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Respected readers,

Forty six years of existence and work of Faculty of physical education and sport of Tuzla University is the testimony to its mission, vision and development. The proof for that is also double issue of magazine "Sport – scientific and practical aspects", which we are publishing on the occasion of marking of faculty anniversary, forty six years of successful work and activity. In this way we prove that scientific thought, cognition interprets and promotes progressive reality but it is also the part of that reality, its designed strength and expression.

Visionariness is reflected in the fact that we can say that we educated our own staff and we can be proud that our faculty is one of the rare faculties at our university, which doesn't have the need for engagement of professors from other institutions and it disposes of the youngest and the most perspective scientific-professional staff.

As for further development, the fact is that we are now experiencing full expansion and that we created all preconditions for promotion of quality and competence.
Our motto is – satisfied employees, satisfied students and the trust of environment.

It is not our intention or wish to impress others with our successes, but to open the door for invention and creativity in the area of physical education and sport and promote scientific orientations and practical work in this area.

Our experience shows that every institution or individual succeeds or doesn't succeed in the life or activity they are occupied with and this depends on how much they are capable of promoting their values. If they don't have skills, the values stay unremarkable and then they transform into its contrariety, which can be fatal.

The Faculty of physical education and sport realized that such institutions can only be built on the value categories and does everything that these values become the real ones. First of all, the values have manifested in people at this faculty and without them it was not possible to build the stairs leading towards the top of science and profession. That's why in this institution the advantage is given first of all to people who can, wish and know to work. And not only that, the promotion of human values and their skills is made here, starting from students, assistants, teachers up to the faculty staff.

The value system has been established by which we have become recognizable institution, not only in the canton and the country, but also outside the borders of our country. We exchange the experiences with similar institutions in the neighbouring European countries and we also have some original achievements, which many others can envy. To be the same and still different from the others, this is the richness we try to achieve.

Editor-in-Chief
Prof. Branimir Mikić, Ph.D.

Poštovani čitaoci,

Četrdeset šest godina postojanja i rada Fakulteta za tjelesni odgoj i sport Univerziteta u Tuzli svjedočanstvo je njegovoj misiji, viziji i razvoju. Dokaz za to je i ovaj dvobroj časopisa "Sport – naučni i praktični aspekti". Kojeg objavljujemo povodom obilježavanja jubileja fakulteta, četrdeset šest godina uspješnog rada i djelovanja , dokazujući da naučna misao, saznanje interpretira i unapređuje progresivnu stvarnost, ali je i sama dio te stvarnosti, njena osmišljena i osmišljavajuća snaga i izraz.

Vizionarstvo se ogleda u činjenici da možemo konstatovati da smo odškolovali sopstveni kadar i sada se možemo pohvaliti da smo jedan od rijetkih fakulteta na našem univerzitetu koji nema potrebe za angažovanjem profesora sa strane i raspolaže najmlađim i najperspektivnijim naučno-stručnim kadrom.

Što se tiče daljeg razvoja, činjenica je da sada doživljavamo punu ekspanziju i da smo stvorili sve preduslove za promovisanje kvaliteta i kompetentnosti.
Naš moto je – zadovoljni uposlenici, zadovoljni studenti i povjerenje okruženja.

Nije nam namjera, niti želja da impresioniramo svojim uspjesima, nego da otvorimo vrata inventivnosti i stvaralaštvu u oblasti tjelesnog odgoja i sporta, te promoviramo naučne orijentacije i praktični rad u ovom području.

Naše iskustvo pokazuje da svaka institucija ili pojedinac uspije ili ne uspije u životu ili djelatnosti kojom se bavi, u zavisnosti od toga koliko je u stanju da promovira svoje vrijednosti. Jer ako nema tog umijeća, vrijednosti ostaju nezapažene i onda se pretvaraju u svoju suprotnost, što može biti pogubno.

Zato je Fakultet za tjelesni odgoj i sport spoznao da se ovakve institucije mogu graditi samo na kategorijama vrijednosti i čini sve da one budu prave. Prije svega, vrijednosti su se očitovale u ljudima ovog fakulteta, jer bez njih nije bilo moguće graditi stepenice što vode do vrha nauke i struke. Zato se u ovoj instituciji prednost, prije svega, daje ljudima koji mogu, žele i umiju da rade. I ne samo to, ovdje je napravljena promocija ljudskih vrijednosti i njihovog umijeća, počev od studenata, asistenata, nastavnika do osoblja Fakulteta.

Uspostavljen je jedan novi sistem vrijednosti po kojem smo prepoznatljiva institucija, ne samo u kantonu i državi, nego i van granica naše zemlje. Razmjena iskustava sa srodnim institucijama u susjednim evropskim zemljama, ali tu su i neka naša originalna dostignuća na kojima nam mnogi mogu samo pozavidjeti. Biti isti, a ipak tako različit od drugih, bogatstvo je koje pokušavamo steći.

Glavni i odgovorni urednik
Dr. Sc. Branimir Mikić, red. prof.

THE DIFFERENCES BETWEEN WINNING AND DEFEATED FOOTBALL TEAMS WHILE PERFORMING VARIOUS ACTIVITIES WITH A BALL

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Original scientific paper

Summary
The aim of research is establishing qualitative differences between winning and defeated football teams while doing different activities with a ball. This research has shown and confirmed that successful football teams (the winner) are statistically better at activities with a ball which enabled them to play more successfully, i.e. the teams which are well-prepared in terms of technique and tactic and they used that in the game and finally won the game. The results of this research allow the insight into the model (character and qualitative structure) of technical and tactical efficiency of winning football teams (i.e. successful teams) taken from the games of particular groups of matches and then comparing this model with specific technical and tactical possibilities of the certain team (with necessary caution) aiming greater efficiency and qualitative restructuring technical and tactical elements in the training process of footballers in order to develop better model of the game and increase the effect of training.

Key words: *winning and defeated football teams, activities with a ball.*

INTRODUCTION

The footballers' success during the match depends on a number of factors, such as physical competences, functional possibilities of their organism, technical and strategic capabilities, the level of theoretical and psychological ability and a set of other internal and external factors. The overall activity may be followed by tests and different scanning methods used in reality. Today there is a strong need to measure footballer's activity under complex game conditions in a quantitative and qualitative way. It is a complex practice but also useful since the information needed for work programming, evaluating of possibilities of footballer's development and assessing the current ability of players will be available. In reality different tests for assessing physical abilities, character and other traits are used. Scanning methods for checking footballer's activities under game conditions is used less frequently. The movement structure in a footballer's game is different. Often, completely new and unique movements required by a situation during the match must be performed, and thus following such activities is much impeded. However, all footballers come into contact with a ball which is an intermediary among them. Therefore all the methods by which technical, strategic and other players' activities during the match are examined are directed to observing players' behaviour when the ball is carried or when they play towards the ball. The references (Lazić, N. 1991, Jovanović, D. 1996, Radosav, R. et al. 2003, Smajić, M. et al. 1999 and 2006) state the measurements where the following footballers' activities have been observed: the overall running with or without a ball during the match, pace of running, range and efficiency of technical elements, length of the match, interruption of the game and so on. With all these observed elements the organizer introduces certain specific features and registers the information he or she considers necessary. All these instances of scanning do not have harmonized methodologies, and usually range and efficiency of these technical and strategic elements are observed. The problem of this research lies in establishing the differences between winning and defeated football teams while performing different activities with a ball. Due to a problem posed in such a way, the objective of research is limited to observing technique elements (ball activities), that is those that can be monitored by video recording. The aim of research is establishing qualitative differences between winning and defeated football teams while doing different activities with a ball.

METHODS

Sample of observed matches

In this research there were 16 matches in total within the Champions League in the season 2007/2008.

Sample of variables

The sample of variables in this research consists of some elements of techniques, that is 9 variables for estimating the activities with a ball: 1. short play from the first attempt [TEKROIPD, TEKROIPP, TEKROIPU], 2. long play from the first attempt [TEDUOIPD, TEDUOIPP, TEDUOIPU], 3. short play after reception [TEKROPPD, TEKROPPP, TEKROPPU], 4. long play after reception [TEDUOPPD, TEDUOPPP, TEDUOPPU], 5. short play after controlling [TEKROPVD, TEKROPVP, TEKROPVU], 6. long play after controlling [TEDUOPVD, TEDUOPVP, TEDUOPVU], 7. goal shot from the first attempt [TEUNGIPD, TEUNGIPP, TEUNGIPU], 8. goal shot after reception [TEUNGPPD, TEUNGPPP, TEUNGPPU], 9. goal shot after controlling [TEUNGPVD, TEUNGPVP, TEUNGPVU].

The possibility of solving the problem of research successfully depends not only on the way of data collecting but also on well-chosen statistical data processing.

The appropriate statistical methods are applied for all the variables used for the objective of research.

The methods for data processing are so chosen that can enable solving the problem in the appropriate way as well as accomplishing the aim of this research. In this research two statistical methods are applied:

1. descriptive statistical parameters, which are used for all winning and defeated teams, every used technical and strategic variable and every variable of the success of football game in attack.

2. discriminative analysis is used to highlight the differences between winning and defeated football teams while doing various activities with a ball.

RESULT AND DISCUSSION

In order to determine the qualitative elements in applied variables, the discriminative analysis between winning and defeated football teams is used. This analysis groups the differences between the two above-mentioned groups of teams. Since the differences between two groups of teams is examined, one discriminative function or factor is gained. For the purposes of establishing the criterion for pointing out the differences between groups in the applied systems of manifesting variables, Wilks' lambda and values of Hi square are calculated and they are placed in the mutual relation (p). Likewise centroids for both groups (winning and defeated football teams) are calculated. The complete procedure is done for proper controlling of certain elements of activities with a ball (if the ball is passed to the player from the same team or if there is a goal shot) and for improper (different from well-performed elements) and for total (the sum of well- and badly-performed elements).

Table (1) shows that the value is p=.03 which means that the differences between winning and defeated football teams regarding the number of well-performed elements of activities with a ball is statistical important, that is the isolated discriminative function is statistically significant.

Comparing the centroids of the group with the average values of each manifesting variable (Tables 2a and 2b) it is seen that the discriminative function belongs to winning teams, that is winning teams are statistically different regarding well-performed activities with a ball. Hierarchically greatest differences are caused by the variable or element of goal shot after controlling (TEUNGPVD), then goal shot after reception (TEUNGPPD) and long play after reception (TEDUOPPD). These variables contribute most to discrimination between groups.

Table 1. The structure of discriminative function between winning and defeated football teams in a well-performed activities with a ball

VARIABLE		FUNCTION
TEKROIPP		.010
TEDUOIPP		-.000
TEKROPPP		.000
TEDUOPPP		**-.306 ***
TEKROPVP		.024
TEDUOPVP		-.146
TEUNGIPP		.218
TEUNGPPP		**.360 ***
TEUNGPVP		**.381 ***
SQUARE OF CANNONIC CORELATION (LAMBDA)		.483
HI – SQUARE TEST		18.510
THE LEVEL OF SIGNIFICANCE (p)		.029
CENTROIDS	***WINNERS***	.999
	DEFEATED	-.999

Table 2a *Descriptive statistic parameters of well-performed activities with a ball of winning football teams*

VARIABLES	MIN	MAX	VWIDTH	AR.MEAN	ST.DEV.	ST.MIST.	Sk	Kt
TEKROIPD	92.000	184.000	92.000	122.750	28.202	7.050	.775	-.273
TEDUOIPD	6.000	29.000	23.000	16.625	6.682	1.670	-.038	-.475
TEKROPPD	52.000	212.000	160.000	133.375	54.232	13.558	-.092	-1.322
TEDUOPPD	8.000	28.000	20.000	15.813	5.844	1.461	.415	-.467
TEKROPVD	33.000	156.000	123.000	70.375	30.135	7.533	1.566	3.570
TEDUOPVD	6.000	19.000	13.000	12.063	3.957	.989	.264	-1.098
TEUNGIPD	1.000	9.000	8.000	4.687	2.626	.656	-.014	-1.111
TEUNGPPD	0.000	4.000	4.000	1.875	1.500	.375	.241	-1.579
TEUNGPVD	0.000	4.000	4.000	1.750	1.064	.266	.189	.213

Table 2b. *Descriptive statistic parameters of well-performed activities with a ball of defeated football teams*

VARIABLES	MIN	MAX	VWIDTH	AR.MEAN.	ST.DEV.	ST.MIST.	Sk	Kt
TEKROIPD	69.000	180.000	111.000	122.125	30.037	7.509	.141	-.227
TEDUOIPD	6.000	29.000	23.000	16.625	7.182	1.795	.070	-1.075
TEKROPPD	69.000	242.000	173.000	133.313	50.976	12.744	.948	.449
TEDUOPPD	9.000	34.000	25.000	20.188	8.248	2.061	.553	-.799
TEKROPVD	30.000	124.000	94.000	68.938	28.983	7.245	.480	-.854
TEDUOPVD	3.000	26.000	23.000	13.688	6.769	1.692	.666	-.181
TEUNGIPD	1.000	9.000	8.000	3.563	2.529	.632	1.018	.165
TEUNGPPD	0.000	3.000	3.000	.938	1.062	.265	.900	-.258
TEUNGPVD	0.000	3.000	3.000	.937	1.062	.265	.900	-.258

Statistically significant differences between winning and defeated football teams regarding the number of wrong activities with a ball are not determined. Table 3 shows discriminative function with p= .55, which is not statistically significant and more detailed interpretation of this function does not have particular significance. By comparing centroids of the groups and average values of every manifesting variable (Tables 4a and 4b) it is possible to point out only possible remark that the greatest projections of manifesting variables on discriminative function belong to defeated teams, that is the defeated teams differ most in badly-performed activities with a ball especially with the element long play after controlling (TEDUOPVP), long play after reception (TEDUOPPP) and goal shot after reception (TEUNGPPP).

Table 3. *The structure of discriminating function between winning and defeated football teams in badly-performed activities with a ball*

VARIABLES		FUNCTION
TEKROIPP		.089
TEDUOIPP		.267
TEKROPPP		-.130
TEDUOPPP		**-.482 ***
TEKROPVP		.174
TEDUOPVP		**-.548 ***
TEUNGIPP		-.177
TEUNGPPP		**.436***
TEUNGPVP		.287
SQUARE OF CANNONIC CORELATION (LAMBDA)		.735
HI – SQUARE TEST		7.836
THE LEVEL OF SIGNIFICANCE (p)		.550
CENTROIDS	***WINNERS***	.580
	DEFEATED	-.580

Table 4a. Descriptive statistical parameters of badly-performed activities with a ball of winning football teams

VARIABLES	MIN	MAX	VWIDTH	AR.MEAN	ST.DEV.	ST.MIST.	Sk	Kt
TEKROIPP	11.000	46.000	35.000	24.000	10.398	2.599	.619	-.438
TEDUOIPP	13.000	51.000	38.000	29.375	10.333	2.583	.238	-.276
TEKROPPP	5.000	28.000	23.000	13.938	5.949	1.487	.880	.674
TEDUOPPP	11.000	26.000	15.000	17.813	4.847	1.211	.243	-1.188
TEKROPVP	2.000	34.000	32.000	12.500	8.197	2.049	1.252	2.051
TEDUOPVP	5.000	22.000	17.000	10.688	4.798	1.199	.919	.583
TEUNGIPP	1.000	9.000	8.000	3.938	1.806	.451	1.346	3.497
TEUNGPPP	0.000	4.000	4.000	1.500	1.154	.288	.593	-.065
TEUNGPVP	0.000	10.000	10.000	2.250	2.516	.629	2.143	5.640

Table 4b. *Descriptive statistical parameters of badly-performed activities with a ball of defeated football teams*

VARIABLE	MIN	MAX	VWIDTH	AR.MEAN	ST.DEV.	ST.MIST.	Sk	Kt
TEKROIPP	9.000	40.000	31.000	23.063	7.270	1.817	.335	1.224
TEDUOIPP	11.000	59.000	48.000	25.563	13.956	3.489	1.243	.982
TEKROPPP	8.000	21.000	13.000	14.688	3.682	.920	-.008	-.715
TEDUOPPP	8.000	32.000	24.000	21.250	7.197	1.799	-.063	-.876
TEKROPVP	5.000	18.000	13.000	11.188	4.036	1.009	-.093	-.916
TEDUOPVP	6.000	23.000	17.000	13.938	5.384	1.346	.449	-.494
TEUNGIPP	1.000	11.000	10.000	4.438	2.920	.730	.971	.010
TEUNGPPP	0.000	3.000	3.000	.937	1.062	.265	.900	-.258
TEUNGPVP	0.000	7.000	7.000	1.500	1.932	.483	1.774	3.403

Table 5 shows statistically significant discriminative function at the level p= .01 which means that winning and defeated football teams differ considerably in term of statistics regarding the elements with a ball. The structure of discriminative function is heterogeneous alongside the forename which means that winning teams have been more successful in case of some elements but the defeated teams have been better in case of the others. Comparing the centroids of the groups with the average values of every manifesting variable (Tables 6a and 6b) it is seen that the winning teams differ considerably from the defeated ones by the absolute number of elements for estimating the activities with a ball although much bigger value in the variables goal shot after reception (TEUNGPPU) and long play after reception (TEDUOPPU) is seen. The previous analyses show that the winning teams had fewer wrong activities with a ball so it is logical that total value in the whole system of variables is smaller, and logically these are positive results, that is they contribute to better performance of winning teams.

Table 5. *the structure of discriminative function between winning and defetead football teams in all* activities perfromed with a ball

VARIABLE		FUNCTION
TEKROIPU		-.021
TEDUOIPU		-.100
TEKROPPU		.005
TEDUOPPU		**.312 ***
TEKROPVU		-.037
TEDUOPVU		.252
TEUNGIPU		-.073
TEUNGPPU		**-.442 ***
TEUNGPVU		-.262
SQUARE OF CANNONIC CORELATION (LAMBDA)		.437
HI – SQUARE TEST		21.095
THE LEVEL OF SIGNIFICANCE (p)		.012
CENTROIDS	***WINNERS***	-1.098
	DEFEATED	1.098

Table 6a. *Descriptive statistical parameters of all performed activities with a ball of winning football teams*

VARIABLES	MIN	MAX	VWIDTH	AR.MEAN.	ST.DEV.	ST.MIST.	Sk	Kt
TEKROIPU	105.000	230.000	125.000	146.750	33.347	8.336	1.163	1.438
TEDUOIPU	20.000	70.000	50.000	46.000	15.130	3.782	-.191	-.776
TEKROPPU	64.000	227.000	163.000	147.313	55.911	13.977	-.116	-1.290
TEDUOPPU	20.000	49.000	29.000	33.625	9.149	2.287	.144	-.814
TEKROPVU	36.000	190.000	154.000	82.875	36.989	9.247	1.583	3.993
TEDUOPVU	13.000	39.000	26.000	22.750	7.707	1.926	.767	-.437
TEUNGIPU	3.000	14.000	11.000	8.625	3.180	.795	-.076	-.822
TEUNGPPU	1.000	8.000	7.000	3.375	1.668	.417	1.282	3.225
TEUNGPVU	0.000	12.000	12.000	4.000	2.851	.713	1.478	3.144

Table 6b. *Descriptive statistical parameters of all performed activities with a ball of defeated football teams*

VARIABLES	MIN	MAX	VWIDTH	AR.MEAN.	ST.DEV.	ST.MIST.	Sk	Kt
TEKROIPU	78.000	205.000	127.000	145.188	33.560	8.390	.107	.224
TEDUOIPU	19.000	88.000	69.000	42.187	19.291	4.822	1.026	.578
TEKROPPU	78.000	261.000	183.000	148.000	53.400	13.350	.935	.381
TEDUOPPU	22.000	65.000	43.000	41.438	13.226	3.306	.245	-.829
TEKROPVU	40.000	134.000	94.000	80.125	30.192	7.548	.359	-.937
TEDUOPVU	15.000	49.000	34.000	27.625	9.769	2.442	.761	.170
TEUNGIPU	3.000	16.000	13.000	8.000	4.412	1.103	.771	-.858
TEUNGPPU	0.000	4.000	4.000	1.875	1.408	.352	.250	-1.079
TEUNGPVU	0.000	10.000	10.000	2.438	2.555	.638	1.877	4.425

CONCLUSION

On the basis of analysis of the results of examining the difference between winning and defeated football teams in doing various activities with a ball where discriminative statistical procedure has been used, the following can be pointed out:

1. All isolated discriminative functions belonged to winning teams and their structures show that all qualitative differences belong to winning teams, i.e. all the winning teams differ from the defeated ones regarding good performance of almost all activities with a ball.
2. The winning teams performed all the activities with a ball better than the defeated ones.
3. All obtained discriminative functions are statistically important in the level of .00 and they convey all the information about the structure of differences between winning and defeated football teams in applied activities with a ball.
4. This overall analysis of data and obtained results lead to the conclusion that the quality of the game is highly influenced by the performance of the activities with a ball and, of course, the number of successful attempts.
5. This research has shown and confirmed that successful football teams (the winner) are statistically better at activities with a ball which enabled them to play more successfully, i.e. the teams which are well-prepared in terms of technique and tactic and they used that in the game and finally won the game.
6. The results of this research allow the insight into the model (character and qualitative structure) of technical and tactical efficiency of winning football teams (i.e. successful teams) taken from the games of particular groups of matches and then comparing this model with specific technical and tactical possibilities of the certain team (with necessary caution) aiming greater efficiency and qualitative restructuring technical and tactical elements in the training process of footballers in order to develop better model of the game and increase the effect of training.

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RAZLIKE IZMEĐU POBJEDNIČKIH I PORAŽENIH FUDBALSKIH TIMOVA U IZVOĐENJU RAZLIČITIH AKTIVNOSTI S LOPTOM

Originalni naučni rad

Sažetak
Cilj rada je utvđivanje kvalitativnih razlika između pobjedničkih i poraženih fudbalskih timova prilikom različitih aktivnosti s loptom. Ovo istraživanje je pokazalo I potvrdilo da su pobjednički timovi bolji u aktivnostma s loptom što omogućava timovima da igraju uspješnije tj. da timovi koji su bolje tehnički i taktički pripremljeni iskoriste tu prednost i na kraju pobijede. Rezultati istraživanja dopuštaju pogled na model (karakter i kvalitativnu strukturu) tehničke i taktičke efikasnosti pobjedničkih timova (tj.uspješnih timova) uzetih iz utakmica posebnih grupa mečeva te zatim poređenje ovog modela sa specifičnim tehničkim i taktičkim mogućnostima pojedinih timova (s neophodnim oprezom) s ciljem veće efikasnosti i kvalitativnog restruktuiranja tehničkih i taktičkih elemenata u trenažnom procesu fudbalera kako bi se razvio bolji model igre i povećao efekat treninga.

Ključne riječi: pobjednički i poraženi timovi, aktivnosti s loptom.

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LATENT STRUCTURE OF STANDARD INDICATORS OF SITUATIONAL EFFECTIVENESS IN BASKETBALL IN BOSNIAN LEAGUE 6

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Original scientific paper

Summary
The aim of this research is to determine latent structure of basketball by applying Factor analysis (alpha method) on 15 standard indicators of situational effectiveness (FIBA), on the sample of 30 games in Bosnian Basketball League 6 for the champion of Bosnia and Herzegovina. Initial co-ordinate system is transformed by nonorthogonal rotation according to Oblimin criterion. By analyzing situational indicators that influence successfulness of the strongest basketball teams that reach the playoffs of Bosnian League 6 in battle for the championship trophy, four latent dimensions which present the structure of basketball have been identified in this research. These dimensions are: effectiveness of scoring from close range, effectiveness of scoring from mid-range, overall defensive effectiveness of players and specific defensive agility. For a complete analysis of the structure it is necessary to expand the basis of situational indicators.

Key words*: latent structure, factor analysis, situational indicators, shooting accuracy, defensive effectiveness, system matrix, extracted factors.*

INTRODUCTION

The research is aimed at providing a closer look as much as possible at professional and scientific conception of basketball, so that its impact contributes to theory and practise, all this with one main goal – that basketball offers its most exciting features to spectators and at the same time to be on the top level of game quality. Driving force of the development of basketball is creativity and brains, in other words intellectual and creative resources. Development of science that deals with basketball issues depends on the used state of accumulation of acquired knowledge, intellectual and creative potentials.

Process of winning trophies in basketball depends on creating a strong team, which is defined by individual quality of its players (Dezman, B. et al. 2002). By analyzing situational indicators which influence successfulness of basketball teams, our intention through this research is to identify structure of the game of basketball, the strongest teams that reach the playoffs on Bosnian League 6 and fight for championship trophy of Bosnia and Herzegovina.

The aim of this research is to determine latent structure of basketball by applying Factor analysis (alpha method) on 15 non-standard indicators of situational effectiveness (FIBA), on the sample of 30 games of Bosnian League 6 for the championship trophy of Bosnia and Herzegovina. Standard indicators of situational effectiveness in the game do not occur in an isolated state, therefore one can assume that it is important to determine their correlations for defining latent structure of basketball game and by that way determine latent dimensions by which basketball game can be well interpreted. (Trninic S, et al.1995).

RESEARCH METHODS

Entity sample

Data is collected on 30 games of Bosnian League 6 for the championship trophy of Bosnia and Herzegovina. Teams competing in the league are top 4 teams in the first part of Bosnian championship and 2 regional league (Goodyear – now known as NLB) members from Bosnia, KK Bosna Sarajevo and HKK Široki Brijeg. Home teams recorded their games and sent video material for the needs of this research. Total number of 30 recorded games was collected, in other words 60 entities (2 teams on every game). Every team played 10 games during League 6.

Variable sample

Activity of a basketball team is objectified by statistics, and it can be recorded through action successfulness. Structure of parameters in competition activity presents basis for comparative

analysis of teams, analysis of structural characteristics of the game itself, and the results by these analysis are starting point for more successful selection of players in team building process, more efficient programming of training camp and better choice of tactical concept in the game of basketball (Hajnal, L. Et al. 1990).

FIBA has standardized 13 indicators of situational effectiveness and you can find them in this research as demonstrating variables. Standard indicators of situational effectiveness (all in the game) are: number of made shots from two point range (S2US), number of missed field goal attempts from two point range (S2NE), number of made shots from three point range (S3US), number of missed attempts from three point range (S3NE), number of made shots from free throw line, one, two or three (SBUS), number of missed free throw attempts (SBNE), defensive rebound (SO), offensive rebound (SN), assists (A), personal fouls (OG), turnovers – lost balls (IL), steals (OL) and blocked shots (B).

We have expanded standard indicators of situational effectiveness with two more indicators: number of made layups (S2PO) and number of slam dunks (S2ZA). Data registration was made by official statisticians specially trained for that job.

DATA PROCESSING METHODS

With respect to the aim of research, alpha factor analysis is applied. For collection of demonstrating variables, this analysis evaluates factors in such a way that it shows us that they have maximal correlation with factors from universe. The basic data was processed by programmes for analysis of variable reliability and factor analysis for determining latent structure of basketball features. Guttman – Kaiser criterion was used for determining number of significant components, and for transformation of initial coordinate system Oblimin sloping-angle rotation.

RESULTS AND DISCUSSION

Table 1 provides measure of sampling adequacy with the value of 0.468. It is desireable that this value is big (maximum 1), but with regard to number of analyzed games (30 games) one could not expect bigger value. If we have less number of games this value will be even smaller and therefore it will practically prevent us from getting valid scores through factor analysis. In the second part of table 1, we can see result of Bartlett's χ^2 sphericity test which has the aim to show that correlation matrix differs from system matrix. In opposite case, every variable would be independent factor and the application of techniques of multivariant analysis would be questionable regarding non-correlation of certain variables.

***Table 1**: Measure of Sampling Adequacy and Barttlet's sphericity Test*

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.468
Bartlett's Sphericity Ttest	Approx. Chi-Square	229.233
	df	105
	Sig	0

Table 2 shows number of significant extracted components. Distinctive values of components bigger than 1 (according to GK criterion) are in bold. Percentage of explained variance by certain components and cumulative percentage of explained variance are shown in the table as well. The last column shows distinctive values after made rotation aimed at better presentation of results. Total number of six factors is extracted, during which the firts three are much more significant than the other three. First three components explain 45% of variability, while the next three explain additional 24%. Total percentage of explained variance is near 70% which is normal for these types of problems, although one can find smaller values in professional literature, and sometimes these values can reach up to 80%.

Table 2: Distinctive values of extracted components and percentage of explained variance

Total Variance Explained				
Component	Extraction Values of Squared Loadings			Rotation Values of Squared Loadings
	Total	% of Variance	Cumulative %	Total
1	**2.51729**	**16.78192**	**16.78192**	2.35530
2	**2.22623**	**14.84156**	**31.62349**	2.07427
3	**2.03783**	**13.58551**	**45.20900**	1.97607
4	**1.35128**	**9.00850**	**54.21750**	1.46048
5	**1.19252**	**7.95015**	**62.16765**	1.36153
6	**1.05755**	**7.05031**	**69.21796**	1.48974

One can see from scree plot (Picture 1) that the first three extracted factors are much more significant from the other three. Picture 1 shows distinctive values (eigenvalues) in component number function. Strong downfall is obvious after the third distinctive value.

Picture 1: Scree plot of distinctive values by factors.

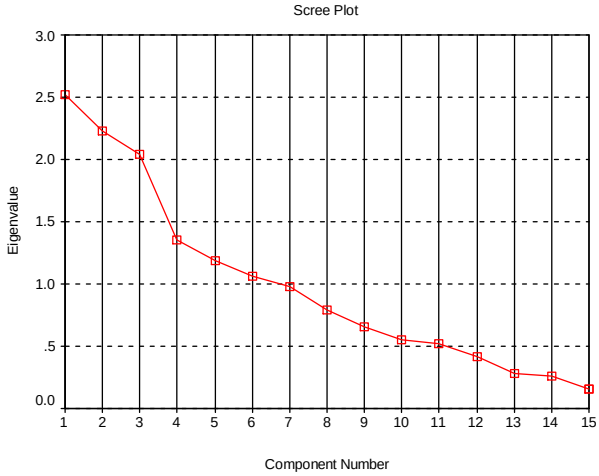

Table 3 shows system matrix. This matrix provides insight in parallel projections of certain variables with Oblimin factor and therefore it gives information about which variables mostly define certain latent dimensions of basketball in Bosnian League 6. One can clearly see from this table that all variables more or less participate in each of the components. However, for the first two components, and partially for the third, it can be concluded that they are almost completely defined by some variables that participate very little in other factors, while other three factors share variables that participate much more in each of the factors, or just in the first three factors. Therefore one can expect bigger correlation between second three extracted factors, unlike the first three which are pretty much independent, especially among each other. Sign before values supports the fact that some demonstrating variables are in opposition by their influence on the game (e.g. made and missed shots, turnovers and steals – lost and won balls etc.), and in that opposition they can still define some latent dimension.

Table 3: System Matrix

System Matrix						
Var	Component					
	1	2	3	4	5	6
S2US	**0.8381**	0.0446	0.1587	-0.0287	-0.2897	-0.1179
S2PO	**0.7214**	0.2846	0.2214	-0.0800	0.0445	0.0135
S2ZA	**0.5736**	0.0458	-0.4422	0.0949	-0.2280	-0.0497
A	0.4690	**0.7237**	-0.0035	0.0742	0.0748	0.0656
S2NE	0.0229	**-0.7122**	0.4327	-0.1907	0.0300	-0.0337
S3US	-0.2685	**0.6942**	0.0798	0.1133	0.3580	-0.1119
SN	0.3448	**-0.4318**	0.3283	0.1124	0.1014	0.2533
SBUS	0.1955	-0.4865	**-0.6186**	0.2756	0.1853	0.0574
OG	0.0537	0.1754	**-0.5171**	-0.1174	0.3920	0.4902
SBNE	0.3298	-0.2837	**-0.4665**	0.3008	0.3232	-0.0565
OL	0.2391	0.0473	0.3446	**0.6905**	0.0648	-0.3166
SO	0.2863	0.1365	-0.1436	**-0.6144**	-0.1736	0.0515
IL	0.0827	0.0178	0.4459	-0.2221	**0.6567**	-0.1434
B	0.3656	-0.1216	0.4558	0.0573	0.1558	**0.5662**
S3NE	-0.3531	0.2406	0.2304	0.4249	-0.3569	**0.5178**

Table 4: Structure matrix

Structure Matrix						
Var	Component					
	1	2	3	4	5	6
S2US	0.8871	-0.1415	-0.0428	0.0686	0.0530	0.1718
S2PO	0.7211	0.1775	0.0379	0.0131	0.2576	0.3044
S2ZA	0.5857	0.0506	-0.4512	-0.1261	-0.2430	-0.1280
S2NE	-0.0937	-0.7639	0.0710	0.0929	0.3145	0.2845
S3US	-0.1965	0.7299	0.2855	0.1522	0.1965	-0.1223
A	0.5388	0.6758	0.0780	-0.0021	0.0445	0.1160
SBUS	-0.0232	-0.2032	-0.8554	-0.0499	-0.1491	-0.0441
SBNE	0.1239	-0.0308	-0.7541	0.0757	0.0526	-0.0008
OL	0.2092	0.0464	-0.0107	0.8293	0.0635	0.1294
SO	0.3836	-0.0074	0.0809	-0.5997	0.0840	-0.1019
OG	-0.1081	0.4376	-0.4473	-0.4991	-0.0329	0.1740
IL	-0.0440	0.0540	0.1651	0.1037	0.8000	0.2750
S3NE	-0.2947	0.2254	0.3490	0.2405	-0.6142	0.3220
B	0.1858	-0.0835	0.0617	0.0634	0.1290	0.8259
SN	0.1610	-0.3881	-0.1289	0.1746	0.1504	0.5665

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.

Table 4 or structure matrix defines correlation between some demonstrative variables and extracted factors. Of course, the biggest correlation is expected between variables that are used to define factors. It can be noticed that some variables have high correlation with some factors, and at the same time almost insignificant with the other. Example for this are variables of free throw successfulness. This means that this factor is also almost fully explained by given variables and that is highly independent from the other. Unlike this, some other variables are almost equally present in explaining factor pair. Example for this is variable which defines assists and it has good presence in the first, and somewhat better in the second factor.

Table 5 shows correlation between extracted components. One can notice that almost completely independent components are calculated after rotation. In the first five extracted components there is no correlation bigger than 0.1 while only six factors have somewhat stronger correlation with the fourth and fifth factor. The point of certain components is that one can expect positive and negative correlation here and that resulted from the choice of demonstrative variables.

Table 5: Component Correlation Matrix

Component Correlation Matrix						
Component	Component					
	1	2	3	4	5	6
1	1.0000	0.0096	-0.0852	-0.0347	0.0633	0.0712
2	0.0096	1.0000	0.0643	-0.0462	-0.0418	-0.0453
3	-0.0852	0.0643	1.0000	0.0927	0.0709	0.0320
4	-0.0347	-0.0462	0.0927	1.0000	0.0181	0.1068
5	0.0633	-0.0418	0.0709	0.0181	1.0000	0.1128
6	0.0712	-0.0453	0.0320	0.1068	0.1128	1.0000

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.

By explaining four factors we can define latent structure of basketball in Bosnian League 6 for the championship trophy of Bosnia and Herzegovina with 15 standard indicators of situational effectiveness. Sure, total structure is not possible to define based only on these indicators. The first factor consists of variables: made shot from two point range, made shot from close range (layup) and successful slam dunk. This factor explains at most (16.78%) of total variability. Certain influence in this factor can also be made by variables of assist, offensive rebound and blocked

shot, but by their nature their belong to some other factors. This factor can be defined as **effectiveness of shooting from close range**.

First of all, this latent dimension is defined by variables that are characteristics of shooting the ball in some stages of game for each player position in a team separately. In set offensive play these variables are characteristic for low post players (centers and power forwards) whose offensive game is near the basket, and who are therefore in good position to have high shooting percentage for 2 point field goals, layups and slam dunks. It should be mentioned here that in transition stage of the game shooting from close range, layups and dunks are done also by backcourt players and small forwards. Assists are also very important feature of this factor. Large number of open 2 point shots, layups and dunks, very high percentage shots occur after a successful pass (assist).

The second factor includes assists variables (which are largely present in the first factor as well), missed 2 point shot, made 3 point shot and offensive rebound. This factor explains 12.84% of variability and together with the first factor more than 31%. Factor can partially be explained by the help of made free throws variable. This factor can be defined as **effectiveness of shooting from mid-range**. We defined the factor this way, because the highest projections with the second latent dimension have 3 point shot variable – successful (0.6942) and 2 point shot – unsuccessful (-0.7122) and assist, as a part of the game which preceeds shooting, but also offensive rebound which follows shooting and which also has high projections in this factor.Rebound effectiveness on the offensive end is a compatible part of basketball in the situation when two point field goal – is unsuccessful. Assist is very often precondition for good look from 3 point range. This means that defender is not near the shooter or he is in previous play drawn away as a help. Assist which in this factor has very high projection (0.7237) dominantly determines later effectiveness of mid range shot, and just as we noticed it has very big contribution to the first factor as well.

Variables of made and missed free throw attempts and personal fouls explain the third factor which gives 13.50% of the explanation of total variance. This factor can be explained by help variables, blocked shots, turnovers (lost balls), missed two point shots, offensive rebound and steals. Factor provides essential definition of **overall defensive effectiveness of players**. This latent dimension is characterized by indicators of situational effectiveness which are distinctive features of players who play on the defensive end. Quality of overall defensive effectiveness is demonstrated through number of personal fouls, blocked shots, and it results in possibility of free throw shots. Made and missed free throws which define this latent dimension suggest that it is about players who play all positions. It is usually the case that the backcourt players (guards and small forward) are good free throw shooters while frontcourt players (center and power forward) are not.

The fourth factor which explains 9.01% of total variance includes the most from the variables of steals and defensive rebound, but in the end it can be explained by free throw variables. This latent dimension is in the first place defined by variables that present agility, aggressiveness, explosiveness, emphasized will to take the possession of the ball, which characterize backcourt players and a small forward, but it can characterize front court players as well, but on the defensive end. In this factor, the two variables that explain it are considerably independent; therefore we can define this factor as **specific basketball defensive agility**.

Two remaining factors, the fifth and sixth, consist of one and two variables respectively. With regard to their high projections in other factors we assigned them for these factors. Blocked shots have significant projection in the third factor which we defined as overall defensive effectiveness. We can here join turnover (lost ball) variable which has isolated itself as independent in describing the fifth factor. Turnovers are direct consequence of defensive effectiveness; at least they should be on this level of competition quality, while in weak competitions we could explain it with insufficient technical quality of players.

CONCLUSION

Latent structure of basketball, in Bosnian League, functional dependence and mutual interaction, we can define as four latent dimensions: **effectiveness of shooting from close range, effectiveness of shooting from mid-range is the second factor, the third factor is defined as overall defensive effectiveness of players, and the fourth one is defined as specific defensive agility.**

In the end of this chapter, as a comparison, we would like to state results of research made by Mr. Trninic and contributors (1995). On games from World Championship in Turin in 1994, using factor analysis on 13 standard indicators of situational effectiveness, they isolated the following factors: effectiveness of back line of defence and front line of offence, effectiveness of front line of offence and back line of defence, overall offensive effectiveness and effectiveness of mid-range field goals.

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LATENTNA STRUCTURA STANDARDNIH POKAZATELJA SITUACIONE USPJEŠNOSTI U KOŠARCI U BOSANSKOHERCEGOVAČKOJ LIGI 6

Originalni naučni rad

Sažetak

Cilj rada je utvrđivanje latentne strukture u košarci primjenom faktorske analize (alpha metod) na 15 standardnih pokazatelja situacione uspješnosti (FIBA), na uzorku od 30 utakmica u Bosanskohercegovačkoj Ligi 6 koja se igrala za šampiona države. Početni koordinatni system je transformisan pomoću neortogonalne rotacije prema oblimin kriteriju. Analizirajući strukturu situacionih pokazatelja koji utiču na uspješnost najačih timova koji su se borili za titulu šampiona države u košarci, vidi se da su indentifikovane četiri latentne dimenzije. Ove dimenzije su: uspješnost poentiranja sa bliskog ostojanja, uspješnost poentiranja sa poludistance, generalna odbrambena uspješnost igrača i specifična odbrambena pokretljivost. Za kompletnu analizu ove strukture neophodno je proširiti bazu situacionih pokazatelja.

Ključne riječi: latentna struktura, faktorska analiza, situacijski pokazatelji, preciznost šutiranja, odbrambena učinkovitost, ekstrahovani faktori.

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THE PARTIAL QUANTITATIVE CHANGES OF HANDBALL SPECIFIC MOTOR ABILITIES PRODUCED BY 12-WEEK FITNESS PROGRAM

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Original scientific paper

Summary
The aim of the study was to find out partial quantitative changes of students' specific handball motor abilities, produced by applied 12-week combined fitness program. All participants were health sport faculty male students with ages 19 ± 1. The experimental program included a three times work out per week, two times resistance, weight training and once a week plyometric training. In order to detect potential changes we conducted paired sample t-test. The obtained results showed that the program has made statistically significant changes on 8 of 9 tests. The highest level of transformation has made on variables for ball handling estimation (28, 20 and 10, 66 %), while the smallest changes are produced on variables for evaluation of movement speed with the ball (2, 87 and 10, 66 %). We think, that fine adjusted training load to all participants, respectively, an individualised approach, contributed to the obtained results. Our opinion is that this kind of fitness program should be a part of regular faculty program during all educational period, in order to enhance students' basic and specific motor capacities and make their way to improve tehnical elements of different sports, easier.

Key words: *wheight and plyometric training, paired sample t-test*

INTRODUCTION

Every sport is demonstration of different basic and specific motor abilities through an application of technique of certain sport. Successful performance in all sports is determined by a large number of different abilities, its level and quality. Only well developed basic motor abilities can be a solid foundation for development of specific motor abilities. What we see, as a technique, during a football, basketball, volleyball or handball match (shooting, passing, dribbling, blocking, slam dunking, faking…) is just a manifest of what is behind it; basic motor abilities, or better said, specific motor abilities or skills. The basic motor abilities have been the interest of many researches in past years Gredelj at al 1975, Metikoš, et al. 1982, while the specific motor abilities are not so investigated.

The researches as Pavlin at al. (1982)[(5)] succeed in revealing the latent structure of handball specific abilities. They factorised twenty five instruments of assessing handball specific motor abilities. The obtained results showed existence of five factors that can be interpreted as factors responsible for shooting precision, ball handling skills, a movement speed with the ball, a movement speed without the ball and the power of throwing the ball. Also, Vuleta at al. (2003)[(11)] analysed a latent structure of similar battery of specific motor tests on sample of 215 Faculty of Kinesiology students and they confirmed research conducted by Pavlin and colleagues.

The other studies have been conducted in order to find out relationships between basic and specific handball abilities. Vuleta and Šimenc (1996)[(7)] using canonical correlation analysis confirmed statistical significant relationship between four basic motor abilities, represented by forty four tests, and handball specific motor abilities, represented by fifteen tests. Also, Vuleta (1999) [(8)] conducted a study on sixty four young handball players Using regression analysis he confirmed relationship between nine variables for basic motor abilities assessment and criterion variable defined as ball handling skills.

There are few researchers who dealt with effects of different fitness programs on the handball specific motor abilities. They mostly were conducting studies in order to test effects of fitness programs on basic motor abilities, or to test a combine handball-fitness program on basic and specific motor abilities. Vuleta et al. (2000)[(9)] analysed effects of 9-week programmed handball training on eight basic and four specific motor abilities. Using pair sample t-test they obtained results that showed positive changes on all tested variables. In addition, Vuleta et al. (2002)[(10)] investigated

changes of anthropological attributes in senior male handball players induced by training. They used 15-test battery (2 physiological tests, 9 basic motor tests and 4 specific handball motor tests). Obtained results showed the changes on fourteen of fifteen tests.

There wasn't any available research that checked only effects of fitness program on handball specific motor abilities. That is the main reason for conducting this study, respectively, to make sure if 12-week combined (resistance/plyometric) fitness program will create any changes of students' specific handball abilities.

METHODS

Participants

Thirty six actually healthy college male students with ages 19 ± 1 year participated in this study. All participants chose subject Fitness as an optional course. All of them had a shorter or longer history of physical activity participation, but during the study they were not included in any organised sport activity except those related with the research. Only participants who had hundred percent of training session attendance have been considered in the examination.

Instruments

The sample of variables consisted of a 9-test battery of measuring instruments assessing handball specific motor abilities. The analyzed tests covered the following hypothetical motor abilities: the ball handling skills: SPR2LO - the two balls dribbling, SBHZ1R - throwing and catching the ball with one hand, SBHL2R - jump shot throwing and catching the ball with two hands; a speed movement with the ball: SBVLS20 - 20 m slalom dribbling, SSBL20 – 20 m acceleration ability with the ball; a speed movement without the ball: SKOTBBL – a triangle movement – defence movement, SBIDP - lateral and back/forward movement speed; the power of throwing the ball: SSBLDS - the power of throwing the ball with the jump, SSBLM - the power of throwing the ball without the jump. In following tables variables are written with letter "I" or "F" at the end of all variables' acronyms. The letters represent initial and final testing session variables. The assessment was carried out in University sport hall in morning hours.

Experimental program

The realised fitness program consisted of two programs combination; the weight training (two times a week) and plyometrics (once a week). The program was carried out in the first semester of school year and it lasted for twelve weeks. Before participants started with weight training, they had been tested by sixteen weight lifting exercises (bench press, squat, hang clean, leg press, step ups, leg extension, leg curl, leg adduction and abduction, back extension, sit ups, sitting military press, triceps press downs, lat pull-downs, barbell upright row, standing curl bar curls) in order to get their 1 RM - repetitium maximum (the maximal load a person can lift in one attempt). Based on 1-RM the exercises' intensity has been determined for each participant. Prior the weight training subjects performed 15-minut warm up. The exercises' intensity has increased linearly from week to week as participants get stronger. Because the subjects were beginners in weight training, first two weeks of the program were designed in order to prepare their musculoskeletal system for the following training and to learn proper techniques and principles of this kind of resistance training. The rest of program was created to enhance muscular endurance and hypertrophy, and, as the program was approaching to the end, participants had to deal with sub maximal and maximal exercise's intensity which implicated maximal power enhancement. A number of series, repetitions and rest intervals were determined according to recommendations for beginners: "Training loads characterized by one to three series, with eight to twelve repetitions, intensities of 70 to 85% of 1MR and pauses between one and two minutes, correspond to the recommendations for muscular hypertrophy training with amateur/intermediate individuals" [(3)].

The second part of the program was related to plyometrics training. "Plyometrics refers to human movement that involves an eccentric muscle contraction immediately and rapidly followed by a concentric contraction. Plyometrics is a type of exercise training designed to produce fast, powerful movements (jumps, sprints, throws...), and improve the functions of the nervous system" [(3)]. Fifteen minutes warm up was standard procedure prior to plyometric exercises. In first two weeks subjects have met plyometrics training, its principles and safety consideration, and using low intensity exercises (skips, sprints, hops, double-leg jumps in place, running in place, skipping rope and side to side jumps over a small barrier) gradually reached more intense exercises, that included different depth jumps and medical balls toss. By means of different bench heights for drop jumps and different medical ball weights we successfully controlled the work out intensity.

The types of exercises and its intensity was determined according to the book "Jumping into plyometrics" (1998)[1], written by Chu, D.A.

RESULTS

Using a paired sample t-test we tried to ensure if the 12-week combined fitness program had produced any partial quantitative effects on tested variables. Two testing sessions were carried out; an initial, before the start of the program, and the other, a final assessment, after the program realisation. Table 1 shows descriptive statistic for all variables. As it noticeable all final variables' values have been increased comparing them with their initial pairs, except time determined variables where lower value means better result. Pre-post standard deviation values reveal that participants had the highest variability in variables for ball handling estimation, but the lowest variability in variables for a speed movement with the ball evaluation. Table 2 shows statistically significant correlation between every pre-post variable.

Table 1.

Paired Samples Statistics					
Pairs	**Variables**	**Mean**	**N**	**Std. Deviation**	**Std. Error Mean**
Pair 1	SPR2LOI	100,6203	36	83,53901	13,92317
	SPR2LOF	98,765	36	74,7458	12,4576
Pair 2	SBHZ1RI	13,33	36	3,389	,565
	SBHZ1RF	18,56	36	3,139	,523
Pair 3	SBHLZ2RI	17,03	36	2,063	,344
	SBHLZ2RF	19,06	36	1,620	,270
Pair 4	SBVLS20I	6,3911	36	,51405	,08568
	SBVLS20F	6,2083	36	,55482	,09247
Pair 5	SSBL20I	3,7689	36	,23889	,03981
	SSBL20F	3,6639	36	,19912	,03319
Pair 6	SKOTBLI	76,31	36	8,239	1,373
	SKOTBLF	83,19	36	6,342	1,057
Pair 7	SBIDPI	88,17	36	7,879	1,313
	SBIDPF	94,00	36	5,782	,964
Pair 8	SSBLDSI	27,71	36	4,192	,699
	SSBLDSF	29,736	36	3,6596	,6099
Pair 9	SSBLMI	28,319	36	4,2023	,7004
	SSBLMF	30,49	36	4,157	,693

Table 2.

Paired Samples Correlations				
Pairs	**Variables**	**N**	**Correlation**	**Sig.**
Pair 1	SPR2LOI & SPR2LOF	36	0,356	0,03
Pair 2	SBHZ1RI & SBHZ1RF	36	0,624	0,00
Pair 3	SBHLZ2RI & SBHLZ2RF	36	0,547	0,00
Pair 4	SBVLS20I & SBVLS20F	36	0,623	0,00
Pair 5	SSBL20I & SSBL20F	36	0,637	0,00
Pair 6	SKOTBLI & SKOTBLF	36	0,626	0,00
Pair 7	SBIDPI & SBIDPF	36	0,688	0,00
Pair 8	SSBLDSI & SSBLDSF	36	0,814	0,00
Pair 9	SSBLMI & SSBLMF	36	0,793	0,00

Table 3, the column "Mean" illustrates average differences of pre-post variables, that is, the effects produced by the 12-week fitness program realisation. The biggest differences are evident with variables for throwing and catching the ball estimation (SBHZ1R), and with variable jump shot throwing and catching the ball with two hands (SBHLZ2R). The t-test values are statistically significant for eight of nine variables, that means, the produced effects can be attributed to the

accomplished fitness program. That was not a case with one variable (SPR2LO), which t-test value are not statistically significant, although, there are some average differences between pre-post results, but they are not consistent across all subjects, i.e. several subjects improved their results, but several others did not. The produced outcome of the variable cannot be attributed to the program.

Table 3.

Paired Samples Test									
Paires	variables	Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	SPR2LOI - SPR2LOF	1,8555	90,08146	15,013	-28,623	32,334	,124	35	,902
Pair 2	SBHZ1RI - SBHZ1RF	-5,222	2,840	,473	-6,183	-4,261	-11,034	35	,000
Pair 3	SBHLZ2RI - SBHLZ2RF	-2,028	1,797	,299	-2,636	-1,420	-6,772	35	,000
Pair 4	SBVLS20I - SBVLS20F	,18278	,46539	,07757	,02531	,34024	2,356	35	,024
Pair 5	SSBL20I - SSBL20F	,10500	,18994	,03166	,04073	,16927	3,317	35	,002
Pair 6	SKOTBLI - SKOTBLF	-6,889	6,532	1,089	-9,099	-4,679	-6,327	35	,000
Pair 7	SBIDPI - SBIDPF	-5,833	5,730	,955	-7,772	-3,895	-6,109	35	,000
Pair 8	SSBLDSI - SSBLDSF	-2,0278	2,4464	,4077	-2,8555	-1,2000	-4,973	35	,000
Pair 9	SSBLMI - SSBLMF	-2,1667	2,6886	,4481	-3,0764	-1,2570	-4,835	35	,000

Table 4 shows a percentage of the effects produced by the applied fitness program. The variables in the table are arranged according to the abilities they represent. As it evident, the highest changes are made on variables for ball handling estimation (28, 20 and 10, 66 %), while the smallest changes are produced on variables for evaluation of movement speed with the ball (2, 87 and 10, 66 %).

Table 4.

Num	VARIABLES	Percentage of produced effect
1.	SBHZ1R - throwing and catching the ball with one hand	**28,20 %**
2.	SBHLZ2R - jump shot throwing and catching the ball with two hands	**10, 66 %**
3.	SBVLS20 - 20 m slalom dribbling	**2, 87 %**
4.	SSBL20 - 20 m acceleration ability with the ball	**2, 79 %**
5.	SKOTBL - a triangle movement	**9, 28 %**
6.	SBIDP - lateral and back/forward movement speed	**6, 21 %**
7.	SSBLDS - the power of throwing the ball with the jump	**5, 50 %**
8.	SSBLM - the power of throwing the ball without the jump	**7, 13 %**

DISCUSSION

Observing the obtained results, it is obvious that the established hypothesis was confirmed i.e. the realised program have produced the partial quantitative changes on eight of nine tested variables for handball specific motor abilities estimation. The highest effects have been produced on variables for ball handling evaluation (28, 20 and 10, 66 %). According to research conducted by Vuleta (1999)[8], for achieving good results in ball handling tests it necessary for one to have a high level of movement speed, agility, and explosive power of lower and upper limbs. Our training program was designed to enhance mentioned abilities. Weight training was a good base for application of plyometric training, that is, for sure, contributed improvement of limbs speed and explosive power. Knowing the structure of the tests (a result depends on number of bouncing

balls in determined time), it is clear that these abilities are dominant in the tests' realisation. On a base of the obtained results, Vuleta and Šimenc (1996) [7] concluded that mechanisms for muscles excitation intensity dominantly determine success in the three handball specific motor factors: a speed movement with the ball, a speed movement without the ball and the power of throwing the ball. Improvement of the mentioned mechanisms is a goal of combined resistance-plyometric training. That is to say, „When we mix weight training and plyometrics the purpose is the enhancement of speed - strength. We are concerned not just with the application of force, but the rate of force development. Speed strength deals with the "amount of internal strength which the neuro-muscular (the body's electrical system) is able to mobilize per unit of time"[6]. Therefore, it can be said that the applied fitness program produced positive changes on the variables.

It is noticeable that the lowest changes (2, 87 and 2, 79 %) are produced on variables for estimation of a speed movement with the ball. This fact, in a certain measure, was expected, because the participants had to apply their speed through a dribbling technique in the tests. As it said before, the applied program didn't include handball training, but only weight and plyometric training, so it wasn't expectable to improve their technique through the training. The low level of the technique probably influenced results obtained on the final testing session, and consequently lower changes comparing to the other variables.

CONCLUSION

As it was hypothesised, the twelve weeks combined fitness program has produced statistically significant partial quantitative changes on students' handball specific motor abilities. The effects are produced on all tested latent dimensions of handball techniques. So it is obvious that fitness program (weight and plyometric training) can be applied, independently of handball training, in order to improve specific handball abilities. Of course, this is not a case in a practice when handball players are trained, but an integrative approach of training is used, a combination of fitness training and handball training.

The research has been conducted to show that an improvement of basic motor abilities can increase a level of specific motor abilities, respectively, that basic motor abilities are, as their name says, a base, foundation, for specific motor abilities development. The fitness program can be used among sport faculty students in order to improve their basic motor abilities, and consequently, to simplifies their sport techniques affiliation.

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PARCIJALNE KVANTITATIVNE PROMJENE SPECIFIČNE RUKOMETNE MOTORIKE NASTALE POD UTICAJEM DVANAESTOSEDMIČNOG FITNESS PROGRAMA

Izvorni naučni rad

Sažetak
Na uzorku od 36 studenata Fakulteta za tjelesni odgoj i sport, dobi 19 ± 1 godina, primjenjen je kombinovani dvanaestosedmični fitnes program, koji se sastojao od dva treninga sedmično s tegovima u teretani i pliometrijskog treninga, jedanput sedmično. Obzirom na cilj rada, da se utvrde eventualne parcijalne kvantitativne promjene rukometnih situaciono motoričkih sposobnosti , nastale pod uticajem provedenog programa, korišten je t-test za zavisne uzorke. Na osnovu dobijenih rezultata vidimo da je provedeni program proizveo statistički značajne promjene na 8 od testiranih 9 varijabli. Najveći nivo promjena desio se na varijablama za procjenu sposobnosti manipulacije loptom, i to od 28, 20 % do 10, 66 %, dok su najmanje promjene nastale na varijablama za procjenu brzine kretanja s loptom. Također, manje, ali ne beznačajnije promjene evidentne su i na ostalim varijablama. Individualno prilagođeno opterećenje svakom ispitaniku, za sigurno je proizvelo ove značajne promjene. Smatramo da bi program trebao biti ugrađen u redovni plan nastave na svim godinama, kako bi doprinjeo povećanju motoričkih kapaciteta studenata, te samim tim poboljšanju svih situaciono motoričihm sposobnosti, a koje su neodvojiv dio tehnike svakog sporta posebno.

Ključne riječi: pliometrijski trening, trening s tegovima, t-test za zavisne uzorke

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ALGORITHM FOR FACTOR ANALYSIS IN INVERSIVE SPACE

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Original scientific paper

Summary
The aim of this research was to determine possibilities of latent dimension explication in inversive space which is usually completely ignored as a systematic and different mistake. Research design was made for PC by Borland Delphi developing tool. For the needs of this research and example, data for students described by 14 morphological variables have been processed. The results have shown that inversive space defined this way is not chaotic and that it possesses real existence which was possible to recognize and comprehend, and therefore credibly explain. Restrictions of models and algorithms only exist in the situation when inversion matrices of initial data are not Gramian, and this procedure is even possible in positive self-definite matrices. Practical implications of this research are more than explicit since they enable more detailed research on phenomena which were until now trapped in the space of unknown without possibilities of scientific clarification. Original way of research is indisputable, because there are simply no similar algorithms.

Key words*: algorithm, inversive, factorization.*

INTRODUCTION

Analysis of existence, content, information contribution and structure of latent dimensions has always been a real challenge for researchers in everyday scientific discipline that deals with exploring the unknown part of variability in research developments (Rao, 1973; Fulgosi, 1979; Bonacin, 2004).
Latent dimensions which are used to describe such developments are almost always defined on the data that are somehow related (e.g. correlations), and therefore information that we can easily recognize as latent dimensions are extracted through them with the help of appropriate procedures (Harmanm 1970; Mulaik, 1972; Momirovic, 1984). Although it all usually "takes place" in so called realistic space, for the purpose of identification of additional phenomena, it is possible to set the metric of variables in other spaces such as Guttman Image, Harris space….(Cooley & Lochnes, 1971; Momirovic, 1984; Johnson & Wicher, 1992; Bonacin, 2004; Bonacin, 2006).
Sure that given results, although initially on the same data, will not be equal if different procedures are applied for defining the metric of variables. It is usually possible to determine certain mathematic relations between different sets of latent dimensions under different metrics. However, there is a metric which is never used, and which maybe has its point. In other words, in determining joint part of variability of variable set or in defining one based on set of the remaining ones (smc, h2), the most effective procedure for determining uniquity is inversion of the matrix of relations, where the joint part (communality) of variables gets inversive matrices of relation through a large diagonal. At the same time, that doesn't mean that it is about completely different space, which is possible to be used on one completely different way.

Model

Information on the inversive dimension of some sample described by a set of, in principle (although not exclusively) quantitative variables which are interested for two reasons:
1) determining the part of variability which slowly slips from our hands and observing (if we look everything from the point of objective and positivistic rationality), & 2) inversive space is not particularly looked into, and therefore it is not very recognized. For the sake of easier understanding, it could be said, for example in terminology of physical technology, that for example relations between elements of some matter can be studied as firmness and inflexibility, that is resistance to primary disintegration, in other words preserving integrity. In that case, inversive space is in essence possibility of deformation, and consequently possibility of elasticity and plasticity as well (if the

force of effect is too high to overcome internal compactness of material). So, inversive space will indeed be opposite to the initial one, which therefore means that we can also study it on equal terms, and not to disregard it as the unknown part of variability. It will include parts of variability for which inversive latent dimensions are responsible.

Algorithm

Let's say that by using some criterion of definition, any object sample was extracted from E population with condition of representation e**i** *(i=1..x**1**)* described by set of variables v**j** *(j=1..y)* extracted from V population. By Hadamar method of value joining using selected objects we can get matrix of gross data B = E ⊗ V with elements b**i,j** *(i=1..x, j=1..y)*. Let's now standardize data in matrix B so that we have z**ij** = (b**ij** – m **j**) / σ**j**, where the vector of arithmetic mean is contained in m=Σb**1j** / x, while the standard deviation is defined as σ**1** = sqrt(Σ(b**ij**-m**j**)^2 / x). In matrix form, from the data standardized this way, we get correlations of variables under model of the highest authenticity such as R = Z' Z **1**/**x.** Using the operation of inversion under conditions I = R**1** * R**1**$^{-1}$, we calculate diagonal elements (such as D**jj** = dg (R**1**)$^{-)}$) from R matrix, which presents evaluation of one part of unexplained variability of all variables separately evaluated on the basis of the remaining ones, that is variable uniquity (u^2**j**).

Sure, communality of variables from R1 and R2 are simply h^2**j** = 1 - u^2**j**. Vector of communality h^2**j** presents explained part of variability for each and every variable on the basis of the remaining ones. At this moment in the procedures of analysis, inversive space is usually given up as uninteresting. However, if we take inversive matrix (R**1**$^{-1}$) we can see that it is positively definite, although there are situations where it is positively semi-definite and negatively definite, which depends on quality of the project in which it was extracted. In any case, if it is really positively definite (which is checked through determinant, distinctive values and communality of the original matrix), it is possible to apply the following procedure:

1. define diagonal matrix C=1/sqrt(dg(R**1**$^{-1}$));
2. operation A = C * R**1**$^{-1}$ * C, pre- and post-multiplication extract matrix A;
3. we now treat matrix A as a correlation of inversive variables in the system;
4. further procedure like the one with authentic data gives inversive latent dimensions.

EXAMPLE, METHODS AND RESULTS

For the model illustration, and for the needs of this work, we chose the sample group of 249 male students who are described by 14 morphological variables from very beginning of the first grade of elementary school, and measurement was made within project "Effectiveness of kinetic treatment for ages from 7 to 10" (MZT RH: 5-10-218). Data from three rounds of measurement were concatenated. Applied variables were: : body height, leg length, arm length, wrist diameter, knee diameter, biacromial width, bicrystal width, body weight, forearm circumference, lower leg circumference, average chest circumference, upper arm skin fold, back skin fold, and abdominal skin fold. These variables covered the whole morphological space within longitudinal transversality, volume and fatty tissue.

Table 1. Aslope rotated unit of Promac factor in the initial space and correlations of factors

	PRX1	PRX2
body height	**0.95**	-0.18
leg length	**0.91**	-0.19
arm length	**0.88**	-0.21
wrist diameter	**0.76**	0.02
knee diameter	**0.72**	0.08
biacromial width	**0.83**	-0.07
bicrystal width	**0.74**	0.09
body weight	**0.80**	0.31
forearm circumference	**0.62**	0.34
lower leg circumference	**0.65**	0.37
average chest circumference	**0.58**	0.47
upper arm skin fold	-0.05	**0.89**
back skin fold	-0.11	**0.95**
abdominal skin fold	-0.07	**0.94**
	PRX1	**PRX2**
PRX1	**1.00**	**0.34**
PRX2		**1.00**

Table 2. Aslope rotated unit of Promac factor in the inversive space and correlations of factors

	PRX1	PRX2	PRX3	PRX4	PRX5	PRX6	PRX7	PRX8
body height	0.06	**0.90**	-0.14	-0.03	-0.17	-0.01	0.01	-0.20
leg length	-0.02	**-0.85**	-0.06	-0.02	-0.03	-0.05	-0.01	-0.49
arm length	-0.12	0.07	0.12	0.02	0.03	-0.10	-0.04	**0.88**
wrist diameter	-0.03	-0.11	0.19	0.07	-0.17	**-0.79**	-0.18	-0.03
knee diameter	-0.13	-0.07	0.18	0.06	-0.16	**0.81**	0.02	-0.16
biacromial width	0.03	0.01	0.06	0.02	-0.05	0.16	**0.86**	-0.02
bicrystal width	0.12	-0.14	-0.15	-0.03	**-0.60**	0.20	-0.46	0.27
body weight	-0.12	-0.16	-0.15	-0.02	**0.93**	0.05	-0.13	0.11
forearm circumference	-0.37	0.03	**-0.71**	0.00	-0.29	-0.11	0.07	-0.05
lower leg circumference	-0.13	-0.07	**0.81**	-0.06	-0.26	-0.06	0.12	0.13
average chest circumference	**0.77**	0.18	0.12	0.01	-0.05	-0.02	-0.26	-0.28
upper arm skin fold	**0.75**	-0.11	-0.10	-0.03	-0.18	-0.08	0.39	0.11
back skin fold	-0.41	0.09	0.04	**-0.85**	-0.03	0.02	-0.08	-0.04
abdominal skin fold	-0.36	0.07	-0.03	**0.87**	-0.05	0.01	-0.05	-0.01
	PRX1	**PRX2**	**PRX3**	**PRX4**	**PRX5**	**PRX6**	**PRX7**	**PRX8**
PRX1	1.00	-0.09	0.00	-0.01	0.19	0.08	0.04	0.11
PRX2		1.00	0.08	-0.06	0.05	-0.04	0.03	-0.12
PRX3			1.00	0.04	0.10	-0.05	-0.07	0.01
PRX4				1.00	-0.05	0.05	-0.09	-0.06
PRX5					1.00	0.01	-0.04	0.01
PRX6						1.00	-0.07	0.06
PRX7							1.00	0.03
PRX8								1.00

DISCUSSION AND CONCLUSION

According to Table 1. we obtained 2 latent dimensions which were easy to identify as: 1. general mechanism of growth and development of active locomotor segments (bones, muscle system); 2. mechanism of growth and development of passive ballast tissues (fatty tissue). These two latent mechanisms are in significant but not so high relations (0.34). It can be concluded that development of students is still largely undifferentiated , that is differentiation which can be recognized in grown men has not yet started, therefore there is still no separation inside the bone development on longitudinality and transversality, while at the same time integration of muscle system in the active syncretistic system is still present.

However, in inversive space (Table 2.), many interesting details can be seen. First of all, that's how no less than 8 relatively independent latent dimensions were isolated. Therefore if integrative processes are registered in the initial space and realistic metrics, in that case the word natural means that disintegrative phenomena can be expected in several (8) ways, where each of them has its characteristics (Cote & Buckley, 1987; Momirovic & sur., 1987; Bonacin, 2004). It is visible that the volume of thoracic cavity and the fold of upper arm go in the same direction (Prx1), and other folds are negative, which presents the evidence of existence of some sub-mechanism of upper body voluminosty. Noticable values of leg height and length can also be seen. Although being very high, these values are with opposite signs (Prx2), which says that there is sub-mechanism of height growth and leg growth divergence. Very similarly, but very topologically, it can also be noticed in lower leg and forearm volume (Prx3), which means that mechanism of uneven development of distal extremity segments. That situation is repeated with fatty tissue (Prx4) which describes topological difference of fatty tissue development in relation to frontal flat surface.Especially interesting is the position of bicrystal range and body mass (Prx5) where it can be seen that one of the directions of disintegration is directed towards mass in relation to body center. Similar to mechanism Prx3, transversal dimensions (Prx6) are sensible to topological functionality, so one can recognize topological divergence of joint development. The last two factors (Prx7 and Prx8) describe only one independent segment of development divergence, specifically biacromial and the growth and development of arm length. As it can be seen, analysis in inversive space gave entirely logical indicators and refers to multiple divergences which can not be detected by other methods. It can be concluded that problems with latent dimensions must not on any account be strictly seen in the initial space, regardless of the fact is it realistic, image, Hariss or something like that. It is obvious that models constructed under conditions of explication of latent phenomena from variable relation can not give complete answers on many questions concerning determining of the phenomena that can not be directly measured, regardless of the fact which scientific discipline we talk about. Part of the answer surely lies in inversion metrics, and as far as we can see, based on examples, many interesting findings

and conclusions are possible, logical and potentially very interesting for the scientific world. It is not out of question that this method will become very poplar, after its good sides are determined, therefore it can be recommended as a very strong complement procedure in all analyses of latent dimensions, regardless of which changes we talk about - explorative, confirmative or other.

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ALGORITAM ZA FAKTORSKU ANALIZU U INVERZNOM PROSTORU

Originalni naučni rad

Sažetak

Svrha ovog istraživanja bilo je utvrđivanje mogućnosti eksplikacije latentnih dimenzija u inverznom prostoru koji se obično potpuno zanemaruje kao sistematska i drugačija greška. Dizajn istraživanja bio je usmjeren na logički model i matematički algoritam koji je kao računalni program je realiziran za PC računalo u razvojnom alatu Borland Delphi. Za potrebe ovog istraživanja i primjer obrađeni su podaci učenika opisanih sa 14 morfoloških varijabli. Rezultati su pokazali da inverzni prostor definiran na ovaj način nije kaotičan i da posjeduje stvarnu egzistenciju koju je bilo moguće prepoznati i razumjeti, pa time i vjerodostojno interpretirati. Ograničenja modela i algoritma samo postoje u situacijama kad matrice inverza inicijalnih podataka nisu gramianske, a čak je postupak moguć i kod pozitivno semidefinitnih matrica. Praktične implikacije ovog istraživanja više nego su jasne jer omogućavaju detaljnije istraživanje fenomena koji su do sada ostajali u prostoru nepoznatog bez mogućnosti znanstvenog rasvijetljavanja. Originalnost istraživanja je nedvojbena, jer sličnih algoritama jednostavno nema.

Ključne riječi: algoritam, inverz, faktorizacija

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COMPONENT ANALYSIS OF ANTHROPOMETRIC VARIABLES OF BOYS AGES 7-9 WHICH ARE CLASSIFIED BY AGE GROUPS

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Original scientific paper

Summary
Following of growth, functional and psychomotor capabilities of pupils enables better perceiving of influences of certain living conditions as well as success of teaching process and measures that need to be taken to have better development. The main goal of this work comes from research project called "Static and explosive strength of 7-9 year old boys in relation to the proportionality of body structure". The goal of this research is establishment of significant main components of anthropometric variables of 7-9 year old boys classified by age groups (+- 6 months). Structure in the area of anthropometric variables of boys aged 7-9 was analysed by using a sample of 286 boys by using a Hotelling component analysis.

Key words*: dynamics of body development, body segments, group types, statistical procedures.*

INTRODUCTION

Researches of anthropometric measures of human bodies and some its parts have been the subject of researches since ancient period until today. Establishment of anthropometric measures is especially important at children and youth whose development process is still in progress. By intensifying research in this field and improving methodology bases new findings have been reached. On the basis of component analysis of anthropometric variables for estimation of body structure of 7-9 years old boys growth and development dynamics can be predicted with higher certainty. At this age programming of educational process in the schools of sports can be eased. With goal of adequate individual programming, planning and dosage of physical exercises we need objective presentation of anthropometrical status of 7-9 year old boys classified in 5 groups with age difference of 6 months.Knowing of characteristics of 7-9 year old boys enables individual approach in inducement and prognosis of development of moving activities.Milicerova, H. (1960) has modified the method of Parnell A. W. (on Sheldon's maxim of classification with a seven degree points scale) adjusting it to special demands of somatic typology of children and youth in order to evaluate the impact of environmental factor, especially physical training and sport on human organism. Four types have been selected by using this method: ectomorph type and mean type dominated by the skeleton length, mezomorphic type and mean type dominated by the skeleton width and muscularity, endomorph type dominated by the body size, and the ideal type and mean type with the balanced relation of the explicitness of the four somatic typology factors. The appliance of taxonomic procedures for classifying examinees into related groups according to morphological and psychomotor characteristics is important in the terms of theoretical researches just as much as for the purpose of classifying examinees into taxons of either the assigned or the natural morphological and psychomotor structures in accordance with the specific needs of physical training and sport practice (Katić, 1995). The researches conducted by: Polič, B., Šepa, M., Stojanović, M., Radmili, V., Horvat, V. in 1962 made possible for Radojević, Đ. i Lešić, V. to develop tables for the evaluation of physical development and physical performance for the school population in Bosnia and Herzegovina. These tables were published in two brochures in 1965 and 1966. Tables for the evaluation of physical development in male and female student in Bosnia and Herzegovina were established in the first publication, while the latter presents the method of monitoring and evaluating students' physical development and physical performances. Szirovicza, L., Momirović, K., Hošek, A., and Gredelj, M. (1980) analysed the anthropometric latent dimensions on the grounds of factor and taxonomic mode. Three latent dimensions have been obtained and presented as longitudinal dimensions of skeleton, subcutaneous connective tissue and body volume. According to body structure, the size of active body mass is largely genetically determined. Body creases are genetically better determined then the upper

extremity creases. Hereditary quality does not have a big effect on somatic type only, but also on the shape and certain components in somatic type (Ervanova, E., 1985). In his works, Derjabin, I.E. (1987), was presenting the procedure for determination of morphological typology (the system of skeleton size, body size, musculature and creases) he elaborates the system of total body structure typology. Kondrič, M.; Mišigoj – Duraković, M. and Mekitoš, D. (2002) conducted a research on junior class students in schools of Republic Slovenia, between the age of seven and nine. Based on the results, a significant connection between anthropometric characteristics, manifest variables as well as latent dimensions and motor performances has been established.

The problem and subject of this research is extraction of significant main components of anthropometric variables 7-9 year old boys who were classified according to age groups +.-. six months. The main goal of this research is to evaluate possibilities of adequate individual planning, programming, and dosage physical exercising on base of extracted structure of used anthropometric variables.

METHODS

Participants

The examination was conducted among 286 7-9 year old boys, which have been healthy, without any major anatomic deformations or locomotors apparatus damage and involved in regular physical training. The age have been defined as a chronological age oscillating +.-, six months from the exemplar age.

Instruments

The longitudinal dimensionality evaluation has been based on ten longitudinal measures of the different body parts (skeleton):

1. ATJVIS – Body height
2. AVISSJ – Sitting height
3. AVISGL – Head height from the atlas
4. AVISSZ – Angle joint height
5. ADUŽND – Upper arm length
6. ADUŽPD – Forearm length
7. ADUŽSA – Hand length
8. ADUŽNA – Upper leg length
9. ADUŽPO – Lower leg length
10. ADUŽST – Foot length

For the evaluation of skeleton transversal dimensionality we used six tests of width measurement for the certain skeleton parts:

1. AŠIRRA – Shoulder width – biachromic range
2. AŠIRLZ – Elbow width – elbow joint diameter
3. AŠIRRZ– Wrist width
4. AŠIRKA – Pelvis width – bitrochanterial range
5. AŠIRKO – Knee width – knee diameter
6. AŠIRSZ – Ankle joint width

Six measures have been used for the assessment of the body mass and volume i.e. circular dimensionality of the body:

1. ATJMAS - Body mass
2. AOGRKO- Bust measurement
3. AONADL- Upper arm circumference
4. AOPODL- Forearm circumference
5. AONATK- Upper leg circumference
6. AOPOTK- Lower leg circumference

Six measures have been used for the evaluation of subcutaneous connective tissue:

1. AKNTAR– skin crease triceps
2. AKNABI – skin crease biceps
3. AKNAPD – skin crease forearm
4. AKNATK– skin crease upper leg
5. AKNPOT – skin crease lower leg
6. AKNABO– skin crease on axel-hip

Methods of data processing

Result processing of the anthropometric measures of 7-9 year old boys was conducted in accordance to the planned complex methodology. The characteristic and the size of the selected exemplar of examinees, particularly the established research hypothesis, determined the basic methods for the processing of the research results. Data gathered during this research have been processed using the program systems for multi variable and mono variable data analysis. Data analysis was performed at Physical Training Institute in Sarajevo.

In order to establish the basic structure of anthropometric variables set, the Hotelling method of major constituents has been applied (Hotelling, 1936). The collective participation of applied variables measure has been established as the first major constituent in the defining of common measurement subject. In the remaining major constituents, the structural correlation between polar variables magnitudes, as a characteristic of the given population of boys, has been applied.

RESULTS AND DISCUSSION

Constituent analysis of anthropometric variables of 7-9 year-old boys according to age groups
The separation of significant major constituents started on the basis of the criteria of distinctive derivations in the anthropometrical scope.

Table 1. Age group of 7-9 years-old boys boys

Final Statistics:			
Gk	Eigenvalue	Pct of Var	Cum Pct
1	11.6025	41.4	41.4
2	6.23572	22.3	63.7
3	2.02587	7.2	70.9
4	1.78012	6.4	77.3
5	1.57488	5.6	82.9
6	1.24057	4.4	87.4

Table 2Age group of 7 years and six months old

Final Statistics:			
Gk	Eigenvalue	Pct of Var	Cum Pct
1	13.00882	46.5	46.5
2	3.73353	13.3	59.8
3	1.94498	6.9	66.7
4	1.38243	4.9	71.7
5	1.24207	4.4	76.1

Correlations	MCI	MC2	MC3	MC4	MC5	MC6
AKNABO	.94213					
AKNABI	.93296					
AOPDL	.93206					
AKNAPT	.92773					
AKNANK	.92693					
AONADL	.92630					
AONADK	.91590					
AKNAPD	.90671					
AKNATR	.81217					
AOGRKO	.76901					
AOPODK	.69501					
ATJMAS	.68846					
ASIRKA	.66598					
ADUZNA		.89900				
ADUZPO		.88859				
ADUZPD		.81635				
ADUZND		.77812				
AV1STJ		.64394				
ASIRLZ			.85903			
AS1RSZ			.79580			
ASIRRZ			.76578			
ASIRKO			.62202			
ADUZST			.54946			
ADUZSA				.91850		
AVISS.T				.70415		
ASIRRA				.61977		
AVISGL					.88123	
AVISSZ						.96769

Correlations	MCI	MC2	MC3	MC4	MC5
AONADL	**.90977**				
AKNANK	**.87783**				
AKNAPD	**.86250**				
AKNAVO	**.92795**				
ATJMAS	**.91623**				
AKNABI	**.91479**				
AOGRKO	**.90581**				
AKNAPT	**.90334**				
AKNATR	**.90186**				
AOPODL	**.89979**				
AKNAPD	**.85169**				
ASIRKA	**.84634**				
AOPODK	**.65331**				
ASIRKO	**.62366**				
ASIRRA	**.61342**				
ADUZPO		**.87704**			
AVISTJ		**.83067**			
ADUZND		**.82291**			
ADUZPD		**.81674**			
ADUZNA		**.79768**			
ADUST		**.71787**			
AVISSJ		**.65959**			
ADUZSA		**.56495**			
ASIRSZ			**.79797**		
ASIRRZ			**.72210**		
AVISSZ			**.66120**		
ASIRSZ				**.68829**	
AVISGL					**.87361**

In the anthropometrical scope, six significant statistic constituents have been derived. These six major constituents cover 87.4% of the applied mutual systematic variables.Table No. l represents the structure of isolated major constituents, i.e. correlation between variable manifestations and major constituents.

The first major constituent is completely defined by high correlations in all variables for subcutaneous connective tissue evaluation and body circumference, and its variable share is 41.4%,

The second major constituent is defined by variables for evaluating the body parts length and body height, and its variable share is respectively 22.3% and 7.2%, The third major constituent has the most significant transversal dimensionalities of the body, and its variable share is 7.2%,

The fourth major constituent is of mean structure and it is defined by the following variables: hand length, sitting height and shoulder width, and its variable share is 6.4%, The fifth major constituent is defined by the head height variable and its variable share is 6.4%, and the sixth variable is defined by the ankle join height, and its variable share is 4.4%.

Based on characteristic root magnitudes criteria **five major constituents** have been isolated with the variability of total 76.1%. Table No.2.

The first major constituent takes the major share of the total variability-46.5%, (the second takes 13.3%, the third takes 6.9%, the fourth 4.9% and the fifth 4.4%) and in its structure are mostly variables that define skin creases, body circumference and body mass (46.5%), **The second major constituent** is defined by variables for body parts evaluation: body height, sitting height and ankle joint height (13.3%), **The third major constituent** is presented by transversal dimensionality of skeleton variables (6.9%), **The fourth major constituent** is presented by head height variable (4.9%) **and the fifth** is presented by the skin crease biceps variable (6.4%).

Table 3 Age group of 8 years and six months old boys

Final Statistics:			
Gk	Eigenvalue	Pct of Var	Cum Pct
1	14.57180	52.0	52.0
2	3.30198	11.8	63.8
3	1.79881	6.4	70.3
4	1.59068	5.7	75.9
5	1.20098	4.3	80.2

Correlations	MCI	MC2	MC3	MC4	MC5
AKNATR	.92578				
AKNABI	.91452				
AKNAPT	.85984				
AKNABO	.85129				
AONADK	.84805				
AOPODL	.81768				
ATJMAS	.78871				
AOGRKO	.75528				
AOPODK	.70711				
AKNATR	.67216				
ASIRKO	.66232				
ASIRKA	.51312				
ASIRRA	.40654				
ADUZNA		.90977			
ADUZPO		.89361			
ADUZPD		.78361			
ADUZST		.74266			
ADUZSA		.73779			
ADUZND		.70583			
AVISTJ		.68613			
AVISSJ		.60324			
AVISSZ		.58085			
ASIRLZ			.76902		
ASIRRZ			.72126		
ASIRSZ			.67597		
AVISGL				.78109	
AKNABI					.87441

Table 4 Age group of 8 year-old boys

Final Statistics:			
Gk	Eigenvalue	Pct of Var	Cum Pct
1	12.98650	46.4	46.4
2	5.14220	18.4	64.7
3	1.54425	5.5	70.3
4	1.20394	4.3	74.6
5	1.07689	3.8	78.4

Correlations	Gk1	Gk2	Gk3	Gk4	Gk5
AONADK	.94915				
AKNANK	.93235				
AONADL	.93019				
AKNAVO	.92795				
ATJMAS	.91623				
AKNABI	.91479				
AOGRKO	.90581				
AKNAPT	.90334				
AKNATR	.90186				
AOPODL	.89979				
AKNAPD	.85169				
ASIRKA	.84634				
AOPODK	.65331				
ASIRKO	.62366				
ASIRRA	.61342				
ADUZPO		.87704			
AVISTJ		.83067			
ADUZND		.82291			
ADUZPD		.81674			
ADUZNA		.79768			
ADUST		.71787			
AVISSJ		.65959			
ADUZSA		.56495			
ASIRSZ			.79797		
ASIRRZ			.72210		
AVISSZ			.66120		
ASIRSZ				.68829	
AVISGL					.87361

Based on characteristic root magnitudes criteria, five major constituents have been isolated and their variable share is 78.4%. Table No.3

In the first major constituent structure there are mostly variables that define skin creases, body circumference, body mass and transversal dimensionality variables: pelvis width, knee height and knee width and its variable share is 46.4%,
The second major constituent is defined by body parts length and body height variables, and its variable share is 18.4%,
The third major constituents is presented by ankle joint and wrist joint width and ankle joint height variables, and its variable share is 5.5%, The fourth constituents is presented by ankle joint width variables, and its variable share is 4.3%,
The fifth major constituents is defined by head height variable, and its variable share is 3. Based on characteristic root magnitudes criteria **five major constituents** have been isolated with the variability of total 80.2%. Table No.4.
The first major constituent is defined mostly by variables for subcutaneous connective tissue, body circumference and body mass, and its variable share is 52.0%,
The structure of **the second major constituents** is defined mostly by variables for body parts length evaluation and body height, and its variable share is 11.8%,
The third and fourth major constituent are defined mostly by variables for skeletal transversal dimensionality, and its variable share is 6.4%,
The fifth major constituent is defined by head height variable, and its variable share is 4.3%.

Table 5 Age group of 9 years-old boys

Final Statistics:			
Gk	**Eigenvalue**	**Pct of Var**	**Cum Pct**
1	15.04698	53.7	53.7
2	3.59119	12.8	66.6
3	2.28581	8.2	74.7
4	1.50726	5.4	80.1
5	1.06547	3.8	83.9

Correlations	M C I	MC2	MC3	MC4	MC5
AKNAPT	.95238				
AKNAPD	.94901				
AKNAB1	.93299				
AKNATR	.93038				
AKNABO	.93018				
AOGRKO	.90669				
ATJMAS	.90051				
AKNANK	.87890				
AONADL	.86211				
AOPODL	.80935				
AONADK	.79637				
AOPODK	.73521				
ASIRKO	.69437				
A S IRK A	.59712				
ASIRRA	.53978				
ADUZPO		.85499			
ADUZPD		.84447			
ADUZSA		.78316			
ADUZNA		.75754			
ADUZST		.74699			
AVISSJ		.56550			
AVISSZ		.4813 1			

Based on characteristic root magnitudes criteria **five major constituents** have been isolated with the variability of total 83.9%. Table No.5.

As with the previous groups, **the first major constituent** is defined by variables for subcutaneous connective tissue, body circumference and body mass, and its variable share is 53.7%,

The second major constituent is defined by variables for body parts length evaluation and the third is defined by variables for transversal dimensionality, and its variable share is 12.8%,

The third major constituent is defined by variables for transversal dimensionality evaluation, and its variable share is 8.2%,

The fourth major constituent is defined by variables for body parts height evaluation, and its variable share is 5.4%; **the fifth major constituent** takes 3.8% of variability.

CONCLUSION

The characteristic of all five detached groups is: The first major constituent takes the biggest share of the total variability and, among all groups; the first major constituent is best defined by variables for subcutaneous connective tissue, body circumference and body mass. The second major constituent, among all groups, takes significantly less variable percentage and it is defined, among all groups, by variables for body parts length evaluation and body height. The third major constituent is, among all groups, defined by variables for skeleton transversal dimensionality evaluation. The fourth, the fifth and the sixth major constituent take the least amount of variable percentage and they are defined mostly by some sorts of individual parameters. The monitoring of the growth of student's functional and psychomotor capabilities enables the better observation of certain life condition effects, as well as the level of success of the teaching process and the measurements that should be taken to ensure the appropriate terms of development. During the analysis of motional and functional capabilities of 7-9 years-old student, it should be taken into account the series of circumstances which, more or less, reflect on the course of their growth and development which gives them specific characteristics.

The results obtained by this analysis favours the assumption that, by establishing of structure anthropometric area, of used variables in this research, can help us in objective individual planning, programming, and dosage physical exercising of boys ages 7-9 which are classified by age groups.

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KOMPONENTNA ANALIZA ANTROPOMETRIJSKIH VARIJABLI DJEČAKA UZRASTA OD 7 – 9 GODINA KLASIFICIRANIH U GRUPE PO STAROSTI

Izvorni naučni rad

Sažetak
Praćenje rasta, funkcionalnih i psihomotoričkih sposobnosti učenika omogućava bolje sagledavanje uticaja određenih uslova života, kao i uspješnosti nastavnog procesa i mjera koje treba poduzeti da bi se razvoj odvijao na što bolji način.Osnovni cilj ovog rada proističe iz istraživačkog projekta pod nazivom „Statička i eksplozivna snaga dječaka uzrasta od 7 – 9 godina u odnosu na proporcionalnost tjelesne građe“. Cilj ovog istraživanja je utvrđivanje značajnih glavnih komponenti antropometrijskih varijabli dječaka uzrasta od 7 – 9 godina klasificiranih u grupe po starosti (+ - 6 mjeseci). Struktura u prostoru antropometrijskih varijabli dječaka uzrasta od 7 – 9 godina analizirana je na uzorku od 286 dječaka Hotellingovom komponentnom analizom.

Ključne riječi: dinamika tjelesnog razvoja, proporcionalnost, segmenti tijela, tipske grupe, statističke procedure.

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PHYSICAL ACITIVITY AND SYMPTOMS OF MENTAL DISORDERS IN BOSNIAN WOMEN

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Summary
Although physical activity is often an indicator of positive mental state, reasons for exercising are numerous. Depending on the motivation, intensity and other factors, physical activity can have both positive and negative influence on women's mental health. The goal of this study was to find out if women in Bosnia and Herzegovina are physically active and to what extent, and to determine if there is a significant relationship between physical activity and symptoms of depression and body dissatisfaction. A sample included 215 female participants from Tuzla Canton. The following scales were used: Stankard body rating figure scale for body dissatisfaction, Beck's depression inventory and demographic scale which was designed for this study.
Contrary to our expectations, there was no significant corelation between physical activity and symptoms of depression nor body dissatisfaction. Results were discussed in the context of current research about physical activity as a factor of mental health.

Key words: *depression, body dissatisfaction, mental health*

INTRODUCTION

In addition to using diets, women often use physical acitivity in trying to achieve perfect body. Level of physical activity has been mentioned as a risk factor in developing body dissatisfaction (Ovens and Slade, 1987)**.** Although physical activity can be a way to mental wellness, there are many reasons for exercising. Actually, reason for exercising as well as the intensity of exercise have shown to be a major indicetor of effects of physical activity on mental health, specifically, body dissatisfaction. Studies have demonstrated that women who exercise in order to keep their body slim have much greater level of body dissatisfaction then women who exercise because of socializing, health or mood (McDonalds and Thompson, 1992).

Relationship between intensity of exercise for loosing weight and the level of body dissatisfaction, Im and Pruit (1991) have tested by dividing women in to three groups by the level of exercise (groups that exercised intensely, moderately and the one that did not exercise at all). They found that body dissatisfaction was more present in the group of women who exercised intensely then in the other two groups even when the body weight was kept constant. In additon to a higher level of body dissatisfaction, first group demonstrated more negative attitudes about themselves. These results clearly demonstrate that highly structured and organized programs for exercise, especially when combined with controlled eating, could have negative effect on one's health.

On the other hand, physical acitivity such as sports and dance have a relaxing effect on the body. Sport has been mentioned as a protective factor in body dissatisfaction. Namely, studies have shown that girls who play sports have higher self-esteem, better self-image and much lower level of body dissatisfaction than girls who don't play sports (Tiggemann, 2001). Many psychologists propose physical acitivity and sports as part of the treatment for depression. Physical activity helps people to go beyond borders of physical body, to let go and loose themselves in time and space. As the above mentioned authors stated, the key to mental health and feeling body satisfaction is in the motivation and moderation.
The goal of this study was to find out if women are physically active and to what extent, and to learn

about relationship between physical activity, depression and body dissatisfaction in women from Bosnia and Herzegovina. It was assumed that physical activity will be in a negative correlation with depression and body dissatisfaction.

METHODS

Participants

A total of 215 participants from Tuzla Canton completed the survey. Age ranged from 17 to 60, with a mean age of 32.63±16,63; the most common age reported was 19. Participants reported a variety of educational backgrounds, including completion of elementary school (5.1%), high school (77.2%) two-year college (7.4%), university (8.4%) and master's degree (1.9%).
Participants scores on the Body-Mass Index (BMI) ranged from 15.50 to 36.70 with an average score of 22.36 ± 3.72.
61,9% of participants reported being physically active while 68% of them spent at least two hours in a physical acitivity a day (2,28 ± 2,4).

Methods

In this study, following scales were used: Stunkard's body figure rating scale (Stunkard, Sorenson and Schulsinger, 1980) to measure level of body dissatisfaction, Beck's depression inventory (Beck, 1967), and a demographic scale which was created for this study.
Stunkard's body figure rating scale consists of 9 silhouettes, which progressively change from extremely thin to extremely fat with figure 3 or 4, which show endomorphic-muscular type of body.

Each figure is marked with a number from 1 to 9. Participants were asked to choose a number, figure, which most closely match their own body, figure which they wish to have and the one they consider ideal in their country. The level of body dissatisfaction was figured as a difference between ideal body figure and the current body figure or country ideal body figure and the current body figure. This instrument has reliable test-retest values of 0.71 to 0.92 and an adequate constructive validity (Stunkard, Sorenson and Schulsinger, 1980).

BDI was used to measure symptoms of depression or the manifestations of depression. It consists of 21 questions that participants fill out in about 10 minutes (Groth-Marnat, 1990). BDI has high internal consistency with alfa coefficient of 0,86 for clinical and 0,81 for non-clinical population (Beck, Steer and Garbin, 1988). It has Cronbach alfa coefficient of reliability of 0,93. Groth-Marnath (1990) measured test-retest reliability to be between 0,48 to 0,86 depending on the intervals between testing and the testing population. Richter and colleagues stated that BDI has high content validity and validity in differentiation between depressed and non-depressed people.

Procedure

Participants completed questionnaires during a Psychology class at the University of Tuzla, at the local institutions ("Zagrebačka" bank, Public health center, Elementary school "Novi Grad") and in private homes. All participants were told about anonymity and confidentiality and that they can discontinue at any time, should they not feel like continuing? They were also informed about risk of participating which are that some questions related to depression could evoke negative reactions in people who have had psychological problems. They were told that should this happen, they will be able to talk with researchers and to get help. Additionally, they were told that they could speak to the researcher about the meaning of their answers in general.

After all questions were answered, participants received packets of questionnaires.After filling out questionnaires, thirteen girls were interested in the meaning of their answers, while only one women reported feeling upset. Researcher talked with her for about twenty minutes, gave her the phone number of clinical psychologist that she previously contacted.

RESULTS

Relatioship between physical activity and simptoms of mental disorders

In the demographic questionnaire, participants were asked whether they are physically active and to what extent. Out of total number of participants, 61.9% reported being physically acitve; 6% of them exercised at least an hour a week, 17.2% two hours a week while 37.7% exercised three hours and more. 38% of participants reported not being physically active. Inconsistent with the hypothesis, no significant corelation was found between physical activity and depression and body dissatisfaction.

Figure 1.

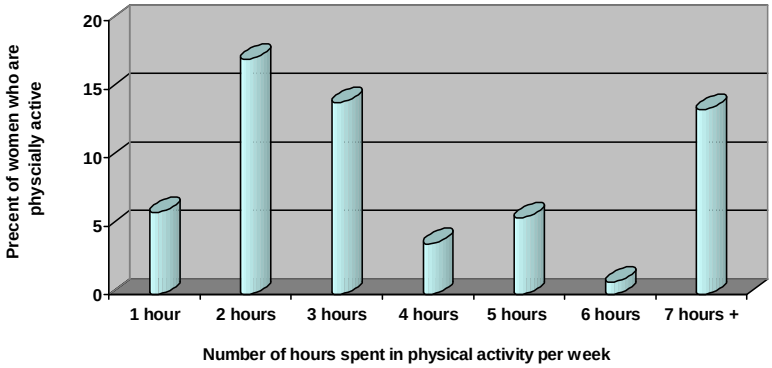
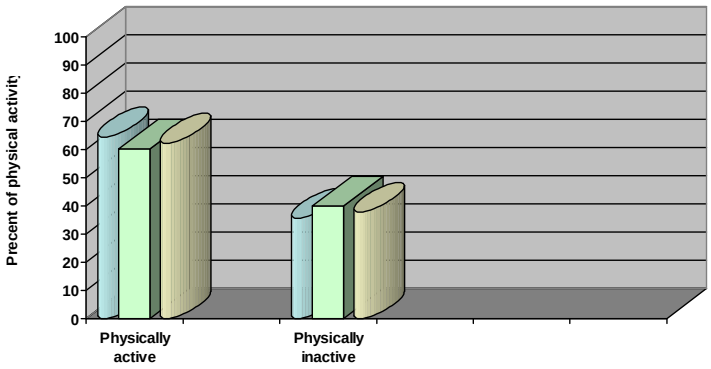


Figure 2.



DISCUSSION

Incosistent with the hypothesis, physical acitivity was not correlated to symptoms of depression nor body dissatisfaction. Two thirds of women stated that they are physically active while little more than one third claimed to spend more than three hours a week in physicall activity. Current world studies have shown that it has relaxing effect on the body, serves as a protector against body dissatisfaction and is used in treating depression. In those studies, physical activity was mainly defined as a free activity, hobi. However, many women in our study stated that physical acitivity they were practicing was physical labor, house work, etc. It is possible that the results of this study would be quite different if women were specifically asked about physical activity such as sports and dance, only.

Possibly, the motivation for physical acitivity had a critical influence on the results. Recent studies have shown that women who exercised intensely in a highly structured and controlled programms show worse self-image and higher level of body dissatisfaction than women who exercise in a relaxed atmosphere and for health and socialization. It is possible that women in this study experienced their physical activity as an obligation (i.e. physical labor of village women) and that such activity does not bring the positive results like it does when it was choosen for care of self and the body. In the future studies, it would be interesting to separate those two kind of physical acitivity and to separately compare them with simptoms of mental disorders.

CONCLUSION

Physical acitivity has been mentioned as a risk factor for body dissatisfaction. However, it has been shown to have quite positive effects on the mental health of many people. The key difference is in motivation and moderation. In this study, physical acitivity has not been correlated to symptoms of depression nor body dissatisfaction. Probable reasons for such results have been discussed.

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FIZIČKA AKTIVNOST I SIMPTOMI MENTALNIH POREMEĆAJA KOD BOSANSKIH ŽENA

Originalni naučni rad

Sažetak

Iako je sama fizička aktivnost često pokazatelj pozitivnog mentalnog stanja, razlozi zbog kojih žene vježbaju su mnogobrojni. Zavisno od motivacije, intenzivnosti i drugih faktora fizička aktivnost može imati i pozitivne i negativne uticaje na mentalno zdravlje žena. Cilj ovog istraživanja bio je saznati da li se žene bave fizičkom aktivnošću i u kojoj mjeri, te ispitati odnos između fizičke aktivnost i depresije i nezadovoljstva tijelom kod žena u Bosni i Hercegovini. Predpostavljeno je da će fizička aktivnost biti u negativnoj korelaciji sa depresivnošću i nezadovljstvom tijelom. Uzorak je činilo 215 učesnica sa Tuzlanskog kantona. Za utvrđivanje postavljenog cilja korištene su: Stankardova skala tjelesnih figura za mjerenje stepena nezadovoljstva tijelom, Bekova skala depresivnosti za mjerenje stepena depresivnosti i demografski upitnik koji je napravljen za ovu priliku.

Nasuprot očekivanjima, nije pronađena statistički značajna korelacija između fizičke aktivnosti i simptoma depresije, niti nezadovoljstva tijelom. Rezultati su diskutovani u kontekstu značajnih svjetskih istraživanja o fizičkoj aktivnosti kao faktoru mentalnog zdravlja.

Ključne riječi: depresija, nezadovoljstvo izgledom tijela, mentalno zdravlje

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CANONICAL RELATIONS OF BASIC-MOTOR AND SITUATIONAL- MOTOR ABILITIES IN SOCCER PLAY

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Original scientific paper

Abstract
Research has been applied on 155 students – 1st and 2nd year of Faculty of sport and physical education in Tuzla, age 19-22. We used a system of 15 variables of basic-motor abilities which represents predictor system and 9 situation motor abilities in soccer which represents criterion system. Primary goal of this research is to establish relation between some of motor and situation-motor abilities in soccer, that while be established by treatment of this special point by canonical correlation analysis. Pursuant to obtained data we expect better results in situational-motor abilities at participants with better coordination abilities and higher level of explosive force and repetitive force.

Key words: *students, situation motor abilities, canonical correlation analysis.*

INTRODUCTION

Awareness of trends in the science and scientific achievements contribute to the development of man's psycho-motor qualities. To know how the relations of numerous factors progress and change, depending on time requirements and achievements in specific sports activities, and in football as well presents an exceptionally essential problem.

The need to know regularities and relations of basic-motor and situational - motor abilities of football players is especially outstanding because situational – motor abilities are possible to be manifested only through the things that characterise entity's basic-motor structure. Consequently, efficiency of situational –motor dimensions directly depends on basic-motor dimensions, as it has been shown in numerous previous researches. Some of the authors that addressed this issue are Smajić,M. Molnar, S. (2007)[(7)], in their work they researched relations between basic-motor abilities and specific precision of the soccer player age 10 – 12 years old. Janković, A. Leontijević, B. (2006) [(2)], in their work they researched relations between motor abilities with situational-motor abilities running football player. Šabotić, B. Dobrnjak, D. (2007) [(9)] in their work they researched relations of basic-motor abilities with situational-motor abilities in soccer. Nožinović, F. (1990) [(5)] in his doctoral dissertation researched influence of anthropometrical characteristics (analysis) and motor abilities of efficiency results in situational tests. Modern method soccer technique requires high level of adopted motor structures due to determination of specific assignments (examples) that occurs during the play in defence stage (mode) and offense. The player has to be able to express his motor abilities in maximal level (readiness, explosive strength, coordination, etc.). Football player technical preparation is basic prerequisite for effective motion performance, apropos, technical preparation allows that players motor potential reach full expression. In a soccer play, it can come to a different styles of dribbling the ball, like straight-route dribbling, dribbling with route and rate (pace) change, whereat kinaesthetic sensitivity of handling (managing) the ball can be very important factor (element) that can restrain or anticipate running speed and dribbling the ball.

METHODS

Participants

Students that have been subjected to the research have completed all exercises in a subject football. All students from the sample were without expressed morphological, motor and psychological aberration and were able to attend the classes regularly on first and second year of the university.

All examinees were given base notations before the test started, towards carrying out the best quality of testing where the number of possible errors will be minimized. All exams (tests) are performed at Tuzla University sports hall.
Examinees in this research are first and second year students of the Faculty for Physical Education and Sport of the University in Tuzla. The research encompassed a sample of 155 testees aged 19 - 22 years.

Instruments
Fifteen (15) tests have been applied for the assessment of basic- motor abilities 15 (predictive union of variables), which belong to some segments of basic-motor area, as follows:

Following tests have been used for the assessment of the frequency movement factor (segmental speed):

- MBFTAR – hand tapping
- MBFTAN – foot tapping
- MBFTNZ – foot tapping against the wall

Following tests have been applied for the assessment of the flexibility factor:

- MFLBOS – side splits
- MFLPRK – forward bend on the bench
- MFLISK – body twist with rod

Following tests have been used for the assessment of the coordination factor:

- MKOOSS – eight with bending
- MKOKUS – long steps aside
- MKOONT - magont /rolling on the ground/

Following tests have been used for the assessment of the explosive force factor:

- MESSVM – high jump with both feet (from a standing start)
- MESSDM – long jump from a standing start
- MESBML – throwing a medicine ball from a lying position

Following tests have been used for the assessment of the repetitive force factor:

- MRSSKL – push ups with burden
- MRSPTL – lifting a torso from a lying position
- MRSZTL – side movements of a torso in a lying position

Nine (9) measuring instruments have been used for the assessment of the situational-motor abilities in the football:
Following measuring instruments have been used for the assessment of the situational preciseness:

- SPPNVM – foot preciseness in a straight line – vertical goal (ball at standstill)
- SPPNVK – foot preciseness in a straight line – vertical goal (ball in a movement)
- SPENVM – elevating foot preciseness– vertical goal (ball at standstill)

Following measuring instruments have been used for the assessment of the ball handling ability

- SBLHOZ – horizontal bouncing of a ball from the wall for 20 seconds
- SBLUPO – hitting against the wall after a ball has bounced from the base
- SBLVSL – guiding a ball in a slalom

Following measuring instruments have been used for the assessment the speed of guiding a ball:

- SBRVPO – fast guiding a ball in a semicircle
- SBRV20 – fast guiding a ball for 20 meters from a standing start
- SBRVPU – fast guiding a ball with the change of the direction at an acute angle

A basic starting point for writing this research was to establish mutual relations or areas that have been the subject of the research, i.e. to establish a maximal connection of unions of variables, so that a number of pairs equals a number of variables, within a smaller number of variables, which will be obtained by the data processing by means of a canonical correlative analysis. In accordance with this method, a normalisation of variables has been done and a connection of variables established within and among analysed groups of variables. Canonical correlations between pairs of canonical factors have been calculated and their significance has been tested by the Bartlett X^2 – test.

RESULTS AND DISCUSSION

By calculating a characteristic equation of non-symmetrical matrix (Table 1) and by applying Bartlett Lambda Test and its testing by means of respective (h2) hi –square of the test, results have indicated existence of two canonical connections that are at the significance level $p = .01$.
A mutual connection of the first pair of isolated canonical factors is high (Canonical R) .71. A mutual relation of the second pair of isolated canonical factors (Canonical R) is .56. These two pairs of isolated canonical factors explain (Canonical R-sqr.) 50 % of the mutual variability. A significance of researched area is (Chi-sqr.) 259. 49.

Table 1. Matrix of characteristic roots and coefficients of canonical correlation

	Canonical	Canonical				Lambda
	R	R-sqr.	Chi-sqr.	df	p	Prime
0	0.71	0.50	259.49	135	0.00	0.16
1	0.56	0.32	161.02	112	0.00	0.32
2	0.45	0.20	106.72	91	0.12	0.47
3	0.40	0.16	75.49	72	0.37	0.59

By analysing a matrix of structure of an isolated canonical factor in the area of variables for the assessment of basic-motor abilities (Table 2), it can be observed that this canonical factor is of a bipolar character.

On the basis of presented data we see that not only some regulatory mechanisms affect the first isolated canonical dimension, but also that this canonical dimension has been formed as a consequence of interaction of a larger number of mechanisms, therefore this canonical factor can be defined as mixed factor of mechanisms for the movement structuring, mechanisms of synergic automatism and a muscle tonus regulation, mechanism of excitation duration regulation.

Šabotić,B. Drobnjak, D. (2007)[9] have got similar research results in their paper. In this research available canonical factor (element) is define as factor (element) of general motor ability, therefore is the coordination factor impact (effect) is the most expressed.

By analysing a matrix of structure of the first isolated canonical factor in the area of variables for the assessment of situational-motor abilities - (Table 3), SPPNVM variable – foot preciseness in a straight line – vertical goal (ball at standstill) (.82), variable SPPNVK – foot preciseness in a straight line – vertical goal (ball in a movement) (.84), variable SPENVM – elevating foot preciseness – vertical goal (ball at standstill) (.44) - have significant projections of manifest vector variables on this isolated canonical factor.

Likewise, from the area of variables for the assessment of an ability to handle a ball, a variable SBLUPO - hitting against the wall after a ball has bounced from the base (.48) - has a significant projection of vectors of manifest variables on this isolated canonical factor. A reason for such high projections of this variable on second isolated latent dimension probably lies in a fact that also preciseness is needed for the performance of this situational-motor test because a ball has to be directed to a defined space on the wall. Therefore we are going to define this as a situational preciseness factor.

By analysing a matrix of structure of the second isolated canonical factor in an area of variables for the assessment of basic-motor abilities (Table 2), [it is seen] that this canonical factor has a bipolar character.

It has to be noted here as well that variables for coordination assessment has a logically negative sign, because these are time tests where in the time and space a distance in meters has to be covered, where a smaller result means a better result. When we have a look at the structure of this isolated factor, the structure of the second isolated canonical factor is also specific. However, in relation to the first isolated factor in the other canonical factor, we have two variables in coordination, which have significant projection on this factor.

Since the other canonical factor has been defined by variables from the area of segmental speed, flexibility, coordination, explosive and repetitive force, and these variables have been defined by excitation speed in nerve centres. Therefore, the second isolated canonical factor can be defined as a factor of excitation process in the movement regulation. Raičković, N. Rašović, D. (2004)[6] have got similar research results in their paper.

By analysing a structure of matrix of the second isolated canonical factor (Table 3) in the area of situational-motor abilities, we see that on this isolated canonical factor variables for the assessment of the ability of the speed to guide a ball have the most important projection of vectors of manifest variables. Somewhat smaller, but still significant projections of vectors of manifest variables on the second isolated canonical factor also have variables for the assessment of the ability to handle a ball.

Pursuant to achieved results and variables that determine this factor, it can be defined as a factor of a general movement ability of player with a ball.

Nožinović, F. (1990) [5] in his doctoral dissertation came up with similar results that indicate importance of coordination and explosive strength against improving results of testing situational – motor abilities.

Table 2. Matrix of canonical factors structure in the area of basic-motor abilities variables

	KF 1	KF 2
MBFTAR	- 0.18	0.17
MBFTAN	- 0.83	0.02
MBFTNZ	0.01	0.22
MFLBOS	0.12	- 0.40
MFLPRK	- 0.17	0.16
MFLISK	- 0.40	- 0.19
MKOONT	- 0.00	- 0.40
MKOOSS	- 0.03	- 0.69
MKOKUS	- 0.62	- 0.11
MESSVM	0.01	0.32
MESSDM	0.04	0.40
MESBML	0.11	- 0.00
MRSSKL	- 0.08	0.16
MRSPTL	- 0.44	0.40
MRSZTL	- 0.50	0.15

Table 3. Matrix of canonical factors structure in the area of situational-motor abilities variables

	KF 1	KF 2
SPPNVM	0.82	0.26
SPPNVK	0.84	0.27
SPENVM	0.44	0.13
SBLHOZ	- 0.31	0.30
SBLUPO	0.48	0.22
SBLVSL	0.13	- 0.55
SBRVPO	- 0.06	- 0.56
SBRV20	0.46	- 0.62
SBRVPU	0.06	- 0.91

CONCLUSION

Pursuant to obtained data we expect that the better results in situational-motor abilities is conditioned by optimally developed basic-motor abilities.

By analysing relations of the first pair or canonical factors, we see that estimating agility variable MKOKUS-long steps aside (.62) has the greatest effect on the situational preciseness, as we have defined the first isolated canonical factor; coordination has the greatest effect and it is the only one that has realised positive connections with this canonical factor. Coordination also presents a basics of the loco-motor system, and we know that without coordination it is not possible to perform any moving structures, so this is probably one of the reasons why such relations have been realised within areas of the research, that is to say, this pair of canonical factors. Since with variables for the preciseness assessment we have preparatory movements that make it possible for favourable conditions to be created for adequate performance of these tests, coordinated work of arms and legs is probably one of essential factors that affect achievement of better results in tests or situational preciseness, therefore, this also can be one the reasons why the relations of the first pair canonical factors have been realised. When we have a look at the relations of other variables having statistically significant coefficients, we see that segmental speed, flexibility and repetitive force have negative relations with the situational preciseness. Šabotić, B. Drobnjak, D.(2007)[8] in their paper researched relations basic-motor abilities with situational-motor abilities in soccer. Final data inside this research refer to suggest that all motor abilities are in direct proportionality with results of testing situational-motor abilities of examinees. Although, authors came up with conclusion that all examinees with better coordination, as well as bigger explosive and repetitive strength will have much better results in testing of specific motor in soccer. By analysing the relations of the second pair of isolated canonical factor we see that positive relations have been realised. When the relation of this pair of canonical factor is analysed, we see that variables for the coordination assessment have a dominant positions, since two variables from this area have a significant projection on the isolated canonical factor. Likewise, the MKOOSS – eight with bending, has the greatest projection of vectors, which amounts to (-.69). We see that a segmental speed is also significant for a general ability of the movement of a player with the ball, which with the coordination presents the basics of loco-motor system. Explosive force, in particular its horizontal and vertical component and a repetitive force also have a significant influence on the improvement results in tests that present a general ability of a player to move with a ball. In his research Raičković, N. (2005)[6], came up with some indicators that shows impact of the legs coordination and explosive musculature in soccer success. Thus, author realizes much better results will have examinees with expressed (registered) specified coordination abilities. Also, in their paper Smajić, M. Molnar, S.(2007)[7], , from the gained results authors came up with the conclusion that examinees with less levelled explosive and repetitive strength accomplished inferior results in testing of specific preciseness hitting horizontal and vertical target. Since we have defined the second isolated canonical factor in the area of situational-motor abilities as a factor of a general ability of a player to move with a ball, these tests that define this factor in its structure contain a movement with a ball, fast changes of the direction of movement, which means those forms of movement that by its structure mostly resemble situations that appear during a football game. Coordination is absolutely essential when a player with a ball moves, in particular work of arms and legs. A speed of curved running, fast changes of the direction of movement, as well as a speed of guiding a ball to a great extend depend on segmental speed and explosive and repetitive force.

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KANONIČKA POVEZANOST BAZIČNIH I SITUACIONO MOTORIČKIH SPOSOBNOSTI U FUDBALU

Originalni naučni rad

Sažetak

Istraživanje u ovom radu je provedeno na uzorku od 155 studenata I i II godine studija Fakulteta za tjelesni odgoj i sport u Tuzli, starosne dobi od 19-22 godine. Korišteni su skupovi od 15 varijabli bazično-motoričkih sposobnosti koje predstavljaju prediktorski sistem i skup od 9 varijabli situaciono-motoričkih sposobnosti u nogometu koji predstavlja kriterijski sistem.Osnovni cilj ovog rada jeste utvrđivanje relacija između bazično-motoričkihi situaciono-motoričkih sposobnosti u nogometu, a što će se dobiti obradom podataka pomoću kanoničke korelacione analize. Na osnovu dobijenih podataka može za očekivati je da će bolje rezultate u situaciono-motoričkim sposobnostima postizati ispitanici sa boljim koordinativnim sposobnostima kao i sa većim nivoom eksplozivne i repetitivne snage.

Ključne riječi: student, situaciono motoričke sposobnosti, kanonička korelaciona analiza

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PREDICTIVE VALUES OF MORPHOLOGICAL CHARACTERISTICS IN RHYTHMIC GYMNASTICS

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Summary:
We examined the predictive values of morphological characteristics at the rhythmic gymnastics exercises performance at the sample consisting of unselected sample of 127 female pupils of first, second and third grades of high school. We used the set of the 22 variables, indicators of morphological characteristics and predictor system representatives, as well as the set of 10 basic rhythmic gymnastics elements as the indicators of criterion system. The examinees participated in a three-month rhythmic gymnastics training programme as a part of regular sport classes. The aim of the programme was to master the basic body elements: jumps, body balance, pirouettes and rhythmic gymnastics flexibility. After the three-month programme we examined the predictive values of the morphological characteristics at the 10 rhythmic gymnastics elements performance results which represent the basic movement structures of the free composition. Regression analysis showed a relatively high multiple correlation coefficients which confirms that the morphological characteristics have a high degree of predictive values in the rhythmic gymnastics elements performance results.

Key words: *rhythmic gymnastics, morphological characteristics, exercise performance*

INTRODUCTION

Research of morphological status as a predictor of a successful performance of esthetic movements in conventional type sports such as rhythmic gymnastics represent one of the important issues in kinesiology as they facilitate us in forming a morphological model of a top rhythmic gymnast based on scientific results.

Referee criteria in rhythmic gymnastics competitions aspire to promoting the ideal esthetic type of a top gymnast. The body type of the gymnasts has been adjusted to this requirement and they nowadays have long muscles and no subcutaneous fat tissue, they are tall and elegant (Branda 1994).

The studies made so far aiming at identifying morphological characteristics as a predictor of success in rhythmic gymnastics show prevailing views according to which a moderate and fat tissue below average is desirable in a gymnast (Douda et al., 1988; Miletić et al., 2004), as well as body weight and height below average (Case, Fleck, Koehler 1980; Alexander 1991; Branda 1994; Wolf-Cvitak 1993; Hume et al., 1993). The following table shows an overview of various researches of certain morphological features (body height, body weight and fat tissue percentage) on the sample of elite, average and beginner rhythmic gymnasts (Table 1.).

Some authors (Jastrjembskaia and Titov 1999) recommend ideal weight and height for beginner gymnasts at the age of 7 to 8 years as a part of the selection process (117 cm and less than 25 kg). The same authors state that rhythmic gymnasts have certain desirable body proportions, for example, the desirable hand length should be 11% of the body height, while the desirable leg length is 50% of the body height. Such authors have done research on gymnasts but, for the selection process and determination of desirable morphological characteristics that may prove to be significant in the process of adoption of specific motor skills in training, the important things is that such research should be conducted on beginners precisely. At the same time, this is the outstanding issue in rhythmic gymnastics as a discipline in which competition rules often change.
Beginner rhythmic gymnasts must overcome a large number of motor skills in exercise with and without props so as to be able to achieve the criteria imposed by the book of rules and be eligible for competitions.

Table 1: Average value of certain morphological characteristics of rhythmic gymnasts according to the results of research conducted so far on the sample of elite (E), average (P) and beginner (PO) rhythmic gymnasts

Research	Sample status	Average age (yrs)	Average height (cm)	Average weight(kg)	% fat tissue
Case, Fleck, Koehler (1980)	E	-	162	53,4	11,24
Gionet et al. (1986)	E	15	160	45	-
Alexander et al. (1987)	E	14	159	42,7	13,6
Alexander (1989)	E	15	164	49,6	13
Alexander (1991)	E	15	164	49,1	12,1
Alexander (1991)	P	13,7	164	48	12
Hume et al. (1993)	E	18	162	50	16,1
Hume et al. (1993)	P	13,6	156	47	17,4
Georgopoulos et al. (2002)	E	17,1	166	47	13,1
Klentrou and Plyley (2003)	P	14,5	160	43,4	14,3
Miletić et al.. (2004)	PO	7	130	26	-

The fundamental issue in this research is to establish whether there are morphological characteristics that can be desirable or limiting for the learning process itself, as well as for the process of adopting basic body elements by beginner rhythmic gymnasts.
The primary goal of this research is determination of predictive values of morphological characteristics on successful performance of elements without props in rhythmic gymnastics. In other words, it is necessary to determine the importance and relative impact of variables of morphological characteristics on a one-dimensional criterion defined as success in performing elements in rhythmic gymnastics in exercises without props. Exercises without props are important as this is the first exercise the girls face in the rhythmic gymnastics training process, and it represents the basis of the future success of a gymnast.

METHODS

The group of examinees in this research is defined as a population of high school female students aged 16 to 18. All examinees attended the „Druga gimnazija“ High School in Sarajevo. The group (sample) can be considered non-selective and beginner rhythmic gymnasts. The overall number of examinees in whom values of variables were registered and who were subjected to final processing and analysis is 127.
The students were involved in a three-month programme of rhythmic gymnastics training within regular sport classes. The aim of the programme was to master basic body elements: jumps, balance, pirouettes and mobility in rhythmic gymnastics.
After the completion of the three-month training programme, there followed the determination of predictive values of morphological characteristics on the success of realisation of ten rhythmic gymnastics elements that represent the basic movement structures of the free stance in exercises without props in rhythmic gymnastics.

The sample of predictor variable for the assessment of *morphological characteristics* in this research includes a group of twenty-two (22) measurement tests. The following variables were used for the assessment of longitudinal skeleton dimensionality: body height (AVISTJ), arm length (ADUZRU), hand length (ADUZSA), leg length (ADUZNO), foot length (ADUZST). The following variables were used for the assessment of *transversal skeleton dimensionality*: biacromial span (ABARAS), elbow diameter (ADJLAK), wrist diameter (ADJRUZ), bicrystal span (ABKRAS), knee diameter (ADJKOL), ankle diameter (ADJSKZ), hand diameter (ADJSAK). The following variables were used for the assessment *body volume and mass*: body mass (ATEZTJ), mean chest volume (ASROGK), upper arm volume (AONADL), upper leg volume (AONATK), lower leg volume (AOPOTK), waits volume (AOSTRU). The following variables were used for the assessment of *subcutaneous fat tissue*: back skin fold, upper arm skin fold (ANNADL), stomach skin fold (ANTRBU), lower leg fold (ANPOTK).

The sample of criterion variables for the assessment of success in performing the elements of rhythmic gymnastics without props in this research includes a group of ten rhythmic gymnastics elements in exercises without props: children's jumps, "arabesque" level , two-leg 720-degrees turn, body wave aside, swing infront of legs, cat jump, ring" balance, rolling on the ground, far-high jump and deer jump.

As a result of the use of the method of the first chief component from the stated system of variables in the factor analysis, the criterion variable containing the greatest amount of data obtained from the system has been labelled rhythmic gymnastics.
Regression analysis was applied for the purpose of determining the predictive values of morphological characteristics on the success in performing rhythmic gymnastics elements, i.e. determining the significance and relative impact of variables of morphological characteristics on the one-dimensional criterion – success in performing the elements of rhythmic gymnastics without props.

RESULTS AND DISCUSSION

Factor method of the first component of criterion variables system (elements of rhythmic gymnastics).

One more variable has been isolated from the criterion variables system (elements of rhythmic gymnastics). It contains the greatest amount of information related to that system and represents criterion variable Rhytmic Gymnastics. The condensation process of the set of applied variables was carried out and it resulted in obtaining variables with the highest variability in the matrix space Z.
The results of the factor method of the first principal component of the criterion variables system are presented in the tables 2 and 3.

The first principal component with the value 6,023 (Total), which is (Cumulative %) 91,229 % of the total variance explained of rhythmic gymnastics variables, was extracted on the basis of the solved characteristic equation of the correlation matrix (Table 2.), that is, by factoring correlation matrix of the applied variables of rhythmic gymnastics elements.

Table 2: Matrix of characteristic roots and total variance explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6,023	60,234	60,234	6,023	60,234	60,234
2	1,638	16,376	76,610			
3	1,024	10,237	86,846			
4	,438	4,383	91,229			
5	,336	3,358	94,588			
6	,228	2,277	96,865			
7	,143	1,434	98,299			
8	,099	,989	99,288			
9	,044	,439	99,727			
10	,027	,273	100,000			

Extraction Method: Principal Component Analysis.

Table 3: Matrix of the isolated first principal component

Varijable	Component 1
SPDJP	,837
RAVAG	,674
OK2NZ	,823
PVZAK	,775
PVZAM	,529
SPMAC	,891
RAPRS	,725
PVKOT	,804
SPDAL	,763
SPJEL	,874

Extraction Method: Principal Component Analysis a 1 components extracted

The analysis of the matrix of the isolated first principal component (Table 3.), in which the coefficients of first matrix component are demonstrated, (correlations of vectors of manifest variables with isolated first component) show that all ten applied rhythmic gymnastics elements have equable and very high correlations with the first principal component. The first principal

component is highly saturated with all estimated rhythmic gymnastics elements and hypothetically represents a general success in rhythmic gymnastics.

The regression analysis of criterion variables (RHYTHMIC GYMNASTICS) in the manifest space of morphological variables (Table 4.) provides information on the impact of applied morphological variables on the success in performing the treated criterion variable.
The predictor system of variables explains (R Sguare = 29 %) the joint variability with the criterion, while the correlation of the overall predictor system of variables with the criterion, i.e. the coefficient of multiple correlation is (RO = .54), which represents a relatively high value, while the correlation is significant at the level (Sig . = .01)
The remaining 71 % in explaining the joint variability can be attributed to other characteristics and examinees' abilities that have not been covered by this research (motor, functional, conative and cognitive characteristics...).

Table 4: The regression analysis of the criterion variable Rhythmic Gymnastics in the manifest space of motor variables

RO	R Square	Adjusted R Square		Std. Error of the Estimate	
,542	,294	,144		,92507017	
	Sum of Squares	df	Mean Square	F	Sig.
Regression	37,001	22	1,682	1,965	,012
Residual	88,999	104	,856		
Total	126,000	126			

Key: RO – multiple correlation coefficient, R Square – criterion variable determination coefficient, Std. Error of the Estimate, Sum of Squares Regression – valid variance, Sum of Squares Residual – outstanding variance, Sum of Squares Total – total variance, df – degrees of freedom, F – the test used for determining the significance of the multiple correlation coefficient, Sig.- the level of multiple correlation significance.

By analysing the impact of particular – partial (Beta) regression coefficients (Table 5.), it can be seen that two variables from the predictor system of morphological characteristics have the statistically significant impact on the criterion variable (RHYTHMIC GYMNASTICS), as follows: body weight (ATEZTJ) and lower leg skin fold (ANPOTK), both of which are significant at the level of (Sig = or < .05).
The research has confirmed that body mass and subcutaneous fat tissue have a highly negative impact on successful learning and mastering the basic body elements in beginner rhythmic gymnasts.
Research results also show that the girls with a greater body mass and a higher percentage of subcutaneous fat tissue will master the basic elements in rhythmic gymnastics exercises without props with more difficulty and in a much more slowly manner.

The Wolf-Cvitak research (1993) showed that the possibility of a more successful performance of jumps in rhythmic gymnastics is evident in middle height girls with narrow hips and relatively small body weight, while the efficiency of performance of elements in balanced positions is negatively affected by morphological variables such as longitudinal and transversal dimensionality and body mass and volume.

Similar results were obtained in the Miletić research (1999), confirming that overly body volume and fat tissue make it difficult to perform complex structures and generally affect the overall impression, including the final mark in rhythmic gymnastics.

The relatively high multiple correlation, the percentage of joint variability of the predictor system of variables with the criterion and a rather modest number of valid partial regression coefficients obtained within the presented regression analysis indicates that the prediction – the prognosis of the impact of predictors on the criterion variable can be better done with the assistance of the entire system of predictor variables of morphological characteristics.

Table 5: Individual - partial results of the regression analysis of the predictor system of morphological variables on the criterion variable Rhythmic Gymnastics

Variables	Unstandardised Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
AVISTJ	-,042	,042	-,275	-1,013	,314
ADUZRU	-,025	,052	-,084	-,475	,636
ADUZSA	,020	,080	,027	,252	,801
ADUZNO	-,036	,047	-,180	-,759	,450
ADUZST	-,088	,086	-,121	-1,023	,309
ABARAS	-,039	,068	-,063	-,573	,568
ADJLAK	,547	,376	,176	1,454	,149
ADJRUZ	,106	,413	,027	,256	,798
ABKRAS	,026	,060	,056	,433	,666
ADJKOL	-,045	,281	-,022	-,161	,872
ADJSKZ	,036	,331	,015	,110	,913
ADJSAK	,308	,282	,121	1,093	,277
ATEZTJ	,107	,056	-,815	1,918	,044
ASROGK	-,030	,035	-,155	-,857	,393
AONADL	,001	,004	,023	,247	,805
AONATK	-,031	,055	-,128	-,554	,581
AOPOTK	-,039	,071	-,094	-,551	,583
AOSTRU	,002	,002	,101	1,102	,273
ANLEDJ	-,098	,054	-,245	-1,830	,070
ANNADL	-,032	,048	-,092	-,652	,516
ANTRBU	-,054	,044	-,181	-1,243	,217
ANPOTK	-,102	,039	-,319	-2,621	,010

Key: Std. Error – standardised regression coefficient error,
Beta – partial regression coefficient, t – each predictor variable's contribution,
Sig.- the level of partial regression coefficients significance.

CONCLUSIONS

The discussion on the anthropometric factors, in addition to a good command of the morphological type of elite gymnasts, must be based on the characteristics of beginners, the monitoring of the level of motor information and the relations with other segments of the anthropological status during growth and development.The research has confirmed that body mass and subcutaneous fat tissue have a highly negative impact on successful learning and mastering the basic body elements in beginner rhythmic gymnasts. Availability of scientific information on the impact of morphological characteristics on the ability of learning, adopting and performing motor skills in rhythmic gymnastics can significantly improve the process of orientation and selection in rhythmic gymnastics schools.

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PREDIKTIVNE VRIJEDNOSTI MORFOLOŠKIH KARAKTERISTIKA U RITMIČKOJ GIMNASTICI

Izvorni naučni rad

Sažetak:
Utvrđivanje prediktivnih vrijednosti morfoloških karakteristika na uspješnost izvođenja vježbe bez rekvizita u rimičkoj gimnastici provedeno je na neselekcionisanom uzorku od 127 učenica I, II i III razreda "Druge gimnazije" u Sarajevu. U istraživanju korišten je skup od 22 varijable za procjenu morfoloških karakteristika koje ujedno predstavljaju prediktorski sistem, i skup od 10 osnovnih elemenata bez rekvizita u ritmičkoj gimnastici koje predstavljaju kriterijski sistem. Učenice su bile uključene u tromjesečni program treninga ritmičke gimnastike u okviru redovne nastave izbornog predmeta – sport. Cilj programa je bio savladavanje osnovnih tjelesnih elemenata: skokova, ravnoteža, pirueta i pokretljivosti u ritmičkoj gimnastici. Nakon tromjesečnog programa obuke, izvršeno je utvrđivanje prediktivne vrijednosti morfoloških karakteristika na uspješnost u realizacji deset elemenata ritmičke gimnastike, koji predstavljaju bazične kretne strukture slobodnog sastava u vježbanju bez rekvizita u ritmičkoj gimnastici. Primjenom regresione analize dobijen je relativno visok koeficijent multiple korelacije, koji potvrđuje da morfološke karakteristike imaju visok stepen prediktivnih vrijednosti u pogledu ostvarivanja uspijeha u ritmičkoj gimnastici.

Ključne riječi: ritmička gimnastika, morfološke karakteristike, vježba bez rekvizita

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RELATION BETWEEN MOTOR AND SITUATIONAL-MOTOR ABILITIES OF SEVENTH AND EIGHTH GRADE STUDENTS PLAYING VOLLEYBALL

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Original scientific paper

Summary
Based on a sample of 112 boys seventh and eight grade of Elementary school, age 13 to 15, we applied system of 21 variables, among them 18 variables were to estimate motor abilities and 3 were to estimate situational-motor abilities in volleyball and all is to determine mutual relations. According to results gained with appliance of canonical correlation analysis we can conclude that relations between observed group of variables – motor ability (as predict group of variables) with criteria group of variables (situational-motor abilities) - will result with statistically significant coefficient of canonical correlation.

Key words: *motor, situational-motor, relations, volleyball, students, canonical correlation analysis*

INTRODUCTION

Aim of physical education is to systematically gain positive influence on development of anthropological characteristics to provide stimulus for normal growth and development of students, to prepare them to self control and test their health and body ability. Regarding to, the aim of education is to help students to strengthen and improve their motor and functional abilities, widen technical and tactical knowledge about sports and other forms of physical education in order to preserve their health, keep their work ability and recreate. It is very important to follow realization of this program and estimate gained results in order to improve corrective-educational practice in physical and health education and stimulate teachers to have more responsible and creative relation toward work. All this provides reliable information that should follow with eventual corrective interventions in practical realization of curriculum.

Correlation between specific motor abilities with other anthropological areas is still basic and actual theoretical and practical problem that is very important because it gives opportunity of forming rational procedures of optimal orientation and selection of youth athletes, as well it provide better foundation for training planning, controlling and programming and more efficiency controlling of anthropological characteristics development. (Findak, 1999, Tokić & Prskalo 1999).By following, checking and evaluation we should get return information about how students accomplished all their tasks in physical and health education, in other words how each student came closer to his program tasks (Findak, Metikoš, Mraković 1992). Subject of this research refers to motor abilities (predictor group of variables) and situational-motor abilities from volleyball (standard group of variables), as well as defining their connections and relations with students age of 13 to 15. Problem of this research refers to defining significant factors (motor) that are important for improvement of situational-motor abilities (in volleyball), in order to gain specific information important to adequately plan and program curricula in the field of physical and health education.

Starting with subject and problem of the research, the main goal of this research is defining relations between motor (predictor group of variables) and situational-motor abilities in volleyball (standard group of variables).

METHODS

Participants

The research was conducted on 112 students of seventh and eight grade of Elementary school "Centar" in Tuzla, age of 13 to 15.

Instruments

Measuring instruments for this research were: motor abilities (18 variables) and situational-motor abilities in volleyball (3 variables).

Sample of predictor variables

Sample of predictor variables in this research included 18 variables to estimate motor abilities.

Group of variables in predictor space was formed of 18 variables for motor space estimation and they include some segments of this space with 3 variables: movement frequency, flexibility, explosive strength, coordination, precision, balance.

MBFTAR – hand tapping
MBFTAN – leg tapping
MBFTNZ – leg tapping against wall
MFLISTK – slewing with bat
MFLPRK – forward band on stand
MFLBOS – side legs wide opened
MFESDM – standing long jump
MFE20V – running 20 m – sprint high start
MFEBML – throwing medicine ball while lying on the beck
MKOS3M – slalom with three medicine balls
MAGTUP – zig-zag test
MAGKUS – step aside
MPGVCN – aiming vertical goal with leg
MPGHCR – aiming horizontal goal with arm
MPGPIK – dart
MBAP2O – standing across on two legs eyes open
MBAU2O – standing vertically on two legs eyes open
MBAU1O – standing vertically on one leg eyes open

Sample of standard variables

To estimate situational-motor abilities in volleyball the sample of standard variables presents a group of (3) measuring instruments:

1. SOTPGS – tennis – forehand above hand serve
2. SOGCPM – aiming goal over the net from base posture
3. SOCOUK – two hand bump within 30 seconds.

Data processing methods

Data we gained through this research were processed through program packages STASTITICA 5.0 and SPSS 12.0. To determine relations between two groups of data we used Hotelling's canonical correlation analysis.

RESULTS AND DISCUSSION

Table 1. Matrix of specific roots and canonical relation coefficients

Chi-Square Tests with Successive Roots Removed (noname.sta)						
	Canonical	**Canonical**				**Lambda**
	R	**R-sqr.**	**Chi-sqr.**	**df**	**p**	**Prime**
0	0,66	0,43	94,94	54	0,00	0,39
1	0,44	0,19	38,01	34	0,29	0,68
2	0,39	0,16	16,94	16	0,39	0,84

According to calculated specific equation of nonsymmetrical matrix (Table 1), applying Bartlett lambda test and suitable χ^2, one of significant and positive pair of canonical factors (Canonical R) was isolated and it explains connection between motor abilities and situational-motor abilities in volleyball on the level of significance $p \leq .01$.

This canonical pair has the largest correlation (Canonical R) .66 and it contains the biggest percentage of mutual variance of first and second set of variables. That correlation indicates that this pair refers to what is important for this two groups of variables, explains (Canonical R-sqr) 43% of variance of this variable groups. Variables are oriented (scaled) in such way that negative harbinger of variable correlation and canonical factor doesn't mean weaker result value that was achieved in this variables, more exactly pre minus signals the lower the value of this variable the better guarantee for results in motor variables. The following variables are: MFE20V - running 20 m - sprint high start, MKOS3M – slalom with 3 medicine balls, MAGTUP- zig-zag test and variable MAGKUS – step aside.This canonical pair explains joint variability between groups of variables with correlation coefficient (.43), while other correlations are not statistically significant and their joint variability does not influence relations of these two sets of variables. Statistical significance of canonical pairs is determined with values of Bartlett's χ^2 test and its value totals 94, 94.Structure of isolated canonical factors matrix in the area of motor and situational mobility.

Table 2.

Factor Structure, left set (noname.sta)	
	KF 1
MBFTAR	0,53
MBFTAN	0,36
MBFTNZ	0,31
MFLISK	0,33
MFLPRK	0,2
MFLBOS	0,23
MFESDM	0,62
MFE20V	-0,66
MFEBML	0,7
MKOS3M	-0,64
MAGTUP	-0,68
MAGKUS	-0,65
MPGVCN	0,08
MPGHCR	0,39
MPGPIK	0,11
MBAP2O	0,38
MBAU2O	0,05
MBAU1O	0,22

Table 3.

Factor Structure, right set (noname.sta)	
	KFO 1
SOTPGS	0,24
SOGCPM	0,94
SOCOUK	0,59

First canonical pair includes first factor from the first set (general motor factor) that can be defined according to biggest correlation of variables: MFEBML – throwing medicine ball while lying on the beck (.70), MAGTUP – zig-zag test (-.68), MFE20V - running 20 m –sprint - high start (-.66), MAGKUS – step aside (-.65), MKOS3M – slalom with 3 medicine balls (-.64), MFESDM – standing long jump (.62), MBFTAR – hand tapping (.53), with first factor from second set, gained according to biggest correlations in all variables: SOGCPM-aiming goal over the net from the base posture (.94), SOCOUK – two hand bump within 30 seconds (.59), SOTPGS – tennis – forehand above hand serve (.24) (factor for estimation of situational-motor abilities in volleyball) (Table 3).
The largest variable correlations from the first statically significant pair are positive and refer to quality realization of these tests. Achieving high and quality results leads us to high development of their latent dimensions, in this case explosive strength, coordination and segment speed. From above mentioned we can conclude that with performing this volleyball elements, like service, explosive strength is very important for strength and for service precision. Also, segment speed has significant role with performance of repeating movements, and we already know that coordination is basic for motor and is necessary to make any kind of movement structures in volleyball and any other sport activities.

CONCLUSION

Relations between motor and situational – motor variables are established with Hotelling method of canonical correlation analysis, and significance of canonical correlation coefficients was tested with Bartlett χ^2 test on the level of significance $p \leq .01$.

We consider that in this work we selected adequate measuring instruments which cover latent areas that are highly significant for curricula in physical and health education. Naturally, better prognoses in result improvement would be gained with completing predictor group of variables and variables from other areas (morphological, functional, conative etc.)
The results of this research will enable optimal and appropriate usage of situational-motor tests in volleyball to follow effects in curricula of physical and health education in order to improve its plan and program. Likewise, the results of this research will enable quality selection what will follow with mentioned age student participation in outclass activities (sections) and activities out of school (like volleyball clubs).

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RELACIJE IZMEĐU MOTORIČKIH I SITUACIONO-MOTORIČKIH SPOSOBNOSTI IZ ODBOJKE UČENIKA VII I VIII RAZREDA

Originalni naučni rad

Sažetak

Na uzorku od 112 dječaka VII i VIII razreda, uzrasta 13-15 godina bio je primijenjen sistem od ukupno 21 varijable, od toga 18 varijabli za procjenu motoričkih sposobnosti i 3 varijable za procjenu situaciono-motoričkih sposobnosti iz odbojke, s ciljem utvrđivanja međusobnih relacija. Na osnovu rezultata dobijenih primjenom kanoničke korelacione analize možemo kazati da će relacije između posmatranih skupova varijabli motoričke sposobnosti (kao prediktorski skup varijabli) sa kriterijskim skupom varijabli (situaciono-motoričke sposobnosti) obrazovati statistički značajne koeficijente kanoničke korelacije.

Ključne riječi: motorika, situaciona motorika, relacije, odbojka, učenici, kanonička korelaciona analiza

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SPORT AS SOCIO-EDUCATIONAL PHENOMENON

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Professional paper

INTRODUCTION

Sport is a socio-educational phenomenon. Isn't it something that is a perceptional and scientific thought interested in? Is it necessary for a teacher, sportsman, coach, pedagogue, social psychologist, sociologist, pupils and students to acquire knowledge of sport, its social reality and perception of it as an educational fact? These days, sport has become a part of everyday life, although much more as a entertainment and ''waste of time'' for sport audience on sport fields as well as in personal homes in front of television sets and radios, than it has become an integral part of educational and upbringing practice of everyday life. Why? Answer on this question should be looked for in the framework of understanding sport as a scientific, social and educational phenomenon. To achieve this, it is necessary, first of all in BH sociological studies, to approach more intensively to development of anthropology of sport, to foundation and development of sociology and pedagogy of sport as well as to development of theory of sport.

Within scientific context in Bosnia and Herzegovina, it is evident that we are at the beginning of developing, in sociological thought, a sociology of sport, as a sub-sociological scientific discipline, which will, in scientifically relevant way, explain sports and sport activity as a social and educational phenomenon and, on the basis of that knowledge, realize sport reality as an educational activity, too. The aim of this work is to initiate development of sociological examination of sport activities as social contents, as well as contents of educational activities on all levels of educational process.

Sport as (an Attractive) Social Fact

For more complete understanding of sports as both, social and scientific fact in the era of industrial and post-industrial realization of social life, it is necessary to ''get out of'' traditional mono-disciplinary categories and concepts of understanding social reality dynamics. Why it should be done? It's because sport is a specific activity, dependent on human society, which is situated mostly on the other side of production necessity. Sport, as an independent and specific part of society and a social fact, has, in addition to anthropology and subjective component, willing, esthetic, emotional, cultural, educational, religious, moral components or, in other words, entire social environment. What are the questions to which sociological study should give answers in order for us to understand sport as a social and educational fact? First of all, here, we will mention those issues we consider the most important from the theoretical perspective of sociology of sport.

Sport activity, regardless of how it is has been organized, has always been a multi-dimensional social phenomenon because it encompasses several aspects for studying. In addition to its social aspect, there are also some other important aspects to be considered, such as: political, ideological, moral, economic, educational and cultural.

Sport as an integral part of entire social environment can be seen as an important political phenomenon, not only on local levels, but also as a global tendency in the world. It is an undisputable fact, proved by everyday sport practice, that sport has been an important political phenomenon suitable for exerting influence on the masses, especially young people. Therefore, we can conclude that sport activity has had a significant role in affirmation of every country and its political ideology. In addition to that, it has also been a unique policy, especially at specific organized levels (state, local, group, individual). Finally, on the basis of the above said, it can be concluded that an official authorities use their privileged status and structural organization to impose on sport activity, especially on some aspects, their operational and strategic decisions in the form of programs, resolutions, laws and other documents.

Sport activity has been significantly related to production, with economic activity of society because of the fact that development of sport activity depends on the level of socio-economic development of society. In underdeveloped countries only some activities can exist, such as football, basketball etc, while others are neglected, not so popular and financially unsubsidized. However, it doesn't mean that kinetic activity,

specially organized as sport, can't have a significant influence on economic development of a country. If some sport performances attract a huge number of spectators, especially people from abroad, it can bring some profit, not only to a sport club, but also to hotels, transportation companies, as well as to government, because if there is a rise in transportation or sale of merchandise, it contributes to the rise of sales taxes. Investments of capital in manufacture of sport equipment, profit from advertising, etc. represent an economic aspect of sport activity.

Educational and moral aspects of sports are directly linked to educational programs and all educational practices in schools. This aspect of sports has an influence on development of moral and good character traits of young people, especially on development of strong will, as well as a range of other positive character traits of a person. The situation is quite different in professional sports. In addition to development of positive character traits, professional sports can cause numerous negative aspects, such as: violence, conflicts on the sport fields, desire to win at any price, etc. This happens outside individual will of a sportsman. However, in spite of these setbacks, there are possibilities for professional sports to develop those positive character traits of players, coaches and spectators which will help to develop collective consciousness, creativity, friendship, and companionship. A society that is not developing general educational values won't be developing them in sports as well, because it depends on general social relations and level of civilization and culture of society how will moral develop in sports or to which moral characteristics will organized sport activity turn.

Sport is one of the positive perspectives of the society under scientific and technological revolution, which force human beings to engage in more and more automatic and impersonal relationships. Sport, as a cultural phenomenon and a part of general culture of a society, has had a humanizing role. Sport is a part of social environment which has had huge potentials for forming and developing new humane creations of a mankind.

Sport is one of numerous practical and conscious activities of human beings which depend on entire social communication and opportunities. Therefore, sport should be considered as socio-historical, spiritual, cultural, and educational phenomenon, which is innate quality of human beings. There are some philosophers and scholars who claim that every human activity is influenced by interest, passion and fear. Something we are particularly interested in is the characteristic of a human being which defines him as a being of a game (homo lidens) because sport, or a sport game, has primarily been a part of human self-determined creation, will, desire, consciousness, determined by specific laws that are part of a structure of social, cultural and spiritual life of a social community in which particular sports activity has been realized. In that sense, phenomenon of sports represents a sphere for demonstration of not only sport rules and regulations, but also of entire socio-cultural regulations and norms, as well as educational reality as an important part of a social reality in general.

To realize all those values and norms in humanistic context, it is necessary to put more emphasize, within entire sport reality, on educational aspect of sport. Sport education, besides its function and meaning, has a function of shaping our society esthetically and artistically. This universal dimension of sport education has always exceeded an individual context, because it, by its nature, represents simultaneous engagement of a huge number of people. Indeed, it wouldn't make sense to be engaged in some sport, the same as it wouldn't make sense to paint, compose, and write, only for yourself. Finally, every human creation, including sports and sport education, can reach human horizon or, in other words, make sense only in communication with other people.

Human being has always been, first of all, a social being. Sport education of a human being can be individual and social. On individual basis, it should be understood as ''confirmation of social life'' because a human being can ''be alone'', differentiate themselves and became a ''name'' only in a company with others. On social basis, if we abstract biological and anthropological dimensions, sport education should be seen as planned and meaningful activity because sport doesn't originate only from nature of human being as an individual. Among other functions, the function of sport education is also to develop human personality in the process of going toward realization of its totality in a concrete social circumstance of living.

Upbringing and Sport

Upbringing is a social process within socialization which enables us to adopt various behaviour values and norms which are products and results of collective social consciousness. Upbringing is a core of socialization process because it is the socialization, although in much narrower sense. ''There are two types of influence on a person,

which contribute to their growing up into mature and complete psychical, social and cultural human being. On one side, there are so called contextual factors which spontaneously affect person from within a structure of a society, including everyday activities which a child or adolescent sees and takes part in (life in family or local community). On the other hand, there are factors of conscious direction whose characteristics are systematization, methodology and organization. According to prevailing opinion only those later factors can be considered as training (upbringing, remark by authors).''[1]

In various aspects of socialization process there are processes which are spontaneous and accidental but upbringing is a consciously directed activity led, first of all, by aims of society. Those aims are, first of all, ideological and ethical and directed toward socially desirable values. In its ontological sense, upbringing leads to good.

To realize process of upbringing successfully or, in other words, to be able to realize upbringing tasks, such as: intellectual, moral, esthetic, working, health, and physical tasks, it is necessary to include education in the process of upbringing. Fundamental function of education is realization specific upbringing tasks.

Sport[2] in these modern times has exceeded meaning of a pure game, understood as entertainment. Therefore, it also includes some other values of society, such as, for example, various economic, cultural and other social values. Because of that, the process of sport education should include these dimensions, too. Sport and sport education by their very nature have general value, because they, as free creative activities, have been present in all societies (developed and underdeveloped, mono-national and multinational, secular and sacral). General social value of sports arises directly from the fact that it belongs to the sphere of free human activity. Sport ''steps across'' cultural borders, and if it is in the broader sense a part of culture, it also steps across borders of different countries and ideologies. Moreover, sport steps across limits of human attachment to nature and geographical limitations. In other words, sport is a universal phenomenon. Overall social value of sport arises from its diversity and complexness, as well as its actuality and attractiveness. To this aspect of sport, if we examine it from a sociological perspective, general laws of sport development and process of sport education are dialectically linked.

Development of sport is inseparably linked to development and advancement of society in general. Sport evolution (evolution of sports) depends on technical and technological advancement of a society itself. At the same time, advancements in a development of sport practice, as a specific, structured and well-organized activity, reflexively affect development of a society. The same as technical and technological development of society affects development of sports, sports reflexively influence increase in heterogeneity of social groups or, in other words, increase level of stratification of social reality in general. At the same time, these two interrelated processes are followed by development of sports, as a specific type of educational process in general. Sport education, as a process of constant advancement, dignifying, coordinating, motivating methods and techniques, has been integral part of sport activity. It is necessary to understand that social value of sport education functions as one of the main elements (segments) of entire physical education.[3]

It has been known, more or less, to all of us that a fundamental function of physical education is preservation, improvement and advancement of human health because health, besides life and freedom, has always been one of universal social values. Life, as the greatest gift to humankind, can be protected by taking care of health. Health is a

[1] Sociological lexicon, p. 728

[2] There are various definitions of sports, often contradictory and paradox. Vagueness of the term "sport game" and claims that sport is a game contribute to that. One group of researchers claim that sport if a fight of a man with themselves, other man or natural obstacles (forces of nature). Others emphasize that sport is educational social institution permeated with game, whose aim is physical and spiritual perfection of a person. Third group of scholars see sport as rational activity, entireness of achievement in specific aspect of social life, etc. (D. Kokovic, Sociology of Sport, Sport Academy, Novi Sad, 2000, p. 21.)

[3] ''Term physical education used here has broader meaning than the school subject with the same name and sphere of educational process in primary and secondary school. This notion presents total educational activity whose purpose is assuring correct physical growing up and developing, improvement of health and raising overall physical ability.''(Vukasinovic, Pedagogy, second expended edition, Zagred, 1991, p. 81). Let remind ourselves that upbringing, as complete social and spiritual process, besides physical, also includes intellectual, moral, esthetic and working upbringing. These types of educational processes have been named ''fundamental educational processes'' by pedagogues. Educational process, as a social practice, happens in concrete social groups and social institutions, such as: family, pre-school institutions, schools, sport collectives, groups of peers, universities, social institutions, institutions for free-time activities, institutions for special education and upbringing, institutions for mass-media productions, etc.

fundamental living condition. Therefore, sport education, as an integral part of educational process in general, has universal and primary role. Sociologists, pedagogues and social psychologists claim that physical education has been ''prerequisite for other educational spheres. Therefore, in this way, it by its very nature comes first because it is necessary, unavoidable base of every successful educational practice.''[4]

As we said, a human being is the most complex and developed living creature on the planet Earth. Among all living creatures on the Earth, only human beings have been able to construct, comprehend, cooperate, evaluate, improve, compete, etc. Thanks to those abilities, we have developed philosophy, science, art, culture, sport, moral, etc. For that reason, through sport, besides overall social values and health, sport education influences development of human values, such as: honesty, goodness, beauty, justice, dignity, fair play, chivalry, etc. Most scholars claim that sport has been an inseparable ''companion'' of human beings. It can be said that it has existed since the first days of humankind. In the broadest sense, sport and games have existed in all times and cultures because, even in prehistoric times, human beings organized sports competitions, entertainment and cult games. Socio-educational value of sport, as a value of education in general, has been a universal social value, present in all societies and times. This was recognized even in classical period of history.[5] ''Upbringing in Athens was divided into gymnastic and musical upbringing. Goal of gymnastic upbringing was to develop beauty and body strength, flexibility and beauty of motion while musical was used to cover areas of intellectual and esthetic upbringing.''[6]

Socio-educational aspect of sport has lied not only in acquiring practical sport skills and habits, helping development of psycho-mobility skills, learning necessary sport knowledge, but also in development of certain lifestyle and attitudes towards world and society. Acquiring those sets of knowledge about meaningful attitudes towards the world, society, and human existence represents social and valuable aspect of sport education. Knowledge has been one of the fundamental values of human life and our imperative obligation. Without acquiring new knowledge, human beings wouldn't be able to survive or, more exactly, wouldn't be able to adapt in natural environment and wouldn't be able to create rational and purposeful social organization.

''The field of upbringing we are talking about here has been in the need of knowledge about basics of hygiene, anatomy of human body, physiology, biology, knowledge about healthy lifestyle, place and importance of physical education in our lives, influences of natural phenomenon on human organism, health importance of particular aspects of physical exercise, harmful consequences of engaging yourself in some activities, about negative consequences of nicotine, alcohol, narcotics, and other intoxicating substances, first aid knowledge, etc. Besides knowledge, physical education develops numerous skills and habits. We will primarily mention skills and habits which have broader practical application in everyday life and work, such as: walking, running, jumping, catching, aiming, climbing, creeping, squeezing, lifting, carrying, pulling … etc.''[7] Besides educational and health values, sport, as a socio-educational phenomenon, develops one more important value, so called active reaction. Every person needs to rest and refresh after hard physical or intellectual work using energy and crating fatigue. Sport, through its educational aspects, directs a person towards active rest and healthy recreation. It has usually been achieved by those forms of sport exercises which don't impose so much physical effort on our organism.

Today, sport understood as a socio-educational phenomenon has exceeded all simplified definitions of sport as merely sphere of entertainment, leisure and spending. Socially valuable aspects of sport have superseded old biased interpretations of sport activity and present it as an integral part of an entire process of reproduction. These days, sport and sport education present distinct types of social activity in overall social distribution of labour. Development of sport and sport culture has influenced internal differentiation within increased social need for sport structuring.

[4] Vukasinovic A, cited work, p. 81.

[5] Historical and scientific description of upbringing has showed that Pythagoras (about 580-500 B.C.) was the first thinker with clearly defined thoughts on upbringing. He founded a boarding school in the town of Kreton (south Italy) in which he used to educate children in accordance with his teachings. First educational system was developed and set by Socrates' student Plato (427-348 B.C.) on the foundations of Spartan and Athenian model. He explained it in his works The Republic and The Laws. In his works The Politics and On Upbringing, Aristotle (384-322 B.C.) explained his theory of upbringing but only parts of those works has been preserved. According to Aristotle, fundamental purpose of upbringing is moral perfection – achievement of strength – wisdom. Aristotle differentiates between three types of upbringing: physical, moral, and intellectual.

[6] Vukasinovic, cited work, p. 83.

[7] Ibid, p. 87.

Development of massive and professional sports, their scopes and achievements, have had an influence on their differentiation, their status in the society and appropriate position in social distribution of labour. For those reasons, it is now necessary to emphasize, through sport education, that first-class, competitive sport has exceeded the limits of mere entertainment and game and has become an independent socially valuable activity. At the same time, professional sport has become one of the perspective social resources of every social community.

By including value categories and notions and premises based on them into sport, it is understood as a part of a complete development process of social totality as well as its position within a system of general social relations and values. Together with understanding the place and role of the sport in social reality, we understand and make critical and value judgments and opinions about type and character of social relations which are being established in sport itself.

In modern days, it is important to emphasize economic aspects of relations in sport. The law of profit (benefit) is becoming one of the most important elements of sport activity, as one of the laws of market in general. To be honest, this law ''has come'' to sport from a life of market way of functioning of work and capital. From all above said we can precisely conclude that in the field of sport and relations within it some socio-historical and socio-economic laws have been working and they, eventually, define its socially valuable essence.

Sport Education as a Human Capital

Sport as a socio-educational process has been an inseparable part of a whole process of socialization of an individual. Process of socialization is happening during whole life, though various forms of human activity and in different social groups. On the process of socialization an individual learns about culture of their social community, adopts social values and norms and forms goals. In that sense, socialization represents ''a complex interactive relationship between an individual and society, linked to the process of adopting knowledge, attitudes, values and norms, behaviour patterns, necessary for participation of an individual in social life.''[8] Through family, group of peers, school, mass-media production, sport collectives, etc society has been shaping skills and motives of its members. What is, then, difference between educational process and socialization? Education/upbringing is a systematically organized and institutionalized process. He directs growing up through learning, acquiring knowledge, development of physical, mental and working skills, often toward an ideal goal set by society itself. Socialization is universal process of social formation of a personality of an individual as a member of: society, family, local community, politics, culture and sport or some other social group.

Sport as an educational process, itself, possesses its own value. It contributes to development of human personality and surmounting life problems. Therefore, sport has been a useful good. In the process of education through sport activity we can talk about an investment that gives individual returns, bigger income in the future, which represents a productive energy whose existence is needed for labour and modernization. In industrialized countries, people, during ''educational revolution'' have understood that school diploma represents the biggest investment in the future of their children, so they are doing their best to gather various diplomas. Talking about sport, in modern times, it is realized that it is one of the best investing values, because children from ''higher classes'' have better chances not only in school, but also they show appropriate character traits, value orientations and ''directions'', motivation to succeed in oral and expressive capabilities, cognitive and emotional skills in sports, too. Transferred educational contents I a complex society with a distribution of labour can't be so easily differentiated as they were in 19th century, when one part of youth were educated for subsequent progress to positions and the other part was raised for obedience: today, there is a need for a differentiated shaping of individuals. However, it means that class influences have less importance and school, in addition to other youth groups, is becoming more important for ''marking'' of an individual.

Socialization has always meant a process of including a human individual into society. It has always been happening primarily within activities of social groups. As a sport group (team, collective, group, fan group) is a part of a social space and reality, rule by particular social norms and codes of behaviour, at the same time, it has been one of the important factors of entire socialization of an individual. Sport group, through sport education, represents a particular behaviour pattern, which has been verified as an acceptable social model. Each sport group, through various codes of behavior and conduct,

[8] Žiga J., Đozić A., *Sociology*, BKC Sarajevo, 2004, p. 88

such as, for example, aspects of symbolic communication, set codes of behavior, influences the process of socialization of its members or more exactly participates in development of individual character traits of its members, which, at the same time, are socially acceptable. According to numerous sociologists, these days, sport as a educational process, through sport activity, sportsmen, sport audience and its behavior, has been more important factor of educational as a human capital than some traditional factors of socialization.

CONCLUSION

Sport as a socio-educational phenomenon represents, not only aspects of sport rules and norms, but also an expression of all socio-cultural rules and norms, as an important part of a social reality in general. These days, realization of sport activities or simply sport as educational practice represents the most valuable human capital of society. Today, sport understood as socio-educational phenomenon has exceeded simplified understandings of sport in the terms of merely: entertainment, leisure and spending. Socio-educational aspects of sport have superseded one-sided interpretations of sport activity and see it as an integral part of entire social reproduction. Sport, understood as a socio-educational phenomenon, represents a special type of social activity within the framework of entire social distribution of labor. As a part of a branchy network of social distribution of labor, besides its sport function, sport in these modern times has an educational, esthetic and artistic function in a shaping of a society.

Development of both, massive and professional sports, their scopes and achievements, has influenced their differentiation, their status in society and appropriate position in social distribution of labour. For those reasons, today, it is necessary to emphasize, through sport education, that first-class, competitive sport has exceeded limits of mere entertainment and game and has become an independent socially valuable activity. At the same time, a professional sport has become one of respective social resources of every social community. In order for sport to be realized as a human capital of a society, it is necessary to affirm educational value of sport within entire sport reality. It is necessary to include in sport activity, as its integral part, some educational values such as: dignity, goodness, chivalry, justice and equity, honesty, health and beauty.

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PREDICTIVE VALUE OF MOTOR ABILITIES ON THE RESULT IN CRITERIA VARIABLE SKI SHORT TURNS

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Original scientific paper

Summary
Set of tests of motor abilities (as the predictor system) was used on a sample of 81 students of the Faculty for physical education and sport in Tuzla, for the purpose of determining predictive value of motor abilities on the results in criteria variable ski short turns. By means of a regression analysis the whole system of predictor variables is statistical significant, so based on these results, occasionally it can be reacted, because of the growth of the same (motor abilities) on the optimal level, for the easier mastering of the elements of Alpine skiing techniques.

Key words: *regression analysis, alpine skiing, motor abilities, short turns, students*

INTRODUCTION

Alpine skiing is sport which takes place in different conditions of environment as well as field (bumps) and weather conditions of environment which are unpredictable for competitors (the wind, snow, fog). Due to all this, the skiers have to have memorized a huge number of different information so they could master better certain tasks which are given to them. Different sections of a track demand from skiers implementation of different techniques of skiing and its elements. In order to ski through all sections successfully, we have to know and overmaster the techniques of skiing as well as its elements. For successful and quality overmastering the specific skiing techniques, the optimal physical preparation of the skier is necessary as the postulate in all that. The efficient managing of the system is possible only if the structure of the system is known and its mutual relations which give us certain information for quality formation of postulates and foe successful management of elements of certain skiing techniques.Some of the authors that are occupied with issues of structure of motor dimensions are Kurelić, N. and his associates (1975)[3] where they speak of the factor of coordination, which embraces the area of agility. Metikoš, D., Hošek, A. (1972)[6] according to factor analyses, came to an assumption on existence of more complex structure of coordination, because the 10 latent dimensions of coordination are isolated. Explosive strength Kurelić, N. and his associates (1975) [3] have defined the explosive strength as the ability of short time maximal mobilization of muscular tissues, because of acceleration of body movement, which reflects in the movement of the body in the space of in effects on the objects around.Some of the authors that are occupied with issue of alpine skiing are Kazazović, E., Nurković, N. (2003)[2], where they research the objectivity of evaluation during overmastering the specific alpine skiing techniques, Mujanović, E. (2007)[7] who research in doctoral dissertation relations between anthropological dimensions and success in alpine skiing, Lilić, Lj. (2007)[5] in his paper research development of motor abilities at students during teaching process in alpine skiing.
The realization of performing the basic elements of alpine skiing depends on more factors of anthropologic areas. In this research, we set up for the aim the determination of predictive value of motor ability (24 variables), on the result in criteria variable ski short turns, so the students could master better the elements of alpine skiing.

METHODS

Participants

The participants in this research were consisted of regular students of the Faculty for physical education and sport in Tuzla, by the age of 21-23. The measurement procedure was done due to the sample of 81 student, who were regularly involved in the subject of skiing. All students from the sample were without expressed morphological,

motor and psychological aberration and were able to attend the classes regularly on third and fourth year of the University. All examinees were given base notations before the test started, towards carrying out the best quality of testing where the number of possible errors will be minimized.

Instruments

***The evaluation tests for motor abilities (predictor system*)**

For evaluation of motor abilities, the variables are chosen for which it is supposed that they cover the area of latent dimensions and energetic regulations, and are present in performance of basic elements of alpine skiing. The 24 variables were chosen for which it is supposed they cover the area of latent dimensions of motor abilities space.

These are the following tests:

For evaluation of balance factor, the following tests were used:

1. MBAP20 - standing on two legs broadside on the bench with opened eyes
2. MBAU20 - standing on two legs along the bench with opened eyes
3. MBAP10 - standing on one leg broadside on the bench with opened eyes
4. MBAU10- standing on one leg along the bench with opened eyes.

For the evaluation of flexibility factors, the following test will be used:

5. MFLISK - skew with a bat
6. MFLPRK - touch toe on the bench
7. MFLPRT - touch toe with a strip
8. MFLBOS - side split

For the evaluation of the speed of frequency of the movement, the following tests will be chosen:

9. MBFTAR - tapping with hand
10. MBFKRR - circulating with a hand
11. MBFTAN - tapping with foot
12. MBFTNZ - tapping with foot against the wall

For the evaluation of coordination factors, the following tests will be used:

13. MKOONT - agility on the ground
14. MKOOUZ - agility in the air
15. MAGOSS - eight with crouching
16. MAGKUS - steps aside

For the evaluation of explosive strength, the following tests will be used:

17. MESSDM - standing long jump test
18. MESSVM - vertical jump
19. MESBML - medicine ball toss
20. MFE20V - running 20 m/sprint

For the evaluation of repetitive strength, the following tests will be used:

21. MRSSKL - push-ups with load
22. MRSPTL - rising the body from the point of lying
23. MRSZTL - screening of the body in lying
24. MRSPCT - half- knee band with extra weight

Criteria variable

As the criteria in this research, the variable of SBRZVI - short turns was chosen, which is defined by curriculum of alpine skiing. The practical part of school skiing program consists of teaching of the elements of alpine skiing. The evaluation of success in performing elements of alpine skiing was done by the three judges. The judges had to fulfil the following conditions:

1. they had to have a degree University degree in Physical education and sport,

2. to own the theoretical and practical knowledge of alpine skiing.

The judges adjusted the criterion by paying special attention to initial position, body position, position of legs, arms, aesthetic performance of practice, coordination of performance of practice, amplitude of movement, speed and rhythm and final position. Evaluation of the teaching process was done by grades from 1-5. The skiing element is performed twice consideration possible mistakes and the judges are evaluated the better performance. Similar research results have got Kazazović, E., Nurković, N. (2003)[2], where they got metrical characteristics of tests, basic skiing elements, evaluated by judges and treat them like measuring instrument.

Metrical characteristics of tests SBRZVI- short turn

We defined metrical characteristics of tests SBRZVI- short turn using factor analysis principal components. In matrix of principal components

(table 1.) on the basis of presented data we see significant projections of vectors and we can tell that the grades for evaluation of skiing element SBRZVI- short turn were good criterion.

Table 1.

	Component 1
Judge 1	0,861
Judge 2	0,843
Judge 3	0,856

The methods of data processing

The information in this research were processed by program systems for multi variety analyses of information, by using the regressive analyses.

THE RESULTS AND DISCUSSION

The regression analyses of criteria variable in manifest area of motor variables, provides enough information on predictive value of manifest variables of motor abilities, used in this research on the result in criterion variable of short turns. By the predictor system of variables, the R Square (.527) was explained, i.e. 53% of common variability with criterion, while the connection of the whole system of variables with criteria R. 73 (table 2.) , which tells us that the whole system of predictor variables is significant for foreseeing the results on success in performance of the basic element of skiing technique, ski short turns. However, the other 47% in explaining the mutual variability can be prescribed to other dimensions of anthropologic status of a man, which are not taken in this research.

Table 2.

Summary Statistics; DV: SBRZVI	
	Value
Multiple R	0,726190
Multiple R²	0,527353
Adjusted R²	0,324789
F(24,56)	2,603398
p	0,001672
Std.Err. of Estimate	0,651062

By detailed overview of the table 3., we have analyzed the practical impact of the variables from the area of basic motor (the predictor set of variables), where we insighted that the seven variables have the statically significant influence and that is: from the area of variables for the evaluation of flexibility of the variable MFLPRT - tip toeing with string, MFLPRK -tip toeing on the bench, MFLISK -skew with a bat, and in the area of variables for evaluation of coordination MAGKUS- steps aside, from the area of variables for evaluation of repetitive strength the tests MRSSKL – push ups with weight, MRSPTL - rising the body from the position of lying and in the area of variables for evaluation of balance the test MBAP10 - standing on one leg broadside on the bench with opened eyes. Following that we can make conclusion that the motor dimensions of refer test are primary motor dimensions for successful execution of skiing element short turn. Anyhow we must considered that the whole system of predictor variables is significant for foreseeing the results on success in performance of the basic element of skiing technique, ski short turns, and the students with larger level of all applied motor abilities have more successes in overcoming the skiing elements.

Similar research results have got Lanc, V.(1984)[4] in his master work came up with conclusion that all motor abilities for evaluation of repetitive strength had large relations with test short turn and the test short turn had large relations with other skiing elements which had large relations with motor abilities for evaluation of balance and flexibility. Also in research paper Agrež, F. (1976)[1] got results that the skiers of quality level have good results in tests for evaluation of balance.

For successful performance of short turns, the practice coordination of basic skiing motion is necessary which controls the middle position of a skier on the ski, the control of the ski pressure on the basis as well as the movement of ski with correct (proper) semicircle. All this guides us on the fact that the short turns is very complex and specific motor task and for its successful performance are mostly responsible the above mentioned motor abilities of a man. Also, there is the irrefutable fact that for the mastering of its skiing element, the parallel development of all motor abilities used in this research are needed, because of the complexity of the system of skiing motion

Table 3.

Regression Summary for Dependent Variable: SBRZVI

	Beta	Std.Err. - of Beta	B	Std.Err. - of B	t(56)	p-level
Intercept			-7,75338	4,002261	-1,93725	0,057765
MBFTAR	0,133407	0,126963	0,03242	0,030850	1,05075	0,297886
MBFTAN	0,103512	0,141225	0,01186	0,016181	0,73296	0,466642
MBFTNZ	-0,049493	0,122816	-0,01492	0,037016	-0,40298	0,688497
MBFKRR	0,023221	0,153781	0,00339	0,022420	0,15100	0,880519
MFLBOS	0,242048	0,133855	0,01651	0,009131	1,80829	0,075932
MFLPRT	0,354017	0,144416	0,05774	0,023553	2,45137	0,017377
MFLPRK	0,422036	0,132797	0,05827	0,018335	3,17805	0,002414
MFLISK	-0,341808	0,153103	-0,01739	0,007787	-2,23253	0,029596
MKOONT	0,097085	0,118092	0,03806	0,046294	0,82212	0,414498
MKOOUZ	-0,153679	0,118657	-0,31006	0,239397	-1,29515	0,200582
MAGOSS	0,135457	0,138604	0,12728	0,130238	0,97729	0,332627
MAGKUS	0,423413	0,167261	0,52555	0,207609	2,53146	0,014193
MESSVM	0,245154	0,160760	0,03015	0,019770	1,52497	0,132895
MESSDM	0,015235	0,166584	0,00068	0,007461	0,09146	0,927455
MESBML	-0,205279	0,141258	-0,01078	0,007420	-1,45322	0,151742
MFE20V	-0,101727	0,134252	-0,44311	0,584787	-0,75773	0,451789
MRSSKL	0,297093	0,121622	0,03434	0,014056	2,44276	0,017756
MRSPTL	0,247738	0,113071	0,03730	0,017026	2,19100	0,032630
MRSZTL	0,030858	0,116651	0,00319	0,012069	0,26453	0,792340
MRSPCT	-0,102940	0,129927	-0,00650	0,008205	-0,79229	0,431534
MBAP20	-0,110157	0,117513	-0,03989	0,042554	-0,93741	0,352575
MBAU20	0,140489	0,122403	0,05341	0,046530	1,14776	0,255948
MBAP10	0,238290	0,113852	0,05555	0,026542	2,09299	0,040893
MBAU10	0,149446	0,108347	0,00747	0,005415	1,37933	0,173278

CONCLUSION

The testing of motor abilities, students, pupils, skiers, have very important role in the frame of program performing and mastering the elements of alpine ski school. Based on these results, occasionally it can be reacted because of the growth of the same (motor abilities) on the optimal level, for the easier mastering of the elements of alpine skiing techniques. We can say that in the base itself, the physical preparations, which is the postulate for technically correct performing of skiing elements.

These results indicate on necessity of practicing of further researches on the population of students and multidimensional over viewing the given problem in the purpose of improvement of educational process of ski learning.

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PREDIKTIVNA VRIJEDNOST MOTORIČKIH SPOSOBNOSTI NA REZULTAT U KRITERIJSKOJ VARIJABLI BRZO VIJUGANJE

Originalni naučni rad

Sažetak
Set varijabli motoričkih sposobnosti (kao prediktorski sistem) je korišten na uzorku od 81 ispitanika studenata III godine Fakulteta za tjelesni odgoj i sport u Tuzli, u svrhu određivanja prediktivne vrijednosti motoričkih sposobnosti na kriterijsku varijablu brzo vijuganje. Regresionom analizom utvrđena je statistički značajna vrijednost prediktorskog sistema na kriterij te se na temelju tih rezultata pravovremeno može reagirati, radi povećanja istih (motoričkih sposobnosti) na optimalan nivo radi lakšeg savladavanja elemenata tehnike alpskog skijanja.

Ključne riječi: regresiona analiza, alpsko skijanje, motoričke sposobnosti, studenti

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MODEL CHARACTERISTICS OF HIGH JUMPERS' COMPETITIVE ACTIVITIES

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Original scientific paper

Summary
Many scientists studied anthropometric characteristics and kinematic parameters of high jumpers. A number of researches were conducted with the aim to supplement and broaden the existing information. First class track and field achievements are not possible without analysis of adequate biomechanical parameters, which is nowadays the area of scientific study in the field of sport. We made a conclusion based on numerous researches that it is not possible to reach top results without the adequate analysis of the training process. Kinematic parameters of last steps of run-up, take-off and flight, which are velocity, knee angles, angles of hip joint, centre of mass (COM) height and others were obtained through the analysis of various researches data. Based on all the parameters mentioned, this text singles out model characteristics of the competitive activities of best ten high jumpers in the recent years.

Key words: *high jump, biomechanics, angle, velocity, analysis.*

INTRODUCTION

During the recent years fosbery-flop technique has taken the leading position at the competitions through out the world. Richard Fosbury used the backward twisting high jump technique for the first time at the Olympic Games in Mexico City in 1968. The technique comprised, and still comprises two main characteristics: curved approach (run-up) and backward crossing of the bar. This technique proved the most efficient so far. High jump can be divided in four phases: run-up, take-off, flight and landing. Run-up is comprised of the first part that is straight run-up, which turns into curve running of four to six steps before the take-off. During this phase, the jumper's speed reaches 8 to 9 m/s. Based on the past researches (Iiboshi et al. 1991; Bruggemann and Arampatzis 1997), we can also compare cinematic parameters of more recent ones, where increase of horizontal speed of approach running (Isolehto 2003) is clearly visible. The purpose of such a run-up is to bring the jumper into the optimal position for take-off, which is in consistency with his speed-strength abilities (Hay 1993). Take-off phase is defined as a period between the moment the take-off foot touches the ground at the bounce spot and the moment the foot leaves it. Many scientists studied the anthropometric characteristics of high jumpers, thus concluding they should be tall, fast, with low body mass and capable to develop appropriate speed during the last run-up steps. Numerous researches were conducted with the aim to supplement and broaden the existing information in the professional literature. However, nowadays we can witness that various constitutional types of jumpers with different motorical abilities and techniques, can successfully compete at the top level. It is well known that top high jumpers should be tall, fast, with low body mass and capable of developing the speed of 9 m/s during the last run-up steps.

THE STUDY SUBJECT AND THE OBJECTIVE

The subject of this study is high jump kinematic parameters. Accordingly, achieving results in top track and field is not possible without analysis of the adequate biomechanical parameters which is nowadays the area of scientific study in the field of sport. We made a conclusion based on numerous researches that it is not possible to reach top results without the adequate analysis of the training process. The objective of the study is to single out model characteristics of competitive activities of high jumpers that are top rated on the world scale, based on the researches done so far and the available literature.

DISCUSSION

Through the analysis of various researches' data we obtained kinematic parameters of the last steps of run-up and take-off (velocity, knee angles, hip joints angles, centre of mass height and others).
In Fosbery technique, rotation is comprised of 'twist, (rotation around longitudinal axis – body), which turns the jumper's back towards the bar, and 'bridge'

(rotation around the transversal axis), which causes shoulders to move downward and knees upward (Dapena1988). Combination of the two elements creates a position of "twisted bridge", which creates face up position at the highest jump point. Use of computer modeling and graphic makes it possible to predict approximate maximum height the jumper may clear without touching the bar during the particular jump.

The COM height (table 1) during the flight over the bar depends on the height and vertical velocity of the COM during the take-off (Isolehto and associates 2003). This table shows the COM height at the moment the foot touches the ground during the take-off (H1), take-off (H2), and the COM height at the moment of the highest flight-over-the bar point (H3). These parameters are illustrated the same way in the percentual relation to the body height.

Dapena and associates (1990) discovered a positive relation (r=0.79) between the horizontal velocity at the end of the take-off and vertical COM velocity at the take-off.

Table 1: Parameters of the best high jumpers' COM heights

Name	H1 (m)	H2 (m)	H3 (m)	Result (m)	H1 %	H2 %	H3%
Yuriy Krymarenko	0.88	1.32	2.40	2.32	47.51	71.08	2.40
Victor Moya	0.85	1.40	2.38	2.29	43.52	71.22	2.38
Yaroslav Rybakov	0.99	1.43	2.32	2.29	50.56	72.96	2.32
Mark Boswell	0.88	1.36	2.31	2.29	46.46	72.06	2.31
Jaroslav Baba	0.93	1.41	2.33	2.29	47.40	71.79	2.33
Nicola Ciotti	0.86	1.34	2.33	2.29	45.83	71.76	2.33
Stefan Holm	0.87	1.28	2.32	2.29	48.07	70.72	2.32
Vyacheslav Voronin	0.89	1.39	2.30	2.29	46.95	72.89	2.30
Dragutin Topić	0.99	1.34	2.31	2.25	50.30	67.92	2.31
Kyrikos Iannou	0.98	1.36	2.29	2.25	50.67	70.47	2.29
Oskari Frosen	0.97	1.42	2.29	2.20	50.05	73.40	2.29
Matt Hemingway	0.97	1.43	2.32	2.20	49.19	72.37	2.32
Andriy Sokolovskyy	0.97	1.40	2.24	2.20	49.44	71.33	2.24
average	0.93	1.37	2.32	2.27	48.15	71.54	2.32
standard deviation	0.05	0.05	0.04	0.04	2.15	1.41	0.04

In order to provide the complete evaluation of the competitive activities of the athletes, it is necessary to single out the crucial moments which in a complex way characterize level of the special preparedness. Nowadays, these moments are singled out through the factor analysis. This way, six basic factors of moments which characterize kinematic structure of the performance of last steps and take-off were obtained by most authors.

Thus, during performance of high jumps at the heights of 228 – 237 cm the main (leading) factor is the last step. This step is the connection between the run-up and take-off and subsequently the final result depends on the regularity of this step's performance. Further order of the elements according to their importance is as follows: take-off markers, speed during the take-off phase, speed during the second last step, rhythm, tempo and the speed of the last step.

The crucial differences in high jump techniques at different heights were established as well. The greatest noticeable difference is between the initial and the final jumps. Unlike the jumps at the maximum height, the most important factor with the jumps at the initial heights is the speed during the last step, following according to the level of the importance: performance of the second last step, tempo of the last run-up steps, rhythm of the last run-up steps, take-off and activities (running) in the last step.

The analysis of performed main factors' technique of the last steps and take-off shows that the biomechanical structure of this part of jump at maximum heights differs from the structure of the last run-up and take-off steps in the jumps at the initial height. Out of six factors only three are characterized by the specific technique at the beginning of the competition and at the end of it as well. Characteristics of the second last step have the leading role at all high jump heights. This is the reason why a special attention must be drawn to this part of run-up at the analysis of jump technique, and also during its improvements at training process.

Some of the markers are also possible to view as model characteristics of top high jumpers' competitive activities. (Table 2)

Table 2: Model Characteristics of Top High Jumpers' Competitive Activities

Ord. No	MODEL CHARACTERISTICS / UNITS OF MEASUREMENT	NUMERICAL RANGE
1.	Time between the touch down and the vertical moment during the second last step, seconds	0,039 – 0,049
2.	Touch down time during the second last step, seconds	0,130 – 0,141
3.	Time of the second last step, seconds	0,232 – 0,246
4.	Touch down time after the vertical momentum during the last step, seconds	0,115 – 0,121
5.	Speed of the initial flight phase, m/s	4,85 – 5,27
6.	Lower knee angle during the last step, degrees	59,5 – 63,9
7.	Angle of the take-off leg knee joint at the moment of amortization during the last step, degrees	128,0 – 144,0
8.	Knee joint angle of the non take-off leg at the moment of amortization during the last step, degrees	47,0 – 56,0
9.	Angle of the hip joint of the take-off leg at the moment of amortization during the second last step, degrees	190,0 – 198,0
10.	Angle of the knee joint of the take-off leg at the moment of landing during the second last step, degrees	149,6 – 159,6
11.	Angle of the take-off leg hip joint at the moment of planting for take-off, degrees	187,0 – 194,0
12.	Angle of the take-off leg hip joint at the moment of landing during the second last step, degrees	225,0 – 249,0
13.	Angle of the take-off leg hip joint at the moment of planting during the last step, degrees	218,0 – 229,0
14.	Tempo of the fourth run-up take-off step, step/s	3,21 – 3,67
15.	Coefficient of the run-up tempo contrast (constituent parts ratio)	1,41 – 1,89
16.	Coefficient of the tempo mobilization	5,98 – 7,98

Results of these researches made it possible to define characteristics of competitive activities of high jumpers. Bearing in mind differences in kinematic structure of last run-up and take-off steps at the performance of jumps at various heights, jumps at the sub maximum and maximum heights should be implemented more often during the trainings of high jumpers, and it is necessary to perform the constant control of the kinematic structure of the jump with the high jumps at various heights.

Regularity of high jump performance should be controlled during the training, paying special attention to the main factors of the kinematic structure. Unfortunately, it is still performed visually in the sport practice in our country. A coach needs a specific experience for this. First of all the attention should be paid to the final part of the run-up. It is well known that the final part of the run-up should be performed with acceleration during the last three steps. Only such running creates optimum conditions for performance of a proper take-off. Especial attention should be paid to the second last step, that is, from the take-off leg to non take-off leg. During performance of this move an excessive reduction of angle of planting leg on the ground causes respective extension of time of the first touch down phase (until the vertical momentum). As a result of this mistake a hip joint angle of the off leg increases during the amortization phase, the jumper's body leans backwards, and non take-off leg goes far away at the front and completely stretches at the final moment of touch down. This causes decrease (deceleration) of motion activities during this step and as a result it influences performance of the whole second last step. The step becomes too long and tempo becomes noticeably reduced. It further causes excessive under squat (decrease of the knee angle) during the last step, planting of the leg at the take-off spot and makes it harder to cross the bar, due to great decrease of the jumper's speed it seems that he "stops" above the bar.
Kinematic structure of the jump is also disturbed when a jumper plants a leg on the ground leaning too much during the second last step. The jumper seems to "slide" and "run across" the take-off, path of the body movement (crossing over the bar) is flattened and its highest point is behind the bar.

During such jump there is a fast increase of the second last step which decreases its length. At the final moment of touch down during the second last step, upper leg of the non take-off leg is elevated high, which forces the jumper to put it on the ground during the last step, with the very fast movement (simply "trip it").

CONCLUSION

Based on the previously presented, it could be concluded that biomechanics in sport is used to prove the main characteristics of moving activities through the development of technique of individual track and field disciplines. It is also used to perfect techniques in order to decrease or avoid injuries, to increase the achievements, develop training process or possibly modify sport technique. This study shows model characteristics of high jumpers' competitive activities such as speed, angles of knee and hip joints and other parameters which are crucial for top quality achievements in high jump. Differences and deviations in cinematic parameters of various researches give us the reason to conclude that there is not one ideal model, that is, technique of flop high jump. Insofar a jumper has characteristics of competitive activities mentioned above, a high quality result in this competing discipline could be expected.

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MODELNE KARAKTERISTIKE SKAKAČA U VIS ZA VRIJEME TAKMIČENJA

Originalni naučni rad

Sažetak

Mnogi naučnici su izučavali antropometrijske karakteristike i kinematičke parametre kod skakača uvis. Sprovedeno je dosta istraživanja sa ciljem da se dopune i prošire postojeće informacije. Postignuće u vrhunskoj atletici nije moguće bez praćenja adekvtnih biomehaničkih parametara kojima se danas i bavi nauka u oblasti sporta. Brojna istraživanja nas navode na konstataciju da bez adekvtnog praćenja trenažnog procesa nije moguće dostići vrhunski rezultat. Analizom podataka raznih istraživnja dobijeni su kinematički parametri poslednjih koraka zaleta, odskoka i leta, a to su brzina, uglovi u kolenu, uglovi u karličnom zglobu, visina centra težišta tela i dr. Na osnovu svih navedenih parametara u ovom radu izdvojene su modelne karakteristike takmičarske aktivnosti skakača uvis koji se svrstavaju među deset najboljih skakača proteklih godina.

Ključne riječi: skok u vis, biomehanika, ugao, brzina, analiza.

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ELEMENTARY GAMES IN BASKETBALL TRAINING

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Professional paper

Summary
The games in sport training are applied as other training operators, in reference to other goals in separate part of sport training. In that way for example, one strength training with usual contents can be replaced with training which contain elementary games that with its content influnce at same ability that we want to achieve. In this work are shown games used for development of speed, strength, flexibility, endurance and other basic abilities, but which in specific measure create positive mood and have equal influence as other kinetic operators.

Key words*: Elementary games, basketball, speed, strength, coordination, flexibility, precision, endurance, balance*

INTRODUCTION

Basketball is a "simple" game with combination of different kinds of movements. Generally, we can divide them in movements with and without a ball. The basis of these movements are running with different intensity and duration, with fast changing of movement direction, stopping and starting, different kinds of jumps, throwing and catching the ball. Basketball is characterized by dynamic movements. The base of these movements is coordination and agility. Basketball develops other psychophysical abilities like speed, endurance, precision and strength.

Game is a part of human life which follows the man trough each stage of his development, from birth to death. It is an adequate and an indomitable mean of working with pupils and preschoolers which ensures creation of positive emotions like satisfaction, laughter and joy.

Elementary games are games with simple rules and content. They usually used in physical training class, but also in training of sportsmen. The main characteristics of these games are that they do not have strict rules and they can be adjusted to the current conditions and to the age of students or sportsmen. They are characterized by big number of simple natural movements. The games are applied in order to learn, or more often to practice already learned motor skills.

They are good way to improve motor abilities and skills through fun and enjoyment. Positive and competitive character of the games and the team work produce intrinsic motivation that is very important factor for motivating children to actively participate in elementary games.

CLASSIFICATION OF GAMES

In his theory of games, Roger Caillois (Sindik, 2000) suggests dividing games in four main subclasses, depending on whether the competition is dominant in games (AGON), coincidence or luck (ALEA), simulation or mimicking (MIMICRY) or enthusiasms (ILINX). AGON is characterized by competition, a fight with inartificially created chances for victory in terms of one or more characteristics or abilities (Sindik, 2000)[1], and in this group, side by side with social games, elementary games are placed.

Looking from different points of view, there are different classifications of games:

- in terms of complexity of organisation (simple and complex)
- games with or without help tool
- in terms of sports in where they are applied (games for basketball, volleyball, judo, handball, football, etc.)
- Elementary games of separate movements structures (running, catching and racing, pulling, pushing, etc.)
- According to Kortnik (1978) they are classified in terms of orientation on development of some motor abilities (games of speed, strength, skilfulness, games of senses, target practice, etc.)

- in terms of place where training or physical exercise is being organised (games on beach, in water, in gym, on mats, on snow etc.)

In this paper, elementary games will be classified according to motor abilities and skills they develop. Within the categories of games that affect certain skills, some variations are possible. It is clear that one game will affect more abilities and skills. This integral influence of elementary games is their biggest advantage.

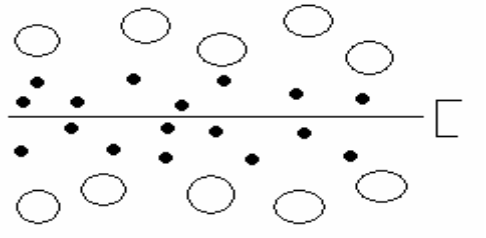
ELEMENTARY GAMES FOR SPEED DEVELOPMENT

Elementary games for development of speed are full of different types of running like (forwards, backwards, sidelong, skip, high skip, sidelong skip...). Usually these movements are combined with imitation of animals or plants (of bees, planes, birds, trees), and different coordination tasks in combination with running (squat, seat, jump), catching and racing.

Game: Catch your pair
All players are divided into pairs. The game begins when one of the players tries to catch his/her pair. When the first one catches his/her pair, they switch roles. While they are catching each other they try to avoid other pairs which are also catching each other moving freely.

When you want to start or to stop a game, it is important to use many visual and sound signals in order to develop players' reaction speed

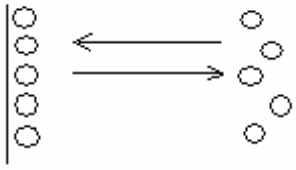
Game: Who will have fewer balls?
Players are set in two groups from both sides of a middle line on a basketball fields. Lots of balls are thrown in the middle of the field and the goal is to get them out of your part of the field. Group which has fewer balls on its field on a sign to stop is the winning group.



ELEMENTARY GAMES FOR STRENGHT DEVELOPMENT

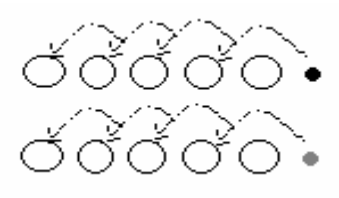
Elementary games for strength development can be classified in games for explosive strength development (sprint, jump, throwing), maximum strength, static, repetitive and elastic strength games.
Contents of games for explosive strength development are sprint, high and long jump, different ways of throwing the medicine ball, throwing other balls etc. For maximum strenght development we usually use our partner in order to produce different types of resistant, as pulling or pushing your pair fro different positions (squat, sitting and standing position). Also, for static strength we use games that we call "who will last longer?" (for instance in various of poses). Elastics strength is developed by applying games with successive bounces or by passing a ball to each other. Repetitive strength is developed by games that are called "who will do more?". (sit-ups, pushes, squats). The most used help tools in this kind of games for strength developing are: rope (pulling), bench (jumps), medicine balls (taking them away in pairs).

Game: Racing a line
Players are standing in a line. On the mark, they start to run towards the opposite side of the field, they touch the wall and go back to the initial position. The one who comes back first is the winner.

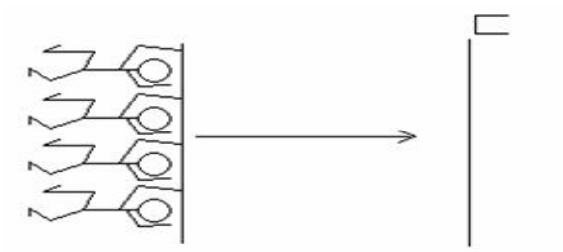


Game: Flood – drought
Players are standing in a line in front of a bench. On the mark "flood" they jump on the bench with legs put together. On the mark "drought" they jump of the bench to the ground.

Game: Whose medicine ball is faster?
Players are standing in several lines of two. Players are distanced from each other about 3 meters. The task si to get the medicine ball to the end of the line as soon as possible by passing it to each other (from the chest, above the head, between the legs).



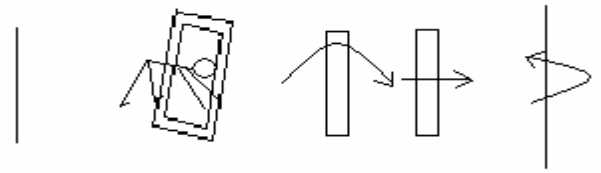
Game: Crocodile race
Players are lying on their stomach behind the line. The task is to get first crawling to the marked line or the wall of a gym (this can be duck racing-walking in squats, spider racing using arms and legs, horse racing-carrying your partner on your back, kangaroo racing- jumps with both legs put together).



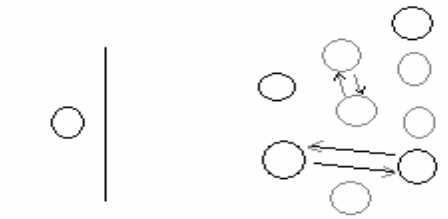
ELEMENTARY GAMES FOR COORDINATION DEVELOPMENT (SKILFULNESS, AGILITY)

By increasing complexity of previously mentioned games, this will get affect body coordination or coordination of body parts of players. Also, by including new (unlearned) or unusual forms of movement coordination demands of a game are increased. Games for coordination skills development often consist of running backwards, jumping with turns, jumping over something, pulling, leading a ball around a stand, passing the ball with clapping, jumping backwards or sidelong, in squats, walking using your legs and arms (forward, backward, sidelong) over the obstacles.Throughout relay races it is possible to form a large variety of training grounds with complex tasks, and in team games (like dodge-ball) to develop perception skills and space coordination. Relay races with marked sections which are to be over come in the shortest time possible by running by turns forward-back, left-right, diagonally are used for agility development (ability to switch directions fast). Ability of space perception can be developed using games such as: walking to the line blindfolded (who will get there faster?), walking blindfolded in circle, three steps front, three steps back (will the person come back to initial position; step-length), visual perception (game who is not on uts place?) and touch perception (searching a group blindfolded – touching faces).

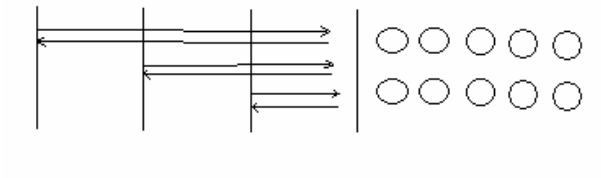
Game: Relay race with tasks
Players are standing in few lines. In front of each line frames of a Swedish case are set in different positions. The task is to go to the srame using arms and legs, jump over it, crawl trough it and repeat the same ehen going back in the shortest time possible.



Game: Who is not on its place?
Players are arranged all over the gym. One is standing in front of them, takes a short look at them and turns away. By short looks (1 sec) he tries to notice have the players changed their places (or have they changed their positions, seat etc.).



Game: Relay race of suicide
Players are standing in lines holding balls. In front of each line there have been lines marked on , 6 and 9 meters. The task of a player is to run to the meter line leading a ball, go back to the start line, run to the 6 meter line, go back to the start line, run to the 9 meter line and go back.

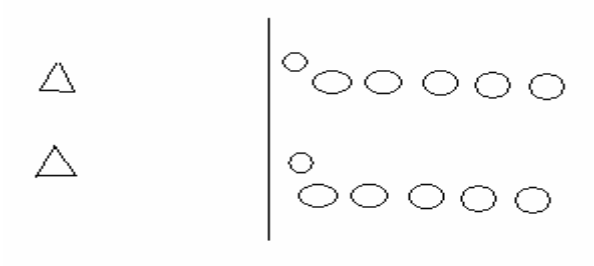


ELEMENTARY GAMES FOR PRECISENESS DEVELOPMENT

Elementary games for preciseness development contain elements of shooting or aiming at a certain static or moving object on a certain distance using your arm (throwing, rolling) or leg.

Help tools which are used as targets in carrying out of the game are pins, Swedish case, basket, goal, medicine ball on the ground, marked parts of a wall or even co-players can be targets (catching, throwing a ball at someone). These games are often of lower intensity and they are applied in a final stage of training.

Game: Throwing erings on pins
Pins are set to distance of 4-5 meters from line. Players hold the rings and they compete who will have the best score, who will have more rings on a pin.



ELEMENTARY GAMES FOR BALANCE DEVELOPMENT

Most often used competitions in the games of balance practicing are: "who will stay longer in a certain position?" for example: standing on one foot (blindfolded, in a position of a scale) or "who will last longer in a certain position with disturbance?" (pulling). These games are of a lower intensity and are used in a final stage of training.

Game: Who will stay longer in one foot?
Players are arranged over the gym. On the mark, they close their eyes and stand on one foot. Who stays longer in this position without touching the ground with other foot is a winner.

ELEMENTARY GAMES FOR FLEXIBILITY DEVELOPMENT

Flexibility can be developed in young age categories by using games of mimicking. In order age categories it is possible to apply dynamic stretching method (swings, circling, walking with a clap under the lifted leg).

Game: Who will make less steps?
Players are standing in a line. In the distance of twenty meters a line is marked. The winner is the one who makes the smallest number of steps until he gets to the line.

ELEMENTARY GAMES FOR STAMINA DEVELOPMENT

It is possible to modify all games which are applied in training so they can influence on some form of stamina. This can be activated by increasing the numbers of repetition or prolonging the task duration.

Games are applied in training as well as the other training operators concerning on goals of each training stage. According to this principle, games can replace some contents in certain periods of a year cycle. So, for example, one training in a stage of basic preparations of a preoperational period with usual contents can be replaced by training which will contain basic games which dominantly affect the same skill. Appliance of different types of games (individual, relay, and team) and games with movement structures and specific sport situations in competition season contributes to the goals of each stage and enriches the training process. Appliance of different team and sport games in active break in transitional period of year-cycle trainings is very often.

Elementary games and natural forms of movement can be applied in all sports or disciplines. As it is already said above, it is possible to shape them according to specific needs of a specific sport. This is what makes them an important part of each training. There are specific manifestations of some skills in relation to a specific sport. So, for example, preciseness is not manifested in a same way in football, basketball or archery, so games do not contain same tasks.

This should be taken into consideration when choosing a game; the goal is to choose a game with a positive transfer on a specific sport. Off course, in wide preparations, games for development of all dimensions of a skill can be used, more or less specific to a certain sport, in this case preciseness. In sport games more often are applied team games, while in individual sports, relay games are used more often. Will the games be related to movement structures or specific sport situations, or will they be only a wide orientation, depend only on a coach. Comparative advantages of games are many, and it is up to coaches to combine them, supplement and shape them according to a specific sport demands.

CONCLUSION

Too large share of games in programme objectively cannot provide appliance of other wanted operators and it creates too big emotional excitement which can negatively affect realization of other contents and goals of training. In the other hand, the game gives possibility to change the hard training regime and it motivates, reinvigorates and puts sportsmen in a good mood (especially those younger ones). Game should not be underestimated, not should be underestimated its help in doing tasks in different stages of preparations.

It should take into account that the games, and any other content as well, are applied with certain goal which fits to a certain stage of a one year cycle of trainings. Games used in trainings give positive effects when they are optimally dosed and adjusted to the sportsmen. Avoiding changing the game or limiting the number of elements with regards to age, sex and unimaginativeness does not have any real foundations. By combining different games and your own creativity, it is possible to bring them closer to the children's interests, aims of a training and to the needs of a specific sport.

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ELEMENTARNE IGRE U KOŠARKAŠKOM TRENINGU

Stručni rad

Sažetak
Igre se u sportskom treningu primjenjuju kao i ostali trenažni operateri, u odnosu na ciljeve pojedine etape sportskog treninga. Tako se na primjer, jedan kondicioni trening sa uobičajenim sadržajima može zamijeniti treningom koji će sadržavati elementarne igre koje svojim sadržajem djeluju na istu ciljanu sposobnost. U ovom radu su prikazane igre za razvoj brzine, snage, fleksibilnosti, izdržljivosti i drugih bazičnih sposobnosti, a koje u dovoljnoj mjeri stvaraju pozitivno raspoloženje i imaju jednak uticaj kao i ostali kineziološki operatori.

Ključne riječi: Elementarne igre, košarka, brzina, snaga, koordinacija, fleksibilnost, preciznost, izdržlivost, ravnoteža

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STRESS AND TECHNIQUES OF OVERCOMING MENTAL STRESS

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Professional paper

Summary
It is often difficult to excommunicate stressful situations. Therefore, people are forced to confront then and to try to overcome them. Strategies of confronting and overcoming stress differ. Naturally, it is very good to know types of stress, both physical and mental, on which an individual can easily react. When a person realises that the situation can be controlled successfully, and that active i.e. problem focused strategies can be used, stress consequences are greatly annulled. The worst thing a person can do is to try and avoid confronting stress, which has a long-term consequence of increasing stress and developing an illness.
Almost all authors, experts who deal with this problem, have a shared opinion that, in transitional countries, a synchronisation of Law on work protection with basic guidelines of EU as well as articulating the problem of stress at work and its impacts is yet to come. Problem needs to be dealt with multi-disciplinary measures, including joined activities of doctors, work psychologists, clinical psychologists, educated staff and sport staff.

Key words: *health, physical activity, yoga, meditation*

INTRODUCTION

Word "stress" originates from medieval English ("stress", "to stress"). Primarily, it had reference to effort, trouble or certain limitations. Stress is based on different experiences of an individual, i.e. one's way of life, reactions caused by a wide projection of diverse events, and thus different definitions of stress (Dunham, J. 1992.).
It is common that by stress one denotes something upsetting or worrying, as for example illness, disagreement, violence, problems at work, exams, communication.... However, our body experiences a feeling of stress in a much sophisticated manner. Stress is everything expected of us, something that requires adjustment, much like every change in our lives, whether good or bad. Just a thought of or presentment of a "change" evokes the feeling of stress. Stress is also a physical effort just as running, carrying heavy things, differences in temperature as well as an excessive meal. Stress is an inevitable part of everyone's life /http://ww.medicina.hr.). In fact, it is a very complex process of interaction between an individual and his/her life.

Basic concepts

The most accepted definition of stress says that stress is a condition or feeling in which one is when one believes that demands in one's life exceed personal and social means which one has at one's disposal. Stress does not always have a negative impact. Lower level or small amounts of stress can pass undetected, and can simultaneously encourage both creativity and productiveness. Such level of stress is often positive in work environment and, as according to research, causes better employees' efficiency. Contrary to lower level of stress, higher level of stress often has very damaging consequences and can initiate some of more serious chronic diseases (Sutović, A. 2005.).
Stress is explained as a condition in which psychophysical balance is disturbed and, due to adjustment, it demands making additional effort. Expression "stress" refers to:

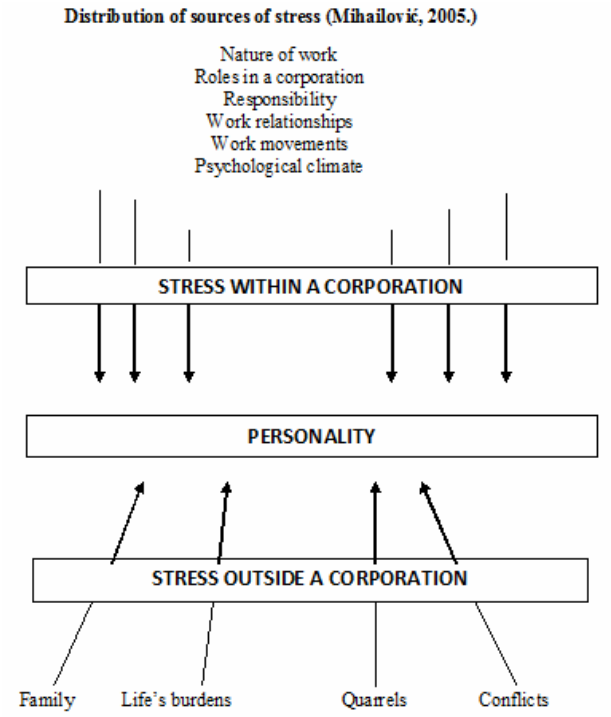
1.Inner body condition (sometimes referred to as "strain")
2.External event (the cause of stress; "stressor") and
3.Experience emerged by individual – environment transaction

STRESS AT WORK

Contemporary theories of stress are all based on interaction of an individual and hi/her environment. One of the most recognized theories of stress is by R. Lazarus and his associates. As according to Lazarus model, stress is being defined as: a complex of emotional, physical (physiological) and behavioural reactions which can be triggered by some, in our opinion, dangerous or upsetting event, or it can be defined

as a complex of mental and physical reactions towards the stressor which raises demands we cannot fulfil.

Stressor (the source of stress), is defined as: an event or a series of events for which we believe are a threat to our lives, lives of our loved ones, material goods, self-respect, and so on. Stressor is an external even, whilst stress is inner condition or experience. "Burn out syndrome" indicates a state of total emotional exhaustion due to excessive but to no purpose hard work (Čukić, B. 2004.). Burn out syndrome is similar to the chronic fatigue syndrome; with the first attitude towards work changes whereas that is not known to be a characteristic with the latter.



STRESSFUL PROFESSIONS

WHO research and announcements of Nation's Business, 1994 say that professions related to education (teaching and similar professions) belong to professions with higher level of stress http://moravek.net/edukacija/stres-posao2, pdf)
To this group belong professions related to health (medical staff) and management (Draker, P. 2006.) It should not be forgotten that an unemployed person is under stress, too. Apart from the mentioned professions, flight controllers, mothers of small children, police officers, newspaper editors, waiters, brokers...also belong to stressful professions. In the basis of their stress is a situation where they have to answer to demands of others within a time limit, and while doing so they are not in control over the events. It is interesting to say that those who suffer from stress the most are between 35 and 45 years of age, and the level of stress grows as long as they stay in one work place.

STRESS PHASES

In 1959, a Canadian physiologist Hans Selieu began with first explanations of stress. His work started from developmental phenomenon of stress and its consequences. He noticed that in each reaction to stress, three basic phases could be detected:

- Phase of panic reaction
- Phase of resistance, and
- Phase of exhaustion.

Phase of panic reaction is the starting phase, which does not last long and in which the body is preparing itself for stressful situation by recuperating. During the phase of resistance, the body starts fighting stress and tries to adapt to it. If the pressure weakens, that means that the personality is overcoming stress. If the stress lasts, a long and tormenting adaptation takes place, which can have a lot of unwanted consequences. Phase of exhaustion sets in if the mechanisms of adaptation fail. Phenomenon of exhaustion is a sign that the body has used all defence mechanisms and is exhausted. According to Salieu's understanding of development of stress, a long fight with stress can grow into so called "stress disease". It can be developed as a consequence of a long resistance to pressures (http://glasjavnosti.co.yu.).

TYPES OF STRESS

Physiological stress relates to encumbering of organs and physical systems (fracture due to stress, etc) i.e. to the correlation between pituitary body and adrenal glands when during the stress period. Psychological stress is defined by cognitive processes and emotional conditions of the body in stressful transactions with an environment. Social stress relates to overall social situation within a specific time period which affects most people. Acute stress is a product of tension in everyday life and often appears in uncomfortable situations which need dealing with. Considering that those situations are habitually coincidental and do not last long, such stress is usually easily overcome. Chronic stress is of a long-lasting character. A victim of chronic stress

cannot see a way out of a stressful situation (such as poverty, unemployment, unsatisfactory job, etc). Traumatic stress is a consequence of a severe tragedy (accident, natural catastrophe, war, etc). Symptoms of such stress can include a vivid memory of a trauma, even after many years. Those people, who are in pain, are diagnosed with "posttraumatic stress syndrome" (PTSP).

REASONS FOR STRESS CONTROL

In the United Nations' report from 1993, stress at work is described as "XX century disease" (Mihailovic, 2005). World Health Organisation (WHO) considers harassment at work "a worldwide epidemic" or pandemic.
Stress costs! One can function under stress a year or two, but over the long term, an employee suffers and his/her stress is a liability to the state. Excessive burden of mental system reflects to the productivity, quality of work done, process itself, number of mistakes made, number of injuries at work, and so on (http://www.medicina.hr.)

ELIMINATING STRESS

Stress control is a key to a successful career. It is thought that not only virtues as self-discipline, ability and systematic approach are important for success but also ability to control negative feelings as fear and tension are as important.

Many try to diminish stress consequences in an inappropriate or even damaging manner. Instead of taking stimuli and tranquilisers, contemporary men should learn methods to avoid stress and to diminish its damaging effects. Some of them we can do ourselves, such as reducing the amount of daily duties (work, family, and school, social), adopting well-balanced diet with lots of vitamins and minerals, avoiding sedatives, well-balance rhythm of sleep and awareness, regular physical activity with relaxation techniques and meditation.
Given the past cognitions and practice of working with stress imply to groups of tasks:

- Those that should be done by a company, and
- Those who are under jurisdiction of participators of a stressful event, an individual.

Therefore, with the goal of overcoming stress, measures, actions and techniques of a company are suggested in order to avoid and recover from stress, within living and work environment. Those two approaches are not mutually exclusive but are complementary done on the same tasks.
A company can do a lot so that the risk of stress would be minimised and its consequences would be put in bearable framework.

Mental training

By the methods of mental training people can be trained on how to mentally correctly overcome a stressful situation and not how to avoid the situation considering that it is, in many professions, simply impossible due to sheer nature of work (for example police, medical staff...). One of the most important parts of stress management, i.e. dealing with stress, is so called Strategy. Many of these strategies could be easily learnt and no additional instructions are needed. It is important to mention that none of these strategies is lesser than any other and one can find it oneself, primarily the one that works the best in a given situation.

Physical activity

Physical activity stimulates discharging of a matter that works as natural anti-depressive – noradrenalin, endorphin, and encephalin. Physical activities can greatly reduce stress and degree of reaction to stress. Fitness and aerobics, as hiking, running, swimming of riding a bike, can be very useful. Stretching is also useful with muscles tension.

Writing

More and more research shows that writing about stressful situations can help stress overcoming and improvement of illness and conditions caused by stress. 10-15 minutes of writing per day is recommended, and one can transfer one's feelings and emotions during the stressful situation on paper.

Discussion

By expressing one's thoughts and sharing them with members of a family or friends, one can better understand one's feelings. Discussion about observations, thoughts and reactions towards stressors and trauma is of great importance, too. Laughter and cry present natural ways of dealing with stress and release of tension. Moreover, they present a part of healing process. Involvement in enjoyable activities, contemplative activities help release of tension, can include a hobby, activities or art. Taking care and playing with pets can also help a great deal.

Rest and relaxation
It is important to retain and ensure sleep rhythm which provides enough sleep and time to relax. Techniques of breathing, muscular relaxation, isometric exercise and creative visualisations should be used. One should relax in a personal usual way: listening to music, reading, walking, etc.

Diet
It is very important to regularly eat. Sugar and coffee craving can appear but it will only increase sensitivity, therefore it is very important to set certain limits. In situations of intense stressors or after traumatic situations, people often tend to start consuming great amounts of alcoholic drinks or they start taking addictive habits, i.e. tranquilisers which could help but any further consumption is damaging.

Reduction of commitments
Excessive number of commitments, whether it is overtime, working on several places, or any other working activity, often creates anxiety and tension. Naturally, all obligations cannot be dismissed and postponed, but one should think about one's obligations on daily basis because there has got to be something which could be dismissed or reduced (Havelka, N. 2005.)

Professional help
Stress can be difficult and discouraging. If the situation is difficult, the best thing would be to ask for some professional help, i.e. help of an analyst, therapist or specialist. By professional help reduction of symptoms of stress and reduction of stress in everyday life can be achieved.

Stress at work can also be reduced or even eliminated by different techniques or possibilities. It is recommended to, at least once a year (preferably more), organise a meeting with an employer or an executive and talk about work. It should be explained what is expected from employees, what are the future plans of a working organisation and where a person (employee) can see oneself in these plans, how can the work be improved, advantages and disadvantages, what are the abilities of advancing professionally, etc.
It is necessary to organise time in a proper way. Professional life should be separate from family life. Technology should not be allowed to influence life at home and to wipe out the boundaries between personal and professional time. Mobile phones should be used wisely. Analysts often recommend that the only way is dealing with stress at work, change of work place or even a job (Mihailović, D. 2005).

MOST COMMON STRATEGIES OF DEALING WITH STRESS

If the environment cannot be changed, personal interpretation of events can be changed and also to try to experience things so that they do not damage us. That is the essence of positive thinking. The same thing can be experienced as a tragedy or as a "little thing". The most important thing is a person knows how to protect him/herself and how to defend his/her interests, in a polite, kind and argumentative manner.

For stress at work it is important to learn to apply cognitive-behavioural modification: a person, an employee needs to learn to recognise events at work which provoke stress, thoughts and emotions which follow these events. A stressful thought and a stressful emotion which follow a stressful event should be replaced with other thoughts and emotions which do not provoke discomfort. The best help for that are laughter, humour, socialising, singing, playing games, etc.

Exercises for eliminating mental stress
Breathing is the essential vital function, with the greatest importance for overcoming stress. Stressed people often forget to breathe. By breathing exercises one can:

- Decrease muscular and mental tension,
- Decrease blood pressure,
- Decrease blood sugar and cholesterol.

By breathing correctly, one can neutralise destructive impact of stress.

Breathing deeply
Correctly inhale and exhale four to five times could make a significant decrease on reduction of tension. A short test could be made, e.g. put one hand on the chest, the other on the stomach and follow which of the mentioned parts of a body moves more during breathing. Probably the movement is superficial, and a part which moves less is thoracic cavity. For this auto-therapy it is important to restrain deep abdominal breathing. Deep abdominal breathing brings a lot more oxygen to lungs than our usual superficial breathing, which indirectly improves blood circulation and the brain gets new amounts of "fresh" blood rich in oxygen. Sitting straight in a chair, feet should be firmly on the ground, and

back comfortably supported. Putting hands on the stomach and thoracic cavity. One should try to achieve lifting a hand which is on the stomach first. Calmly and slowly, one should inhale through the nose, letting the stomach blow up as long as the person is inhaling. When the stomach "comes out" a person should attempt filling the thoracic cavity with air. Exhaling is done through the mouth, in reverse order. First comes the air from the thoracic cavity and then from the stomach. As exhaling, one should relax the shoulders and the rest of the body. When a person becomes more skilful with performing deep abdominal breathing, he/she should try and hold the air around four seconds after inhaling it. Exhale should last longer that inhale

Self-massage

Self-massage can be performed for example in an office: sitting in an office chair, start with the movements of pounding from the top of your head with your fingertips. Poundings should be as light as possible and they should associate us with drops of rain. Same movements are repeated to the neck area and shoulders. Firm and symmetrical movements of smoothing down use your left hand for the left part of your neck, and your right hand for the right part of your neck, from the scull to the shoulders. Firm and symmetrical movements of circling a painful and sensitive back of the head is often massaged. Start squeezing right part of the neck, shoulders and your whole right arm finishing with a palm with your left hand. Using the same hand with circular pressures go down your right shoulder-blade and massage "knots" which have accumulated due to stress and fatigue.

Muscle relaxation

Techniques for muscle relaxation are often combined with techniques of deep breathing and are simple to perform, and they are very useful for relaxation and better sleep. Initially, it is better to perform these exercises with a partner who will control relaxation by lifting one's arm and releasing it. If it freely falls, the person is totally relaxed. With practice one can faster achieve a state of relaxation.

Sequence of procedures:

- Assume a comfortable prone position without crossing your arms or legs; concentrate on each part of your body individually.
- Maintain easy breathing (deeply) during the whole exercise.
- Tighten every muscle as much as possible and count till 10 and then slowly relax
- Try to feel how every muscle in your body slowly relaxes
- Focus on each part of your body starting from the top of your head and slowly moving towards your toes
- It is crucial to include: forehead, ears, lips, neck, shoulders, hands, palms, fingers, chest, stomach, thighs, calves and feet
- When done with external muscles try to relax internal ones

Cognitive- behavioural methods

These methods are the most practical and the most productive ways of reducing stress. They include identification of cause of stress, define priorities, change of reaction towards stress, as well as finding methods to deal with stress(Stojakovic, P. 2002).This method is especially useful when dealing with mental and physical stress. Identification of source of stress consists of keeping a journal of daily activities and events. Although this technique could seem stressful by itself, journal note needn't be very detailed (Trunk Širca, Nin Ronceli, Vaupot, S. 2001). A few words as a reminder of times and events are usually enough. First step is to recognising activities which consume our energy and time, cause nervousness or anger, or cause negative physical response (e.g. stomach ache, headache...). Additionally, it is necessary to replace a negative event with the positive ones, like those that cause physical relief and relaxation and feeling of accomplishment and content.

WAYS OF OVERCOMING PHYSICAL STRESS

Physical stress and tension negatively reflects on the feeling we transmit towards the outside world. Therefore it is very important to find a proper way for detecting and reducing such stress. Release of physical stress has a positive impact on our emotional life. One of the most productive ways of physical stress release is body stretching: stretch out your arms forward and backward, around your head and back. Make a few stretching exercises of your neck, shoulders, back, hips, legs where ever you are. Relax all your body parts that seem tense.

For example, there are many techniques for stress release which can be done in bathrooms (spa centres). Bath and face and foot massage are the simplest techniques anyone can afford. Aromatic scents of candles, candle light induce relaxing feelings. Feet and ankle massage, "reiki" (radiating of warmth that surround a person), yoga, meditation, etc, should not be forgotten.

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