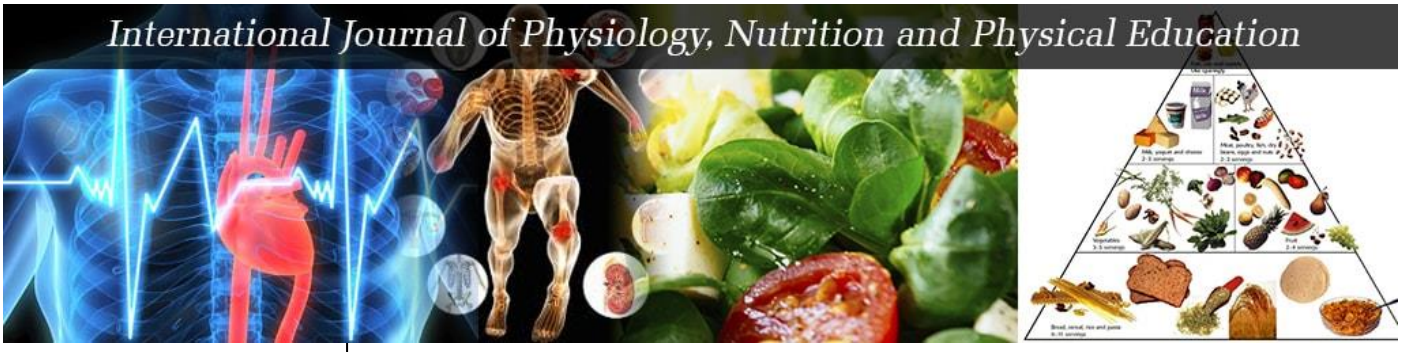

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Relationship of selected anthropometric variables with short distance swimming performance

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Abstract
Anthropometry is the branch of anthropology that is concerned with the measurement of human body. The definition has confined to the kind of measurements commonly used in associate in physical performance with body build. Anthropometry involves the measurement of external part of the body, including body diameters; body circumferences somatic types. The purpose of the study was to investigate the relationship of anthropometrical variables (Thigh Girth, Calf Girth, Foot Length and Foot Breadth) with Short Distance swimming performance. For this study, 25 District level Short Distance male swimmers, specialized in 50 meters free hand swimming from different clubs of West Bengal were considered as subjects. Subjects were selected purposively and the age of the subjects ranged 16 to 17 years. Correlation of co-efficient was employed to calculate the collected data at 0.05 level of confidence. The result showed that there was significant Relationship on Swimming Performance with Thigh Girth and Calf Girth. As we know it is established fact that performance has an inverse relation with time. So it can be concluded that both variables ware positively associated with each other in true sense. In case of Foot Length and Foot Breadth there was no significant correlation between them. As we know it is established fact that performance has an inverse relation with time. So it can be concluded that both variables were inversely associated with each other in true sense.

Keywords: Swimmer, thigh girth, calf girth, foot length and foot breadth

Introduction
Life was first sustained in water and that it took millions of years before it was established on land. Millions more passed before man came into being. As a land animal and man learned to walk upright, taking the weight of his body on his feet, and he discovered that the water, where he could no longer walk upright and employ his muscles as or land, was a source of danger (N.W. Sarsfield, 1965). Man learned to swim long before it was possible for him to leave us any written record of his aquatic accomplishments (Robert Bartels, 1969). Most animal swim by instinct, even those who do not really like water, and can swim at their first attempt by performing their accustomed movements of running (Edna Simms, 1963). Man, on the other hand, has to be taught this art and he finds the process of learning to swim somewhat artificial inspite of the fact that water is the first natural element for man

Childhood is considered one of the most important stages in man's life. During this stage, a child's abilities develop and his talents mature and she/he gets manageable and docile. This makes the early years crucial for his/her future as they have a profound effect on his/her lifelong formation. This also makes the attention paid to childhood one of the most important criteria against which the progress of any society is measured (El-lababidy and khalaima, 1993). Anthropometry is the branch of anthropology that is concerned with the measurement of human body. The definition has confined to the kind of measurements commonly used in associate in physical performance with body build. Anthropometry involves the measurement of external part of the body, including body diameters; body circumferences somatic types. Anthropometry plays an important role in deciding the particular build of the body with various measurements of the segments of the body.

Anthropometric Measurements consists of objective measurements of structure and functions of body. The measurements of the structure include such items as weight, total height, and the width, the depth and the circumference of the chest (Goswami and Abraham, 2010). For performance excellence, in any activity, Anthropometric measurements,

Physical fitness and psychological profiles of sports participants are three important factors besides technical & tactical efficiency and intellectual soundness. The physique of an athlete is considered to be an important determinant of success in many sports, and in top level sport there would appear to be a tendency for individuals to gravitate towards the event to which they are anthropometrically best suited. (Garay *et al*, 1974)

Swimming is one of the most exciting of Olympic sports as it offers many challenges and attractions for sport and recreation purposes. Swimming is also an attractive pastime, its cardiovascular benefits being promoted for health and general fitness. Nowadays a considerable body of knowledge about swimming is available to sports scientists (Parminder pal singh, 2016). In order for successful performance, the athlete needs well-developed physical characteristics specific to the requirements of swimming and the particular events in which they compete.

Swimming includes events involving four different strokes (freestyle, breaststroke, butterfly and backstroke) and a medley, where the one swimmer undertakes all in a predetermined order. Competitive pool swimming events are contested over distances ranging from 50- to 1500-m. These events are typically divided into sprint (50- and 100-m), middle distance (200- and 400-m) and distance (800- and 1500-m) categories. In the shortest sprint events in swimming (50-m freestyle and form stroke), which last only 22 to 30 seconds. The sprint athletes have a program that is more speed orientated, while the middle distance/distance swimmers focus more on developing speed endurance qualities to a greater extent. The volume of training varies from one individual to another, particularly at the elite level. It also varies according to the swimmer's current phase of training. While there are marked differences in training between different types of swimmers, there are several common elements. In a usual week, elite swimmers typically train for 8-10 sessions in the pool, and undertake several dry land and weight training sessions, and occasionally add cross-training activities such as running or cycling.

Swimming requires high muscle strength and technical ability in order to achieve a good performance. This sport involves four different swimming style including freestyle stroke, butterfly stroke, breaststroke and backstroke. In the swimming, performance depends on a number of factors including development of relevant muscle groups and anthropometry. Several researchers have indicated that development of relevant muscle strength is important to achieve a success (Gola *et al*., 2014) [7].

Apart from muscle strength, anthropometry is the most important factor for swimmers to achieve success. There is a strong correlation between age and height variables and swimming performance (Zampagni *et al*., 2008). On the other hand, Mameletzi *et al*. (2003) reported that there is a relationship between lean body mass (LBM) and knee muscles strength. Although in freestyle, stroke speed is little influenced by some anthropometric variables, the combination of stroke length and stroke frequency is very much a function of swimmers anthropometric characteristics (Grimston and Hay, 1986).

Methodology

The Purpose of the study was to identify the relationship of anthropometrical variables with Short Distance swimming performance. For these study 25 District level Short Distance male swimmers, specialized in 50 meters free hand swimming from different clubs of West Bengal were considered as subjects. Subjects were selected purposively and the agerange of the subjects ware 16 to 17 years. Correlation of co-efficient was employed to calculate the collected data at 0.05 level of confidence.

Criterion Measures

The following variables were selected to fulfill the objective of the present study and the tests were conducted to measure the parameters were.

Variables	Measuring Tools	Unit of Measurement
Thigh Girth (TG)	Measuring Tape	Centimeter
Calf Girth (CG)	Measuring Tape	Centimeter
Foot Length (FL)	Sliding Caliper	Centimeter
Foot Breadth (FB)	Sliding Caliper	Centimeter

Findings

Table 1: Relationship of Thigh girth and Performance Level of Short Distance Swimmers

Name of the Variables	Mean	Standard Deviation	Standard Error	Highest Score	Lowest Score	'r' Ratio
TG (cm)	37.76	13.43	2.686	55	17	-0.48*
Performance (Seconds)	26.72	0.87	0.174	28.13	25.5	

*Significant at $\mathbf{r_{0.05}}$ (2, 23) = 0.396

From the above table- 1, it is clearly reveled that in respect of thigh girth of short distance swimmers, mean and standard deviation were 37.76+13.43 with standard error 2.686 and in performance 26.72+.87with standard error 0.174. The table also reflected that the correlation of coefficient was -0.48 which was higher than the tabulated value [$r_{0.05}$ (23) = 0.396]. So there was inverse significant relationship existed between thigh girth and performance. As we know it is established fact that performance has an inverse relation with time. So it can be concluded that both variables ware positively associated with each other in true sense. The strength of relationship was moderate correlation between them

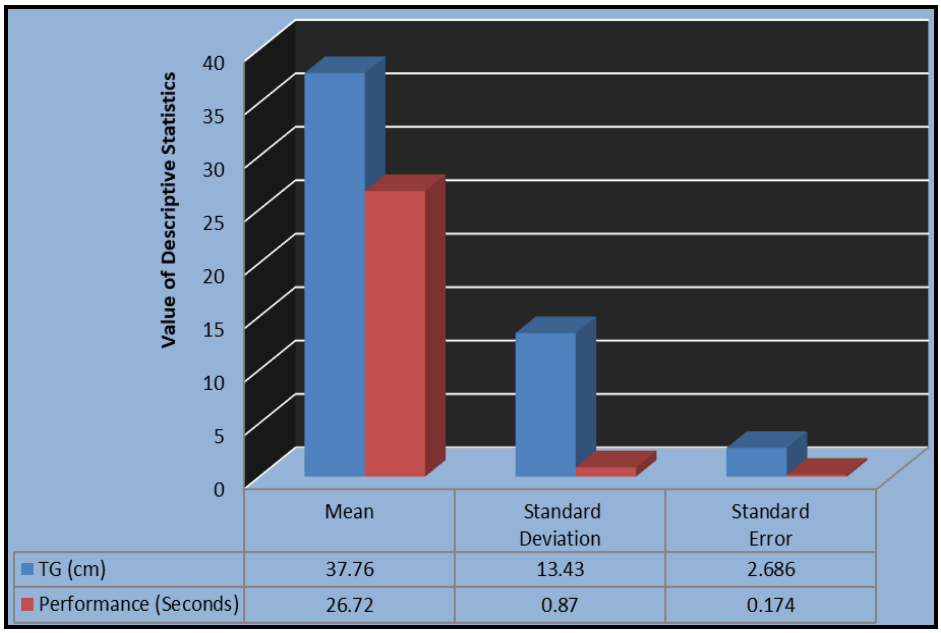

Fig 1: Graphical Presentation Regarding Relationship of Thigh girth and Performance Level of Short Distance Swimmers

Table 2: Relationship of Calf girth and Performance Level of Short Distance Swimmers

Name of the Variables	Mean	Standard Deviation	Standard Error	Highest Score	Lowest Score	'r' Ratio
CG (cm)	25.21	8.82	1.764	35.5	11	-0.47*
Performance (Seconds)	26.72	0.87	0.174	28.13	25.5	

*Significant at $r_{0.05}$ (2, 23) = 0.396

From the above table- 2, it is clearly seen that in respect of calf girth of short distance swimmers, mean and standard deviation were 25.21+8.82 with standard error 1.764 and in performance 26.72+.87with standard error 0.174. The table also reflected that the correlation of coefficient was -0.47 which was higher than the tabulated value [$r_{0.05}(23) = 0.396$]. As we know it is established fact that performance has an inverse relation with time. So it can be concluded that both variables ware positively associated with each other in true sense. The strength of relationship was moderate correlation between them

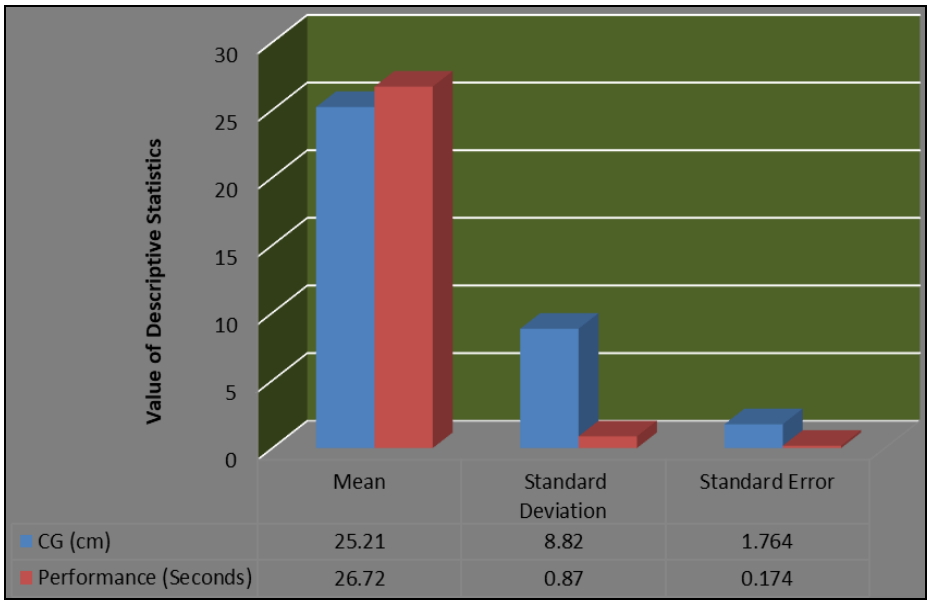

Fig 2: Graphical Presentation Regarding Relationship of Calf girth and Performance Level of Short Distance Swimmers

Table 3: Relationship of Foot Length and Performance Level of Short Distance Swimmers

Name of the Variables	Mean	Standard Deviation	Standard Error	Highest Score	Lowest Score	'r' Ratio
FL (cm)	24.3	2.06	0.412	27	17.9	0.22
Performance (Seconds)	26.72	0.87	0.174	28.13	25.5	

*Significant at $r_{0.05}$ (2, 23) = 0.396

From the above table- 3, it is clearly seen that in respect of foot length of short distance swimmers, mean and standard deviation were 24.3+2.06 with standard error 0.412 and in performance 26.72+.87with standard error 0.174. The table also reflected that the correlation of coefficient was 0.22 which was lower than the tabulated value [$r_{0.05}(23) = 0.396$]. So there was positive insignificant relationship existed between foot length and performance. As we know it is established fact that performance has an inverse relation with time. So it can be concluded that both variables ware inversely associated with each other in true sense. The strength of relationship was low between them.

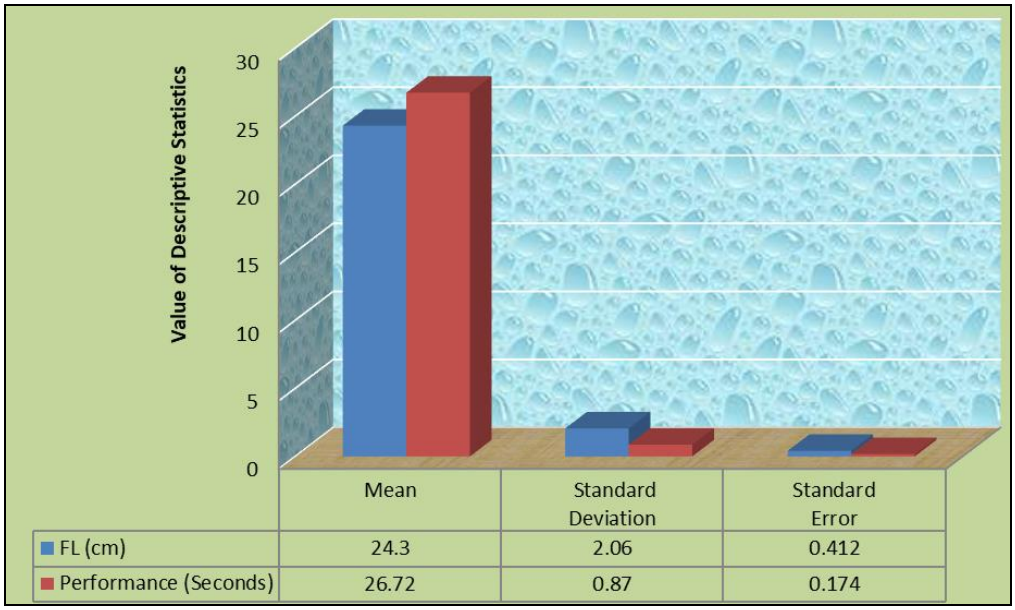

Fig 3: Graphical presentation regarding relationship of foot length and performance level of short distance swimmers

Table 4: Relationship of Foot Breadth and Performance Level of Short Distance Swimmers

Name of the Variables	Mean	Standard Deviation	Standard Error	Highest Score	Lowest Score	'r' Ratio
FB (cm)	8.24	0.49	0.098	9	7.4	0.16
Performance (Seconds)	26.72	0.87	0.174	28.13	25.5	

*Significant at $r_{0.05}$ (2, 23) = 0.396

From the above table- 7, it is clearly seen that in respect of foot breadth of short distance swimmers, mean and standard deviation were 8.24+ 0.49 with standard error 0.098 and in performance 26.72+.87 with standard error 0.174. The table also reflected that the correlation of coefficient was 0.16 which was lower than the tabulated value [$r_{0.05}(23) = 0.396$]. So there was positive insignificant relationship existed between foot breadth and performance. As we know it is established fact that performance has an inverse relation with time. So it can be concluded that both variables ware inversely associated with each other in true sense. The strength of relationship was slight between them.

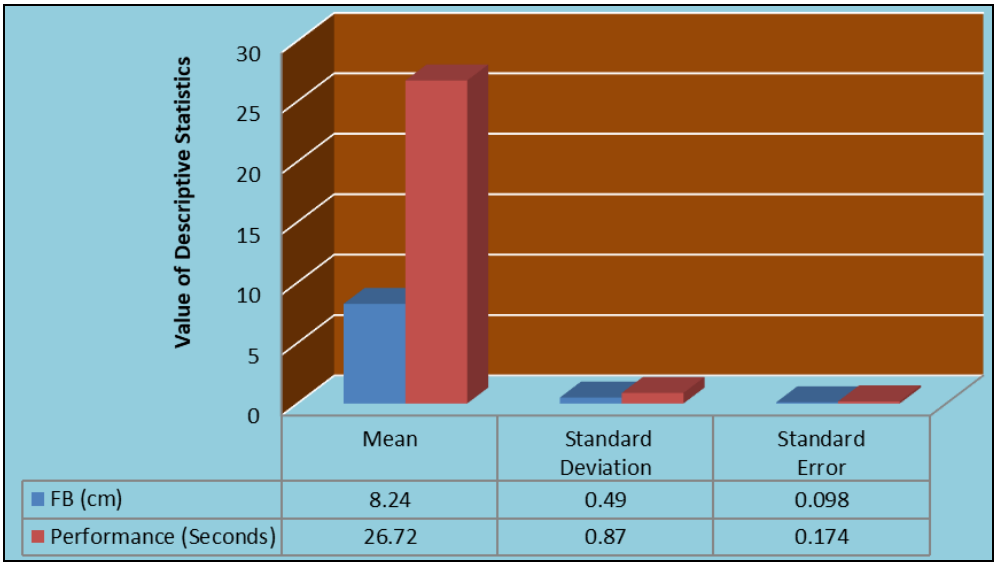

Fig 4: Graphical Presentation Regarding Relationship of Foot Breadth and Performance Level of Short Distance Swimmers

Discussion of Findings

The findings on the basis of the results revealed that no significant association were found in relation to foot length and foot breadth with performance of short distance

swimmers. Whereas in thigh girth and calf girth of short distance swimmers significant association were found. The swimmers in our study were young (16-17 years) and it was seen that swimmers of age group 16-17 years had higher power values on the power testing. Young age and training load led to higher muscular power production in swimmers. Results were seen in the studies which found that swimmers had been achieving peak performances in a very younger age. Swimmers of the present study performed high intensity short distance swimming sprints; therefore an increase in the value of girths and diameters resulted in increased power values. Cross sectional area of the muscle was presented with increased muscle strength generating characteristics. Since swimmers of our study demonstrated muscularity and increased cross-sectional area, it led to greater muscular power and thus decreased swimming time as it would improve the propulsive efficiency. On the other hand, a number of other studies had emphasized the important role of 'muscular power' as a determinant of athletic performance. They also showed high correlations between measures. Our leg muscles are among the largest in your body and working them out can provide a significant metabolic effect on our body. Exercises that tax the leg muscles, according to Bodybuilding.com, can stimulate the release of growth hormones that increase mass and size. Legs can help to improve our ability to engage in cardiovascular exercise and lifting, because stronger legs translate into better endurance and core strength. Adding weight can increase resistance and subsequently, the demands on our leg muscles that force them to grow to adapt. As the relationship is positive we can say that in this study thigh girth is influencing swimming performance of short distance swimmers. Calf muscles help in generate power in our legs while swimming. So that we can propel our leg as fast as we can. As the relationship is positive we can say that in this study calf girth is influencing swimming performance of short distance swimmers. Feet are attached to extremely flexible ankles, which work like fins. Feet's are used to push the water. Foot breadth helps to propel the water, it generates force.

Conclusion

On the basis of the results and discussion following conclusions can be drawn

1. The anthropometric variables of short distance swimmers namely thigh girth and calf girth are significantly related to the performance level of short distance swimmers.
2. The anthropometric variables of short distance swimmers namely foot length and foot breadth are not significantly related to the performance level of short distance swimmers.
3. The anthropometric variables of short distance swimmers namely foot length and foot breadth have positive relation with the performance level of short distance swimmers but as we know it is established fact that performance has an inverse relation with time. So it can be concluded that both variables were inversely associated with each other in true sense.
4. The anthropometric variables of short distance swimmers namely thigh girth and calf girth have negative relation with the performance level of short distance swimmers but as we know it is established fact that performance has an inverse relation with time. So it can be concluded that both variables ware positively associated with each other in true sense.

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