Relationship between selected Anthropometric Parameters and 50m Freestyle Swimming Time in Teenage Swimmers

RMUS Sugathadasa[1#], MRMA Jayasinghe[1] and RMKT Rathnayaka[2]

[1]*Department of Sports Sciences and Physical Education, Faculty of Applied Sciences, Sabaragamuwa University of Sri Lanka, P.O.Box.02, Belihuloya, Sri Lanka.*
[2]*Department of Physical Sciences and Technology, Faculty of Applied Sciences, Sabaragamuwa University of Sri Lanka, P.O.Box.02, Belihuloya, Sri Lanka.*

[#]Saubhagyasugathadasa6@gmail.com

Abstract*: Swimming is an Olympic sport which is a very popular endurance development activity around the world. Anthropometry is one of the main factor that influences the swimming performance of teenagers. This study aimed to examine the relationship between selected anthropometric parameters and 50m freestyle swimming time in teenage swimmers. The sample was thirty (n=30) provincial level male swimmers with 13-17 years of age. Their body weight, height and BMI were 35.0-96.5 Kg, 136.0-181.9 cm and 21.81 Kgm^{-2}. The dependent variable was 50m freestyle swimming time and the independent variable was anthropometric parameters including; body weight, height, length measurements (upper arm, lower arm, hand, upper leg, lower leg, foot, arm span), circumference (chest, abdomen) and skinfold measurements (bicep girth, tricep girth). Data were collected from 50m freestyle swimming race and measuring thirteen anthropometric parameter sites of the body. Stadiometer, digital weighing scale, skinfold caliper, measuring tape and stopwatch was used as measuring instruments. Pearson correlation coefficient in SPSS 26.0V was applied to determine the relationship between 50m freestyle swimming time and anthropometric parameters of sample swimmers at P<0.05 level of significance. As a result; the mean values of swimming time, body weight and height were 39.9±7.30 seconds, 57.65±15.91 Kg and 162.56±9.74 cm. The body weight (r=0.376, P=0.041), height (r=0.375, P=0.041) and hand length (r=0.397, P=0.030) had a significant positive moderate correlation with 50m freestyle swimming time. The study concludes that some anthropometric parameters influence to the swimming time of the teenage male swimmers. Therefore, they have to manage their anthropometric parameters of the body, to achieve their target apart from the other influencing factors which related to the swimming.*

Keywords: *Anthropometric, Freestyle, Swimming, Teenage male swimmers*

1. Introduction

Swimming is the most challenging sport in the Olympics and also a recreational event. It consists of four different strokes; freestyle, breaststroke, butterfly stroke, backstroke, and medley (Benarjee, 2019). Competition swimming distances ranging from 50m – 1500m. They are categorized into three; sprint (50m and 100m), middle distance (200m and 400m), and long (800m and 1500m). 50m freestyle swimming event is the shortest and fastest sprint event in competitions which lasts only 22 to 30 seconds. Therefore, sprint swimmers need more programs oriented on speed and the middle and long-distance swimmers focus more on developing speed endurance. The front crawl, the stroke, used in competitive swimming, has become the fastest

of all strokes. It was in use in the Pacific at the end of the 19th century. The crawl was like the old side stroke in its arm action, but it had a fluttering up- and – down leg action performed twice for each arm stroke. In the crawl, the body is prone, flat on the water's surface, while the legs are kept slightly submerged. The arms more alternatively, timed so that one will start pulling just before the other has finished its pull, thus making propulsion continuous. Turning the head to either side while recovering the arm from that side allows you to breathe. The crawl has been utilized in more races than any other stroke since 1896.

Normally, swimming performance is examined by the physiology, morphology, neuromuscular characteristics and psychological profile of swimmers. To be successful at the international level swimming competitions, it is good for training must start before puberty. Swimming performance has been related to various kinds of factors and anthropometry is one of the most important characteristics of teenage swimmers. Anthropometric measurements are the objective measurements of the structure of a human body including body weight, height, lengths, width, depth, and circumference of the body segments (Goswani and Abraham, 2010). Most of the previous studies have investigated the correlation between swimming time and anthropometric measurements of young swimmers. Height, body weight, hand length, upper extremity length, and foot length have been shown to correlate with the 100m swimming performance in young male swimmers Geladas (2005). Apart from that Geladas (2005) investigated the height, upper extremity length and hand length were correlated with the swimming time of female swimmers. Considering the above pieces of evidence of literature, swimming performance is affected by anthropometric parameters. Therefore, this study aimed to examine the relationship between anthropometric parameters and 50m freestyle swimming time in teenage male swimmers.

2. Methodology and Experimental Design

Thirty (n=30) male teenage swimmers (13 – 17 years) participated as a sample. There were two variables. 50m freestyle swimming time was the dependent variable and the anthropometric measurements were the independent variable. It has measured thirteen anthropometric parameters including;

Bodyweight was measured from a digital calibrated scale to the nearest 0.1 Kg and the subject straightly stand on the scale without shoes and light clothes.

Height via stadiometer (Seca 700, Germany) to the nearest 0.1 cm and shoeless height was measured after deep breathing using a graded wall. It was measured while the subject's hand, shoulders, buttocks and ankles were connected to the wall. Lengths and circumferences measured via measuring tape to the nearest 0.1 cm.

Upper Arm; The region between the shoulder and the elbow, is composed of the humerus with the elbow joint at its distal end. **Lower Arm**; The forearm comprises the lower half of the arm. It is made up of the ulna and radius bones and extends from the elbow joint to the hand. **Hand**; It was measured subject was standing, the hand was bent at the elbow and the forearm was 90^0 from the 3rd metatarsal to 3rd distal phalanx at the anterior part.

Upper Leg; It was measured at the distance of the greater crochanter of the thigh to the head of the patella, while the subject was sitting on a chair with his knee bent 90^0. **Lower Leg**; Measured from the patella to the ankle while the subject sat on a chair at 90^0 knee ankle. **Foot**; Take the place of paper on a flat surface. The subject should put feet on the paper. Mark acropodion and ptrenion. Using the tape measure the length between two mark points.

Arm Span; The arms are open and parallel to the ground. The distance between the tip of the third right and the tip of the third left finger is measured after a deep breath using a greaded wall with the meter.

Chest; It was measured with a meter at the height of the nipple while the subject was standing anatomically and arms were slightly away from the trunk.

Abdomen; Measured at the midpoint between the rib or costal margin and the iliac crest in the midaxillary line. The maximal gluteal (buttock) circumference is also measured with the subject standing erect. Skinfold measurements from skinfold caliper to the nearest 0.1mm.

Bicep; Exact opposite of the triceps skinfold, being on the anterior aspect of the arm and at the same mid-point level.

Tricep; Back of the area between the shoulder and elbow joints, in a vertical direction.

Table 1: Descriptive statistics for anthropometric variables and 50m freestyle swimming time of teenage male swimmers

	Mean	SD	Minimum	Maximum
50m freestyle swimming time (s)	**39.90**	7.30	**24.00**	**58.00**
Body Weight (Kg)	57.65	15.91	35.0	96.5
Height (cm)	162.56	9.74	136.0	181.9
Upper Arm (cm)	30.27	2.64	23.4	35.6
Lower Arm (cm)	26.85	2.29	23.1	32.1
Hand (cm)	18.10	1.12	16.0	20.0
Upper Leg (cm)	48.20	3.47	40.0	56.0
Lower Leg (cm)	43.96	3.23	35.1	50.0
Foot (cm)	25.27	1.57	20.7	27.7
Arm Span (cm)	168.73	11.08	138.0	188.2
Chest Circumference (cm)	85.24	9.46	66.3	103.0
Abdominal Circumference (cm)	81.55	13.26	61.7	114.0
Bicep Girth (mm)	15.10	5.78	6.0	31.3
Tricep Girth (mm)	15.18	5.61	6.3	31.8

50m freestyle swimming time was measured in a 50m swimming pool under race conditions using stopwatch. All participants were included in the test after the standard warm-up. The normality of data was assessed using Shapiro- Wilk test. After that mean (M), standard deviation (SD), minimum and maximum values were calculated for all variables. The relationship between anthropometric variables and 50m freestyle swimming time was evaluated using the Pearson correlation analysis. All analysis was performed with SPSS 26.0 version. Statistical significance was set at $P< 0.05$.

3. Results

Mean (M±SD) 50m freestyle swimming time was 39.9±7.30 seconds. Maximum swimming time among them is 58.0s and the minimum swimming time of them is 24.0s. Descriptive statistics for anthropometric variables and 50m freestyle swimming time are presented in table 1.

Table 2: Pearson correlation coefficient (*r*) and P values for anthropometric

Anthropometric Parameter	Pearson Correlation Coefficient (r)	P-Value
Body Weight (Kg)	**0.376***	**0.041**
Height (cm)	**0.375***	**0.041**
Upper Arm Length (cm)	0.318	0.087
Lower Arm Length (cm)	0.276	0.140
Hand Length (cm)	**0.397***	**0.030**
Upper Leg length (cm)	0.233	0.215
Lower Leg Length (cm)	0.313	0.093
Foot Length (cm)	0.242	0.198
Arm Span (cm)	0.242	0.197
Chest Circumference (cm)	0.111	0.600
Abdominal Circumference (cm)	0.280	0.134
Bicep Girth (cm)	0.101	0.597
Tricep Girth (cm)	0.029	0.881

Correlations of 50m freestyle swimming time with selected anthropometric variables are presented in Table 2.

4. Discussion and Conclusion

Correlation analysis showed that 50m freestyle swimming time was significantly positively correlated with body weight (r=0.376, P=0.041), height (r=0.375, P=0.041) and hand length (r=0.397, P=0.030) at P=0.05 level of significance. There was no significant relationship between upper arm length, lower arm length, upper leg length, lower leg length, foot length, arm span, chest circumference, abdominal circumference, bicep girth, and tricep girth with 50m freestyle swimming time.

The results showed that the body weight, body height and hand length positively affect to the 50m freestyle swimming time with a correlation. Apart from that upper arm length, lower arm length, upper leg length, lower leg length, foot length, arm span, chest circumference, abdominal circumference, bicep girth, and tricep girth also positively affect to 50m freestyle swimming time without correlation at the 0.05 level of significance. The study investigated the relationship of various anthropometric parameters to sprint freestyle swimming time in teenage male swimmers. The main findings of this study were 50m freestyle swimming time was significantly related to body weight, height, and hand length at a P=0.05 level of significance.

Most of the previous studies have investigated the relationship between 50m freestyle swimming time with body weight and height. (Hlavaty, (2010); Zuoziene, Drevinskaite (2019); Matinho,

Benarjee (2019) has reported that there was no correlation between foot length with 50m front crawl swimming time. The present study also gets the same results regarding the foot length. The study has investigated there was a correlation between arm span and there was no correlation between upper arm with 50m freestyle swimming time (Nasirzade, 2014). But, in the present study, there was no relationship can be found between upper arm length and arm span with 50m freestyle swimming time at P=0.05 level of significance. A study has reported that 50m front crawl swimming performance was significantly related to arm's length, arm span and leg length (YARAR, 2021).

To summarize the above results, it indicated that anthropometric measurements (body weight, height, and hand length) are very important for freestyle sprint swimming time, especially 50m. The practical benefit of this study is that anthropometric measurements and swimming performance time could be used to identify talented swimmers. If a player selected

swimming, they have to develop their fitness level and swimming skills not only considering anthropometry. As a result, swimmers are troubled to get better results and they tend to face injuries. Some athletes body size is not suitable for sports because they can face long-term injuries. According to this study, it can be recommended, selecting the best athlete for a sport without injuries through the well anthropometry. Also the study helps coaches and players to develop their swimming skills and performance time. The study can be suggested to do the female swimmers also.

Acknowledgement

I acknowledged for all the academic and non-academic staff members in the Faculty of Applied Sciences, Sabaragamuwa University of Sri Lanka, my family members, all the staff members in Sugathadasa National Sports Complex Authority (SNSCA), all the participants of swimming school in SNSCA and all are who supported me to complete this research.

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Author Biography

I; R.M.U.S. Sugathadasa, Graduate of Department of Sports Sciences and Physical Education, Faculty of Applied Sciences, Sabaragamuwa University of Sri Lanka