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ORGINAL SCIENTIFIC PAPER

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UDK: 796.012.1.332
DOI: 10.7251/SIZ0218005C

RELATIONS OF MOTOR ABILITY WITH SITUATION-MOTOR ABILITY OF YOUNG FOOTBALLERS

Summary:

The main objective of this research is to determine the correlation of motor skills and situational-motor skills of young footballers aged 9 to 10 years. The relationship between predictor variables and criterion variables is determined by regression analysis. A statistically significant connection of the space of motor skills with a criterion variable has been established. Observing the individual connection of the variables with the criterion, only the variable sprint 10 meters with a high start has achieved a statistically significant connection.

***Keywords**: football, motor ability, situational-motor ability, relations, regression analysis*

INTRODUCTION

The population that is treated in this paper is in the pre-puberty period, in which boys begin transforming themselves into an adult. The result should not be a priority in the development and training of this population, but the continuous development of footballers, who in their later years will demonstrate top-notch soccer in dynamic conditions and a game with maximum display of fitness and quality. Coaches of younger categories should possess an optimal level of knowledge from the methodology of development of investigated motor skills, especially with the age that is the subject of this work. When we look at the motor skills that were explored in this paper, I can warn that their development is tempestuous but still harmonious, can control, the development of speed, explosive power and agility in this period is significant. Stević, et al. (2012) also found that the relationship between the criterion variable and the slalom with a ball with predicates variables has been linked to the problem of the correlation between motor abilities and situational abilities. This proves the interconnection of motor situations with situational and motor skills. Smajić, et al., (2008) show that footballers with higher dimensionality of skeletons, higher explosive forces and better speed stamina, achieve better results in tests of specific precision in football. Molnar et al. (2008) found that boys in a soccer school who achieved poorer results in all types of ball strikes, as well as in the running of the ball and the speed of running with the change in the direction of movement were those who also had unfavorable morphological measures, and a higher amount of subcutaneous fatty tissue, that is, better results were achieved by boys who have better motor skills.

The problem of this research is to determine whether there is a connection between motor skills with situational and motor skills of young footballers aged 9 to 10 years

The subject of this research is the motor and situational-motor skills of young footballers

The aim of this research was to investigate certain physical abilities of young footballers aged 9-10 years, that is, to determine the connection of motor skills with situational and motor skills.

Based on the subject, problems and goals of the research, the following hypothesis was posed: "There is a statistically significant correlation of motor skills with the situational and motor skills of young footballers aged 9 to 10 years.

RESEARCH METHODOLOGY

The sample of examinees

The sample of examinees consists of 25 selected subjects aged 9 to 10 years.

The Sample of variables

Tests of motor skills, predicate set:

1. 10 m sprint-high start (M10s)
2. 20 m sprint-flying start (M20LS)
3. 30 m sprint (M30S)
4. Zig-zag test without ball (MCC)
5. A jump from a squat without a hand swing with hands on the sides (MVSP)
6. Jump with a swing with swinging hands (MVSZR)
7. Test 7 consecutive jumps (M7US)

Criterion variable: zig-zag test with a ball (MCCL)

Data processing methods:

A regression analysis was used to determine the relationship between predictor variables with the criterion variable

RESULTS AND DISCUSSION

On the sample of 25 young selected footballers from the school Olimp from Pale, a survey was conducted with the aim of determining the connection of motor skills with situational and motor skills. The relationship between the motor and situational-motor skills of the students of the football school "Olimp" from Pale was processed by regression analysis. On the basis of Table 1, we can conclude that statistically significant connection of predictor variables with criterion was established. The coefficient of multiple correlation R = .820 and shows the relation between the predictor variables and the criterion variable as seen on the level of significance p = .003. Based on 7 variables of basic motor abilities, 67% of the total variation of the Critical Variable Zigzag with a Ball was explained. The remaining 23% in explaining common variability can be attributed to some other anthropological characteristics and abilities of respondents that were not the subject of this research. From the set of applied basic motor variables (Table 2) the largest and statistically significant influence on the criterion variable was realized by the variable M10M (BETA) =. 495, which is significant at the level p = .02. Such results of the partial correlation coefficients are logical, as these tests hypothetically cover the speed range, and the speed of the speed depends to a large extent on the success of the running ball with the change of direction.

Table 1.Regression analysis of the criterion variableMCCL-running the zig-zag with ball
R = .820 $R_{\acute{c}}$ = .673 Adjusted $R_{\acute{c}}$ = .539 F (7.17) = 5.019 p <.003 Std.Error of estimate: .514

		St. Err.		**St. Err.**		
	BETA	of BETA	B	of B	t(17)	p-level
Intercpt			10.327	4.805	2.148	.046
M10M	.495	.196	2.767	1.099	2.517	.022
M20M	-.278	.255	-1.081	.991	-1.091	.290
M30M	.116	.172	.004	.006	.676	.507
MCC	-.012	.239	-.029	.576	-.051	.959
MVSP	-.353	.219	-.087	.054	-1.608	.126
MVSZR	-.405	.269	-.085	.056	-1.507	.150
MUS7	-.052	.203	-.010	.042	-.257	.799

Legend / Legend: R - Multiple corelation coefficient (Multiple coefficient of correlation); R Square - Determination coefficient (Determination coefficient); Adjusted R Square - Adjusted determination coefficient (Adjusted coefficient of determination); Std. Error of the Estimate

By a further statistical procedure (analysis of multiple regression variance), Table 2 shows the significance of the multiple regression link, from which it can be seen that the values of the explained (regression) variability are less than the unexplained (residual). The value of the F test is 4.235, and the achieved significance level p = 0.003 shows that there is a statistically significant difference between the explained and unexplained part of the total multi-regression variance, ie that the explained variability is statistically significantly lower than the unexplained variability. Therefore, it can be concluded that the information provided by the multiple determination coefficient (R^2) is confirmed

Table 2.ANOVA Critical Variables: MCCL

	Sums of		**Mean**		
	Squares	df	Squares	F	p-level
Regress.	9.288	7	1.326	5.019	.003
Residual	4.493	17	.264		
Total	13.781				

Legend / Legend: Sum of Squares; df - Degrees of freedom; Mean Square (Mean square value); F - Fisher's test for statistical significance determination (Fischer test for determining statistical significance); Sig. - Signifi cance (Level of statistical significance of the multivariate test)

CONCLUSION

The connection of the predictor variables with the criterion variable velocity of the ball is confirmed at the multivariate level, while the variation of the variation is determined individually only in the sprint 10-meter high-starting variable. The connection of the predictor variables with the criterion variable at the multivariate level has been achieved, so that the motor skills are in direct proportionality with the result of the test of the situational-motor skills of the respondents and it can be concluded that the subjects with a better starting speed will have better results in the specific motor test in football. These results are also logical in view of the structure of the exercises in football, which require good speed, coordination of the movement, as well as a certain level of power. The results we have come to this paper are similar to the results of previous studies that confirm that the starting speed in football is one of the most important motor skills, and that it is directly related to the success in position speed with the ball. Respondents who were the subject of work are in the period of the sensitive phases of stated motor skills, which points to the possibility of maximum development of these motor skills in these age categories. Space velocity, although genetically conditioned, can be enhanced by special programs for improving the frequency of movement, length of steps and running technique, so that the lifetime in which the respondents find it should be used to develop the stated motor abilities, the level of which is one of the most important in modern football . One of the possible methods is the SAQ method, a method that trainers increasingly use in the population analyzed in this paper. Compared to the model for this age category (Serbia's model of representation), we can say that students of the football school "Olimp" are at a satisfactory level of speed and agility, while the space of explosive force is underdeveloped. On the basis of the information received, the trainers should approach the correction of the program and try to raise this motor capability to a higher level, of course taking into account the quality and selection in the football school "Olimp". Based on these results, trainers who implement the school football program and program have an insight into the current skills of their participants and the differences that have been identified, the trainers should give each individual an indication of what should be improved, both through team and individual training, and which motor competency should be maximally developed in this period. The trainers should give each participant recommendations for further development of abilities that are below average in comparison with the best result, recommendations containing exactly defined exercises that will be continuously applied over a time interval of about three months after which re-testing

is recommended. Monitoring of the development of the child's organism and the sensitive phases in which the organism of the tested athletes is currently in need should be continuously and implemented at each individual training, and compared with the models every six months, in order to be able to analyze and modify the development and training programs in order to properly develop and progress these respondents in their future football career. If the investigated spaces are not properly developed during this period of sensitive phases, their further progress at a later age will be limited.

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ORGINAL SCIENTIFIC PAPER

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PARAMETERS OF A SITUATION ACHIEVEMENT AS INDICATORS OF SHOOTER EFFICIENCY IN A BASKETBALL

SUMMARY:

In the research, which subject was the situation indicators of basketball efficiency, regression analysis was applied in order to determine the impact of the predictor system of 18 variables of situational efficiency on the criterion variable of the total percentage of shots in the match. The sample in this research was 29 basketball matches, KK Budućnost from Podgorica (Montenegro) played in the ABA League for the 2017/18 season. The obtained results have determined that the predictor system with almost 100% of success predicts the outcome of the overall efficiency of the percentage of shots at the match. Individually speaking, it was concluded that the effectiveness of the shots in the match will solely depend on the parameters of the situational efficiency of one, two and three points shot. Also, it was concluded that other parameters for monitoring the situational efficiency in basketball, provided by FIBA, have no impact on the analyzed criterion variable. In general, it could be concluded that for KK Buducnost from Podgorica, in the season 2017/18 the offense was the best defense.

Key words: *Situational efficiency, basketball, shot, regression analysis*

1. INTRODUCTION

Basketball is a team game in which a player can help his team primarily by improving his own technique and abilities. It requires unselfish integrations of individual qualities in a team game with the inalienable importance of technically correct performance of the basic elements of basketball technique that, once mastered, connect in complex movement structures during training and matching (Wissel, 2004).

As in all sports disciplines, in basketball, the goal of the game is to win the opponent respecting the rules of fair play. In order for the final result of the game to be favorable, ie to win, it is necessary that the whole range of factors, both individuals and the team as a whole, be best aimed at achieving that result. Most of the factors, especially those endogenous (anthropological abilities and characteristics), can be successfully controlled and possibly predicted through sporting achievement, while exogenous factors that influence the result in top sport (the importance of the game, fans, climatic factors, time, etc.) in the smaller measures can be predicted. The coordination of these factors, or the very performance of a basketball team, can be seen through the team's situational efficiency within the framework of the statistics of the match. Thanks to modern technology, as well as improving the monitoring of situational efficiency parameters, both the individual and the team as a whole, it is possible to see which parameters most influenced the final results to be favorable in terms of winning or unfavorable in terms of defeat. The standard indicators of situational basketball efficiency, prescribed by FIBA, are the subject of research in this paper. The problem of work is reflected in determining the influence of particular situational indicators on the criterion variable that makes up the final percentage of the total shooter efficiency. Researches with similar issues are increasingly present in the scientific community, because the obtained results can contribute in the direction of emphasis on

particular segments in the training process. Ćeremidžić and Delić (2016) determined differences in situational efficiency between the teams in the Euroleague and NBA league and concluded that the quality of NBA league teams was best seen through the performance of the defense jump, the total jumps and the number of attempts to throw the ball into the basket for two points, while teams from Euroleague were best characterized by three points shot. Korjenic, Varešlija, Vučić and Spahalić (2013) came to similar results, and found that representations participants of the 2012 Olympic Games in London, which had a better percentage of two-point shots, more jumps accomplishments in the defense phase, more assists, more steal balls and more personal fouls, also had better placement on the Olympic Games. Šeparović, Pojskić and Užičanin (2010) found that the statistically significant impact on the final result of the matches at the European Championship for Cadets (B Division) have three variables; the number balls for two points thrown into the basket in the game, the number field goals for three points, and the number of attempts to throw the ball into the basket from the free-throw line.In accordance with the above mentioned problematic and the subject of research, the aim of this research was to determine the influence of the predictive system of situational efficiency variables on the criterion variable of the total percentage of the shooter efficiency in the match.

2. METHOD OF THE WORK

2.1. Sample of examinee

The sample in this survey presents 29 basketball matches, KK Budućnost from Podgorica, Montenegro. All KK Budućnost matches were played in the ABA League in the 2017/18 season. In the mentioned season, KK Budućnost was the champion of the competition for the first time since the founding of the ABA League. In a total score of 29 games, in 22 matches KK Budućnost was a winner, while in 7 matches it was defeated.

2.2. Sample of variables

The situation or action efficiency, according to Trninić (1996), comes from registration of events during the basketball game, thus gaining performance indicators during the game, as well as the parameters belonging to the tactical responsibility, engagement, behavior of the players and the team and other parameters interesting for the analysis of basketball game.

In the analyzed sample of 29 games, the influence of 18 variables (indicators) of situational efficiency as a set of predictor variables, on the criterion variation total, percentage of the effectiveness of the shots in the match was analyzed, as a criterion variable (TOTALS).

The predictor set consisted of the following variables: a successful shot from the free throw line (SLBACA), a total of attempts of shot from the free throw line (SLBACP), a percentage of the success of shot from the free throw line (SUT1PO), a successful two-point shot (SUT2PU), a total of attempts of two-point shot (SUT2PP), a percentage of the success of two-point shot (SUT2PO), a successful three-point shot (SUT3PU), total attempts of three-point shot (SUT3PU), a percentage of the success of three-point shot (SUT3PO),defense jump (SKOODB), offense jump (SKONAP), assists (ASISTE), steal balls (UKRADL),lost balls (turnovers) (IZGUBL), personal fouls (LICNEG), fouls by the opponent (FAULPR), blocks (BLOKAD), opponents blocks (BLOKPR).

The set of predictor variables is defined by FIBA, as a set of indicators of the situational efficiency of the basketball team. The values of the statistical parameters of situational success were taken from the official ABA League website, for KK Budućnost from Podgorica (http://www.aba-liga.com/KK.php?id=12).

2.3. Data processing methods

In order to obtain the basic statistical parameters of the set, the data collected were first processed at the level of descriptive statistics, where the arithmetic mean, Minimum and Maximum Result (Min./Max.), Standard Deviation (Standard Dev.), Standard Error of arithmetic mean (Std. Error) and variance (Variance) were determined.

In order to determine the influence of the predictor set of variables on the criterion variable, the total percentage of the efficiency of the shot at the match (TOTALS), regression analysis was applied. All data is processed in the statistical program Statistics SPSS 20.0.

3. THE RESULTS AND DISCUSSION

The table chart no. 1 shows the results of descriptive statistics for the criterion and predictor set of variables. Based on the results of the arithmetic mean for the criterion variable, the total percentage of the efficiency of the shot at the match (TOTALS), it is concluded that the efficiency of the shot was 46.96%. The highest score was for two-point shot with a percentage of 53.71%. It can be noted that high efficiency in two-point shot was achieved and slightly higher compared to similar studies where the performance of two-point shot was 45.9% on the sample of representations participants of the 2012 Olympic Games (Varešlija, 2014) and 50.85% on the sample of representation participants of the European Championship 2017(Subotić and Ćeremidžić, 2017). The smallest percentage of the efficiency was of three-point shot, with a percentage of 37%, which is almost identical to the percentage with teams from Euroleague for half-season 2016/17, where the percentage for three-point shot was 37.22 (Ćeremidžić and Delić, 2016). The percentage of shots from the free throw line was 55.60% and is the smallest compared to similar researches where the percentage was 58.22% (Varešlija, 2014) or even 68.70% (Korjenic et al., 2013).

Table chart 1. Descriptive statistical parameters of analyzed variables

Variables	N	Minimum	Maximum	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
TOTALS (dependent)	29	33.90	59.10	46.9621	1.08914	5.86518	34.400
SLBACA	29	5.00	27.00	18.2759	1.05734	5.69396	32.421
SLBACP	29	9.00	36.00	23.9310	1.29125	6.95358	48.352
SUT1PO	29	55.60	90.50	75.9069	1.60771	8.65778	74.957
SUT2PU	29	9.00	29.00	18.6897	.80348	4.32686	18.722
SUT2PP	29	26.00	47.00	34.7586	1.06287	5.72373	32.761
SUT2PO	29	32.10	71.40	53.7138	1.68638	9.08145	82.473
SUT3PU	29	4.00	19.00	8.8966	.59626	3.21097	10.310
SUT3PP	29	15.00	37.00	23.9655	.85455	4.60188	21.177
SUT3PO	29	16.70	69.60	37.1828	2.08346	11.21979	125.884
SKOODB	29	15.00	30.00	22.8621	.78270	4.21497	17.766
SKONAP	29	2.00	15.00	7.5862	.62089	3.34362	11.180
ASISTE	29	7.00	30.00	14.6552	.91414	4.92280	24.234
UKRADL	29	2.00	12.00	6.5862	.50004	2.69281	7.251
IZGUBL	29	6.00	15.00	10.2069	.44217	2.38117	5.670
LICNEG	29	16.00	29.00	20.7931	.59840	3.22246	10.384
FAULPR	29	14.00	30.00	23.3448	.75148	4.04683	16.377
BLOKAD	29	.00	6.00	2.7931	.34161	1.83963	3.384
BLOKPR	29	.00	6.00	1.8276	.27214	1.46553	2.148

From table chart no. 1 it is characteristic to point out that KK Budućnost, on average per game, had similar number of personal fouls as the teams that played against it in relation to 20.79-23.34 personal fouls per match. The defense jump was on average much more dominant than the offense jump (22.86-7.58), which is mostly the case in all basketball matches. However, the values of efficiency of offensive and defensive jumps on average are considerably higher compared to a similar survey on a sample of basketball teams participating in the 2008 Olympic Games in London, where the average of jumps was 6.35-14.12 in favor of a defense jump (Džajić, Drljević and Kovačević2009).

Based on the analysis of the obtained data in Table charts 2 and 3, it was found that a high coefficient of determination was obtained (R Square .999) and that the determination coefficient is at a statistically significant level (Sig. .000) In accordance with the above results, it is noted that the predictive system of variables related to situational efficiency in basketball, with almost 100% explaining the criterion variable, the overall percentage of the efficiency of the shot at the match. Such a high level of determination is not surprising, since in the analyzed predictor variable of situational efficiency all the anthropological characteristics and abilities of each player are shown, as well as the technical tactical preparation of the players and the team as a whole. In other words, everything that is the subject of transformational processes through training is manifested through analyzed situational efficiency parameters. A high level of coefficient of determination (R Square .998) was also obtained in the research Šeparović et al. (2010), as well as in the research of Varešlija (2014), where the coefficient of determination was .927.

Table chart 2. Coefficient of determination

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.999[a]	**.999**	.997	.33119

Table chart 3. Statistical significance of the model

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	962.111	18	53.451	487.291	**.000[b]**
	Residual	1.097	10	.110		
	Total	963.208	28			

By analyzing the individual determinations of the predictor variables on the TOTALS criterion variable, it was found that the 7 predictor variables had a statistically significant impact. The largest standardized Beta coefficient (Beta .668), or the greatest single impact on the TOTALS criterion variable, made the variable a successful shot for two points SUT2PU. Positively and at statistically significant level (Sig. .004), the effect of the percentage variable of the success rate of the 2-point SUT2PO score (Beta .384) as well as the percentage of the success of the shot from the free throw SUT1PO (Beta .178) is achieved. The variable of the total attempt of 2-point SUT2PP score also had a statistically significant effect (Sig. .001) on the dependent variable TOTALS, however, it is a negative sign (Beta = - .326). We can conclude that all attempts to score 2 points which were not successful influenced the negative sign of the standardized Beta coefficient. This can be especially noted if it is already defined that successful 2-point shots positively and to a large extent determine the criterion variable (Beta .668). All variables related to the 3-point shot parameters have made a statistically significant impact on the dependent variable TOTALS. The positive effect on the dependent variable TOTALS had the variables of a successful shot for 3 points SUT3PU (Beta .529) and the total percentage of the shot for 3 points SUT3PO (Beta .348), while the variable of total attempts of the 3-point SUT3PP shot had a negative impact Beta -.390), so here and in the case of variables of total attempts of 2-point SUT2PP points, it can be concluded that all unsuccessful attempts of 3-point shots influenced negatively on the TOTALS criterion variable.

All variables, which were not related to the efficiency of the shot (SKOODB, SKONAP, ASISTE, UKRADL, IZGUBL, LICNEG, FAULPR, BLOCK and BLOKPR), as well as the free throw line shot variables SLBAC and the total attempt of the shot from the free throw line SLBACP, did not have statistically significant influence on the dependent, ie the criterion variable the total percentage of the efficiency of the shot at the match (TOTALS).

Table chart 4. Beta coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	17.451	6.334		2.755	.020
SLBACA	-.427	.213	-.415	-2.003	.073
SLBACP	.332	.161	.393	2.065	.066
SUT1PO	**.121**	**.043**	**.178**	**2.787**	**.019**
SUT2PU	**.905**	**.214**	**.668**	**4.229**	**.002**
SUT2PP	**-.334**	**.122**	**-.326**	**-2.739**	**.021**
SUT2PO	**.248**	**.068**	**.384**	**3.647**	**.004**
SUT3PU	**.966**	**.258**	**.529**	**3.745**	**.004**
SUT3PP	**-.498**	**.115**	**-.390**	**-4.335**	**.001**
SUT3PO	**.182**	**.051**	**.348**	**3.568**	**.005**
SKOODB	-.014	.027	-.010	-.501	.628
SKONAP	-.062	.052	-.036	-1.190	.261
ASISTE	.020	.039	.016	.497	.630
UKRADL	-.018	.030	-.008	-.613	.554
IZGUBL	.014	.049	.006	.282	.784
LICNEG	-.059	.038	-.032	-1.529	.157
FAULPR	-.010	.053	-.007	-.193	.851
BLOKAD	-.006	.051	-.002	-.118	.909
BLOKPR	.053	.060	.013	.886	.396

4. CONCLUSION

By applying regression analysis the influence of the predictor system of the situational efficiency variables on the criterion variable the total percentage of the effectiveness of the shot at the match TOTALS has been determined, which was the aim of this research. Based on the obtained results, it was established that the predictive system of 18 variables at a statistically significant level influences the dependent, ie the criterion variable TOTALS with almost 100% impact (R Square .999).The obtained results suggest that with a high percentage of security it is possible to predict the overall shooter efficiency in the game, analyzing the applied variables of situational efficiency as predictor variables. Individually, 5 variables (SUT1PO, SUT2PU, SUT2PO, SUT3PU, SUT3PO) achieved statistically significant and positive influence on the criterion of the variable, while the variables SUT2PP and SUT3PP had a negative impact. All other variables of situational efficiency did not have a statistically significant effect on the TOTALS variable. Based on the individual analysis of the influence of the predictor system of the variables of the situational success on the criterion variable, the total percentage of the efficiency of the shot at the game TOTALS, it can be concluded that the efficiency of the shot for three and two points largely determines the result of the match, or the overall efficiency of the percentage of shots. According to the obtained results and the fact that no prediction variable except for variables directly related to the shot, did not affect the criterion variable TOTALS, it can be generally concluded that for the KK Budućnost from Podgorica, the offense was the best defense in the 2017/18 season.

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PROFESSIONAL ARTICLE

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ATTITUDES AND OPINIONS OF HIGH SCHOOL STUDENTS ABOUT SWIMMING

Summary

Sample consisted of 30 (16 male and 14 female) participants born in year 2000 +6 months and -6 months who attended Gymnasium in Prijepolje in period May 2018. The research concerned with introduction of swimming into elementary and high schools, as well as universities and the questionnaire on knowledge about 100 m free style swimming.
Likert scale was used and it consisted of a number of statements which cause positive or negative attitude towards swimming. Participants were asked to express the level of agreement on a scale with odd number of units. Total attitude is obtained by summing up the answers. Scale is designed in the following manner: application of statements on a group of assessors who express their level of agreement with every statement on scale 1–5.
Statement: Swimming should be introduced as course at universities was assessed affirmatively by 100% of male students and 85.71% female students, whereas the statement: swimming should be introduced as subject at elementary and high schools was assessed affirmatively by 87.5% of male students and 71.42% of female students.

Key words: research, questionnaire, scale, free style swimming, Gymnasium

INTRODUCTION

Marković (2018) stated: "each swimmer should have the ability for fast and efficient acquisition of new movements and more efficient performance of complex movements and coordination of all swimming techniques as well as starts, turns and reaching the finish line. Such ability therefore helps the swimmer to advance faster and hence achieve better results."

Čokorilo, R., Jovanović, M., Čokorilo, N. (2003), analysed the results of research performed on high school students about Physical education classes on sample of 421 students of first and third grade of high schools in Sombor and Apatin. Contingency coefficient was used for testing the relationships in value and affective, value and conative and affective and conative component of attitude. Statistically significant connection was established between the value and affective component of attitude. Statistically significant link was also established between affective and conative component of attitude

whereas there was no statistically significant link established between value and conative component of attitude. Results obtained in this research are different from results by other authors who dealt with research of links between conative, emotional and conative component of attitude. In those cases there was established more significant link between individual components of attitude. Reasons should be found in the fact that the attitudes were subject of research at one specific area – classes of Physical Education where students already take part. In such situation some components are conditioned by opposing social interactions, organisational elements used in classes, equipment in the gyms, teacher's ability to motivate the students and keep them interested and so on. They also added that the research was conducted at students at adolescence when the attitudes are still being formed and are not stable enough; in this light the results become clear.

Malacko, Popović (1997) Scaling as a technique of measuring is relatively contemporary procedure and it is used for evaluation of personal and social attitudes."In the beginning, scaling was used for research mainly when conducting research on attitudes of individuals or groups towards society ideology of society). However, at contemporary level of development of methodological techniques, it is successfully used for assessment of other characteristics of personality conditioned by physiological and genetic basis. When conducting a research on attitudes, main difficulty lies in their complexity because they consist of three basic components:

- Emotional, as included emotion towards the object of attitude from positive to negative – from liking and admiration over understanding and compassion to discomfort and hate,
- Conative, as tendency towards action in relation to action towards the object – from help and cooperation in positive attitude, independence in neutral attitude to critic, aggression and attack in negative attitude,
- Cognitive, as creation, knowledge and value of judgement on object – from providers of education and socialisation (parents, teachers, means of communication etc.) over creating own system of value to, so called, personal view of the world (personal philosophy)."

RESEARCH METHODOLOGY

Subject of research

Subject of research in this paper is the introduction of swimming to elementary schools, high schools and universities.

Problem of research

Problem of the research is with regard to: questionnaire with possibility to answer with: I totally disagree, I partially disagree, I have no opinion/I am not sure, I partially agree and I totally agree to offered answers of students of high school that swimming should be introduced as subject in elementary and high schools as well as at universities.

Aim of research

Aim of research is to establish the attitudes of participants from Gymnasium in Prijepolje in school year 2018 in May.

Hypotheses

According to the established aim of research the following hypotheses were set:

H_0 – I disagree that swimming should be introduced at elementary schools, high schools and universities.

H_1– I totally agree that swimming should be introduced at elementary schools.

H_2– I totally agree that swimming should be introduced at high schools.

H_3 – I totally agree that swimming should be introduced as course at universities.

Sample

Sample consisted of 30 (16 male and 14 female) participants born in year 2000 +6 months and -6 months who attended Gymnasium in Prijepolje

Sample of variables – questionnaire

Sample of variables related to seven (7) questions from the questionnaire.

Questionnaire had options to provide answer in form of:

- I totally disagree,
- I partially disagree,
- I have no opinion/I am not sure,
- I partially agree,
- I totally agree.

General data, write "X" into empty field.

Gender	Male	Female	Year of birth	School	Grade
X	16		2000. +6-	Gymnasium in Prijepolje	3

Only one "X" in the table is used for correct answer.

RESULTS AND DISCUSSION

Likert scale of attitudes consists of series of statements which evoke positive or negative attitude towards the object of attitude. Participants are asked to express level of agreement on a scale with odd number of units. Total attitude is obtained by summing all the answers. Scale is constructed in the following manner:

Application of statements on a group of assessors who express their agreement with each statement on scale from 1 to 5.

Assessment of level of correlation between each statement and total result;

Elimination of all the statements without sufficient level of correlation with total result.

Likert scale is psychometric scale used to determine level of agreement or disagreement of participants with a statement (their attitude towards the statement) on continuum from absolutely positive to absolutely negative towards the subject of research of interest. It is applied in research where questionnaires are used (or structured interview) for obtaining the required data. Scale was developed by Rensis Likert who described it in paper entitled "A Technique for Measurement of Attitudes" in 1932 in the magazine "Archives of Psychology". In addition to expressing agreement, the participant is also able to assess frequency, quality, importance and other constructs. The scale usually has 5 degrees (according to Likert), rarely 7 or 9. We can therefore define Likert scale as a group of statements (units) that participant agrees or disagrees with on a scale of assessment. Agreement with the statements is considered to be an indicator of latent attitude we can not directly evaluate.

Likert scale with five degrees was used for the purpose of this research.

variables – claims	(1)	(2)	(3)	(4)	(5)

Table 1, Attitudes of male students towards swimming 100m crawl

Upon completion of high school education students should be able to swim 100m crawl	Total points and percentage %	total
	Male participants	
I totally disagree	0 0%	Count %of total
I partially disagree	1 6.25%	Count %of total
I have no opinion/I am not sure	1 6.25%	Count %of total
I partially agree	2 12.5%	Count %of total
I totally agree	12 75%	Count %of total
Total		100.00%

Research results presented in this Table suggest that there is significant difference in percentages between the attitudes, where the highest percentage (75%) was "I totally agree", whereas the lowest percentage was "I totally disagree" with 0% and "I partially agree" had 12,5%, whereas "I have no opinion/I am not sure" had 6.25%.

Basic elements of swimming should be introduced to elementary school

I totally disagree	I partially disagree	I have no opinion/I am not sure	I partially agree	I totally agree
			2	14

Table 2, Attitudes of male students towards swimming in elementary schools

Basic elements of swimming should be introduced in elementary school	Total points and percentage %	total
	Male participants	
I totally disagree	0 0%	Count %of total
I partially disagree	0 0%	Count %of total
I have no opinion/I am not sure	0 0%	Count %of total
I partially agree	2 12.5%	Count %of total
I totally agree	14 87.5%	Count %of total
Total		100.00%

Research results in this Table suggest that there is significant difference in percentages between the attitudes, where the highest percentage (87.5%) was for "I totally agree", whereas the lowest percentage was for statement "I totally disagree" with 0% and for "I partially agree" there was 12.5%, and "I have no opinion/I am not sure" and "I partially disagree" scored 0%.

Swimming should be introduced in high schools

I totally disagree	I partially disagree	I have no opinion/I am not sure	I partially agree	I totally agree
			2	14

Table 3, Attitudes of male students about swimming in high schools

Attitudes of students about swimming in high schools	Total points and percentage % Male participants	total
I totally disagree	0 0%	Count %of total
I partially disagree	0 0%	Count %of total
I have no opinion/I am not sure	0 0%	Count %of total
I partially agree	2 12.5%	Count %of total
I totally agree	14 87.5%	Count %of total
Total		100.00%

Research results in this table suggest that there is significant difference between the attitudes where the highest percentage was for "I totally agree" (87.5%) and the lowest percentage was for statement "I totally disagree" with 0%; "I partially agree" scored 12.5%, and "I have no opinion/I am not sure" had 0%.

Swimming should be mandatory course at universities

I totally disagree	I partially disagree	I have no opinion/I am not sure	I partially agree	I totally agree
				16

Table 4, Attitudes of male students about swimming at universities

Swimming should be mandatory course at universities	Total points and percentage % Male participants	total
I totally disagree	0 0%	Count %of total
I partially disagree	0 0%	Count %of total
I have no opinion/I am not sure	0 0%	Count %of total
I partially agree	0 0%	Count %of total
I totally agree	16 100%	Count %of total
Total		100.00%

Research results presented in this Table suggest that there is significant difference between the attitudes where the highest percentage (100%) answered "I totally agree"; "I partially agree" had 0%, "I have no opinion/I am not sure" had 0%, "I partially disagree" had 0%, and "I totally disagree" had 0%.

Attitudes of female students of Gymnasium in Prijepolje

Upon completion of high school education students should be able to swim 100m crawl

I totally disagree	I partially disagree	I have no opinion/I am not sure	I partially agree	I totally agree
		1	4	9

Table 5, Attitudes of female students about swimming 100m crawl

Upon completion of high school education students should be able to swim 100m crawl	Total points and percentage % Female participants	total
I totally disagree	0 0%	Count %of total
I partially disagree	1 6.25%	Count %of total
I have no opinion/I am not sure	1 7.14%	Count %of total
I partially agree	4 28.57%	Count %of total
I totally agree	9 64.28%	Count %of total
Total		100.00%

Research results presented in this Table suggest that there is significant difference between the attitudes where the highest percentage 64.28% of answers was "I totally agree", whereas the lowest percentage of answers was "I totally disagree" with 0%; "I partially agree" had 28.57%, whereas "I have no opinion/I am not sure" had 7.14% and "I partially disagree" had 6.25%.

Basic elements of swimming should be introduced to elementary school

I totally disagree	I partially disagree	I have no opinion/I am not sure	I partially agree	I totally agree
			4	10

Table 6, Attitudes of female students towards swimming in elementary schools

Basic elements of swimming should be introduced to elementary school	Total points and percentage % Female participants	total
I totally disagree	0 0%	Count %of total
I partially disagree	0 0%	Count %of total
I have no opinion/I am not sure	0 0%	Count %of total
I partially agree	4 28.57%	Count %of total
I totally agree	14 71.42%	Count %of total
Total		100.00%

Research results presented in this Table suggest that there is significant difference between the attitudes where the highest percentage 71.42% of answers was "I totally agree", whereas the lowest percentage was for answer "I totally disagree" with 0%; "I partially agree" had 28.57%, whereas "I have no opinion/I am not sure" and "I partially disagree" had both had 0%.

Swimming should be introduced to high school

I totally disagree	I partially disagree	I have no opinion/I am not sure	I partially agree	I totally agree
			4	10

Table 7, Attitudes of male students about swimming in high schools

Basic elements of swimming should be introduced to high school	Total points and percentage % Female participants	total
I totally disagree	0 0%	Count %of total
I partially disagree	0 0%	Count %of total
I have no opinion/I am not sure	0 0%	Count %of total
I partially agree	4 28.57%	Count %of total
I totally agree	14 71.42%	Count %of total
Total		100.00%

Research results presented in this Table suggest that there is significant difference between the attitudes where the highest percentage 71.42% answered "I totally agree", and the lowest percentage answered "I totally disagree" with 0%; "I partially agree" had 28.57%, whereas "I have no opinion/I am not sure" and "I partially disagree" had 0%.

Swimming should be mandatory course at universities

I totally disagree	I partially disagree	I have no opinion/I am not sure	I partially agree	I totally agree
			2	12

Table 8, Attitudes of female students about swimming at universities

Swimming should be mandatory course at universities	Total points and percentage % Female participants	total
I totally disagree	0 0%	Count %of total
I partially disagree	0 0%	Count %of total
I have no opinion/I am not sure	0 0%	Count %of total
I partially agree	2 14.28%	Count %of total
I totally agree	12 85.71%	Count %of total
Total		100.00%

Research results presented in this Table suggest that there is significant difference between the attitudes where the highest percentage 85.71% of answers was "I totally agree", and the answer "I totally disagree" had 0%; answer "I partially agree had 14.28%, and "I have no opinion/I am not sure " and "I partially disagree" had 0% of answers.

CONCLUSION

Sample of participants who were subject to research using the questionnaire was 30 (16 male and 14 female participants) born in year 2000, +6 and – 6 months, students of Gymnasium in Prijepolje in May 2018. In the paper the research was aimed at swimming, i.e. introduction of swimming to elementary schools, high schools and universities and questionnaire on knowledge about swimming 100m free style.

Established hypotheses were confirmed in the following manner:

H_1– I totally agree that swimming should be introduced as subject in elementary schools: 87.5% of male students and 71.42% of female students.

H_2– I totally agree that swimming should be introduced as subject in high schools: 87.5% of male students and 71.42% of female students.

H_3– I totally agree that swimming should be introduced as course at universities: 100% of male students and 85.71% of female students.

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ORGINAL SCIENTIFIC PAPER

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MORPHOLOGICAL CHARACTERISTICS ASTHE PREDICTORS OF SITUATIONAL SUCCESSFUL IN THE WATER POLO

Summary:

At the sample of 39 water polo players, aged 12 years (± 6 months), the research was conducted to determine the impact of morphological characteristics on the situational performance in the water polo. In this paper, a set of 12 anthropometric measures as a predictor set of variables was applied, while the criterion variables were situational motor tests; swimming speed at 25 meters with and without a ball, vertical jump from the water and side swimming 8 times 2.5 meters. On the basis of the obtained results it was concluded that the morphological characteristics significantly influenced the performance of situational motoric tasks in water polo, depending on the test from 39% to as much as 71%. The most significant applied variables from the morphological space of water polo players were variables; the volume of the thorax, the height of the body, the width of the hand and the foot with a positive effect, while the weight of the body and the subcutaneous fatty tissue were aggravating factors for the performance of situational motoric tasks for the 12-year-old water polo players.

Key words: *water polo, morphological characteristics, situational motoric, regression:*

1. INTRODUCTION

As an integral part of the anthropological status of man there are morphological characteristics whose significance in water polo is confirmed in the previous research (Aleksandrović&sar. 2015, Kondrič&sar. 2012, Tsecouras&sar. 2005, Uljević&Spasić 2009). Situational performance assessed through the application of situational motoric tests is a very important source of information especially for trainers, as it provides the response to the effects of the training process. Water polo as a sport discipline has a very long tradition. The first water polo match was played in Crystal Palace in London in 1874, while water polo was included in the Summer Olympics program since 1900, which, together with football, placed it in the oldest team sports disciplines of modern summer Olympics (Snayder, 2008). From the first water polo match (1874) to the present day, water polo rules have changed and made water polo very popular sports discipline and, therefore, demanding in terms of psycho-physical load for water polo players. The studies in the past 15-20 years (Lozovina&Pavičić, 2004, Uljević&Spasić 2009) found that the constitution of water polo players has changed significantly compared to the previous period, which is especially important to know when selecting children for water polo, positioning players in water polo. In addition to the fact that morphological space and situational efficiency have been investigated by many authors, similar research has to be carried out on different age categories and populations because the dynamics of water polo games, the constitution of water polo players from different countries, as well as the specificity of the training process again indicate interesting results.

Water polo is Montenegrin sport with the highest number of trophies. In addition to the fact that Montenegro has more than half a million inhabitants and is one of the smallest European countries, the Montenegrin senior team has excellent results at the biggest competitions (the champions of Europe 2008, the world champions 2009 and 2018, the world's champions in 2013, fourth place at the Olympic Games 2008, 2012, 2016). Also, the junior national team of Montenegro won the European championship in 2017. These results imply the need for maximum involvement of the professional and scientific public, especially in younger selections, in order to contribute to the preservation of the water polo tradition in Montenegro. Also, the need for surveys, where the sample of respondents is Montenegrin water polo players, is also necessary due to the fact that very few of the previous researchesare related to water polo in Montenegro.

In accordance with the above, the aim of this paper is to determine the impact of morphological characteristics on situational performance for young water polo players.

2. METHOD OF WORK

2.1. Sample respondents

The sample of respondents included 39 water polo players aged 12 years (± 6 months), participants of water polo school VK Budva and VK Jadran from Montenegro. The sample included respondents who had been training water polo for at least 18 months, had a good medical condition during the testing period. Respondents voluntarily participated in all stages of measurement and testing, with the consent of parents and trainers.

2.2. Variables sample

Measuring instruments included a set of 12 anthropometric measures and a battery of 4 situational motoric tasks

The morphological space is covered with the following variables:

- Longitudinal dimension – body height (VIST), arm span (RASR) and arm length (DUŽR),
- Transverse dimensionality –shoulder width (ŠIRR), foot width (ŠIRS) and width of the hand (ŠIRŠ)
- Subcutaneous fat –triceps skinfold(KNND),subscapular skinfold (KNNL) and abdominal skinfold (KNNT),
- Volume and body mass–body weight(TEŽT), triceps volume (ONAD), chest volume (OGRK)

Measurement of morphological characteristics was carried out according to the recommendations of the International Biological Program *(Lohman, Roche and Martorell, 1988).*

Situational motoric variables:

- Speed of swimming at 25 meters water polo crawl without a ball (P25BL),
- Swimming speed of 25 meters water polo crawl with ball (P25SL),
- Vertical jump from water (VERSK) and
- Lateral swimming 8 times 2.5 meters (B8X2.5)

The situational motoric tests applied in this study were applied in similar studies, where it was established that they adequately assess the situation of motor efficiency of water polo players (Kondrič et al., 2012; Platanou, 2006; VaramentiiPlatanou, 2009; Donevisar., 2009 Bampouras and Marrin, 2009).

2.3. Data processing methods

In order to obtain the basic statistical parameters, the collected data are processed at the level of descriptive statistics, where the arithmetic mean (Mean), Minimum and Maximum Result (Min./Max.), Standard deviation (Std. Dev.), Standard error of the arithmetic mean (Std. Error), variance (Variance), skew (Skew) and kurtosis (Kurt).
In order to determine the influence of the predictor set of morphological variables to the criterion variables of situational motoric problems in water polo, the regression analysis was applied. All data is processed in the statistical program Statistics SPSS 20.0.

3. THE RESULTS AND DISCUSSION

By analyzing the values of skews (Skew) and kurtosis (Kurt) for all applied variables, a normal distribution of results can be established, which provides a good premise for the quality application of results in further statistical processing. Respondents were on average higher (Mean - 160.46) compared to the same age in similar studies (Aleksandrovic&sar 2015), where the average height was 156.99cm. It is characteristic that in comparison with the results of the research Aleksandrovic&sar, in 2015, the body weight was almost identical to 50.99 kg compared to 51.79 kg in this study. It is characteristic to point out that the results in the test of swimming speed of 25 meters water polo crawl (Mean - 16.40) were considerably better than the results of the research Aleksandrovic&sar. (2015), where the average speed of swimming was 18.09. The test procedure in both cases was the same, where the respondents started from the water on the sign of the measurer, swimming in a 25 meter section of water polo crawl.

Table No1 Basic statistical parameters of morphological and situational-motoric variables

Variable	N	Min	Max	Mean	Std. Dev	Variance	Skew	Kurt
VIST	39	151.00	175.30	160.46	6.47	41.97	.68	-.13
RASR	39	148.20	174.20	161.21	6.73	45.32	.22	-.60
DUŽR	39	61.00	72.00	67.19	2.91	8.48	-.23	-.62
ŠIRR	39	31.00	39.30	34.60	2.26	5.12	.55	-.40
ŠIRŠ	39	7.00	10.00	8.26	.75	.57	.61	-.11
ŠIRS	39	8.30	11.00	9.55	.69	.48	-.04	-.69
KNND	39	5.80	21.10	11.96	3.98	15.85	.44	-.60
KNNL	39	5.00	18.10	8.92	3.68	13.59	1.15	.08
KNNT	39	3.80	26.00	11.60	6.17	38.09	.58	-.73
TEŽT	39	38.00	75.00	51.79	10.01	100.33	.63	-.23
ONAD	39	21.00	32.00	26.10	3.16	9.98	.26	-.99
OGRK	39	67.50	96.50	82.73	6.96	48.51	.28	-.36
P25BL	39	14.08	21.10	16.40	1.59	2.55	.74	.70
P25SL	39	14.50	23.40	17.95	1.99	4.00	.67	.97
VERSK	39	10.00	41.00	23.74	7.49	56.24	.22	-.64
B8X2,5	39	9.47	15.55	13.33	1.61	2.61	-.60	-.36

Variable *-variables,* ***N****-number of respondents,* ***Min****-minimum score,* ***Max****-maximum score,* ***Mean****-arithmetic mean,* ***Std. Dev****-standard deviation,* ***Variance****- variance,* ***Skew****-skew,* ***Kurt****-kurtosis,* ***VIST****-height of the body,* ***RASR****-arm span,* ***DUŽR****-arm length,* ***ŠIRR****-width of the shoulders,* ***ŠIRŠ****-width of the hands,* ***ŠIRŠ****-width of the feet,* ***KNND****-triceps skinfold ,*
KNNL*-* subscapular skinfold, ***KNNT****-* abdominal skinfold, ***TEŽT****--body weight,* ***ONAD*** *upper arm volume,* ***OGRK****-chest volume,* ***P25BL****-swimming 25 meters without a ball,* ***P25SL*** *swimming 25 meters with a ball,* ***VERSK*** *-vertical jump from the water,* ***B8X2,5****-side swimming 8 times 2.5 meters.*

By the regression analysis of the applied set of morphological variables to the criterion variable of swimming speeds of 25 meters without a ball, it is concluded that there is a statistically significant influence of the predictor on the criterion (Tables 2, 3 and 4). The coefficient of multiple correlation (R = .817) indicates a high degree of connection between the predictor and the criterion. Also, by analyzing the corrected determination coefficient (Adjusted R Square = .515), it can be concluded that the swimming speed of a water polo crawl at 25 meters without a ball is about 52% dependent on the applied set of morphological variables, while the remaining 48% depends on some other anthropological abilities and characteristics which were not the subject of this research. Given that this is a relatively small sample of the respondents, as a coefficient of determination, the value of the corrected coefficient (Adjusted R Square) of the determination was analyzed. The Adjusted R Square indicator in relation to R Square gives a more realistic estimate of the actual value of the coefficient of determination in the population; therefore its application is more logical in the work with smaller samples (Tabachnick&Fidell, 2013).

Table No 2 Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.817[a]	.668	.515	1.11264

Table No3 ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	64.746	12	5.396	4.358	.001[b]
	Residual	32.187	26	1.238		
	Total	96.934	38			

By analyzing the individual effects of the predictor on the criterion, it was noted that only the variable volume of the chest had a statistically significant influence on the predictor P25BL (sig = .036). The negative sign of the Beta (-626) coefficient for the OGRK variant indicates that respondents with a larger chest volume needed less time to swim a 25-meter section of the water polo crawl, or that they achieved a better result.

Table No 4Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	42.438	11.980		3.542	.002
	VIST	.056	.118	.229	.478	.637
	RASR	-.126	.117	-.531	-1.076	.292
	DUŽR	.091	.187	.166	.487	.630
	ŠIRR	-.158	.126	-.225	-1.258	.219
	ŠIRŠ	-.266	.398	-.126	-.668	.510
	ŠIRS	-.651	.469	-.284	-1.390	.176
	KNND	-.197	.102	-.490	-1.922	.066
	KNNL	.253	.178	.584	1.423	.167
	KNNT	.155	.097	.600	1.607	.120
	TEŽT	.109	.110	.686	.992	.330
	ONAD	-.095	.228	-.188	-.417	.680
	OGRK	**-.144**	**.065**	**-.626**	**-2.210**	**.036**

Similar results were obtained when analyzing the influence of the predictor on the criterion variable of the swimming speed of 25 meters water polo crawl with a ball (P25SL). High level of connectivity (R = .749) is also evident, but somewhat lower level of influence of the predictor on the criterion (Adjusted R Square = .358).

Table No 5 Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.749[a]	.561	.358	1.60188

Table No 6 ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	85.278	12	7.107	2.769	.014[b]
	Residual	66.716	26	2.566		
	Total	151.995	38			

The individual effect from the predictor set of variables on the criterion variable P25SL was achieved by the variables of the abdominal skinfold (KNNT) with a positive sign (Beta = .968) and the variable chest volume (OGRK) with a negative Beta coefficient (-.987). Due to the inverse scaling of the analyzed value of the results, it was found that a better result when swimming at 25 meters with a ball water polo crawl were achieved by respondents with a larger volume of the chest, while worse was the result of respondents with higher subcutaneous fat tissue in the abdomen area.

Table No 7 Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	56.371	17.248		3.268	.003
	VIST	.045	.170	.147	.267	.792
	RASR	-.089	.168	-.299	-.527	.603
	DUŽR	-.086	.269	-.125	-.320	.752
	ŠIRR	-.059	.181	-.067	-.326	.747
	ŠIRŠ	-.881	.573	-.333	-1.538	.136
	ŠIRS	.161	.675	.056	.239	.813
	KNND	-.208	.147	-.413	-1.409	.171
	KNNL	.117	.256	.216	.458	.651
	KNNT	**.314**	**.139**	**.968**	**2.257**	**.033**
	TEŽT	.160	.159	.803	1.010	.322
	ONAD	-.167	.329	-.263	-.507	.617
	OGRK	**-.290**	**.094**	**-.987**	**-3.097**	**.005**

The regression analysis of the criterion of variable vertical jump from water (VERSK) and the predictor set of morphological variables indicates a statistically significant association and impact (Sig = .000) of the predictor on the criterion. The applied system of morphological variables is responsible for approximately 71% (Adjusted R Square = .711) for the realization of a vertical jump from the water.

Table No 8 Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.896[a]	.802	.711	4.03282

Table No 9 ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	1714.581	12	142.882	8.785	.000[b]
	Residual	422.855	26	16.264		
	Total	2137.436	38			

Of the 12 applied predictor variables, 4 variables individually produced a statistically significant effect; body height, hand width, foot width and body weight (VIST, ŠIRŠ, ŠIRS, TEŽT). Carrying out the conclusion of the partial impact, and taking into account the inverse scaling of the obtained results, it can be concluded that the vertical jump from the water was better performed by the higher respondents, with a larger diameter of the hand and the feet, as well as less weight respondents. Considering the movement of the vertical jump from the water, where it is necessary to strongly tackle the hands and feet on the water, the obtained results are logical. Due to the larger diameter of the foot and the hand, the force acting on the water during the retraction breaks into a larger surface, which creates a better base for retraction during a vertical jump. Respondents who had greater weight also needed more power to perform the task that placed them in an unfavorable position compared to the less weight respondents.

Table No 10 Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	-200.944	43.422		-4.628	.000
	VIST	**.914**	**.428**	**.790**	**2.138**	**.042**
	RASR	-.079	.424	-.070	-.185	.855
	DUŽR	.422	.677	.164	.623	.539
	ŠIRR	.297	.456	.090	.650	.522
	ŠIRŠ	**4.354**	**1.442**	**.438**	**3.019**	**.006**
	ŠIRS	**3.324**	**1.698**	**.308**	**1.957**	**.001**
	KNND	.068	.371	.036	.183	.856
	KNNL	-.968	.645	-.476	-1.501	.145
	KNNT	.427	.350	.352	1.221	.233
	TEŽT	**-1.226**	**.400**	**-1.637**	**-3.068**	**.005**
	ONAD	1.068	.828	.450	1.290	.209
	OGRK	.275	.235	.256	1.170	.253

The obtained results of the regression analysis of the predictor set of 12 morphological variables on the criterion of lateral swimming 8 times 2.5 meters indicate statistically significant influence and connection (Sig. = .010). Corrected coefficient of determination (Adjusted R Square = .385) indicates that the performance of the situational motoric task 8 times 2.5 meters lateral, is with about 39% conditioned by the applied set of morphological variables.

Table No 11 Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.761[a]	.579	.385	1.26910

Table No 12 ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	57.601	12	4.800	2.980	.010[b]
	Residual	41.876	26	1.611		
	Total	99.477	38			

By partial analysis of the impact of the predictor on the criterion, it was established that no variable individually had a statistically significant impact. The obtained result suggests the conclusion that the predictor set only as a whole has an impact and successfully predicts with about 39% the performance of the situational motoric task of lateral swimming 8 times 2.5 meters in water polo.

Table No 13 Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	44.999	13.665		3.293	.003
	VIST	-.018	.135	-.072	-.134	.895
	RASR	-.078	.133	-.326	-.588	.562
	DUŽR	-.062	.213	-.112	-.291	.773
	ŠIRR	-.295	.144	-.413	-2.053	.150
	ŠIRŠ	-.253	.454	-.118	-.556	.583
	ŠIRS	-.461	.534	-.198	-.862	.396
	KNND	.028	.117	.069	.239	.813
	KNNL	-.046	.203	-.104	-.225	.824
	KNNT	.080	.110	.306	.728	.473
	TEŽT	.149	.126	.923	1.186	.246
	ONAD	-.283	.261	-.553	-1.087	.287
	OGRK	.043	.074	.184	.578	.569

4. CONCLUSION

A survey conducted on a sample of 39 water polo players, aged 12 years (± 6 months), aimed to determine the impact of morphological characteristics on situational performance in young water polo players. The morphological space with 12 variables was analyzed, as well as the situational motoric of water polo players with a battery of 4 tests used in previous studies with similar problems. Using the regression analysis, a statistically significant influence of the predictor set of morphological variables on situational motor assays was determined; swimming speed at 25 meters water polo crawl with and without a ball (P25BL and P25SL), vertical jump from water (VERSK) and side swimming 8 times 2.5 meters (B8X2.5). Corrected determining coefficients in all four analyzed cases were at a statistically significant level and it can be concluded that morphological characteristics significantly influence the efficiency of the realization of situational motoric tasks. By analyzing the individual effects of applied variables on the analyzed criterion variables, it is concluded that the volume of the chest, body height, width of the hand and foot have a positive effect on performing situational motoric

tasks, while subcutaneous fat tissue in the area of the abdomen, as well as increased body weight, present aggravating factors in situational efficiency for young water polo players.

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ORGINAL SCIENTIFIC PAPER

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THE RELATION BETWEEN ESTIMATED MOTOR SKILLS WITH FUNCTIONAL MOVEMENT SCREENING AND PERFORMANCE OF GYMNASTIC ELEMENTS ON THE FLOOR ROUTINE AND THE VAULT

Abstract:

The aim of this research was to verify the FMS (Functional Movement Screening) method as a predictor of success in performing gymnastic elements on the floor routine and vault, on a selected sample composed of 36 male subjects aged 20 - 22 years, students of Faculty of Physical Education and Sport, University of Banja Luka. A battery of 11 motor skills tests was assessed: 7 at floor routine (side-to-side and front-to-back cartwheel, roundoff, front and back handspring, forward and backward flip) and 4 on vault (squat through on the vault and straddle vault with pre-flight, front handspring on vault, roundoff vault) together with FMS results all results received normal distribution and a relatively low average FMS value (14.313), which according to many authors is near the limit of the risk of injury (14). The overall results of the correlation analysis indicated statistically significant relationship between FMS and variables PRENAZ (0.049) and SALNAZ (0.038) at significance level of 0.05, while the applied regression analysis gave general information on the prediction model that showed statistical significance of 0.03 with the predictor variable FMS at the level of significance 0.05. Observing the values of the determination coefficients R2, it was established that the FMS method can predict the performance of the selected gymnastic elements on the floor routine and the vault as an integral model, explaining about 96% of the common variability with a criterion, representing a significant statistical value.
Key words: *gymnastics, FMS, floor routine, vault, prediction.*

INTRODUCTION

An integral part of every learning or training process is testing, form of checking level of knowledge or the achieved level of motor or other abilities. Tests in the narrowest sense are divided into laboratory and field tests. Both groups of tests have their characteristics with certain advantages and disadvantages, but often due to the complexity of the organization and / or number of respondents, the authors decides to use field tests. One of the field tests is functional testing or FMS (Functional Motion Screening) which presents a diagnostic method for assessing the performance of the loco motor system of an individual with an emphasis on assessing the stability and mobility of individual parts of the system as a risk factor of injury (Cook (2004), Cook et al. 2006), Myers (2001). FMS is a diagnostic procedure that is applied

in practice quickly and easily, using little space and accessories to quantify the performance of the movement through the measurement and evaluation of functional patterns of movement. This diagnostic method has been used more and more often in recent years as a result of an increase in awareness of the importance of preventive programs, with a significant number of trainers starting to use FMS technology in initial testing as a risk assessment tool for sports injuries but also for predicting success in other fieldsof movement (Milanović et al., 2011). The FMS method allows detection of causes and locations of reduced flexibility suggesting the selection of appropriate corrective exercises that will lead to the departure from the risk area of injury and increase the efficiency of performing individual exercises in training or recreational programs (Kiesel, Butler and Plisky (2008, 2014); Chapman, Laymon and Arnold (2013), Lockie and al. (2013, 2014), and Lloyd et al., 2014). On the other hand, in the process of learning gymnastic elements at certain time intervals, it is necessary to quantify the acquired knowledge as well as to determine the further course of the training. Therefore, there is a need for instruments that can give a prediction of the success of certain gymnastic elements in order to improve and individualize the process itself. According to various previous studies, morphological characteristics and motor skills have a dominant influence on the success in the performance of elements of sports gymnastics (Petković 1989, Tabaković 2000, Gaverdovskiy 2002, Saisoev 2010, Hadjiev, Andonov, Dobrev & Petrov, 2011, Petković et al. Fuluria et al., 2017, Jovanović et al., 2018), so this research is focused on determining the prediction characteristics of the FMS method on the success of the performance of sports gymnastics on the ground and the leap.

Methodology

The aim of this exploratory research was to determine the relations between FMS method and performance of technical elements on the floor routine and the vault. The sample consisted of 36 male subjects, students of Faculty of Physical Education and Sport in Banja Luka, aged 20 to 22. The subjects regularly attended "Sport Gymnastic 1" classes where they acquired knowledge and elements on the floor routine and the vault, and after which the testing of specific skills with FMS method and knowledge estimation was conducted by a committee of experts. Predictor variables are presented through a set of tests: 1.Deep Squat; 2. Hurdle Step; 3. In-LineLunge; 4. Shoulder Mobility; 5.ActiveStraight-Leg Raise; 6.Trunk Stability Push-up; 7.Rotary Stability. Used test are considered to cover the area of performance of the apparatus elements which were standardized by Sparling 2003, Cook 2004, Cook andal. 2006. In further analysis, the sum score calculated for each respondent was used individually on the existing FMS scale.

Table 1. Criteria for assessing the performance of FMS tests

1	During the movement, there is pain and the respondent is not able to perform the given movement.
2	During the movement, a certain degree of restriction and compensation on the move has been observed.
3	During the movement, all the completeness is correct and fully meets all the required criteria.

The sample of criterion variables on the floor routine consisted of the following elements: side-to-side cartwheel (PRSTBO), front-to-back cartwheel (PRSTČE), roundoff (RONDAT), front handspring (PRENAP), back handspring (PRENAZ), forward flip (SALNAP), and backward flip (SALNAZ). Criterion variables of the vault consisted of the following elements: squat through on the vault with pre-flight (ZGRLET), straddle vault with pre-flight (RAZLET), front handspring vault (PRNAPR), and roundoff vault (PRERON). The level of success in performance of the elements was evaluated by a three-member committee of

experts who awarded each performance grades from 1 to 5 (Table 2) using the criteria taken from Petković et al. (2016). In addition to basic descriptive parameters, all variables were also subjected to correlative and regressive analysis in order to determine the existence of relations, which was done in the statistical software SPSS 22.

Table 2. Criteria for performance grades

1	insufficiently	The student is unable to perform an element
2	enough	The student performs the element with great technical and aesthetic errors
3	good	Student performs element with medium technical and aesthetic errors
4	very good	Student performs element with less technical and aesthetic errors
5	perfect	A student performs an element without technical and aesthetic errors

RESULTS AND DISCUSSION

At the beginning of the analysis, the descriptive indicators for all variables were calculated and it can be said that the data of curvature and flattening is in normal distribution, as well as the data of the arithmetic mean of the used variables (Table 3). It is important to highlight the value of the arithmetic mean of the FMS variable - 14,313. Namely, numerous authors have studied, on different samples, which is the minimum normative value of achievement in FMS testing that has been proven to be associated with the great possibility of injury and found that it was 14 (Agresta, Slobodinsky and Tucker (2014); Schneiders, Davidsson , Hörman and Sullivan (2011), Peate et al. (2007), Letafatkar et al (2014); Perry and Koehle, 2013; Loudon et al., 2014; Kiesel, Plisky and Voight, 2007. Thus, by observing the obtained data of the average FMS values, it can be said that the respondents showed relatively low values and that a certain number of subjects are in the risk zone of the injury.

Table 3. Descriptive statistics

	MIN.	MAX.	AM	SD	S	SD	K	SD
PRSTBO	1	5	3.313	1.493	-0.477	0.564	-1.196	1.091
PRSTČE	1	5	3.063	1.389	-0.297	0.564	-1.275	1.091
RONDAT	1	5	3.063	1.436	0.185	0.564	-1.355	1.091
PRENAP	1	5	3.000	1.592	-0.227	0.564	-1.628	1.091
PRENAZ	1	5	2.750	1.770	0.185	0.564	-1.925	1.091
SALNAP	1	5	3.000	1.633	-0.105	0.564	-1.635	1.091
SALNAZ	1	5	3.000	1.751	-0.085	0.564	-1.823	1.091
ZGRLET	1	5	3.500	1.461	-0.587	0.564	-1.104	1.091
RAZLET	1	5	3.313	1.401	-0.307	0.564	-1.136	1.091
PREMET	1	5	3.125	1.746	-0.217	0.564	-1.896	1.091
PRERON	1	5	3.250	1.653	-0.354	0.564	-1.634	1.091
FMS	10	19	14.313	2.701	0.363	0.564	-0.921	1.091

Legend: AM-arithmetic mean, MIN-minimum, MAX-maximum, SD-standard deviation; S-skjunis; K-kurtosis

In order to better understand the obtained results of the evaluation of the functionality of the loco motor system, the distribution of results were performed (Table 4). On the basis of the distribution obtained, one third of the respondents are in the injuries risk area, showing a low score of 8-14 points on FMS testing (Chorba, Chorba, Bouillon, Overmyer and Landis, (2010); Kiesel, Butler and Plisky, (2008, 2014); Raleigh et al. (2010)).

Table 4. Frequency distribution of FMS testing

	BI	KBI	PKBI
8 -10	1	1	2,7
10-12	5	6	16,6
12 - 14	6	12	33,3
14 - 16	14	26	72,1
16 -18	8	34	94,1
18 - 21	2	36	100.0

Legend: BI-number of respondents, KBI-cumulative number of respondents, PKBI-percentage cumulative number of respondents

Observing the data in Table 5 which contains the results of the correlation analysis, a statistically significant correlation of the predictor variable FMS with the criterion variables PRENAZ (0.049) and SALNAZ (0.038) at the significance level of 0.05 can be noted. The negative sign of all correlation values should be mentioned, indicating the influence of the low level of the acquired values of mobility testing on the performance of the gymnastic elements on the ground and the leap.

Table 5. Correlation matrix

		FMS
PRSTBO	PC	-0.224
	Sig.	0.404
PRSTČE	PC	-0.041
	Sig.	0.880
RONDAT	PC	-0.246
	Sig.	0.358
PRENAP	PC	-0.388
	Sig.	0.138
PRENAZ	PC	-0.498
	Sig.	0.049*
SALNAP	PC	-0.484
	Sig.	0.058
SALNAZ	PC	-0.521
	Sig.	0.038*
ZGRLET	PC	-0.296
	Sig.	0.266
RAZLET	PC	-0.309
	Sig.	0.244
PREMET	PC	-0.419
	Sig.	0.107
PRERON	PC	-0.392
	Sig.	0.133

Legend: PC-Person correlation; Sig. - Significance; *. Significance at level 0.05

In the further analysis of the results achieved, a regression analysis was performed using the general data shown in Table 6. Data of the prediction model showed statistical significance of 0.03 with the predictor variable FMS at the significance level of 0.05. Observing the values of the determination coefficients R^2, it can be said that the FMS method can predict the performance of the selected gymnastic elements on the floor routine and the vault as an integral model, explaining about 96% of the common variability with a criterion, representing a significant statistical value.

Table 6. Results of general regression analysis

Model	R	R^2	Adj. R^2	SE	S^2	df1	df2	F	Sig.
1	0.978	0.957	0.840	1.08193	104.755	11	4	8.135	0.03

Legend: R-coefficient of multiple correlation, R2-coefficient of determination, Adj. R2-adjusted determination coefficient; SE-standard error; S^2-Suma squared; df 1/2 -degrees of freedom; F-determination factor; Sig. – significance

Analyzing the ratio of the predictor model at the individual level of the variables that compose it, with the FMS criterion (Table 7), it can be said that the values of the Beta coefficients indicate the possibility of a prediction only in the case of the observed model as a complete system or in the case where the predicate model consists only of variables PRSTČE, SALNAZ and ZGRLET, which showed a statistically significant relationship at the significance level 0.01. A smaller number of statistically significant partial regression coefficients obtained in the framework of the regression analysis leads to the conclusion that the prediction of the success of the performance of gymnastic elements on the floor routine and vault by the FMS method can be performed, on this sample, using only as a complete system, or in order to better predict the performance of individual variables should use a variety of variations of the variables themselves or a different choice when entering data in statistical operations. In addition to simpler elements, more complex acrobatic elements have been applied to both apparatus, and the authors consider that the very low average score on FMS testing in combination with the performance of more complex gymnastic elements has led to the results that are showing the possibility of using the FMS method only as predictive variables for the system of gymnastic elements. Namely, it is known that flexibility and mobility in the joints of the hands, shoulders and hooks are important for the elements used in order to achieve high amplitude and technically correct performance of the elements themselves, which is in contrast to the obtained assessment of the mobility of the joint-bone system of the subjects by FMS testing.

Table 7. Summary of results of standardized beta coefficients

Variable/Model	1	2	3	4	5	6	7	8	9
PRENAZ	0.857								
RAZLET	0.758	0.777							
PREMET	0.736	0.737	0.752						
PRERON	0.702	0.700	0.734	0.879					
RONDAT	0.589	0.564	0.517	0.539	0.497				
SALNAP	0.777	0.635	0.413	0.408	0.332	0.321			
PRENAP	0.725	0.494	0.240	0.174	0.143	0.131	0.229		
PRSTBO	0.270	0.133	0.101	0.080	0.060	0.042	0.059	0.108	
PRSTČE	0.365	0.118	0.064	0.045	0.030	0.010	0.011	0.012	**0.000**
SALNAZ	0.145	0.011	0.003	0.001	0.000	0.000	0.000	0.000	**0.000**
ZGRLET	0.118	0.078	0.014	0.008	0.002	0.001	0.000	0.000	**0.000**

Legend: dependent variable – FMS

CONCLUSION

The aim of this research was to verify the FMS method as a predictor of success in the performance of gymnastic elements on the floor routine and vault on the selected sample consisting of 36 male respondents from the Faculty of Physical Education and Sport at the University of Banja Luka, aged 20-22. On the sample of 11 variables on the floor routine and vault and the FMS testing, normal distribution was obtained and a relatively low average FMS value (14.313), which according to many authors is near the limit of the risk of injury (14). As Distribution of frequency of FMS results is shoving that it can be concluded that 33% of subjects is in the injuryrisk zone. Further analysis correlated statistically significant links between FMS and variables PRENAZ (0.049) and SALNAZ (0.038) at significance level of 0.05, while the applied regression analysis gave general information of the prediction model that showed statistical significance 0.03 with the predictor variable FMS at the level of significance 0.05. Observing the values of the determination coefficients R^2, it was established that the FMS method can predict the performance of the selected gymnastic elements on the floor routine and vault as acomplete system, explaining about 96% of the common variability with a criterion, representing a significant statistical value. By analyzing the ratio of the predictor model at the individual level of the variable, it can be said that the values of the Beta coefficients indicate the possibility of a prediction only in the case of the observed model as a complete systemor in the case that the predicate model consist only the variables PRSTČE, SALNAZ and ZGRLET,a statistically significant relationship on the significance level 0.01. A smaller number of statistically significant partial regression coefficients obtained in the framework of the regression analysis leads to the conclusion that the prediction of the success of the performance of gymnastic elements on the floor routine and vault by the FMS method on this sample can be performed using only a complete system of gymnastic elements, that is, in order to better predict success individual variables should use a different choice of variables themselves, or a different choice when entering data in statistical operations.

By considering the results obtained, it can be concluded that, although the respondents showed a relatively low average result on FMS testing, this method on a given sample and with the selected system of elements on the floor routine and vault, can be used to predict the success of performing them as a single entity. In further work with respondents, it is necessary to suggest and choose the right individual work programs that would improve mobility in the joint-bone system reduce the risk of injury and contribute to better performance of the selected tasks. In this way, they could have a better basis for functional movement which then positively influences through a better functional performance on the better functionality of the acquired skill that makes the basis of the FMS approach theory.

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ORGINAL SCIENTIFIC PAPER

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SUCCESS RATE OF RESULTS IN SWIMMING 400m FREESTYLE DEPENDANT OF TIME TRIALS BY SECTIONS

SUMMARY

For the purpose of this research, sample of 36 participants was divided into three sub-samples of 12 swimmers, participants in Open Championship of Bosnia and Herzegovina in 2017 and 2018, as well as rally at 25th International memorial race "Ante Lambaša" in Belgrade in 2017. Data was obtained from entries for time trials as well as final results of competition in 400m freestyle swimming.
Research was conducted with the aim of establishing the influence of sections (50m, 100m, 150m, 200m, 250m, 300m and 350m) as predictor set of variables and influence on criterion variable of success rate of results in 400m freestyle swimming. Results obtained using the regression analysis lead to conclusion that there is statistically significant connection between the set of variables (50m, 100m, 150m, 200m, 250m, 300m and 350m) and criterion variable of 400m freestyle swimming.
Values of coefficient of multiple correlation which determine the influence of the set of of predictor variables (50m, 100m, 150m, 200m, 250m, 300m and 350m) to criterion variable of 400m freestyle swimming are respectively: for 50 m 42%, 100 m 52%, 150 m 65%, 200 m 67%, 250 m 67%, 300 m 68%, 350 m 43% of the common variance of swimmers who took part in rally "Olimp Banja Luka" in 2018.
Values of coefficient of multiple correlation which determine the influence of the set of of predictor variables (50m, 100m, 150m, 200m, 250m, 300m and 350m) to criterion variable of 400m freestyle swimming are respectively:for 50 m 58%, 100 m 59%, 150 m 71%, 200 m 70%, 250 m 71%, 300 m 70%, 350 m 41% of the common variance of swimmers who took part in rally "Olimp Banja Luka" in 2017.
Values of coefficient of multiple correlation which determine the influence of the set of of predictor variables (50m, 100m, 150m, 200m, 250m, 300m and 350m) to criterion variable of 400m freestyle swimming are respectively:for 50 m 58%, 100 m 65%, 150 m 62%, 200 m 84%, 250 m 67%, 300 m 89%, 350 m 76% of the common variance of swimmers who took part in rally 25th International memorial race "Ante Lambaša"in 2017 in Belgrade.
Conclusion: set of predictor variables (50m, 100m, 150m, 200m, 250m, 300m and 350m) of freestyle swimming has significant percentage of influence to criterion variable 400m freestyle swimming for swimmers who took part in rally 25th International memorial race "Ante Lambaša" in Belgrade in 2017 in Seerbia when compared to the same one for swimmers who took part in Open Championship of Bosnia and Herzegovina in 2017 and 2018.

Key words: *rally, freestyle swimming, Olympic pool, regression analysis*

INTRODUCTION

In course of research conducted for the purpose of this paper we used the results obtained in following competitions: rally in banja Luka in 2017 and 2018. Organiser was swimming club "Olimp" from banja Luka on 26th and 27th May 2018 and 27th and 28th May 2017. Competition was held at swimming pool "GOB" in Banja Luka, with dimensions 50m by 10 lanes. Absolute rally record was 3:55.18 set by Stjepanović Velimir UAE Banja Luka on 31st May 2015. Organiser of 25th International memorial race "Ante Lambaša" was swimming club "Baracuda", it was held in Serbia (Novi Beograd, 4th and 5th March 2017).

Contemporary research

By structure of movement swimming is in the group of cyclic sports and by form and manner of performance relatively simple movements which are constantly the same (Eigth International Conference "Sport science and health" 2018.235) which periodically repeat in course of swimming using certain technique (Madić, Okičić & Aleksandrović, 2007; Jevtić, 2011; Marković, 2017). Basic aim of in sport swimming is swimming specific section in the shortest amount of time using specific swimming technique (Ahmetović, 1994). Success in any sport activity, swimming included, depends of large number of anthropological characteristics and abilities, as well as their mutual connection. Importance of influence of specific characteristics to success in swimming is not the same for all the characteristics. It is certain that the individual with anthropological abilities at higher level will achieve better results if connections between them are at the optimal level. In addition to motor, functional, cognitive and conative characteristics which can have influence on results in swimming there are also morphological characteristics (Malacko, 1991). Many researchers dealt with the influence of specific segments of anthropological space to success rate in terms of results achieved. Influence of basic motor abilities in swimmming provides information on which abilities have the greatest influence on results and should be accordingly monitored and developed in the training process. Lokken (1998) established in his research the influence of strength to results in disciplines 100m and 200m crawl by 74% and 72% respectively. Establishing the influence of parameters of specific motor abilities to success rate of results in swimming can be performed on seniors as well as young swimmers, as in research performed by (Jurimae, Halljaste, Cicchela, Latt, Purge et al., 2007; Latt, Jurimae, Maestu, Purge, Ramson, et al., (2010). Zahorjević (1990) performed research on influence of motor abilities to results in swimming of young swimmers aged 8–10. Leko (2001) performed research on the influence of motor abilitiesto results in swimming 100 m crawl of young swimmers aged 9–12. Okičić (1996) performed research on influence of flexibility to results in swimming of young swimmers. Influence of certain basic and specific motor abilities to results in sport discipline 100m stroke of young swimmers. Sample consisted of 30 swimmers aged 9–12 who are in the category of young pioneers (Okićič et al., 2012).

METHODS

Sample of participants

Total sample (36) is divided into three sub-samples by 12 who are in absolute category of swimming 400 m achieved results during rallies and open championships: 26th and 27th May 2018, banja Luka, Bosnia and Herzegovina; second part: Rally Olimp Banja Luka 2017; third: Rally International memorial race "Ante Lambaša" 2017 held in Belgrade. Sample was taken from the ranking list of first 12 participants with the best achieved results in the course of competition.

Sample of variables – Procedures

Predictor variables

In connection to swimming following sections: 50m, 100m, 150m, 200m, 250m, 300m and 350m.

Criterion variables were in connection to success rate of results in 400 m freestyle swimming.

Data processing methods

All the data was processed in program ”Statistica 10”. The following parameters were calculated and presented (in tables) for all the applied variables:
– Mean value (Mean),
– Minimum (Min),
– Maximum (Max),
– Standard deviation (Std. Dv).

In order to determine the influence of time trials by sections (50m, 100m, 150m, 200m, 250m, 300m and 350m) to success rate of results achieved in 400 m freestyle swimming, a number of regresional analysis was applied in a manner that each variable of the predictors was observed as single predictor in swimming results.
Explanation of regression analysis symbols:
– (R) – coefficient of multiple correlation;
– (R^2) – coefficient of determination;
– (Beta) – beta-values;
– F – significance of t-test value (t);
– p-level – significance level.

Statistical analysis

“Hypotheses: H_0: Between the regressional (explained) and residual (unexplained) part of total variance of multiple regression there is no statistically significant difference.
In order to render the regression model usable during the prognosis of dependent variable in line with the data on independent variables, it is necessary to establish the level of statistical significance of the calculated coefficients of regression. For that purpose are used several procedures. One of the most frequently used is the above explained procedure of calculating the corrected coefficient of multiple determination. The second procedure which also deals with analysis of joint influence of independent variables to dependant one is the analysis of variance of multiple regression. Using these two procedures it is therefore not possible to determine separate influence of independent variables. For that purpose testing the evaluated parameters of regression is frequently used in multiple regression analysis. Using the T-test in this procedure we can establish separate influence of independent variables on defining the dependant variables. Variance analysis used for multiple regressional lines shows great analogy with the procedure used for testing simple linear regression. Three characteristic values used for this purpose are: orginal data of dependent variable (Y) which indicate vertical disagreement with regression plane; adjusted values (Yp) directly on the regression plane and arithmetic mean of original data of the dependent variable (My). They are used for calculation of three already explained characteristic variables: total, explained (so called regressional) and unexplained (residual). When each of these three variables is divided by corresponding number of degrees of freedom we get the three variances of regression line: total, regression and residual. For the purpose of testing the significance of regression line only regressional (Vy) and residual (VR) variance are relevant and from their umeric relationship we obtain characteristic, previously explained F-value. Therefore, in the language of mathematics, F value is calculated as quotient of regression and residual value. Value obtained in that manner is compared with corresponding table f-value read from Table 4 according to the number of degrees of freedom by comparing the variances. In header of Table 4 are degrees of freedom of regression variance (df_1) which is determined as n-1 (where n was total number of observed variables including dependent and independent variables and in first column degree of freedom of residual variance (df_2) calculated as N-n. In the cross-section of coordinates drawn from corresponding values of degrees of liberty (df_1 and df_2) are read table (limit) values for desired level of significance (p). According to the same analogy zero hypothesis is established as well as its testing using calculated and table value. Calculated F-value on the level of significance of 0.01 overcomes the corresponding table value – f-value, and in line with that we may conclude that the regression (explained) variability is statistically significantly greater than residual (unexplained) variability (F>f). Such conclusion automatically guarantees statistical significance of regression line. Therefore, the information provided by coefficient of high determination (R^2) is confirmed. Calculated coefficients of multiple regression (b_0, b_1, b_2 etc.) relate only to the sample results and represent evaluation of regression parameters (B_0, B_1, B_2) which are the basic group (population). They enable prognosis of dependent variable according to empirical data on independent variables. Therefore it is important to

determine whether the parameters are statistically significant or not. In statistics it is important to have so called coefficient slope (b_1, b_2, ..) whereas the determining coefficient – intercept (b0) has secondary significance. Using the previously mentioned procedures for testing the significance of regression coefficients (coefficient of multiple determination and variance analysis) it was possible to reach conclusion about joint influence of independent variables, whereas the information on their individual influence on dependent variable missed. Such possibility of separate testing of statistical significance of regression coefficients is provided by separate procedure based on application of T-test. Its logic is analogous to T-test used for testing calculated values b_1 and b_2 and it is based on using assessment and standard error (Perić, 2001)."

RESULTS

Table 1. Descriptive analysis of rally Olimp Banja Luka 2018. Time trials by sections

Table 1. Time trials rally BL 18

Valid N 12	Mean	Min.	Max.	Std.Dev.
12	28.71	27.71	30.21	0.78
12	60.42	57.35	63.76	1.81
12	92.66	87.46	96.82	2.86
12	125.27	117.83	130.80	4.12
12	157.79	147.05	164.93	5.81
12	190.55	176.48	199.61	7.57
12	224.06	205.27	239.15	10.37
12	253.00	235.27	266.48	10.99

Table 2, Time trials by sections BL 18

Valid N	Mean	Minimum	Maximum	Std.Dev.
12	28.71	27.71	30.21	0.78
12	31.69	29.96	33.55	1.01
12	32.18	30.11	34.13	1.08
12	32.53	30.37	34.43	1.26
12	32.44	29.22	34.35	1.67
12	32.79	29.43	34.71	1.76
12	32.63	28.79	34.99	1.90
12	31.38	28.00	33.98	1.67

Table 2, Descriptive statistics of rally Olimp Banja Luka 2018 time trials by sections
In Tables 1 and 2 are minimum and maximum values of time trials as well as mean value with standard deviation of Open Championship Bosnia and Herzegovina during the rally Olimp Banja Luka 2018.

Table 3, Regression analysis of criterion variable swimming 50 m (rally Olimp Banja Luka 2018) and its effect to criterion variables swimming 400 m freestyle

Table 3, Swimming 50 m

b*	Std.Err. of b*	b	Std.Err. of b	t(10)	p-value
		18.62	3.37	5.51	0.00
0.68	0.22	0.32	0.10	2.99	0.01

Table 4, Swimming 100 m

b*	Std.Err. of b*	b	Std.Err. of b	t(10)	p-value
		17.43	3.93	4.42	0.00
0.75	0.20	0.45	0.12	3.62	0.00

Table 3. Regression Summary for Dependent Variable: 50 M BL 18 R= .84 R^2= .71 Adjusted R2= .68 F(1.10)=25.28 p<.00 Std.Error of estimate: .43
Table 4. Regression Summary for Dependent Variable: 100M BL 18 (R= .82 R^2= .68 Adjusted R2= .65 F(1.10)=21.54 p<.00 Std.Error of estimate: 1.07

In Table 3 are presented results of regression line of results in swimming 50 m crawl with swimming 400 m freestyle. It is evident from the Table that the coefficient of multiple correlation is (R=.68), and coefficient of determination (R^2=.42), which indicates 42% of common variance. Value of regression coefficients is je: beta values (Beta=.22) in swimming 400 m, and significance level of F value is F(1.10)= 8.96, with t-test (10) value it is 5.51 at significance level .00 (p<0.01).
In Table 4 are presented results of regression line of results in swimming 100 m crawl with swimming 400 m freestyle. It is evident from the table that coefficient of multiple correlation is (R=.75), and coefficient of determination is (R^2=.52), which indicates 52% of common variance. Value of regression coefficients is: beta values (Beta=.17) in swimming 400 m, and significance level of F value is F(1.10)= 13.15, with t-test (10) value is 4.42 at significance level .00 (p<0.00).

Table 5, Regression analysis of criterion variable of swimming 150 m (rally Olimp Banja Luka 2018) and its effect to criterion variables of swimming 400 m freestyle

Table 5, Swimming 150 m

b*	Std.Err. of b*	b	Std.Err. of b	t(10)	p-value
		38.21	11.76	3.24	0.00
0.82	0.17	0.21	0.04	4.63	0.00

Table 6, Swimming 200 m

b*	Std.Err. of b*	b	Std.Err. of b	t(10)	p-value
		47.46	17.17	2.76	0.01
0.82	0.18	0.30	0.06	4.53	0.00

Table 5. Regression Summary for Dependent Variable: 150 M BL 18 R= .82 R^2= .68 Adjusted R2= .65 F(1.10)=21.45 p<.00 Std.Error of estimate: 1.69
Table 6. Regression Summary for Dependent Variable: 200 M BL 18 R= .82 R^2= .67 Adjusted R2= .64 F(1.10)=20.57 p<.00 Std.Error of estimate: 2.47

In Table 5 are presented results of regression line of results in swimming 150 m crawl with swimming 400 m freestyle. It is evident from the Table that the coefficient of multiple correlation is (R=.82), and coefficient of determination is (R^2=.65), which indicates 65% of common variance. Value of regression coefficients is: beta value (Beta=.21) in swimming 400 m, and significance level of F value F(1.10)= 21.45, with t-test (10) value is 4.63 at significance level .00 (p<0.00).

Tabele 6, regression analysis of criterion variable of swimming 200 m (rally Olimp Banja Luka 2018) and its effect to criterion variables of swimming 400 m freestyle

In Table 6 are presented results of regression line of results in swimming 200 m crawl with swimming 400m freestyle. It is evident from the Table that the coefficient of multiple correlation is (R=.82), and coefficient of determination is (R^2=.67), which indicates 67% of common variance. Value of regression coefficients is: beta value (Beta=.30) uin swimming 400 m, and significance level F(1.10)= 20.57, with t-test (10) value is 4.53 at significance level .00 (p<0.00).

Table 7, regression analysis of criterion variable of swimming 250 m (rally Olimp Banja Luka 2018) and its effect to criterion variables of swimming 400 m freestyle

Table 7, Swimming 250 m

b*	Std.Err. of b*	b	Std.Err. of b	t(10)	p-value
		48.12	24.25	1.98	0.07
0.81	0.18	0.43	0.09	4.52	0.00

Table 8, Swimming 300 m

b*	Std.Err. of b*	b	Std.Err. of b	t(10)	p-value
		45.90	30.81	1.48	0.16
0.82	0.17	0.57	0.12	4.69	0.00

Table 7. Regression Summary for Dependent Variable: 250 M BL 18 R= .81 R^2= .67 Adjusted R2= .63 F(1.10)=20.48 p<.00 Std.Error of estimate: 3.49
Table 8. Regression Summary for Dependent Variable: 300 M BL 18 R= .82 R^2= .68 Adjusted R2= .65 F(1.10)=22.06 p<.00 Std.Error of estimate: 4.43

In Table 7 are presented results of regression line of results in swimming 250 m crawl with swimming 400 m freestyle. It is evident from the Table that the coefficient of multiple correlation is (R=.81), and coefficient of determination is (R^2=.67), which indicates 67% of common variance. Value of regression coefficients je: beta value (Beta=.43) of swimming 400 m, and significance level of F value F(1.10)= 20.48, with t-test (10) value is 4.52 at significance level of .00 (p<0.00).

Table 8, regression analysis of criterion variable of 300 m (Rally Olimp Banja Luka 2018) and its effect to criterion variable of 400 m freestyle

In Table 8 are presented results of regression line of results in swimming 300 m crawl with swimming na 400 m freestyle. It is evident from the Table that koeficijent of multiple correlation is (R=.82), and coefficient of determination is (R^2=.68), which indicates 68% of common variance. Value of regression coefficients is: beta value (Beta=.57) in swimming 400 m, and significance level of F value F(1.10)= 38.11, with t-test (10) value is 4.69 at significance level of .00 (p<0.00).

Table 9, regression analysis of criterion variable of 350 m (Rally Olimp Banja Luka 2018.) and its effect to criterion variable of 400 m freestyle

b*	Std.Err. of b*	B	Std.Err. of b	t(10)	p-value
		66.08	56.68	1.16	0.27
0.66	0.23	0.62	0.22	2.78	0.01

Table 9, Regression Summary for Dependent Variable: 350 M BL 18 R= .66 R^2= .43 Adjusted R2= .38 F(1.10)=7.78 p<.00 Std.Error of estimate: 8.16

In Table 9 are presented results of regression line of results in swimming 350 m crawl with swimming 400 m freestyle. It is evident from the Table that coefficient of multiple correlation is (R=.66), and coefficient of determination (R^2=.43), which indicates 43% of common variance. Value of regression coefficients is: beta value (Beta=.62) in swimming 400 m, and significance level of F value F(1.10)= 41.84, with t-test (10) value is 2.78 at significance level of .00 (p<0.00).

Table 10, descriptive statistics of Rally Olimp Banja Luka 2017, time trials by sections

Table 10, Time trials rally BL 17

Valid N	Mean	Min	Max	Std.Dev.
12	28.79	27.73	30.10	0.83
12	60.43	57.34	62.62	1.70
12	92.84	88.34	96.10	2.88
12	125.48	119.10	129.95	4.16
12	157.88	148.74	164.97	5.88
12	190.56	178.72	200.18	7.63
12	224.56	208.02	239.15	9.50
12	252.25	236.23	268.92	11.95

Table 11, swimming time by sections BL 17

Valid N	Mean	Min	Max	Std.Dev.
12	28.82	27.76	30.10	0.79
12	31.74	30.08	32.67	0.81
12	32.48	30.30	34.27	1.20
12	32.69	30.76	34.18	1.25
12	32.47	29.64	35.02	1.67
12	32.72	29.98	35.21	1.71
12	32.42	29.30	34.81	1.79
12	31.13	28.08	34.16	2.20

Table 11, Descriptive statistics Rally Olimp Banja Luka 2017, times by sections

In Tables 10 and 11 are presented minimum and maximum values of time trials as well as mean value with standard deviation for Open Championship of BiH at Rally Olimp Banja Luka 2017.

Table 12, regression analysis of criterion variable of 50 m (Rally Olimp Banja Luka 2017) and its effect to criterion variable of swimming 400 m freestyle

Table 12, swimming 50 m BL 17

b*	Std.Err. of b*	b	Std.Err. of b	t(10)	p-value
		15.32	3.56	4.30	0.00
0.76	0.20	0.05	0.01	3.78	0.00

Table 13, swimming 100 m BL 17

b*	Std.Err. of b*	b	Std.Err. of b	t(10)	p-value
		31.90	6.93	4.59	0.00
0.79	0.19	0.11	0.02	4.11	0.00

Table 12, Regression Summary for Dependent Variable: 50 M BL 17 R= .76 R^2= .58 Adjusted R2= .54 F(1.10)=14.31 p<.00 Std.Error of estimate: .55

Table 13. Regression Summary for Dependent Variable: 100 M BL 17 R= .79 R^2= .62 Adjusted R2= .59 F(1.10)=16.94 p<.00 Std.Error of estimate: 1.08

In Table 12 are presented results of regression line of results of swimming 50 m crawl with swimming 400 m freestyle. It is evident from the Table that coefficient of multiple correlation is (R=.76), and coefficient of determination is (R^2=.58), which indicates 58% of common variance. Value of regression coefficients is: beta value (Beta=.05) of swimming 400 m, and significance level of F value F(1.10)= 14.31, with t-test (10) value is 3.78 at significance level of .00 (p<0.00).

Table 13, regression analysis of criterion variable of swimming 100 m (Rally Olimp Banja Luka 2017) and its effect to criterion variable of swimming 400 m freestyle

In Table 13 are presented results of regression line of results of swimming to coefficient of multiple correlation which is (R=.76), and coefficient of determination (R^2=.58), which indicates 58% of

common variance. Value of regression coefficients is: beta value (Beta=.05) in swimming 400 m, and significance level of F value F(1.10)= 14.31, with t-test (10) value is 3.78 at significance level of .00 (p<0.00).
Table 14, regression analysis of criterion variable of swimming 150 m (Rally Olimp Banja Luka 2017) and its effect to criterion variable of swimming 400 m freestyle

Table 14,swimming 150 m BL 17

b*	Std.Err. of b*	b	Std.Err. of b	t(10)	p-value
		41.53	10.31	4.02	0.00
0.84	0.16	0.20	0.04	4.98	0.00

Table 15, swimming 200 m BL 17

b*	Std.Err. of b*	b	Std.Err. of b	t(10)	p-value
		51.50	15.01	3.43	0.00
0.84	0.17	0.29	0.05	4.93	0.00

Table 14, Regression Summary for Dependent Variable: 150 M BL 17 R= .84 R^2= .71 Adjusted R2= .68 F(1.10)=24.82 p<.00 Std.Error of estimate: 1.61
Table 15. Regression Summary for Dependent Variable: 200 M BL 17 R= .84 R^2= .70 Adjusted R2= .67 F(1.10)=24.32 p<.00 Std.Error of estimate: 2.35

In Table 14 are presented results of regression line of results of swimming 150 m crawl with swimmming 400 m freestyle. It is evident from the Table that coefficient of multiple correlation is (R=.84), and coefficient of determination (R^2=.71), which indicates 71% of common variance. Value of regression coefficients je: beta value (Beta=.20) of swimming 400 m, and significance level of F value F(1.10)= 24.82, with t-test (10) value is 4.98 at significance level of .00 (p<0.00).
Table 15,regression analysis ofcriterion variable of swimming 200 m (Rally Olimp Banja Luka 2018.) and its effect to criterion variable of swimming 400 m freestyle

In Table 15 are presented results of regression line of results of swimming 200 m crawl withnswimming 400 m freestyle. It is evident from the Table that coefficient of multiple correlation is (R=.84), and coefficient of determination (R^2=.70), which indicates 70% of common variance. Value of regression coefficients is: beta value (Beta=.29) of swimminga 400 m, and significance level of F value F(1.10)= 24.32, with t-test (10) value is 4.93 at significance level of .00 (p<0.00).

Table 16, regression analysis of criterion variable of swimming 250 m (Rally Olimp Banja Luka 2017) and its effect to criterion variable of swimming 400 m freestyle

Table 16, swimming 250 m Bl 17

b*	Std.Err. of b*	b	Std.Err. of b	t(10)	p-value
		53.15	21.18	2.50	0.03
0.84	0.17	0.41	0.08	4.94	0.00

Table 17, swimming 300 m BL 17

b*	Std.Err. of b*	b	Std.Err. of b	t(10)	p-value
		53.02	26.52	1.99	0.07
0.85	0.16	0.54	0.10	5.19	0.00

Table 16, Regression Summary for Dependent Variable: 250 M BL 17 R= .84 R^2= .71 Adjusted R2= .68 F(1.10)=24.50 p<.00 Std.Error of estimate: 3.32
Table 17. Regression Summary for Dependent Variable: 300 M BL 17 R= .85 R^2= .72 Adjusted R2= .70 F(1.10)=26.94 p<.00 Std.Error of estimate: 4.16

In Table 16 are presented results of regression line of results of of swimming 250 m crawl with swimming 400 m freestyle. It is evident from the Table that coefficient of multiple correlation is (R=.84), and coefficient of determination (R^2=.71), which indicates 71% of common variance. Value of regression coefficients is: beta value (Beta=.41) of swimming 400 m, and significance level of F value F(1.10)= 24.50, with t-test (10) value is 4.94 at significance level of .00 (p<0.00).
Table 17, regression analysis of criterion variable of swimming 300 m (Rally Olimp Banja Luka 2017) and its effect to criterion variable of swimming 400 m freestyle

In Table 17 are presented results of regression line of results of swimming 300 m crawl with swimming 400 m freestyle. It is evident from the Table that coefficient of multiple correlation is (R=.85), and coefficient of determination (R^2=.70), which indicates 70% of common variance. Value of regression coefficients is: beta value (Beta=.54) of swimminga 400 m, and significance level of F value F(1.10)= 26.94, with t-test (10) value is 5.19 at significance level of .00 (p<0.00).

Table 18, regression analysis of criterion variable of swimming 350 m (Rally Olimp Banja Luka 2017) and its effect to criterion variable of swimming 400 m freestyle

b*	Std.Err. of b*	b	Std.Err. of b	t(10)	p-value
		94.80	48.46	1.95	0.07
0.64	0.24	0.51	0.19	2.68	0.02

Table 18, Regression Summary for Dependent Variable: 350 M BL 17 R= .64 R^2= .41 Adjusted R2= .35 F(1.10)=7.60 p<.02 Std.Error of estimate: 7.6

In Table 18 are presented results of regression line of results of swimming 350 m crawl with swimming 400 m freestyle. It is evident from the Table that coefficient of multiple correlation is (R=.64), and coefficient of determination (R^2=.41), which indicates 41% of common variance. Value of regression coefficients is: beta value (Beta=.51) of swimming 400 m, and significance level of F value F(1.10)= 7.60, with t-test (10) value is 2.68 at significance level of .00 (p<0.02).

Table 19, Descriptive statistics (Rally 25th International memorial race "Ante Lambaša" 2017). Time trials by sections Table 20, Descriptive statistics (Rally 25th International memorial race "Ante Lambaša" 2017). Time trials by sections

Table 19, Time trials by sections Bg

Valid N	Mean	Minimum	Maximum	Std.Dev.
12	28.82	27.76	30.10	0.79
12	31.74	30.08	32.67	0.81
12	32.48	30.30	34.27	1.20
12	32.70	30.76	34.18	1.26
12	32.47	29.64	35.02	1.68
12	32.72	29.98	35.21	1.72
12	32.42	29.30	34.81	1.79
12	31.13	28.08	34.16	2.21

Table 20, Time trials by sections Bg

Valid N	Mean	Minimum	Maximum	Std.Dev.
12	30.14	27.68	31.90	1.46
12	38.01	29.86	61.88	10.31
12	43.96	30.00	94.85	22.20
12	49.61	30.11	128.43	34.43
12	55.21	30.11	161.50	46.58
12	60.75	30.35	195.52	59.03
12	66.31	30.51	228.60	71.30
12	70.57	29.64	261.17	83.84

In Table 19 are presented results of time trials of 50 m freestyle by sections to final result of 400 m through: mean value, minimum, maximum and standard deviation. Minimum times show better results, whereas the largest numeric number is at the same time the poorest overall score in swimming at international Rally 25th International memorial race "Ante Lambaša" 2017 in Belgrade.

In Table 20 are presented results of time trials freestyle by sections to final result of 400 m through: mean value, minimum, maximum and standard deviation. Minimum times show better results, whereas the largest numeric number is at the same time the poorest overall score in swimming at international Rally 25th International memorial race "Ante Lambaša" 2017 in Belgrade.

Table 21, regression analysis of criterion variable of swimming 50 m (Rally„Memorijal ANTE LAMBAŠA" 2017 and its effect to criterion variable of swimming 400 m freestyle

Table 21, swimming 50 m Bg 17

b*	Std.Err. of b*	b	Std.Err. of b	t(10)	p-value
		9.94	3.30	3.00	0.01
0.89	0.14	0.07	0.01	6.34	0.00

Table 22, swimming 100 m Bg 17

b*	Std.Err. of b*	b	Std.Err. of b	t(10)	p-value
		4.17	5.52	0.75	0.46
0.86	0.15	0.85	0.15	5.48	0.00

Table21, Regression Summary for Dependent Variable: 50 M Bg 17 R= .76 R^2= .58 Adjusted R2= .54 F(1.10)=14.31 p<.00 Std.Error of estimate: .78

Table22, Regression Summary for Dependent Variable: 100 M Bg 17 R= .80 R^2= .65 Adjusted R2= .61 F(1.10)=18.91 p<.00 Std.Error of estimate:3 .02

In Table 21 are presented results of regression line of results of swimming 50 m crawl with swimming 400 m freestyle. It is evident from the Table that coefficient of multiple correlation is (R=.76), and coefficient of determination (R^2=.58), which indicates 58% of common variance. Value of regression coefficients is: beta value (Beta=.07) of swimming 400 m, and significance level of F value F(1.10)= 14.31, with t-test (10) value is 6.34 at significance level of .00 (p<0.00).

Table 22, regression analysis of criterion variable of swimming 100 m (Rally 25th International memorial race "Ante Lambaša" 2017 and its effect to criterion variable of swimming 400 m freestyle

In Table 22 are presented results of regression line of results of swimming 100 m crawl with swimming 400 m freestyle. It is evident from the Table that coefficient of multiple correlation is (R=.80), and coefficient of determination (R^2=.65), which indicates 65% of common variance. Value of regression coefficients is: beta value (Beta=.19) of swimming 400 m, and significance level of F value F(1.10)= 30.12, with t-test (10) value is 4.34 at significance level of .00 (p<0.00).

Table 23, regression analysis of criterion variable of swimming 150 m (Rally 25th International memorial race "Ante Lambaša" 2017 and its effect to criterion variable of swimming 400 m freestyle

Table 23, swimming 150 m Bg 17

b*	Std.Err. of b*	b	Std.Err. of b	t(10)	p-value
		35.41	15.65	2.26	0.04
0.79	0.19	0.22	0.05	4.08	0.00

Table 24, swimming 200 m Bg 17

b*	Std.Err. of b*	b	Std.Err. of b	t(10)	p-value
		4.15	17.55	0.23	0.81
0.92	0.12	0.46	0.06	7.49	0.00

Table23, Regression Summary for Dependent Variable: 150 M Bg 17 R= .79 R^2= .62 Adjusted R2= .58 F(1.10)=16.67 p<.00 Std.Error of estimate: 3,71

Table24. Regression Summary for Dependent Variable: 200 M Bg 17 R= .92 R^2= .84 Adjusted R2= .83 F(1.10)=56.17 p<.00 Std.Error of estimate: 4.16

In Table 23 are presented results of regression line of results of swimming 150 m crawl with swimming 400 m freestyle. It is evident from the Table that coefficient of multiple correlation is (R=.91), and coefficient of determination (R^2=.62), which indicates 62% of common variance. Value of regression coefficients is: beta value (Beta=.13) of swimming 400 m, and significance level of F value F(1.10)= 16.67, with t-test (10) value is 4.08 at significance level of .00 (p<0.00).

Table 24, regression analysis of criterion variable of swimming 200 m (Rally 25th International memorial race "Ante Lambaša" 2017 and its effect to criterion variable of swimming 400 m freestyle

In Table 24 are presented results of regression line of results of swimming 200 m crawl with swimming 400 m freestyle. It is evident from the Table that coefficient of multiple correlation is (R=.92), and coefficient of determination (R^2=.84), which indicates 84% of common variance. Value of regression coefficients is: beta value (Beta=.46) of swimming 400 m, and significance level of F value F(1.10)= 64.67, with t-test (10) value is 7.94 at significance level of .00 (p<0.00).

Table 25, regression analysis of criterion variable of swimming 250 m (Rally 25th International memorial race "Ante Lambaša" 2017 and its effect to criterion variable of swimming 400 m freestyle

Table 25, swimming 250 m Bg 17

b*	Std.Err. of b*	b	Std.Err. of b	t(10)	p-value
		43.13	27.79	1.55	0.15
0.82	0.17	0.45	0.09	4.59	0.00

Table 26, swimming 300 m Bg 17

b*	Std.Err. of b*	b	Std.Err. of b	t(10)	p-value
		-8.13	23.34	-0.34	0.73
0.94	0.10	0.76	0.08	9.26	0.00

Table25, Regression Summary for Dependent Variable: 250 M Bg 17 R= .82 R^2= .67 Adjusted R2= .64 F(1.10)=21.07 p<.00 Std.Error of estimate: 6.60

Table26, Regression Summary for Dependent Variable: 300 M Bg 17 R= .94 R^2= .89 Adjusted R2= .88 F(1.10)=85.81 p<.00 Std.Error of estimate: 5.54

In Table 25 are presented results of regression line of results of swimming 250 m crawl with swimming 400 m freestyle. It is evident from the Table that coefficient of multiple correlation is (R=.82), and coefficient of determination (R^2=.67), which indicates 67% of common variance. Value of regression coefficients is: beta value (Beta=.45) of swimming 400 m, and significance level of F value F(1.10)= 189.04, with t-test (10) value is 4.59 at significance level of .00 (p<0.00).

Table 26, regression analysis of criterion variable of swimming 300 m (Rally 25th International memorial race "Ante Lambaša" 2017 and its effect to criterion variable of swimming 400 m freestyle
In Table 27 are presented results of regression line of results of swimming 300 m crawl with swimming 400 m freestyle. It is evident from the Table that coefficient of multiple correlation is (R=.94), and coefficient of determination (R^2=.89), which indicates 89% of common variance. Value of regression coefficients is: beta value (Beta=.76) of swimming 400 m, and significance level of F value F(1.10)= 143.12, with t-test (10) value is 9.26 at significance level of .00 (p<0.00).

Table 27, regression analysis of criterion variable of swimming 350 m (Rally 25th International memorial race "Ante Lambaša" 2017 and its effect to criterion variable of swimming 400 m freestyle

Table 27swimming 350 m Bg 17

b*	Std.Err.	b	Std.Err.	t(10)	p-value
	of b*		of b		
		-16.36	45.87	-0.35	0.72
0.87	0.15	0.92	0.16	5.65	0.00

Table27, Regression Summary for Dependent Variable: 300 M Bg 17 R= .87 R^2= .76 Adjusted R2= . 73 F(1.10)=32.00 p<.00 Std.Error of estimate: 10.89

In Table 27 are presented results of regression line of results of swimming 350 m crawl with swimming 400 m freestyle. It is evident from the Table that coefficient of multiple correlation is (R=.87), and coefficient of determination (R^2=.76), which indicates 76% of common variance. Value of regression coefficients is: beta value (Beta=.92) of swimming 400 m, and significance level of F value F(1.10)= 32.00. with t-test (10) value is 5.65 at significance level of .00 (p<0.00).

DISCUSSION

Subject of discussion were results achieved in the following competitions: rally in Banja Luka in 2018 and 2017. Competition took place at the community Olympic pool "GOB" in Banja Luka with dimensions 50 m with 10 lanes. and the third sub-sample was from result success rate at 25th International Swimming rally 25th International memorial race "Ante Lambaša" organised by swimming club "Barakuda", held in Novi Beograd, Belgrade on 4th and 5th March 2017.
Results of regression line of swimming 2018 in Banja Luka are as follows: 50 m crawl with swimming 400 m freestyle, coefficient of multiple correlation is (R=.68), and coefficient of determination (R^2=.58), which indicates 58% of common variance, regression line of the results of swimming 50 m crawl with swimming 400 m freestyle.
Results of swimming 100 m crawl with swimming 400 m freestyle have: coefficient of multiple correlation (R=.75), and coefficient of determination (R^2=.52), which indicates 52% of common variance. Value of regression coefficients is: beta value (Beta=.17) of swimming 400 m, and significance level of F value F(1.10)= 13.15, with t-test (10) value is 4.42 at significance level of .00 (p<0.00).
Results of swimming 150 m crawl with swimming 400 m freestyle have: coefficient of multiple correlation (R=.82), and coefficient of determination (R^2=.65), which indicates 65% of common variance. Value of regression coefficients is: beta value (Beta=.21) of swimming 400 m, and significance level of F value F(1.10)= 21.45, with t-test (10) value is 4.63 at significance level of .00 (p<0.00).
Results of swimming 200 m crawl with swimming 400 m freestyle have: coefficient of multiple correlation is (R=.82), a coefficient of determination (R^2=.67), which indicates 67% of common variance. Value of regression coefficients is: beta value (Beta=.30) of swimming 400 m, and significance level of F value F(1.10)= 20.57, with t-test (10) value is 4.53 at significance level of .00 (p<0.00).
Results of swimming 250 m crawl with swimming 400 m freestyle have: coefficient of multiple correlation (R=.81), and coefficient of determination (R^2=.67), which indicates 67% of common variance. Value of regression coefficients is: beta value (Beta=.43) of swimming 400 m, and significance level of F value F(1.10)= 20.48, with t-test (10) value is 4.52 at significance level of .00 (p<0.00).

Results of swimming 250 m crawl with swimming 400 m freestyle have: coefficient of multiple correlation is (R=.84), and coefficient of determination (R^2=.71), which indicates 71% of common variance. Value of regression coefficients is: beta value (Beta=.41) of swimming 400 m, and significance level of F value F(1.10)= 24.50, with t-test (10) value is 4.94 at significance level of .00 (p<0.00).
Results of swimming 300 m crawl with swimming 400 m freestyle have: coefficient of multiple correlation (R=.82), and coefficient of determination (R^2=.68), which indicates 68% of common variance. Value of regression coefficients is: beta value (Beta=.57) of swimming 400 m, and significance level of F value F(1.10)= 38.11, with t-test (10) value is 4.69 at significance level of .00 (p<0.00).

Rally Olimp Banja Luka 2017.
Results of swimming 50 m crawl with swimming 400 m freestyle have: coefficient of multiple correlation (R=.76), and coefficient of determination (R^2=.58), which indicates 58% of common variance. Value of regression coefficients is: beta value (Beta=.05) of swimming 400 m, and significance level of F value F(1.10)= 14.31, with t-test (10) value is 3.78 at significance level of .00 (p<0.00).
Results of swimming 100 m crawl with swimming 400 m freestyle have: coefficient of multiple correlation (R=.79), and coefficient of determination (R^2=.59), which indicates 59% of common variance. Value of regression coefficients is: beta value (Beta=.11) of swimming 400 m, and significance level of F value F(1.10)= 16.94, with t-test (10) value is 4.11 at significance level of .00 (p<0.00).
Results of swimming 150 m crawl with swimming 400 m freestyle have: coefficient of multiple correlation (R=.84), and coefficient of determination (R^2=.71), which indicates 71% of common variance. Value of regression coefficients is: beta value (Beta=.20) of swimming 400 m, and significance level of F value F(1.10)= 24.82, with t-test (10) value is 4.98 at significance level of .00 (p<0.00).
Results of swimming 200 m crawl with swimming 400 m freestyle have: coefficient of multiple correlation (R=.84), a coefficient of determination (R^2=.70), which indicates 70% of common variance. Value of regression coefficients je: beta value (Beta=.29) of swimming 400 m, and significance level of F value F(1.10)= 24.32, with t-test (10) value is 4.93 at significance level of .00 (p<0.00).
Results of swimming 250 m crawl with swimming 400 m freestyle have: coefficient of multiple correlation (R=.84), and coefficient of determination (R^2=.71), which indicates 71% of common variance. Value of regression coefficients is: beta value (Beta=.41) of swimming 400 m, and significance level of F value F(1.10)= 24.50, with t-test (10) value is 4.94 at significance level of .00 (p<0.00).
Results of swimming 300 m crawl with swimming 400 m freestyle have: coefficient of multiple correlation (R=.85), and coefficient of determination (R^2=.70), which indicates 70% of common variance. Value of regression coefficients is: beta value (Beta=.54) of swimming 400 m, and significance level of F value F(1.10)= 26.94, with t-test (10) value is 5.19 at significance level of .00 (p<0.00).
Results of swimming 350 m crawl with swimming 400 m freestyle have: coefficient of multiple correlation (R=.64), a coefficient of determination (R^2=.41), which indicates 41% of common variance. Value of regression coefficients is: beta value (Beta=.51) of swimming 400 m, and significance level of F value F(1.10)= 7.60, with t-test (10) value is 2.68 at significance level of .00 (p<0.02).

CONCLUSION

Sample of 36 participants is divided to three sub-samples by 12 swimmers, participants of Open Championship of Bosnia and Herzegovina in 2017 and 2018, as well as rally at 25th International Competition Memorijal „Ante Lambaša“ in Belgrade, Serbia. For the purpose of research were used records from swimming competitions, i.e. time trials and final results of swimming freestyle 400 m.

Research was conducted with the aim of establishing the influence of swimming sections (50m, 100m, 150m, 200m, 250m, 300m and 350m) as predictor set of variables to criterion variable of result success rate of swimming 400 m freestyle. Obtained results of the regression analysis indicate statistically significant connection of the set of variables (50m, 100m, 150m, 200m, 250m, 300m and 350m) to criterion variable of swimming 400 m freestyle. Value of coefficients of multiple correlation which determine the influence of the set of predictor variables (50m, 100m, 150m, 200m, 250m, 300m and 350m)to criterion variable of swimming 400 m freestyle is: for 50 m 42%, 100 m 52%, 150 m 60%, 200 m 61%, 250 m 71%, 300 m 77%, 350 m 78% of common variance of swimmers at Rally Olimp Banja Luka in 2018.

Value of coefficients of multiple korelacije which determine the influence of set of predictor variables (50m, 100m, 150m, 200m, 250m, 300m and 350m) to criterion variable of swimming 400 m freestyle is: for 50 m 58%, 100 m 59%, 150 m 66%, 200 m 61%, 250 m 71%, 300 m 70%, 350 m 35% of common variance of swimmers at the Rally Olimp Banja Luka in 2017.

Value of coefficients of multiple correlation which determine the influence of set of predictor variables to criterion variable of swimming 400 m freestyle is: for 50 m 61%, 100 m 75%, 150 m 83%, 200 m 67%, 250 m 68%, 300 m 93%, 350 m 96% of common variance of swimmers at Rally 25th International memorial race "Ante Lambaša" in 2017 in Belgrade.

Set of predictor variables (50m, 100m, 150m, 200m, 250m, 300m and 350m) of swimming freestyle has significant percentage of influence to criterion variable of 400 m freestyle of swimmers at Rally 25th International memorial race "Ante Lambaša" in Serbia (Novi Beograd 2017) in comparison to the one of swimmers at Open Championship of Bosnia and Herzegovina (Rally Olimp Banja Luka 2018 and 2017).

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PROFESSIONAL ARTICLE

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THE RELATION BETWEEN MOTOR SKILLS AND PERFORMANCE OFSPECIFIC TECHNICAL ELEMENTS IN HANDBALL

Abstract:

The aim of this research was to establish a relationship between motor skills and performance of specific elements in handball. A battery of 18 motor skills tests was assessed on the sample of 58 male subjects, students of Faculty of Physical Education and Sport, aged 21-23 years.Variables of coordination, figure eight running drill with bending under rope, lateral shuffle, agility on the floor, and agility in the air, all indicate to negative projection on the first isolated canonical factor, as do the two flexibility tests, shoulder and chest opener with rod and standing shoulder extension were applied as predictor variables and two tests dribbling around the cones (Metikoš and al. 1989) and throwing the ball against the wall (Rogulj and al. 1995).The overall results of the canonical correlation analysis indicated to the evaluation of the applied canonical model on motor tests in relation to the performance of specific handball elements, to the canonical correlation value of 0.765, with the Chi-Square test value of 320.101, and to statistically significant correlation of used variables on level p .008. Through further analysis, 4 canonical roots were extracted, out of which only the first one was statistically significant (p .008). Through observation of data on the correlation between motor variables and canonical roots, it can be concluded that the MRCZTL (0.58) and MFEBML (0.56)variables have the highest projection on the canonical factor, and thus are also most significant in conditioning the results achieved. Also the MAGKUS (0.55), MBFTAP (0.51) and MBAU1Z (0.51) variables has statisticaly significant results in conditioning the results achieved.Results of this analisys are ppointing to the fact that the subjects with lower degree of those motor skills have also had lower performance of specific handball elements, indicating the need for greater engagement of motor skills in performing the aforementioned elements.

Key words: *handball, accuracy, movement with the ball.*

INTRODUCTION

During his development, handball was constantly undergoing a transformation process to become more modern, more popular and more attractive to spectators. In this transformation process, nowadays, handball has become a complex game that adorns speed, explosiveness and ability to overcome individual and group specific situational conditions that emphasize accuracyas one of the dominant motor skills. Gabrijelić (1977), Pavlin, Šimenc and Delija (1982) and Vuleta and al. (2003) named accuracy as one of the five situational-motor dimensions: accuracy, the speed of the player's movement with the ball, the speed of the player without the ball and the strength in throwing balls. The motor ability of accuracy is represented through the precision of the individual or group movement of the players, the mutual addition and at the end of the shot towards the goal in order to achieve as many goals as possible. Another important ability, the player'smovement with the ball, is reflected in frequent situations when the players move with the ball overcoming the space and / or the opponent's, creating a better chance of passing the ball to other players or shooting to goal. Marković and Pivač (2005) have established a high degree of connection between some basic motor skills and a set of variables for assessing the specific situational-motor skills of handball players, with 55% of total variability explaining the players performance with ball and his speed of movement, while Vuleta et al. (2006) have established the connection between some motor skills and the precision of making the shot to goal. These two dimensions were the subject of this work by testing the relationship of motor skills with individual tests that presented accuracyand manipulation with the ball.

METHODOLOGY

The aim of this research was to establish a relationship between motor skills and performance of specific elements in handball. A battery of 18 motor skills tests was assessed on the sample of 58 male subjects, students of Faculty of Physical Education and Sport, aged 21-23 years.The subjects regularly attended "Handball" classes where they acquired basic knowledge and specifically elements with or without the ball, passing and shooting on goal, and after which the testing of motor skills and two specifically test in handball estimation was conducted.

Predictor variables are presented through a set of 18 motor tests, which are considered to cover the area of performance of the apparatus elements which were standardized by Metikoš and al. 1989. The following tests were applied: push-ups (MRESKL), agility on the floor (MAGONT), crawling under barrier and jumping over it (MBKPOP), figure eight running drill with bending under rope (MAGOSS), lateral shuffle (MAGKUS), one leg stand facing along the beam with eyes closed (MBAU1Z), leg tapping against the wall (MBFTAZ), hand tapping (MBFTAP), leg tapping (MBFTAPN), shoulder and chest opener with rod (MFLISK), standing shoulder extension (MFLPRG), lateral arm raises (MFLONK), standing long jump (MFESDM), standing triple jump (MFETRO), lying medicine ball throw

(MFEBML), supinated pull-ups (MRAZGP), laying back extensions (MRCZTL). The sample of criterion variables consisted of the following elements:dribbling around the cones (Metikoš and al. 1989) and throwing the ball against the wall (Rogulj and al. 1995). All variables were also subjected to correlative analysis in order to determine the existence of relations, which was done in the statistical software SPSS 22.

RESULTS AND DISCUSSION

In a further process of statistical analysis, the procedure of canonical correlative analysis was conducted so as to determine the relations between motor skills of the subjects and their performance of the specific handballelements: dribbling around the cones and throwing the ball against the wall. The overall results of the canonical correlation (Table 1) indicate to canonical correlation value0.765, with the Chi-Square Test value 320.101, and to statistically significant connection of the used variables on level p .008. Through further application of the analysis, 4 canonical roots were extracted, out of which only the first one was statistically significant (p .008).

Table 1. General results of canonical analysis

		N	R	R2	HI	DF	L	P
LS	64,8	1	0.765	0.812	301.101	243	0.000000	0.008
RS	100	2	0.544	0.808	206.877	212	0.000014	0.545
RVLS	29.114	3	0.210	0.564	132.121	169	0.000894	0.899
RVRS	66.230	4	0.113	0.224	102.002	140	0.002344	0.954
CR	.776							
HI	301.101							
DF	243							
P	.008							

In further analysis, as seen in Table 2, the excerpt from cross correlation matrix, the subjects showed statistically significant connection between strength tests, explosive strength tests, and variables concerning speed of individual movement, variables concerning flexibility of the shoulder zone with criterion variables, and a significantly lower number of connections between variables of coordination abilities and balance, which discriminated the subjects and their results in performance of elements and which indicated to a complex connection between strength and flexibility of the shoulder zone and other motor skills with the goal of better performance of specific handball elements. The data indicate a greater number of variables that are associated with the accuracy (all variables except MBFTAP), suggesting that the accuracy is affected by several factors, i.e., in this case, the level of more motor skills that are needed to accurately perform the task. As for the variables that did not have statistically significant level of interconnection, that does not necessarily mean that they have no share in the performance of the selected handball elements, but rather could indicate to certain ranking of required motor skill degrees in order for the demonstration of the given elements to be more successful.

Table 2. The excerpt from cross correlation matrix

	SLALOM	ORBLZ
MFEBML	0.27	**0.41**
MAGKUS	**0.53**	**0.36**
MRCZTL	0.28	**0.55**
MFLISK	0.12	**0.41**
MBAU1Z	0.25	**0.54**
MBFTAP	**0.44**	0.27

Regarding the correlation between the motor variables and canonical roots (Table 3), it can be concluded that the variables MRCZTL (0.58) and MFEBML (0.56), MAGKUS (0.55) and MBFTAP and MBAU1Z with a value of 0.51,have the highest projection on the canonical factor, and thus are also most significant in conditioning the results achieved. Interpreting the data, it can be said that those subjects who had theirs back muscles strong enough had a better body posture, and therefore better preconditions for more precise performance of the task itself. Shoulder strain as well as maintenance of the balance position is necessary and indispensable as a prerequisite for performing precise additions or shooting at goal. The steps to the side are indirectly related to precision, but directly with the slalom of the ball, with the speed of the individual hand movement showing extraordinary importance.

Table 3. Canonical factors of predictor and criterion variables

predictor set variables	1			criterion set variables	1
MRESKL	0.42	MBFTAZ	0.21	SLALOM	0.63
MFESDM	0.41	MRAZGP	0.22	ORBLZ	0.65
MFETRO	0.32	MRCZTL	0.58		
MBKPOP	0.24	MFEBML	0.56		
MAGOSS	0.20	MBAU1Z	0.51		
MAGKUS	0.55	MFLPRG	0.12		
MAGONT	0.19	MFLISK	0.29		
MKTOZ	0.28	MFLONK	0.15		
MBFTAP	0.51				
MBFTAPN	0.32				

Observing the results of a set of criterion variables, it can be said that both variables showed a connection with a higher statistical significance with the first root, than in the case of a connection with the set of predictor variables.

CONCLUSION

An efficient individual player movement and good ball manipulation, which, for the final result, can display motoric ability of accuracyscoring the goal, directly affects the handball game result.The research has indicated that there are several factors that influence this efficiency in moving with the ball and accuracy. In this case, they were the motor skills that were treated, through the selected set of tests, in order to investigate the relationship with accuracy and manipulation of the ball. During the testing and further analysis of the results, MRCZTL (0.58) and MFEBML (0.56) have showed statistical significant results, which speaks in favor of the need for a high level of torso and shoulder strength as a factor of success in precisely performing tasks. The positive contribution was also given to the variables that represent the balance, the speed of the individual hand movement and the agility movement to the side, which confirmed the complexity of the handball movement in order to achieve the best possible outcome. It can be concluded that a greater number of motor skills affect the success of ball manipulation in player moves as well as in the accuracy of adding and / or shooting, and that these specific motor tasks in the handball, applied in the game itself, the more efficient they are, there is a need for a high level of silence abilities and their further treatment in the training process.

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