

ANALYSIS OF CENTER OF GRAVITY WITH THE PERFORMANCE OF ELITE LONG JUMPERS

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Abstract: The relationship was carried out to study takeoff's center of gravity with elite long jumpers' performance. For this research, ten male long jumpers of Manipur national level and University level from the track and field match practice in different groups able to perform more than 4 meters, first purposively as the subject from match practice long jumper and then randomly selected the 10 subjects according to best performance for the study and their range of age was between 19 to 25 years. Pearson's product-moment correlation was used to determine the relationship between the center of gravity at takeoff and the performance of the long jump. For testing the hypothesis, the level of significance set at 0.05 was employed with the help of the statistical IBM SPSS-20 version, where it was hypothesized that there might be a significant association between the center of gravity at takeoff and the performance of the long jump. For this, through the segmentation method, the center of gravity was determined to see the association with the performance of the long jump. After applying product-moment correlation, the obtained value of correlation (i.e., $r=1.000$ and $-.231$) for 7 degrees of freedom, only the height of the center of gravity at takeoff of the subjects was greater than the required value of 0.666 at 0.05 significance level. The center of gravity of height of takeoff has exhibited no significant association with the performance of subjects at takeoff. Therefore, the research study revealed that there is a significant relationship between the center of gravity (height of cg of the body) and the performance of the long jump.

Key words: Videography, height of center of body, center of gravity of body and performance.

Introduction: The term athletics is derived from the Greek word "ATHLON," which means a contest, and the word "ATHLETE" denotes a person who takes part in a sort of contest involving physical activity. The modern long jump, standardized in England and the United States around 1860, bears a resemblance to the ancient event, although no weights are used. Athletes sprint along a track length leading to a jumping board and a sandpit. The athletes must jump before a marked line, and their achieved distance was measured from the nearest point of sand disturbed by the athlete's body. The event was created and included in the Olympics because it was deemed necessary for warriors to be agile and able to avoid obstacles, such as leaping across ditches or

streams. The modern Olympics started in 1896; the first long jump gold medal winner was Ellery Clark who jumped 6.35 meters.

Biomechanics is an applied form of mechanics, and consequently, the methods used to investigate it must be derived from those of mechanics. However, Biomechanics has not developed in the wake of mechanics but as a bordering science in other scientific disciplines such as Anatomy, Psychology, and the technique of sport.

Kinematics is the branch of biomechanics that describes the motion of bodies. Thus, kinematics deals with how far a body moves, how fast it moves, and how consistently it moves. It is not concerned with what causes a body to move in the way it does. This latter aspect of motion is the preserve of kinetics—a complementary branch of biomechanics. Linear kinematics deals with the kinematics of translation or linear motion, while angular kinematics deals with the kinematics of rotation or angular motion.

The study's main objective is to determine the relationship between the center of gravity variables and the horizontal distance performance of long jumpers.

Hypothesis of the Study: It was hypothesized that there might be no significant relationship between selected center of gravity variables and horizontal distance of long jumper performance.

Method and procedure:

The photographs obtained by digital photography were analyzed using a standard analysis method using Kinovea software version -08.25 and a segmentation method suggested by **James G. Hay**. The researcher only analyzed one movement execution. Simultaneously, experts were asked to evaluate the moment and horizontal distance subjectively.

Selection of subject: 10 long jumpers were selected as subjects. Elite male long jumpers who had represented the National and University levels were selected as subjects based on performance preceding competition and their age range between 19-25 years.

Center of Gravity: The center of gravity of the human body may be defined as the point of exact center, around which the body may rotate freely in all directions.

Selection of variables:

- height of cg of body
- cg of body
- horizontal distance

Criterion measure: The criterion measure for this study was the performance of the long jumper, and the researcher gave a total of six attempts to each subject. The performance of each jump was judged accurately, and performance was recorded. For this, through the segmentation method, the center of gravity was determined to see the association with the performance.

Filming protocol:

The researcher's motion capture technique / digital videography was used to analyze the kinematics variables of 10 male long jumpers. A digital video camera, a Sony A7S IV, was used to videotape the subject's long jump performance, recorded with a stroboscopic effect from approach to landing.

Statistical procedure:

The researcher collected data was entered into an Excel sheet, and statistical analyses were conducted using the IBM SPSS 20 version. The normality of statistical distribution was tested by using descriptive statistics, mean, standard deviation, and Pearson product-moment coefficient correlation statistical techniques were calculated between the selected center of gravity variable

with the performance of 10 male long jumpers. In order to check the significance level, it was set at 0.05 percent.

Result:

Table 1
Average Height Of Center Of Gravity At (Height Of Cg Of Body And Cg Of Body)

S.no.	Center of Gravity (height of cg of body) in mt	Center of Gravity (cg of body) in mt
1	0.59	1.53
2	0.62	1.67
3	0.59	1.77
4	0.47	1.5
5	0.62	1.6
6	0.65	1.5
7	0.62	1.54
8	0.79	1.55
9	0.6	1.61
10	0.67	1.5

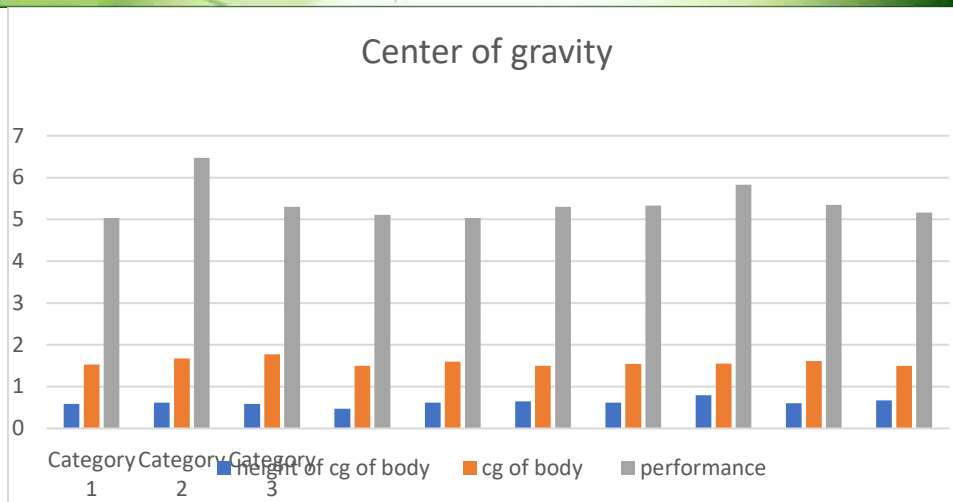


Fig 1: Graphical representation of Average height of center of gravity at (height of cg of body and cg of body)

Table 2: Coefficient of Correlation (r)

Variables	N	Mean	SD	Correlation (r)
Height of center of gravity of body	10	.56	0.05	1.000
Center of gravity of body	10	1.57	.08	-.231
Performance	10	5.39	.44	

'R' 0.05(7) = 0.666, significant at 0.05 level of significance.

Table 2 shows that mean and standard deviation (SD) value height of center of body was 0.56_+0.5 respectively and 1.57_+ 0.08 for center of gravity of body respectively. But in performance of long jumpers the mean and standard deviation (SD) value is 5.39_+0.44 respectively. At the time calculation of relationship between height of center of gravity with the performance of long jumpers the (r) value was 1.000 it is greater than the tabulation value. The outcome does recommend that there is significant relationship between height of center of gravity of body with performance of long jumpers and center of gravity of body with performance of long jumpers the (r) value was -.231 it is lesser than the tabulation value, the outcome does recommend that there is insignificant relationship between center of gravity of body with the performance of long jumpers.

Discussion and finding:

The result of the study inform that there was significant relationship between height of center of gravity of body with the performance long jumpers as the obtained $(r) = 1.000$ was greater than the tabulation value $(r) = 0.666$ at 0.05 level of confidence, there was significant relationship between height of center of gravity with the performance of long jumpers and center of gravity of body with performance of long jumpers as the calculated $(r) = -0.231$ was lesser than the tabulated $(r) = 0.666$. On the basis of the data researcher found that the earlier study of Dr. Ranjit Singh Rawat and Dr. Rakesh Yadav “Relationship of center of gravity with the performance of jump shot high in team handball” supported the present study.

Conclusion:

On the basis of the finding of the study the following conclusions are drawn: mean, standard deviation and score of height of center of gravity of body have been found as the mean and standard deviation was is $0.56_{+0.5}$ and performance of long jump was $5.39_{+0.44}$ and the mean and standard deviation was for center of gravity of body was $1.57_{+0.08}$ and performance of long jumpers was $5.39_{+0.44}$ respectively.

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