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## Correlation between angular kinematical variables with the performance of forehand overhead clear in badminton

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### Abstract

The aim of the research was to establish the correlation between joint angles and the efficacy of executing the forehand overhead clear stroke in badminton.

**Methodology:** In this study, the sample group was comprised of twelve male players who were selected from the inter-university or national level. The participants' ages fell within the range of 18 to 25 years. Body angles were meticulously measured using kinovea software, with the data recorded in degrees. Additionally, performance assessments were conducted through subjective evaluations by experienced officials, employing a comprehensive three-judge rating system. Data analysis was carried out using the correlation test, specifically the Pearson correlation method. The significance level for the analysis was set at 0.05, ensuring thorough scrutiny and reliability of the results.

**Conclusion:** Based on the findings of the study, it is determined that there exists a notable discrepancy in the right wrist angle concerning the execution of the forehand overhead clear stroke in badminton.

**Keywords:** Kinematical, forehand clear, badminton

### Introduction

The primary tactic frequently suggested for regaining positioning at center court involves executing a high deep clear. Whenever uncertainty arises, especially in singles matches, opting for a clear is advisable. This defensive maneuver entails a high return resembling a tennis lob in its trajectory. Whether executed with an underhand or overhand stroke, the clear aims to compel the opponent onto their forehand or backhand, driving them deep into the backcourt. Players employ the clear alongside drop shots to induce opponents into covering all four corners of the court while on the defensive.

Strive to strike the shuttlecock promptly, minimizing your opponent's reaction time. Execute overhead and underhand returns at the utmost point of contact. When preparing for a clear shot, raise your racket upward as you position yourself, meeting the shuttlecock with a flat racket and extending your elbow. With the objective of sending the shuttle high and deep, swing your racket forward and upward, leading with your hand. Complete the motion with a follow-through directed towards the bird's trajectory.

In competitive play, the primary advantage of employing the clear is to keep the shuttle out of reach of your opponent and compel them to move swiftly. By positioning the bird behind your opponent or prompting them to move faster than intended, you reduce their available time and increase their fatigue. A well-executed clear forces your opponent to rush their returns for accuracy and effectiveness. An offensive clear is characterized by a flatter, faster trajectory, aiming to place the shuttle behind your opponent and possibly inducing weak returns. Conversely, a defensive clear follows a high, deep path.

### Objective of the study

The study aimed to investigate the joint angles correlate with the execution of the Forehand Overhead Clear during the contact phase in Badminton.

### Methodology

For this particular investigation, the sample comprised twelve male Badminton players from

inter-university and national levels. The subjects' ages ranged between 18 to 25 years. The study specifically focused on right-handed players and their execution of the Forehand Overhead Clear during the contact phase in Badminton.

**Procedure of data collection**

Two Casio EX-F1 high-speed cameras were utilized, with a frame frequency ranging from 60 to 300 frames per second (fps), based on their availability. Data were captured from both the sagittal and frontal planes. Kinovea motion analysis software was employed to analyze the recorded data.

**Statistical procedure**

The study gathered data from twelve male inter university/ national Badminton players for statistical analysis. The correlation test, specifically the Pearson correlation, was employed to compute the data analysis. A significance level of 0.05 was set to evaluate the relationships obtained through the correlation test. All statistical computations were conducted using SPSS software version 20.

**Findings and results of the study**

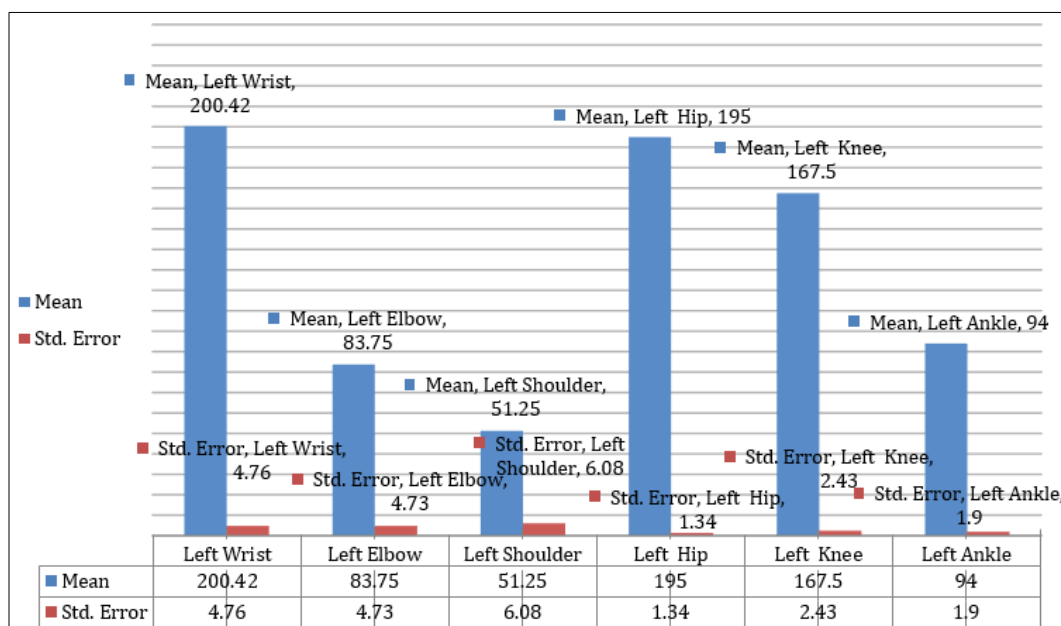
The findings and results of the study were derived from its investigation. The researcher arrived at empirical results, which are depicted in Tables 1 and 2, as well as Figure 1.

**Table 1:** Descriptive statistics of male Badminton players in relation to Right angular kinematical variables of forehand overhead clear stroke in Badminton

| Variable       | N  | Range | Minimum | Maximum | Mean   | Std. Error | Std. Deviation |
|----------------|----|-------|---------|---------|--------|------------|----------------|
| Right wrist    | 12 | 40.00 | 170.00  | 210.00  | 193.00 | 5.52       | 19.12          |
| Right Elbow    | 12 | 14.00 | 149.00  | 163.00  | 155.92 | 1.29       | 4.48           |
| Right shoulder | 12 | 22.00 | 125.00  | 147.00  | 132.75 | 1.71       | 5.93           |
| Right hip      | 12 | 26.00 | 165.00  | 191.00  | 177.75 | 2.30       | 7.98           |
| Right knee     | 12 | 32.00 | 138.00  | 170.00  | 149.08 | 2.68       | 9.30           |
| Right ankle    | 12 | 27.00 | 102.00  | 129.00  | 113.92 | 2.51       | 8.70           |

Table 1 provides clear insights into the mean and standard deviation scores of right angular kinematic variables measured in degrees during the forehand overhead clear stroke in Badminton. Specifically, the mean values for various angles are as follows: right wrist angle at 193.00

degrees and Std. 19.12, right elbow angle at 155.92 degrees and Std. 4.48, right shoulder angle at 132.75 degrees and Std. 5.93, right hip angle at 177.75 degrees and Std. 7.98, right knee angle at 149.08 degrees and Std. 9.30, and right ankle angle at 113.92 degrees and Std. 8.70.



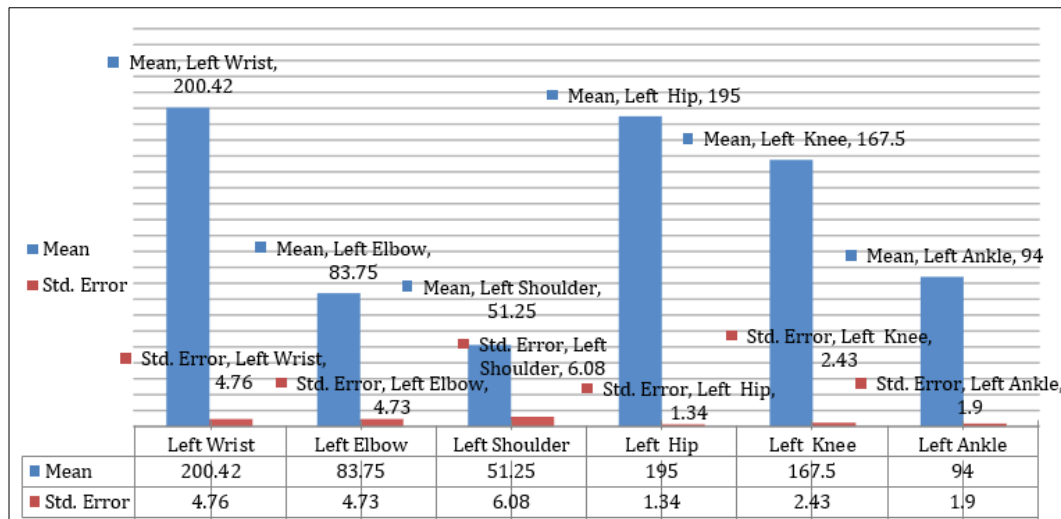
**Fig 1:** Graphical representation of male Badminton player in relation to right angular, Kinematical variables of forehand overhead clear stroke in Badminton

**Table 2:** Descriptive statistics of male Badminton players in relation to Left angular kinematical variables of forehand overhead clear stroke in Badminton

| Variable      | N  | Range | Minimum | Maximum | Mean   | Std. Error | Std. Deviation |
|---------------|----|-------|---------|---------|--------|------------|----------------|
| Left Wrist    | 12 | 57.00 | 168.00  | 225.00  | 200.42 | 4.76       | 16.48          |
| Left Elbow    | 12 | 52.00 | 57.00   | 109.00  | 83.75  | 4.73       | 16.40          |
| Left Shoulder | 12 | 79.00 | 34.00   | 113.00  | 51.25  | 6.08       | 21.05          |
| Left Hip      | 12 | 14.00 | 190.00  | 204.00  | 195.00 | 1.34       | 4.63           |
| Left Knee     | 12 | 27.00 | 151.00  | 178.00  | 167.50 | 2.43       | 8.43           |
| Left Ankle    | 12 | 20.00 | 86.00   | 106.00  | 94.00  | 1.90       | 6.58           |

Table 2 provides clear insights into the mean and standard deviation scores of left angular kinematic variables measured in degrees during the forehand overhead clear stroke in Badminton. Specifically, the mean values for various angles are as follows: left wrist angle at 200.42

degrees and Std. 16.48, left elbow angle at 83.75 degrees and Std. 16.40, left shoulder angle at 51.25 degrees and Std. 21.05, left hip angle at 195.00 degrees and Std. 4.63, left knee angle at 167.50 degrees and Std. 8.43, and left ankle angle at 94.00 degrees and Std. 6.58.



**Fig 2:** Graphical representation of male Badminton player in relation to left angular, Kinematical variables of forehand overhead clear stroke in Badminton

**Table 3:** Relationship of Right Angular Kinematical Variables with the Performance of Forehand Overhead Clear Stroke in Badminton

|                | Right wrist | Right elbow | Right shoulder | Right hip | Right knee | Right ankle | Performance |
|----------------|-------------|-------------|----------------|-----------|------------|-------------|-------------|
| Right wrist    | 1           | .099        | .378           | -.295     | .221       | -.146       | .803**      |
| Right elbow    |             | 1           | -.008          | .383      | -.146      | -.269       | .102        |
| Right shoulder |             |             | 1              | .099      | -.372      | .028        | .112        |
| Right hip      |             |             |                | 1         | -.551      | -.053       | -.271       |
| Right knee     |             |             |                |           | 1          | -.541       | .179        |
| Right ankle    |             |             |                |           |            | 1           | -.313       |
| Performance    |             |             |                |           |            |             | 1           |

\*Significant at 0.05 level

Table 3 reveals that in case of wrist right obtained value of (.803\*\*) is greater than tabulated value. Therefore it shows significant relationship of this independent variable with Forehand Overhead clear stroke performance. Whereas, in case of, elbow right, shoulder right, hip right, knee right,

ankle right, the obtained values (.102), (.112), (-.271), (.179), (-.313) are lower than tabulated value. Therefore it shows insignificant relationship of these independent variables with performance of forehand overhead clear stroke performance in Badminton.

**Table 4:** Relationship of Left Angular Kinematical Variables with the Performance of Forehand Overhead Clear Stroke in Badminton

|               | Left wrist | Left elbow | Left shoulder | Left hip | Left knee | Left ankle | Performance |
|---------------|------------|------------|---------------|----------|-----------|------------|-------------|
| Left Wrist    | 1          | -.147      | .244          | .268     | -.012     | .209       | -.378       |
| Left Elbow    |            | 1          | .032          | -.356    | -.496     | -.226      | -.007       |
| Left Shoulder |            |            | 1             | -.222    | .327      | .016       | -.505       |
| Left Hip      |            |            |               | 1        | .165      | .721**     | -.149       |
| Left Knee     |            |            |               |          | 1         | .251       | .100        |
| Left Ankle    |            |            |               |          |           | 1          | .095        |
| Performance   |            |            |               |          |           |            | 1           |

Table 4 reveals that the significant relationship was found between angle of left hip and angle of left ankle among independent variables as calculated 'r' (.721\*\*) is found greater than the required tabulated value of (.549) at 0.05 level of significance.

**Discussion of the study**

The primary aim of the study was to investigate the correlation between joint angles and the proficiency of executing the Forehand Overhead Clear stroke during the contact phase in Badminton. Upon conducting the research,

it was observed that there existed a noteworthy variance in the right wrist angle specifically during the contact phase of the Forehand Overhead Clear Stroke among Badminton players, which significantly influenced their performance. This observation can be linked to the nature of the Forehand Overhead Clear Stroke, which is predominantly regarded as a defensive technique in the sport of badminton. Its primary function is to propel the shuttlecock towards the opponent's rear boundary line, strategically creating distance and buying time for repositioning towards the center court. During the contact phase of this stroke, the wrist joint

emerges as a pivotal component of the hitting hand's mechanics. Emphasizing the importance of technique, players are often advised to execute a prolonged backswing while maintaining a locked wrist and flexed elbow, thereby generating the necessary power and precision for an effective clear shot.

### **Conclusion**

Based on the findings derived from the current investigation, the following conclusions were made: significant relationship was observed in the right wrist angle during the contact phase of the Forehand Overhead Clear stroke among badminton players. The finding of the study also indicates that the right wrist plays a pivotal role during the contact phase of the Forehand Overhead Clear stroke.

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