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KINEMATIC ANALYSIS OF FLIGHT IN LONG JUMP AMONG COLLEGE MEN

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ABSTRACT

The aim of this study was to make kinematic analysis of flight in long jump among college men. randomly selected ten long jumpers were determined of their long jump performance (LJP) more than six meters in Andhra Pradesh and their kinematic variables, time between heel strike and toe take off (TBS&TO), angle of lead leg knee while take off (ALKTO), time taken to reach the apex from the floor(TRAFF) and time taken to reach apex to floor(TRAF). The long jump performances of the subjects were measured through 'long jump performance' and the kinematic variables were measured through video graphical analysis and the measures determined through computer-based software 'Silicon Coach'. The results of the study showed mean value of LJP was 5.038 the TBS&TO was 0.1615, the ALKTO was 113.7, the TRAFF was 0.203 and the TRAF was 0.484. The analysis of kinematic variables of flight of long jump with the subjects proved the relationship between LJP with independent variables TBS&TO, ALKTO, TRAFF, TRAF showed there was significant relationship between LPJ with TBS&TO, JPJ with TRAFF, LPJ with TRAF. The results proved that there was no significant relationship between LPJ and ALKTO. The inter-relationship analysis of kinematic variables of flight of long jump of the subjects proved that there was significant relationship between Time taken between heel strike and Toe take off(TBS&TO) and Time from floor to apex (TRAFF), while all other inter-relationships did not brought any significant relationships. It was concluded that there were significant relationship between long jump performance of college athletes with kinematic variables of flight in long jump.

Key Words: Kinematic Analysis and Long Jump

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INTRODUCTION

Human Kinetics, "is the science of human movement. It focuses on how the body functions and moves. A kinesiological approach applies scientific based medical principles towards the analysis, preservation and enhancement of human movement in all settings and populations. Kinesiologists work in research, the fitness industry, clinically, and in industrial environments. Studies on human motion may be supported by computer vision, using stereo camera systems for pose recognition and motion modeling." (Rosenhahn, Klette and Metaxas (2007)

The long jump "is an athletics (track and field) event in which athletes combine speed, strength, and agility in an attempt to land as far from the take-off point as possible. The long jump techniques consists of the approach, the ideal speed, the last two strides, take off, the flight through air, the landing, optimum take off angle," (Bruening DA, and Richards JG. (2006) .

The long jump flight techniques can be observed from "(a) a competitor leaves contact with the ground there is nothing that can be done to alter the flight path of his or her center of gravity. What 'will' affect the distance of the jump is the body position at landing. If a competitor was to leave the ground without taking any action to prevent forward rotation in the air, the body would naturally move into a facedown position as the velocity of the lower half of the body at takeoff is greater than the upper half of the body due to the contact with the ground. The three predominant in-the-air techniques used in the long jump in order of increasing difficulty of execution are the sail, hang, and hitch-kick. (b) the sail technique is one of the most basic long jump techniques practiced by competitors. After the takeoff phase is complete, the jumper immediately lifts the legs into a toe-touching position. This is useful for the novice jumper, as it allows the competitor to move into the landing position early. The downside of this technique is that it does not counter the body's natural tendency to rotate too far forward. (c) The hang technique works by lengthening the body to make it as efficiently long as possible. Here both the arms and legs are extended to reach a maximum distance from the hips. This position is held until after the jumper reaches the apex of the jump, at which point the athlete will snap the legs forward into a landing position. This technique helps to diminish the tendency to tumble forward or lose the extension of the body. Generally the competitor is encouraged to flex the knees at a 90 degree angle, which enables the feet to swing with the fastest possible angular

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momentum when snapping into the landing position. (d) The hitch-kick is also known as 'cycling' or 'running in the air'. As the name might suggest, this technique relies on a cycling action of the arms and legs through the air to maintain an upright body position. This technique takes longer to execute and is therefore generally reserved for more experienced jumpers. In-the-air techniques are generally selected by the athlete and coach during training based on an individual athlete's skills and experience. When landing, it is the primary objective of the competitor to not fall back in the landing pit. The jump is measured from the location in which the body contacts the sand closest to the takeoff point. For this reason many jumpers will work on keeping their feet in front of the body at a maximum distance from the hips. Upon landing, competitors will often use their arms in a sweeping motion to help keep the legs up and the body forward. Generally a jumper will bend the knees upon contacting the ground to cushion the impact on the body." (Bruening DA, and Richards JG. (2006).

Korhonen MT, et.al. (2009) investigated the "age-related decline in sprint running ability through a cross-sectional examination of biomechanical and skeletal muscle characteristics in 77 competitive male sprinters aged 17-82 yr. and concluded Age-related slowing of maximum running speed was characterized by a decline in stride length and an increase in contact time along with a lower magnitude of GRFs. The sprint-trained athletes demonstrated an age-related selective muscular atrophy and reduced force capacity that contributed to the deterioration in sprint running ability with age." Pappas E, et.al. (2007) determined the "effect of landing type (unilateral vs. bilateral) and gender on the biomechanics of drop landings in recreational athletes and concluded that compared to bilateral landings, male and female recreational athletes performed unilateral landings with significant differences in knee kinematic and EMG variables. Female athletes landed with increased knee valgus and VGRF compared to males during both types of landing." Nolan L, and Lees A. (2007) investigated "the adjustments to posture, kinematic and temporal characteristics of performance made by lower limb amputees during the last few strides in preparation for long jump take-off and found unable to flex their prosthetic knee sufficiently, achieved this by abducting their prosthetic leg during the support phase, which led to a large downward velocity at touch-down (-0.6 m x s(-1)). This, combined with their slower approach velocity (7.1 m x s(-1) at touch-down), restricted their performance." Graham-Smith P, and Lees A.(2005) conducted "a three-dimensional analysis of the touch-down to take-off phase in the long jump and to explore the interrelationships between key variables and

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concluded that in the long jump, variables that are important to performance are interdependent and can only be identified by using appropriate statistical techniques. This has implications for a better understanding of the long jump event."

In the light of the previous researches reported it was found that there was further scope for research in finding out the kinematic analysis of flight in long jump among college men.

METHODOLOGY

The randomly selected ten long jumpers were determined of their long jump performance (LJP) more than six meters in Andhra pradesh and their kinematic variables, time between heel strike and toe take off (TBS&TO), angle of lead leg knee while take off (ALKTO), time taken to reach the apex from the floor(TRAFF) and time taken to reach apex to floor(TRAF). The long jump performances of the subjects were measured through 'long jump performance' and the kinematic variables were measured through video graphical analysis and the measures determined through computer-based software 'Silicon Coach'. Simple correlation was computed to analyze to examine the relationship between Long Distance performance and selected kinematic variables through. Pearson's Correlation Co-efficient was calculated separately. Further, correlation matrix was computed to analyze inter- relationship among the selected variables.

RESULTS

Table I shows the mean and standard deviation for the dependent variable, long jump performance and independent variables, time between heel strike and toe take off, angle of lead leg knee while take off, time taken to reach the apex from the floor, time taken to reach the floor from the apex.

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Table-1

MEAN AND STANDARD DEVIATION FOR DEPENDENT AND INDEPENDENT VARIABLES OF COLLEGE MEN LONG JUMPERS

S.No	Variables	Mean	Std. Deviation	N
1	Long Jump Performance (LJP)	5.038	1.066	10
2	Time taken between heel strike and toe take off (TBS&TO)	0.1615	0.011	10
3	Angle of lead leg knee while take off (ALKTO)	113.7	5.599	10
4	Time taken to reach the apex from the floor(TRAFF)	0.203	0.026	10
5	Time taken to reach the floor from the apex(TRAF)	.4680	0.062	10

The Pearson's Correlation Coefficient between dependent variable long jump performance and Time between the heel strike and toe take off, Angle of lead Leg knee while take off, Time taken to reach the apex from the floor and time taken to reach the floor from the apex is presented in Table II.

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Table- II

Pearson's Correlation Coefficient between dependent variable long jump performance with Independent Variables

S.No.	Variables **Long Jump Ability**(LJP) **Vs**	Correlation Coefficient	Level of Signifi-cance
1	Time taken Between heel strike and toe at take off(TBS&TO)	0.623*	<0.05
2	Angle of lead leg knee while take off(ALKTO)	-0.127	NS
3	Time taken to reach the apex from the floor(TRAFF)	-0.711*	<0.05
4	Time taken to reach the floor from the apex(TRAF)	-0.666*	<0.05

Table value required for 9 df for significant at 0.05 and 0.01 levels are 0.602 and 0.735

Table- III

THE INTER-RELATIONSHIP CO-EFFICIENT MATRIX TO ANALYSE AMONG CRITERION VARIABLES SELECTED

	TBS&TO	ALKTO	TRAFF	TRAF
Long Jump Ability(LJP)	0.623*	-0.127	-0.711*	-0.666*
Time taken between heel strike and Toe take off(TBS&TO)		-0.333	-0.603*	-0.482

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Angle of Lead Leg knee(ALKTO)			-0.346	0.467
Time from floor to apex(TRAFF)				0.215

* Significant

DISCUSSIONS

Table I shows the mean value of long jump performance was 5.038 the time between heel strike and toe take off was 0.1615, the angle of lead leg knee while take off was 113.7, the time taken to reach the apex from the floor was 0.203 and the time taken to reach the floor from apex was 0.484. The analysis of kinematic variables of flight of long jump with the subjects proved the relationship between LJP with independent variables TBS&TO, ALKTO, TRAFF, TRAF showed there was significant relationship between LPJ with TBS&TO, JPJ with TRAFF, LPJ with TRAF. However, the results proved that there was no significant relationship between LPJ and ALKTO.

The inter-relationship analysis of kinematic variables of flight of long jump of the subjects proved that there was significant relationship between Time taken between heel strike and Toe take off(TBS&TO) and Time from floor to apex (TRAFF), while all other inter-relationships did not brought any significant relationships.

CONCLUSIONS

It was concluded that there were significant relationship between long jump performance of college athletes with kinematic variables of flight in long jump.

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