**RELATION OF ANTHROPOMETRIC MEASUREMENTS AND BODY COMPOSITION TO**

**PERFORMANCE IN STATE SUB-JUNIOR SWIMMERS**

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**ABSTRACT**

The purpose of this study was to find out the relation of anthropometric measurements and body composition of Sub-junior state level swimmers. There were 24 female swimmers and 23 male from the state of Karnataka were selected. The subjects age was ranged between 10-14 years among male and 10-18 years among female participants. The swimmers were subjected to the same measurements; there were 10 items of anthropometric variables and 4 body composition measures by skin fold thickness. Pearson's product moment correlation method was used for the statistical calculation to find the significant correlation between swimming performance and selected anthropometric measurements and body composition. It was seen that Body fat was the most reliable single body composition component which significantly correlated with swimming performance in male swimmers, the sitting height, arm length and arm span was the most reliable anthropometric measurement which significantly correlated with swimming performance in female swimmers, and no other component and anthropometric measurements were found significant to the swimming performance in both male and female swimmers.

Keywords: Anthropometric Measurements, Body Composition, Swimming and Performance.

**INTRODUCTION**

It is said that in the late 17th century Britain people had water therapy and use to swim on the seashores. Swimming got its popularity throughout the world in the 19th century both as recreation and sport. The first swimming championship was a 400 metre race, held in Australia in 1846 and annually thereafter. The Federation International de Natation Amateur (FINA) was founded in 1909. Through swimming, the entire body and cardiovascular system get an excellent way to workout. Swimming for an hour burns as many calories as running, and also without an impact on the bones and joints. In swimming the whole body moves against the resistance of water which works as an excellent workout. It keeps the heart rate up while also taking some of the impact of stress off the body.

Anthropometry first developed in the 19th century as a method employed by physical anthropologists for the study of human variation and evolution in both living and extinct populations. Anthropometry is the science of systematically recording measurements of the human body in terms of the dimensions of bone, muscle, and adipose tissue, by measurements of body weight, height, triceps skinfold, calf circumference, abdominal circumference, elbow breadth, and subscapular skinfold. This provides information about the distribution of body fat and skeletal muscle mass.

Body composition is used to find out the percentages of fat, bone, water, and muscle in human bodies. There can be two people of same sex and body weight but could look completely different from each other as they have a different body composition. Body composition and growth are key components of health in both individuals and populations. Body composition also players a vital role for a professional athlete.

The body is composed of two types of mass: Body fat and non-fat mass.

Body fat is found in muscle tissue, under the skin, or around the internal organs. Some amount of fat is necessary for overall health. This fat which helps protect internal organs, stores fuel for energy, and regulates important body hormones is known as essential fats. But the excess storage of fat in the body is called non-essential fat.

Non-fat mass includes bone, water, muscle, organs, and tissues. It is also called lean tissue, which are metabolically active, that is they burn calories for energy, while body fat is not.

Anthropometry, Body Composition and Sports Performance

Swimming is one of the most popular competitive sport, and to be at the top it is not just luck or chance. Competitive sports performance in all the games are influenced by various factors such as physical, physiological, psychological abilities including nutrition, technique, tactics, etc.

**METHODOLOGY**

The purpose of this study is to find out the relationship of Anthropometric measurement and body composition to the performance of the state level female and male swimmers of Karnataka state. The study was delimited to male and female swimmers between the age 10-14 and 10-18 years respectively. The study was further delimited to the following Anthropometric measurements - height, weight, sitting height, buttocks -knee-length, low leg length, arm length, foot length, chest circumference, and shoulder circumference. Body composition of swimmers through skinfold measurement of four sites. Performance of swimmers in various competitions (performance of any of the four strokes)

The study was conducted on 23 male swimmers of 10-14 years and 24 female swimmers of 10-18 years were selected as subjects from the state of Karnataka. The swimmers were subjected to the same measurements; there were 10 items of anthropometric variables and 4 body composition measures by skin fold thickness.

The following anthropometric variables and body composition variables were selected for the purpose of this study

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S. No.** | **Variables** | **Unit of Measurement** | **S. No.** | **Variables** | **Unit of Measurement** |
| Anthropometric Variables | Standing Height/Stature | Centimeters | Body Composition | Biceps skin-fold thickness | Millimeter |
| Weight/Body Mass | Centimeters | Triceps skin-fold thickness | Millimeter |
| Sitting Height | Centimeters | Sub-scapular skin-fold thickness | Millimeter |
| Arm Length | Centimeters | Suprailiac skin-fold thickness | Millimeter |
| Arm Span | Centimeters |  |  |
| Lower Leg Length | Centimeters |  |  |
| Buttocks-Knee Length | Centimeters |  |  |
| Foot Length | Centimeters |  |  |
| Chest Circumference | Centimeters |  |  |
| Shoulder Circumference | Centimeters |  |  |

Before the conduct of the tests, the subjects were assembled on the testing venue, the help of the coaches was taken to collect the necessary data. The purpose of the test was explained and a demonstration of the procedure was given before recording the necessary measurements. Efforts were made to ensure accuracy and uniformity in collecting data.To find out the relationship between anthropometric measurements and body composition Pearson's product moment correlation was employed.

TABLE 3

INTER CO-RELATION MATRIX OF ANTHROPEMETRIC MEASUREMENTS, BODY COMPOSITION TO

PERFORMANCE OF STATE LEVEL MALE SWIMMERS

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Height** | **Weight** | **Body** **Fat** | **LBM** | **Sitting Height** | **Buttocks Knee Length** | **Lower Leg Length** | **Arm Length** | **Arm** **Span** | **Chest Circumference** | **Shoulder** **Circumference** | **Foot Length** | **Performance** |
| **Height** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Weight** | 0.920\* |  |  |  |  |  |  |  |  |  |  |  |  |
| **Body Fat** | 0.288 | 0.323 |  |  |  |  |  |  |  |  |  |  |  |
| **LBM** | 0.896\* | 0.975\* | 0.108 |  |  |  |  |  |  |  |  |  |  |
| **Sitting Height** | 0.890\* | 0.892\* | 0.17 | 0.896\* |  |  |  |  |  |  |  |  |  |
| **Buttocks Knee Length** | 0.851\* | 0.890\* | 0.432\* | 0.832\* | 0.829\* |  |  |  |  |  |  |  |  |
| **Lower Leg Length** | 0.903\* | 0.930\* | 0.301 | 0.906\* | 0.854\* | 0.948\* |  |  |  |  |  |  |  |
| **Arm Length** | 0.878\* | 0.920\* | 0.238 | 0.913\* | 0.835\* | 0.862\* | 0.950\* |  |  |  |  |  |  |
| **Arm Span** | 0.893\* | 0.930\* | 0.197 | 0.930\* | 0.826\* | 0.843\* | 0.944\* | 0.979\* |  |  |  |  |  |
| **Chest Circumference** | 0.784\* | 0.877\* | 0.309 | 0.854\* | 0.736\* | 0.754\* | 0.788\* | 0.843\* | 0.839\* |  |  |  |  |
| **Shoulder Circumference** | 0.637\* | 0.686\* | 0.890 | 0.706\* | 0.590 | 0.609\* | 0.682\* | 0.760\* | 0.762\* | 0.738\* |  |  |  |
| **Foot Length** | 0.863\* | 0.890\* | 0.256 | 0.869\* | 0.769\* | 0.765\* | 0.859\* | 0.895\* | 0.910\* | 0.738\* | 0.622\* |  |  |
| **Performance** | -0.143 | -0.144 | -0.436\* | -0.045 | -0.096 | -0.265 | -0.090 | -0.043 | -0.074 | -0.178 | -0.041 | -0.78 | 1.00 |

r.05(df 21) = 0.413

Table-3 shows that there is a significant relation between performance and body fat in the male swimmers, this explains that the body fat becomes an important factor which assists in better performance, moderate levels of fat actually aids performance by providing additional buoyancy and insulation provided by the fat to a reduced heat loss.

An important consideration in a persons floating is the capacity of the lungs, heavily muscled and who has heavy bones, but who has little amount of fat, the floatation given by air in the lungs is critical and the swimming styles adopted will be modified to meet this drawback. Usually men have less amount of fat content in the body compared to the women increase % of fat may contribute to me performance as according to the correlation matrix. There were other significant correlations found but none has got direct relation to the increase of performance in both male and female swimmers.

It is evident from table 4, that there is a significant correlation between the variables B, D, E, H, I, and L in relation to A. Though the variables show a significant positive correlation, it foils to show any significance to performance. Also there is a negative correlation found between performance and height.

There is a significant correlation found between D, E, G, H, I and J in relation to B. Though the variables show a significant positive correlation, it fails to show any significance to performance. There is a negative correlation found between performance and weight.

There is a significant correlation found between D and K in relationship to C. Though the variables show a significant positive correlation, it fails to show any significance to performance. Also, there is a negative correlation found between arm length and body fat, arm span and body fat also foot length and body fat.

There is a significant correlation found between E, G, H, I, J and K in relation to D. Though the variables show a significant positive correlation, it fails to show any significance to performance. Also there is a negative correlation found between performance and LBM.

There is a significant correlation found between H, I, and L in relation to E. Also there is a significant positive correlation between performance and sitting height. This study shows that sitting height may have a contributing factor for an increased performance. The increased upper body length may give a good reach for a swimmer to perform well, also giving an aerodynamic shape and this also allows the swimmer to reduce drag in the water.

There is a significant positive correlation found between H, I, J, K and L in relation to G. Though the variables show a positive correlation, it fails to show any significance between performance and Lower Leg Length.

There is a significant positive correlation found between I, J, K and L in relation to H. Also there is a significant negative correlation found between performance and Arm length. It explains that arm length could be a contributing factor for better performance. The final touch to the wall becomes the important part for a swimmer as it may give him the best timing for an early touch.

There is a significant correlation between J, K and L in relation to I. Also there is a significant negative correlation found between performance and Arm Span. It may be possible for a greater performance for a swimmer with a good Arm span. As the arms are the most useful part for a swimmer and the arm span may give the swimmer a greater reach and a greater pulling length in the water, this may increase the speed in water and contributing to the swimmer.

There is a significant positive correlation found between K and J. A negative correlation found between performance and Chest circumference. Although negative correlation was found between performance and Shoulder circumference and also performance and Foot Length.

Discussion on significant correlation between the means of selected anthropometric and body composition variables to the performance of female swimmers:

TABLE 4

INTER CO-RELATION MATRIX OF ANTHROPOMETRIC MEASUREMENTS, BODY COMPOSITION TO

PERFORMANCE OF STATE LEVEL FEMALE SWIMMERS

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Height** | **Weight** | **Body Fat** | **LBM** | **Sitting Height** | **Buttocks Knee Length** | **Lower Leg Length** | **Arm** **Length** | **Arm** **Span** | **Chest Circumference** | **Shoulder** **Circumference** | **Foot** **Length** | **Performance** |
| **Height** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Weight** | 0.494\* |  |  |  |  |  |  |  |  |  |  |  |  |
| **Body Fat** | 0.180 | 0.367 |  |  |  |  |  |  |  |  |  |  |  |
| **LBM** | 0.454\* | 0.930\* | 0.005\* |  |  |  |  |  |  |  |  |  |  |
| **Sitting Height** | 0.692\* | 0.436\* | 0.015 | 0.458\* |  |  |  |  |  |  |  |  |  |
| **Buttocks Knee Length** | 0.205\* | 0.249\* | 0.97 | 0.227 | 0.167 |  |  |  |  |  |  |  |  |
| **Lower Leg Length** | 0.390 | 0.464\* | 0.127 | 0.470\* | 0.336 | 0.220 |  |  |  |  |  |  |  |
| **Arm Length** | 0.420\* | 0.547\* | -0.91 | 0.634\* | 0.550\* | 0.149 | 0.793\* |  |  |  |  |  |  |
| **Arm Span** | 0.452\* | 0.594\* | -0.190 | 0.718\* | 0.610\* | 0.229 | 0.703\* | 0.927\* |  |  |  |  |  |
| **Chest Circumference** | 0.256 | 0.853\* | 0.373 | 0.791\* | 0.256 | 0.147 | 0.436\* | 0.489\* | 0.839\* |  |  |  |  |
| **Shoulder Circumference** | 0.317 | 0.906 | 0.430\* | 0.821\* | 0.349 | 0.212 | 0.442\* | 0.505\* | 0.762\* | 0.934\* |  |  |  |
| **Foot Length** | 0.462\* | 0.178 | -0.077 | 0.220 | 0.564\* | 0.151 | 0.526\* | 0.532\* | 0.910\* | 0.054 | 0.008 |  |  |
| **Performance** | -0.362 | -0.283 | 0.084 | -0.329 | 0.486\* | -0.630 | -0.384 | -0.459\* | -0.074 | -0.054 | -0.131 | -0.195 | 1.00 |

r.05(df 21) = 0.404

Further, Table - 4 shows that there is a significant relation between performance and sitting height, performance and arm length and performance and arm span in the female swimmers.

The table explains that if the sitting height is more, it shows an increase in the performance, this may be because of the greater reaching ability as the upper body length increases the body may possess a good aero dynamic shape which helps to reduce drag and increases the speed of the body to move through water.

Another significant relation is that the arm length contributes to the increase in performance the greater the arm length, the swimmer may be able to give a great reach and is able to get more distance of pull in the water and also this helps to lot in the finishing where 'touch' becomes the important factor of winning in second's time.

There is also a significant relation between performance and Arm span. The longer the arms the better the performance given as the swimmer can get a longer distance of pull on each arm and this may allow the body to increase the speed of the body moving inside the water.

**CONCLUSIONS**

This study was undertaken to find out the relationship of anthropometric measurements and body composition to the performance of state level male and female swimmers. Selected anthropometric measurements such as height, weight, sitting height, buttocks-knee-length, lower leg length, arm length, arm span, chest circumference, shoulder circumference, foot length and skinfold thickness of triceps, biceps, subscapular and suprailiac also with performance in various strokes of freestyle, breast stroke, butterfly stroke and back stroke (50 m) a total of 47 swimmers, 23 male and 24 female from BAC were selected as subjects.

Pearson's product moment correlation method was used for the statistical calculation to find the significant correlation between swimming performance and selected anthropometric measurements and body composition.

Body fat was the most reliable single body composition component which significantly correlated with swimming performance in male swimmers.

Sitting height, arm length and arm span was the most reliable anthropometric measurement which significantly correlated with swimming performance in female swimmers.

No other component and anthropometric measurements were found significant to the swimming performance in both male and female swimmers.

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