Performance of Women 100m Sprinters in Relation to 'Number of Strides' and 'Stride Frequency'

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ABSTRACT

The main aim of this study is to understand the pros-cone of women sprinting performance in relation to the 'stride frequency' and the number of strides. The 28 female sprinters were chosen as subject for this study, those who successfully completed 100m sprinting competition in "three semifinal & final" during Commonwealth Games 2010,at Delhi. All these 28 sprinters were with Mean (± SD) of 'performance 11.61 Sec (± 0.2241), The Mean value of 'Number of Strides' is 50 (± 1.1090), The Mean value of 'stride frequency' is 4.31 (± 0.1057), The Mean value of Reaction Time is 0.173(± 0.022). the results of performance in 100m sprinting and reaction time were taken from the official website of Commonwealth Games 2010, Delhi as well as also download the movies available of 'All three Semifinal and final from Official website of Commonwealth Games 2010, Delhi'In this study, it was found that a significant positive correlation is in between performance and the Reaction Time ($p<0.05$). It is natural as much as early an athlete react to gun fire, she may be able to perform well or we can say take less time in 100m sprint. .This study also reveals significant positive correlation between "number of strides" and "stride frequency", ($p<0.05$). It means as "number of strides" decreases "stride frequency" also decreases or we can say "number of strides increases", "stride frequency" also increases. ". The data of "groups based on frequency", is divided in two groups.

i) *Group 'A': those athletes performed (greater stride frequency) more than 4.30 stride/sec.*
ii) *Group- 'B': those athletes performed (slower stride frequency) less than 4.30 stride/sec.*

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INTRODUCTION

Sprint is a very popular event in sports arena especially in track & field and draw a great amount of attention from the athletes and spectators. Sprinting is a complex task that places a high neuromuscular demand on the performance and requires high levels of coordinated movement and appropriate sequencing of muscle activations to perform at peak levels. This study will examine, sprint mechanics with particular focus on the primary factors affecting performance, the mechanics associated with those factors, and the causal relationships that occurs as a result of optimal sprinting mechanics. Although, it is understood that maximum velocity sprinting mechanics cannot be taken out of the context of either the 'number of strides' and 'frequency of strides' that preceded it or the bio motor abilities of a given athlete.

The ability to move the legs faster through the full running motion is limited by the physiology of the athlete. It seems apparent that stride frequency is basically an inherent trait. The most important sprinting component, the stride frequency, is best developed between the age 7 to 11 years, after that the development is limited and to some little extent it is possible to improve the stride frequency and further progress in sprinting depends mainly on the development of strength to increase stride length [Torim,1988].

Schmolinsky (1978) described that speed is a function of stride length and stride frequency. The athlete who wishes to gain speed will either take longer strides or increase the frequency of his strides or use a combination of the two. This of course, is a much greater importance for The speed a sprinter develops while running is a result of a combination of stride length and stride frequency. In order for a sprinter to be able to increase speed it is necessary either to increase stride or use the combination of two. This of course, is a much greater importance for sprinters.

Moore [1980] found that there have been great sprinters with short strides and great stride frequency and there have been equally great sprinters with long strides and slower stride frequency length and or stride frequency. The most important element for success is maximum running velocity, though a fast reaction time after the start signal and quick acceleration are also important. World class sprinters reach their maximum velocity at about 70-80 meter of the race, and the maximum sprint running velocity of sprinters who run 100m in less than 10 seconds is >12.1m/sec. To achieve such a velocity, a sprinter requires a strong body and efficient running movement [Akira Ito, Koji Fukuda, Kota Kijima, 2008].

METHODOLOGY

The subject for this study were 28 Female sprinters, those successfully

completed 100m sprinting competition in "three semifinal & final" during Commonwealth Games 2010, Delhi,The data was collected from net ,as well as from movies collected from net as well as researcher also download the movies available of 'all three semifinal and final' from the Official website of Commonwealth Games 2010, Delhi. Performance is also judged on the basis of frequency of strides, by bifurcating in Group A and Group B. The data of "Groups based on Frequency", is divided in two groups.

i) Group 'A': those Athletes performed (Greater Stride Frequency) more than 4.30 stride/sec.
ii) Group- 'B': those athletes performed (Slower Stride Frequency) less than 4.30 stride/ sec.

Study Designs

It is hypothesized that an increase in 'Stride Frequency' or decrease in 'Number of Strides' or both will increase the performance. So, to find out the relation of 'performance' with 'stride frequency' and 'Number of Strides' we also choose the 'reaction time' because reaction time also is the part of 'Stride Frequency'.

The results of performance in 100m sprinting and reaction time were downloaded from Official Website of Commonwealth Games 2010, Delhi, as well as also download the movies available of 'all three semifinal and final' from the official website of Commonwealth Games 2010, Delhi.

RESULTS & DISCUSSION

The mean value and Standard deviation of "the performance", "the number of strides" and The Frequency of Strides as well as Reaction Time" of 28 subjects Table I.

Table-I

Means & Standard Deviation

Variable	Mean	Std. Deviation
Performance (sec)	11.61	± 0.22241
No. of strides	50.00	± 1.1090
Frequency of Strides (per sec)	4.31	± 0.105701
Reaction Time (sec)	0.173	± 0.022

The mean value & Standard deviation of "The Performance (after each 10 strides), and "The Frequency" (after each10 strides) given below in Table II.

Table-II

Mean & Standard Deviation Value of Performance & Frequency of each10 Strides

Variable	Mean & Std Deviation					
No. of strides		10	20	30	40	50
Frequency of Strides (per sec)	**Mean**	3.89	4.23	4.28	4.36	4.31
(After 10 Strides)	**S.D.**	±0.186	±0.149	±0.149	±0.110	±0.103
Performance (sec)	**Mean**	2.57	4.72	7.01	9.17	11.61
After 10 Strides)	**S.D.**	±0.135	±0.169	±0.248	±0.234	±0.222

The data were analysed with Pearson correlation (2-tailed) by computer in the SPSS (version-16) software. The value of correlation for "The performance", "The Number of Strides" & "The Frequency of Strides" as well as "Reaction Time" is mentioned in Table III.

Table-III

The Correlation

Variable	Performance	No. of strides	Stride Frequency	Reaction Time
Performance	-	.309	- .501*	.393*
No. of Strides	.309	-	.669**	- .029
Stride Frequency	-.501*	.669**	-	.333
Reaction Time	.393*	-.029	.333	-

As shown in Table IV Fig.1 that as the Number of strides increases the Stride frequency is also increase, and in last 10 strides the stride frequency is only decreases. This might be due to:-

1. The muscles got fatigue, thus stride frequency decreases in last 10 strides, Duanmu Shi & Yanhua Tong (2003).
2. Athletes is try to finish the race in last 10 strides thus they started to stretch the leg tend to cover the distance quickly resultant an increase in stride length Compromising decrease in 'stride frequency' (Singh,S. 2007).

Table-IV

The Difference of Average Stride Frequency After Each 10 Strides

Strides	Frequency	Rate of Change in Frequency
10 Strides	3.89	
20 Strides	4.23	91.96%
30 Strides	4.278	99.06%
40 Strides	4.36	97.93%
50 Strides	4.30	-1.377%

Table-V

Mean & Std. Deviation value of performance & Stride Frequency (of each 10 stride)

Variable		Mean & Standard Deviation									
		Group-A					Group-B				
No of Strides		10	20	30	40	50.32	10	20	30	40	49.59
Performance (sec)	Mean	3.95	4.29	4.36	4.43	4.37	3.80	4.14	4.16	4.26	4.21
	S.D	±0.108	±0.115	±0.104	±0.072	±0.078	±0.246	±0.155	±0.129	±0.075	±0.059
Stride Frequency (per sec)	Mean	2.53	4.66	6.88	9.04	11.51	2.64	4.83	7.21	9.39	11.77
	S.D	±.068	±.222	±.162	±.154	±.166	±.185	±.184	±.230	±.170	0.213

The data were analyzed with the Pearson Correlation (2- tailed) by computer in SPSS (version-16) Software. The value of correlation in between " the performance", " the number of strides" and "the frequency of strides" for the group-A & Group- B mentioned in Table VI and Table VII, respectively.

Table-VI

Group-'A', Correlation

Variable	Performance	No. of strides	Stride Frequency	Reaction Time
Performance	-	.426	-.360	.507*
No. of Strides	.426	-	.691**	.528*
Stride Frequency	-.360	.691**	-	.589
Reaction Time	.507*	.528*	.589*	-

Group- A : 'Table VI', shown the following :-

1. 'Stride Frequency' and 'Number of Strides' has significant positive correlation ($p<0.01$).
2. 'Reaction Time' has significant positive correlation with 'Number of Strides'. ($p< 0.05$).
3. 'Reaction Time' has significant positive correlation with performance ($p< 0.05$).

All studies stated that 'Stride frequency' and 'Number of strides' both are important factor in 100m sprinting.

As Fred Wilt (1978) explains "stride length" is directly proportional to the speed. Greater the speed longer the stride, but, hence researcher noticed that Gold, Silver & Bronze Medal winners fall in group-A, while their "number of stride" are lesser comparing within group.

Group- A is the group of those

athletes were performed with higher frequency, and stride frequency' has significant positive correlation with 'Number of Strides' it means as the 'stride frequency' increases "number of strides" also increases as 'number of stride' increases the 'Stride length' decreases, Singh,S. (2007). Thus, with greater frequency and lesser stride length performance not be good. So, we can say the performance will be greater, if 'number of strides' is lesser (correct form of technique) with higher the 'stride frequency", Tabaschnik (1990).

Table-VII

Group-'B', Correlation

Variable	Performance	No. of strides	Stride Frequency	Reaction Time
Performance	-	.842**	-.506	.082
No. of Strides	.842**	-	.715*	.221
Stride Frequency	.506	.715*	-	.517
Reaction Time	.082	-.221	-.517	-

Group- B : Table – VII shows the following:-

1) 'Number of stride' has significant highly positive correlation with the performance ($p<0.01$).
2) 'Number of stride' has significant highly positive correlation with 'stride frequency' ($p<0.05$).

This finding supported by Schomolinsky (1978), F, Wilt (1978), Singh, S. (2007).

'Number of strides' has significant highly positive correlation with performance it means that the length of stride is bigger comparing to Group- A as shown in Table V and in Fig 1.

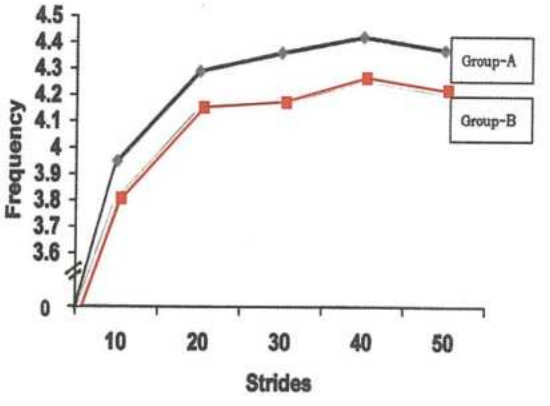

Fig.1: Comparison of Group A & Group B

Even stride frequency is lower comparing to Group- A. But the medal winner has taken 'number of strides' equal to 'GROUP-B'. Thus the medal winner won the 100m sprint on the basis of 'greater frequency' with greater 'stride length', or lesser 'number of strides' comparing to their opponents, this finding supported by Tabaschnik and Papanov (1988), Mahrrikadze (1986), Lease (1990), Karp (2001).

CONCLUSION

The aim of 100m sprinting to run at maximum speed and to won the race in prestigious event. To run at maximum speed, strides require specific combination of 'stride frequency' and 'stride length', it is not possible to measure 'Stride length' during the prestigious competition in Common wealth Games 2010, Delhi. Thus, we have chosen 'Stride Frequency' and 'number of strides' to reinvestigate these parameters of world class female sprinters.

The main aim of the study is to understand "The relationship of performance with 'stride frequency' and 'number of srides' in 100m female sprinters".

The 28 female sprinters are chosen as subjects for this study; those were successfully completed 100m sprinting during Commonwealth Games 2010, Delhi.

The competition performance and three variable viz. 'reaction time', 'stride frequency' and 'number of strides' were analyzed of 28 subjects by the researcher and used all scientific tools to understand relation between them.

Some interesting focal points are as follows.

Performance can be improved in three ways:-

1. Performance can be improved by an increase in 'stride frequency' but the 'length of stride' be constant with correct technique of stride i.e. the foot should touch the ground just below the hip under C.G. projection.

A. Performance can also be improved by an increase in 'stride length' by keeping stride length constant, and this can possible to reduce the contact time during supporting phase.

B. Performance can also be improved by increasing both 'stride frequency' and 'stride length' (but with perfect technique).

Hence, we can suggested that in future to reinvestigate the problems of performance in relation to 'stride frequency' and 'number of strides' should be considered with the followings:-

i) Body composition in relation different limbs as well as body mass.

ii) The various movements of different joints and limbs.

iii) The technique analysis

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