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Kinematical analysis of stride length and stride rate during sprint performance in athletics

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Abstract

Objective: The aim of the study was to compare Stride Length and Stride rate during sprint performance in acceleration zone.

Methodology: For the purpose of this study 05 male National/ All India inter University sprinters were selected as subject. The age of the subject ranged from 18-25 years. The subject selected from Lucknow, Allahabad, and Varanasi District. The performance of the subject's taking by filming protocol by using Casio ex-f1 high speed camera. Silicon Coach Pro-7 Motion analysis software was used for collecting raw data. The data was calculated in meter and hertz. The data for the selected variables were obtained with the help of filming protocol by using Casio ex-f1 high speed camera and further analyzed by using Silicon Coach Pro-7 Motion analysis software by an expert during the sprint performance. The data has been recorded only acceleration zone (50 meter distance) of the 100 meter race. There were two trials had given to the each subjects and the best trial was used for the analysis. Results of the study have shown that, mean value of Stride Length (4.2080) is higher than the stride rate (2.150). This means that the Stride Length plays important role in sprint Performance in acceleration zone. The acceleration phase is the most important phase in a race. During this phase, after the sprinter has left the blocks, the athlete increases the length of their stride and decreases the amount of strides taken per second.

Conclusion: Stride Length showed the higher affective variable which influence the Performance than Stride Rate. Acceleration Zone is the most important phase in the race.in this phase the athlete increases the length of their stride and decreases the amount of strides taken per second.

Keywords: Stride length, Stride rate, Hertz, Kinematics

Introduction

All movements of living beings are governed by the laws of mechanics, as every movement is mechanical in nature involving locomotion of the body mass in space and time. However, in contrast to the movements of non-living beings, which are subjected to mechanical laws, the movements of living bodies besides being governed by mechanical laws are also subjected to biological laws. Kinematical analysis is the process of measuring the kinematic quantities used to describe motion. In engineering, for instance, kinematic analysis may be used to find the range of movement for a given mechanism, and, working in reverse, kinematic synthesis designs a mechanism for a desired range of motion. In addition, kinematics applies algebraic geometry to the study of the mechanical advantage of a mechanical system or mechanism. Athletics is an exclusive collection of sporting events that involve competitive running, jumping, throwing, and walking. The most common types of athletics competitions are track and field, road running, cross country running, and walking. The simplicity of the competitions, and the lack of a need for expensive equipment, makes athletics one of the most commonly competed sports in the world. Athletics is mostly an individual sport, with the exception of relay races and competitions which combine athletes' performances for a team score, such as cross country. Sprinting is the fullest form of running performed over short distance in which maximum or near maximum effort can be sustained. Sprinting figures in the program of all major athletic championships including the Olympic game, in which the standard sprint event for men and women are the 100m, 200m, 400m, hurdle, as well as 4×100m and well as 4×400m relay. Stride Length-It is the linear distance from the point of heel strike of one lower extremity to the next heel strike of the same extremity. Stride Rate - Number of strides taken per unit of time.

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Methodology

Subjects- For the purpose of this study 05 male National/ All India inter University sprinters were selected as subject. The age of the subject ranged from 18-25 years. The subject selected from Lucknow, Allahabad, and Varanasi District.

Tools- The performance of the subject's taking by filming protocol by using Casio ex-f1 high speed camera. Silicon Coach Pro-7 Motion analysis software was used for collecting raw data. The data was calculated in meter and hertz.

Procedure- The data for the selected variables were obtained with the help of filming protocol by using Casio ex-f1 high speed camera and further analyzed by using Silicon Coach Pro-7 Motion analysis software by an expert during the sprint performance. The data has been recorded only acceleration zone (50 meter distance) of the 100 meter race. There were two trials had given to the each subjects and the best trial was used for the analysis.

Analysis of Data and Result of the Study

The obtained data statistically analyzed by SPSS- 20 version. Descriptive statistics was used. The results are depicted with the help of table -01.

Table 1

S. No.	Stride Frequency	Stride Rate
N	5	5
Mean	4.2080	2.150
Std.Error of Mean	.09682	.10644
Std. Deviation	.21649	.23801
Variance	.047	.057
Skewness	-.176	1.299
Std. Error of Skewness	.913	.913
Kurtosis	1.272	1.102
Std.Error of Kurtosis	2.000	2.000
Range	.60	.59
Minimum	3.90	1.94
Maximum	4.50	2.53

Thus, it is evident that from the table that, the mean value and standard deviation of Stride Length and Stride Rate has been found 4.2080 and 2.150 and .21649 and .23801 respectively and range of score was .60 and .59 respectively whereas standard error of mean was found .09682 and .10644 respectively.

Further the Descriptive value of Mean Score Of Stride Length and Stride rate During Sprint Performance in acceleration Zone has been represented by the Following Figure-01

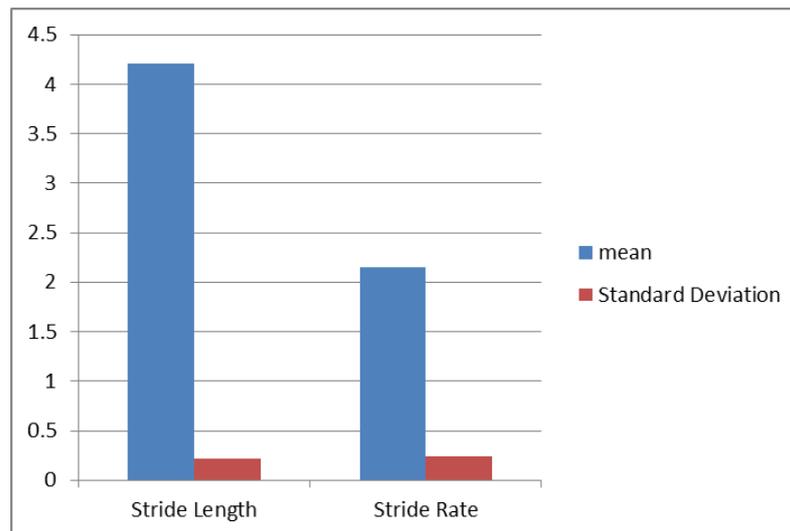


Fig 1: Graphical Representation of Mean Score of Stride Length and Stride Rate during Sprint Performance in Acceleration Zone.

Discussion of Findings

Results of the study have shown that, mean value of Stride Length (4.2080) is higher than the stride rate (2.150). This means that the Stride Length plays important role in sprint Performance. The acceleration phase is the most important phase in a race. During this phase, after the sprinter has left the blocks, the athlete increases the length of their stride and decreases the amount of strides taken per second. Stride length can be improved by increasing leg strength and flexibility. Therefore stride length plays an important role than the stride rate during the performance simultaneously. Sprinting speed is defined with the frequency and the length of strides. These parameters are mutually dependent with their optimal ratio enabling maximal sprinting speed. The increase of speed can be achieved by increased length or frequency of strides. The increase of both parameters simultaneously is quite difficult due to mutual dependency. Therefore an increase in one factor will result in an improvement in sprint velocity, as long as the other factor does not undergo a

proportionately similar or larger decrease (Hunter et al., 2004) [6]. Increased frequency results in shorter stride length and vice versa. Therefore the increase in stride length must be directly proportional with the decrease of stride frequency, especially at the beginning of the race – the initial acceleration phase.

Conclusion

Stride Length showed the higher affective variable which influence the Performance than Stride Rate. Acceleration Zone is the most important phase in the race.in this phase the athlete increases the length of their stride and decreases the amount of strides taken per second.

On basis of result and finding it may be concluded that while performing the sprint race in athletics Stride Length Plays an important role than Stride rate in the acceleration zone of 100 meter race.

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