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Relationship between Swimming Performance and Selected Biomechanical Variables of Indian Male Swimmers

V. Selvam[1] & Prof. R. Subramanian[2]

[1]*Ph.D., Scholar, Department of Advanced Training and Technology, TNPESU, Chennai, Tamilnadu, India.*
[2]*Former Professor & Head, Department of Advanced Training and Technology, TNPESU, Chennai, Tamilnadu, India.*

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Abstract

The aim of this study was to determine the relationship between swimming performance and selected biomechanical variables of Indian male swimmers. To achieve this purpose of the study fifty Indian male swimmers who had attended coaching Camps at NIS Patiala and Delhi were selected as subjects in the age group between 18 to 23 years. Swimming performance of the swimmers was determined through freestyle 100 M swim and the time was recorded. To determine stroke length and stroke frequency 50 M swim test was administered to the swimmers based on the number of strokes the swimmer took to complete 50 M swim, stroke length was recorded in meters and stroke frequency was scored in seconds. Pearson correlation coefficient results proved the relationship between swimming performance and selected biomechanical variables were presented proved that biomechanical variables stroke length and stroke frequency were significantly related with swimming performance of the simmers as the obtained 'r' values 0.612 and -0.406 were significant at 0.05 level. It was concluded that swimming performance are significantly related with stroke length and stroke frequency of Indian male swimmers.

Keywords: Swimmers, Bio-mechanical Variables.

Introduction

In swimming each stroke requires a set of specific techniques; in competition, there are distinct regulations concerning the acceptable form for each individual stroke. There are also regulations on what types of swimsuits, caps, and jewelry and injury tape that are allowed at competitions. Although it is possible for competitive swimmers to incur several injuries from the sport, such as tendinitis in the shoulders or knees, there are also multiple health benefits associated with the sport.(Escalante, Yolanda; Saavedra, Jose M. (2012). Swimming is an individual or team racing sport that requires the use of one's entire body to move through water. The sport takes place in pools or open water. Competitive swimming is one of the most popular Olympic sports, with varied distance events in butterfly, backstroke, breaststroke, freestyle, and individual medley. In addition to these individual events, four swimmers can take part in either a freestyle or medley relay. A medley relay consists of four swimmers who will each swim a different stroke, ordered as backstroke, breaststroke, butterfly and freestyle.

Sports Biomechanics is the application of physics and mechanics to the human body during sport.

Correspondence
Prof. R. Subramanian
E.Mail: *drrstnpesu@gmail.com*

In such a technical sport such as swimming, it plays a very important role in elite swimmers preparation and is an important part in maximizing performance. Here are a few applications of biomechanics to the sport of swimming.(Robert Wood, 2016) Water is 773 times as dense as air and 55 times as viscous. From the start of a race, the body position on the block must be maximized to achieve the most efficient push off and get the body in position to enter the water, to make the 'hole ' to follow in through. Biomechanics also helps to understand the best body position to reduce drag following the dive, to maximize the speed that is achieved off the blocks. After the push off the wall, body position is also important to have a streamlined glide away from the wall and reduce drag. For each swimming stroke, the technique has developed over the years due to close examination and research by sports biomechanics staff.(Robert Wood, 2016). For the purpose of the study strike rate and strike frequency were considered for this study.

Ricardo Peterson Silveira et. al, (2019) compared different methods to assess the arm stroke efficiency ($?_F$), when swimming front crawl using the arms only on the Measurement of Active Drag System (MADSystem) and in a free-swimming condition, and to identify biophysical adaptations to swimming on the MAD System and the main biophysical predictors of maximal swimming speed in the 200 m front crawl using the arms only ($?_{200m}$). Although all methods provided

values within the limits of agreement, the speed-based method provided the closest values to the "actual efficiency". The main biophysical predictors of $?_{200m}$were included in two models: biomechanical (R^2 = 0.98) and physiological (R^2 = 0.98). The results suggest that the speed-based method provides the closest values to the "actual $?_F$" and confirm that swimming performance depends on the balance of biomechanical and bioenergetic parameters. Allison J Higgs et.al. (2017) determined which kinematic variables of the upbeat and downbeat are associated with prone undulatory under water swimming (UUS) performance in an elite sample. A multiple stepwise regression model explained 78% of variance in mean horizontal centre of mass velocity (V_{COM}.) Peak toe velocity explained 72% of the variance, and mean body wave velocity explained an additional 6%. Elite swimmers should strive for a high peak toe velocity and a fast caudal transfer of momentum to optimise underwater undulatory swimming performance. Ludovic Seifert et.al. (2014) documented that in a biophysical approach to the study of swimming performance (blending biomechanics and bioenergetics), inter-limb coordination is typically considered and analysed to improve propulsion and propelling efficiency. This perspective explains how behaviours emerge from a set of interacting constraints, which each swimmer has to satisfy in order to achieve specific task performance goals and produce particular task outcomes. This overview updates understanding on inter-limb coordination in swimming to analyse the relationship between coordination variability and stability in relation to interacting constraints (related to task, environment and organism) that swimmers may encounter during training and performance. The aim of this study was to find out the relationships between swimming performance and biomechanical variables, strike length and strike frequency of Indian male swimmers.

Methodology

For the purpose of the study randomly selected 50 Indian male swimmers who had attended National coaching Camps in NIS Patiala and Delhi. The subjects selected were in the age group between 18 to 23 years. Swimming performance of the swimmers was determined through freestyle 100 M swim and the time was recorded. To determine stroke length and stroke frequency 50 M swim test was administered to the swimmers based on the number of strokes the swimmer took to complete 50 M swim, stroke length was recoded in meters and stroke frequency was scored in seconds. Pearson correlation coefficient was used to determine the association between swimming performance (timing for 100 M swim) and the biomechanical variables selected, stroke frequency and stroke length of the Indian male swimmers.

Results

Table 1. *Descriptive statistics on swimming performance selected biomechanical variables of the subjects*

S.No	Variables	N	Mean (M)	Standard Deviation (SD)
1	Swimming	50	108.72	14.234
1	Stroke Length	50	0.9882	0.09244
2	Stroke Frequency	50	53.00	2.900

The descriptive statistics presented in Table 1 shows the swimming performance of 100 M swimming mean was 108.72 with standard deviation ± 14.234. The biomechanical variable stroke length mean was 0.9882 with standard deviation of ± 0.09244, stroke frequency of the subjects was 53.00 with standard deviation of ± 2.900. The association between selected biomechanical variables with swimming performance was statistically analysed through Pearson Correlation Coefficient and the results presented in Table 2.

Table 2. *Correlation coefficient between swimming performance and selected biomechanical variables of the subjects*

S.No	Swimming Performance Vs Biomechanical Variables	N	Mean (M)	Obtained 'r' value
1	Stroke Length	50	0.9982	0.612*
2	Stroke Frequency	50	53.00	-0.406*

* Significant at 0.05 level.

Discussions

The results presented in Table 1 shows the descriptive statistics on swimming performance, biomechanical variables stroke length and stroke frequency. The relationship between swimming performance and selection biomechanical variables were presented in Table 2. And the results presented proved that biomechanical variables stroke length and stroke frequency were significantly related with swimming performance of the simmers as the obtained 'r' values 0.612 and -0.406 were significant at 0.05 level. .

In the present study, biomechanical variables, stroke length and stroke frequency were selected as variables related with swimming performance. Emmet Crowley, Andrew J Harrison, and Mark Lyons (2017) documented the majority of propulsive forces in swimming are produced from the upper body, with strong correlations between upper body strength and sprint performance and found Stroke length would improve overall swimming performance. Roberto Baldassarre et.al. (2017) found that to sustain high velocity for many hours of swimming, endurance swimmers need a high propelling efficiency and a low energy cost.Shilo J Dormehl et.al. (2017) evaluated the efficacy of existing performance models to assess the progression of male and female adolescent swimmers through a quantitative and qualitative mixed-methods approach. And found In addition, the 100-m freestyle and backstroke for males and 200-m freestyle for males and females were almost directly proportional. Maria I Ferreira et.al. (2016) summarized evidence on masters swimmers energetics, biomechanics, and performance gathered in selected studies and showed shows the lack of a solid body of knowledge (reflected in the amount and quality of the articles published) on the changes in biomechanics, energetics, and performance of master swimmers over time. Thus, the results of the study were in agreement with the previous researches.

Conclusions

It was concluded that swimming performance are significantly related with stroke length and stroke frequency of Indian male swimmers.

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