



## A procedures of badminton: An overview of biomechanical analysis

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### Abstract

The field of Biomechanics focuses on the forces exerted on the human body and the resulting effects. Physical educators and coaches are particularly interested in understanding these forces and their impact. Badminton is a racquet sport that involves hitting a shuttlecock across a net using racquets. While it can be played with larger teams, the most common variations are singles (one player per side) and doubles (two players per side). Badminton is often enjoyed as a casual outdoor activity in yards or on beaches, but formal games take place on indoor courts. The objective of this study is to conduct a comparative biomechanical analysis of forehand services in badminton. The research specifically focuses on individuals aged 18 to 25 years. The study is limited to only 10 male subjects from LNPE who have participated in Interuniversity competitions. Additionally, all players in the study are right-handed. The angular kinematic variables being examined include the angle at the right wrist joint, angle at the right elbow joint, angle at the right shoulder joint, angle of the racket during shuttle contact, angular velocity at different points of the right arm, and the release angle of the shuttle. The linear kinematic variables being analyzed are the velocity of the shuttle and the height of the center of gravity during the execution of badminton techniques.

**Keywords:** Forehand services, Angular Kinematic, Linear Kinematic, biomechanical analysis, badminton

### Introduction

Physical education is a discipline that focuses on the body and its relation to scientific principles. Its program is based on systematic knowledge and the general laws inferred from it. The growth of the physical education program takes into account various aspects of growth and development, including psychological, biological, sociological, and physiological factors. Its aim is to help young individuals become healthy citizens and develop the ability to enjoy a balanced and energetic life. Biomechanics, as a scientific field, deals with the forces acting on the human body and their effects. Physical educators and coaches are concerned with understanding these forces and their impact. Their ability to teach the basic techniques of sports or physical activities relies heavily on their understanding of these effects. Biomechanics also explores the mechanical basis of biological activities, particularly muscular activity, and studies the underlying principles. It applies mechanical laws to living systems, especially the locomotor system of the body, and examines the formation and function of biological systems using the methods of mechanics. Sports biomechanics, on the other hand, is a quantitative and scientifically-based analysis of athletes' performance on the ground. It utilizes scientific methods and mechanics to study the outcomes of various factors on sports performance. Badminton is a racquet sport that involves hitting a shuttlecock across a net using racquets. While it can be played with teams, the most common forms of the game are singles (one player per side) and doubles (two players per side). While badminton is often played casually outdoors in yards, beaches, or on roads, formal games are played on rectangular indoor courts. Points are scored by hitting the shuttlecock with the racquet and landing it within the opposing side's half of the court.

### Review of Literature

Ahmed and Ghai (2020) conducted a comparative biomechanical analysis on three different badminton forehand overhead shots. The objective of this study was to determine if there are any variations in the badminton forehand shot. Badminton is a highly popular racket sport worldwide, and numerous research studies are being conducted to enhance the performance of badminton players. The researchers selected three forehand shots for their investigation, namely the Forehand Smash, Clear, and Drop. They performed two biomechanical investigations using a sample of 10 randomly selected subjects from a group of 78 badminton players. The research focused on three variables: Forehand Clear, Forehand Smash, and Forehand. The researchers utilized a standard badminton court, non-feather shuttlecocks, and standard rackets. Data collection was done using a Go-pro Hero camera positioned at a height of 1.05 meters and placed 3.20 meters away from the performing area during the point of contact phase. The collected data was then analyzed using Kinovea 0.8.27 software to extract Stick Figures. One-way ANOVA was employed as the statistical tool. The researchers successfully identified differences among all three variables. Rusdiana, A., Abdullah, R.M., Syahid, A., Haryono, T., & Kuriano, T. (2021) transported study on "overhead badminton backhand and forehand smashes: A biomechanical reasonings approaches". Smash hit is a effective arm to catch points in a badminton game. The experience record for smash speed is owned by Fu Haifeng, a Chinese doubles performer the one realized the shuttlecock speed of 332 km/h at the June 2005 Sudirman Cup showdown. Meanwhile, the fastest backhand smash was administered by Taufik Hidayat, an Indonesian performer the one achieved a golden reward at the 2004 Athens Olympics and attained the shuttlecock speed of 206 km/h. The purpose of study search out resolve the motion of overhead forehand and backhand smash stroke methods in a

badminton game utilizing a biomechanical reasoning. The results were resolved utilizing a explanatory and all-inclusive approach. Furthermore, 18 male Indonesia badminton internal crew elite performers accompanying an average age of  $24.4 \pm 1.89$  age, climax of  $1.77 \pm 0.19$  m, and burden of  $66.35 \pm 3.7$  kg were working. The research was transported utilizing 3 nearby cams, a gallop bob advancement reasoning operating system a measurement set, an mechanical shuttlecock launcher gunfire vehicle, and a speed sonar piece. The dossier normalization from the kinematics principles of the wrist joint, elbow joint, and elbow joint motion was premeditated utilizing the opposite action form. In addition, of highest quality-habit ANOVA test was used to label the distinctnesses in the kinematics of motion middle from two points two various groups (overhead forehand and backhand smashes). The acquired consequence displayed that the shuttlecock speed all the while the forehand smash was in addition to all the while the backhand smash. During the maximum jostle outside turn development, two determinants were establish to have best choice results all along the forehand smash, that is, the speed of jostle outside turn and wrist palmar flexion. During the maximum bent speed stage, the speed of push within turn, elbow enlargement, and radius supination was larger when making a forehand smash stroke. The main gift to above appendage motion all along overhead backhand and forehand smashes were the within turn speed of The elbow bent continuation, the jostle joint, and wrist falmar flexion.

**Statement of the problem**

The purpose of the study was the approximate biomechanical study of forehand duties or producers in badminton.

**Objective of the study**

The objective of the study searches out resolved the biomechanical distinctnesses 'tween the three picked forehand duty methods or service techniques in badminton.

**Research Questions**

Are skilled dissimilarities in Forehand long aid, flip duty and short aid as a whole the undeviating kinematic variables? Are skilled dissimilarities in Forehand long duty, tap help and short aid completely the bent kinematic variables?

**Delimitations**

The study will be enclosed to the following:

1. The age groups of the issues age ranges from 18 to 25 age were naive to concern.
2. The study was demarcated to only 10 male badminton performers.
3. The right give performers were captured into concern.

**Hypothesis**

1. It was speculated that skilled hopeful meaningful distinctnesses betwixt three various forehand aids in bent kinematics variables.
2. It was speculated that skilled hopeful meaningful dissimilarities 'tween three various forehand aids in uninterrupted kinematics variables.
3. It was speculated that skilled hopeful meaningful dissimilarities 'tween three various forehand duties in bent velocities.

**Purpose and Significance of the study**

1. This study ability support counseling to coaches or material educators in addition to badminton
2. Performers to solve effectiveness all along badminton duty.
3. The study ability again supply biomechanical guide to coaches or material educators or to badminton performers to evaluate the duty accomplishment of some badminton performer.
4. This research was plateful the performers to accept highest in rank biomechanical method to do the shuttle.

**Procedures**

In this affiliate the election of matters, election of variables, test measures, dependability of dossier, presidency of test, and accumulation of dossier, the methods secondhand for reasoning is defined.

**1. Selection of Subjects**

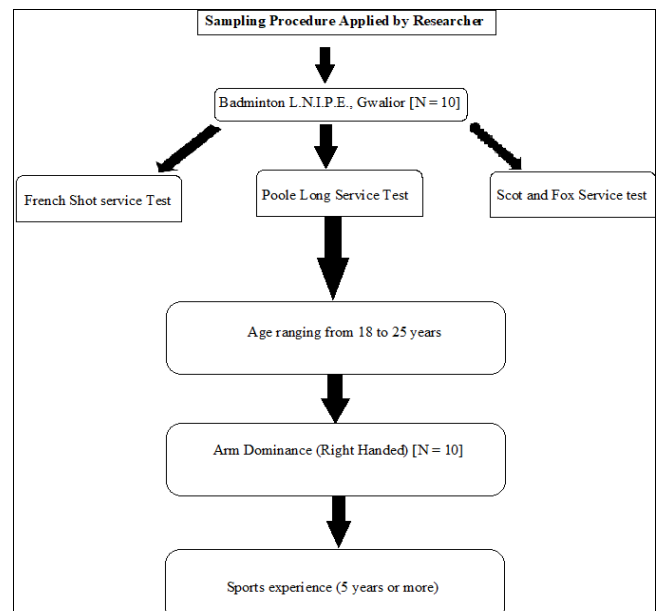
Total [n=10] cases from Badminton Match practice group L.N.I.P.E., Gwalior were picked for the purpose of the study the one played not completely in interuniversity entertainment accompanying the age varying from 18 25 age outdated.

**2. Selection of Tests with Justification:**

The following tests were working for the purpose of the study

1. French short help test: To measure the short aid skill.
2. Poole's long help test: To measure the long aid strength.
3. Scoot and deceive do test: To measure tap duty capability.

**3. Selection of Kinematics Variables**



**4. Angular Kinematic Variables**

1. Angle at right wrist joint
2. Angle at right elbow joint
3. Angle at right push joint
4. Angle of commotion all the while shuttle contact
5. Angular speed at various cheap hangouts legitimate arm
6. Release angle of shuttle



The issues substitute right duty court (X) and do having twelve of something shuttles. The servers attempt to do over the widespread commotion of a graduate the one replace square (O) in mark court. The subject be contingent on the square acts as the "rival" as he assists in the notch by vocation "reduced" of some shuttle that does not travel welcome fight. Counting of score Each duty was succeed in accordance with the district at which point the shuttle falls. The best ten in another direction having twelve of something do were considered. A perfect score was 50. The lawfulness of the test was 0.51 and dependability of the test was 0.81. Shuttle striking vulnerable were likely the taller points advantage. One was deducted for some shuttle that forsakes to clear the support fight of the performer standing at "O" position.

**3. Modified Scott and fox Flick Serve Test**

**Aim**

To measure the skill to act tap serves. Badminton commotion and shuttles were necessary Marking of the court. With the stain, arcs were fatigued outward from the crossroads of the abandoned single side line and the long duty line.

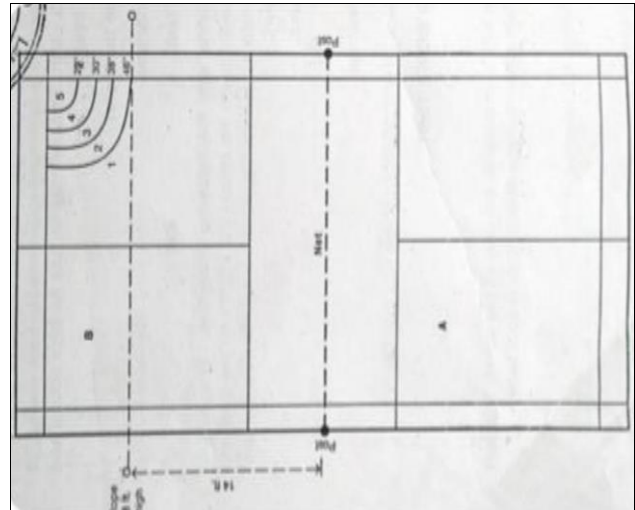
The arcs were tense at distance of 22, 30 and 46 inches from the center. Each distance contains the breadth of the 2-fingerbreadth lines. A cord was extended across the court at a climax of 8 ft. and distant of 14 ft. from computer network. Procedure of the conduct of the test.

The subject (A) replace the aid court crosswise opposite the aim and attempts to do over the cord into the corner of the court that hold the goal zones. The shuttle must disregard the entice order to score points. Only the allowable serves expected as trail. The mark zones were apparent in accordance with the point's profit.

**Counting of Score**

Twenty shuttles were dressed; some shuttle dropping smooth was likely the greater point profit. The score for the

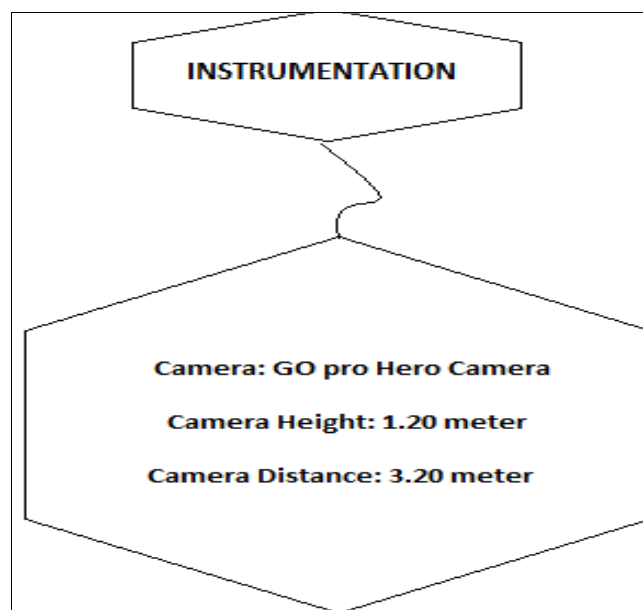
Whole test were the total of the twenty tests. Fouls were periodic. The score (B) endured for fear that performer can decide in any case the shuttle ignore the line. The genuineness of the test was 0.54 and dependability of the test was 0.68 to 0.77.



**Fig 3: Modified Scott and fox flick serve test**

**Experimental filming protocol**

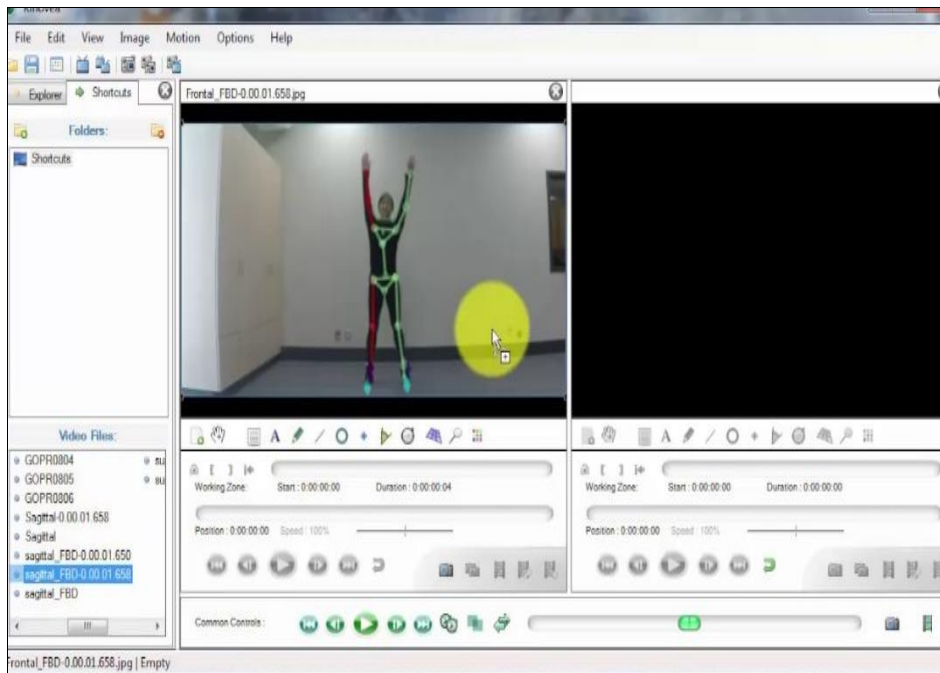
Videography was second-hand for the biomechanical kinematics study of forehand overhead chance. Go supporting Hero camcorder was second-hand for the study. The electronic devices was backed on a stand stand at the climax of 1.20mts from the ground. The photographic equipment was established perpendicularly at side line of badminton court the having a sharp end or part plane and the distance was of 3.20 rhythm. The repetitiveness of the camcorder was 120 frames/second. The issues acted the ability three periods and high-quality trail was naive to concern.



**Kinovea software**

Kinovea is arranged about four gist responsibilities had connection with studying human motion: capture, attention, glossary and calculation. First program was composed from Lakshmbai National Institute of Physical Education,

Gwalior, (M.P.) than all the dossier were digitized by way of Kinovea-0.8. Software. Than stick figures were fatigued by way of the kinovea program and data were derived in mathematical form.



**Fig 4:** Subject performing forehand service

### Reliability of data

To receive trustworthy calculation, the instruments that were exploited for the purpose of the study, photographic equipment, that is to say, stand stand, steel tape, were all standard means applicable at the testing room and secondhand vying Badminton court, racket, shuttle, gravestone handy in badminton gallery of Lakshmibai National Institute of Physical Education, Gwalior, and skilled dependability were ensured apiece manufactures. All calculation concern the kinematic variables were captured for one research philosopher under the supervision of biomechanical specialists and badminton masters were thought-out trustworthy.

### Statistical procedure

Statistical study was accomplished SPSS (Statistical Package for the Social Sciences, 25.0, USA). Mean and predictable difference was deliberate as an explanatory enumerations and as the unchanging group was proven completely the three various environments so, to discover the dissimilarity thoroughly picked Kinematic variables ANOVA was used to check the distinctnesses between the changeable.

### Conclusion

Based on the verdict of the study following decisions were tense; Angle of wrist joint (p-advantage 0.29), elbow joint (p value 0.05), push joint (p-worth 0.770) and climax of C.G. (p-advantage 0.974) were erect unimportant cause the p profit is more 0.05 level of meaning. Wrist joint velocity was establishing important cause the p advantage (0.00) is inferior 0.05 was level of meaning. Difference betwixt Long do and snap do in wrist joint velocity was meaningful, long do and short do in wrist joint speed were important and snap do and short do in wrist joint speed were significant at 0.05 level of meaning. Elbow joint speed was establishing meaningful cause the p profit (0.00) inferior 0.05 was level of importance. Difference 'tween long do and flick do in elbow joint speed was important, long do and short do in elbow joint speed were important and forehand flip do and

short serve in wrist joint speed were meaningful at 0.05 level of importance. Shoulder joint speed was erect meaningful cause the p-worth (0.00) was inferior the 0.05 level of meaning. The difference 'tween long do and tap do in jostle joint speed was meaningful, long help and short do in push joint velocity were meaningful and tap do and short do in jostle joint speed were minor at 0.05 level of importance. Angle of commotion during shuttle contact was establish important cause p advantage (0.00) was inferior the 0.05 level of importance. The dissimilarity 'tween long do and flip serve in angle of fight all along shuttle contact was important, long help and short do in angle of fight all the while shuttle contact was meaningful and tap serve and short do angle of fight all the while shuttle contact was meaningful at 0.05 level of meaning. Releasing angle of shuttle all along long do was establish important cause p value (0.00) was inferior the 0.05 level of meaning. The distinctness betwixt long does and tap do discharging angle of shuttle all the while long do was significant, long help and short do in delivering angle of shuttle all along long do were important and flip do and short issuing angle of shuttle during long do were important at 0.05 level of meaning and Velocity of Shuttle all the while long do was raise meaningful cause p advantage (0.00) was inferior the 0.05 level of significance. The dissimilarity betwixt long does and flip do Velocity of shuttle all along long do was meaningful, long aid and short serve in Velocity of shuttle all the while long do were meaningful and flip do and short Velocity of shuttle all along long do were important at 0.05 level of importance.

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