. Main goal of this study is to determine differences in situational efficiency between winning and losing teams. Analysis of the games finished in three sets was done separately from analysis of the games finished in four sets. By this, besides determining changes we are also going to determine whether there are changes in the structure of competitive demands in games played in three and four sets. In accordance with this we will be able to accurately determine factors important for winning against the opposing team. We consider information obtained by this research very helpful in setting tactical ideas and strategies of the game, because tactics depends on quality, function and position of players within a team's rotation on the court.

Material and methods

Sample of examinees

For the needs of this research we analyzed 53 games played in 2010 FIVB Volleyball Men's World Championship in Italy. First group of entities was defines as "THREE" and this group includes winning and losing national teams which played in games finished in 3 sets. Within group "THREE", 29 games were analyzed. With regard to the fact that we have both a winning and a losing team in one game, group "THREE" was comprised of 58 entities. The other group of entities was defined as "FOUR" and that group included winning and losing national teams which played in games finished in four sets. Within this group, 24 games were analyzed and in accordance with that the group was comprised of 48 entities. It should be emphasized that of all games played in the world championship, tied games were not taken into

consideration as well as the games ended after 5 sets.

Sample of variables

Data on situational efficiency of national teams that took part in in 2010 FIVB Volleyball Men's World Championship in Italy, were taken from the official web site FIVB (Federation internationale de Volleyball, 2010). The site offers official statistics, which is recorded for all competitions organized by FIVB. For the needs of this research we used twelve variables evaluating situational efficiency of teams within the games: S – overall number of spikes; SF – spike faults; PWAS – point won after a spike; KB – point won after a block (kill block), BF – blocking fault; AS – ace (serve); SF – serving fault; SS – successful serve; D – dig ; DF – dig faults; ER – excellent reception; RF – reception fault.

Statistical analyses

Measuring can be performed in a way to produce results which can then be classified as discrete and continuous data. Data in our study belong to discrete variables, that is the variables that can only take on a finite number of values. In accordance with that, in our research we used positional central value *Median* as a measure of central tendency. Median is a value that is in the middle of the numerical order of results. *Median test* was used to determine differences between winning and losing

national teams. This is a very simple test, which is based on chi-squared test used to analyze whether two samples belong to population with the same median. The first step of the test includes finding common median for the combination of two samples which are compared. The next step is counting cases that are above and below common median in each sample, which produces fourfold contingency table. Data of observation are neither paired nor correlated, and N can be different in the two samples. However, it should be emphasized that equal values for N make the use of the test easier. In accordance with the fact that we talk about 2 x 2 contingency table, *Yates' correction* was also used (Petz, 1997).

Results

For determining differences in situational efficiency variables, *Median test* was used. Tables 1 and 2 show median test results between winning and losing national teams in games finished in three sets. On the basis of these results we can see that statistically significant difference was determined in six of twelve used variables for situational efficiency evaluation. As we can see, winning national teams have higher average of successful spikes, kill blocks, aces and successful serves. On the other hand, losing teams have higher number of spike faults as well as higher number of reception faults. Determined differences between winning and losing teams are on the significance level .01.

Table 1: Frequencies

		"THREE"	
		WINNING TEAMS	DEFEATED TEAMS
S	> Median	20	6
	<= Median	9	23
SF	> Median	5	23
	<= Median	24	6
PWAS	> Median	10	18
	<= Median	19	11
KB	> Median	22	4
	<= Median	7	25
BF	> Median	12	15
	<= Median	17	14
AS	> Median	18	5
	<= Median	11	24
SF	> Median	10	14
	<= Median	19	15
SS	> Median	24	5
	<= Median	5	24
D	> Median	14	15
	<= Median	15	14
DF	> Median	10	14
	<= Median	19	15
ER	> Median	10	17
	<= Median	19	12
RF	> Median	6	18
	<= Median	23	11

Table 2: Test Statistics

		S	SF	PWAS	KB	BF	AS	SF	SS	D	DF	ER	RF
N		58	58	58	58	58	58	58	58	58	58	58	58
Median		37.00	12.00	24.00	5.00	13.00	3.00	11.00	51.00	25.00	9.00	30.00	3.00
Chi-Square		13.663	22.371	4.419	22.587	.624	12.176	1.137	24.897	.069	1.137	3.395	10.235
df		1	1	1	1	1	1	1	1	1	1	1	1
Asymp. Sig.		.000	.000	.036	.000	.430	.000	.286	.000	.793	.286	.065	.001
Yates' Continuity Correction	Chi-Squa re	11.781	19.955	3.383	20.147	.277	10.375	.640	22.345	.000	.640	2.495	8.600
	df	1	1	1	1	1	1	1	1	1	1	1	1
	Asy mp. Sig.	.001	.000	.066	.000	.599	.001	.424	.000	1.000	.424	.114	.003

Tables 3 and 4 show results of median test between winning and losing national teams in games finished in four sets. Results in table 4 help us see that statistically significant differences in two variables were determined: **SF** – spike fault and **SS**–

successful serve. On the basis of table 3 results we can see that losing teams had more spike faults, and that winning teams have higher average of successful serves. Determined differences are on significance level .01.

Table 3: Frequencies

		"FOUR"	
		WINNING TEAMS	DEFEATED TEAMS
S	> Median	12	10
	<= Median	12	14
SF	> Median	6	18
	<= Median	18	6
PWAS	> Median	11	13
	<= Median	13	11
KB	> Median	14	7
	<= Median	10	17
BF	> Median	13	8
	<= Median	11	16
AS	> Median	11	10
	<= Median	13	14
SF	> Median	13	11
	<= Median	11	13
SS	> Median	17	5
	<= Median	7	19
D	> Median	11	12
	<= Median	13	12
DF	> Median	10	11
	<= Median	14	13
ER	> Median	9	13
	<= Median	15	11
RF	> Median	10	11
	<= Median	14	13

Table 4: Test Statistics

		S	SF	PWAS	KB	BF	AS	SF	SS	D	DF	ER	RF
N		48	48	48	48	48	48	48	48	48	48	48	48
Median		52.00	18.50	36.00	10.00	18.00	3.00	14.50	74.00	36.00	12.00	45.00	3.00
Chi-Square		.336	12.000	.333	4.148	2.116	.085	.333	12.084	.083	.085	1.343	.085
df		1	1	1	1	1	1	1	1	1	1	1	1
Asymp. Sig.		.562	.001	.564	.042	.146	.771	.564	.001	.773	.771	.247	.771
Yates' Continuity Correction	Chi-Square	.084	10.083	.083	3.048	1.354	.000	.083	10.154	.000	.000	.755	.000
	df	1	1	1	1	1	1	1	1	1	1	1	1
	Asymp. Sig.	.772	.001	.773	.081	.244	1.000	.773	.001	1.000	1.000	.385	1.000

Discussion

On the basis of the obtained results we see that in games finished in three sets winning

teams accomplished higher number of spikes, kill blocks, successful serves as well as higher number of aces. From the results in tables 1 and 2 it can be clearly seen that

winning national teams accomplished higher frequency in stated variables from median values in relation to losing national teams. Losing national teams had higher number of spike faults as well as higher number of receiving faults during a game, in relation to winning national teams. It should be emphasized that a quality spike largely depends on a good reception, which is confirmed by some previous researches (Nishijima et al., 1987). Good reception allows faster and more diverse attack against defense that is not well organized (Đurković et al., 2009). Having that in mind we can say that better and more accurate reception allows more diverse use of tactical variations which is directly connected with allowing favorable situation for spikers. Spiking is a successful finishing touch of offensive tactical plays, and it is influenced by big number of factors, technical as well as tactical (Janković and Marelić, 1995). Results of our study clearly point to the fact that a quality spike and a good reception are factors that lead to a win. In their research, *Marelić et al. (2004)* determined that serving and reception are variables which significantly distinguish between winning and losing sets in volleyball. Determined canonical correlation coefficient was $R=.58$, which is on significance level .01 ($p=0.00$). Moreover, *Eom and Schuttz (1992)* also determined that block and spike in the phase of attack and spike in the phase of counterattack are very important factors that contribute to success in volleyball. Results obtained within our study (table 1 and table 2) clearly indicate that winning national teams had higher number of successful serves and aces in relation to losing national teams. The results indicate that winning teams dominated in both complexes of the game. It is highly

probable that aggressive serve leads either to direct points or to easier counterattack for winning national teams. *Đurković et al. (2009)* determined in their research that variable serve has the highest projection on discriminative function (-.54) and the second is variable counterattack (-.33). Also, some researches determined higher average values in variable serve and block between winning and losing sets (*Marelić et al., 2004*). Determined average values in both variables are to the advantage of winning sets (winning sets- serve: mean 2,36, block : mean 2,84; losing sets – serve: mean 2,27, block: 2,58). By a good serve it is possible to slow down and predict opposing team's attack which makes a good block easier. Aggressive and predictive serve allows creating optimal conditions for effective stop of opposing team's attack, which eventually results in tactical coordination of the plays performed by players whose role is blocking. This is supported also by the results of our study that show higher number of points won after the block for winning teams. High number of points won after the block show that losing teams have weak reception and winning teams have effective serve, which is also confirmed by the results of our study. Previous researches indicate that number of kill blocks is a factor that strongly separates winning from losing teams, but also points to a high number of mistakes for low quality teams (*Hayrinen et al., 2004*). Therefore, authors determined that differences between winning and losing teams in variable kill block (winners 2,9 kill blocks per set, losers 2,0 kill blocks per set) are statistically significant, on the significance level .05. The obtained results indicate that variables in which differences were determined are very significant for the success in a game. Those are technical

abilities which should be focal point of their improvement throughout player development process in younger categories. Previous discussion is also confirmed by some previous researches in which significant differences in variable *positive serve* and *positive block* were determined (Davila-Romero et al., 2012). For 12-14-year-old players, differences are on the significance level $p = 0.001$ and they have average values *positive serve* (win) 5.41 and *positive block* (win) 1.15, while losing teams have average values *positive serve* (loss) 2.35 and *positive block* (loss) 0.78. Young players in the age category 14-16 have average values *positive serve* (win) 4.59 and *positive block* (win) 1.46 for winning teams, while losing teams have average values *positive serve* (loss) 2.01 and *positive block* (loss) 1.04. Based on the obtained results within our study (tables 3 and 4) we can see that statistically significant differences were determined although in lower number of variables evaluating situational efficiency. The results clearly indicate that after four completed sets winning teams had higher number of successful serves, while losing teams had higher number of spike faults. We can say that competitive demands within games played in four sets are slightly changed in relation to games played in three sets. We see that for winning a game, tactical serve and successful spike were determining factors. In their research, Zdražnik et al. (2009) determined that there is significant difference between winning and losing teams, and that variable *serve* with canonical correlation coefficient .69 is the most responsible for these differences in rotation 3. Also, analyses of the games played in 2008 Olympic Games in Beijing show that winning national teams are better in variables *serve points* (M (win)=5.11; M

(lost)=3.52), *excellent reception* (M (win)=51.79; M (lost) =47.48) *total serves* (M (win)=91.28; M (lost)=83.17) (Patsiaouras et al., 2011). In the same study, authors determined that losing teams have higher number of spikes which ended in opposing team's block (*attacks blocked* M (win)=7.48; M (lost)=11.31). Based on the obtained results we can assume that winning teams performed tactically optimal serve which allows the prediction of opposing team's attack. Such serve made reception much more difficult which eventually doesn't not result in a successful and accurate reception of a serve and also increases effectiveness of winning team's block.

Conclusion

2010FIVB VolleyballMen'sWorld Championship in Italy was one of the strongest competitions because only the best national teams took part in the championship. The results of our study indicate that within group "THREE" as well as within group "FOUR" there are statistically significant differences in certain parameters of situational efficiency between winning and losing teams. Determined differences are especially stressed in quantitative distribution of used technical elements. Winning teams within group "THREE" had higher number of accomplished spikes, kill blocks, aces and successful serves. Winning teams within group "FOUR" had higher number of successful serves in comparison to losing teams. On the basis of the obtained results we can detect which of situational efficiency parameters contribute to a win in games played in three or four sets. On the basis of presented results we can see that the structure of competitive demands changes

in relation to number of played sets within a game. In games played in three sets, differences in high number of used variables were determined in relation to games played in four sets where the difference was expressed in lower number of variables. The obtained information can be helpful in choosing strategic procedures as well as tactical ideas of a team. Winning national teams in group "THREE" have to be better in high number of technical elements which contributes to maximum efficiency, that is achieving win in three sets. In group "FOUR" winning teams are better only in number of successful serves in relation to losing teams. With regard to this we can say that in group "FOUR" differences in the quality of technical and tactical actions are much fewer between national teams than in group "THREE". On the basis of the obtained results we see that variable *number of successful serves* is the variable that distinguishes between winning and losing teams in both games played in three and games played in four sets. Tactical serve is a key factor in games played in four sets, which is especially interesting. Such serve is of extreme

importance for winning teams, because it allows predicting opposing team's attack which at the same time contributes to block effectiveness. Block effectiveness depends also on the quality of players setting a block which together with prediction of opposing team's attack causes higher number of spike faults for losing teams. Future researches should be aimed at determining differences in situational efficiency between winning and losing teams by sets and in accordance with number of sets played in a game. With regard to the fact that serve is a very important factor in determining winning and losing teams, future researches should include variables which analyze a type of serve used by winning and losing teams. In other words frequency of serve performed in each set should be determined, again in accordance with number of sets played in a game. By this way we can get more complete picture about dynamics of volleyball played at the highest competition level. This would contribute to a clearer strategy setting with the accent on the efficient use of technical and tactical actions that contribute to achieving a win.

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ANALIZA SITUACIONE EFIKASNOSTI POBJEDNIČKIH I PORAŽENIH EKIPA NA SVJETSKOM ODOJKAŠKOM PRVENSTVU 2010

Sažetak

Osnovni cilj ovog istraživanja jeste utvrđivanje razlika u situacionoj efikasnosti između pobjedničkih i poraženih ekipa. Za potrebe ovog istraživanja analizirane su 53 utakmice koje su odigrane na Svjetskom prvenstvu u odbojci 2010 godine u Italiji. Prva grupa entiteta definisana je kao grupa „TRI“ a unutar te grupe nalaze se pobjedničke i poražene reprezentacije gdje je konačan ishod utakmice ostvaren nakon tri odigrana seta. Unutar ove grupe analizirano je 29 utakmica. Druga grupa entiteta je definisana kao grupa „ČETIRI“ a unutar ove grupe se nalaze pobjedničke i poražene reprezentacije gdje konačan ishod utakmice ostvaren nakon četiri odigrana seta. Unutar grupe „ČETIRI“ analizirane su 24 utakmice. Za potrebe ovog istraživanja u obzir je uzeto dvanaest varijabli koje procjenjuju situacionu efikasnost ekipa unutar odigranih utakmica. Median test korišten je u svrhu utvrđivanja razlika u parametrima situacione efikasnosti između pobjedničkih i poraženih reprezentacija. Rezultati naše studije ukazuju da su unutar grupe „TRI“ kao i unutar grupe „ČETIRI“ utvrđene statistički značajne razlike u određenim parametrima situacione efikasnosti između pobjedničkih i poraženih ekipa. Na osnovu prezentiranih rezultata možemo vidjeti da se struktura takmičarskih zahtjeva mijenja u odnosu na broj odigranih setova unutar utakmice. U

utakmicama sa tri odigrana seta, utvrđene su razlike u većem broju primjenjenih varijabli u odnosu na utakmice sa četiri odigrana seta gdje je razlika izražena u manjem broju varijabli.

Ključne riječi: odbojka, efikasnost, razlika, median test

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RELATIONS BETWEEN PREDICTORY SYSTEM VARIABLES NECESSARY FOR THE ASSESSMENT OF NEURO-MUSCULAR CONDUCTIVITY AND CRITERIA OF ALTERNATING VARIABLES DURING A 30 SECOND TIME PERIOD IN RELATION TO ARM AND LEG KICKS

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Abstract

Main goal of this study was to find what effect does the neuromuscular conductivity has on the effectiveness of alternating leg and arm kicks during a 30 second period. The sample of respondents we used for this research where 30 of the best karate masters from Bosnia and Herzegovina, they earned their masters titles during an official European and world competitions. In this study we used the system of four predictor variables for the assessment of neuron – muscular conductivity and variable criteria of alternating arm and leg kicks during 30 seconds for the evaluation of the segmental speed frequency. Results of this research showed the existence of significant statistical relation between the system of predictor variables for the assessment of neuron-muscular conductivity and criterion variables of alternating leg and arm kicks during a 30 second period. We can conclude that neuromuscular conductivity has an enormous effect on the frequency of alternating leg and arm kicks during a 30 second period. By determining the quality of neuron-muscular conductivity we can effectively select the future karate masters.

Keywords: *neuromuscular conductivity, karate, arm and leg reaction to a audio and visual signals, reaction-meter*

Introduction

Striving for a higher achievement and better results caused a great change in many sports including karate. During the previous

researches the main question was “How fast can individuals arms and legs react to a visual and tactile stimulations?”. In a book “ Skill and information “(Leg,G. i Barker,

P. 1976), it is confirmed-proven that a small occurrence of the correlation between the visual and proprioceptive information is adequate for the interior change which is able to adjust the types of a given information. Jovanović S. (1988) used a sample of 107 karate martial artists (46 karate masters, 61 karate artists with a green, blue and brown belt) by using the 6 criterion variables of specific abilities he confirmed a presence of significant differences in specific speed abilities which are used for a solution of tasks during a sports match. On the basis of the obtained results significant effect of motoric abilities of karate martial artists was found in a set of experimental tasks. One of the main karate segments is the neuro-muscular conductivity. It is directly connected with a reaction speed as an important parameter for the assessment of the prediction for a high level quality of karate performance. Fox Le, Bowers, R, Foss ML. (1989). Jovanović S. and Milošević M. (1992) found the difference between the real time and theoretical time of performing a specific technique. This time difference was shown as a reserve time, which was different during the performance of different fight tasks.

Milosevic and others (1993) analysed the time parameters of basic karate techniques in accordance to the specific tasks by using a sample of 121 karate masters aged between 19-30 with a goal of getting a theoretical model of time structure during a real fight performance.

Attack time of zuki, kizami zuki i gyaku zuki, mawashii ger (right, left leg) and gyaku zuki was tested in the laboratory and real fight conditions. In the laboratory they measured the reaction time of simple and complex movements in accordance to light

signals, by using classical techniques of pure kicking and movement by using a cinematographic method.

For the real time conditions computer simulator was used, the computer simulator provided adequate cumulative by analysing the usage of different techniques. Difference between the theoretical and real time attack was confirmed. Speed of neuromuscular conductivity can be divided into 2 segments: reaction time and movement time. Reaction time is defined as a interval between the stimulus time and response time (how fast is the reaction time in direct correspondence to a stimulus). Measurements are easily defined by using reaction-meter which stimulus is represented by visual or audio signals. Movement is defined as the interval between the start and the end of a movement. Sparrow WA, (1994).

Čupina S.(2003) conducted a research on a sample of 73 karate masters aged 18 and up, he confirmed that predictive values of anthropometric measurements and motor capabilities are a part of direct structure function of specific karate techniques. The results which the authors, Čoh, M, Dolenc. A (2006), obtained on the basis of electromyographical measures give us important information about the muscle activation time, which are causing the kinetic chain effect, neuromuscular stimulation and intramuscular coordination. They also concluded that one of the most important muscles in athletics, more precisely in a sprinter step-stride, is musculus biceps femoris. Linder, B. (2010) researched the speed of neuromuscular conductivity during practical conditions. He concluded that situational tactical tasks during the real fight are more complex with the system elements which are needed for processing,

perception and forecasting of reactions and decision making.

Top karate masters must meet a large number of general and specific conditions in order to successfully overcome the intensity of the training process. Constant changes of stances, kicks, blocks and positions during different dynamic and quite often surprising conditions, demands a very precise function of the central nervous system. Karate is characterized as a sport of variety and technical elements (reaction speed, opponent movement prediction, precise decision making, situational response etc). All of this requires basic and specific motor readiness and psychological readiness so that all the technically complex karate tasks could be performed without any mistakes.

Problem of this research was to determine the effect of neuromuscular conductivity and its effect on the segmental speed of upper and lower extremities.

Methodes

Respondent sample:

Respondent sample in this research is represented by 30 top karate masters from Bosnia and Herzegovina, ages 18 to 26, all of the 30 karate masters received bronze and silver medals, (medals from official European and World competitions), individually and as members of teams

Sample variables for neuromuscular conductivity

In this study we used the system of four predictor variables for the assessment of neuron – muscular conductivity and variable criteria of alternating arm and leg

kicks during 30 seconds for the evaluation of the segmental speed frequency.

Predictor variables

1. Audio signal arm reaction (AUDREAK)
2. Visual signal arm reaction (VIZREAK)
3. Specific arm reaction to the Visual signal (VIZSPREAK)
4. REUŠ-test (REUŠ).

Criterion variable

Speed frequency of alternating kicks performed by lower and upper extremities for 30 seconds – mae-geri (OKRLP30).

Program and steps of neuromuscular conductivity measurement

Research was done as follows

Measuring conditions

All the karate masters were tested in the gym with adequate lighting and strict silence which is necessary for the performance of neuromuscular conductivity tests – audio stimulus test.

Instruments

1. Reaction meter with three stimulus levels, with a possibility of getting three decimal values (EI Niš)
2. Rueš color table with enough of recognition contrast
3. Stopwatch
4. Desk
5. Chair
6. Chock
7. Graphite pencil

8. Measurement sheet

Test measurement technique for the assessment of neuromuscular conductivity.

AUDREAK -Arm reaction speed to an audio stimulus measured by the reaction meter, 10 arm reactions where performed on a given audio signal, middle value is taken. To get the exact results the system takes out the highest and lowest score. Time is measured in milliseconds with a possibility of mistake registration. The equipment needed for the performance of this test is the reaction meter made by El Niš, chair, school desk and the measurement sheet.

VIZREAK – arm reaction speed to an visual stimulous for the assesment of neuro muscular conductivity is also done by reaction meter, 10 arm reactions were performed with enough of rest time between the each reaction. Time is measured in milliseconds with a possibility of mistake registration. The equipment needed for the performance of this test is the reaction meter made by El Niš, chair, school desk and the measurement sheet.

VIZSPREAK – Specific arm reaction to a visual stimulus aplayed through 4 operation tasks in one test. Yelow was a stimulous for a reaction of both arms. In accordance to the colors which apeared the teste reacted adequatly to the color with, one or both arms accordingly as fast as posible wihout making a mistake. Reactiometer which was used for the performance of this test was able to record mistakes made, based on 10 repetitions. At the end of each test average of all the results was taken. The equipment needed for the performance of this test is the

reaction meter made by El Niš, chair, school desk and the measurement sheet.

All three tests of neuromuscular conductivity where done in one transversal measurement by two measurers, one read the results and the other wrote them down.

RUEŠ TEST

Test is represented bay 5 different color squares drawn on a piece of paper (blue, red, green, black, yellow) which are randomly placed in 5 rows , 10 squares in each row. Main tasks for the testes are to read out as fast as possible all the colors in 5 rows without a mistake. This test measures the degree of attention and concentration, short visualization and speed oscillation. Tester needs to pay attention is the taste making a large number of mistakes and is he focusing on the colors. Tolerated time for the people without any speech impairments and high level of concentrations is $T \leq 40$ seconds.

(OKRPL 30) Speed frequency of alternating kicks performed bay lower and upper extremities for 30 seconds – mae-geri .

Duration:

Total assessment of test time per subject- karate master was 1,5 minutes

Number of testers: 1 tester and1 helper

Test place description

Test can be conducted indoors or outdoors on mats of minimal dimensions 2,5 x 2,5 m

Necessary equipment:

Loud alarm stopwatch, Measurement sheet , karate focuser (self standing)

Task :

Speed frequency of alternating kicks by connecting leg and arm strokes – kicks, task lasted 30 seconds. One repetition combines both strokes-kicks (arm-leg) and each one is registered in a given time period.

Grading - Calculating:

Two measurers are assigned to this test-task, one keeps the time and the other one calculates the number of correctly performed strokes-kicks and writes them down on the measurement sheet.

Statistical analysis

Data processing for this research was conducted at the Faculty of Physical Education and Sports in Tuzla, analysis was preformed by statistical program package SPSS 12,0 and STATISTICA 5,0. Regression analysis is used to determine the system relation of predictor variables for the assessment of neuromuscular conductivity and the criterion variables of alternating kicks performed bay lower and upper extremities for 30 seconds – mae-geri.

Discussion and Results

Constant changes of stances, kicks, blocks and positions during different dynamic and quite often surprising conditions, demands a very precise function of the central

nervous system. Karate is characterized as a sport of variety and technical elements (reaction speed, opponent movement prediction, precise decision making, situational response etc). We researched the effect of neuromuscular conductivity's efficiency of upper and lower extremity kicks – strokes during 30 seconds and we got the following results:

In the table 1 it can be seen that the predictor variable systems for the assessment of neuron-muscular conductivity and the criterion variable of alternating leg and arm kicks during 30 seconds (OKRLP 30) are statistically in a significant relation (Sig.= .029), that is that coefficient of multiple correlation is $R = .584$, which explains the common variability of 34%(R Square = .341), and the rest of 66% in the explanation of the total criterion variability for the segmental frequency of alternating leg and arm kicks during a 30 second period (OKRLP 30), can be attributed to other anthropological characteristics (other anthropometric variables, motor, conactive, etc).

Based on the effect analysis of some predictor variables for the assessment of neuron-muscular conductivity (Table 3), it can be concluded that no single variable for the assessment of neuron-muscular conductivity has statistically significant effect on the criterion variable , of alternating leg and arm kicks during a 30 second period (OKRLP 30). Closest to the statistically significant size of the partial effect is the variable; specific arm reaction to a visual sign (VIZSPREAK) at the level Sig.= .065.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	,584 ^a	,341	,235	3,92833	,341	3,233	4	25	,029

a. Predictors: (Constant), RUES, VIZREAK, VIZSPREAK, AUDREAK

Table 2

ANOVA^b

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	199,573	4	49,893	3,233	,029 ^a
	Residual	385,794	25	15,432		
	Total	585,367	29			

a. Predictors: (Constant), RUES, VIZREAK, VIZSPREAK, AUDREAK

b. Dependent Variable: OKRLP30

Table 3

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		
		B	Std. Error	Beta			Zero-order	Partial	Part
1	(Constant)	-12,137	12,338		-,984	,335			
	AUDREAK	,027	,025	,238	1,091	,286	,441	,213	,177
	VIZREAK	,022	,026	,188	,867	,394	,449	,171	,141
	VIZSPREAK	,057	,029	,358	1,928	,065	,392	,360	,313
	RUES	,002	,002	,144	,781	,442	,079	,154	,127

a. Dependent Variable: OKRLP30

Conclusion

From the results we obtained by using regression analysis, we can conclude that neuromuscular conductivity which is defined by predictor variables in this case for the assessment of arm audio reaction (AUDREAK), visual reaction (VIZREAK), specific visual sign reaction (VIZSPREAK) and by using the RUEŠ test, greatly effects the frequency of performing alternating arm and leg kicks during 30 seconds which is proven by using a criterion variable of alternating leg and arm kicks during 30 seconds (OKRLP 30).

Statistically significant relations are confirmed by a degree of importance a level (Sig.= .029).

Research confirmed that the coefficient of multiple correlation $R=.584$, which explains the common variability at 34% (R Square = .341), and the rest of 66% , in the explanation of the total variability of the criterion variable for evaluating segmental speed frequency of alternating arm and leg kicks during a 30 second period (OKRLP 30, can be assigned to other anthropological characteristics (other anthropometric variables, motoric and conational).

These results lead us to a conclusion that large percentage of total explained variability in the overall system of reaction speed to an outside stimulus, which can be divided into three stages:

1 Sensor stage which starts with the effect of a signal and lasts until the first sign of muscle activity.

2 Pre-motor stage, which is related occurrence of biopotential start of a muscle movement.

3 Motor stage which is determined by a period from the start until the end of a movement. (Mikić, 2000).

In the end we can conclude that speed of neuromuscular conductivity greatly depends upon the orientation towards the direction of testiest attention just before the expected move.

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RELACIJE IZMEĐU SISTEMA PREDIKTORSKIH VARIJABLI ZA PROCJENU NEUOROMIŠIČNE PROVODLJIVOSTI I KRITERIJSKE VARIJABLE NAIZMJENIČNI UDARAC GORNJIH I DONJIH EKSTREMITETA

Sažetak

Cilj ovog rada bio je utvrditi uticaj neuro-mišićne provodljivosti na efikasnost izvođenja naizmjeničnih udarca noge i ruke u trajanju od 30 sekundi. Uzorak ispitanika u ovom istraživanju bilo je 30 vrhunskih karatista Bosne i Hercegovine koji su to zaslužili osvajanjem bronzanih i srebrnih medalja kako ekipno tako i pojedinačno na zvaničnim evrposkim i svjetskim takmičenjima. U ovom istraživanju korišten je sistem od četiri prediktorske varijable za procjenu neuro-mišićne provodljivosti i kriterijske varijable naizmjenični udarac noge i ruke u trajanju od 30 sekundi za evaulaciju segmentalne brzine-učestalosti. Rezultati ovog istraživanja su pokazali da postoje značajne statističke relacije između sistema prediktorskih varijabli za evaulaciju neurmuskulatorne provodljivosti i kriterijske varijable naizmjenični udarac noge i ruke u trajanju od 30 sekundi. Možemo zaključiti da neuro-mišićna provodljivost u velikoj mjeri utječe na frekvenciju izvođenja naizmjeničnih udaraca nogama i rukama u trajanju od 30 sekundi. Utvrđivanjem nivoa kvalitete neuro-mišićne provodljivosti možemo selekcionirati buduće vrhunske karatiste.

Ključne riječi: neuro-mišićna provodljivost, karate, reakcija ruku i nogu na audio i vizuelni signal, rekciometar, audioreakcija ruku.

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ASSESSMENT OF PROFESSIONAL WORK IN SPORTS FACILITIES BASED ON THE OPINIONS AND VIEWPOINTS OF SERVICE USERS

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Abstract

Sports and recreation have become the fields of interest for many people who have a wish to use their free time the right way, or in other words to have active lifestyle which has become more and more popular. Sports facilities as infrastructure resources should offer the largest number of options and possibilities for engagement in “various sports products and physical activities”, and in relation to its specific qualities just like any other activity, they make efforts in trying to offer appropriate service for people. Therefore, sports services in the business-range of sports facilities should be available for the general population, because they meet various needs and have various influences on potential users. Previous experiences showed that consumers use very similar criteria in assessing the quality of services. This can definitely be related also to the assessment of sports services, where one assesses their: reliability, sensitivity, competence, availability, communicativeness, safety, understanding and reference to consumers. A special place in this system of assessment belongs to the question of users' satisfaction with the quality of professional work in sports facilities. Empirical research, conducted on the sample of 242 examinees was aimed at evaluating certain aspects of professional work, drawn on the basis of viewpoints and opinions of people with a different user status, as well as of employees from JP SPC (Sports and Business Center) “Vojvodina”, from Novi Sad. The aim of this research was to find basic factors determining the level of sports services in SPC “Vojvodina” based on the viewpoints and opinions of users as well as employees about professional work in the facility.

Key words: *assessment, sports facilities, professional work, users.*

Introduction

Modern life, which is marked by scientific and technological progress, significantly influences changes in work habits and life habits of people. Hypokinesia of inadequate

and excessive nutrition which has become more and more present, big neuro-emotional tension and ecological pollution are serious Threats to biological, health and

sociopsychological balance of people. On the other hand, people in these modern life conditions meet new needs and wishes almost on a regular basis, where the needs for movement and physical activity are becoming some of the focal points. It can be said that for people sports (in the widest sense of the word) has become a new “old” need. Just like any other activity, sports also should offer certain service to people. Kotler (1991:455) defined service in its general context. His viewpoint starts with the belief that service can be defined as any action or benefit, which one side can offer to another and which is in essence impalpable and has no connection with any type of appropriation.

On the basis of these viewpoints and having in mind the characteristics and significance of sports as a public activity, it can be considered that sports service covers certain activities where service provider (on one side) directs its offer to beneficiaries (on the other side), in terms of physical exercises, sports training, active rest, fun or psychophysical satisfaction. In this sense we can talk about sports service in the narrowest sense (so called pure sports service). On the other hand, when certain characteristics of sports are treated as a part of public service activities, then we can talk about sports services in wider sense of the word (or in terminological meaning “service in sports”). They include totality of various benefits, goods and services aimed at meeting sports and recreational needs of people (as users), which are available during the use of the service for a certain time and at one place (Nešić, 2008). But, regardless of the theoretical approach in defining this notion, a common thing is condition for sports service existence, and that is publicly expressed need for the service and its effect.

Various needs of people in the area of sports, recreation and healthy lifestyle in general (active lifestyle) put chances of existence and realization of its program in focus. Local communities, with its spatial and infrastructural resources (as the places where people have rights to satisfy various needs) represent relevant places for both realization of needs in the field of sports and in the field of physical exercise (Nešić i Fratrić, 2013).

Generally speaking, various sports services should be available to all social classes, because they meet various needs and have multiple influence on potential users (Nešić, 2008). Because of this one can say that they should be marked by a phrase – “at arm’s length” because they should be within the reach for all people who are interested. However, one must not forget that modern changes in the way people live and work, changes in the speed of communication and increasing number of various information that we get from various media on a daily basis, can replace sports or sports-recreational services as the focal point. In other words although there is a need for huge number of people to use sport services, it can still stay unaccomplished (Nešić i Popmihajlov-Zeremski, 2011).

Without and doubt, it is difficult to perform overall identification and classification of all sports and sports-recreational services, because users always have new demands and there are also new models of training activities which are in constant improvement. However, previous practice in the area of sports and sports-recreational services showed that the biggest number of service activities can be classified in four basic categories: 1) service in user’s place of residence; b) service outside user’s place

of residence; 3) current and new service; and 4) other (additional) services related to sports and recreation of citizens. In this regard we can talk about the significance of the first category of services and their relationship with direct users. In other words, users of recreational activities can be considered (and accepted) as active and relevant factors of their assessment.

Starting point of research

Inalienable right of all people is the right for active physical exercise. Physical exercise has a big influence on health, education, upbringing, and overall human development, and eventually it also has an influence on the happiness and welfare of people. Due to this fact it is necessary that communities ensure appropriate conditions for all people and by that way create possibilities for the realization of these rights. The realization of these rights, which can often be considered as personal goals, helps the realization of certain overall goals in the area of sports activity (physical culture). This confirms the belief that this field of life knows no public goals that would be above or outside the interest of each individual. In this context, Constitution of the Republic of Serbia recognizes and defines sports as the category of a great social importance. It is largely funded from the budget of the Republic of Serbia. Modern way of planning sports facilities gives advantage to those facilities which have polyvalent purpose and which would be of use for all age groups in accordance with their need, with good organization and schedule. When we talk about Novi Sad as administrative, commercial, sports and cultural center of Vojvodina, while also having in mind the tradition and structure of its population and the existing awareness that physical

exercise and recreation are very useful, it can be concluded that there are high demands (need) for the facilities of this purpose. One of the biggest and most recognizable facilities in Vojvodina is under control of Public Company Sports and Business Center "Vojvodina" in Novi Sad. It was built for the Table Tennis World Championship, held in 1981, and in the following years it has been expanded and its activity has been much improved. Sports services were primary activities offered by this company. Today it is a facility which aims at meeting the widest range of people's needs (sports, catering, business, tourist, commercial, artisanal and other).

With regard to the fact that most of our sports centers are owned by the country, political leadership has a direct influence on the choice of management responsible for the quality and ways of how these centers operate. Management chosen this way, very often shows very low level of competence in practice. It is also obvious, in essence, that country does not show enough interest in efficient local function of sports centers. Therefore, the assessment of their work and functioning is just a formality, where business results are evaluated one-sidedly by the management. In other words, service provider very often is the only one that evaluates its own work, which causes indicators to be very insufficient and later become an incomplete basis for new planning cycles (Nešić i Popmihajlov-Zeremski, 2011).

For this reason, the research we conducted was aimed at pointing to the need and significance of external and internal assessment of the sports service qualities based on the opinions and viewpoints regarding professional work in a sports facility, given by direct users and also by

employees. Public Company Sports and Business Center “Vojvodina“ in Novi Sad was chosen as a model of this research, with regard to the fact that it is representative sports facility of a complex type.

Method

Within the research study (Popmihajlov-Zeremski, 2010) that included Public Company Sports and Business Center “Vojvodina“ in Novi Sad, empirical non-experimental research (Surva) was also conducted with the aim of detecting viewpoints and opinions of examinees about the importance of professional work as the factor of quality for certain aspects of sports services offered by Public Company Sports and Business Center “Vojvodina, Novi Sad.

Sample of entity for this research included 242 examinees of different social and biological characteristics, who used some type of sports services provided by Public Company Sports and Business Center “Vojvodina“ but in different roles and with different reasons. Variables observing examinees within the research area were directed Through the following aspects: user status, sex, age and qualifications.

As a basic measurement instrument we used a questionnaire especially prepared for this research. It was designed for all categories of examinees and it consisted of Three parts. The first part of the questionnaire consisted of questions regarding personal information of examinees (sex, age, education and qualifications). The second and the third part of the questionnaire consisted of questions regarding the subject of the research. Questions were constructed in such a way that examinee had multiple choices and options to choose his answers from (closed type). Statements, included in

the third part were constructed by Libert scale model.

During statistical data processing we used methods of descriptive and comparative statistics. From the field of comparative statistics discriminative procedures were dominantly used, especially contingency analysis X^2 - test (since variable sorted as nominal scales dominated among empirical procedures). By using cross tabulation, data obtained Through this research were sorted and shown in a table of dimensional contingency. For comparing variables done minimally as ordinal scales, we also used parametric discriminative procedures (T-test and variance analysis)

Results and discussion

The quality of professional work in Public Company Sports and Business Center “Vojvodina“, Novi Sad was evaluated using Three explicit statements on which examinees gave their opinions and viewpoints by choosing one of five scalar values on Likert (summated) scale. The first statement (indicator) was about the importance of the fact that programs should be performed by a qualified person, and it was set in negative connotation (“For me, it is not important whether the person who organizes and performs exercises is qualified.“), while the other two were defined as positive statements, and were about personal feeling of safety when the practice is managed by a qualified person (“I feel safe when the person organizing and controlling exercises is qualified for the job.“) and about the feeling of satisfaction when the program is performed by an educated person (“The best option for me are coaches – educators who finished collegiate school or faculty of sports“).

All users of sports services provided by Public Company Sports and Business Center “Vojvodina“, Novi Sad, no matter if they are employed, athletes, recreationists

or visitors, highly appreciate the importance of qualified people in the process of performing sports and/or sports-recreational programs (Table 1).

Table 1- Distribution of the answers by examinees of a different user status

Indicator	Category	I totally disagree	I disagree	I'm indecisive	I agree	I totally agree
For me, it is not important whether the person who organizes and performs exercises is qualified. $\chi^2 = 33,273$ *Sig. = ,001	Employees	20 44,4%	20 44,4%	2 4,4%	3 6,7%	0 0
	Athletes	34 39,5%	21 24,4%	11 12,8%	11 12,8%	9 10,5%
	Recreationists	15 26,3%	35 61,4%	1 1,8%	3 5,3%	3 5,3%
	Visitors	20 37,0%	23 42,6%	5 9,3%	6 11,1%	0 0
	Σ	89 36,8%	99 40,9%	19 7,9%	23 9,5%	12 5,0%
I feel safe when the person organizing and controlling exercises is qualified for the job. $\chi^2 = 26,209$ *Sig. = ,010	Employees	0 0	0 0	0 0	23 51,1%	22 48,9%
	Athletes	1 1,2%	2 2,3%	6 7,0%	24 27,9%	53 61,6%
	Recreationists	0 0	1 1,8%	0 0	34 59,6%	22 38,6%
	Visitors	0 0	0 0	5 9,3%	27 50,0%	22 40,7%
	Σ	1	3	11	108	119

		0,4%	1,2%	4,5%	44,6%	49,2%
The best option for me are coaches – educators who finished collegiate school or faculty of sports. $\chi^2 = 12,611$ Sig. = ,398	Employees	1 2,2%	3 6,7%	6 13,3%	20 44,4%	15 33,3%
	Athletes	2 2,3%	4 4,7%	15 17,4%	30 34,9%	35 40,7%
	Recreationists	1 1,8%	1 1,8%	2 3,5%	31 54,4%	22 38,6%
	Visitors	0 0	2 3,7%	8 14,8%	27 50,0%	17 31,5%
	Σ	4 1,7%	10 4,1%	31 12,8%	108 44,6%	89 36,8%

Statistically significant differences in the distribution of the answers given by employees, athletes and recreationists were determined for the first two statements (“For me, it is not important whether the person who organizes and performs exercises is qualified.” and “I feel safe when the person organizing and controlling exercises is qualified for the job.”). In both cases we noticed much bigger number of answer frequencies on the positive side of the scale, but some examinees gave more answers “I totally agree“, while some were more moderate (“I agree“). Their empirical order was very irregular, so that is why it was difficult to notice some systematic regularity. Due to this, significant

differences treated as a consequence of sample fluctuation, were determined.

Very positive assessment of certain professional work aspects, expressed by examinees of a different user status, together with the absence of systematic (statistically significant) differences between them, definitely confirmed that results were variance analysis (Table 4). Calculated F-value was very low, and accomplished significance level was very much above the upper theoretical limit (Sig. >.05).

Table2 – Average scalar values which examinees of a different **user status** used to express their opinion about the importance of qualified program leadership

Examinees	Sv.	St. Dev.	S.Gsd.	Minimum	Maximum
Employees	4,2519	,57364	,08551	2,67	5,00
Athletes	4,0775	,75956	,08191	2,00	5,00
Recreationists	4,1988	,57687	,07641	1,67	5,00
Visitor	4,1543	,61331	,08346	2,67	5,00
Σ	4,1556	,65418	,04205	1,67	5,00

$$F = ,814 \quad Sig. = ,487$$

When it comes to sex status, examinees gave very high assessment of the significance to have qualified experts in the process of sports and sports-recreational program management (Table 3). Statistically significant differences in the distribution of answers given by male and female examinees were determined only for

the second statement (“I feel safe when the person organizing and controlling exercises is qualified for the job.”), but it was largely influenced by somewhat more positive opinions and viewpoints of female examinees. In both cases, much more frequencies of the answers that belong to positive side of the scale were registered.

Table 3 - Distribution of opinions by examinees of a different sex

Indicator	Sex	I totally disagree	I don't agree	I'm indecisive	I agree	I totally agree
For me, it is not important whether the person who organizes and performs exercises is qualified. $\chi^2 = 5,919 Sig. = ,205$	Male	43 35,5%	54 44,6%	6 5,0%	14 11,6%	4 3,3%
	Female	46 38,0%	45 37,2%	13 10,7%	9 7,4%	8 6,6%
	Σ	89 36,8%	99 40,9%	19 7,9%	23 9,5%	12 5,0%
I feel safe when the person organizing and controlling exercises is qualified for the job. $\chi^2 = 10,125* Sig. = ,038$	Male	0 0	3 2,5%	5 4,1%	63 52,1%	50 41,3%
	Female	1 0,8%	0 0	6 5,0%	45 37,2%	69 57,0%
	Σ	1 0,4%	3 1,2%	11 4,5%	108 44,6%	119 49,2%

The best option for me are coaches – educators who finished collegiate school or faculty of sports. $\chi^2 = 3,187$ $Sig. = ,527$	Male	2 1,7%	6 5,0%	12 9,9%	59 48,8%	42 34,7%
	Female	2 1,7%	4 3,3%	19 15,7%	49 40,5%	47 38,8%
	Σ	4 1,7%	10 4,1%	31 12,8%	108 44,6%	89 36,8%

Results of T-test for independent samples also confirmed very positive assessment of certain aspects of scientific work, expressed by examinees of a different sex. Calculated

t-value was extremely low, and accomplished level of significance was very much above the upper theoretical limit ($Sig. > .05$).

Table 4 Average scalar values which examinees of a different **sex status** used to express their opinion about the importance of qualified program leadership

Sex	Sv.	St.Dev.	S. Gsd.	Minimum	Maximum
Male	4,1322	,66872	,06079	1,67	5,00
Female	4,1791	,64124	,05829	2,00	5,00
Σ	4,1556	,65418	,04205	1,67	5,00

$t = -,556$ $Sig. = ,579$

Just like in previous analyses, the age aspect showed that examinees of all age groups have very high assessment of qualified people and their role in the process of sports and sports-recreational program

management. In other words, they highly assess the quality of services in a sports facility if qualified experts from their field of work are hired to organize professional work with service users (Table 5).

Table5 - Distribution of opinions by examinees of a **different age group**

Indicator	Age	I totally disagree	I don't agree	I'm indecisive	I agree	I totally agree
<p>For me, it is not important whether the person who organizes and performs exercises is qualified.</p> <p>$\chi^2 = 42,647$ *Sig. = ,000</p>	10-15	3 21,4%	0 0	5 35,7%	3 21,4%	3 21,4%
	16-25	30 34,9%	34 39,5%	9 10,5%	7 8,1%	6 7,0%
	26-40	28 38,9%	33 45,8%	1 1,4%	8 11,1%	2 2,8%
	41-65	25 37,9%	31 47,0%	4 6,1%	5 7,6%	1 1,5%
	Over 65	3 75,0%	1 25,0%	0 0	0 0	0 0
	Σ	89 36,8%	99 40,9%	19 7,9%	23 9,5%	12 5,0%
<p>I feel safe when the person organizing and controlling exercises is qualified for the job.</p> <p>$\chi^2 = 21,673$ Sig. = ,154</p>	10-15	0 0	0 0	2 14,3%	6 42,9%	6 42,9%
	16-25	1 1,2%	2 2,3%	4 4,7%	25 29,1%	54 62,8%
	26-40	0 0	1 1,4%	4 5,6%	38 52,8%	29 40,3%
	41-65	0 0	0 0	1 1,5%	36 54,5%	29 43,9%
	Over 65	0 0	0 0	0 0	3 75,0%	1 25,0%
	Σ	1 0,4%	3 1,2%	11 4,5%	108 44,6%	119 49,2%
<p>The best option for me are coaches – educators who finished collegiate school or faculty of sports.</p>	10-15	1 7,1%	2 14,3%	2 14,3%	5 35,7%	4 28,6%
	16-25	2 2,3%	2 2,3%	11 12,8%	33 38,4%	38 44,2%

$\chi^2 = 14,051$ Sig. = ,595	26-40	0 0	2 2,8%	8 11,1%	37 51,4%	25 34,7%
	41-65	1 1,5%	4 6,1%	9 13,6%	31 47,0%	21 31,8%
	Over 65	0 0	0 0	1 25,0%	2 50,0%	1 25,0%
	Σ	4 1,7%	10 4,1%	31 12,8%	108 44,6%	89 36,8%

Statistically significant differences in the distribution of the answers by examinees of a different age group were determined only for the first statement (“For me, it is not important whether the person who organizes and performs exercises is qualified”), which came as a consequence of slightly more extreme beliefs of the youngest and the oldest age group. Examinees from the youngest age group (10-15 years old) showed certain aloofness towards the importance of qualified people for the program, while examinees from the oldest age group (over 65 years old) gave strong support to the importance of qualification. Moreover, in the youngest age group we registered frequency higher than 20% for the answers “I agree” and “I completely agree”, while the oldest examinees gave no such answers.

These differences in the intensity of expressing viewpoints towards the statement that it is important to have a qualified person organizing and controlling exercise, caused low value of accomplished significance level ($Sig. < .05$) during the application of variance analysis (Table 6). Therefore, basic source of variability

between calculated scalar averages were systematic deviations of intensity (and degree) of viewpoints by examinees from the youngest and the oldest age group. More precisely, Post-hoc analysis showed that the only source of variability was in fact insufficient respect for qualification shown by the youngest examinees. This can also be explained by the fact that younger population has not yet gained enough experience, neither life nor education experience, so they view their involvement in exercises just as the source of fun and game. On the other hand, examinees with enough life experience can very clearly observe and assess the importance of qualification and competence of people organizing and controlling physical activity and exercises.

Table 6 - Average scalar values which examinees of *adifferentage* used to express their opinion about the importance of qualified program leadership

Age	Sv.	St. Dev.	S. Gsd.	Minimum	Maximum
Od 10-15	3,5714	,70926	,18956	2,00	5,00
16-25	4,1899	,65587	,07072	2,00	5,00
26-40	4,1898	,66860	,07880	1,67	5,00
41-65	4,1869	,58800	,07238	2,67	5,00
Over 65	4,3333	,47140	,23570	4,00	5,00
Σ	4,1556	,65418	,04205	1,67	5,00

$$F = 3,117^* \quad Sig. = ,016$$

The influence of examinees' education level showed similar tendencies just like the results of the previous analysis. Examinees of all qualification levels gave very high

assessment of the role and importance of having qualified people involved in the process of sports and sports-recreational programs in a sports facility (Table 7).

Table7 - Distribution of opinions by examinees of *adifferent qualification*

Indicator	Qualification	I totally disagree	I don't agree	I'm indecisive	I agree	I completely agree
For me, it is not important whether the person who organizes and performs exercises is qualified. $\chi^2 = 54,608^* Sig. = ,000$	Elementary	4 25,0%	0 0	5 31,3%	3 18,8%	4 25,0%
	Secondary school	29 34,9%	29 34,9%	8 9,6%	11 13,3%	6 7,2%
	Collegiate school	14 34,1%	22 53,7%	2 4,9%	3 7,3%	0 0
	Faculty	40 41,2%	47 48,5%	4 4,1%	4 4,1%	2 2,1%
	Dr/M.A./Spec.	2 40,0%	1 20,0%	0 0	2 40,0%	0 0
	Σ	89	99	19	23	12

		36,8%	40,9%	7,9%	9,5%	5,0%
I feel safe when the person organizing and controlling exercises is qualified for the job. $\chi^2 = 15,126$ Sig. = ,515	Elementary	0 0	1 6,3%	1 6,3%	5 31,3%	9 56,3%
	Secondary school	1 1,2%	1 1,2%	6 7,2%	33 39,8%	42 50,6%
	Collegiate school	0 0	0 0	2 4,9%	25 61,0%	14 34,1%
	Faculty	0 0	1 1,0%	2 2,1%	42 43,3%	52 53,6%
	Dr/M.A./Spec.	0 0	0 0	0 0	3 60,0%	2 40,0%
	Σ	1 0,4%	3 1,2%	11 4,5%	108 44,6%	119 49,2%
The best option for me are coaches – educators who finished collegiate school or faculty of sports. $\chi^2 = 44,00$ Sig. = ,000	Elementary	1 6,3%	3 18,8%	1 6,3%	5 31,3%	6 37,5%
	Secondary school	1 1,2%	4 4,8%	18 21,7%	31 37,3%	29 34,9%
	Collegiate school	0 0	0 0	6 14,6%	23 56,1%	12 29,3%
	Faculty	1 1,0%	2 2,1%	6 6,2%	46 47,4%	42 43,3%
	Dr/M.A./Spec.	1 20,0%	1 20,0%	0 0	3 60,0%	0 0
	Σ	4 1,7%	10 4,1%	31 12,8%	108 44,6%	89 36,8%

Statistically significant differences in the distribution of answers given by examinees of a different qualification were determined for two indicators (“For me, it is not

important whether the person who organizes and performs exercises is qualified” and “I feel safe when the person organizing and controlling exercises is

qualified for the job“). These differences can be explained as a consequence of somewhat more extreme beliefs by the groups with the highest and lowest qualification. While examinees with the lowest education level expressed slightly moderate viewpoint towards the importance of having qualified people in the program, people with the highest level of education gave stronger support than others to the importance of people with sports qualification to be involved in processes of physical education offered by the Center to its service users. In the group that involves people with formally the highest level of education there was also the highest polarization of viewpoints, so besides 40 % of the members who gave positive viewpoint towards qualified program leaders, the same number considers the same question to be unimportant. In the group involving people with elementary school, 25 % of them considered the idea of having qualified people as sports and

recreation program leaders not too important, and 31.3 % was not sure in the correctness of the given statement.

These differences in the intensity of viewpoints towards the statement that having a qualified person as an exercise leader is important, determined low value of accomplished significance level ($Sig. < .05$) during the application of variance analysis (Table 8). Therefore, a basic source of variability between calculated scalar averages were systematically lower averages of scalar values for examinees with the lowest and highest formal education. Therefore, it can be said that the level of education can present an important determinant for creating (and expressing) viewpoint about the role and importance of having qualified exercise leaders in a sports facility.

Table 8 - Average scalar values which examinees of **a different qualification** used to express their opinion about the importance of qualified program leadership

Level	Sv.	St. Dev.	S. Gsd.	Minimum	Maximum
Elementary	3,6458	,90651	,22663	1,67	5,00
Secondary	4,0482	,70640	,07754	2,00	5,00
Collegiate school	4,1951	,53736	,08392	3,00	5,00
Faculty	4,3402	,52919	,05373	2,33	5,00
Dr/M.A./Spec.	3,6667	,66667	,29814	3,00	4,67
Σ	4,1556	,65418	,04205	1,67	5,00

F = 6,137* Sig. = ,000

Conclusion

For the purpose-serving work, development and existence of sports facilities (as necessary infrastructural resources and places where sports services are offered) the main factor is successful management. One of the primary tasks for that management is developing working integrality and functionality of the sports facility they control. Management of a sports facility first of all has to ensure that all clients have appropriate program, which includes creating and developing various program models aimed at achieving optimal use of available resources and capacities. In this segment of work it is very important to pay enough attention to ensure a sufficient number of quality experts (mainly from the field of sports) who would control and execute program of sports and sports recreation. Their task is not just to organize sports and sports-recreational activities in a sports facility, but also to actively control and maintain these activities (depending on the needs, requirements and interest of users). Precisely in this segment lies the biggest responsibility of qualified experts, because controlling and organizing physical activities in essence presents controlling transformational processes which directly influence changes in bio-psycho-social characteristics of people. Mistakes in this process should not happen, therefore a high level of qualification, competence, experience and responsibility of qualified people related to the work area of sports facilities in connection strictly with sports has to be understood as axiom of responsible operating.

Heough insight into the results of research, that is distribution of descriptive assessment, as well as numerical evaluation from Likert scale, it can be concluded that

examinees had very positive viewpoint towards the need that sports and/or sports-recreational programs are planned and performed strictly by qualified (educated) people. Very similar opinions regarding the same question were given by all categories of examinees. Statistically significant differences between opinions of examinees from different categories occurred in six cases (there were two cases where two examinee groups had different opinions as a result of a different user status and qualification, and one case where two examinee groups had different opinions as a result of a different sex and age group). None of these cases had direction as a reason for these significant differences. The reason was strictly intensity (and level) of expressed viewpoints. The best illustration of this are viewpoints expressed by examinees of a different age group and sex. In both cases for all groups, dominant answers were the answers from a positive side of the scale, and for the youngest age group together with examinees who finished elementary school (who didn't have time to get higher education because of their age status) we see more balanced presence of all scalar values, while older examinees and examinees with higher qualifications had very polarized answers, which means that they were moved towards positive end of a value scale.

Nowadays, it is necessary in modern business environment to pay enough attention to the question of sports service quality as the part of overall trade sector. If one is aware that general notion of service quality is related to the level of satisfaction which consumers show to express how well their needs are met, than quality of sports services can generally be considered as

created viewpoint and opinion of the consumers about the benefit they gained through the use of those services. In this context, one very important segment is question of hiring appropriate qualified experts in sports facilities, who should meet the demands of users by their knowledge and quality. This should be in positive accordance not just with the demands of users, but also from the point of view

related to responsible leadership and successful development of sports service system. For the management of a sports facility this question should be a priority in everyday managing activity, and regular assessments. Though identification of opinions and satisfaction of users should become necessary standard in the organization philosophy.

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EVALUACIJA STRUČNOG RADA U SPORTSKIM OBJEKTIMA NA BAZI STAVOVA I MIŠLJENJA KORISNIKA USLUGA

Sažetak

Sport i sportska rekreacija su postale oblasti kojima su se okrenuli mnogi pojedinci sa željom da na pravi način iskoriste svoje slobodno vreme, odnosno realizuju sve aktuelniji aktivni životni stil. Sportski objekti kao infrasturktturni resursi sporta treba da ponude najšire mogućnosti za konzumiranje „raznovrsnih proizvoda sporta i fizičkog vežbanja“, a u odnosu

na svoje specifičnosti, kao i svaka javna delatnost, nastoje da ljudima pruže odgovarajuću uslugu. Stoga sportske usluge u poslovnom asortimanu sportskih objekata treba da budu dostupne najširim slojevima društva, jer zadovoljavaju različite potrebe i imaju različito dejstvo na potencijalne korisnike. Dosadašnja istraživanja su pokazala da potrošači koriste vrlo slične kriterijume prilikom ocenjivanja kvaliteta usluga. To se svakako može odnositi i na evaluaciju sportskih usluga, gde se procenjuje njihova: pouzdanost, osetljivost, kompetentnost, pristupačnost, komunikativnost, sigurnost, razumevanje i upućenost na potrošača. Posebno mesto u ovom sistemu procene zauzima pitanje zadovoljstva korisnika kvlitetom stručnog rada u sportskom objektu. FEmpirijsko istraživanje, koje je sprovedeno na uzorku od 242 ispitanika imalo je zadatak da izvrši evaluaciju nekih aspekata stručnog rada, izvedenih na osnovu stavova i mišljenja ljudi različitog korisničkog statusa, kao i zaposlenih u JP SPC "Vojvodina" u Novom Sadu. Cilj istraživanja bio je usmeren na utvrđivanje osnovnih činilaca koji determinišu nivo kvaliteta sportskih usluga u SPC "Vojvodina", baziranih na stavovima i mišljenjima o stručnom radu u sportskom objektu, kako od strane direktnih korisnika, tako i zaposlenih u organizaciji.

Ključne reči: *evaluacija, sportski objekti, stručni rad, korisnici*

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TEAM WORK AND INTERPERSONAL RELATIONSHIPS WITHIN A SPORTS ORGANIZATION

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Abstract

The abilities of individuals may be raised to a much higher level of experience and self-actualization working in a team that automatically leads to an increase in both efficiency and effectiveness of the sports organization to which they belong. As the team members realize personal goals, gain benefits as well as work in their own interests, implementation of the objectives set both by a sports organization and its personnel is possible only through effective team work and high-quality interpersonal relationships. No matter how trivial a business meeting may seem, every individual should be paid full attention and given kindness, understanding and generosity that could be expressed at that moment, without expecting anything in return. This is considered a great foundation for establishing high-quality interpersonal relationships within a sports organization.

Keywords: *team work, efficiency, interpersonal relationships, sports organization*

Introduction

If we assume that teamwork is the foundation or the basis for the successful implementation of the assigned tasks and goals, then we can understand the desire of many sports organizations to form efficient teams. Since the business efficiency and productivity are directly related to relationship quality between people, then we can safely conclude that effective teamwork is directly determined by the quality interpersonal relationships. For creating a quality team, a relationships of

mutual respect (through the participation of all and humane approach among employees) may be far more important motivator than material incentives.

Efficient teams with interpersonal respect achieve better results than the individual ones, they are more flexible, take more risks, produce more ideas, are faster, easier to make decisions, etc. Organization in which teams and participatory teamwork were introduced can achieve, in theory and in practice, due to the group synergy, higher levels of productivity and efficiency, i.e.

greater and better results, since the shared resources within the team provide higher and better performance results compared to the individual works and their effect.

Interpersonal relationships in the organization are often not given great importance. However, if the work is not performed properly, this segment should first be explored. Our interpersonal relationships with colleagues in the team can affect us and our job more than we realize. Since we spend most of the time of our lives with persons we are working with, we share and experience many important moments with them, which is why it is very important to build the quality interpersonal relationships with them.

Teamwork in a sports organization

In a world of rapid and continuous changes, in order to meet the demands and challenges of the contemporary sports and the business community, sports organizations are increasingly replacing the old hierarchical and formal systems with teams and teamwork, as teamwork is promoted as a reliable way of making the right decisions and their effective implementation.

Thus, regardless of which form a classical organizational structure has, it became clear that without teams there is hardly a way to meet the increasingly complex problems and demands of the market. Therefore, the successful companies in the West and Japan form the so-called "quality circles", which consists of experts around the comprehensive set task. Those are the teams that have the necessary independence and responsibility for the overall task, and the team members are aware of their own capabilities and responsibilities. Nadoveza (2011) pointed out that teamwork is highly developed in the practice of Western

companies, especially in the United States and Canada. Basically, teamwork is a common solution of a problem that involves multiple experts in different fields or more professionals of the same specialty.

Kamegi, D. (1994) noted that a highly functional team usually comprises a group of people with complementary skills who work interactively in order to achieve a common goal, i.e. a group of people committed to a common purpose, goals and approach to collective responsibility. Discovering and understanding the individual characteristics of each individual staff is the first step towards constructing motivated group of people – a team.

When it comes to the types of teams, it is clear that there are several different types, depending on the criteria by which they are formed, hence there are homogeneous and heterogeneous teams, which are created based on the tasks to be performed, then there are internal, external and mixed teams that are formed based on the origin of the team members, permanent and temporary teams that are formed based on the time of the team existence, formal and informal teams that are formed on the basis of their form, etc.

One of the important questions to be asked when it comes to forming teams, refers to the size of a team, i.e. the number of members within the team. Team size usually depends on the complexity of the tasks and the time dimension in which the task should be solved. Also, the size of the team may depend on the expertise of the staff who make it. The optimal size of the team occurs when the number of members and team structure are adapted to the scope and complexity of the task to be solved.

When considering the issue of teams, the basic thought and effort goes in the direction to make them efficient. Nadoveza (2011) considers it necessary to do several things in the beginning:

- That each member of the group clearly expresses priority for participation in the group
- That every individual indicates their expectations for involvement in the group
- To make a precise allocation of responsibility
- That each member of the group accepts the presented goals of the group
- To define the operating guide for decision-making (methods of work and forms of participation of members in decision-making) and coordination
- To set an objective system for monitoring and evaluating the work of each member and reward accordingly

In order for the teams to function effectively towards achieving the goals, it is necessary to clearly define the tasks and problem solving methods, as well as the method of resolving any conflicts within the team. Team goals must be set in advance, as part of the objectives or plans of the wider organizational unit within which the teams are formed. Also, the individual tasks of team members should be known, clearly defined and connected with the tasks of other team members, as the team can't act as the sum of the individual activities of its members if these activities are not correlated.

For managing conflicts in practice different approaches are used, tools, methods and means. The specific application depends on the nature and

severity of conflicts, the conditions and the environment, personal traits and characteristics of the conflicting parties. Basic techniques for conflict resolution are:

- Domination over another person – it is not considered an effective means of resolving conflicts
- Using an external influence, arbitration and mediation – an objective judge
- Planned delay – when one wants by introduction of standstill period to postpone conflict resolution for a more favorable moment, when emotional tension is reduced
- Loosening and withdrawal – when one side realizes their own mistake and withdraws from the conflict
- A compromise solution – the most commonly used approach and represents a mutually acceptable solution
- Troubleshooting – when you can build mutual trust of the participants in the conflict, and change their initial attitude with respect to possible options to solve problems.

What should be emphasized is that these negative effects can be prevented and corrected, if we notice them in time and if we are working on their correcting. For successful teamwork time is necessary in which the team will build up in the long-term effective mechanism.

According to Donnellon A. (2009) "synergy created by a variety of skills, experiences and motivation of the members enables the teams to respond quicker to technological, economic and market changes in our increasingly complex world."

When it comes to methods of teamwork, Radosavljević, Ž. (2008) lists three basic methods of teamwork:

- Working by the method of closed group – team members, the method of closed groups are set up so that they have constant mutual contact when solving problems. This method is particularly applicable to the project organization or organizations involved in the diagnosis of social and economic problems;
- Working by the method of relays – in this method of work each participant, i.e. team member executes part of the overall task, certain jobs and assignments that he has to perform in a given time. After the completion of certain operations, the team member hands their solutions to the next member to make amendments on the same document with their own appropriate data. Finally, there is a manager or group that collects all solutions, gives their own opinion and makes decisions so as to synchronize the resulting solution in the best way possible;
- The combined method of work – combined method of teamwork applies to higher and more complex forms of organizing organizations. In certain stages of the project the method of closed groups is applied, and in other work by the extent of relay.

Interpersonal relationships in sport organization

We live in a turbulent world in which we are undergoing massive changes, a fundamental turnovers. However, despite

the increasing connectivity at first glance, owing to social networks above all, many have forgotten that interpersonal relationships are in fact the basis of everything, having in mind that a successful sports organization, with a high quality teamwork, are made by good interpersonal relationships at all levels leading to positive result.

Even though there is no golden rule or recipe for creating of good interpersonal relationships, there are still certain commonly acknowledged guidelines which can help us in building better relationships. During the building of good interpersonal relationship honesty, sincerity, acknowledgment, respect, understanding and time for others are the traits which can help us, whereas neglecting others, egocentricity and others are most commonly the ones to obstruct us.

Tracy, B. (2010) emphasizes that you should treat a person you meet and work with, at home and at work, as if they were the most important in the world. Seeing that when we treat people as important and valuable, they will return by behaving the same.

Analysis of interpersonal relationship problem falls behind the key problems of social sciences, because the problems of human relationships are treated as peripheral, even though it is commonly known that human beings have the basic necessity to form, maintain and develop interpersonal relationships, which are above all necessary for good psychological health of people, as well as better perception of the environment surrounding us. The theory of interpersonal relationships stems from the fact that every man is an individual for themselves and has a separate

approach to life and work, along with their individual motives, needs and desires. This is of paramount importance, because each man must not only be approached separately but be treated separately as well, if greater effects are strived for, i.e. to achieve better relationships.

Interpersonal relationships represent direct relationships in different fields of social life of individuals or groups. They represent a dynamic system, *a living organism* which incessantly changes throughout its existence, since it has its beginning, lasting and ending. The interpersonal relationships study encompasses multiple branches of social sciences, including the disciplines such as sociology, psychology, anthropology etc.

Tomic, M. (2010) says about the theory of interpersonal relationships that it dedicates specific attention to motivation and stimulation of the people in achieving individual and group goals. In the same fashion the managerial function receives a new dimension exactly by giving priority to motivation, communication and coordination among the employees during managing.

We are by nature social beings which aim to interact and connect to others, regardless how far we have reached in development of our own independence, autonomy and self-sufficiency. From that whole-life-interaction with other people grows a necessity in terms of being accepted by other people, because every person has the need for social relationships with others, as well as to feel comfortable in their relationships, to be considered as a part of the team and be accepted as such. In essence, managing interpersonal relationships represents choosing and

acting with the aim to making sincere and strong relationship with others. When it comes to activities which we could do to improve interpersonal relationships, the most commonly recommended activities are:

- Analyze the type of the current interpersonal relationship in the organization we work;
- Imagine the type of interpersonal relationship we would like to have;
- Think about what we could do to improve interpersonal relationships;
- Start improving interpersonal relationships.

Conclusion

When it comes to sport, it tends to maintain quality interpersonal relationships by nature by developing friendship, amity and unity in which informal communication has a very significant role. However, we are prone to mostly getting into superficial and partial relationships rather than being deeply connected to the whole personality of each individual we meet. That means that we actually put little energy into maintaining our relationships with most of the people around us. Consciously or unconsciously, our relationships with most of the people are simply functional. One of the ways to manage relationships well is relying on your own discomfort and taking a moment to accept, not suppress or change the feelings of other people. We don't need to agree with how people feel, but we must recognize the feelings as justified and respect them.

If the cooperation among the employees is better and more dynamic, then the task will seem easier, i.e. it will be done quicker, simpler and more efficient, and the pleasure of such work will be felt by employees, as

well as their superiors, but the final beneficiaries of the product or services.

In regards to the modest and scarce possibilities of individuals, we can conclude that teamwork enables creating more ideas, greater creativity and improved communication which additionally contributes to the business and reaching better results, that is offers more reliable achievement of interest and goals of sports

organization. Also, it is a fact that relationships of people in sports or any other organization are highly complex in the least. Good interpersonal relationships should be created, nurtured and improved, since it represents a sure means to not only the satisfaction of the people within the organization, but to greater efficiency and productivity of the whole organization.

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TIMSKI RAD I INTERPERSONALNI ODNOSI U SPORTSKOJ ORGANIZACIJI

Sažetak

Samo timskim radom pojedinac može sopstvene sposobnosti podići na mnogo viši nivo i doživeti aktuelizaciju, a to implicira automatsko povećanje efikasnosti i efektivnosti same sportske organizacije kojoj pripada. Implementacija postavljenih ciljeva kako organizacije tako i pojedinaca u njoj, budući da članovi tima ostvaruju i lične koristi, ciljeve i interese, jedino je moguća kroz efektivan timski rad i kvalitetne interpersonalne odnose. Pružajući svakoj osobi, bez obzira na to koliko trivijalan izgledao susret, svu svoju pažnju, ljubaznost, razumevanje i velikodušnost koju možemo iskazati u tom trenutku, i to bez ikakve pomisli na reciprocitet, predstavlja dobar temelj za izgradnju kvalitetnih interpersonalnih odnosa.

Ključne reči: *timski rad, efikasnost, interpersonalni odnosi, sportska organizacija*

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TRANSFORMATION EFFICIENCY OF VARIOUS KINESIOLOGICAL CONTENT ON MORPHOLOGICAL DIMENSION OF HIGH SCHOOL FEMALE STUDENTS

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Abstract

The aim of this study was to determine the potential effectiveness of various transformational kinesiological content on changes in selected morphological measures in two groups of high school female students, the experimental and the control group. Kinesiology activities are implemented through two-hour, double gym classes. Firstly, the experimental group was a subject, during one school year, of kinesiology content related to volleyball, whereas the control group was subject to content of regular curriculum for technical high schools of the Federation of Bosnia and Herzegovina. Based on the research results, the changes have been identified, caused and conditioned by different kinesiological content which can be interpreted as the advantages and recommendations when setting up the structure and content to teaching physical and health education. There are, also, some deficiencies which have to be addressed to as well.

Key words: *kinesiological content, transformational efficiency, morphological dimensions, female students*

Introduction

Due to trend of globalization and the development of technology, the need for mobility is reduced and the time of physical activity, which is also optional, is reduced to that within a two-hour weekly realization of the physical and health education in

schools. In teaching, it is important to find and determine the most efficient operators and content that will have positive effects on the participants, teaching in harmony with their needs and capabilities and to achieve the set of goals and objectives of physical and health education. Different studies of elementary and secondary school

students, showed that the students' interest increases if one of sports was chosen, which is not a part of standard curriculum [1]. The same author notes inefficiency in the allocation of time after the started subject matter has been disrupted. In that case, for successful continuation, more time must be spent on repetition and confirmation of, the already addressed to, elements which have not been mastered completely. Analysis of existing plans and programs shows that there is a pronounced demand for diversity which prevents continuity in realization contents of one sport. According to Najšteter [2] every student, actively involved in the teaching process, has its biorhythm, growth and development of its capabilities, interests and abilities that need support and help, which is the meaning of physical and health education classes. Planned treatment of experimental group consists of 70 hours of regular teaching classes. The contents of the experimental program consisted of units of trainings, tests, repetition of element of techniques in the volleyball game. Throughout the school year, the female students in the experimental group were mastering the volleyball basic elements such as setting, digging, spiking, blocking, serving. Moreover, teaching units included the contents of specific exercises, development of motor skills as well as content processing organization and tactics of volleyball games that have been realized through the application of different methodical organizational forms of work, such as the frontal forms of work, group work (in pairs, threes, fours), alternate work, group work, work at stations and circular training.

Methodology

The aim of this study is summarized in the

framework of the research, i.e. in determining the dimensions of the morphological changes of the chosen group of high school female students conditioned by educational content of the various sporting activities such as volleyball and programmed contents of two or more sports games through the election and an additional sport, in the course of one academic school year.

The population sample

Testing was conducted on a sample group of 147 female high school students, age group from 14 to 16 years. In the research process were included, female students who are healthy and who regularly attend classes of physical and health education.

The sample of variables

The selection of variables was based on previous studies and on the basis of suitability, performance techniques and the complexity of performance, age and gender of the sample.

Variables for assessment of morphological dimension

To assess the chosen morphological dimension, the following variables were used: body height and weight, skinfold of back, upper arm and abdominal.

Results

Differences between the two arithmetic means can be determined by simply comparison. However, the observed difference may not be statistically significant (difference greater than that which can happen accidentally as a result of a random selection of entities in the

sample). To determine statistically significant difference of arithmetic means, sample dependencies and correlations, the so called paired T-Test was used, two-way ,

i.e. testing the significance of mean differences because in studies such as this , there is a correlation between the initial and final measurements.

		Mean	Std. Deviation	Std. Error Mean	df	t	Sig.	
Pair 1	AVISTJ – AVISTJF	-,44167	,63151	,07442	-5,934	71	,000	EKSPERIMENTALNA GRUPA
Pair 2	AMASTJ - AMASTJF	-1,98611	5,10797	,60198	-3,299	71	,002	
Pair 3	ANALED - ANALED F	-,51389	4,69340	,55312	-,929	71	,356	
Pair 4	ANANAD - ANANAD F	-1,29167	3,40024	,40072	-3,223	71	,002	
Pair 5	ANATRB - ANATRB F	-2,48153	7,08742	,83526	-2,971	71	,004	
Pair 1	AVISTJ - AVISTJF	-,57600	,88177	,10182	-5,657	74	,000	KONTROLNA GRUPA
Pair 2	AMASTJ - AMASTJF	-1,71333	2,58918	,29897	-5,731	74	,000	
Pair 3	ANALED - ANALED F	,68000	3,08510	,35624	1,909	74	,060	
Pair 4	ANANAD - ANANAD F	-,14667	3,89973	,45030	-,326	74	,746	
Pair 5	ANATRB - ANATRB F	-,42667	5,54386	,64015	-,667	74	,507	

Table 1. Analysis of the diff. in the arithmetic means for the purpose of assessment of morphological dimensions of experimental & control group.

Testing the significance of mean differences initial and final measurement variables for assessing morphological dimension of the experimental group, according to the assessed value of the standard error deviation difference arithmetic average of the medium (Std.error mean) , the variables for estimating body height (AVISTJ) was .07442 , while the t-value was -5.934 and together with the degree of freedom (df = 71) is statistically significant at the level sig . 000 (p = 0.05). The same was observed in the variables for estimating body mass , AMASTJ (Std.error.mean = .60198, t-value=-3.30, The level of sig .002), subcutaneous fat of the upper arm, ANANAD (Std.error mean = .40072, t - value = - .929 ,sig ,002) and subcutaneous adipose tissue of the abdomen , ANATRB (Std.error mean = .83526 , t - value = 2.971 with sig .. 004) . These values standard errors and t-values , which are above the threshold values of tolerance (limit t-values), shows that the mean of the variables analyzed , the initial

and final measurements , statistically significant differences at the level of p = 0.05 . In the control group, statistically significant mean differences initial and final measurement , which is not the result of random differences were observed in the variables for estimating body height (AVISTJ - Std.error mean = 0.10182 , t - value = -5.657 with statistical significance = .000) to assess body mass (AMASTJ - Std.error mean = .29897, t - value = -5.731 and statistical significance = .000) . These values are above the threshold values of tolerance , with the value of these groups , which are free to vary (df = 74), indicating the mean differences statistically significant at the significance level of p = 0.05.

Discussion

The program that the experimental group was subject to, has caused changes in the observed difference of means ,morphological space that is treated , monitored and measured in this study through the variables to estimate them. The

calculated value of T shows that the mean differences of the first and second measurements is statistically significant, since likelihood that such differences can occur by chance is less than 0.05 (5 %). When we analyze the control group, the applied content of teaching and the changes observed on the basis of analysis of difference of means, are statistically significant. This all suggest that they originated in the variables that estimate height and weight. It has not been scientifically proven so far, but it is certain that the selected operators and specificity of volleyball game have the task to support development process and proper posture in this age. It has been proven that the increment of height to 96% is predetermined by genetics. Statistical significance was obtained in this analysis for the variables that estimate morphological dimensions such as body height and it is the result of biological and expected growth and development. On the other hand, the studies made show that an insufficient activity has a negative effect on bone growth [3]. When we talk about the impact of planned content of volleyball classes in the high school, on the body weight and subcutaneous adipose tissue, it certainly remains a place where the treatment (operators) caused changes , along with the influence of genetic factors (60 % predestination) and various external factors (diet). The way in which we can reduce the amount of subcutaneous fat as well as body weight , is based on their exploitation for energy processes through activities with lower intensities work with sufficiently long continuous operation. In volleyball is prevailing load of medium and submaximal intensity, depending on the stage of the game. Applied content of volleyball game in two-hour weekly classes

with the existence of a certain level of motor knowledge, did not result in exploitation of fatty acids that is only possible in aerobic mode. However, is not present here because of insufficient extensiveness and intensity that makes substantive .

On the contrary , an increase in body weight and fat tissue was noticed , according to the development process and the gender of legality in body weight gain in girls but also with the influence of external factors such as diet and lack of exercise (in the classroom and outside of it). Different studies have demonstrated twice the presence of adipose tissue in body weight in girls as opposed to boys , as is present in this age period . In the control group , is showed changes of longitudinal dimension (physical height) as well as body weight . When we analyze previous studies [4] which are based on a longitudinal study, comparing development of some physical characteristics and motor abilities of two generations of students in primary and secondary schools in Slovenia (age group 7 till 18 years), we found that the greatest changes in body height were recorded at the beginning of elementary school and at the end of high school . The girls add weight in high school and the reason cited improper diet and hypoactivity.

Markovic [5,6] conducted two studies which have investigated the effects of teaching based on the continued implementation of one of sports games , versus one that planned implementation of larger or smaller education of sports basic elements. The both studies have not identified significant changes in the morphological characteristics of the causes of the respondents of both gender age groups from 15-16 and 16-17 years. The

growth and development of a human are dominant and dynamic biological activities in the first two decades of his/her life. Longitudinal dimension (physical height) as a morphological dimension that defines the structure of human, through his four developmental stages [3] are completed till the age of eighteen years. The height is genetically conditioned and can not be influenced by outside factors and operators. Body height is one of the basic requirements of modern volleyball and its efficiency . The top volleyball player's average height is between 180 and 185 cm.

By analyzing the results of this research, in the area of morphological dimension , changes are shown in favor of the final measurements . However , we can conclude that the increase in body height is not a result of the influence of the applied kinesiological content of the selected groups of students, but the natural flow of their development.

In contrast to the height, the body weight and subcutaneous adipose tissue can be influenced by the appropriate operators, but only if the operators are adequate and sufficient. When we observe the path of development of this size in both gender groups, it is almost identical before entering the puberty. The boys , however are slightly heavier and higher than girls. This relationship is changing in favor of girls or rather their increase in height and weight in the initial period of early adolescence. Yet, by the end of the period of puberty the boys are increasing height and weight more than girls. The pace and rate of growth is different. When it comes to total body weight, the boys gradually increase over a period of development while in girls increases greatly . In adolescence, the total body mass of girls is two times higher than

for boys . The share of subcutaneous fat in the total body weight is great in girls and bigger than in boys of the same age. Research and various analyzes showed that the average percentage of body fat in volleyball female players is 10-18 % of total body weight. For instance, Bandalo et al. [4] in their study compare younger age categories of volleyball and handball players. The results of the study showed that female players have a prominent height and smaller amounts of subcutaneous adipose tissue , unlike handball players of the same age (12-16 years) and three years of active training.

Conclusion

Using the paired t - test for paired samples , we have been able to prove that there is a difference in arithmetic means of variables that estimate morphological dimension , measured at two time points. Differences emerged after conducting a scheduled course content , which consisted of mastering the game of volleyball in the experimental group and content of various sports in the control group . The main objective of this study was to determine the morphological changes in size conditional various instructional content sporting activities with girls ages 14-16 years. For this purpose, a sample of 147 female students was tested using five morphological measurement instruments. To test the difference between the two runs, we used t-test for two dependent groups (Paired - Samples T Test). Neither science nor this study were able to confirm that there is significant influence of the course content resulting in changes in terms of height and body growth. As stated before, the height will change according to gender

and age characteristics of the tested groups. Partially, the program content consisting of volleyball games, facilitate proper growth and development and the changes that have occurred in the variables body mass and subcutaneous adipose tissue were determined. However, all changes are reflected by the increase of body weight and the subcutaneous adipose tissue of the abdomen, upper arms and back. The development of body weight and body fat, although not genetically conditioned, justifies the conclusion that the increase in the data analysis of this research. With respect to the fact that the percentage of ballast weight of the total body mass in females twice higher than in peer- counter half. Factors such as nutrition, in addition to biological development, have further influenced gain weight and in cases leave a negative impact on its growth and we can conclude that not enough stimulus (volume and intensity) were given for its maintenance or reduction. This means, that two-hour gym classes per week, comprising of volleyball games as well as traditional content that was present in the control group, was not sufficient to have a positive impact on this morphological characteristic. Adding to it the analysis of other authors' researches that got to same conclusion, we can say that the experimental treatment group did not achieve positive changes in the morphological characteristics other than those resulting from the biological laws of growth and development.

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TRANSFORMACIJSKA EFIKASNOST RAZLIČITIH KINEZIOLOŠKIH SADRŽAJA NA MORFOLOŠKE DIMENZIJE KOD UČENICA SREDNJE ŠKOLE

Sažetak

Cilj rada bio je utvrditi potencijalnu transformacijsku efikasnost različitih kinezioloških sadržaja na promjene u odabranim morfološkim mjerama kod eksperimentalne i kontrolne grupe učenika srednje škole. Kineziološki sadržaji su realizirani kroz dvočasovnu nastavu tjelesnog i zdravstvenog odgoja. Eksperimentalna grupa je u toku jedne školske godine bila podvrgnuta kineziološkim sadržajima savladavanja odbojkaške igre, dok se u kontrolnoj grupi realizovao sadržaj prema nastavnom planu i programu za srednje tehničke škole Federacije Bosne i Hercegovine. Na osnovu dobijenih rezultata ovog istraživanja, utvrđene su promjene uvjetovane različitim sadržajem a koje se mogu protumačiti kao prednosti i preporuka prilikom postavljanja strukture sadržaja nastave tjelesnog i zdravstvenog odgoja, ali i nedostataka na koje je potrebno isto tako obratiti pažnju prilikom programiranja nastavnog sadržaja.

Ključne riječi: kineziološki sadržaji, transformacijska efikasnost, morfološke dimenzije, učenice

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TRANSFORMATION DYNAMICS OF THE CURRICULUM ADOPTION IN RELATION TO THE AGE OF FEMALE PUPILS

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Original scientific paper

Abstract

With the goal to determine the level of adoption of movement structures of girls aged 11-14 within one school-year period, variables for the evaluation of the volleyball, basketball and handball curriculums have been applied. The research results have shown that the biggest dynamics of the increase in motor knowledge level is found at the ages between 11 and 12. One of the reasons is most probably the phenomenon of accelerated growth and development which is reflected in coordination disorder, which is a prerequisite for high level of ball manipulation at other ages.

Key words: *girls 11-14 years old, motor knowledge, mancova.*

Introduction

Although all anatomical and physiological characteristics of all people are basically the same, there are still significant differences among them which need to be taken into account when working with children, pupils and youth. Those differences, besides other things, come from their connection to specific development periods (Findak V. 2001).

In human's life development, the development rate of antropological characteristics does not go evenly, i.e. periods of acceleration and deceleration can be noticed, as well as stagnations in growth and development. Authors refer to this period as the period of adolescence, which has been divided by an American

psychologist E.Harlokove in three parts: preadolescence (between the ages ten to twelve), early adolescence (between the ages thirteen and sixteen) and late adolescence (between the ages of seventeen and twenty), (V. Smiljanić-Čolanović, Toličić I. 1967). The necessity for systematic and qualitative implementation of physical and health education from the earliest days does not only come from altered way of life, but also from the fact that in modern living and working conditions exactly those functions and abilities of an organism that can be quickly and effectively changed, developed and improved by physical and health education become more and more endangered. (Džibrić Dž. 2010).

Work methodology

The main goal of this research is to determine the level of adoption of movement structures of girls aged 11-14 within one school-year period. The research was conducted on 313 girls aged 11-14.

The sample of variables used for the evaluation of the level of adoption of movement structures in basketball

Situation-motor tests have been applied for the evaluation of adoption of movement structures in basketball in order to determine the competence in basic technique elements: dribbling, passing and catching the ball and shooting.

1. Throwing and catching the ball against the wall for 30 seconds.....(KDODLOP)
2. Slalom dribbling.....(KVODLOP)
3. Shooting for 30 seconds.....(KŠUTKOŠ)

The sample of variables used for the evaluation of the level of adoption of movement structures in volleyball

Situation-motor tests have been applied for the evaluation of adoption of movement structures in volleyball in order to determine

the competence in basic technique elements: serving, returning the ball with fingers and forearms.

1. Tennis serving..... (OSERVIS)
2. Shooting at target over the net from the basic position.....(OGORODB)
3. Returning the ball with forearms in a circle for 30 seconds.....(ODONODB)

The sample of variables used for the evaluation of the level of adoption of movement structures in handball

Situation-motor tests have been applied for the evaluation of adoption of movement structures in handball in order to determine the competence in basic technique elements: passing and catching the ball, dribbling and shooting.

1. Throwing and catching the ball against the wall for 30 seconds.....(RDODLOP)
2. Slalom dribbling.....(RVODLOP)
3. Penalties.....(RSEDMER)

Results and discussions

The results of multi-variant and univariant analysis of covariance of motor capabilities of girls aged 11 to 14

Table 1

Manova test	Value	p-level
Wilks' Lambda	,606298	
Rao R Form 2 (27,853)	5,907250	,000000
Pillai-Bartlett Trace	,446493	
V (27,882)	5,711919	,000000

Table 2

Variables	Age 11-12	Age 12-13	Age 13-14	Age 14-15	F(df 1,2)	p-level sign.
KDODLOP	20,10	22,04	18,89	20,65	5,98665	,000565
KVOÐLOP	10,04	10,42	10,51	10,45	1,32615	,265940
KŠUTKOŠ	5,36	4,77	5,21	5,87	3,39897	,018195
OGORODB	5,53	5,71	5,60	6,90	5,75466	,000772
ODONODB	10,23	8,78	8,35	8,91	1,26700	,285824
OSERVIS	5,81	5,11	4,47	4,40	4,54124	,003946
RDODLOP	23,25	16,87	16,64	16,04	18,44892	,000000
RSEDMER	5,31	4,47	4,98	3,64	9,60826	,000004
RVOÐLOP	10,36	11,10	10,99	11,48	4,98444	,002175

One of the goals of this research was to determine the dynamics of adoption of new movement structures, i.e. motor knowledge.

The results of multi-variant and univariant covariance analysis of motorknowledge increasedynamics of girls aged 11 to 14 have been presented in table 1. The first part of the table are the results of multi-variant analysis of covariance where it can be seen, based on relevant indicators, that the statistic importance, in the overall hyper-dimensional space of motor knowledge, between different ages is at the level $p < 0.01$.

The biggest increase of the value of passing and catching the ball in basketball (KDODLOP) was recorded at the age between 12 and 13. As it can be seen in the above mentioned table, the increase dynamics of motor knowledge in basketball dribbling (KVOÐLOP) is not statistically important, i.e. it does not significantly differ between different ages, which means that the dynamics of changes of that motor knowledge is the same with at all ages. The same dynamics of changes was also noticed in the motor knowledge of ball returning with forearms in volleyball (ODONODB).

Statistically important dynamics of increase, at the ages between 14 and 15, was noticed in the motor knowledge of shooting in

basketball (KŠUTKOŠ) and upper return of ball in volleyball (OGORODB). It is very difficult to give a profound interpretation for the main reason for this condition taking into account that the level of manifestation of this motor knowledge depends on many motor and morphological factors.

In further interpretation of above mentioned table, it is interesting to notice that the dynamics of changes in the level of motor knowledge of tennis serving (OSERVIS), passing the ball in handball (RDODLOP), shooting penalties in handball (RSEDMER), and dribbling in handball (RVOÐLOP) is the most expressed at the age between 11 and 12. Logical and profound explanation of this condition one should search in the fact that girls of that age, for the first time, meet with the technical structures of sport games and therefore the level of adoption of stylized movements is at the greatest.

Therefore, the general conclusion would be that the biggest dynamics of the increase of motor knowledge level of elementary school girls population is between the ages 11 and 12. One of the reasons we have previously explained, and the other reason is most likely the phenomenon of accelerated growth and development which is reflected in weaker coordination which is prerequisite to the high

level of ball manipulation. In other words, the dynamics of changes in motor knowledge greatly depends on the dynamics of changes in growth and development of an organism arisen from the influence of juvenile acceleration on one side, and, on the other side, the level of motor knowledge also depends on the dynamics of changes of basic motor capabilities which are relevant to achieving better results in motor knowledge. The statistic significance is not identified at the motor knowledge of dribbling in basketball (KVOÐLOP) and returning the ball with forearms in volleyball (ODONODB).

changes of basic motor capabilities which are relevant to achieving better results in motor knowledge.

Conclusion

This research was conducted with the goal to determine the level of adoption of movement structures of girls aged 11 to 14 within one-school-year period. The research was conducted on 313 girl examinees aged 11 to 14. The sample of variables for evaluation of curriculum adoption was comprised of the variables for the evaluation of movement structures in volleyball, basketball and handball. Thus, the general conclusion would be that, at the girl population of elementary school ages, the biggest dynamics of the increase of motor knowledge levels is at the ages between 11 and 12. One of the reasons is most likely the phenomenon of accelerated growth and development which is reflected in weaker coordination which is prerequisite to the high level of ball manipulation. In other words, the dynamics of changes in motor knowledge greatly depends on the dynamics of changes in growth and development of an organism arisen from the influence of juvenile acceleration on one side, and, on the other side, the level of motor knowledge which also depends on the dynamics of

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DINAMIKA TRANSFORMACIJE USVOJENOSTI NASTAVNE GRAĐE U ODNOSU NA UZRASNU DOB UČENICA

Sažetak

U cilju da se utvrdi stepen usvojenosti kretnih struktura djevojčica uzrasta 11-14 godina u vremenskom periodu jedne nastavne godine, primjenjene su varijable za procjenu usvojenosti nastavne građe iz oblasti odbojke, košarke i rukometa. Rezultati istraživanja su pokazali da je najveća dinamika prirasta nivoa motoričkog znanja u uzrastu 11-12 godina. Jedan od razloga je najvjerojatnije fenomen ubrzanog rasta i razvoja koji se reflektuje na narušavanju koordinacije koja je uslov za visok stepen manipulacije sa loptom kod ostalih uzrasta.

Ključne riječi: djevojčice uzrasta 11-14 godina, motorička znanja, mancova

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EFFECTS OF EXPERIMENTAL PROGRAM OF TEACHING PRIMARY SCHOOL CHILDREN SWIMMING TECHNIQUES AS A PART OF EXTRACURRICULAR ACTIVITIES

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Original scientific paper

Abstract

The aim of this study was to determine the effects of experimental program of learning to swim as extracurricular activity of boys and girls in primary school. The study was done on a sample of around 150 randomly selected children from Sarajevo area, of both genders, aged 11.8 ± 2.5 years. The sample included eighty (80) boys and seventy (70) girls. Five variables were used for assessing the situational motorics, including assessment of swimming skills, assessment of swimming front crawl, assessment of swimming back crawl, assessment of swimming breaststroke, time required to swim 25 meter freestyle. The research was conducted over a period of 24 weeks (6 months). The swimming curriculum was implemented in a swimming pool of dimensions 50x25 meters (average water temperature 27.9°C), in 45 minute periods twice a week. The data on participating children were obtained by measuring the same variables at two points in time, before and after implementation of the experimental program. MANOVA and ANOVA were used in analyzing the obtained data. Conclusion drawn from the results of the study is that the swimming curriculum has significantly contributed to homogenization of elements that are responsible for efficacy of aspects of swimming with regards to all used variables. Therefore, one may conclude that the methodics of teaching swimming as an extracurricular activity applied in this study proved very effective, the main reason for that being the use of adequate methodical principles of systematicity and graduality, as they are of extreme importance in work with children in this age group.

Keywords: swimming, teaching methodics, physical education

Introduction

Although achieving best possible results is one of the primary reasons for doing sports, sports for children must also have other messages, particularly those of lasting value. One may say that a general goal of physical education in school is that the children acquire the habit of engaging in regular physical exercise. By improving models of educating children on moving and movement an attempt is made to raise their awareness of the effects of practical physical exercise on health. This approach in schools aims to help the youth to become aware of their bodies, and the time devoted to “education about movement” should be increased in primary and secondary schools (Constantino, 2012). However, a myriad of factors decide whether and in what extent a child will develop a lifestyle that includes awareness of importance of physical exercise for their health and continue with such exercise throughout their lives. A number of earlier studies (Rado, 2000; Schmidt et al, 2004) state that performance of a movement, as any other motoric skill, improves with practice, and the system of individual parts of a move undergoes a significant change and is perfected over time. Specifically, each additional form of engaging in physical activity, besides the regular physical education in schools, is of great benefit and importance for young people, and this is particularly the case with swimming, which requires high-utility motoric skill and therefore all

needs to be done to improve swimming literacy (Findak, 2003). Based on a series of studies of effects of transformational processes developing under the influence of swimming (Medved, 1987), a conclusion was made that from medical, and particularly orthopedic point of view, swimming is one of the most appropriate sports. Water-based exercise has numerous advantages over other types of exercise. Water resists the movement, and the degree of resistance depends on the speed and method of doing the exercise. Therefore, the exercise in water may be useful not only for increasing the scope of movements, but also for improving coordination and balance and improving aerobic capacity, that combined lead to better functional capacities and building of self-confidence (Chrysagis et al, 1997). Intense swimming training in pre-puberty age increases static and dynamic lung volume, and improves connection and condition of large and small breathways (Cuurteix et al, 1997). Because of this, swim training in this period of growth and development strongly encourages lung development, in harmony with development of speed of air passage and alveolar lung space. On the other hand, seen from expert point of view, swim training is a pedagogic process of transferring skills from instructor onto the swimmer-beginner with the purpose of preparing them for independent and safe stay in water (Wiesner, 2008). Teaching swimming requires good experience of the teacher, as well as strict implementation of principles of

education, clarity, attention, diligence, awareness and activity, systematicity and graduality, variety, applicability, as well as individualization (Findak, 1988 Grčić-Zubčević et al, 2009). The aim of this study was to determine the effects of experimental program of teaching swimming techniques as extracurricular activity for primary school children.

METHODS

Sample

The study was done on a sample of 150 randomly selected children from Sarajevo area, of both sexes and aged $11,8 \pm 2,5$ years. The sample included eighty (80) boys, aged $11,6 \pm 2,5$ years, and seventy (70) girls, aged $11,9 \pm 2,3$ years.

Variables

Five variables were used for assessing the motorics of swimming, including assessment of swimming skill, assessment of front crawl swimming technique, assessment of back crawl swimming technique, assessment of breaststroke swimming technique, time needed to swim 25 meters freestyle (Table 1). Assessments were graded one to five, using only “whole” grades, meaning that no other marks were allowed. Testing and evaluation was done by an expert team against criteria that had been set in advance. The swimming skill was determined by evaluating adaptation parameters necessary for staying in the water (Table

2) and the length of swimming (Kazazovic et al, 2007). Evaluators were highly educated individuals with long practical experience. Team members had to meet the following requirements: they had to be graduated professors of sports and physical education, had to have at least one year of experience in work with children in education programs for non-swimmers and teaching swimming techniques, had to have experience in work with children in education programs in the area of kinesiology. Before the testing, the evaluators were clearly explained the procedures, course and criteria for evaluation. In terms of procedure, criteria emphasizing body position, use of legs and arms, proper breathing and coordination were harmonized. At testing, children used each technique once. In terms of criteria variable in assessing baseline and final performance of swimming techniques (Table 3), the candidates were graded numerically using grades 1-5 (Rado, 1997).

Table 1: Sample of variables

Variable	Assessment	Measure / record
OPPL	Assessment of swimming skill	Expert assessment graded 1-5
OPTK	Assessment of crawl swimming technique	Expert assessment graded 1-5
OPTL	Assessment of backcrawl swimming technique	Expert assessment graded 1-5
OPTP	Assessment of breaststroke swimming technique	Expert assessment graded 1-5
V25MS	25 meters section swam freestyle	Time in seconds

Table 2: Evaluation model for variable “Assessment of swimming skill”

GRADE	Evaluation of movement
GRADE 5 - swimmer	Independently jumps on the legs in deep water, swims at least 50 meters – two styles and able to get out of the swimming pool on their own
GRADE 4 – swimmer beginner	Independently jumps on the legs in deep water, swims at least 25 meters freestyle, and able to get out of the swimming pool on their own.
GRADE 3 – semi-swimmer	Jumps independently on the legs in deep water, swims 10-24 meters freestyle and leaves the pool independently or with instructor’s help.
GRADE 2 – floater	Capable of staying on the surface for a shorter period of time an swim up to 10 meters freestyle and leave the pool on their own or with instructor’s help.
GRADE 1 – non swimmer	Possesses no swimming skill.

For the purpose of assessing their swimming techniques, candidates were asked to swim 25 meters using the following techniques: front crawl, back

crawl and breaststroke. Variables used for evaluating performance of the swimming techniques were:

Table 3: Model for evaluating of performance of swimming techniques (Rađo, 1997)

Grade	Evaluation of action of movement
GRADE 5	Performance with optimum striking angle (depending on the swimming technique), optimal body movement amplitude (depending on the swimming technique), around longitudinal and transversal axis, proper entry of hand into the water and proper realization of propulsive and retro propulsive part of the stroke, regular legwork, excellent hand, leg and breath coordination.
GRADE 4	Performance with optimal striking angle (depending on swimming technique), optimal body movement amplitudes (depending on swimming technique), around longitudinal and transversal axis, proper entry of hand into the water, errors in realization of propulsive and retro propulsive parts of the stroke, regular legwork, good hand, leg and breath coordination.
GRADE 3	Technique well done, with small errors in above listed elements, but overall, movement structure is not corrupted, there is satisfactory hand, leg and breath coordination.
GRADE 2	Corrupted technique, errors in almost all above listed elements, poor han, leg and breath coordination.
GRADE 1	Poorly performed technique, significant irregularities in all above listed elements. Movement structure significantly corrupted. Very bad hand, leg and breath coordination.

Exercise program

The experimental exercise program was specifically prepared with the aim of testing effectiveness of learning and perfecting swimming techniques and situational efficacy in water as a part of extracurricular activities. The swimming practice was organized in groups of 10-15 children, expertly led by professors of sports and

physical education. The practice was done in afternoon hours over the period of 24 weeks, twice a week, for 45 minutes (Table 4). The swimming curriculum was realized in a swimming pool of dimensions 50x25 meters (average water temperature was 27.9 °C). The selected variables were assessed individually and as a part of sets of tested areas they belonged to. The analysis showed that they represented adequate and

representative sample of variables. The data were obtained by measuring (testing) the same variables at two points in time – before and after completion of the exercise program. In order to determine effects of

the implemented program over such time period an analysis of changes was done under the difference model.

Table 4. Thematic presentation of learning and perfecting front crawl, back crawl and breaststroke swimming techniques

TOPICS TO BE COVERED AT TRAINING PRACTICE																
1. Evaluating crawl swimming technique	*															
2. Set of shaping exercises	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
3. Hydrogymnastics	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
4. Legwork exercises (in water)	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
5. Hand work exercises (in water)			*	*	*	*	*	*	*	*	*	*	*	*	*	*
6. Exercises for synchronization of hands and legs-crawl				*	*	*	*	*	*	*	*	*	*	*	*	*
7. Start jump exercises								*	*	*	*	*	*	*	*	*
8. Practicing turn in crawl													*	*	*	*

TOPICS TO BE COVERED AT TRAINING PRACTICE																
1. Set of shaping exercises	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
2. Hydrogymnastics	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
3. Repeating elements of crawl technique	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
4. Legwork exercises (in water)	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
5. Hand work exercises (in water)	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
6. Coordination exercises and jumps (in water)				*	*	*	*	*	*	*	*	*	*	*	*	*
7. Practicing starts and turns in back crawl technique.								*	*	*	*	*	*	*	*	*

TOPICS TO BE COVERED AT TRAINING PRACTICE																	
1. Set of shaping exercises	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
2. Hydrogymnastics	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
2. Repeating front crawl and back crawl techniques	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
3. Legwork exercises (in water)	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
4. Hand work exercises (in water)		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
5. Hand-leg coordination exercises				*	*	*	*	*	*	*	*	*	*	*	*	*	*
6. Practicing starts and turns in breaststroke technique								*	*	*	*	*	*	*	*	*	*

Result processing methods

The data on test subjects were obtained by measuring the same variables at two points in time – before and after completion of experimental swimming curriculum. The SPSS 13.0 software for Windows was used for data analysis. The results were analyzed using MANOVA (multivariate analysis of variance) method. The analysis was conducted at two levels: the overall level of all variables i.e. their variance, and on individual level of each variable (ANOVA). This method was used to test the significance of difference in value of

variance, being in fact a linear combination (sum, coefficient, multiplier of differentially weighted or by coefficient multiplied) individual variables, such that enables the biggest possible differentiation among groups of results.

Results

Average grade given for swimming skill (OPPL1) at the initial evaluation of boys was 2.06, placing them in the category of floaters. At final evaluation, average grade for swimming skill (OPPL2) for boys was 4,97 (Table 5).

Table 5: Descriptive statistics - boys

	Variable	Mean	N	Std. Devia.	Std. error
Pair 1	OPPL1	2.06	80	1.083	.121
	OPPL2	4.97	80	.157	.017
Pair 2	OPTK1	1.92	80	.838	.093
	OPTK2	4.28	80	.782	.087

Pair 3	OPTP1	1.45	80	.571	.063
	OPTP2	3.00	80	.595	.066
Pair 4	OPTL1	1.47	80	.711	.079
	OPTL2	3.21	80	.669	.074
Pair 5	V25MS1	30.07	80	5.286	.591
	V25MS2	20.30	80	3.288	.367

This shows that after the completion of swimming curriculum, the swimming skills among boys averaged at the level of a “swimmer”. Average grade for front crawl swimming technique (OPTK1) at the initial assessment was 1.92. After completion of swimming curriculum, the average front crawl grade (OPTK2) was 4.28 (very good). At initial assessment, average grade given for breaststroke (OPTP1) for boys was 1.45. Upon completion of swimming curriculum, their average grade for breaststroke swimming technique (OPTP2) was 3.00 (good). At the initial assessment, average grade given for the back crawl technique (OPTL1) for boys was 1.47. After completion of the swimming curriculum,

their average grade for back crawl technique (OPTL2) was 3.21 (good). When assessing situational efficacy of freestyle swimming 25 meters (V25MS1), at initial testing boys swam the said length very slowly, with average time of 30.07 seconds. At final testing, the boys have significantly improved the time they needed to swim 25 meters, and at the final testing (V25MS2) it took them 20.30 seconds.

Average grade for swimming skill (OPPL1) at initial testing for girls was 2.57, placing them in a category between floaters and semi-swimmers. At final testing, average grade given for swimming skill (OPPL2) for girls was 5.00 (Table 6).

Table 6 : Descriptive statistics - girls

	Variable	Mean	N	Std. Devi.	Std. error
Pair 1	OPPL1	2.57	70	.986	.117
	OPPL2	5.00	70	.000	.000
Pair 2	OPTK1	2.08	70	.775	.092
	OPTK2	4.27	70	.679	.081
Pair 3	OPTP1	1.70	70	.573	.068
	OPTP2	3.27	70	.657	.078
Pair 4	OPTL1	1.51	70	.631	.075

	OPTL2	3.30	70	.748	.089
Pair 5	V25MS1	30.20	70	6.275	.750
	V25MS2	20.29	70	3.445	.411

This shows that after the completion of swimming curriculum, the swimming skills among girls averaged at the level of a “swimmer”. Average grade for front crawl swimming technique (OPTK1) at the initial assessment for girls was 2.08. After completion of swimming curriculum, the average front crawl grade (OPTK2) was 4.27 (very good), and it was very similar to this parameter for boys. At initial assessment, average grade given for breaststroke (OPTP1) for girls was 1.70. Upon completion of swimming curriculum, their average grade for breaststroke swimming technique (OPTP2) was 3.27 (good). At the initial assessment, average grade given for the back crawl technique (OPTL1) for girls was 1.51. After completion of the swimming curriculum, their average grade for back crawl

technique (OPTL2) was 3.30 (good). When assessing situational efficacy of freestyle swimming 25 meters (V25MS1), at initial testing girls also swam the said section very slowly, with average time of 30.20 seconds. At final testing, the girls have significantly improved the time they needed to swim 25 meters, and at the final testing (V25MS2) it took them 20.29 seconds.

The result analysis at multivariate level (Table 7) shows a significant difference in values of all swimming variables taken together in situations before and after completion of swimming curriculum ($p = .000$), as well as between boys and girls ($p = .000$). In addition, a significant correlation between the gender and exercise program has been observed ($p = .004$).

Table 7: Multivariate analysis of variance (MANOVA) difference in values of applied variables of initial and final measuring, and difference between genders

Source of variability	Factor	Assessment of characteristic root	Value	F-ratio	Factor freedom degree	Error freedom degree	Level of significance
Between groups	GENDER	Pillai's Trace	0.142	4.766	5.000	144.000	0.000 **
		Wilks' Lambda	0.858	4.766	5.000	144.000	0.000 **
		Hotelling's Trace	0.165	4.766	5.000	144.000	0.000 **
		Roy's Largest Root	0.165	4.766	5.000	144.000	0.000 **
Within groups	Program	Pillai's Trace	0.961	707.427	5.000	144.000	0.000 **

Correlation Program * GENDER	Wilks' Lambda	0.039	707.427	5.000	144.000	0.000 **
	Hotelling's Trace	24.563	707.427	5.000	144.000	0.000 **
	Roy's Largest Root	24.563	707.427	5.000	144.000	0.000 **
	Pillai's Trace	0.113	3.655	5.000	144.000	0.004 **
	Wilks' Lambda	0.887	3.655	5.000	144.000	0.004 **
	Hotelling's Trace	0.127	3.655	5.000	144.000	0.004 **
	Roy's Largest Root	0.127	3.655	5.000	144.000	0.004 **

* F-ratio is statistically important at level below 5%

** F-ratio is statistically important at level below 1%

Therefore, the exercise program has not only resulted with significant change in overall value of swimming variables, but it has also modified the difference between boys and girls at multivariate level.

The results of the analysis of variance (ANOVA) with repeated measuring (Table 8) show that the F-ratios that are related to the swimming curriculum are statistically significant at the level below 1%, so it may be concluded that the swimming curriculum

has resulted with significant change in value of each of swimming variables. As expected, the curriculum resulted with decrease in variable V25MS, with simultaneous increase in values of all other swimming variables. Having in mind that variable V25MS presents the time needed to swim 25 meters freestyle, the smaller number in final measuring shows that all the subjects swam the 25 meter section much faster than at the initial measuring.

Table 8: Results of analysis of variance (ANOVA) with repeated measuring between initial and final assessment, and between the genders

Source of variability	Variable	Sum of squares (type III)	Degree of freedom	Variance	F-ratio	Level of significance
Program	OPPL	532.505	1.000	532.505	1000.578	0.000 **
	OPTK	386.143	1.000	386.143	2428.099	0.000 **
	OPTP	181.875	1.000	181.875	1056.774	0.000 **
	OPTL	231.710	1.000	231.710	1197.526	0.000 **
	V25MS	7229.251	1.000	7229.251	1316.190	0.000 **
Gender	OPPL	5.321	1	5.321	9.487	0.002 **
	OPTK	0.391	1	0.391	0.376	0.541

	OTPT	5.075	1	5.075	9.288	0.003 **
	OPTL	0.300	1	0.300	0.393	0.531
	V25MS	0.265	1	0.265	0.007	0.935
	OPPL	4.371	1.000	4.371	8.214	0.005 **
	OPTK	0.583	1.000	0.583	3.668	0.057
Correlation program x gender	OTPT	0.009	1.000	0.009	0.050	0.824
	OPTL	0.043	1.000	0.043	0.224	0.637
	V25MS	0.431	1.000	0.431	0.078	0.780
	OPPL	78.765	148.000	0.532		
	OPTK	23.537	148.000	0.159		
Error	OTPT	25.471	148.000	0.172		
	OPTL	28.637	148.000	0.193		
	V25MS	812.899	148.000	5.493		

** F-ratio is statistically significant at level below 1%

Since other variables concerned the assessment of technical performance of different swimming techniques, higher value of such variables suggest improved quality of swimming skill in all test subjects. Difference between boys and girls was proven only with regards to variable “assessment of breaststroke swimming technique” (OTPT $p = .003$), so it is safe to assume that girls have significantly higher values of this parameter both before and after completion of swimming curriculum. The correlation between the gender and exercise curriculum is significant only with regards to the variable “assessment of swimming skill” (OPPL $p = .005$). This is a negative correlation, since difference between boys and girls were significantly reduced after completion of the curriculum

DISCUSSION

The study results show that the swimming curriculum has significantly contributed to homogenization of elements responsible for efficacy of aspects of swimming front crawl, back crawl and breaststroke swimming techniques. At final assessment of swimming technique obvious was the improvement in proper performance of all three swimming techniques. Over time, the test subjects learned that they had to start “paddling” through water at a specific time in order to make the swimming easier and smooth. This has in any case led to reduced resistance and reduced negative part of the stroke, and increase in its positive part. During the implementation of the curriculum, the test subjects learned to properly and rationally use mechanics of breathing, hand movements and leg movements, thus ensuring good body position and faster and more efficient moving through the water. The better they

learned the moves, the higher continuous speed they had and required less adjustment when combining moves in fine combination of positions and movements. As it had been concluded in earlier studies (Ruhl et al, 1985, Bear et al, 1995), in the process of learning new moves (in this study – the swimming techniques), a motoric habit has been created that represents optimal use of the programmed moves. The obtained results suggest that swimming performance significantly improves under influence of adequate teaching methods, confirming results of earlier studies (Pivač, 1994; Franki, 1996; Dias et al, 2012). Comparison of results of earlier studies (Marinho et al, 2010; Catarina et al, 2009) leads to conclusion that a longer period is needed (in this case, a six month program) to achieve significant influence in terms of improving swimming performance of test subjects. Evidently, there is a correlation between performance of swimming techniques and time needed to swim 25 meters freestyle, confirming results of similar studies (Leko, 2011; Šamija, 2008; Thanopoulos, 2010; Beganović et al, 2012) on effectiveness of this form of teaching on transformation and improvement of swimming techniques and situational motorics.

Conclusion

Evidently extracurricular activities designed in this way may have a wide use, not only in kinesiology and health, but also in other areas closely related to growth and development of children. We must be aware of the fact that basic swimming skills may be lifesaving. What follows from this is that everything should be done to

improve swimming literacy from early childhood. Unfortunately, most children in Bosnia and Herzegovina complete their education without having learned elements of swimming in any systematic way. Ultimate goal of teaching swimming as extracurricular activity of primary school children should be to create proper motoric stereotype in swimming and moving in water until completion of primary education. Water-based exercises and games may have important educational value. Use of this curriculum may have positive effects not only in terms of learning elements of swimming, but also in terms of socialization of children through fun and play. This provides a good foundation for children to develop into independent and confident swimmers as they gradually learn, through play, elements of swimming. Once the children learn to swim properly, they can do such activities throughout their life. In addition, this curriculum may be implemented anywhere with basic conditions for swimming in place. Results of this study may serve as good basis for future studies aimed at improving physical and health education curricula of school children. Therefore, it may be concluded that methodics of teaching swimming as extracurricular activity shown in this paper proved very effective, main reason for it being the use of adequate methodical principles of systematicity and graduality, as those are of such extreme importance in work with children of this age. The presented results may have significant role and provide important directions when setting the goals of future studies in the field of physical education and kinesitherapy.

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EFEKTI EKSPERIMENTALNOG PROGRAMA UČENJE PLIVAČKIH TEHNIKA U OKVIRU VANNASTAVNIH AKTIVNOSTI KOD DJECE U OSNOVNOJ ŠKOLI

Sažetak

Cilj ovoga istraživanja bio je da se utvrde efekti eksperimentalnog programa nastave plivanja u okviru vannastavnih aktivnosti na dječake i djevojčice u osnovnoj školi. Ispitivanje je provedeno na uzorku od 150 djece iz sarajevske regije koja su odabrana metodom slučajnog uzorka, oba spola, dobi od $11,8 \pm 2,5$ godina. Od ukupnog uzorka, osamdeset (80) ispitanika su dječaci i sedamdeset (70) djevojčica. Za procjenu situacione motorike plivanja korišteno je pet varijabli što je obuhvatilo ocjena poznavanja plivanja, ocjena plivanja tehnikom kraul, ocjena plivanja tehnikom leđni kraul, ocjena plivanja tehnikom prsno, vrijeme preplivanje 25 metarske dionice slobodnim stilom. Istraživanje je provedeno u periodu od 24 sedmice (6 mjeseci). Program plivanja realizovan je u bazenu dimenzija 50x25 metara (prosječna temperatura vode bila je $27,9^{\circ}\text{C}$), dva puta sedmično po 45 minuta. Podaci o ispitanicima dobijeni su mjerenjem istih varijabli u dvije vremenske tačke, odnosno prije i poslije relizacije eksperimentalnog programiranja plivanja. Za analizu dobijenih rezultata korištena je MANOVA-a i ANOVA. Na osnovu rezultata istraživanja došlo se do zaključka da je program plivanja u znatnoj mjeri doprinio homogenizaciji elemenata odgovornih za efikasnost aspekata plivanja kod svih korištenih varijabli. Shodno tome može se zaključiti da metodika nastave plivanja u sklopu vannastavnih aktivnosti koja je primijenjena u ovom radu pokazala se veoma efikasnom, a glavni razlog za to je primjena adekvatnih metodičkih principa sistematičnosti i postupnosti, što je od iznimne važnosti u radu sa djecom ove dobi.

Ključne riječi: plivanje, metodika nastave, tjelesni odgoj.

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THE INFLUENCE OF MOTOR SKILLS ON SITUATIONAL–MOTOR EFFICIENCY OF SWIMMERS AGED 13 - 15

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Abstract

The main goal of this research was to determine the influence of motor skills on situational-motor efficiency of swimmers aged 13-15. The study was conducted on a sample of 70 swimmers aged 13-15 who are in a continuous training process in their clubs. In this study, we used a set of 10 variables of motor skills and 2 variables of situational-motor efficiency. Regression analysis was used within multivariate level in order to determine how strong is the influence of the system of predictor variables, in other words motor abilities, on the criterion system of variables which is represented by situational-motor skills in swimming. Displayed predictive values of used variables, as well as the ability to predict the results proved to be significant in this research, in all used criterion variables.

Key words: swimming, examinees, motor skills, influence, efficiency.

Introduction

Swimming is one of the oldest physical activities and sports. We witness constant growth in the popularity of swimming at the Olympic Games which has become very popular in modern sport, with the venues for swimming competitions being sold out at a record time. Nowadays swimming has become, except maybe in our country, definitely one of the most popular sporting disciplines. Swimming is a sporting discipline performed in specific conditions in water (water is 780 times more dense than air). It is necessary to distinguish between “swimming” and “swimming as a sport” because swimming is a basic movement through water, activity of a great

need and importance for every person, while swimming as a sport is about achieving quality sport results. Swimming belongs to monostructural motion of a cyclic type, where basic motor manifestation is directed towards propulsion in the water. Propulsion in the water is performed on the basis of a driving force which is the most important force for moving forward or in other words propulsion in the water, and is produced by the work of arm, leg and body muscles. The ability to maintain the body on the water surface is based on the principles of specific body weight, propulsion and balance in the water (Mikić et al. 2004). Human swimming is a human skill of self propulsion through water or other liquid or

maintaining body on the surface of the water, with horizontal body position, and by locomotor movement. Similar to other types of physical exercise, swimming also has its characteristics, which influence morphological, functional, motor, psychological and intellectual development of a person (Volčanšek, 1996). Gravitational and thrust force which have a relationship that can be described as action and reaction forces, have an influence on inactive body on the water surface. Gravitational force is more or less a constant, while thrust force is based on Archimedes' principle (Rađo, 1998). When human body moves through the water it is also influenced by a driving force (force of muscles) and a water resistance force. Water resistance force depends on the body shape, speed of movement through fluid, angle of attack for swimmer's longitudinal axis, liquid density and body smoothness. Resistance can be frontal, lateral and absorbing (Mikić et al., 2004). Driving force by its influence is opposite to resistance force and it depends on physiological cross-section of muscles, speed of biochemical processes occurring in muscles, amount of active motor units and on the central nervous system and its mobilization (Volčanšek, 1996). The main goal of this research is to determine the influence of motor skills on situational–motor efficiency of swimmers aged 13 – 15.

RESEARCH METHODOLOGY

Sample of examinees

Sample of examinees in this research includes swimmers from swimming teams “11. April” and “OLIMP”, both from Banja Luka.

This sample of examinees can be considered to be representative, since the most of medals and records were achieved by swimmers from this population.

Research included 70 swimmers aged 13-15, and testing included only examinees who were completely healthy during measurements. Examinees who didn't go through complete measurements were not taken into consideration.

Variables for the assessment of basic-motor skills

Motor skills are precondition for a quality performance of swimming techniques. For this research we made a selection of basic–motor variables from four latent dimensions of motor space, which were appropriate for the research. Testing of motor skills was conducted on recommendation. (Mikić, 1999).

Latent dimensions used in this research were: coordination explained by two variables (agility on the ground and coordination with a stick), flexibility explained by three variables (stick twist exercise, plantar flexion and toe-touch exercise on bench), repetitive strength explained by three variables (body lifting from a supine position, body lifting from a position of lying on the stomach and push-ups), explosive strength explained by two variables (long jump from a standing position and medicine ball throw from a recumbent position)

1. Stick twist exercise (MFLISK)
2. Toe-touch exercise on bench(MFLPRK)
3. Plantar flexion(MFLPLF)
4. Long jump from a standing position(MFESDM)
5. Medicine ball throw from a recumbent position(MFEBML)

6. Push-ups (MRESKL)
7. Body lifting from a supine position (MRCDTL)
8. Back twist exercise in a recumbent position (MRCZTL)
9. Agility on the ground (MKOKNT)
10. Agility with a stick (MKTOSP)

Variables for the assessment of situational-motor efficiency in swimming

1. Time of 50m crawl swimming (SMVPLK)
2. Time of 50m breaststroke swimming (SMVPLP)

Statistical data processing

In order to determine motor skills (predictor variables) on situational-motor efficiency of swimmers (criterion variables) we used **regression** analysis.

RESULTS AND DISCUSSION

Regression analysis of motor skills and criterion variable time of breaststroke swimming (SMVPLP)

Through regression analysis we determined statistically significant connection between motor skills, as a predictor system, and criterion variable time of breaststroke swimming (SMVPLP), as a criterion variable.

Multiple correlation coefficient has a relatively high value 64 % ($R = .642$), with overall explained variability of about 41 % ($R^2 = .411$) on statistically strictest level $Sig = .002$.

We can conclude that analyzed variables of motor skills in this paper participate in the prediction of criterion variable breaststroke swimming with participation of 41 % , while the other 59 % of variance belong to all other anthropological dimensions and other factors.

Partial influence of individual variables of basic-motor skills on criterion variables time of breaststroke swimming is selected in four variables with statistical significance.

The largest predictive value was expressed by variables: long jump from a standing position (MFESDM), toe-touch exercise on bench (MFLPRK), body lifting from a supine position (MRCDTL) i plantar flexion of the foot (MFLPLF).

Tests responsible for mechanisms of explosive strength of legs, flexibility and repetitive strength have dominant role on isolated predictive function.

This research is in accordance with researches conducted by Bulgakov (1979) who determined the significance of joint flexibility and explosive strength on the result in swimmi

Table 1. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.642 ^a	.411	.193	.65635

a. Predictors: (Constant): MFLISK, MFLPRK, MFLPLF, MFESDM, MFEBML, MRESKL, MRCDTL, MRCZTL, MKOKNT, MKTOSP

Table 2. Anova^b

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	10585	10	1,125	2,688	,013 ^a
Residual	23699	55	,433		
Total	34258	69			

a. Predictors: (Constant): MFLISK, MFLPRK, MFLPLF, MFESDM, MFEBML, MRESKL, MRC DTL, MRCZTL, MKOKNT, MKTOSP

b. Dependent Variable: SMVPLP

Table 3. Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	4,411	1,431		2,886	,009
MFLISK	,004	,002	-,283	-1,447	,121
MFLPRK	,014	,006	,407	3,122	,003
MFLPLF	,011	,006	,393	2,866	,008
MFESDM	,011	,008	,381	2,866	,009
MFEBML	,002	,001	,241	1,533	,091
MRESKL	,003	,012	,055	,244	,399
MRC DTL	,015	,006	,378	3,030	,008
MRCZTL	,009	,006	,306	1,605	,084
MKOKNT	,028	,086	,042	,216	,222
MKTOSP	,121	,095	,286	1,470	,096

a. Dependent Variable: SMVPLP

Regression analysis of motor skills and criterion variable time of 50m crawl swimming (SMVPLK)

Through regression analysis we determined statistically significant connection between motor skills, as a predictor system, and time of 50 m crawl swimming (SMVPLK).

Multiple correlation coefficient has a high value 69 % ($R = .682$), with overall explained variability of about 46 % ($R^2 = .463$) on statistically strictest level $Sig = .001$.

We can conclude that analyzed variables of motor skills in this paper participate in prediction time of 50m crawl swimming

with 46 % of participation, while the other 54 % of variance belong to all other anthropological dimensions and other factors.

Partial influence of individual variables of basic-motor skills on time of 50m crawl swimming is selected in six variables with statistical significance.

The largest predictive value was expressed by variables: stick twist exercise (MFLISK), plantar flexion of the foot (MFLPLF), toe-touch exercise on bench (MFLPRK), long jump from a standing position (MFESDM), medicine ball throw from a recumbent position (MFEBML) i back twist exercises in a recumbent position (MFLPLF).

Tests responsible for mechanisms of explosive strength, flexibility and repetitive strength have dominant role on isolated predictive function.

These results are in accordance with researches conducted by Volčanšek (1980) who wanted to determine crawl swimming time speed on 25, 50 and 300m on selected sample of examinees using testing of motor

skills. Tests of flexibility and explosive strength proved to be significant predictors which influence the speed of swimming on 50m. However, these tests showed no statistical significance for 25 and 300m swimming.

Table 4. Model Summary

Model	R	R Square	Adjusted R Square	Std.Error of the Estimate
1	,692 ^a	,463	,314	,65240

a.Predictors:(Constant):MFLISK,MFLPRK,MFLPLF,MFESDM,MFEBML,MRESKL,MRC DTL,MRCZTL,MKOKNT,MKTOSP

Table5 Anova^b

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	11829	10	1,166	3,886	,001 ^a
Residual	17783	55	,317		
Total	28513	69			

a.Predictors:(Constant):MFLISK,MFLPRK,MFLPLF,MFESDM,MFEBML,MRESKL,MRC DTL,MRCZTL,MKOKNT,MKTOSP

b. Dependent Variable:SMVPLK

Table6. Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std.Error	Beta		
1 (Constant)	5,125	1,288		3,971	,000
MFLISK	,018	,007	,486	4,090	,005
MFLPRK	,111	,077	,336	1,997	,041
MFLPLF	,014	,006	,488	3,988	,004
MFESDM	,011	,006	,386	2,125	,042
MFEBML	,009	,007	,361	1,833	,046
MRESKL	,003	,010	-,055	-,321	,633
MRC DTL	-,002	,004	-,226	-1,244	,103
MRCZTL	,008	,004	,411	3,820	,009
MKOKNT	,023	,072	,211	1,435	,062
MKTOSP	,031	,066	,052	,320	,660

a.Dependent Variable: SMVPLK

Conclusion

There are many swimming disciplines, so for each of them there is a need for a special model to be built, in relation to age, sex and discipline. Parameters being monitored in all age categories are mostly in connection with anthropometric features and motor skills (Leko, 2001). Motor skills can be divided in two groups: basic and specific. Basic motor skills are the base for each study. Specific motor skills depend on specificity of each sport discipline Kocić et al., 2009). Motor skills have a role in achieving swimming results, but their influence is unambiguously marked, because swimming results also depend on

other dimensions (morphological, functional skills and psychological factors). As far as the style of swimmers is concerned, it is individual and more successful for swimmers who do a better job in coordinating strength, speed, flexibility, endurance and coordination (Maglischo, 2003).

Through this research we determined that there is a statistically significant influence of motor skills, especially of explosive strength, flexibility and repetitive strength as predictors of situational-motor efficiency (as criterion) of swimmers aged 13-

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UTICAJ MOTORIČKIH SPOSBNOSTI NA SITUACIONO-MOTORIČKU EFIKASNOST PLIVAČA UZRASTA 13 DO 15 GODINA

Sažetak

Osnovni cilj ovog istraživanja je utvrđivanje uticaja motoričkih sposobnosti na situaciono-motoričku efikasnost plivača uzrasta 13-15 godina. Istraživanje je provedeno na uzorku od 70 plivača uzrasta od 13-15 godina koji se nalaze u kontinuiranom trenažnom procesu u svojim klubovima. U ovom istraživanju je primjenjen skup od 10 varijabli motoričkih sposobnosti i 2 varijable situaciono-motoričke efikasnosti. Regresiona analiza primijenjena je u okviru multivarijantnog nivoa s ciljem utvrđivanja veličine uticaja sistema prediktorskih varijabli, odnosno motoričkih sposobnosti, na kriterijski sistem varijabli koji je predstavljen situaciono-motoričkim sposobnostima u plivanju. Iskazane prediktivne vrijednosti primijenjenih varijabli, kao i mogućnost predikcije rezultata pokazala se značajnom u ovom istraživanju u svim primijenjenim kriterijskim varijablama.

Ključne riječi: plivanje, ispitanici, motorika, uticaj, efikasnost.

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STRUCTURAL DIFFERENCES IN BASIC MOTOR SKILLS OF FOOTBALL PLAYERS COMPETING ON DIFFERENT LEVELS OF COMPETITION

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Original scientific paper

Abstract

The aim of this paper is to determine structural differences in basic motor skills of football players competing on two different levels of competition. For the needs of the paper we used sample of 160 examinees and 12 manifest variables determining 4 latent dimensions: speed, agility, explosive strength and flexibility. Data obtained through this research show that there are differences between two levels of competition in basic motor skills, and that modern football that is higher level football requires from players even in the veteran stage of their career to have the following motor skills: quick and strong movement, ability of sudden acceleration and deceleration, quick change of direction, good and favourable body positioning, all of this in relation to the main prop used in football – ball, as well as handling the ball while in full speed and in contact with the opponent, in the conditions of high energy consumption.

Key words: Basic motor skills, structural differences, football players.

Introduction

Precondition for playing any sports, in this case football understands having specific skills, knowledge and abilities (Malacko; Rado 2004) which are manifested through the game of football. Game such as football, consists of many attributes and competences – it is a multivariate and specific game. It includes technical and tactical knowledge of the game, physiological, psychomotor and psychological factors. These qualities are necessary when a player competes and owns the ball, in maintaining a high level of work during the whole 90 minutes of a football match, for quick reaction and adaptability to change circumstances, regulating mental attributes before and

during a match. All these skills are manifested on higher or lower level, and all that depends on the level of competition, team positions and game style. They also vary in accordance with the age group, sex, and in different stages of a football season. Basis for the top quality performance in football is represented also by a spectrum of skills and tactical sense of individual players.

AIM OF THE PAPER

Determine structural differences in basic motor skills for two levels of competition.

SUBJECT AND PROBLEM OF THE PAPER

The subject of the paper are differences in basic motor skills of football players

competing on two levels of competition, and the problem is to determine the statistical significance of differences in basic motor skills of football players competing on two different levels of competition.

METHODS

Sample of examinees

For the needs of this research, sample of examinees included population represented by all U-19 football players from 8 teams (4 teams – 80 football players – Quality junior football leagues in Bosnia and Herzegovina and 4 teams – 80 football players –Entity junior football league), with total number of 160 examinees.

Sample of variables

For the needs of this research we used manifest variables determining speed, explosive strength, type of vertical and horizontal jump, agility, flexibility (12 variables). Tests for speed assessment: Sprint 5m from a standing start (MSB5M), Sprint 10m from a standing start (MSB10M), Sprint 20m from a standing start (MSB20M). Tests for agility assessment: Agility 93639 (MSA936), Illinois (MSAILL) Zigzag (MSAZIG). Tests for explosive strength assessment: Long jump (MSSDM), High jump (MSST), Drop jump (MSDJ). Tests for flexibility assessment: Leg stretching from the position of lying on the chest (MSFZL), Leg stretching from the position of lying on the back (MSFPL), Leg stretching from the lying recumbent position (MSFOLB). Metric characteristics of the tests were determined in the research Sporiš, G., (2007*), on the representative sample of

football players (U-19) from HNL. For that purpose, RTT12G program was used (Momirović. 1999).

Data processing methods

Factor analysis was conducted under congruence model (matching factor scores of the first and second level of competition). By matrix factoring, intercorrelation of manifest basic motor variables in hyperdimensional space, extracted in latent dimensions (main components) used to explain latent space of motor skills.

Results

In the space of basic motor skills of football players competing on Level 1 football competition, data from table 1 which were tested under Bartlett's test confirm that they can be subject to factorisation, which shows significance level (sig. .00). KMO and Bartlett's test of sphericity (table 1) were used to obtain data which show us that matrix is suitable for analysis using factor analysis method. For the sample of football players competing on Level 1 football competition, in the space of variables from motor group and by Keiser-Guttman criterion (lambda higher or equal to 1) 70.79 % of shared valid variance was used up which can be explained by 4 isolated factors (table 2). The first factor uses up most information about the used system of measures 34.90 %, while others use up less – the second factor 14.49 %, the third factor 11.71 % and the fourth factor 9.66 % of shared variance.

Four pure, independent and homogenous factors were isolated. The first main

* Sporiš, G. (2007). Effects of situational polystructural complex practice for morphological, motor, situational – motor and functional features

(Doctoral dissertation) Zagreb: Faculty of Kinesiology, University of Zagreb.

component with the largest part of explained variance was used up by variables (table 3): MSB5M (variable of speed on 5m), MSB10M (variable of speed on 10m) and MSB20M (variable of speed on 20 m) and it can be defined as a pure speed factor while at the same time being a general factor. The second isolated factor can be interpreted as a pure flexibility factor, since variables MSFZL, MSFPL, MSFOLB (Leg stretching from the position of lying on the chest, Leg stretching from the position of lying on the back, Leg stretching from the lying recumbent position) or in other words variables determining flexibility have the largest projections on this factor. The third isolated factor can be called a factor of explosive strength MSSDM, MSST, MSDJ (Long jump from a standing position, High jump – sargent jump test, Drop jump test). Variables which have the largest projection on this factor are manifest variables of vertical and horizontal explosiveness. We can define the fourth factor as a pure agility factor, since variables determining this motor skill: MSA936, MSAILL, MSZIG (test 93639, Illinois agility test and Zigzag) have the largest projection on this factor. In the space of basic-motor skills of football players competing on Level II football competition data from table 1a-4a which were subject to Bartlett's test confirm that they can be subject to factorisation, which shows significance level (sig. .00). By KMO and Bartlett's test of sphericity (table 1a) we obtained data which show information about suitability of matrix for analysis using factor analysis method. For the sample of football players competing on Level 1 football competition, in the space of variables from motor group and by Keiser-Guttman criterion (λ higher or equal to 1) 70.48 % of shared valid variance was

used up which can be explained by 4 isolated factors (table 2a). The first factor uses up most information about the used system of measures 32.92%, while others use up less – the second factor 16.96 %, the third factor 12.15 % and the fourth factor 8.44 % of shared variance. Through the analysis of structure matrix (table 3a) we see that on the main component the largest part of explained variance is used up by variables: MSA936, MSAILL, MSZIG (test 93639, Illinois agility test and Zigzag), therefore this factor can be defined as an agility factor while at the same time being a general factor. The second isolated factor can be interpreted as a pure factor of explosive strength MSSDM, MSST, MSDJ (Long jump from a standing position, High jump – sargent jump test, Drop jump test) since manifest variables determining this skill have the largest projection on this factor. The third isolated factor can be called a flexibility factor, since variables having the largest projections on this factor are manifest variables of flexibility MSFZL, MSFPL, MSFOLB (Leg stretching from the position of lying on the chest, Leg stretching from the position of lying on the back, Leg stretching from the lying recumbent position) and agility variable (agility test 93639). Variables MSB5M (variable of speed on 5m), MSB10M (variable of speed on 10m) and MSB20M (variable of speed on 20 m) have the largest projections on the fourth factor, so this factor can be defined as a pure factor of speed.

Table 1 i 1a. Values of KMO and Bartlett's test of motor skills – I and II level of competition

Table I – I level of competition

KMO i Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.745
Bartlett's Test of Sphericity	Approx. Chi-Square	385.833
	df	66
	Sig.	.000

Table I a – II level of competition

KMO i Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.718
Bartlett's Test of Sphericity	Approx. Chi-Square	318.146
	df	66
	Sig.	.000

Table 2 i 2 a. Factor analysis in the space of motor skills – I and II level of competition

Table 2 I level of competition

Explained variance								
Component		Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings ^a
		Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
dimension0	1	4.189	34.908	34.908	4.189	34.908	34.908	3.102
	2	1.740	14.499	49.407	1.740	14.499	49.407	1.655
	3	1.406	11.718	61.125	1.406	11.718	61.125	2.904
	4	1.160	9.668	70.794	1.160	9.668	70.794	2.802

Table2.a II level of competition

Explained variance								
Component		Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings ^a
		Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
dimension0	1	3.950	32.920	32.920	3.950	32.920	32.920	2.740
	2	2.036	16.968	49.888	2.036	16.968	49.888	2.853
	3	1.458	12.152	62.039	1.458	12.152	62.039	1.710
	4	1.014	8.447	70.486	1.014	8.447	70.486	2.606

Table 3 i 3 a. Structure matrix of motor skills – I and II level of competition

Table3 I level of competition

Structure matrix				
	Component			
	1	2	3	4
MSB10M	.924	.027	-.429	-.297
MSB20M	.874	-.132	-.518	-.362
MSB5M	.835	.028	-.132	-.470
MSFPL	-.037	.834	.083	-.002
MSFZL	-.273	.743	.150	-.006
MSFOLB	.228	.597	-.172	-.212
MSST	-.302	-.019	.882	.313
MSDJ	-.291	.041	.874	.226
MSSDM	-.321	.020	.772	.325
MSAILL	.365	.008	-.278	-.872
MSZIG	.455	.125	-.300	-.835
MSA936	.202	.114	-.268	-.777

Table 3a II level of competition

Structure matrix				
	Component			
	1	2	3	4
MSZIG	.855	-.269	.020	-.491
MSA936	.785	-.260	.251	-.043
MSAILL	.743	-.365	.033	-.441
MSST	-.345	.923	-.127	.117
MSDJ	-.363	.864	-.062	.190
MSSDM	-.189	.826	-.126	.188
MSFPL	-.080	.220	-.845	-.122
MSFOLB	-.040	-.157	-.687	.035
MSFZL	-.305	.367	-.647	.013
MSB10M	.377	-.131	-.056	-.862
MSB5M	.110	-.211	-.021	-.828
MSB20M	.547	-.171	.023	-.799

Table 4 i 4 a. Intercorrelation matrix of isolated motor skills components – I and II level of competition

Table4 I level of competition

Correlation of isolated components					
Component		1	2	3	4
dimension0	1	1.000	-.023	-.342	-.370
	2	-.023	1.000	.023	-.101
	3	-.342	.023	1.000	.299
	4	-.370	-.101	.299	1.000

Table 4a II level of competition

Correlation of isolated components					
Component		1	2	3	4
dimension0	1	1.000	-.299	.133	-.293
	2	-.299	1.000	-.114	.147
	3	.133	-.114	1.000	.054
	4	-.293	.147	.054	1.000

Discussion

Through the analysis of factors isolated in both groups of examinees, we see for the success in football well developed skills of quick and efficient change of direction are of primary importance, which is in fact precondition of success in quick and effective ball handling in situational conditions. From the structure of the first factor for both groups of examinees, we see that optimal situational efficiency is possible if it is based on well developed basic skills of agility and speed of football players. The only question is which motor skill is in fact the first and the most important in the hierarchy, speed or agility. Many authors consider speed to be a difference maker that separates successful teams from less successful (Marković, Bradić, 2008.). However, if we know that during a game from 1000 to 1400 different activities occur, in an average time of every 4 to 6 seconds, among which 150 to 250 of them are very short with high-energy (change of direction, turn, dribbling), (Mohr, Krustup i Bangsbo 2003; Bangsbo, Norregaard i Thorso, 1991; Rienzi et al., 2000; Reilly i Thomas, 1976) , where direction is not a straight line and doesn't have the end of movement, in that case this fact tells us that predominant activities in a football game are activities that can be identified with the definition of basic motor skill – agility. “Ability is the ability to change the body's position in space efficiently in a quick and purpose-serving way in the conditions of sudden stopping and change of direction (Jukic, I. et al, 2003). According to the opinion of experts

in the field sports and contact sports, agility is one of the most important motor skills regarding its contribution in top quality accomplishments in sports (Jukic, I. et al , 2003). By defining the first isolated components we can see that for Level I football competition speed was isolated as a factor which uses up most information about the used system, while agility does the same for the second. By analyzing the work and information obtained through conversations with coaches in the preseason we can draw conclusions which are completely equal with obtained first main components. In other words, we know that the two levels had different conditions and different work methods. Level I football competition had more serious approach to work in terms of organization, practice conditions, monitoring and control, however with lots of drill and controlled movement, while Level II had a game as a predominant method, not because coaches used new methods for development of football players' skills, but because that was maybe the only way for football players of that level to stay in training process and have any kind of preparation for the upcoming football season. Football players of Level II neither have better value nor better agility, the only advantage for them is that they are more homogenous group, on these grounds.

This fact is also confirmed by a graph “comparative arithmetic mean data of basic motor skills for football players competing on Level I and II football competition“. In fact, arithmetic mean values for all three variables are to the advantage of Level 1 football competition¹.

MSB5M	1,1468	1,1548
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¹Variables agility are inversely scaled variables, time variable where distance in meters is covered in

time and space and where lower result is in fact a better result

MSB10M	1,9196	1,9304
MSB20M	3,2316	3,269
MSSDM	210,6076	204,3768
MSST	47,5709	45,2072
MSDJ	48,038	45,0203
MSFZL	37,7848	43,5507
MSFPL	77,7848	80,6522
MSFOLB	60,5696	62,3188
MSA936	8,2859	8,5027
MSAILL	17,3509	17,5887
MSZIG	5,906	5,9772
PEAKTEPD	212,5696	195,6928
PEAKTEPL	210,9481	195,3609
PEAKTFPD	123,8101	114,7783
PEAKTFPL	118,9051	109,8493
MMO_D	57,9937	58,7696
MMO_L	56,5025	55,8783
IS	4,7646	4,7145

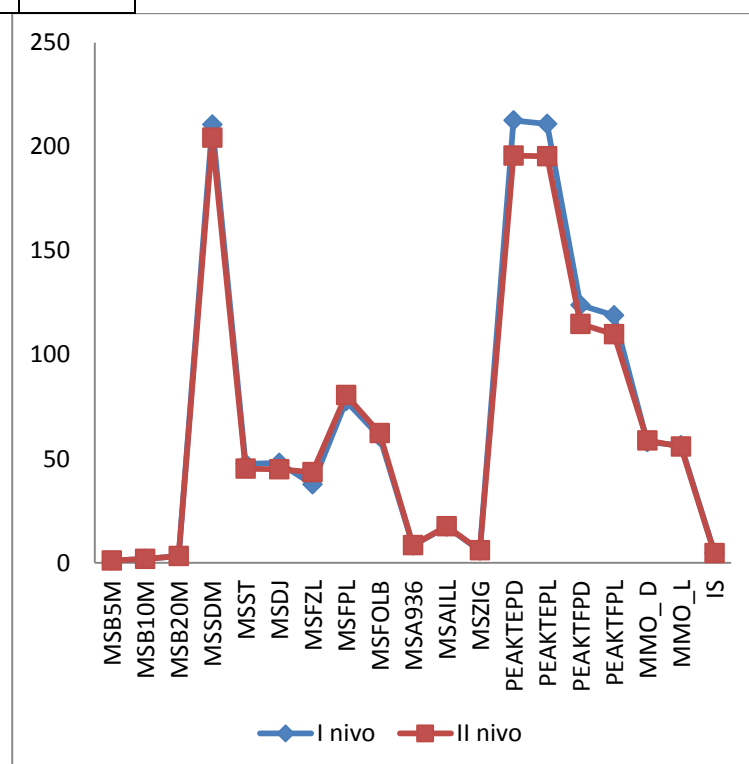


Table 5. Arithmetic means **Graph 1.** Comparative arithmetic mean data of basic motor skills of football players competing on Level I and II football competition

In fact, there is a possibility that work method causes creation of homogenous groups in certain skills. Football match used as a dominant method for football players development was the reason why

homogenous groups of players were created in one of the most important skills for the success in football. However, we can not say that the only thing needed for success is to have agility. Agility is useful to the

fullest extent only if we know how to use it at the right time and at the right place, whether a player or an opponent controls the ball. Many previous researches make connections between distance covered using high energy and sprint with the success in football, and therefore draw conclusions that they are important indicator of success (Krustrup *et al.*, 2005; Mohr *et al.*, 2003; Rampinini *et al.*, 2007). However, research conducted by Di Salve *et al.* (2009) on big sample including 53 players from English Premier League indicates that for matches in which lower ranked teams play better ranked teams, higher number of high intensity activities occur. Rampini *et al.* came up with similar results for Italian first league (2009). Authors came up with conclusions that performance ability of repeated high intensity activities is not crucial for the success in football but it is in connection with the importance of this activity in the function it has during a football match. They think that more intensive activities for lower ranked teams come as an inevitable consequence of their efforts to control the ball possession. In other words, overall time of high intensity activities and the number of covered meters using high intensity are not enough to be considered indicators of success in football.

Conclusion

Football is a very complex sport with many factors playing role in achieving top quality results. That is why there is no best and most suitable method for football players development, but with regard to the fact that we get ready to face the opponent, time, space, in that case the best indicator one should pay attention on when it comes to football training model is a match itself.

From a football match, we learn what should be focal point of a football practice. Bennhakker thinks that the secret of success in football lies in the need: “Always look for better and for improvement in training“. Conclusion in fact is that in order to have the best possible preparation for the upcoming games, preparation and practice should be organized in similar conditions that occur during a football match. Training to develop certain skills has to be based on specific features of football, or in other words through situations of a football match. A match can help us draw characteristics as well as specific features of football. (Verheijen, 1997.) Modern top quality football requires from players in the veteran stage of their careers to have the following motor skills: quick and strong movement, ability of sudden acceleration and deceleration, quick change of direction, good and favourable body positioning, (Rađo *et al.*, 2002) all of this in relation to the main prop used in football – ball, as well as handling the ball while in full speed and in contact with the opponent, in the conditions of high energy consumption (Komes *et al.*, 2005). A player does not have to be agile and quick but has to have a strong start and good timing, feel for the space or in other words good positioning (Alić, 2008). Those skills can be well developed only through a football match, because training of agility and sprint is not enough to ensure the success in football. Training and its situations then have clear aims of the game of football. Purpose of such models of training are further development of basic motor skills which eventually are used to accomplish the main goal and achieve the best possible results.

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STRUKTURALNE RAZLIKEBAZIČNO MOTORIČKIH SPOSOBNOSTI NOGOMETAŠA RAZLIČITIH NIVOVA TAKMIČENJA

Sažetak

Cilj ovo rada je da se utvrde strukturalne razlike bazično motoričkih sposobnosti kod nogometaša koji se takmiče na dva različita nivoa takmičenja. Za potrebe rada korišten je uzorak od 160 ispitanika i 12 manifestnih varijabli koje determiniraju 4 latentne dimenzije brzine, agilnost, eksplozivnu snagu i fleksibilnost. Dobijeni podaci nam govore da postoje razlike između dva nivoa takmičenja u bazično motoričkim sposobnostima, te da savremeni nogomet tj. nogomet većeg nivoa od igrača traži da u zreloj dobi posjeduje sljedeće motoričke vještine: brze i snažne pokrete, sposobnost naglog ubrzanja i kočenja, brze promjene pravca kretanja, postavljanjetijela u najpovoljniji položaj, a sve to u odnosu na svoj rekvizit – loptu, kao i baratanje njome u punoj brzini u kontakt s protivnikom i u uvjetima velike potrošnje energije.

Ključne riječi: *Bazično motoričke sposobnosti, strukturalne razlike, nogometaši.*

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CHANGES IN MOTOR CAPABILITIES OF DANCERS UNDER THE INFLUENCE OF THE PROPRIOCEPTIVE TRAINING AND JUMP ROPE TRAINING

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Original scientific paper

Abstract

The research was conducted on 84 examinees – young dancers of both sexes aged between 11 and 16. The examinees were divided by random chance into two groups, experimental (N=44) in which an experimental three-month program with 40 training unit was carried out and control group (N=40) where examinees were trained in a standard dance program. The experimental program consisted of the proprioceptive exercises on a balance board and trampoline, and skipping rope exercises. 8 variables for the evaluation of the motor capabilities and 1 variable for the evaluation of the situation-motor capabilities were applied during the research (the composite test).

The main goal of this research is to determine the existence of the statistically important differences and quantitative changes in motor capabilities of dancers after the application of the proprioceptive training program and jump rope training.

DIFFG and SSDIF analysis of the quantitative changes in motor capabilities was applied in determining global quantitative changes between initial and final measuring.

The results indicate that statistically significant quantitative changes (differences) have occurred under the influence of the proprioceptive training and jump rope training.

Key words: *dance, proprioceptive training, jump rope training, motor capabilities, differences, DIFFG and SSDIF analysis.*

Introduction

Dance belongs to a group of polystructural conventional sports. There are numerous researches which confirm the influence of the anthropological dimensions on dance in general and sport dancing (Oreb, 1989; Zagorc, Karpljuk i Friedl, 1999; Kostić, Zagorc i Uzunović, 2004; Lukić i Bijelić, 2006; Uzunović, 2008; Uzunović, Kostić i

Miletić, 2009; Vlašić, Oreb, Prlenda i Zagorc, 2011).

Proprioception can be understood as complex functioning of the nervous-muscular system in terms of transferring information from the peripheral receptors through the afferent and efferent nerves of the nervous system, which enables the body to maintain stability and orientation during the static and dynamic activities (Laskowski, Newcomer-Aney & Smith,

1997). Proprioceptive training stimulates the activation of proprioceptors, which enables an optimal reaction of the organism in urgent situations which may lead to an injury (Jukić, 2003).

Proprioception has been rarely used as an experimental program in dance, although it is essential for dancers both in preventing injuries and improving dance technique and performance. Batson (2009) indicates that it is necessary to work on the endorsement of the proprioceptive programs specially created for dancing, while the effects of targeted proprioceptive exercises on the dancers' technique, except children, were noticed as early as in 1992 (Green-Gilbert & Smith). In several researches, the effects of the proprioceptive training on the capabilities of the muscular strength have been determined (Heitkamp, Horstmann, Mayer, Weller & Dickhuth, 2001), agility (Malliou i sar., 2004; Yaggie & Campbell, 2006) and jump (Ziegler, Gibson & McBride, 2002; Kovacs, Birmingham, Forwell & Litchfield, 2004). Wolf-Cvitak, Grčić-Zubčević & Dolančić (2002) indicate that learning certain moves, in polystructural conventional sports, can be accelerated by relying on the kinesthetic feeling. Šebić-Zuhrić, Rado and Bonacin (2007) deduce that the proprioceptive training has accelerated the forming of the global control structures and enabled local differentiation, which resulted in higher endurance and higher quality movement. Moreover, it is deduced that proprioceptive training contents should be included in creating training activities for rhythmical gymnastics, and that precise defining of the types of activities, the number of repeating depending on transformation phases and activity goals, and the overall size and detailed contents should be programmed in accordance with the characteristics of

certain sports. Lukić (2010) deduces that, after conducted proprioceptive program, positive changes have occurred in all analyzed balance tests, one coordination test (MAGOSS) and the quality of performing the dance technique elements under the influence of the proprioceptive training. From this, a conclusion can be made that training program elements in sport dancing should also be based on the use of the proprioceptive training. Srdić (2012) has indicated that the proprioceptive training and jump rope training have produced statistically significant differences and quantitative changes (effects) of the treated anthropological areas (among the examinees of the experimental group in relation to the control group). On the basis of the regressive analysis results, Srdić (2013) has deduced that proprioceptive training and jump rope training have resulted in positive changes, which have a positive correlation with morphological characteristics, motor and functional capabilities (predictors) and changes in structure. The same author concludes that success in dance demands joint action of all above mentioned predictors.

Jump rope is used at the beginning of the training as a warm-up tool, but also for developing motor capabilities such as speed, coordination, reaction speed, explosive strength, agility balance, rhythm and kinesthetic and proprioceptive sensibility. Lee (2003) indicates that jump rope also helps to improve the dynamic balance. When it comes to motor and functional capabilities, Bašić, M. i Bašić D. (2005) point out that the jump rope training has an effect on the development of the aerobic endurance, anaerobic endurance, speed, reaction speed, agility, rhythm, balance, explosive strength, coordination,

and kinesthetic and proprioceptive sensibility.

The purpose of this paper is to determine the existence of statistically significant differences and quantitative changes in motor capabilities of dancers after the application of the proprioceptive exercise program and jump rope exercise program.

Work methodology

The sample of examinees

The research was conducted on the sample of 84 examinees – young dancers of both sexes aged between 11 and 16 from Dance club “Gemma” from Banja Luka, Dance club “City Jazz” from Banja Luka, Dance club “Bolero” from Banja Luka and Dance club “Orion” from Pale. The examinees were divided by random choice into two groups, experimental (N=44) in which an experimental three-month program with 40 training unit was carried out and control group (N=40) where examinees were trained in a standard dance program. All the examinees are competitors, properly registered at the national dance association, and regularly take part in competitions on the state's level or participated at least 3 months prior to undertaking the experimental treatment. The dance level of the competitors was I (international) or A (the highest national level).

The following criteria were used for selecting the examinees: all examinees were of age between 11 and 16, all of them were medically examined, all of them regularly attended the experimental program and all were registered competitors at the national dance association at the state level of Bosnia and Herzegovina.

The sample of variables

The sample of variables for the evaluation of motor capabilities was comprised of: the variables for the evaluation of balance (Flamingo balance test - MFLAMI), variables for the evaluation of segmental speed – movement frequency (hand tapping- MTAPRU, foot tapping - MTAPNO), variables for the evaluation of the explosive strength of legs (the long jump from a place – MFESDM, Sergeant jump test – MFEVIS), variables for the evaluation of coordination – the performance of the rhythmical structures (playing drums with hands and legs - MBUBRN), variables for the evaluation of the agility (lateral change of speed to the left - MLATBL, lateral change of speed to the right - MLATBD). The variable for the evaluation of the performance efficacy level of dance technique elements was represented by a composite test - SMKOMET. The above mentioned variables for the evaluation of motor capabilities were tested before the beginning of the experimental program and after the completion of the three-month program.

The composite test and grading scale

The composite test (SMKOMET) was specially designed for the needs of the evaluation of the performance efficacy level of dance technique. It was performed with the music of a different tempo and comprised of the following dance elements: salsa basic walk, chasse to the right, chasse to the left, releve, passe, padebure, turn to the right in hops 360 degrees, kick ball change, slide to the right, slide to the left and contraction- release action.

The performance efficacy of dance technique elements (the composite test) was evaluated during the trainings in the sports halls or gyms where the examinees practice

by three independent evaluators who had referee or coach certificates issued by the dance association. The grades were determined by the specially designed scale and criteria for the evaluation of the performance efficacy of dance technique. The examinees warmed up 15 minutes prior to undertaking the test. One dance instructor was employed for the purpose of demonstrating the test who explained the test elements in a pattern with music. The

examinees had the right to repeat given elements three times at most with music before they were evaluated.

The scale and criteria for the evaluation of the performance efficacy level of dance technique elements of the composite test are presented in Table 1.

Table 1. *The scale and criteria for the evaluation of the performance efficacy level of dance technique of the composite test*

Grade	Criteria
0	None of the elements was performed correctly or the most of the elements were not performed correctly, the examinee performs the elements out of the given rhythm
1	Several elements were not performed or were performed incorrectly, the examinee performs the elements out of the given rhythm
2	Elements were performed in given pattern with mistakes, the examinee did not perform all of the given rhythmical structures
3	The elements were performed correctly and in given pattern with minor mistakes, the examinee performed the elements in given rhythm with minor mistakes
4	The elements were performed correctly and in given pattern with one mistake, the examinee performed all elements in given rhythm, insufficiently good presentation
5	All elements were performed correctly and in given pattern, the examinee performs the elements in the given rhythm, dancer's presentation is good

Experimental program

The experimental program was carried out in three-month period, and it was comprised of the proprioceptive program (exercises on the balance board and exercises on the trampoline) and jump rope program. 40 training units were realized in total. At the beginning of each dance practice there was a warm-up for 10-15 minutes, and then experimental program was carried out for 15-20 minutes. Single tasks from the contents of the experimental program lasted between 30 seconds and 2 minutes. Within the experimental program, 13 trainings were carried out on the balance board, 13 trainings were carried out with the jump

rope, 12 trainings on the trampoline and 2 trainings on the balance board and trampoline in combination.

Data processing methods

The processing of the obtained results from this research with the application of the statistics and mathematical procedures was determined by the program packages SPSS 14 and STATISTIKA 6. DIFFG and SSDIF analyses were used for determining the global quantitative changes.

Results and discussion

The results of the DIFFG analysis of the quantitative changes presented in table 2

indicate to what extent the changes have occurred in the first main component of the differences of the motor capabilities. As it can be seen, the quantitative changes in the

motor capabilities in the first main component are not statistically significant because $p = 0,9251$.

Table 2 *The results of the DIFFG analysis of the quantitative changes*

Variables	P	K
MFLAMI	- 0.0187	- 0.0666
MTAPRU	0.0539	0.1683
MTAPNO	0.0007	0.0021
MBUBRN	- 0.0161	- 0.0953
MFESDM	0.9982	0.9998
MFEVIS	- 0.0885	- 0.0366
MLATBL	- 0.0055	- 0.1585
MLATBD	- 0.0077	- 0.2354

Mean	1.8928
F test	0.0083
DF 1	1
DF 2	83
P=	0.9251

Legend: Partial involvement of variables in the formation of the first main component of differences (P), The structure of the first main component (K), Arithmetic center of the component (Mean), F-test, degrees of freedom (DF 1,2) and testing the importance of differences in the first main component (P=)

In table 3, the results of the SSDIF analysis of the quantitative changes in motor capabilities have been shown for the experimental and control groups during the initial and final measuring. On the basis of

the given results, it can be seen that the global quantitative changes are statistically significant, but they do not extend through the entire system but in separate cases.

Table 3 *The results of the SSDIF analysis of the quantitative changes in morphological characteristics*

	A	D	S	R
MFLAMI	-1,9405	-0,1465	-0,5005	-0,4302
MTAPRU	2,4764	0,1111	0,5591	0,4806
MTAPNO	1,7933	0,0341	0,3871	0,3327
MBUBRN	1,7857	0,3381	0,763	0,6558
MFESDM	1,7543	0,004	0,1272	0,1093
MFEVIS	0,1648	0,0717	0,0515	0,0443
MLATBL	-0,0143	1,0947	-0,03	-0,0258
MLATBD	-0,1051	-1,198	-0,2318	-0,1992

M	=	1,3534
H	=	113,6819
F	=	13,0118

DF1	=	8
DF2	=	76
P	=	0,000

Legend: *A*-differences of the arithmetic centers; *D*-discriminating coefficients; *S*-standardized orthogonal projections; *R*-factors discrimination structure; Mahalanobis distance (*M*); *H*-Hoteling test (*H*); *F*- *f*-test of the variance analysis (*F*); *DF1*,*DF2*- degrees of freedom; *P*-probability

On the basis of the given results in table 4, the quantitative global changes in motor space have occurred under the influence of the proprioceptive training and jump rope training, and they are statistically significant at the level $p = 0,000$. The overall importance of all arisen changes is statistically significant, the changes did not occur through the entire system, but only in separate cases. The variables that contribute to the quantitative changes are: the balance test (MFLAMI), arms and legs speed movement frequency test (MTAPRU and MTAPNO), coordination test (MBUBRN),

and the test of agility to the right (MLATBD). Therefore, dance and proprioceptive training have an effect on the movement component and the increase in the capability of nerves to carry information (information for agility components). Statistically significant changes did not occur during the agility test to the left (MLATBL) and during the tests for the evaluation of the legs jumping ability which are characterized by the energy component.

Table 4. *Partial tests of the hypothesis on differences*

	F	P
MFLAMI	21,0414	0,0001
MTAPRU	26,262	0,0000
MTAPNO	12,5868	0,001
MBUBRN	48,8979	0,0000
MFESDM	1,3586	0,2456
MFEVIS	0,2227	0,6435
MLATBL	0,0757	0,7804
MLATBD	4,512	0,0344
DF1 = 1	DF2 = 83	

On the basis of the given indicators, it can be deduced that, in the experimental group of examinees, dance and proprioceptive training has had an effect on the increase in nerve capability to carry information to the movement structure components in dancing. In that way, an internal adaptation

has occurred, which is logical to happen as it is a precondition for movement and learning. It would later contribute to the influence on the energy component as well, which represents a good precondition for further development of the technique, i.e. esthetic expression component in dancing.

All of this contributes to the fact that internal adaptation and a breakthrough from the inside must occur.

Directions in which the above mentioned changes in motor capabilities have developed will be presented in the further analysis procedure. In table 5, the results of the SSDIF motor capabilities have been presented – Promax rotated askew assembly of differences in measuring which provides us with information on the direction of the above mentioned quantitative changes. On the basis of the given results in table 5, it can be easily noticed that the changes in motor capabilities occurred in four global directions.

The first direction (factor) describes the agility and explosive strength because it is mostly defined by the variables for the evaluation of the agility to the left and to the right (MLATBL, MLATBD) and the variable for the evaluation of the explosive strength of legs (MFESDM). This change is not surprising since dancing requires a lot of energy for the progressive horizontal

movement, sliding in space, i.e. gaining space.

The second factor describes the observation of the movement of legs, because it is mostly defined by the variables for the evaluation of the legs movement speed (MTAPNO) and playing drums with hands and legs (MBUBRN).

The third factor describes the coordination of arms and legs since it is defined by the variables for the evaluation of the arm movement (MTAPRU) and the variable for the evaluation of the vertical jump (MFESVM). A vertical component of the movement comes to the expression here because it is necessary to make the best jump as possible and have the least frequency of arms at the same time. When you jump less, you can work more with hands and vice versa. Therefore, the third factor is the vertical component of the dancer's movement, and specific dancing movement actually lies within it.

The fourth factor describes the balance since it is mostly defined by the test for the evaluation of the balance (MFLAMI).

Table 5. *The results of the SSDIF analysis of the motor capabilities – Promax rotated askew assembly of differences in measuring*

Variable	LD01	LD02	LD03	LD04
MFLAMI	0,0069	-0,1824	0,0277	-0,9497
MTAPRU	-0,139	0,0275	-0,7395	0,1381
MTAPNO	-0,0939	-0,8517	-0,1476	-0,2018
MFESDM	0,1342	-0,6457	0,5186	0,0463
MFESVM	(-0,5807)	-0,3046	0,139	-0,1643
MBUBRN	-0,0407	0,1922	(-0,6172)	0,3926
MLATBL	-0,7626	-0,2236	-0,1474	-0,0882
MLATBD	-0,862	-0,0042	0,1153	-0,0157

Legend: LD01,02,03,04 = factors

On the basis of the given results it can be deduced that the changes in the motor space developed in four global directions, scientifically and dance justified: the energy component for the realization of specific

dance movements in space, leg frequency, vertical component of movement and balance. All four factors are the result of the application of the proprioceptive training and jump rope training.

In further analysis, differences within individual groups have been presented. The group discrimination on the discriminating variable is significant and the groups differ between themselves. Considering that the changes went in four directions and that the occurred changes have been described, now it is necessary to understand in which way they can be projected on the discriminating variable (function).

The first factor, defined as the agility, is the factor that requires energy for movement in order to be realized. It has a positive value on the discriminating function and it amounts to 0,43 which can be considered that the changes went in the direction of the agility improvement, i.e. running with changes in direction. The groups mostly differ in that, and in a way that those examinees that have more energy are better, which is logical.

The second factor, defined as a step frequency factor, has negative projection on the discriminating variable and it amounts to -0,156. It has the great part because, in order to successfully realize dance structures, a greater movement frequency is required. It is certainly contributed in great extent by the proprioceptive training.

The third factor, defined as the coordination of arms and legs factor and directed towards the vertical movement component, did not occur under the influence of the proprioceptive training and it is not critical in distinguishing between the groups.

The fourth factor, defined as the balance factor, has a positive projection on the

discriminating variable and it amounts to 0,103, which has an effect on the distinguishing between the groups of examinees in a way that examinees from the weaker (control) group express better balance, and the experimental group express weaker balance. The probable reason for this is that the experimental group has practiced the dynamic balance more, since in dance the balance is always brought down, and also the experimental program is dynamically conceptualized. This fact gives us the right to deduce that the applied test for the balance evaluation (MFLAMI) is not suitable for the researches in dancing and that more convenient and valid test for the evaluation of the dynamical balance important for dancing should be found.

In general, it can be concluded that the quantitative changes have occurred in the motor space and that those changes occurred under the influence of the experimental program.

In table 6, the correlation between the isolated factors and their projection on the discriminating variable has been presented. On the basis of the correlations between the isolated factors, it can be seen that significant connections were not realized between the isolated latent dimensions. A connection can be noticed between the first and the third factor (0,182), and between the first and the fourth factor, where the connection is negative (-0,116). The above mentioned connections are relatively low.

Table 6. *Correlation of factors*

	LD01	LD02	LD03	LD04	DIVA
LD01	1	-0,1136	-0,0212	-0,0561	0,43
LD02	-0,1136	1	0,0295	0,2287	-0,156
LD03	-0,0212	0,0295	1	0,0084	0,053
LD04	-0,0561	0,2287	0,0084	1	0,103

DIVA	0,43	-0,156	0,053	0,103	1
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Legend: *LD01,02,03,04* = factors; *DIVA* = discriminating variable

In table 7, the results of the translation and dilatation analysis have been presented. On the basis of the analysis results given in the table, it can be noticed that the linear movements in the final measuring were a lot bigger in relation to the initial measuring. Dilatation denotes that the improvement in all variables has been made except in the variables for the evaluation of the explosive strength of legs and agility (MFESDM, MFEVIS, MLATBL, and MLATBD). During the balance test (MFLAMI), a strong homogenization of examinees has occurred. During the test (MTAPRU) there

were disagreements, and during the test (MTAPNO) there were no changes. During the test by which the coordination evaluation is conducted (MBUBRN), the increase in dispersion between the examinees has occurred.

Dispersion (spreading) is the evidence that the training has indeed had an effect (influenced) on the examinees' capabilities and thereby had an effect on the differentiation between them, which gives the right to make a conclusion that programmed tasks were sufficient to cause changes.

Table 7. *Translation and dilatation analysis of motor capabilities*

	MEAN-1	MEAN-2	DELTA	TL	VAR-1	VAR-2	DT
MFLAMI	7,4167	5,4762	-1,9405	0,7384	23,505	13,4399	0,7562
MTAPRU	38,2976	40,774	2,4764	1,0647	23,9812	29,12	1,1019
MTAPNO	50,0121	51,8055	1,7933	1,0359	27,9011	22,9739	0,9074
MBUBRN	9,7976	11,5833	1,7857	1,1823	5,3519	7,505	1,1842
MFESDM	146,7613	148,5156	1,7543	1,012	627,23835	90,7432	0,9705
MFEVIS	31,9626	32,1274	0,1648	1,0052	62,1494	59,4497	0,978
MLATBL	4,8499	4,8356	-0,0143	0,9971	0,3192	0,3555	1,0553
MLATBD	4,8996	4,7945	-0,1051	0,9785	0,357	0,4697	1,147

Legend: *Mean-1,2* = arithmetic centers at the 1. and 2. measuring; *DELTA* = difference; *TL* = translation coefficient; *VAR-1,2* = variance at the 1. i 2. measuring; *DT* = dilatation coefficient

Conclusion

The main goal of this research was to determine the existence of the statistically significant differences and quantitative changes in motor capabilities of dancers after the application of the proprioceptive exercise program and jump rope exercise program.

Through the DIFFG analysis of the quantitative changes in motor capabilities, it can be noticed that the changes in motor capabilities on the first main component of the treatment differences are not statistically important.

The results of the SSDIF analysis of the quantitative changes in motor capabilities have confirmed that the global changes in motor capabilities are statistically important

at the level $p = 0,0000$ and that occurred changes are more likely the result of the individual contribution of the variables to the quantitative changes in motor capabilities. On the basis of presented results, a conclusion can be made that the changes in motor space have developed in four global directions, scientifically and dance justified: energy component for the realization of the specific dance movements in space, leg frequency, vertical movement

component and balance. Therefore, a three-month transformational program has caused significant changes in the structure of motor capabilities, and thus it can be asserted that, after the conducted three-month transformational treatment, statistically important quantitative changes in motor capabilities have occurred in both groups of examinees.

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PROMJENE MOTORIČKIH SPOSOBNOSTI PLESAČA POD UTICAJEM PROPRIOCEPTIVNOG TRENINGA I TRENINGA SA VIJAČOM

Sažetak

Istraživanje provedeno na uzorku od 84 ispitanika - mladih plesača oba pola uzrasta 11 – 16 godina. Ispitanici su slučajnim izborom podijeljeni u dvije grupe, eksperimentalnu (N=44) sa kojom je realizovan tromjesečni eksperimentalni program sa 40 trenažnih jedinica i kontrolnu grupu (N=40) koji su trenirali po standardnom programu plesa. Eksperimentalni program su činile proprioceptivne vježbe na balans ploči i trampolini, te vježbe sa vijačom. U istraživanju je primijenjeno 8 varijabli za procjenu motoričkih sposobnosti i 1 varijabla za procjenu situaciono-motoričkih sposobnosti (kompozitni test).

Osnovni cilj istraživanja je da se utvrdi postojanje statistički značajnih razlika i kvantitativnih promjena motoričkih sposobnosti kod plesača poslije primjene proprioceptivnog programa vježbanja i vježbanja sa vijačom.

Za utvrđivanje globalnih kvantitativnih promjena između inicijalnog i finalnog mjerenja primijenjene su DIFFG i SSDIF analiza kvantitativnih promjena motoričkih sposobnosti.

Rezultati ukazuju da je došlo do statistički značajnih kvantitativnih promjena (razlika) motoričkih sposobnosti pod uticajem proprioceptivnog treninga i treninga sa vijačom.

Ključne riječi: ples, proprioceptivni trening, trening sa vijačom, motoričke sposobnosti, razlike, DIFFG i SSDIF analiza.

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DIFFERENCES IN POSTURAL STATUS OF FEMALE PUPILS AGED BETWEEN 11 AND 12 UNDER THE INFLUENCE OF VARIOUS PROGRAMS IN THE PHYSICAL AND HEALTH EDUCATION LESSONS

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Abstract

The period between 10 and 12 years old is called the period of older school age, or the period of sexual maturation, and denotes a group of physiological and morphological changes which are related to, or happen at the same time, the maturation of sex glands, sex organs and secondary sex-related characteristics. The purpose of this research is to determine the differences in postural status of female pupils aged between 11 and 12 under the influence of implementation of various programs during physical and health education lessons. The experimental group of female pupils had an aerobics program within the physical and health education. Obtained results have shown that the applied experimental program has significantly contributed to the improvement of proper posture.

Key words: *postural status, body posture, female pupils, physical and health education.*

Introduction

When considering the postural status of children, it is often, without good reason, spoken about deformities of a vertebral column, but it is actually meant on bad body posture, which, in relation to deformities, denotes more benign level of deviation from the normal posture. What all studies have in common is to point out the existence of the specific growth dynamics in the forming of upright posture where the

changes mostly happen in the direction of reduced spine mobility and more distinct deviation from the correct posture. Past researches most commonly point out deviations from normal posture in pupils of all ages (Milenković, 2000; Hadžikadunić i Balta, 2000; Ihme i sar.(2002); Bogdanović, 2006; Turković i sar. 2007; Saračević 2008 Džibrić, 2010; Čehajić,2012;

WORK METHODOLOGY

The purpose of this research is to determine differences in postural status of female pupils aged between 11 and 12 under the influence of various programs in physical and health education lessons.

Program and technique for the evaluation of body posture

In making the diagnosis and evaluation of body posture, Napoleon Wolanski's (1975) criteria was used to evaluate the interrelation of eight body parts by visual projection of marked points. Deviations are classified by size where:

0 point – denotes good posture,

1 point – denotes minor deviation,

2 points – denote significant deviation.

- zero 0 points - EXCELLENT posture,

- between one and four points – VERY GOOD posture,

- between five and eight points – GOOD posture,

- between nine and twelve points – BAD posture,

- between thirteen and sixteen points – VERY BAD posture.

Results and discussions

Percentage values of evaluations

Percentage values of the head posture evaluation

Table 1. Head posture evaluations of the experiment and control groups

Experiment group			Control group		
Grade	Frequency	Percentage	Grade	Frequency	Percentage
,00	32	53,33	,00	30	50,00
1,00	27	45,00	1,00	28	46,66
2,00	1	1,66	2,00	2	3,33
3,00	0	0,00	3,00	0	0,00
Total	60	100,0	Total	60	100,0

Percentage values of the head posture evaluations among girls from distinct groups are presented in table 1. Upon inspection of the above mentioned results we can assert that both sub-populations express high percentage values of the head posture deviations (no less than 50% of

examinees). Therefore, if we compared the groups of girls in this case, we could conclude that they do not quantitatively differ much from each other, i.e. that all those factors that caused bad head posture had an equal influence on all of them.

It is evident that the control group of girls has some bigger percentage values of grades 0 and 1. One can assume that the reason for this are insufficiently strengthened muscles of the head and neck (m.lonissimus capitis,

m.sternoclediomastoideus, m. spienius, m. trapesius, etc.).

Percentage values of the shoulder posture evaluations

Table . Shoulder posture evaluations of the experiment and control groups

Experimental group			Control group		
Grade	Frequency	Percentage	Grade	Frequency	Percentage
,00	30	50,00	,00	26	43,33
1,00	29	48,33	1,00	30	50,00
2,00	1	1,66	2,00	4	6,66
3,00	0	0,00	3,00	0	0,00
Total	60	100,0	Total	60	100,0

The analysis of the table 2 shows that female pupils of the experimental group, compared to the female pupils of the control group, have significantly higher percentage of deviated shoulder posture.

In other words, 50,0 % of girls from the experimental group have bad shoulder posture, while the percentage of girls from

the control group is at 56,66 %. However, in more detailed analysis of the tables it can be noticed that 6,66% of girls from the control group are evaluated with grade 2 which means that bad shoulder posture can be effectively eliminated by the corrective treatment of strengthening the back muscles.

Percentage values of the shoulder blades posture evaluations

Table 3. Posture evaluations of the shoulder blades of the experiment and control groups

Experimental group			Control group		
Grade	Frequency	Percentage	Grade	Frequency	Percentage
,00	28	46,66	,00	27	45,00

1,00	27	45,00	1,00	20	33,33
2,00	5	8,33	2,00	13	21,66
3,00	0	0,00	3,00	0	0,00
Total	60	100,0	Total	60	100,0

Percentage values of the shoulder blades posture evaluations among girls are presented in table 3. Upon inspection of the above mentioned results we can assert that both sub-populations express high percentage values of the shoulder blades posture deviations (experimental group 53,33 %, and control group 55,0 %). What is really worrying is the fact that the girls from the control group have high

percentage of bad shoulder blade posture evaluated even with grade 2. One can assume that the factors responsible for bad shoulder blades posture are insufficiently strengthened muscles responsible for moving shoulder blades towards the vertebral column (m. rhomboideus, m. trapezius, pars transversa, m. latissimus dorsi, pars scapularis).

Percentage values of the chest posture evaluations

Table 4. Chest posture evaluations of the experiment and control groups

Experimental group			Control group		
Grade	Frequency	Percentage	Grade	Frequency	Percentage
,00	40	66,66	,00	38	63,33
1,00	19	31,66	1,00	19	31,66
2,00	1	1,66	2,00	3	5,00
3,00	0	0,00	3,00	0	0,00
Total	60	100,0	Total	60	100,0

Upon inspection of the percentage values of the chest posture evaluations, given in table 4, it can be noticed that a lot of girls have normally developed chests, and 5,0 % of examinees from the control group was

evaluated with grade 2. Based on these results, a conclusion can be made that this part of the body is not deviated and therefore it is not necessary to apply corrective treatments.

Percentage values of the vertebral column posture evaluations

Table 5. Vertebral column posture evaluations of the experiment and control groups

Experimental group			Control group		
Grade	Frequency	Percentage	Grade	Frequency	Percentage
,00	33	55,00	,00	28	46,66
1,00	25	41,66	1,00	25	41,66
2,00	2	3,33	2,00	7	11,66
3,00	0	0,00	3,00	0	0,00
Total	60	100,0	Total	60	100,0

Percentage values of the vertebral column posture evaluations are presented in table 5. Upon inspection of the above mentioned results we can assert that both sub-populations express high percentage values of the vertebral column posture deviations, whereof the girls from the control group

have that percentage significantly higher and it is 53,33%. One can assume that the factors responsible for bad vertebral column posture are bad sitting habits and insufficiently strengthened back muscles responsible for correct posture of the vertebral column.

Percentage values of the stomach posture evaluations

Table 6. Stomach posture evaluations of the experiment and control groups

Experimental group			Control group		
Grade	Frequency	Percentage	Grade	Frequency	Percentage
,00	33	55,00	,00	29	48,33
1,00	25	41,66	1,00	27	45,00
2,00	2	3,33	2,00	4	6,66
3,00	0	0,00	3,00	0	0,00
Total	60	100,0	Total	60	100,0

The analysis of table 6 shows that the large number of examinees have good stomach

posture and that there are only six registered cases of bad stomach posture evaluated

with grade 2, which means that the strength of the stomach muscles is at the satisfactory level. The front upper body musculature is significantly stronger in relation to the back

musculature, which resulted in examinees having, in most cases, posture deviations of those body parts for which functioning the back musculature is responsible.

Percentage values of the legs posture evaluations

Table 7. Posture evaluations of legs of the experiment and control groups

Experimental group			Control group		
Grade	Frequency	Percentage	Grade	Frequency	Percentage
,00	29	48,33	,00	24	40,00
1,00	29	48,33	1,00	31	51,66
2,00	2	3,33	2,00	5	8,33
3,00	0	0,00	3,00	0	0,00
Total	60	100,0	Total	60	100,0

Upon inspection of the percentage values of the legs posture evaluations, given in table 7, it can be noticed that a lot of girls from the control group have deviated legs posture (60,0%), while the experimental group has

the percentage of 51,66%. Based on these results, a conclusion can be made that this part of the body is greatly deviated and therefore it is necessary to apply corrective treatments.

Percentage values of the feet posture evaluations

Table 8. Posture evaluations of feet of the experiment and control groups

Experimental group			Control group		
Grade	Frequency	Percentage	Grade	Frequency	Percentage
,00	35	58,33	,00	28	46,66
1,00	18	30,00	1,00	22	36,66
2,00	7	11,66	2,00	10	16,66
3,00	0	0,00	3,00	0	0,00
Total	60	100,0	Total	60	100,0

The results of the percentage values of the feet posture evaluations of girls are given in table 8. The result analysis shows that girls from the experimental group have less deviations in bad feet posture, but the percentage of 11,66% which is evaluated with grade 2 makes a big problem. The same percentage at the girls from the control group is even more noticable and numbers 16,66%, and therefore corrective treatments are necessary in this case, either in corrective exercises or orthopedic devices. The final discussion or final

conclusion of this part of the paper would be that bad posture of certain body parts has been noticed, which is most likely a reflection of nonharmonic strength development of certain muscle groups, and which occur as a result of inadequate application of programs in the physical and health education lessons, and inadequate choices of everyday physical activities, or as a result of everyday and uncontrolled practice of negative life habits.

Discriminating analysis of the postular status

Table 9. The results of the discriminating analysis of the postular status of girls from experimental and control groups

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	,195	100,0	100,0	,404

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1	,837	20,315	8	,009

Variables	Function
ODGLA	,750
ODRAM	,526
ODTRB	,364
ODGRU	,337
ODLOP	,244
ODSTO	,176
ODNOG	-,144
ODKIČ	-,036

Centroids

1,00	,438
2,00	-,438

The quantitative differences of the postural status of the girls from both control and experimental groups occurred while applying various programs in physical and health education lessons are presented in table 9. The analysis of the results shows that one statistically important discrimination function has been obtained at the level $p < 0.01$.

The position of the centroids points out that the control group was on the positive side of the discriminating function, which means that the larger number of examinees from the control group had grades one (1) and two (2). The inspection of the results from the given table shows that the greatest contribution to the discriminating function has the value of the head posture (ODGLA). It is assumed that the applied experimental program has sufficiently strengthened the muscles of the head and neck (m. lonissimus capitis, m. sternoclediomastoideus, m. spienius, m. trapezius, etc.), which resulted in the fact the experimental group had significantly less deviations of the head posture. Moreover, evaluations of the shoulder posture (ODRAM), stomach posture (ODTRB) and chest posture (ODGRU) have significant projections on the discriminating function. Back muscles (m. rhomboideus, m. trapezius, pars transversa, m. latisimus dorsi, pars

scapularis, etc.) are responsible for the correct postures of these body parts. On the basis of the above mentioned interpretations of the results, a conclusion can be made that the applied experimental program has significantly contributed to the improvement of the correct posture of upper body parts.

Conclusion

On the basis of the presented indicators, a conclusion can be made that increased longitudinal dimensionality of internal support system has a significant influence on the aberration of the upper body posture, and increased body weight and the amount of adipose tissue have negative influence on the lower extremities posture.

Obtained results from this research can serve as the significant prognostic factors which carry important information on the influence of some indicators of anthropometric dimensions on the posture of girls of juvenile age, and, at the same time, they can serve as the foundation guideline for the application of the kinesiology treatments in removing the above mentioned aberrations.

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RAZLIKE U POSTURALNOM STATUSU UČENICA 11-12 GODINA POD UTICAJEM RAZLIČITIH PROGRAMSKIH SADRŽAJA NASTAVE TJELESNOG I ZDRAVSTVENOG ODGOJA

Sažetak

Razdoblje od 10. do 12. naziva se razdoblje starijeg školskog uzrasta, ili period spolnog sazrijevanja, a podrazumijeva skup fizioloških i morfoloških promjena koje su povezane ili se zbivaju uporedno sa sazrijevanjem spolnih žlijezda, spolnih organa i sekundarnih spolnih osobina. Cilj ovog istraživanja je utvrđivanje razlika u posturalnom statusu učenika 11-12 godina pod uticajem primjene različitih programskih sadržaja u nastavi tjelesnog i zdravstvenog odgoja. Eksperimentalna grupa učenika je u okviru nastave tjelesnog i zdravstvenog odgoja imala programske sadržaje aerobika. Dobiveni rezultati su pokazali da

je primijenjeni eksperimentalni program u značajnoj mjeri doprinijeo poboljšanju pravilnog držanja tijela.

Ključne riječi: posturalni status, držanje tijela, učenice, tjelesni i zdravstveni odgoj.

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