2d Kinematical Analysis with the Performance of Smash Shot on Badminton Players

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***Abstract*—The purpose of the study was to investigate the relationship of selected kinematic variables with the performance in Badminton Jump Smash. The subjects for the study were the eight best male Badminton players of Lakshmibai National Institute of Physical Education, N.E.R.C Guwahati, who had a good command of the particular skill. Their average height and weight were [168.2 ± 5.118cm] and [67.6 ± 4.613kg] of mean and standard deviation respectively. The videography technique was employed to register the performance of the subjects in the preparation and point of contact phase of the badminton jump smash. The iPhone 11 camera and the subjects were videos graphed in the sagittal plane from the right side. Each subject was given three trials and the best trial was used for analysis. The selected phases were taken out from the video by using kinovea software. From the photographic sequence, the stick figures of selected movements were prepared by using a human modal in kinovea software, and the linear kinematic variables (CG at preparation and point of contact phase) were obtained from Jump Smash. A stick modal of kinovea software was employed to assess the Centre of gravity of the body during a badminton jump smash. The best performance of jump smash was used as the criterion measure for the study. The data were analyzed by using Pearson's moment product correlation to ascertain the relationship of the selected kinematic variables with the performance in jump smash. The biomechanical variable was linear kinematics i.e., the height of the Centre of gravity at the preparation phase and point of contact phase of the badminton jump smash, total time taken during performing the whole technique.**

***Index Terms*—Kinematical Analysis, Biomechanics, Jump Smash, Centre of Gravity etc.** *(key words)*

I. INTRODUCTION

Biomechanics is the investigation of powers and their consequences for the living framework, while exercise and sports biomechanics is the investigation of powers and their impacts on people in exercise and games. Utilization of Biomechanics may prompt execution improvement of the decrease and restoration of damage through improved technics, gear, or preparation. (McGinnis, Peter M., 2005). The inside and outside power following up on a human body decide how the pieces of that body move amid the execution of the motor skills. They decide, so, what is ordinarily alluded to, as the player's technique. (Uppal, A.K., 2009). According to (Brahms 2014) approx. 75% of a player's range is in the forehand area and 25% is in the backhand area. (Brahms, 2014).

There are six important strokes in Badminton, with the exclusion. Out of these six strokes, the Smash is an emblematic and powerful aggressive Badminton technique to defeat the opponent. Here, smash can be defined as a short to word the adversary's court with a downward power and speed where the angle of the shuttlecock path is very sharp. (Yap, 2012). The main aim of this research thesis observes the forehand overhead smash is not only the most communal technique used during Badminton rallies[1] but as well often decides the champion of the game[2]. You have to have some idea of the "Centre of gravity" to understand badminton biomechanical principles. The Centre of gravity is a point in the body, which is pivotal in balancing the entire body. At that point, your body will be in perfect balance without any need to change posture or rotate to keep it in balance.

Therefore, the present study aimed to analyse the relationship of the selected kinematic variable with the performance of jump smash in Badminton. By analysing the phases of preparation position to the point of making contact with the shuttle.

Statement of the Problem

The purpose of the study was to analyse the relationship of the selected kinematic variable with the performance of jump smash in Badminton. By analysing the phases of preparation position to the point of making contact with the shuttle.

Objectives of the Study

To compare and correlate the performance of forehand jump smash with selected linear kinematic variables.

Delimitation

1. The study was delimited to a total of eight (N= 8) badminton players
2. The study was delimited to 18 to 24 years old professional badminton players only.
3. The study was further delimited to LNIPE NERC male athletes.
4. The study was further delimited to the following linear kinematics variables.

Linear kinematic variables of Jump Smash in Badminton: -
1. Height of Centre of Gravity at preparation.
2. Height of Centre of Gravity at contact.

II. METHODOLOGY

For the present study a total of eight (N=8) i.e., male badminton players belonging to Lakshmibai National University of Physical Education, Guwahati were purposely selected. Their average height and weight were [168.2 ± 5.118cm] and [67.6 ± 4.613kg] of mean and standard deviation respectively. All the subjects selected for the present study were free from injuries as well as chronic diseases. Their consent was also taken into consideration before collecting the final data.

The following variables were selected in the cast on the execution of the forehand jump smash purpose of the study.

Performance Variable: -

Performance of badminton jump smash.

Linear Kinematic Variable: -

CG at Preparation.

CG at Point of Contact.

A. Criterion Measures

Badminton Smash Performance: - Badminton Skill Test for the Smash developed by Boldrick was used to give the target score out of five (5), along with the subjective score given by judges. Each player was given 3 trials, and all the judges score them accordingly out of five (5) and a combined score (Target Score + Judge Score) of 10 was taken and an average is taken as the final performance.

Centre of Gravity: - Centre of Gravity during preparation and point of contact during smash was evaluated using Kinovea software.

B. Administration of the Test

Purpose: - To measure the performance of Badminton Jump Smash.

Equipment: - Racket, Shuttle, measuring tape, marking tape.

Procedure: - The subjects were assembled and briefed about the procedure of the test. They were given time for proper warm-up followed by time for knocking with the shuttle so that they get familiarized with the playing environment. Each subject was given 3 trials and the shuttle was fed evenly. They have to perform a badminton jump smash to the target area and were marked accordingly. Three judges were assigned to score the test. The target area score along with the judge's subjective score based on the quality of the smash was also taken into account.

Scoring: - Designated areas were marked accordingly points were distributed. When the shuttle fell on the line, a higher point was awarded, the target score and Judge's subjective score both were given separately out of five and a combined score out of ten was taken. The best among the three average combined scores was taken as the final performance.

C. Procedure of Collection of the Data

For purpose of the study the selected subjects [N=8] were early informed about the date and time of the test. On the day of the test, the researcher assembled the subjects and give all the instructions regarding the procedure and administration of the test. Before the test proper warmup was given to the subjects. All the test committee members were assigned their work. One by one all the tests would be conducted properly, and accurately and data would be recorded. The test was conducted in the evening time.

D. Experimental Protocol

A proper warmup was conducted before the test. Players did some shadow movements as well as knocking with the shuttle before the test. The test would be taken in a real-time situation of playing the shot. Proper videography would be there for minimum error data collection. White tape was placed as markers on joints to assist during analysis in kinovea software.

Figure 1- Placement of white tape marker on Reference Point

Figure 2- Height of Centre of Gravity in the Preparation Phase of Jump Smash

Figure 3- Height of Centre of Gravity in Point of Phase of Jump Smash

E. **Camera Specification**

• Dual 12MP Ultra-Wide and Wide cameras
• Wide: *ƒ*/1.8 aperture
• Ultra-Wide: *ƒ*/2.4 aperture and 120° field of view
• 2x optical zoom out
• Digital zoom up to 5x

F. **Data Reduction**

A window-based kinovea motion analysis system (version 0.827 x64) software package was used to reduce data from film to make separate clips of some biomechanical variables. The Centre of gravity of the player is measured by kinovea software.

The particular frame was used to analyse the shot during the following phases: -

Preparation Phase: - It is a frame just before the body starts making the first upward movement for the jump.

Point of Contact Phase: - It is a frame just before the shuttle starts leaving the racket in a downward trajectory.

G. **Software Analysis**

For CG the Kinovea motion analysis system (0.827x64) was used.

H. **Statistical Technique**

To find out the relationship of selected biomechanical variables with the performance of the Badminton Jump Smash. Correlation coefficient 'r' will be applied to see the relationship between the selected biomechanical variables and the performance of the Badminton Jump Smash at 0.05 level of significance with the help of SPSS software.

III. Analysis of Data and Result of the Study

The data were collected on 8 badminton players following the standard procedure. Pearson's product-moment correlation was used to find out the relationship between selected kinematic variables with the performance of Badminton Jump Smash. To test the hypothesis, the level of significance was set at 0.05.

The score of each independent variable of linear kinematic variables was correlated with the performance of subjects in Badminton Jump Smash. The movement used for analysis was the preparation and point of contact phase. The outcome of the study has been shown in table 2 and table 4.

References

There are no sources in the current document.

Table no1: Shows the Descriptive Statistics of Performance and Centre of Gravity (at the Preparation Phase)

TABLE NO 1	Mean	Std. Deviation	N
Performance	7.2575	1.98880	8
CG_Preperation	81.8687	6.89414	8

Table no 2: Shows the relationship of the centre of gravity (at the Preparation phase) with the performance of badminton jump smash

TABLE NO 2		Performance	CG_Preperation
Performance	**Pearson Correlation**	1	.186
	Sig. (2-tailed)		.658
	N	8	8
CG_Preperation	**Pearson Correlation**	.186	1
	Sig. (2-tailed)	.658	
	N	8	8

*Significant at 0.05 level of significance CG – Centre of Gravity

Since the value of the coefficient of correlation is required to be significant at less than 0.05 level of significance. The above table clearly shows that the statistic of the Centre of gravity at the Preparation phase and Performance was greater than the 0.05 level of significance and therefore linear kinematic variables did not show any significant relationship with the performance of subjects in Badminton Jump Smash. In this case, the null hypothesis which was formulated to test the research hypothesis failed to be rejected at a 0.05 level of significance.

Table no 3: Shows the Descriptive Statistics of Performance and Centre of Gravity (at the Point of Contact Phase)

TABLE NO 3	Mean	Std. Deviation	N
Performance	7.2575	1.98880	8
CG_POC	140.7046	9.55379	8

Table no 4: Shows the relationship of the centre of gravity (at the Point of Contact phase) with the performance of badminton jump smash

TABLE NO 4		Performance	CG_POC
Performance	**Pearson Correlation**	1	-.171
	Sig. (2-tailed)		.685
	N	8	8
CG_POC	**Pearson Correlation**	-.171	1
	Sig. (2-tailed)	.685	
	N	8	8

*Significant at 0.05 level of significance CG – Centre of Gravity; POC- Point of Contact

Since the value of the coefficient of correlation is required to be significant at less than 0.05 level of significance. The above table clearly shows that the statistic of the Centre of gravity at the Point of Contact phase and Performance was greater than the 0.05 level of significance and therefore linear kinematic variables did not show any significant relationship with the performance of subjects in Badminton Jump Smash. In this case, the null hypothesis which was formulated to test the research hypothesis failed to be rejected at a 0.05 level of significance.

DISCUSSION OF FINDINGS

The relationship of the selected linear kinematic variable (Height of CG at the selected moment i.e., at the preparation and point of contact) with the performance of the subjects at the selected moment was found insignificant. As in this study, the researcher was only confined to the relationship of the height of CG at a selected moment with the performance of the subject in Badminton Jump Smash but a significant relationship may be obtained by studying the path of displacement of C.G in the whole moment.

Numerous similar types of studies have addressed the descriptive and causing (kinematic and kinetic) aspects of different games and sports during the last decade and the researchers found an insignificant relationship between the independent variables (selected kinematics) and dependent variables (sports performances) except very less kinematic variables[3–6]. Whereas, the researcher [7] has found a significant relationship between all the selected kinematic variables with the performance of flick in hockey.

On the whole, it may be ascertained that the low value of the coefficient of correlation shown by the selected variables does not mean that these variables are not contributing to the performance of subjects in Badminton Jump Smash, however, the insignificant value of the coefficient of correlation of these variables with the performance may be due to small sample size level of performance and non-availability of sophisticated equipment's.

CONCLUSION

Based on the analysis and within the limitation of the present study following conclusions were drawn:

All the selected linear kinematic variables also did not show any significant relationship with the performance in Badminton Jump Smash.

RECOMMENDATION

Based on the conclusions drawn in this study, the following recommendations have been made:

1) The results of this study may be helpful for the analysis of other skills in badminton.
2) The results may be used by the badminton players for self-evaluation of their techniques.
3) Similar studies can be conducted using cinematography, multidimensional photographic, and video graphic techniques.
4) The study may also be conducted on different age levels, performance levels, and sex for comparing the performance.
5) The finding of the present study may be helpful to badminton players to know the correct way of executing the skill.
6) A study of similar nature can be conducted on International Badminton players.
7) A similar study can be conducted in a larger subject group with the same variables.

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