THE INFLUENCE OF FLEXIBILITY ONTO THE SWIMMING RESULTS IN STUDENTS OF SPORT AND PHYSICAL EDUCATION

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Abstract

In this research we used the sample of 70 students of the third year at the Faculty of Sport and Physical Education in Niš applying 6 variables for evaluation of flexibility (predicative system) and 3 variables for evaluation of swimming results (criteria variables). The purpose of it is to define the influence of flexibility onto students' swimming results in 50 m swimming crawl, back and breast. The regression analysis was used to determine the influence of flexibility onto the swimming results. Based on the results obtained it can be concluded that there was no confirmed relevant influence onto the swimming results in the group of students in question. On the other hand, in competition swimmers there is a positive connection between the achieved results and flexibility. It is considered that the main cause of these results is students' poor knowledge of swimming techniques. It is recommendable to increase the number of practical swimming lessons in students of Faculty of Sport and Physical education, and to homogenize the groups according to the degree of implementation of the swimming techniques.

Key words: *students, flexibility, results, swimming, influence*

Introduction

Swimming is the ability to keep the body on the water surface and the ability to move through water with adequate movements of arms, legs and the body (Madić et al., 2007). Sport swimming appertains to the group of mono-structural sports of the cyclical type (Malacko & Rađo, 2004). Swimming techniques are the manners in which the swimmer is moving cyclically and they are determined by competition rules. There are four main techniques in sport swimming: crawl, back, breast and butterfly (Kapus et al., 2002). The efficacy in every sport discipline, in swimming as well, depends of 5 basic factors: 1) the correctness of movement performance (swimming technique) 2) energy capacities; muscles' contraction capability; 4) joint mobility and 5) technique (Milišić, 2003). Joint mobility refers to flexibility. It is defined as person's ability to do a movement with greatest possible amplitude (Malacko & Rađo, 2004). Optimum flexibility enables correct performance of swimming movements without spending extra energy to overpower the resistance of ligaments and tendons that form part of joints performing the movement. Many authors have done the researches of how the relation of flexibility and other motor skills influence the swimming results. Volčanšek (1979) in his research points out the relevance of flexibility when it comes to swimming results. The author thinks that the swimming success is guaranteed for those swimmers who

besides good coordination skills, fast movement frequency, and successfulness in resolving new motor tasks, also have greater degree of flexibility in the shoulder joint. Okičić (1996) concludes in his research that the swimmers of younger age categories have greater flexibility of shoulder area, knee and hock and they are obtaining better results, which can be used in selection of young swimmers. This was collaborated in the research of Madić et al. (2002). Also, the junior and senior swimmers of international level possess great level of flexibility that is in significant correlation with success in swimming (Colman et al., 1992; Rama et al., 2006). Pivač & Rađo (1996) and Vidović (2000, 2004) and others conducted a research on relations and influence of flexibility along with other motor skills onto the swimming results in population of students. The purpose of this research is to determine the influence of flexibility onto the 50 m swimming results crawl, breast and back.

Methods

The research sample consisted of 70 students of the third year at the Faculty of Sport and Physical education. The participants had two classes per week of their regular subject "Swimming". Testing was performed at the last practical class; at the end of second semester attending the "Swimming" class. The sample of variables consisted of six flexibility evaluation variables as a system of predictor variables and three swimming results evaluation variables as

criteria variables. Six measuring instruments were used for evaluation of flexibility: twist (FISK), a forward bend on the bench (FPRK) a forward bend in straddle (FPRR), plantar foot flexion (FPFS), dorsal foot flexion (FDFS) and arms retroflexion (FRFR). The first 3 tests were taken from the research of Metikoš & al. (1989), and the remaining three from Šoše & Rađo (1998). Three measuring instruments were used for evaluation of swimming results: the swimming result for 50 m crawl (PK50), swimming result for 50 m back (PL50) and swimming result for 50 m breast (PP50). The measuring was performed in the sports hall and the pool of the Sports Center "Čair" in Niš. All measuring was performed at the end of the third year of studies that consisted, among other things, of theoretical and practical classes of swimming. The practical classes consisted of one 90 minutes class per week. All the results obtained were processed in the program *Statistica 6.0.* The basic parameters of descriptive statistics were calculated for all variables AS-arithmetic mean, R- spread, MAX-maximum result, Min-minimum result; SD-standard deviation. Results distribution symmetry was evaluated based on the values of Skewness (Skew) and results distribution uniformity based on the values of kurtosis (Kurt). By using the Kolmogorov-Smirnov test it was determined whether the distribution of results in applied variables has a statistically relevant variation from the normal distribution (max D i K-S test). The correlation between applied variables was determined using linear correlation coefficients that are shown in the variables' correlations matrix. For determining the influence of the whole predictor system onto the criteria variables the regression analysis was used and following statistical parameters obtained: multiple correlation coefficient (R), determination coefficient, (R^2), F-test result (F), statistical relevance (p). For determining the influence of each individual variable in regression analysis we calculated: partial correlation coefficients (Part-R), Correlation coefficients (R), standardized coefficients of partial regression (Beta), t-test results (t) and statistical relevance (p). For statistical relevance we used the relevance level up to 0.05 ($p \leq 0.05$).

Results

Table 1. indicates the values of descriptive statistics basic parameters, the values of Skewness, Kurtosis and Kolmogorov-Smirnov test. The values of Kolmogorov-Smirnov test indicate that in all applied variables the distribution of results do not have a statistically relevant variation from normal distribution, since the greatest difference between the relative and the theoretical cumulative

frequency in each variable (max D) is lower than the constant (K-S test) 0.16. This enables using the obtained results for further analysis.

Table 1. The results of descriptive statistics

Var	AS	SD	Min	Max	Bnd	Sk	Ku	mxD
PK50	44,50	7,79	30,64	70,1	39,46	0,81	1,54	0,08
PL50	61,69	11,37	40,00	98,6	58,60	0,93	1,02	0,09
PP50	64,36	11,29	46,00	92,4	46,40	0,54	-0,36	0,09
FISK	80,90	14,52	42,00	110,0	68,00	-0,39	-0,34	0,15
FPRK	40,24	7,29	15,00	54,0	39,00	-0,58	1,02	0,08
FPRR	73,96	11,41	48,00	112,0	64,00	0,84	2,13	0,11
FPFS	46,23	6,82	25,00	60,0	35,00	-0,19	0,53	0,10
FDFS	20,41	4,72	10,00	29,0	19,00	-0,26	-0,29	0,09
FRFR	24,26	9,73	6,00	47,0	41,00	0,10	-0,59	0,07
							K-S test	= 0.16

Table 2. shows the results of inter-correlation of applied variables matrix, where the statistically relevant correlations are indicated with an asterisk (*). There is statistically relevant and high correlation among all 3 variables for swimming results evaluation. There is also a statistically relevant correlation among certain variables for evaluation of flexibility. There is no statistically relevant correlation between the variables for evaluation of flexibility as a predictor system and the variables for evaluation of swimming results, except in variables FRFR and PL50 (-0.35). The negative sign in this case represents a positive correlation considering the fact that these two variables are inversely scaled.

Table 2. Applied variables correlation matrix

Var	PK50	PL50	PP50	FISK	FPRK	FPRR	FPFS	FDFS	FRFR
PK50	1.00	**0.71**	**0.60**	-0.04	0.09	0.04	0.05	0.04	-0.21
PL50		1.00	**0.64**	0.07	0.02	-0.04	-0.10	0.12	**-0.35**
PP50			1.00	0.07	0.07	0.08	0.07	0.15	-0.10
FISK				1.00	**-0.33**	**-0.26**	**-0.36**	-0.05	-0.14
FPRK					1.00	**0.61**	**0.28**	**0.25**	0.21
FPRR						1.00	**0.31**	0.13	**0.33**
FPFS							1.00	0.11	0.13
FDFS								1.00	-0.10
FRFR									1.00

Regression analysis results in Table 3. are indicating that there is no statistically relevant influence of the whole system of predictor variables for evaluation of flexibility onto the criterion variable *swimming result 50 m crawl* (p= 0.59). This is also confirmed by low values of multiple correlation coefficient (R= 0.26) and determination coefficient (R^2 = 0.07). Individually, out of each applied predictor variables, the statistically relevant influence onto the criterion variable has the predictor variable FRFR (p= 0.05). Since the whole system of predictor variables has no statistically relevant influence onto the criterion variable, then the influence of predictor variable FRFR is considered to be random. Regression analysis results in Table 4. indicate that there is no statistically relevant influence of predictor system of variables for evaluation of flexibility onto the 50 m results (p= 0.11).

Table 3. *Regression analysis for 50 m crawl Swimming result (PK50) variable*

Var	R	Part-R	Beta	t (63)	p
FISK	-0.04	-0.01	-0.01	-0.08	0.94
FPRK	0.09	0.08	0.10	0.62	0.54
FPRR	0.04	0.04	0.06	0.35	0.73
FPFS	0.05	0.04	0.04	0.30	0.77
FDFS	0.04	-0.02	-0.02	-0.18	0.86
FRFR	-0.21	-0.25	-0.26	-2.01	0.05

$R = 0.26$, $R^2 = 0.07$, $F(6.63) = 0.78$, $p = 0.59$

This is also confirmed by low values of multiple correlation coefficient ($R= 0.38$) and determination coefficient ($R^2 = 0.15$). Individually, out of each applied predictor variables, the statistically relevant influence onto the criterion variable has the predictor variable FRFR ($p= 0.00$). Since the whole system of predictor variables has no statistically relevant influence onto the criterion variable, then the influence of predictor variable FRFR is considered to be random.

Table 4. *Regression analysis for 50 m back Swimming result (PL50) variable*

Var	R	Part-R	Beta	t (63)	p
FISK	0.07	0.04	0.04	0.30	0.76
FPRK	0.02	0.06	0.08	0.49	0.63
FPRR	-0.04	0.05	0.07	0.43	0.67
FPFS	-0.10	-0.08	-0.08	-0.65	0.52
FDFS	0.12	0.07	0.07	0.57	0.57
FRFR	-0.35	-0.35	-0.37	-2.93	0.00

$R = 0.38$, $R^2 = 0.15$, $F(6.63) = 1.82$, $p = 0.11$

Regression analysis results in Table 5. are indicating that there is no statistically relevant influence of the whole system of predictor variables for evaluation of flexibility onto the criterion variable *swimming result 50 m breast* ($p= 0.75$). This is also confirmed by low values of multiple correlation coefficient ($R= 0.23$) and determination coefficient ($R^2 = 0.05$).

Table 5. *Regression analysis for 50 m breast Swimming result (PP50) variable*

Var	R	Part-R	Beta	t (63)	p
FISK	0.07	0.11	0.12	0.91	0.37
FPRK	0.07	0.03	0.04	0.22	0.83
FPRR	0.08	0.07	0.08	0.52	0.60
FPFS	0.07	0.08	0.08	0.60	0.55
FDFS	0.15	0.11	0.12	0.89	0.37
FRFR	-0.10	-0.11	-0.12	-0.88	0.38

$R = 0.23$, $R^2 = 0.05$, $F(6.63) = 0.58$, $p = 0.75$

Discussion and conclusion

The obtained results indicate that there is no relevant influence of predictor system of variables for evaluation of flexibility onto the predictor variables (swimming results for 50 m crawl, back and breast) in students that took part in this research. The results obtained in this way are similar to the ones obtained in the one researching relation of motor skills with styled forms of movements in swimming the techniques crawl, back and breast (Vidović, 2000; Vidović 2004). The author determined, inter alia, that the flexibility is not in relevant correlation with breast swimming technique, while the correlation of flexibility and swimming technique crawl is statistically relevant, but of low values. Pivač & Rađo (1996) determined that flexibility has a relevant influence on students' degree of successfulness in acquiring the swimming techniques. Unlike our own, the results of many other researches confirmed the influence of flexibility onto the swimming results, primary in population of swimmers, but in students as well. The reason we obtained this type of results in this research is inadequately acquired and mastered swimming technique, indicated by the swimming results themselves that are below the expected (Table 1). If the swimming technique hasn't been acquired properly the influence of flexibility and other motor skills onto the swimming efficacy is reduced and limited (Okičić et al., 2007).

It is obvious that one 90 minutes long swimming class per week is not enough for the students to acquire and master the swimming techniques properly. In general it can be concluded that in students of third year of Faculty of Sport and Physical Education in Niš hasn't been determined the existence of relevant influence of the flexibility onto the swimming results (techniques crawl, back and breast). We believe that the number of practical swimming classes where the swimming techniques would be practiced and mastered should be increased. There is also an issue of higher criteria when it comes to selection of future students of Faculty of Sport and Physical Education that should be introduced by tightening the swimming norms. Also we suggest redefining the teaching process of the swimming exercises towards homogenization of the groups.

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UTJECAJ GIBLJIVOSTI NA REZULTATE U PLIVANJU KOD STUDENATA SPORTA I TJELESNOG ODGOJA

Sažetak

Na uzorku od 70 studenata treće godine Fakulteta sporta i tjelesnog odgoja Univerziteta u Nišu, primjenjeno je 6 varijabli za procjenu gibljivosti (prediktorski sistem) i 3 varijable za procjenu rezultata u plivanju (kriterijske varijable). Cilj je bio da se utvrdi utjecaj gibljivosti na rezultate u plivanju na 50 metara tehnikama kraul, leđno i prsno kod studenata. Za utvrđivanje utjecaja gibljivosti na rezultate u plivanju korištena je regresiona analiza. Na osnovu dobivenih rezultata može se zaključiti da nije utvrđen značajan utjecaj gibljivosti na rezultate plivanja kod ispitivane grupe studenata. S druge strane, kod plivača takmičara postoji pozitivna veza između gibljivosti i ostvarenih rezultata. Smatra se da je glavni razlog ovako dobivenih rezultata nedovoljno pravilno i kvalitetno usvojena plivačka tehnika od strane studenata. Preporuka je da se u praksi poveća broj praktičnih časova plivanja kod studenata Fakulteta sporta i tjelesnog odgoja kao i da se izvrši homogenizacija grupa prema stepenu usvojenosti plivačkih tehnika.

Ključne riječi: studenti, gibljivost, rezultati, plivanje, utjecaj.