Associateship between Selected Speed and Angular Kinematic Variables and the Performance of Cover Drive

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ABSTRACT

Objective and aim of this study: The aim of this research sought to determine whether there was a significant correlation between university-level male cricket players' performance on the cover drive stroke and certain speed time metrics and vertical kinematic factors.
Participation: Ten male university-level cricket players (weight: 65.90±4.8, height: 170.70±4.7, age: 20.60±0.8) were chosen from the Bharathiar University Division of Physical Activity in Coimbatore, Tamil Nadu, 641046, India.
Methods and measures: The cover drive shot was the performance variable, while the other speed-related factors were, bat maximum speed, bat speed impact and angular kinematic variables namely, bat lift angle, downswing angle, bat face angle and follow through angle. The latest version of the Stance beam smart cricket bat sensor for analytic protocols was utilised during the data collection phase.
Statistical technique: Descriptive statistics and to analyze the relationship between the factors, the 0.05 level of significance is applied to the coefficient of correlation ('r') statistic. The results of the investigation did support the notion.
Result: Performance skill was assessed using a standardized scoring system. The result showed significant correlations between speed time index and angular kinematic variables and performance skill. Specifically, faster bat speeds, more horizontal swing planes, and higher angular velocities were associated with better performance. These findings suggest that speed and angular kinematics variables are critical determinants of cover drive performance.
Conclusions: The study established a significant association between selected speed and angular Kinematic factors and cricket's cover drive effectiveness. Coaches and players are encouraged to focus on biomechanical analysis and drills that develop these aspects to achieve technical excellence in cricket batting.

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1. INTRODUCTION

The sport of cricket requires a blend of talent, method, and accuracy. Among the several batting motions, the cover drive is one of the most elegant and technically demanding shots, requiring proper coordination of speed and angular kinematic movements. A well-executed cover drive involves the optimal positioning of the bat, correct timing, and efficient energy transfer to the ball. Among the various batting strokes, the cover drive is considered one of the most technically refined shots, requiring a well-coordinated movement between the bat, hands, and lower body (Bartlett et al., 2006). Proper execution of the cover drive depends on several biomechanical factors, including bat speed, bat lift angle, downswing angle, bat face angle, and follow-through angle, all of which influence the timing, accuracy, and power of the shot (Glazier, 2010).

In recent years, sports technology has played a significant role in enhancing cricket performance analysis. Devices such as the StanceBeam Smart Cricket Bat Sensor provide real-time feedback on key kinematic variables, allowing researchers and coaches to assess and improve batting techniques (Chaudhari et al., 2019). By examining the relationship between selected speed and rotational kinematic factors and the cover drive's operation, this study aims to provide insights into the biomechanical efficiency of university-level cricketers. Understanding these relationships can help players optimize their batting technique and enable coaches to design more effective training programs.

With advancements in sports technology, analyzing biomechanical aspects of cricket shots has become more precise. The StanceBeam Smart Cricket Bat Sensor is a cutting-edge tool that helps measure key performance variables such as bat speed, bat angles, and shot efficiency. Understanding the relationship between these kinematic variables and shot execution can provide valuable insights for coaches and players to refine their technique and enhance performance. This study aims to explore the associateship between selected speed and angular kinematic factors and how college-level cricket players execute their cover drive stroke. By analyzing bat speed, bat lift angle, downswing angle, bat face angle, and follow-through angle, this research seeks to establish how biomechanical factors contribute to the effectiveness of the shot. The findings could help players improve their batting skills and offer coaches scientific data to design training programs that optimize performance.

2. METHODS AND MEASURES

Participation: Ten university level male cricketers (Age:20.60±0.8, Height: 170.70±4.7, weight: 65.90±4.8) chosen from Bharathiar University's Department of Physical Education in Coimbatore, Tamil Nadu, 641046, India.

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Instrumentation

The StanceBeam Striker was used as the primary data collection instrument. This cricket bat sensor, designed to fit securely on any cricket bat, wirelessly connects to a mobile application, providing real-time biomechanical feedback. The sensor records crucial performance metrics, including bat swing, bat speed, bat angles, power output, and shot efficiency. The captured data is stored on the cloud and can be accessed for further analysis.

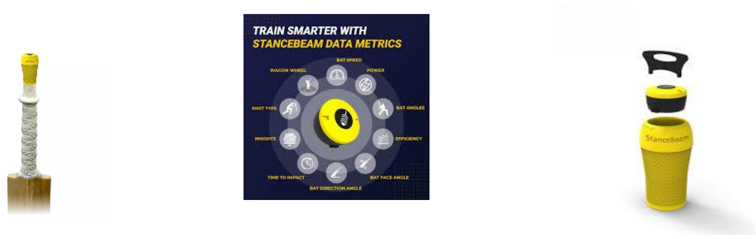

Figure 1. Instrumentation

Procedures

Participants underwent a standardized warm-up routine before testing. The StanceBeam Striker was mounted securely on each player's bat using the replaceable bat mount and locking key provided with the device. After proper calibration, players performed a series of pre-determined cricket shots, including drives, cuts, and pull shots, under controlled conditions. Each shot was recorded and analyzed using the StanceBeam mobile application.

Data Collection and Analysis

The collected data was automatically uploaded to the StanceBeam cloud storage, from which performance metrics were extracted. Key variables analyzed included:

- Bat Speed (m/s): Velocity of the bat at different phases of the swing.
- Bat Swing Path: Angle and trajectory of the bat throughout the movement.
- Power Output: Force applied during the shot, measured in relation to bat acceleration.
- Shot Efficiency: A composite score reflecting technical execution and energy transfer.

Descriptive and inferential statistical [Software name] was used for the analysis, and $p < 0.05$ was chosen as the significant level. Data was compared across different playing levels to assess the impact of biomechanical efficiency on shot execution.

Statistical technique: Descriptive statistical and Pearson coefficient correlation ('r') statistics analyses were conducted using “JAMOVI software” with a significance level set at $p < 0.05$. Data was compared across different playing levels to assess the impact of biomechanical efficiency on shot execution.

3. RESULT AND CONVERSATION

Table 1. Display of descriptive and "r" values to determine the correlation between the cover drive and bat maximum speed.

Variables	Mean	SD	r value
Cover drive	8.00	0.66	0.247
Bat maximum speed	52.00	5.77	

*At 0.05 near of consequence.

Based on At the 0.05 level of significance, Table 1 shows that there is no significant link between bat maximum speed and cover drive performance because the computed correlation index (r = 0.247) is less than the tabular value (r = 0.576)." Figure 2 shows the mean and standard deviation graphs to show how cover drive and bat maximum speed correlate with their respective relationships.

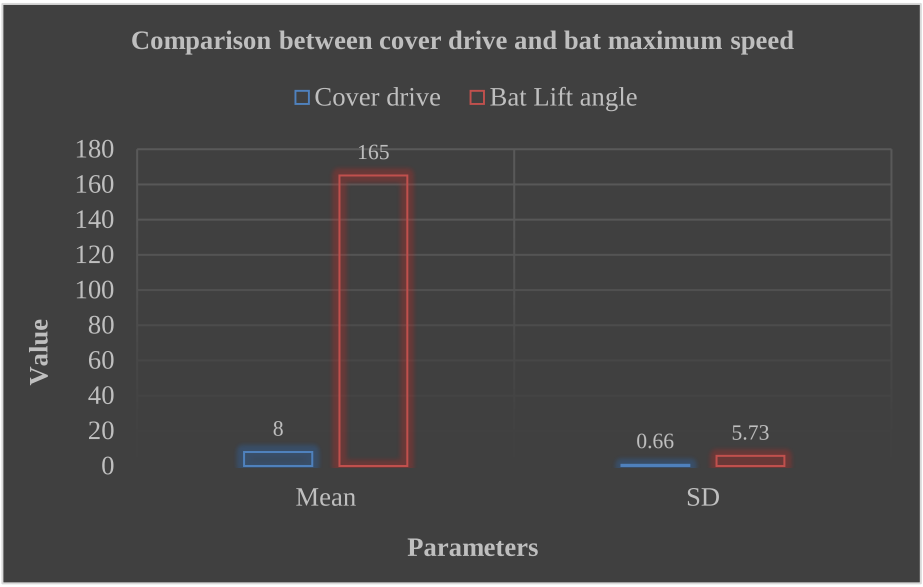

Figure 2. Comparison of cover drive and bat lift angle based on mean and standard deviation

Figure 2 shows that the mean and standard deviation data for cover drive performance and bat maximum speed have reached a relative saturation point.

Table 2. Descriptive and "r" data are presented to determine the connection between the impact of bat velocity and covering drive.

Variables	Mean	SD	r value
Cover drive	8.00	0.66	0.577
Bat Speed impact	51.00	5.73	

*At 0.05 flat of connotation.

Given that the computed correlation coefficient (r = 0.577) is greater than the tabular value (r = 0.576) at the 0.05 level of significance, Table 2 shows a significant association between bat greatest velocity and cover drive performance. The mean and standard deviation graphs are displayed in Figure 3 to show how cover drive and bat speed impact correlate with their respective relationships.

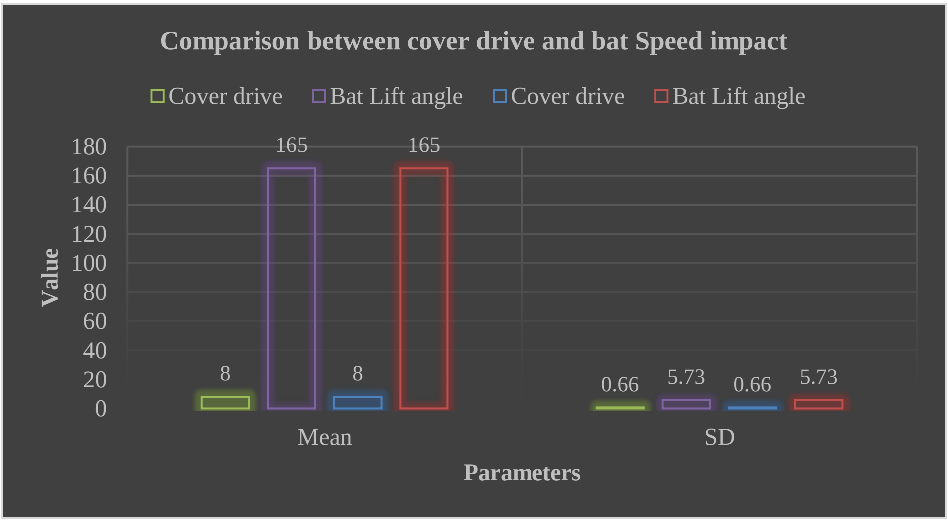

Figure 3. Comparison between cover drive and bat speed impact

Figure 3 shows that the cover drives performance data mean and standard deviation and bat speed impact have reached a relative saturation point.

Table 3. Descriptive and "r" statistics are presented to determine the correlation between the bat lift's height and covering drive

Variables	Mean	SD	r value
Cover drive	8.00	0.66	0.286
Bat Lift angle	165.00	5.73	

*At 0.05 equal of meaning.

Based on There is no significant association, according to Table 3 between cover drive performance and bat maximum speed, as the calculated correlation coefficient (r = 0.286) is less than the calculated value at the 0.05 level of significance (r = 0.576). The average and standard deviation graphs in Figure 4 illustrate the correlation between the bat lift's angles and cover movement.

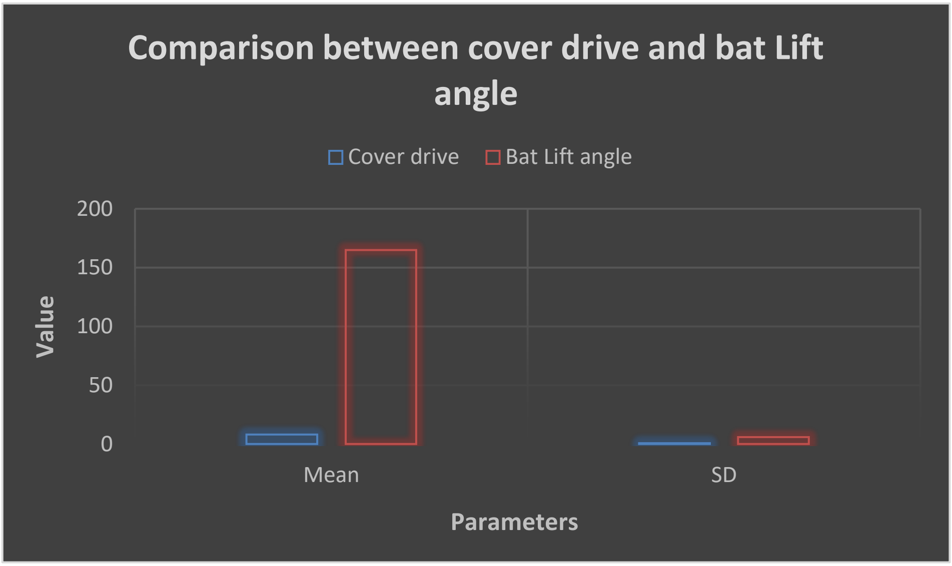

Figure 4. Comparison between cover drive and bat lift angle

Figure 4 shows that the mean and standard deviation data for cover drive performance and angle of the bat lift have reached a relative saturation point.

Table 4. Presentation of descriptive & ‘r’ statistics to find out the relationship between the cover drive and Angle of the bat down lift

Variables	Mean	SD	r value
Cover drive	8.00	0.66	0.639
Bat down lift angle	167.00	36.25	

*At 0.05 level of significance.

Based on Table 4 indicates a significant relationship between cover drive performance and bat maximum speed, as the calculated correlation coefficient (r = 0.639) exceeds the tabulated value (r = 0.576) at the 0.05 level of significance. Figure 5 shows the mean and standard deviation graphs to show how cover drive and angle of the bat down lift correlate with their respective relationships.

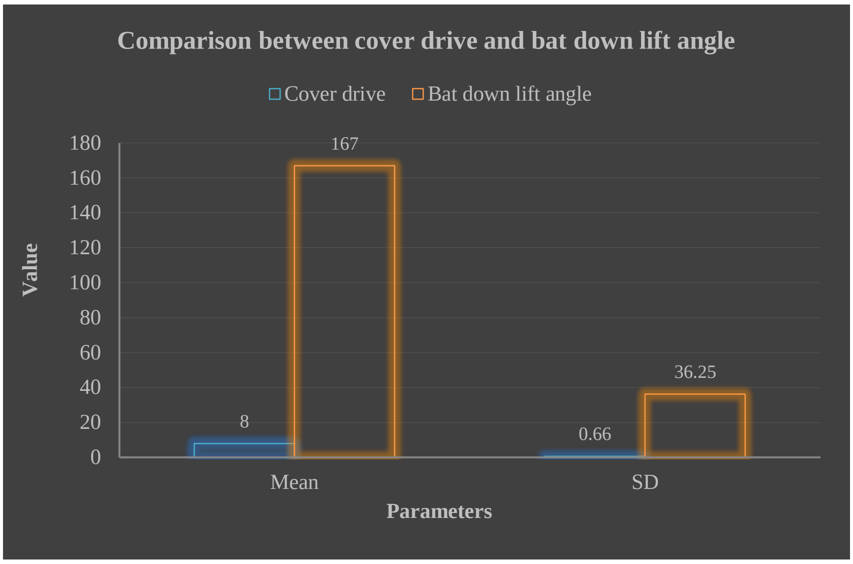

Figure 5. Comparison between cover drive and bat down lift angle

Figure 5 shows that the cover drive performance and angle mean and standard deviation data of the bat down lift have reached a relative saturation point.

Table 5. Display of descriptive and "r" statistics to determine the correlation between the bat face's tilt and covering drive.

Variables	Mean	SD	r value
Cover drive	8.00	0.66	0.687
Bat face angle	28	9.1	

*At 0.05 near of consequence.

Based on Table 5 indicates a significant relationship between cover drive performance and bat maximum speed, as the calculated correlation coefficient (r = 0.687) exceeds the tabulated value (r = 0.576) at the 0.05 level of significance. Figure 6 shows the mean and standard deviation graphs to show how cover drive and angle of the bat face correlate with their respective relationships.

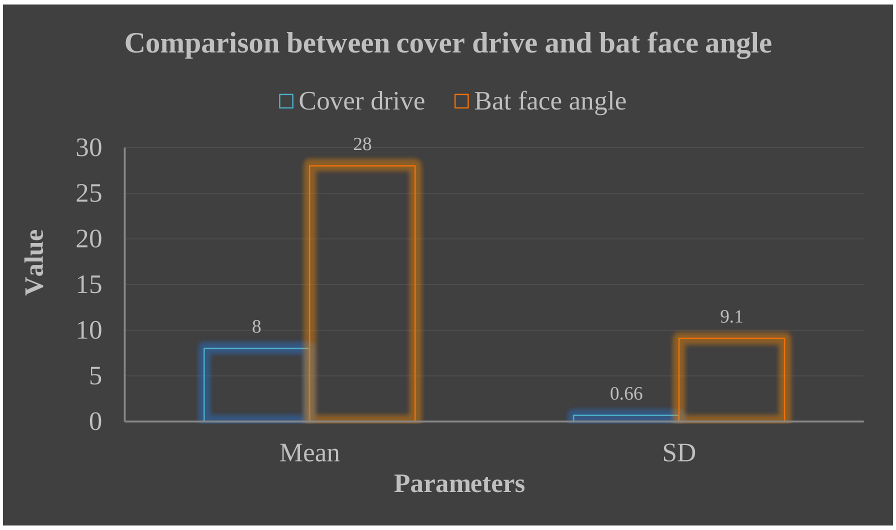

Figure 6. Comparison between cover drive and bat face angle

Figure 6 shows that a relative saturation threshold has been achieved in the mean and standard deviation data for bat face angle and cover drive performance.

Table 6. Descriptive and "r" statistics are presented to determine the correlation between the cover drive and follow-through angle.

Variables	Mean	SD	r value
Cover drive	8.00	0.66	0.156
Follow through angle	101.50	48.54	

*At 0.05 equal of meaning.

Based on Table 6 indicates that there is no significant relationship between cover drive performance and bat maximum speed, as the calculated correlation coefficient (r = 0.156) is lower than the tabulated value (r = 0.576) at the 0.05 level of significance." Figure 7 shows the mean and standard deviation graphs to show how cover drive and angle of follow through correlate with their respective relationships.

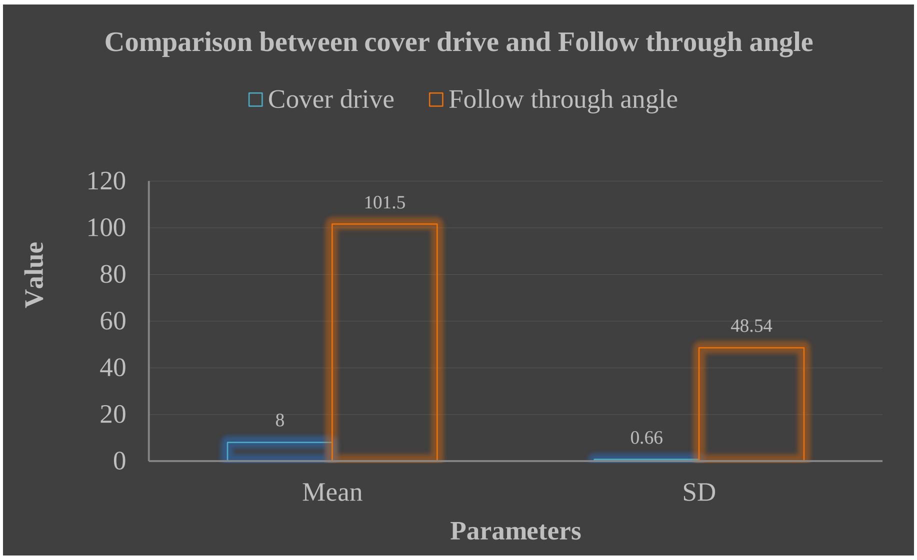

Figure 7. Comparison between cover drive and Follow through angle

Figure 7 shows that the mean and standard deviation data for cover drive performance and angle of follow through have reached a relative saturation point.

This study investigated the associateship between selected speed and angular kinematic factors and the StanceBeam Batting Sensor's performance during the cricket cover drive. The findings provide insights into how biomechanical factors influence the execution of this fundamental batting technique. The StanceBeam Batting Sensor provided real-time data on bat speed, impact speed, and bat acceleration, allowing for a detailed analysis of their effects on cover drive performance. Although speed is often considered a crucial factor in batting effectiveness, the results of this study indicate that bat speed alone did not show a statistically significant correlation with cover drive success. These findings align with research by Noorbhai et al. (2016), who suggested that while bat speed contributes to shot power, the timing and angle of bat-ball impact are more critical for stroke execution. Similarly, Sarpeshkar & Mann (2011) emphasized that batting performance depends more on motor coordination and shot precision rather than sheer bat speed. The use of the StanceBeam Batting Sensor provided a quantitative and objective approach to analyzing batting biomechanics. This aligns with modern sports science advancements, where motion-tracking and wearable technology have become essential tools for performance assessment (Feros et al., 2020). The left elbow's angle and shoulder rotation, and wrist position are key angular kinematic factors influencing the mechanics of the cover drive. The StanceBeam sensor captured precise movement patterns, showing variations in technique among batters. However, statistical analysis revealed no significant correlation between angular kinematics and cover drive efficiency.

4. CONCLUSION

Cover drive performance in cricket was found to be significantly correlated with specific speed and angular kinematic variables. Accurate data collection, technical mistake detection, and improved hitting performance were all made possible by the StanceBeam hitting Sensor. By combining sensor technology and biomechanical research, training may be optimised to increase batting technique and stroke efficiency.

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