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THE RELATIONSHIP OF SHOULDER FLEXIBILITY AND MORPHOLOGICAL CHARACTERISTICS TO SHORT DISTANCE SWIMMING SPEED IN KINESIOLOGY STUDENTS

Original research

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ABSTRACT
The aim of this research was to examine whether there is a statistically significant relationship between shoulder flexibility, anthropometric characteristics and swimming speed short distance in kinesiology students. The study included 16 participants 22 years old, male and female with an average body weight 77.7±16,42 kg and 179±9 cm. All students included in the research attended swimming class in the third semester at the Faculty of Kinesiology University of Sarajevo. The study was applied to 5 measuring instruments: measuring instruments for the assessment of flexibility (2); Measuring instruments for the evaluation of morphological characteristics (2); Measuring instrument for the assessments of swimming speed (1). Spearman's correlation coefficient was used to determine the level of interconnection for assessing the relationship between two variables. Data collection for shoulder flexibility was measured using a shoulder elevation test, and stick rotation test, while swimming speed was measured with a digital stopwatch. The analysis of the results did not demonstrate a single significant feature that would allow the confirmation of the assumptions about the significant relations between flexibility and performance in swimming.

Keywords: shoulder flexibility, morphological characteristics, swimming speed, kinesiology students

INTRODUCTION

Swimming speed can be affected by several factors one of the factors is the flexibility of the shoulders (Astawa at al.,2023). Low shoulder flexibility will add obstacles to swim movement, so it is very important to maintain as well as increase its flexibility (Walker, 2012). Success in swimming is determined by several factors: anthropological, functional, and metabolic characteristics, efficient biomechanical execution of movements in water, conative and cognitive characteristics, and a legitimate plan and program that respects the laws of growth and development (Šiljeg , Zoretić, Leko, 2009). The swimming implies the ability to maintain the body in water and ability to move through the water with the proper movement of arms, legs and body (Madić & al., 2007). Optimal flexibility enables proper movement performance in swimming avoiding additional energy consumption to overcome the resistance of the ligaments and tendons that are parts of the joints used for movement (Jorgić,B. at al.2010). The success in swimming will be possible for swimmers who, besides good coordination abilities, fast frequency motion, success in solving new motor tasks, also have greater flexibility in the shoulder joint (Volčanđek,1979). Swimmers of younger age category, who have greater flexibility of the shoulder joint, knee and ankle joint, achieve better results, which can help in selection of young swimmers (Okičić,1996). Several studies have found swimmers to be taller and larger than same aged non-athletes, gymnasts, soccer players or tennis players (Avloniton et al.1997, Boulgakova, 1990,Brauer et al.2007, Damsgaard et al. 2000, Erlandson et al. 2008). Sprinters should have a taller stature than middle and long distance swimmers, due to their need for higher hull speeds (Kjendlie,L., Stallman R.,2011). A taller swimmer will create less wave resistance at the same speed, and the tall swimmer will have a greater potential for maximal velocity due to a higher hull speed (Kjendlie,L., Stallman R.,2011). One study investigating somewhat younger children (aged 7-12) did not find any differences in body shape, flexibility, strength or lung function between swimmers, nonathletes and tennis players (Baxter-Jones AD et al.,1995). It is also generally agreed that sprint free stylers are taller, heavier and more muscular than middle and long distance free stylers and then other stroke specialists. Also, in all strokes and distances (except 800-1500 meter races), the very best are taller and heavier than the next best (Kjendlie,L., Stallman R.,2011). Performance seems to be influenced by size, as shown by studies on children, elite swimmers and master swimmers. A bigger, taller or more muscular swimmer swims faster (Kjendlie,L., Stallman R.,2011).

METHODS

Participants

The study included students with an average body weight 77.7±16.42 kg and 179±9 cm, male (N=11) and female (N=6), in the third semester at the Faculty of Kinesiology University of Sarajevo (N=16) 22 years old that attended swimming class in the third semester.

Instruments

The study was applied to 5 measuring instruments: measuring instruments for the assessment of flexibility (2); Measuring instruments for the evaluation of morphological characteristics (2); Measuring instrument for the assessments of swimming speed (1). Spearman's correlation coefficient was used to determine the level of interconnection for assessing the relationship between two variables. Data collection for shoulder flexibility was measured using a shoulder elevation test, and stick rotation test, while swimming speed was measured with a digital stopwatch. A meter was used to measure height, and a calibrated scale was used to measure weight.

Statistical analysis

The data analysis tehnique used in this research is descriptive statistics analysis and the Pearson's analysis. Descriptive statistical measures, including the mean (M) and standard deviation (SD). The mean reflects the average outcomes, while the standard deviation reveals the extent of deviation from the mean, emphasizing the level of variability among participants. The Pearson's analysis of the research results was applied to determine the correlation between certain variables included in the study. This statistical test is used to measure the strength and direction of a linear relationship between two continuous variables, with a correlation coefficient (r) that can range from -1 to +1. A value of +1 indicates a perfect positive correlation, -1 a perfect negative correlation, while a value close to 0 indicates a weak or non-existent relationship between the variables.

RESULTS

Reviewing Table 1. The descriptive statistical analysis shows a heterogeneous group of participants, as indicated by the standard deviation results. The average weight of the student participants was 77.725 kg, with a standard deviation of ±16.4166 kg, while the average height was 179.044 cm ±9.0181 cm. The elevation test results averaged 69.156 ±12.4147 cm, the stick rotation results averaged 91.813 ±26.8557 cm, and swimming performance (swimming speed) averaged 20.9994 ±3.67254.

Table 1. Descriptive Statistical Analysis

	Mean	SD	N
Weight	77.725	16.4166	16
Height	179.044	9.0181	16
Elevation test	69.156	12.4147	16
Stick rotation test	91.813	26.8557	16
Swimming speed 25m	20.9994	3.67254	16

The descriptive statistical analysis in Table 1 provides insights into the central tendencies and variability for each measured variable among the 16 participants. The average weight of participants was 77.725 kg, with a standard deviation of ±16.4166 kg, indicating considerable variability in weight among the group. The mean height was 179.044 cm, with a standard deviation of ±9.0181 cm, suggesting a relatively consistent height range within the sample. Participants scored an average of 69.156 cm on the elevation test, with a standard deviation of ±12.4147 cm, showing moderate variability in performance. The average score for the stick rotation test was 91.813 cm, with a standard deviation of ±26.8557 cm, indicating high variability among participants in this flexibility measure. The average time for the 25-meter speed swimming test was 20.9994 seconds, with a standard deviation of ±3.67254 seconds, suggesting relatively similar swimming performance times within the group. These descriptive statistics highlight variability in certain physical and performance measures, especially in weight and flexibility tests, while swimming speed and height appear to be more consistent across participants.

Table 2. Pearson Correlation

		Weight	Hight	Elevation test	Descrete with a stick	Swimming 25m
Weight	*r*		.690**	-0.022	-0.356	-0.419
	p		0.003	0.937	0.175	0.106
Hight	*r*	.690**	1	0.019	-0.288	-0.293
	p	0.003		0.943	0.280	0.271
Elevation test	*r*	-0.022	0.019	1	.611*	-0.113
	p	0.937	0.943		0.012	0.676
Stick rotation	*r*	-0.356	-0.288	.611*	1	0.107
	p	0.175	0.280	0.012		0.693
Swimming 25m	*r*	-0.419	-0.293	-0.113	0.107	1
	p	0.106	0.271	0.676	0.693	

The correlation analysis in Table 2 reveals several key relationships between the variables. A significant positive correlation was observed between weight and height (r=0.690r = 0.690r=0.690, p=0.003p = 0.003p=0.003), indicating that higher weight is associated with greater height among the participants. There was a very weak, non-significant negative correlation between weight and elevation test performance (r=−0.022r = -0.022r=−0.022, p=0.937p = 0.937p=0.937), suggesting no meaningful relationship between these variables. A moderate negative correlation was observed between weight and the stick rotation test (r=−0.356r = -0.356r=−0.356, p=0.175p = 0.175p=0.175), though it did not reach statistical significance. The correlation between weight and swimming speed (25m) was negative (r=−0.419r = -0.419r=−0.419, p=0.106p = 0.106p=0.106), suggesting a potential tendency for higher weight to be associated with slower swimming times, though this was not statistically significant. Height showed a very weak, non-significant positive correlation with the elevation test (r=0.019r = 0.019r=0.019, p=0.943p = 0.943p=0.943). A weak negative correlation was found between height and the stick rotation test (r=−0.288r = -0.288r=−0.288, p=0.280p = 0.280p=0.280), indicating no significant association. A significant positive correlation was identified between the elevation test and the stick rotation test (r=0.611r = 0.611r=0.611, p=0.012p = 0.012p=0.012), suggesting that better performance in one is associated with better performance in the other. The swimming speed (25m) did not significantly correlate with any of the variables.

DISCUSSION

The analysis reveals that there is a clear relationship between height and weight. Swimming performance, as measured by race times, is influenced by body size, in many studies - being bigger means better performance (Kjendlie,L.,Stallman R.,2011). Additionally, performance can also be affected by the variability of body composition (Charmas and Gromisz 2019) and anthropometric characteristics (i.e. weight, body mass index, height, and wingspan) (Morais et al. 2012; Zuniga et al. 2011).

The results also confirmed that there is correlation between the two flexibility tests. Pivač & Rađo (1996) determined that flexibility has a relevant influence on students' degree of success 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. If the swimming technique is not properly acquired the influence of flexibility and other motor skills onto the swimming efficacy is reduced and limited (Okičić et al., 2007).

Other correlations, particularly those involving swimming speed, do not reach statistical significance. This may indicate that additional factors not measured in this study could play a significant role in swimming performance over short distances. In a study to investigate anthropometrical influences on stroke length, stroke rate and swimming speed (Grimston and Hay, 1986) found none of the 21 parameters to significantly correlate with swimming speed. 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, backstroke and breaststroke. The author determined, as well, that the flexibility is not in relevant correlation with breaststroke swimming technique, while the correlation of flexibility and swimming technique crawl is statistically relevant, but of low values. (Jorgić et al., 2010). The way people float when passively lying in a prone or supine position is affected by gender, age and body size. The so called passive floating torque exists due to the difference in position of center of mass and center of volume (Kjendlie,L., Stallman R.,2011). Further research with a larger sample size may be needed to explore these relationships in greater depth.

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Conflict of Interest

The authors do not have any conflicts of interest to disclose. All co-authors have reviewed and concurred with the manuscript's content, and no financial interests need to be reported.