Research Paper Physical Education

Interaction of Knee Kinematics During Sprint Running

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ABSTRACT

The purpose of the study was to find-out the relationship between the knee kinematics and sprint performance of the inter-collegiate male sprinters. 12 athlete's sprint performance and knee-kinematics namely knee flexion at foot strike and knee extension at foot strike was observed during the 100meter dash. The collected data were analysed with simple correlation. The analysis of the data indicates that 100meters sprint timing was depends upon the knee kinematics.

KEYWORDS | knee kinematics, knee flexion and knee extension

Introduction

The 100m sprint in athletics is considered an event of human ability to compete at maximum running velocity without any artificial assistance. There are a lot of studies on the 100m sprinting from which insights into effective running techniques can be obtained. In coaching and teaching, it is well known that the first step in learning and improving sprint techniques is to imitate skilled performers as a template of model technique. Coaches and teachers frequently adopt a model technique or a template in which sequential pictures and figures of a skilled performer are used as a motion model(**Yada, et al.,2011**). Sprinting, a cyclic locomotor stereotype of human movement consists of maximum-rate running strides. Lower extremity kinematics and kinetics during level running have been well-documented (**Milliron and Cavanagh, 1990**). Recently, many research studies have been conducted to investigate sprinting performance factors.

To excel in the sport of track and field, not only are physiological characteristics important but runners must possess the kinematics needed for the event. Specific kinematics contributes to the race allowing a runner to excel in power, economy, or a combination of both. By understanding the kinematics needed for the competition distance, performance can be improved. Runners who compete at different distances typically display differences in kinematics. For example, sprinters spend less time on the ground and have less knee flexion during stance phase compared to distance runners at maximum and competition speeds (**Bushnell and Hunter, (2007), Novacheck, (1998) and Vaughanm (1984)**). Above these facts, the researcher made an attempt to findout is there any relationship between the sprint performance and knee kinematics.

Objectives

The objective of the study was: to findout the relationship between the knee kinematics and sprint performance.

Methods

To achieve the purpose of the study, 12 male athletes were selected as subjects and who were participated in 100meters trials in the Madurai Kamaraj Universtiy Inter-Collegiate Athletic meet held at Race Course stadium, Madurai during the year 2014-2015. Data were collected during the men's 100meter trials. Athletes' 100meter trial timing was considered as the sprint performance. Sprinters motion were Videotaped at 30 frames per second and video camera was fixed at a distance of 8m from the outer edge of the 8th lane. One camera was fixed at the 30meters of 100m races and the other at the 80meters of 100m races. The video was carefully observed with the help of *Quintic* Sports Biomechanics Video Analysis Software (trial version) on knee kinematics namely angle of knee flexion at foot strike and angle of knee extension at foot strike. After repeated observation the angle of the above mentioned parameters was found-out and recorded in degrees. To achieve the purpose of the study the simple correlation was used as a statistical technique. The level of significance was fixed at 0.05 level.

Analysis

Table I

Descriptive statistics

Variables		Mean	SD	Mini.	Maxi.
30 meters of 100 meter race	Angle of Knee Flexion at Foot Strike (in degrees)	49.43	8.19	35.28	64.37
	Angle of Knee Extension at Foot Strike (in degrees)	141.12	6.82	132.3	155.63
80 meters of 100 meter race	Angle of Knee Flexion at Foot Strike (in degrees)	49.29	7.12	38	60.28
	Angle of Knee Extension at Foot Strike (in degrees)	146.41	8.75	130.8	161.53
Sprint Performance (in Seconds)		11.59	0.29	11.18	12.19

Cunningham, et al., (2013).

Data analysis

TABLE II

CORRELATION AMONG SPRINT PERFORMANCE AND KNEE KINEMATICS AT 30METERS OF 100METER RACE

Variables	Angle of Knee Flexion at Foot Strike	Angle of Knee Flexion at Foot Strike	Sprint Performance
Angle of Knee Flexion at Foot Strike	1.000	-0.270	0.551
Angle of Knee Extension at Foot Strike	-0.270	1.000	0.091

*Significant r0.05 (10) = 0.576.

TABLE III

CORRELATION AMONG SPRINT PERFORMANCE AND KNEE KINEMATICS AT 80METERS OF 100METER RACE

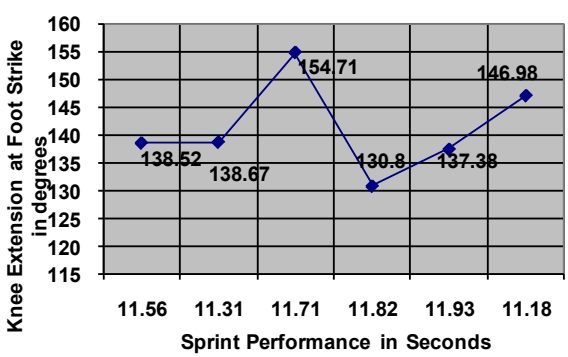
Variables	Angle of Knee Flexion at Foot Strike	Angle of Knee Flexion at Foot Strike	Sprint Performance
Angle of Knee Flexion at Foot Strike	1.000	-0.238	0.457
Angle of Knee Extension at Foot Strike	-0.238	1.000	-0.668*

*Significant r0.05 (10) = 0.576.

Results

Analysis of the data indicates that 100meters sprint performance was not significantly correlated with the angle of knee flexion at foot strike in 30 and 80meters of 100meter race. There was some association between angle of knee flexion and sprint performance. At the same time 100meters sprint performance was significantly correlated with the angle of knee extension at foot strike in 80meters of 100meter race.

Figure- 1: Relationship among the sprint Performance and knee extension at 80meters of 100meter race



Discussion

The purpose of this study was to determine the association between the sprint performance and knee kinematics. This study was performed in synthetic surface. Results showed that angle of knee extension at foot strike at 80m of 100m race significantly associated with the sprint performance. The present study findings may depends on the following factors: According to Stanley Brown's "Exercise Science." Powerful hip flexors and greater knee flexion help to bring your recovery leg forward sooner and increase speed. When one accelerates, one's knee should be fully extended, which allows for the greatest degree of hip extension. As one recover, the knee flexes as one's hips flex, which sends one's foot toward one's buttocks (**Tang, 2015**). According to Usain Bolt coach Glen Mills, said. Bolt needs to eradicate lateral movement of the torso when he's pumping his arms. Mills stated that push one's knees forwards and up high. This will generate more power, encourage a longer stride and cover more distance. When the foot is coming towards the ground, lift the toes up towards the shin so one's foot is horizontal. One should land on the mid-foot, with the foot underneath the body, not in front. Heels should come off the floor and travel high in an arc towards the bum, almost flicking it, before travelling through to the front (**McCarthy, 2015**).

Conclusion

The present study was concluded that

1. Sprint performance was depends upon the knee flexion and knee extension at foot strike.
2. Negative association between angle of knee flexion and knee extension at 30 and 80meters of 100m race.
3. Positive association between angle of knee flexion at foot strike and sprint performance
4. Negative association between angle of knee extension at foot strike at 80m of 100m race and sprint performance.
5. The results of this study may help the coaches and teachers to understand the knee kinematics during the 100meters run.

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