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INFLUENCE OF RADIAL LENGTH ALTERATION ON CURVE SPRINTING PERFORMANCE

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ABSTRACT

The purpose of the present study was to observe the influence of radial length alteration on curve sprinting performance. Twenty (20) male state level sprinters from different districts of West Bengal, India, were purposively selected for the study. The average age of the subjects was 21 year, ranging from 18 to 24 year. A running distance of 100 meter was marked from the starting line in each of these curves of a running track laid for the purpose of present study. To find out the significant difference of running time, running velocity and centrifugal force of eight different curves, 'ANOVA' test was employed at the 0.05 level. The present study did not show any significant difference of running time and running velocity among eight different curves but the centrifugal forces of running were significantly different. So the researcher concluded that the different centrifugal forces of eight different curves radii track were not having any effect on running performance of sprinters.

Keywords: Curve Radius, Running Time, Running Velocity, Centrifugal Force, Distance.

1. INTRODUCTION

The glamour of track and field surrounds over different events in the broad areas of running, jumping and throwing. The present study concerned with running event. The running events are of different types and these are sprinting, middle and long distance. The all running events except 100 m sprint are partially run in the curve. This study dealt specifically with curve sprinting event which are most interesting and exciting events in athletics. The maximum velocity in running around a bend is less than that obtained while running in a straight line. Greene (1985) described the effects that runners experience around bends. He pointed out that lanes are unequal because of the effect of their radii on the runner's "speed, since in order to balance centrifugal acceleration, a runner must lean over into the turn, with the approximate centerline of his body making an angle with respect to the vertical.

- The objective of the study was to investigate the difference in sprinting performance in different curve radius track.
- The secondary objective of the study was to analyze the changing influence of centrifugal force on different curve sprinting performance.

2. METHODS

2.1 Selection of Subject

Twenty (20) state level sprinters were purposively selected from eight (8) different districts of West Bengal (4 subject from Birbhum, 3 from Burdwan, 3 from Nadia, 3 from Murshidabad, 2 from Bankura, 2 From Hooghly, 2 from Howrah, 1 from Cooch Behar).

2.2 Criterion Measure

The running performance was assessed by the time taken in second. The running velocity was measured by distance / using time i.e. meter / second. The centrifugal force was measured by applying the formula

$$C_f = \frac{Mass \times Velocity^2}{Radius}$$

2.3 Lay Out of Track and Lanes

Four different ratios of curve and straight were selected from each and every track of 400 m, 500 m, and 600 m.

Four Different Ratios of Curve and Straight of Every Track -according to standard track.

1. 2.59: 2.41
2. 2.89: 2.11
3. 3.1: 1.81 and
4. 3.49: 1.51.

On the above ratio, the distance of straight is 84.39m for standard track (400 m track). On that basis the ratios of curve and straight distance was 2.89: 2.11 (36.60 m curve radius track without raised border). Consider this as a standard. 0.30 was deducted from the curve ratio and 0.30 was added to the straight ratio for first one, 0.30 was added to the curve and 0.30 was deducted from the straight for third ratio and 0.60 was added to the curve and 0.60 was deducted from the straight for fourth ratio. This particular deduction and addition of straight and curve ratio was made by consultation with the experts in this field. So according to the four (4) different ratio of curve and straight for every individual track of 400 m, 500 m, and 600 m total twelve (12) different curve distance radii (C.D.R) were discovered, four (4) from 400 m track, four (4) from 500 m track and four (4) from 600 m track. These different curve distance radii are as follow in table-1.

TABLE 1
TOTAL TWELVE (12) DIFFERENT C.D.R. OF 400M, 500M AND 600M TRACKS

Four Different C.D.R. of 400m Track	Four Different C.D.R. of 500m Track	Four Different C.D.R. of 600m Track
32.76m	41m.	49.25m.
36.60m (According to standard track)	45.78m.	54.97m.
40.40m	50.55m.	60.70m.
44.22m.	55.32m.	66.43m.

But in 500m track, 1st and 2nd C.D.R i.e. 41m and 45.78m are too close with the 3rd and 4th C.D.R of 500m track i.e. 40.40m and 44.22m. On the other hand similarly in 600m track 1st and 2nd C.D.R i.e. 49.25m and 54.97m is approximately same as 3rd and 4th C.D.R of 500m track i.e. 50.55m and 55.32m. For that reason the researcher had finally chosen four (4) C.D.R from the above eight (8) C.D.R. These four C.D.R. are 40.40m, 44.22m, 50.55m and 55.32m.

The researcher conducted the experiment on eight (8) lanes. Four (4) lanes from 400m track, two (2) lanes from 500m track and two (2) from 600m track following the above ratio of curve and straight. These eight (8) lanes are presented in table-2.

TABLE 2
FINAL EIGHT (8) DIFFERENT C.D.R OF 400 M, 500 M AND 600 M TRACKS

Four Different C.D.R. of 400m Track	Two Different C.D.R. of 500m Track	Two Different C.D.R. of 600m Track
32.76m	50.55m.	60.70m.
36.60m (According to standard track)		
40.40m	55.32m.	66.43m.
44.22m.		

The same process was followed for every running lane. Running distances of 100 m were marked in each of these curves. The width of the lane was 1.22 m. A single midpoint was used for marking every curve lanes. The all eight (8) curves drew in the same direction and a single horizontally straight finishing line used for every running path. The layout of different eight (8) 100 m curve lanes was diagrammatically presented below.

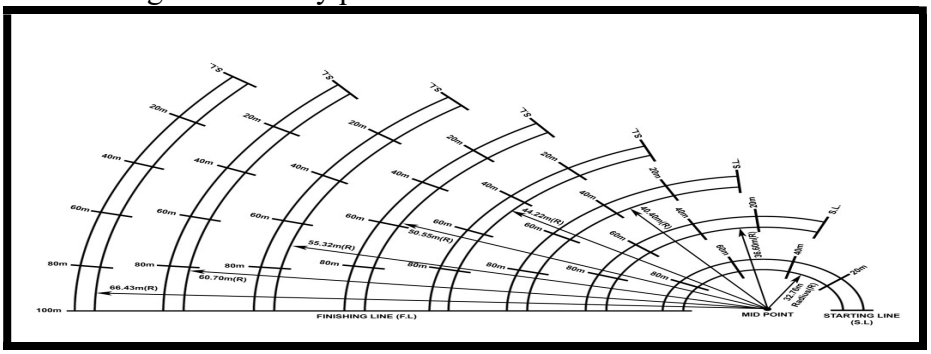


Fig.–1: Layout of Different Eight (8)Curve Lanes of 100m Distance

2.4 Detail of Experimentation

The researcher used total four (4) days for experimentation or data collection. One day before data collection all the twenty (20) subjects arrived at Santiniketan. The researcher residentially accommodated all subjects nearest to the Visva-Bharati Ashram Ground. Every morning from 6am to 9am (1st session) and afternoon from 4pm to 7pm (2nd session) the

researcher collected the data. In a single session all twenty (20) subjects performed one (1) time in a 100m curve lane. First day morning and afternoon subjects ran in 32.76m and 36.60m C.D.R lanes. Similarly second day subjects ran in 40.40m and 44.22m C.D.R lanes, 3rd day they ran in 50.55m and 55.32m C.D.R lanes and last day i.e. 4th day subjects ran in 60.70m and 66.43m C.D.R lanes. At a time one (1) subject ran for a 100m curve distance. The subjects were instructed to run their best. They were given the incentives for their best performance.

2.5 Collection of Data

The researcher took help from four (4) Physical Education students. They worked as officials (one starter and three time keepers). Subject ran one at a time using block start. All time keepers were instructed to start their watches on the clap of the starter and they stopped their watches when the torso of the sprinter touched the imaginary line perpendicular to the finished post. The timing elapsed to run was found by subtracting the time clocked up to the end from the starting line. Total one hundred sixty (160) individual times (8 track × 20 subjects) were collected from this field work and considered as raw data.

2.6 Statistical Procedure

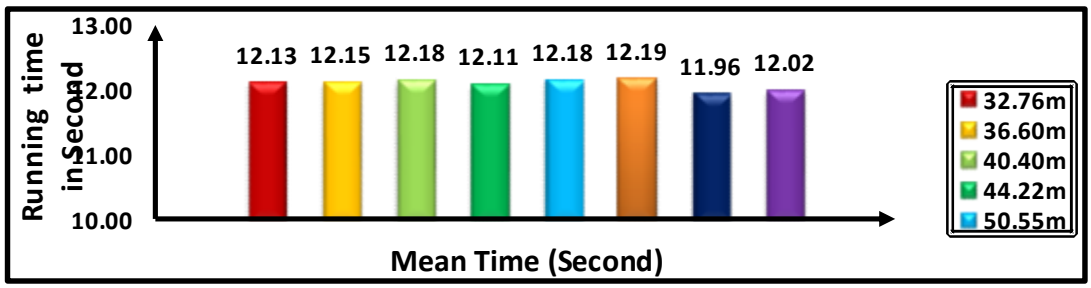
Computed mean for calculating the average Running Time and average Running Velocity. The collected data were put into ANOVA test to find out the significance of mean difference in different times and different velocities of eight different curve radius lanes for 100m distance.

3. RESULT AND DISCUSSION

The mean running time of 100 meter distance for different curve radius is presented below in Table-3

TABLE-3
MEAN RUNNING TIME OF TOTAL DISTANCE (0M-100M) FOR DIFFERENT CURVE LANES

Curve Radius	32.76m	36.60m	40.40m	44.22m	50.55m	55.32m	60.70m	66.43m
Mean Time (Second)	12.13	12.15	12.18	12.11	12.18	12.19	11.96	12.02
S.D.	0.44	0.51	0.57	0.51	0.52	0.57	0.49	0.51



➢ **Fig.–2 Graphical Representation of Mean Running Time of Total Distance (0m-100m) for Different Curve Lanes**

According to mean running time of different eight curve lanes of 100 m the best performance was achieved in 60.70 m C.D.R track (11.96s) and maximum running time was elapsed in 55.32 m C.D.R track (12.19s). In the curve of standard track 12.15s was the mean value of 100m sprint. No significance mean differences of running time of different curve tracks in 100 m were found and mean values were marginally differed.

TABLE 4
SIGNIFICANCE MEAN DIFFERENCE OF RUNNING TIME OF EIGHT DIFFERENT CURVE LANES

	SS	df	MS	'F' Value ('p' Value)
Between	0.972	7	0.139	0.523 (0.816)
Within	40.335	152	0.265	
Total	41.307	159		

Table value = 2.07 (at 0.05 level)

There were no significant differences among running time of eight different curve lanes for 100m distance. The mean average velocity of 100m running time in eight different curve radii tracks are presented in Table 5 below.

TABLE-5
MEAN RUNNING VELOCITY (M/ S) OF TOTAL DISTANCE (0M-100M) FOR DIFFERENT CURVE LANES

Curve Radius	32.76m	36.60m	40.40m	44.22m	50.55m	55.32m	60.70m	66.43m
Mean Velocity (m/s)	8.26	8.25	8.23	8.27	8.22	8.22	8.37	8.33
S.D.	0.30	0.35	0.38	0.35	0.35	0.38	0.34	0.35

The graphical representation of mean velocities of 100 run in 8 different running lanes are presented in the Fig.3 below.

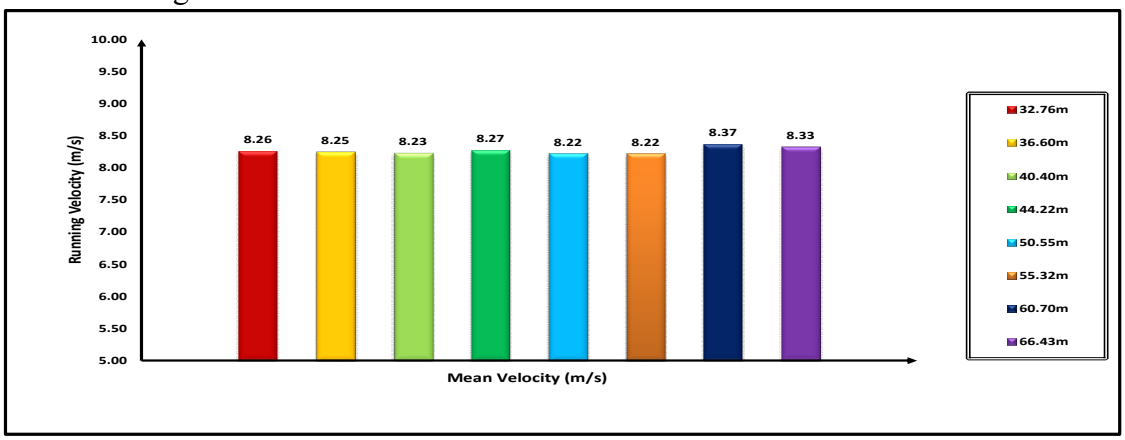


Fig.–3 Graphical Representation of Mean Running Velocity of Total Distance (0m-100m) for Different Curve Lanes of 100m

Table-5 shows the maximum running velocity achieved by the sprinters in 60.70 m C.D.R track and minimum velocity achieved in 50.55 m and 55.32 m C.D.R tracks and in standard track the velocity was 8.25 m/s. Significance of mean difference in running velocities of 100m is presented in Table-6 below.

TABLE 6
SIGNIFICANCE OF MEAN DIFFERENCE OF RUNNING VELOCITY OF EIGHT DIFFERENT CURVE LANES

	SS	df	MS	'F' Value ('p' Value)
Between	0.428	7	0.061	0.503 (0.831)
Within	18.472	152	0.122	
Total	18.9	159		

Table value = 2.07 (at 0.05 level)

There were no significant differences among running velocity of eight different curve lanes for 100m distance.

4. CONCLUSION

4.1. A sprinter can achieve highest performance in 100 m curve running when radius of the curve is 60.70 m and lowest performance in 55.32 m curve radius.

4.2. In respect of all eight curve tracks the running times and running velocities are very close but these small differences are very crucial for sprint event.

4.3. Running time and running velocities do not significantly differ in different eight curve radii tracks of 400 m, 500 m and 600 m length.

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