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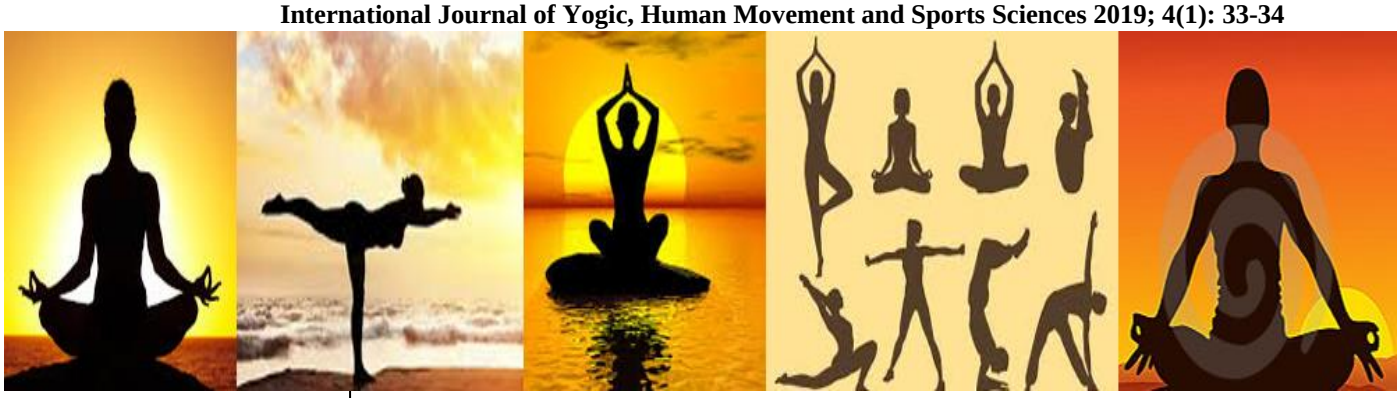

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Kinematic analysis of take-off in triple jump of two Indian international level jumpers

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Abstract
The purpose of the study was to give an account of the various kinematic parameters of take-off in triple jump and their relationship with the performance of the jumpers. Two male triple jumpers participated in this study one of which had Gold medal in the 2018 Asian games while the other participant was a bronze medalist in the Commonwealth games. The data was recorded with a video camera that recorded at 50 fps. Kinematic variables were extracted with motion analysis software (Silicon coach pro ver-8). The relation between the investigated kinematic parameters and the triple jump performances were calculated using the Karl Pearsons coefficient of correlation. This study found that hip joint angle at take-off and take-off time correlated negatively with the triple jump performance of the jumpers with values of correlation -0.441 and -0.407 respectively.

Keywords: Kinematic, jump, hip joint, take of time

Introduction
Triple jump is one of the three jumping events in the track and field. A triple jump performance starts with an approach run fallowed by three complex movements that include hop, step and jump compared to long jump which only has one touchdown after the take-off. Triple jump is an asyclic - movement in structure, and a very demanding and complex athletic discipline characterized by a very high unity of motor skills and abilities (speed, explosive power, coordination, flexibility balance) that are precisely crucial for a successful performance (Pavlovic, 2018) [1]. The distance of the third jump is crucial, how to make the distance of the third jump farther is an important means to improve the overall performance. The take-off angle of the third jump is also crucial the performance of the triple jump. (Jin S; Liu F, 2014) [2].

Procedure and Methodology
The problem is entitled Kinematic analysis of take-off in triple jump. Two male triple jumpers participated in this study one of which had Gold medal in the 2018 Asian games while the other participant was a bronze medalist in the Commonwealth games. Testing took place in the track B of NIS Patiala was the two athletes have been training for an upcoming international athletics event. The athletes were allowed to warm-up which included jogging and then stretching exercises. The warm-up session lasted for up to 30 minutes. By the time athletes had finished their warming up the researcher's team had set the recording situation. The two jumpers then did their triple jumps one after the other, with enough time between the jumps to make them recover.30 jumps were recorded from each athlete and the jump length was measured for each attempt. The jumps were the athlete overstepped or did any other fouls; those attempts were discarded and were not used for analysis process. The data was recorded with a video camera that recorded at 50 fps. Kinematic variables were extracted with motion analysis software (Silicon coach pro ver-8). The relation between the investigated kinematic parameters and the triple jump performances were calculated using the Karl Pearsons coefficient of correlation.

Table 1: Relationship between take-off time of triple jumper's hip joint vertical acceleration and their performance

Trials	Variables	Mean	Standard Deviation	Correlation (R) Values
30	Hip joint vertical acceleration	5.109	1.588	0.658
30	Performance	15.527	0.207	

'r'$_{0.05}$(28)= .361 significant at .05 level of significance

The table 1 shows the relationship between the hip joint vertical acceleration of the triple jumpers with their performance. The mean value of take-off is 5.109(s) while the standard deviation is 1.588. A correlation value of 0.6587 was found between the two variables

Table 2: Relationship between take-off times of the triple jumpers with their performance

Trials	Variables	Mean	Standard Deviation	Correlation (R) Values
30	Take-off time	0.195	0.019	-0.407
30	Performance	15.527	0.207	

r'$_{0.05}$(28)= .361 significant at .05 level of significance

The table 2 shows the relationship between the take-off times of the triple jumpers with their performance. The mean value of take-off is 0.195(s) while the standard deviation is 0.019. A correlation value of -0.407 was found between the two variables.

Conclusion

This study claims two relationships of the selected kinematic variables with the performance of the athletes at 7m. The kinematic variables and their correlation values are: hip joint vertical acceleration at the take-off time (r=0.658), take-off time and their performance (-0.407). There was a significant relationship between take-off time and Performance of Indian elite male triple jumpers. Further there was significant relationship between Hip joint vertical acceleration and Performance of Indian elite male triple jumpers.

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