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Kinematic Analysis on Triple Jump Performance of Senior State Men Athletes

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Abstract

The purpose of the study was to assess the effect of 2D kinematical selected variables on triple jump with jumping Performance of senior level state Athlete championship tournament held at Kochi on 2016. Three (3 State level) triple jumpers' athletes from Kerela state have been selected for this study. The mean (M) and standard deviation (SD) of jumpers were age (17.44, 1.55), height (1.74. m, .84 m), weight (62.25 kg, 4.55), arm length (65.00 cm, 3.72) and leg length (96.35 cm, 2.71). Biokin-2D motion analysis system V4.5 can be used for acquiring two-dimensional kinematical data/variables on triple jump with jumping Performance. For the purpose of kinematic analysis a standard motion driven camera which frequency of the camera was 60 frame/ second i.e. handy camera of Sony Company were used. The sequence of photographic was taken under controlled condition. The distance of the camera from the athletes was 12 mts away and was fixed at 1.2-meter height. The result was found that State level athletes significant difference in there, Officially measured distance, Real distance, Loss at take-off (toe-to-board),Loss by landing, Liner velocity, Hop Distance, Step Distance and Jump Distance. whereas insignificant difference was found between State level triple jumpers athletes in their approaches run to landing in triple jumping performance. For all the Statistical test the level of significance was set at $p<0.05$.

Keywords: 2D Kinematic Analysis, Triple jump Performance, Senior state Athletes.

Introduction

The most powerful nations of the world namely USA, Russia, France, Australia, China etc. are strong enough not only in World Economics, Army Strength or in science technology but they are also advanced in the field of sports, therefore it is quite apparent that to exist strongly in world map nation has to be advanced in the field of sports also. To achieve the same adoption of new techniques and methodology is highly required in Sports Sciences and Physical Education. Sciences of applied mechanism are fulfilling these demands of high technological knowledge for the enhancement of performance in the field of sports. Athletes taking up this event should be fast sprinters with great ballistic strength. The event requires the athlete to have good rhythm, balance and agility and the ability to master a complex technique. It is generally thought that the jump event of the ancient Olympics was a 'multi jump', since the record was 16.76m. However, the documented history of the triple jump began in the 18th century where various combinations of three jumps were used. Two hops and a jump was the dominant technique in those early days. The modern triple jump requires a fast run followed by a hop, then a step (bound) and finally a jump into the sand pit.

Kinematics describes the motion of mechanical systems, without considering the Forces that produce that motion. Kinematics deals with velocities and accelerations which are defined for points of interest on the mechanical systems. The description of motion is relative in nature. Velocities and accelerations are therefore defined with respect to a reference frame. Kinematics is the study of motion without reference to force and masses. We will need to learn some definitions: A Scalar quantity is a measurement that has a magnitude only: mass, distance, speed, energy, time. A vector quantity is a measurement that has a magnitude and a direction: position, displacement, velocity, acceleration, Force…Distance (d) is a measure of the separation between two points .It does not include a direction, only the magnitude of the Distance (d) is a scalar quantity .Distance (d) can also be a measure how far an object has moved over a period of time. This is also a scalar quantity.

Triple Jump Technique
1. The Run-up
2. The start should be from standing – for accuracy.
3. The run should accelerate smoothly until the last four strides.
4. The last two strides into take-off are made with a galloping (daa-de) rhythm.

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5. The rhythm of the three jumps is vitally important to gaining good distance.
6. Beginners often demonstrate a long hop and very short step, followed by a medium jump! This pattern is very inefficient. The best distance ratio for a good triple jumper should be approximately: Hop 36% Step 30% Jump 34%.

Methods & Procedures

The subject selected for the study were triple jump men section in state level senior athletic meet Championship 2016, held at Maharajs College Stadium Cochin. The mean (M) and standard deviation (SD) of jumpers were age (17.44, 1.55), height (1.74. m, .84 m), weight (62.25 kg, 4.55), arm length (65.00 cm, 3.72) and leg length (96.35 cm, 2.71).

Selection of Variables

   i. Officially measured distance
   ii. Real distance
   iii. Loss at take-off (toe-to-board)
   iv. Loss by landing
   v. Liner velocity
   vi. Hop Distance
   vii. Step Distance
   viii. Jump Distance

Collection of Data

The data collected by the help of Biokin-2D motion analysis system V4.5 method and the sprinting performance of the subject during jumper start in athletic.

Filming Procedure

Biokin-2D motion analysis system V4.5 can be used for acquiring two-dimensional kinematical data/variables on Jumper Start with Jumping Performance. For the purpose of kinematic analysis a standard motion driven camera which frequency of the camera was 60 frame/ second i.e. handy camera of Sony Company was used. The sequence of photographic was taken under controlled condition. The distance of the camera from the athletes was 12 mts away and was fixed at 1.2 meter height. The performance of sprinters were measured manually hand timing with stopwatch for each subject. Before data acquisition subjects were asked to go for complete warm-up for at least 15 minutes by stretching all major muscle groups for better performing the sprint start. After warming up all the athletes have to perform 100 meters sprint and the time recorded in 1/1000 of the seconds for each athlete was selected for further analysis.

Recording of Data and Analysis

All trials were recorded, but the best valid jump for each athlete was selected for further analysis. The data analysis was done using quintic software.

The placement of the cameras and their filming view
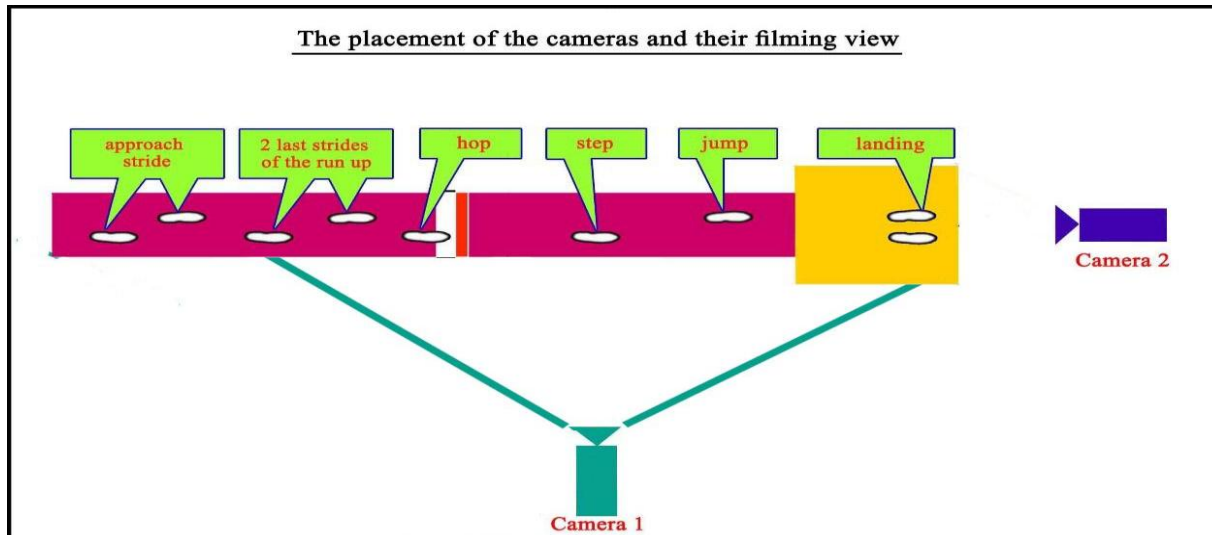
Analysis of Data and Result of the Study

The purpose of the research was to study the kinematic analysis on triple jump performance of the State men triple jumpers. The data collected has been analyzed and presented below:

Name of the Athletes	Attempt	Officially measured (Meters)	Real Distance (Meters)	Loss of take off (Meters)	Hop of distance (Meters)	Step distance (Meters)	Jump distance (Meters)	Loss of landing (Meters)	Linear velocity (Meters)
Swaroop	1	13.71	13.88	0.17	4.69	3.72	5.30	0.00	6.82
	2	13.72	13.84	0.12	5.21	3.22	5.29	0.00	6.80
	3	13.99	14.16	0.17	4.98	3.88	5.13	0.00	6.92
Eldhose Paul	1	13.94	14.08	0.14	4.71	4.65	4.58	0.00	8.25
	3	13.69	13.76	0.07	4.65	4.45	4.59	0.00	8.41
Ajith M.N	1	15.02	15.29	0.27	5.30	4.11	5.61	0.00	7.55

Attempt Results

The above graph shows the performance presentation of jumpers in different attempt during the competition. Under these study there are three participants ;Swaroop, Eldhose and Ajith. Ajith M.N made a better performance among the all three athletes under study. But he made good result (15.02m) in the first attempt later all his jumps were foul. Swaroop made his all the three attempts but he made his good jump at third attempt (13.99m). Eldhose Paul made good result at the first attempt (13.94) which is less than 0.5m of the Swaroop.

Take off Results

The takeoff mark is a board, and in modern championships a strip of plasticize or modeling clay is attached to the board to record athletes overstepping the mark. The first landing has to be done with the takeoff foot. The next phase is a step, landing on the opposite foot, and is followed by the jump, into a sand-filled box, as in the long jump.
1. The hop-dominated technique, where the hop distance is at least 2% of the actual distance greater than the next longest phase distance,
2. The jump-dominated technique, where the jump distance is at least 2% of the actual distance greater than the next longest phase distance, and
3. The balanced technique, where the longest phase distance is less than 2% of the actual distance greater than the next longest phase distance.
4. 4) Best jumper under our study was Ajith M.R he had done a balanced jumping technique.
5. All the three jumpers used balanced technique in their better performance.

Linear velocity Results

Linear velocity: Linear velocity was measured form the approach run of the jumper. An increase in linear velocity which in turn helps in maintained of optimum height for jumping. So maximum is the linear velocity maximum will be the performance (distance) expected from the jumpers.

In the case of liner velocity compare to Ajith M.N and Swaroop the linear velocity of Eldhose was high then also he was placed second in the competition. That may be due to time he took to complete the distance travelled during the jump. But the best performer Ajith M.N took less linear velocity may be due to his fast running to cover the distance of jump.

Conclusion

All the athletes under the study were using balanced jump technique. Best jumper Ajith M.R had used less linear velocity to complete the distance in the triple jump. It may be due to his fast running to complete the distance of the jumping. Real distance was greater for Ajith M.R corresponding to that of official distance. Loss of Take off was maximum for Ajith M.R which may influence in his official distance of jumping. That causes reduction of his official distance. So elite performer should reduce loss of take off which will increase his official distance of jumping.

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