Dr. Praveen Kumar
Associate Professor, Noida
College of Physical Education,
Dadri, G.B. Nagar, Noida, Uttar
Pradesh, India

A kinematic analysis of technique of sprinters at national level

Dr. Praveen Kumar

Abstract
The purpose of the study was to compare the selected kinematics variables of the technique of national male and female sprinters. The subjects of this study were three males and three females Inter-university athletes of Lakshmibai National Institute of Physical Education, Gwalior (M.P.). The age the subjects were between 18-25 years.

The sequence photographic technique was employed to register the sprinters technique. A motor driven, Nikon Model EM Camera was used. The subjects were photographed at 40-55 meters marks in sagittal plane. The filming Zone was 15 meters in width only moment take-off was analyzed. From the photographs, the stick figures were prepared by using joint point method and various kinematics variables were obtained. Segmentation methods were employed in order to assess the center of gravity of the body during the moment of take-off. Selected kinematics variables were Angle at Ankle Joint (sprinters), Angle at knee Joint (Supporting Leg), Angle at Ankle Joint (Swinging Leg), Angle at knee Joint (Swinging Leg), Angle at Trunk Inclination (with vertical), Push-up Angle, Height of Center of Gravity at Moment Take-off, Take-off Distance and stride length.

The data were analyzed by 't' test to ascertain the comparison of male and female sprinters. The results have shown the insignificant values of 't' ratio for all the selected kinematics variables of the study at the significance level of 0.05.

Keywords: Sprinters, supporting leg, swinging leg

Introduction
Biomechanical analysis is the evaluation of technique, whether in sports, industry or everyday life. Method of analysis used in biomechanics vary from those requiring expensive and complex equipment to technique utilizing little else than in acute eye and an understanding of the mechanics of the movement. Analysis method in biomechanics may be classified under three general areas, namely subjective, objective and predictive techniques). Objective technique in biomechanics refer to the collection, measurement and evaluation of data from the activity of interest.

It appears that social participation in an activity has an effect on world records. However, there remains an anatomical and physiological difference between the sexes which may account for performance discrepancies. A measurement of the exact contribution of inherent and social factors to performance is not possible, but little research has examined the performance of the sexes matching the same activity.

The purpose of the study was to compare the selected kinematics variables of the technique of national male and female sprinters. The subjects of this study were three males and three females Inter-university athletes of Lakshmibai National Institute of Physical Education, Gwalior (M.P.). The age the subjects were between 18-25 years.

The sequence photographic technique was employed to register the sprinters technique. A motor driven, Nikon Model EM Camera was used. The subjects were photographed at 40-55 meters marks in sagittal plane. The filming Zone was 15 meters in width only moment take-off was analyzed. From the photographs, the stick figures were prepared by using joint point method and various kinematics variables were obtained. Segmentation methods were employed in order to assess the center of gravity of the body during the moment of take-off. Selected kinematics variables were Angle at Ankle Joint (Supporting Leg), Angle at knee Joint (Supporting Leg), Angle at Ankle Joint (Swinging Leg), Angle at knee Joint

Corresponding Author:
Dr. Praveen Kumar
Associate Professor, Noida
College of Physical Education,
Dadri, G.B. Nagar, Noida, Uttar
Pradesh, India

(Swinging Leg), Angle at Trunk Inclination (with vertical), Push-up Angle, Height of Center of Gravity at Moment Take-off, Take-off Distance and stride length.

The data were analyzed by 't' test to ascertain the comparison of male and female sprinters. The results have shown the insignificant values of 't' ratio for all the selected kinematics variables of the study at the significance level of 0.05.

Objective of the study

The purpose of this study is to compare the technique of male and female sprinters from kinematics point of view.

Methodology
Subjects

Five male and five female sprinters of track and field athlete of university level were selected. The age of the subjects were between 18-25 years. Purposive sampling were used for the collection of sample. Static group design were used for the study.

Variables

The following selected kinematics variables for analyzing the technique of sprinters

- Angle at Ankle Joint (Supporting Leg)
- Angle at knee Joint (Supporting Leg)
- Angle at Ankle Joint (Swinging Leg)
- Angle at knee Joint (Swinging Leg)
- Angle at Trunk Inclination (with vertical)
- Push-up Angle
- Height of Center of Gravity at Moment Take-off,
- Take-off Distance
- Stride length.

Collection of Data

The sequential photography was used as a technique of kinematics comparison of male and female sprinters. A standard motor driven camera i.e. Nikon Model EM, was used to obtain photo sequences of selected movements during the movement take-off.

The subjects were photographed between 40-55 meters in sagittal plane filming zone was 15 meters for obtaining individual photographic sequence the subjects were photographed in controlled condition. The distance of the concern from the subjects was 11.20 meters and fixed 1.20 meters high. The moment take-off was measured manually for each subject. The scholar-developed stick figure utilizes joint-point methods on which the body projections at the joints facing the camera were considered. The inclination of torso was measured by deviation of torso from the vertical axis. The center of gravity of each subject at the moment take-off was located by using segmentation method as suggested by James g. Hay.

Statistical Analysis

The data were analyzed by 't' test to ascertain the comparison of male and female sprinters. Data were analyzed by using S.P.S.S. (Statically package of Social Science)

Finding

Table 1: Comparison of the Performance of Male and Female Sprinters in Ankle Joint (Supporting Leg)

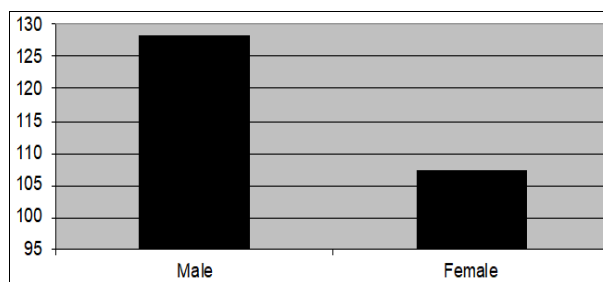| Means		T-Ratio
Male	Female	
128.9	107.3	0.158

Significant at 0.05 level t-value=2.306

Fig 1: Comparison of Performance of Male and Female Sprinters in Ankle Joint (Supporting Leg)

Table-1 clearly indicates that insignificant difference was found between the means of male and female students as the observed T-ratio was 0.158, which was lower value than the required value (2.306) to be significant at 0.05 level of significance.

Table 2: Comparison of the Performance of Male and Female Sprinters in Ankle Joint (Swinging Leg)

Means		T-Ratio
Male	Female	
106.8	90.1	0.151

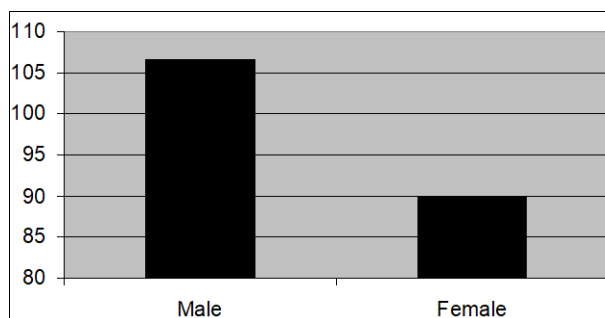Significant at 0.05 level t-value=2.306

Fig 2: Comparison of the Performance of Male and Female Sprinters in Ankle Joint (Swinging Leg)

Table-2 clearly indicates that insignificant difference was found between the means of male and female students as the observed T-ratio was 0.151, which was lower value than the required value (2.306) to be significant at 0.05 level of significance.

Table 3: Comparison of the Performance of Male and Female Sprinters in Knee Joint (Supporting Leg)

Means		T-Ratio
Male	Female	
166.6	166	0.02

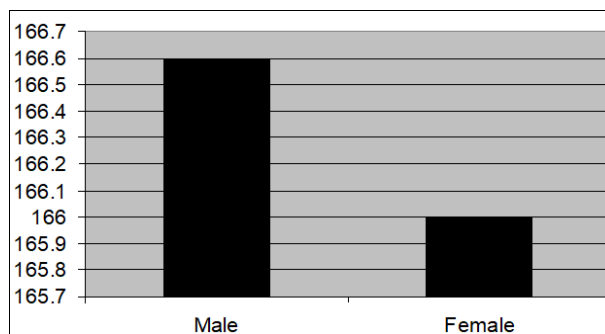Significant at 0.05 level t-value=2.306

Fig 3: Comparison of the Performance of Male and Female Sprinters in Knee Joint (Supporting Leg)

Table-3 clearly indicates that insignificant difference was found between the means of male and female students as the observed T-ratio was 0.02, which was lower value than the required value (2.306) to be significant at 0.05 level of significance.

Table 4: Comparison of the Performance of Male and Female Sprinters in Knee Joint (Swinging Leg)

Means		T-Ratio
Male	**Female**	
81.6	93.3	-0.115

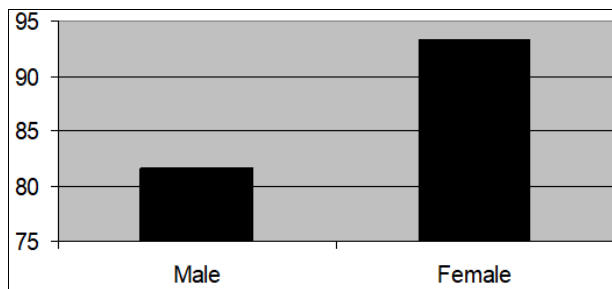Significant at 0.05 level t-value=2.306

Fig 4: Comparison of the Performance of Male and Female Sprinters in Knee Joint (Swinging Leg)

Table-4 clearly indicates that insignificant difference was found between the means of male and female students as the observed T-ratio was
-0.115, which was lower value than the required value (2.306) to be significant at 0.05 level of significance.

Table 5: Comparison of the Performance of Male and Female Sprinters in Push-up Angle.

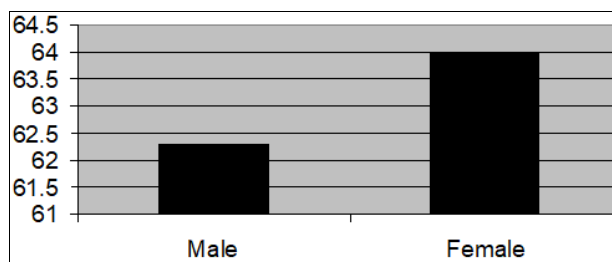| Means		T-Ratio
Male	**Female**	
62.3	64	-0.023

Significant at 0.05 level t-value=2.306

Fig 5: Comparison of the Performance of Male and Female Sprinters in Push-up Angle

Table-5 clearly indicates that insignificant difference was found between the means of male and female students as the observed T-ratio was
-0.023, which was lower value than the required value (2.306) to be significant at 0.05 level of significance.

Table 6: Comparison of the Performance of Male and Female Sprinters in Trunk Inclination.

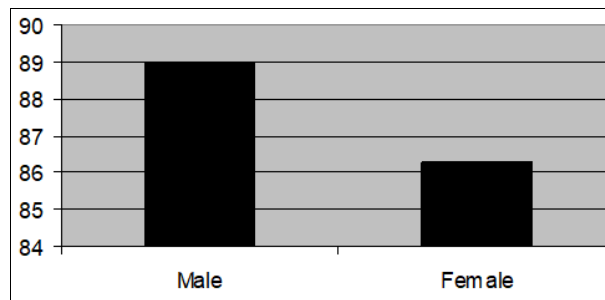| Means		T-Ratio
Male	**Female**	
89	86.3	0.153

Significant at 0.05 level t-value=2.306

Fig 6: Comparison of the Performance of Male and Female Sprinters in Trunk Inclination.

Table-6 clearly indicates that insignificant difference was found between the means of male and female students as the observed T-ratio was 0.153, which was lower value than the required value (2.306) to be significant at 0.05 level of significance.

Table 7: Comparison of the Performance of Male and Female Sprinters in Height of C.G. at moment of Take-off.

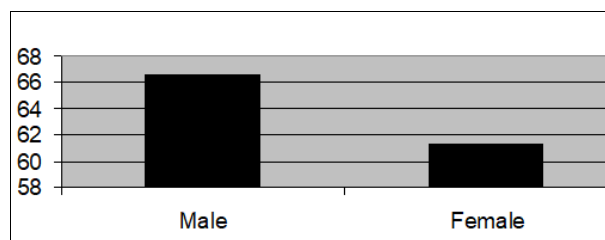| Means		T-Ratio
Male	**Female**	
66.4	61.2	0.072

Significant at 0.05 level t-value=2.306

Fig 7: Comparison of the Performance of Male and Female Sprinters in Height of C.G. at moment of Take-off

Table-7 clearly indicates that insignificant difference was found between the means of male and female students as the observed T-ratio was 0.071, which was lower value than the required value (2.306) to be significant at 0.05 level of significance.

Table 8: Comparison of the Performance of Male and Female Sprinters in Take-off Distance.

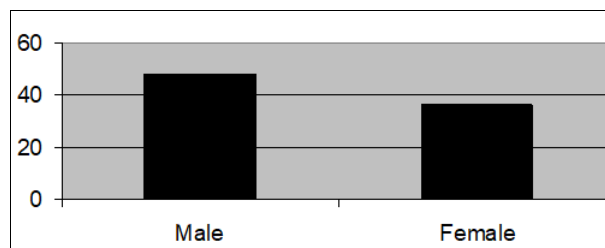| Means		T-Ratio
Male	**Female**	
48	36.3	0.248

Significant at 0.05 level t-value=2.306

Fig 8: Comparison of the Performance of Male and Female Sprinters in Take-off Distance

Table-8 clearly indicates that insignificant difference was found between the means of male and female students as the observed T-ratio was 0.248, which was lower value than the required value (2.306) to be significant at 0.05 level of

significance.

Table 9: Comparison of the Performance of Male and Female Sprinters in Stride Length.

Means		T-Ratio
Male	**Female**	
2.09	1.76	0.486

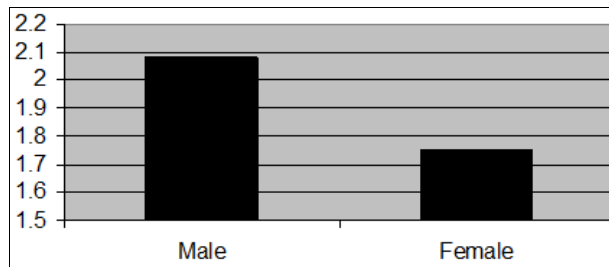Significant at 0.05 level t-value=2.306

Fig 9: Comparison of the Performance of Male and Female Sprinters in Stride Length.

Table-9 clearly indicates that insignificant difference was found between the means of male and female students as the observed T-ratio was 0.487, which was lower value than the required value (2.306) to be significant at 0.05 level of significance.

Findings and conclusions:
With the limitations and findings of the study the following conclusion may be drawn. None of the Kinematics variables such as Angles at ankle joint, Angle at knee joint of supporting leg and Angles at ankle joint, Knee joint of swinging leg, Trunk Inclination, Height of the Center of gravity at moment of take-off, Take –off distance and Stride length did not differ significant in case of technique of male and female sprinters. It was concluded that linear and angular kinematics show exhibited the insignificant difference of the technique of male and female sprinters .The angular kinematics variable which importance of greater planter flexion at moment of take-off in a sprinting stride. It may due to the small size of the sample or the Kinematics variables between male and female sprinter at the selected level of significance 0.05 therefore, the hypothesis as stated that these may not be significant difference in selected kinematics variables of male and female sprinters in accepted.

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