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Relationship of Kinematical Variables with the Sprint Performance in Athletics

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Abstract

Objective- The aim of the study was to find out the Relationship of Kinematical Variables with the performance of Sprinters. **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 raw data further statistically analyzed by SPSS- 20 Version software. 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:** Result of the study have shown that,there was insignificant relationship found between all the selected Kinematical variables namely -Stride Length, Stride duration, Stride Frequency, Stride rate, Step Length, Step Duration, Horizontal Velocity and Sprint performance.

KEYWORDS- Stride length, Stride Frequency, Stride duration, Stride rate, Step Length, Step Duration, Horizontal Velocity, 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 Frequency –Stride frequency corresponds to the number strides that are completed in a specified time period. Running is a cyclic movement in which two

consecutive strides make up a complete cycle of movement. It is an athletic event in itself and at the same time important in numerous other sports. Scientific investigations have been playing an increasingly important role in the training of athletics to attain excellence in performance in different spheres of sports. Athletics concentrates on the development of speed, flexibility, strength, ability, endurance etc. as a part of preparation of their respective sport game.

Objective of the Study: Objective of the study was to find out the Relationship of Kinematical Variables with the performance of Sprinters.

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.

Selection of Variables

The following kinematical variables were selected for the purpose of this study:-

Kinematical Variables

1. Stride Length.
2. Stride rate.
3. Stride Duration.
4. Horizontal velocity.
5. Stride Frequency.
6. Step Length.
7. Step duration.

CRITERION MEASURES

Variables	Tests	Units of Measurement
Horizontal Velocity	Silicon Coach Pro-7 Motion Analysis Software	meter/second
Stride length, Step Length	Silicon Coach Pro-7 Motion Analysis Software	meter
Stride Frequency, Stride Rate	Silicon Coach Pro-7 Motion Analysis Software	Hertz
Stride duration, Step Duration	Silicon Coach Pro-7 Motion Analysis Software	seconds

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.

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 by collecting the raw data. The raw data further data statistically analyzed by SPSS- 20 Version software. 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 and Pearson correlation (Multiple) was used. The results are depicted with the help of table -01 and table -02

Table -01

	N	RANGE	MINIMUM	MAXIMUM	MEAN	STD. ERROR	STD. DEVIATION	VARIANCE
STRIDELENGTH	5	.60	3.90	4.50	4.2080	.09682	.21649	.047
STRIDEDURATION	5	.07	.43	.50	.4778	.01191	.02663	.001
STRIDEFREQUENCY	5	1.00	10.00	11.00	10.6000	.24495	.54772	.300
STRIDERATE	5	.59	1.94	2.53	2.1500	.10644	.23801	.057
STEPLENGTH	5	.32	1.94	2.26	2.1000	.05099	.11402	.013
STEPDURATION	5	.03	.22	.25	.2382	.00460	.01028	.000
HORIZONTALVELOCITY	5	2.62	8.18	10.80	9.0380	.47272	1.05703	1.117
PER100	5	.88	11.34	12.22	11.758	.18922	.42311	.179

It is evident from table – 0 that mean, standard deviation, scores of kinematical parameters was found as follow: Stride Length(4.20±.216),Stride Duration(.477±.266), Stride Frequency (10.60±.547), Stride Rate (2.15±.238), Step Length (2.10±.114), Step Duration (.23±.010),Horizontal Velocity (9.038±1.057), respectively whereas standard error and range of scores was found as follow: Stride Length(.096 &.60),Stride Duration(.011 & .07), Stride Frequency (.244 &1), Stride Rate (.106 & .59), Step Length (.050& .32), Step Duration (.004 & .003),Horizontal Velocity (.472 & 2.62) respectively.

Table no.02

Relationship between Kinematical Parameters and Sprint Performance

.	N	STRL	STRD	STRF	STRR	STEPL	STEPD	HV	PER100MTR
STRIDE. LENGTH.(STRL)	5	1	-.248	-.641	-.134	.997**	-.416	.315	-.311
STRIDE. DURATI.ON(STRD)	5	-.248	1	-.367	**-.923***	-.194	**.933***	-.995**	.659
STRIDE. FREQUENC.Y(STRF)	5	-.641	-.367	1	.614	-.641	-.071	.309	-.047
STRIDE RA.TE(STRR)	5	-.134	-.923*	.614	1	-.184	-.774	**.898***	-.621
STEP LEN.GTH(STEPL)	5	.997**	-.194	-.641	-.184	1	-.350	.265	-.295

STEP DU.RATION (STEPD).	5	-.416	.933*	-.071	-.774	-.350	1	**-.929***	.539
HORIZON.TAL VELOCIT.Y (HV)	5	.315	-.995**	.309	.898*	.265	-.929*	1	-.720
100 MTR. PERFORM.ANCE IN TIME (PER.100MTR)	5	-.311	.659	-.047	-.621	-.295	.539	-.720	1

Correlation is significant at the 0.05 level (2-tailed).

Significant value of the Coefficient of correlation at 0.05 level with 3 degree of freedom is (.878)

Table 03 reveals that in case of Stride Length, Stride duration, Stride Frequency, Stride rate, Step Length, Step Duration, Horizontal Velocity the calculated value of 'r' (-3.11), (.659), (-.047), (-.621), (-.295), (.539) and (-.720) respectively which was found lower than the required tabulated value of 'r' (.878) ,at 0.05level of significance with 3 degree of freedom therefore it showed insignificant relationship with 100 meter performance of sprinters.

Table 03 also reveals that Stride duration showed a significant relationship with Stride rate (-923) and Step duration (.933), similarly Step duration showed the significant relationship with the Horizontal velocity (-929) further, Horizontal velocity showed the significant relationship with Stride rate (.898) because the calculated value 'r' were found greater than the required tabulated value (.878) at (.05) level of significance with 3 degree of freedom. However, the obtain value of Coefficient of correlation in other variables were less than the required tabulated value at selected level of significance, therefore these selected independent variables have shown insignificant relationship with the other selected variables.

Conclusion- There was insignificant relationship found between all the selected Kinematical variables and Sprint performance.

Discussion of Findings-

In many cases runners seem to have different stride length for right and left foot (Rompotti). Stride Length is governed by the velocity and the trajectory of the Runner's center of gravity as he leaves the ground (Fred and Ecker). In this present study Horizontal Velocity having no influence to the Performance, therefore the result of the present study found that stride length showed insignificant relationship with the performance. Thus we can also say that from the above discussion since Stride Length showed the insignificant relationship therefore Step Length also showed the insignificant relationship in the present study because the horizontal velocity found to be no influence with the performance. Fred and Ecker also find that an effort to increase the length of stride by raising the trajectory would be ineffective, as it would lengthened the time spent in the air and decrease forward velocity.

The use of dimensionless velocity was shown to be no more effective than conventional methods in the prediction of a SL vs. velocity relationship. (Bennett JP, Sayers and Burkett BJ et al).

Since Sprinting speed is defined with the frequency and the length of strides (Mann and Herman, 1985; et al., 1992; Delecluse et al., 1998; Bruggemann et al., 1999; Gajer et al., 1999;

Ferro et al., 2001). In the present study Stride length found to be insignificant relationship with the performance. Since we know that stride length and stride frequency having the inverse relationship to each other (Mann and Herman), therefore stride frequency also showed the insignificant relationship with the performance.

Since Efficiency of running and running performance are multivariate in nature. For example, physiological, psychological, morphological, and mechanical factors to the running efficiency and performance of the athlete (Taylor). Therefore in the present study Stride frequency, Stride rate, horizontal velocity, stride Duration, step duration showed the insignificant relationship with the performance because of efficiency of running and running performance are multivariate in nature.

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