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An Analytical Study of Selected Biomechanical Variables and the Accuracy of Forecourt and Backcourt Shots in Wheelchair Badminton Players

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ORIGINAL STUDY

An Analytical Study of Selected Biomechanical Variables and the Accuracy of Forecourt and Backcourt Shots in Wheelchair Badminton Players

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Abstract

The significance of this study lies in analyzing player movement through biokinematic variables using video recording and Kinovea motion analysis software. By investigating selected biomechanical variables, the researchers aimed to improve the accuracy of forecourt and backcourt shots among wheelchair badminton players based on insights derived from this analysis. The findings aim to guide coaches and players by utilizing motion analysis outcomes to enhance training strategies and achieve higher levels of technical performance and athletic accomplishment. The study aimed to describe and analyze the biomechanical variables influencing shot accuracy and identify the relationship between these variables and shot accuracy among wheelchair badminton players. The researchers adopted a descriptive methodology utilizing analytical and correlational approaches, as this design aligns with the nature of the research problem. The study population consisted of athletes from the Iraqi national wheelchair badminton team, selected intentionally, totalling four players. The research sample was chosen purposefully and included the same four athletes, thereby representing 100% of the study population. The (Zina-WH1-WH2) test was conducted to measure the accuracy of backcourt and forecourt shots. The researchers used the Statistical Package for the Social Sciences (SPSS) to process the research data, employing the following statistical tools: arithmetic mean, standard deviation, skewness coefficient, and Pearson's simple correlation coefficient. The results revealed a significant correlation between shuttlecock launch speed and launch angle with forecourt shot accuracy. Based on these findings, the researchers recommended using video recording and motion analysis during training sessions. The extracted data reveal strengths and weaknesses in the biomechanical variables of each shot, guiding players toward optimal performance. and this achieves one of the sustainable development goals of the United Nations in Iraq which is (Quality Education)

Keywords: Accuracy of forecourt and backcourt shots, Biomechanical variables, Wheelchair badminton

1. Introduction

Badminton is a distinguished sport that requires advanced coordination between motor skills and physical capabilities. In recent years, the sport has gained increasing attention across various athletic domains, prompting researchers to develop training techniques and adopt scientific methods to enhance performance. With the advancement of training technologies in badminton, it has become essential to investigate the biokinematic factors that influence athletic performance, particularly in sports that demand precise and complex movements. As Abbas and Malih (2021) note, modern technologies and software provide coaches with information about athletes' abilities, enabling performance analysis, error diagnosis, and the correction of technical mistakes. Biomechanical analysis is considered a fundamental tool for precisely understanding the mechanics of athletic performance. It enables the evaluation of the effects of mechanical forces on the human body and the examination of various movements performed by athletes. As Abbas and Malih (2021) emphasize, the implementation of exercises in training programs

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now relies heavily on the use of modern technological tools, equipment, and software, as they allow for accurate determination of targeted objectives. Among the core movements in badminton, forecourt and backcourt shots are particularly significant, as they play a critical role in determining athletic performance and match outcomes. In the case of athletes who use wheelchairs (wheelchair badminton), additional challenges emerge related to the biomechanical adaptation of athletic performance in light of the movement limitations imposed by the wheelchair. Recent studies in the field of badminton have demonstrated that the use of advanced technologies and software plays an effective role in analyzing biomechanical variables and in the precise design of training exercises, which, in turn, facilitates error correction and enhances player performance (Abbas and Malih, 2024).

The significance of this research lies in analyzing player movement through the examination of biokinematic variables using video recording and the Kinovea motion analysis software. By analyzing these biomechanical variables, the researchers aimed to enhance the accuracy of both forecourt and backcourt shots among wheelchair badminton players, based on the insights and data extracted from this analysis. The study further sought to guide coaches and players by utilizing the motion analysis findings to improve technical execution, ultimately striving for higher levels of skill performance and athletic achievement in wheelchair badminton.

2. Research problem

Current studies on wheelchair badminton lack precise analyses of the biokinematic variables associated with the accuracy of forecourt and backcourt clear shots. This gap in knowledge limits the ability of coaches and athletes to enhance performance and develop effective training methods tailored to the biomechanical characteristics unique to this category of players.

Through their observation of national team training sessions, the researchers noted the limited use of biomechanical analysis to identify strengths and weaknesses in skill performance during training units. This deficiency has a noticeable impact on the players' performance levels and overall development.

Accordingly, the researchers posed the following question:

- Do the biokinematic variables under investigation affect the accuracy of forecourt and backcourt clear shots among wheelchair badminton players?

3. Research objectives

1. To describe and analyze the biomechanical variables related to the accuracy of forecourt and backcourt clear shots among wheelchair badminton players.
2. To identify the relationship between biokinematic variables and the accuracy of forecourt and backcourt clear shots in wheelchair badminton players.

4. Research hypothesis

There is a correlation between the biokinematic variables and the accuracy of forecourt and backcourt clear shots among wheelchair badminton players.

5. Research Scope

- **Human Domain:** Athletes from the Iraqi National Wheelchair Badminton Team.
- **Temporal Domain:** From January 15, 2025, to January 25, 2025.
- **Spatial Domain:** Badminton courts at the Iraqi Paralympic Committee.

6. Methodology and instruments

6.1. *Research methodology*

The researchers employed the descriptive method using analytical and correlational approaches, as this design is well-suited to the nature of the problem under investigation.

6.2. *Population and sample*

The study population was intentionally selected and comprised athletes from the Iraqi National Wheelchair Badminton Team, totalling four players. The research sample was also chosen purposively and consisted of the same four players, thus representing 100% of the study population. Table 1 presents the sample description.

The data presented in Table (1) show that the mean body weight was 62 kg, with a standard deviation of 8.287 and a skewness coefficient of 0.181. The mean total height was 158.75 cm, with a standard deviation of 9.069 and a skewness coefficient of 0.413. The mean chronological age was 23.5 years, with a standard deviation of 3.416 and a skewness coefficient of 0.439. The mean training age was 2.5 years, with a standard deviation of 0.577 and a skewness coefficient of 0.000. These values indicate that the research sample is normally distributed, as all skewness coefficients

Table 1. Presents the sample description in terms of the variables of height, weight, chronological age, and training age.

Variables	Unit of Measurement	Mean	Median	Standard Deviation	Skewness Coefficient
Weight	kg	62	61.5	8.287	0.181
Height	cm.	158.75	157.5	9.069	0.413
Chronological Age	years	23.5	23	3.416	0.439
Training Age	years	2.5	2.5	0.577	0.000

fall within the acceptable range of ±1, suggesting conformity with the Gaussian distribution.

7. Instruments, equipment, and data collection tools

A variety of devices, instruments, and data collection methods were employed, including Arabic and international references, the Internet, direct observation, and the assistance of a support team[1]. Additional tools included one measuring tape, a standard international badminton court for athletes with disabilities, four badminton rackets, 50 shuttlecocks, a Casio video camera with a frame rate of 240 frames per second, and a personal laptop computer (Dell).

7.1. Research tests

The (Zina-WH1 + WH2) test for the accuracy of the backcourt clear shot was adopted (Abbas and Malih, 2024).

7.2. Purpose of the test

To measure the accuracy of the backcourt clear shot.

7.3. Required equipment

Badminton rackets, a data recording form, a court marked according to the modified test design, adhesive tape, a measuring tape, and a data registration form.

7.4. Performance description

After the test is explained to the participants, an adequate amount of time is allocated for warming up. Each participant is then given five trial attempts.

The participant stands within the designated area. The coach sends the shuttlecock toward the participant's left side (if the racket is held in the right hand, and vice versa for left-handed players), enabling the execution of a backcourt clear shot.

Each participant is allowed ten attempts only. Upon the shuttlecock's release from the coach, the player must move backward—a motion essential for a successful attempt—and execute an overhead backcourt clear shot to send the shuttle over the net toward the designated scoring zones, whether diagonally or straight.

The participant may choose not to respond to any shuttle that they believe will not result in a successful attempt. If the coach deems the feed invalid, they may call out "Repeat" to allow for a retry.

7.5. Test scoring

- The participant is awarded 1 point if the shuttlecock lands within the designated area measuring 2.35 cm, extending from the midcourt line to the service line.
- The participant is awarded 2 points if the shuttlecock lands in the rear court area, specifically within the 2.35 cm zone extending from the midcourt line to the far back service line (doubles long service line).
- The participant is awarded 3 points if the shuttlecock lands within the designated zone measuring 60–76 cm near the service lines on both the right and left sides.
- The participant is awarded 4 points if the shuttlecock lands within the designated zone measuring 60–76 cm near the rear boundary lines on both the right and left sides.
- In the event the shuttlecock lands on a boundary line separating two zones, the higher score is awarded for the zone in which the shuttlecock lands, as the boundary is considered part of the scoring area.
- No points are awarded for shuttlecocks that land outside the court boundaries or are caught in the net.

[1] The support team consisted of:
Assist. Lect. Sarmad Saad Hameed–College of Physical Education and Sport Sciences, University of Kirkuk
Assist. Lect. Ghadir Amer–Iraqi National Paralympic Committee
Prof. Dr. Ferdaws Majeed Ameen–College of Physical Education and Sport Sciences, University of Diyala
Assist. Lect. Mohammed Rafiq Mohammed–College of Physical Education and Sport Sciences, University of Kirkuk.

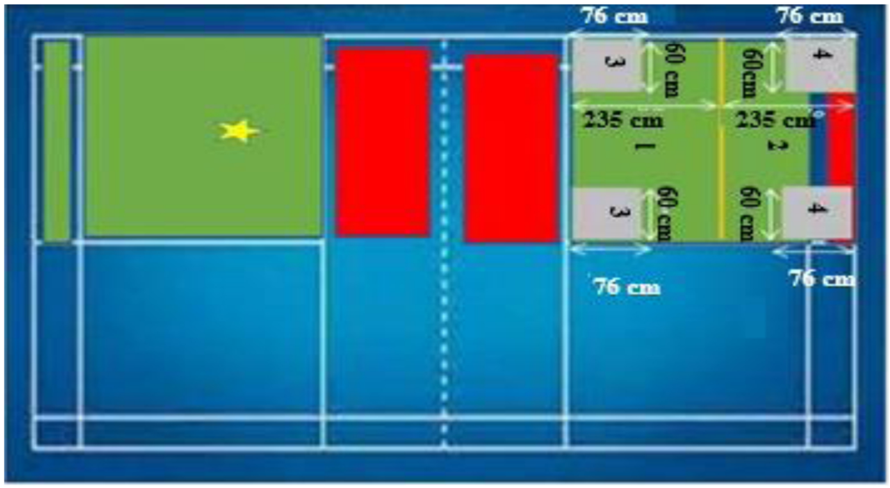

Fig. 1. Illustrates the Zina-WH1+WH2 test used to assess the accuracy of backcourt shots.

- The maximum score a participant can achieve from their best ten attempts is 40 points, as illustrated in Fig. 1.

Test (Zina-WH1-WH2) for the Forecourt Clear Shot (Abbas and Malih, 2024)

Test Name: Forecourt Clear Shot

Purpose of the Test: To assess the accuracy of forecourt clear shot performance.

Required Equipment: A badminton court marked as shown in the figure, badminton rackets, adhesive tape, measuring tape, data recording forms, and shuttlecocks.

7.6. Performance description

After the test is explained to the participants, each is given sufficient time to warm up, followed by five trial attempts.

- The participant stands in the designated area (Zone B).
- The coach serves the shuttlecock to the participant's left side (if the racket is held in the right hand, or vice versa), allowing the participant to perform a forecourt clear shot.
- Upon the coach's serve, the participant must move as part of the shot execution. They may choose to leave any shuttle they believe will not result in a successful attempt. If the coach determines that the serve was incorrect, they will call "repeat."
- Each participant is given twelve attempts, with only the best ten used for scoring.

7.7. Test scoring

- The participant receives 1 point if the shuttlecock lands in the designated area measuring 3.12 m in length × 46 cm in width along the sides of the court specific to wheelchair badminton players.
- 2 points are awarded if the shuttlecock lands in the area measuring 2.13 m in length × 76 cm in width, starting from the inner service line and extending inward to the court's back boundary, maintaining the same width.
- 5 points are given when the shuttlecock lands in the corner zones of the court's back boundary on either the right or left side, within the specified range of 46 cm–76 cm.
- 4 points are awarded for shuttlecock landings in the central zone of the court, measuring 2.13 m in length, which corresponds to the player's standing area.
- The participant receives 3 points if the shuttlecock lands in the front corner areas of the court—on both the left and right sides—within a range of 46 cm–76 cm.
- No points are awarded for shuttlecocks that hit the net or fall outside the court boundaries.
- The maximum achievable score from the best 10 attempts is 50 points, as illustrated in Fig. 2.

7.8. Biomechanical variables

First: Shuttlecock Launch Speed: Defined as the distance covered by the shuttle divided by the frame duration following its release, as illustrated in Fig. 3 based on the researchers' work.

Launch speed) Majid and Shalash, 1992).

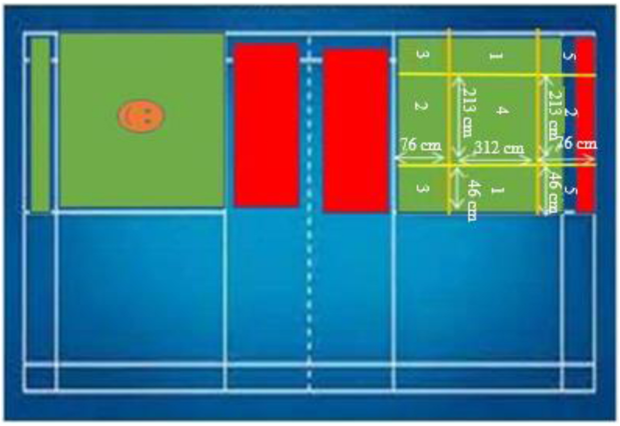

Fig. 2. Zina-WH1-WH2 Test for Assessing the Accuracy of the Forecourt Clear Shot

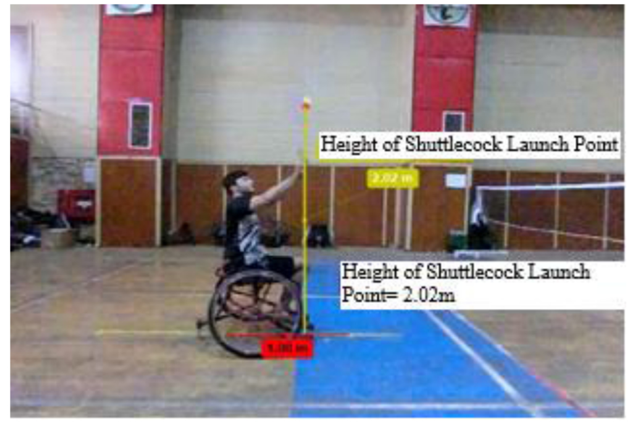

Fig. 4. Illustrates the height of the shuttlecock's launch point.

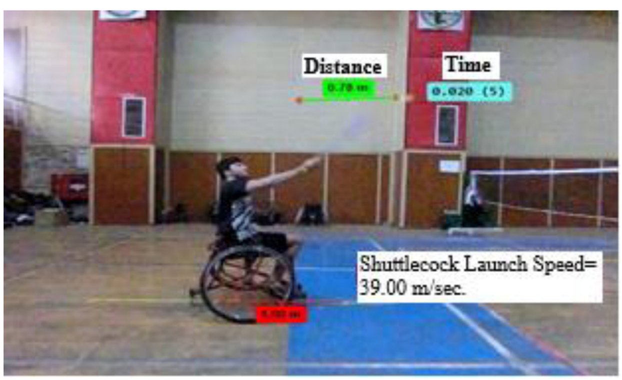

Fig. 3. Illustrates the shuttlecock's launch speed.

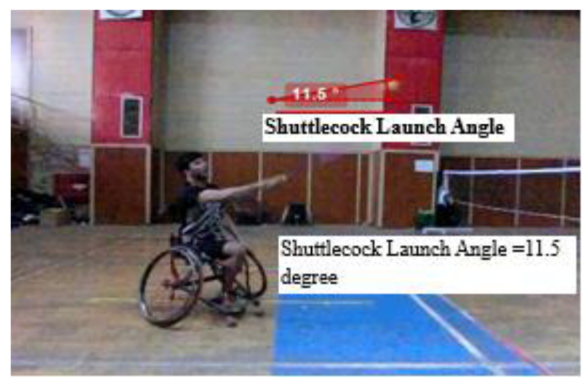

Fig. 5. Shuttlecock launch angle

7.9. Second: Height of shuttlecock launch point

This refers to the vertical height of the shuttlecock's launch point from the ground at the moment of impact. It was measured by drawing a perpendicular line from the point where the shuttlecock met the racket at the moment of striking down to the surface of the court (Majid and Shalash, 1992). This measurement is illustrated in Fig. 4, based on the work of the researchers.

7.10. Third: Shuttlecock launch angle

The shuttlecock launch angle is defined as the angle formed at the moment the shuttlecock departs immediately after being struck by the player (Al-Tarawneh and Al-Khawalda, 2018). This angle was measured by constructing an angle between two lines: the first is a horizontal line passing through the point of contact between the shuttlecock and the racket at the moment of impact, and the second is a line connecting two points—the initial contact point and the point at which the shuttlecock leaves the racket. This method is illustrated in Fig. 5, as documented by the researchers.

7.11. Fourth: Hitting arm angles

A. Wrist Angle: This refers to the angle formed at the wrist of the hitting hand at the moment of shuttlecock impact.

The wrist angle was measured by drawing the angle formed between two lines: one extending from the elbow joint to the wrist joint (representing the forearm), and the other from the wrist joint to the end of the palm (representing the hand), as illustrated in Fig. 6 based on the researchers' work.

B. Elbow Angle: This refers to the angle of the elbow joint of the striking arm at the moment the shuttlecock is hit.

The elbow angle was measured by drawing an angle formed between two lines: the upper arm line, extending from the shoulder joint to the elbow joint, and the forearm line, extending from the elbow joint to the wrist joint, as illustrated in Fig. 7 based on the researchers' analysis.

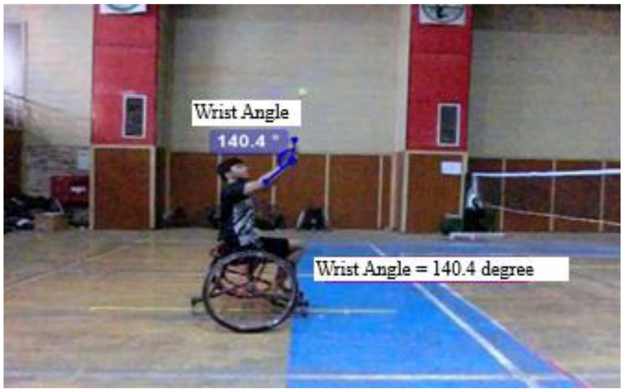

Fig. 6. Illustrates the wrist angle at the moment of shuttlecock impact.

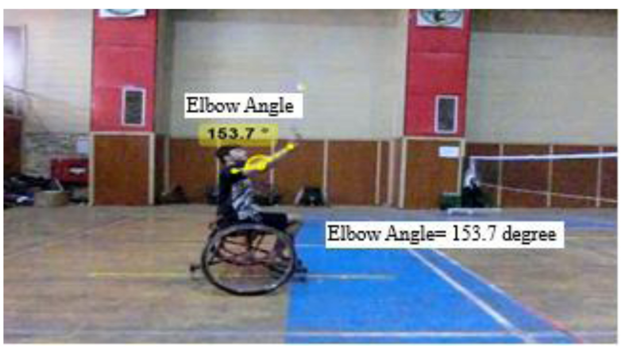

Fig. 7. Illustrates the elbow angle at the moment of shuttlecock impact.

7.12. Pilot study

The pilot study was conducted on January 15, 2025, at 12:00 p.m. to identify potential obstacles that might hinder the functionality of high-speed video cameras during testing. The procedure also aimed to ensure the proper operation of the rackets and verify the performance of the cameras and iPad devices. Additionally, it served to confirm the accurate recording of variable data on the designated forms and to train the supporting team on conducting the test procedures.

7.13. Main experiment procedures

After selecting the appropriate tests, establishing the testing protocols, and preparing all necessary equipment and the supporting team, the main experiment was conducted on January 25, 2025, at 12:00 p.m. on the badminton courts of the Iraqi Paralympic Committee. The tests were administered to the research sample following a standardized warm-up.

During the performance of the forecourt and backcourt shot accuracy tests, the researchers recorded all test attempts using two high-speed video cameras operating at 240 frames per second. The cameras were positioned at mid-court, with each lens set 1.5 meters away from the sideline and the focal point of the lens placed at a height of 1.30 meters above the ground.

7.14. Statistical methods

The data were statistically analyzed by the researchers in collaboration with the data analyst (Mr. Sarmad Saad Hameed–College of Physical Education and Sports Sciences, University of Kirkuk) using the Statistical Package for the Social Sciences (SPSS). The following statistical measures were applied: arithmetic mean, standard deviation, skewness coefficient, and Pearson's correlation coefficient.

8. Results

8.1. Presentation of biokinematic analysis results for the variables of the forehand clear stroke

The results presented in Table 2 indicate a statistically significant correlation between both the shuttlecock launch speed and the launch angle variables with the accuracy of the forehand clear shot. However, no significant correlation was found between the shuttlecock's height at the moment of impact and the accuracy of the forehand clear shot.

8.2. Presentation of the biokinematic analysis results for the variables of the backhand clear skill

Table 3 reveals a statistically significant correlation between the variables of shuttlecock launch speed, launch angle, and shuttlecock height at the moment of impact for the back clear stroke, and the accuracy of performance.

Table 2. Presents the correlation coefficients between the biomechanical variables of the racket (shuttlecock) during the forehand clear stroke and accuracy.

No.	Variables	Unit of Measurement	–MD	+SD	Accuracy –M	Accuracy +SD	Calculated R-value	Sig	Significance
1	Shuttlecock Launch Velocity	meters/second	40.4	6.875	3.2	1.281	*0.806	0	Significant
2	Shuttlecock Launch Angle	degrees	8.325	5.574			*–0.475	0.034	Significant
3	Shuttlecock Height at the Moment of Launch	meters	1.903	0.091			–0.394	0.086	Not-Significant

*Significant at a significance level of > 0.05.

Table 3. Presents the values of the correlation coefficients between the biomechanical variables of the implement (shuttlecock) in the backhand clear shot and performance accuracy.

No.	Variables	Unit of Measurement	–MD	+SD	Accuracy –M	Accuracy +SD	Calculated R-value	Sig	Significance
1	Shuttlecock Launch Speed	meters/second	36.9	5.77	2.650	1.039	*0.892	0.000	Significant
2	Shuttlecock Launch Angle	degrees	7.50	3.98			*–0.786	0.000	Significant
3	Shuttlecock Height at the Moment of Launch	meters	1.85	0.114			*–0.554	0.010	Significant

*Statistically significant at a significance level of $p < .05$.

Table 4. Shows the correlation coefficients between the angles of the striking arm joints at the moment of shuttlecock impact during the execution of the forehand clear stroke and performance accuracy.

No.	Variables	Unit of Measurement	–M	± SD	Accuracy –M	Accuracy ± SD	Calculated R-value	Sig	Significance
1	Wrist Angle	degrees	138.64	7.491	3.2	1.281	*0.508	0.022	Significant
2	Elbow Angle	degrees	145.725	4.691			–0.129	0.589	Not-Significant

*Statistically significant at a significance level of > 0.05.

8.3. Presentation of the biokinematic analysis results for the joint angles of the body at the moment of shuttlecock impact during the forehand clear stroke

Table 4 reveals a statistically significant correlation between the wrist angle of the striking arm during the forehand clear and accuracy. However, no significant correlation was found between the elbow angle of the striking arm during the forehand clear and accuracy.

8.4. Presentation of the biokinematic analysis results for joint angles at the moment of shuttlecock contact during the backhand clear

Table 5 indicates the presence of statistically significant correlations between both the wrist angle and the elbow angle of the striking arm during the backhand clear and the accuracy of performance.

9. Discussion of results

The forehand and backhand clears in badminton are fundamental skills that play a critical role in controlling the shuttlecock's trajectory and the overall game strategy. These skills rely directly on the shuttlecock's initial velocity. To ensure the shuttlecock reaches the far end and corners of the court, it is essential to achieve maximum velocity and accuracy. This is grounded in the principle of instantaneous velocity, which states that "velocity equals the smallest change in distance divided by the smallest change in time." As the shuttlecock transitions from the moment of contact with the racket to the moment it departs from it, it reaches its peak speed, necessitating precise directional control to ensure shot accuracy (Majid and Shalash, 1992).

The researchers attribute this to the fact that as the shuttlecock's launch velocity increases, the accuracy of the stroke improves correspondingly.

Regarding the variable of launch angle—defined as "the angle formed between the horizontal line parallel to the ground surface and the trajectory path of the shuttlecock" (Abdel Karim and Alwan, 2012)—it plays a significant role in determining the precision and effectiveness of badminton strokes. An optimal launch angle enhances the accuracy of delivering the shuttlecock to the intended target area (Al-Khawalda and Al-Tarawneh, 2018).

The correlation results between launch angle and the accuracy of both forehand and backhand clears indicate an inverse (negative) relationship. This means that as the launch angle decreases, the accuracy increases. This relationship is explained by the fact that the shuttlecock behaves as a projectile, and in both forehand and backhand clears, the launch

Table 5. Presents the correlation coefficients between the angles of the striking arm at the moment of shuttlecock contact during the backhand clear and the accuracy of performance.

No.	Variables	Unit of Measurement	–M	± SD	Accuracy –M	Accuracy ± SD	Calculated R-value	Sig	Significance
1	Wrist Angle	degrees	145.93	8.526	2.65	1.039	*0.527	0.017	Significant
2	Elbow Angle	degrees	148.1	9.353			*–0.62	0.004	Significant

*Statistically significant at a significance level of > 0.05.

point is higher than the landing point. Therefore, a lower launch angle is required to achieve optimal accuracy.

All the aforementioned findings are related to the angles of the striking arm. As the wrist angle increases, the accuracy of the stroke also improves, indicating a statistically significant relationship. The wrist angle has a positive impact on accuracy, highlighting the importance of precise wrist control to direct and drop the shuttlecock into the intended target area.

The researchers attribute this to the backward movement of the arm, which increases angular displacement and contributes to an extended range of motion, thereby enhancing the stroke's reach. Additionally, the activation of shoulder and chest muscles plays a key role in efficiently extending the arm, enabling the player to execute a quick, snapping motion using the wrist joint. This allows for powerful and accurate shuttlecock direction (Al-Sumaidai and Rashid, 2018). Consequently, the speed of the shuttlecock stroke increases, as the wrist joint is the final segment of the arm to execute the motion, making it the primary element responsible for guiding the racket and shuttlecock along the correct trajectory.

This motor function of the wrist contributes significantly to enhancing performance accuracy (Hossam El-Din, 1993). The wrist angle plays a critical role in the precision of both the forehand and backhand clear strokes. Proper control of the wrist angle can influence the shuttlecock's trajectory, velocity, and directional accuracy toward the intended target area on the court. A strong statistical correlation exists between wrist angle and performance accuracy, particularly in forehand strokes. As the wrist angle increases, accuracy also improves—an association that is likewise observed in backhand strokes.

Regarding the elbow angle, an increase in the angle of the striking arm is associated with a decrease in shot accuracy. This indicates a non-significant correlation between elbow angle and accuracy in the forehand clear stroke, as it may lead to a loss of control and instability in the shuttlecock during execution. To achieve high accuracy in backhand clear strokes, it is essential to focus on optimizing the wrist angle while minimizing the elbow angle within its natural range to ensure successful and precise shots.

In contrast, a significant relationship exists between the angles of the striking arm and accuracy in backhand strokes. The elbow plays a direct or indirect role in shot accuracy, as it acts as both a generator and transmitter of force—from the shoulder through the elbow to the wrist. This makes the elbow a critical component in determining the accuracy of backhand shots directed toward both near and far areas of the court.

10. Conclusion

The results obtained from motion analysis using Kinovea software revealed that biomechanical variables significantly influence the accuracy of both forehand and backhand clear strokes. These variables play a critical role in training and in the correction of performance errors during practice or competition. The findings underscore the importance of developing specialized training programs tailored to biomechanical variables derived from visual and video analysis. Such programs aim to correct technical weaknesses and enhance strengths by providing comprehensive data on shuttlecock strokes, including shuttle velocity, launch angle, launch height, and striking arm joint angles. The study confirmed that these variables are significantly correlated with stroke accuracy in both forehand and backhand clears.

Accordingly, the researchers recommend incorporating video analysis techniques into training sessions to improve the accuracy of various strokes in wheelchair badminton and among able-bodied players. The data yielded from such analyses can guide coaches and athletes in adjusting performance based on biomechanical variables shown to influence shuttlecock direction and accuracy. This targeted approach enables the optimization of shuttle trajectory through ideal angles and high-speed execution, ultimately enhancing technical proficiency and competitive achievement among wheelchair badminton players.

Accordingly, the researchers conclude that it is essential to focus on the identified weaknesses, particularly the shuttlecock's launch height and the elbow angle during the execution of forehand clear strokes, in addition to the other variables examined in this study, in order to enhance the accuracy of both forehand and backhand clears. Through video and image-based analysis during training, coaches and players can monitor angular changes associated with each stroke and implement corrective exercises along with immediate feedback. This approach facilitates the adjustment of joint angles and the applied force when striking, blocking, or directing the shuttlecock, thereby improving targeting precision and overall performance outcomes.

Conflict of interest

No conflict of interest declared.

Author contribution

1. Prof. Dr. Fatimah Abed Malih 45% Selecting the research topic and identifying the research problem - Choosing the appropriate methodology for addressing the research problem - Designing appropriate

research instruments (e.g., questionnaires, physical tests, observations...) - Comparing the results with those of previous studies - Discussing and interpreting the results in the context of theory and practice

2. Asst. Lect. Zina Abdulkareem Abbas 45% Formulating the research questions and hypotheses. - Reviewing the relevant scientific literature and linking it to the research problem. - Conducting the field procedures for the tests, supervising the implementation of the tools, and ensuring the accuracy of data collection. - Assisting in the statistical analysis of the data using SPSS software. - Assisting in video analysis using the Kinovea software for motion analysis.

3. Assist. Lect. Sarmad Saad Hameed 10% Analyzing and evaluating the data statistically using SPSS software. - Conducting video analysis of the research tests using Kinovea software for motion analysis.

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Data availability

The authors confirm that the data supporting the findings of this study are available within the article [and/or] its supplementary materials.

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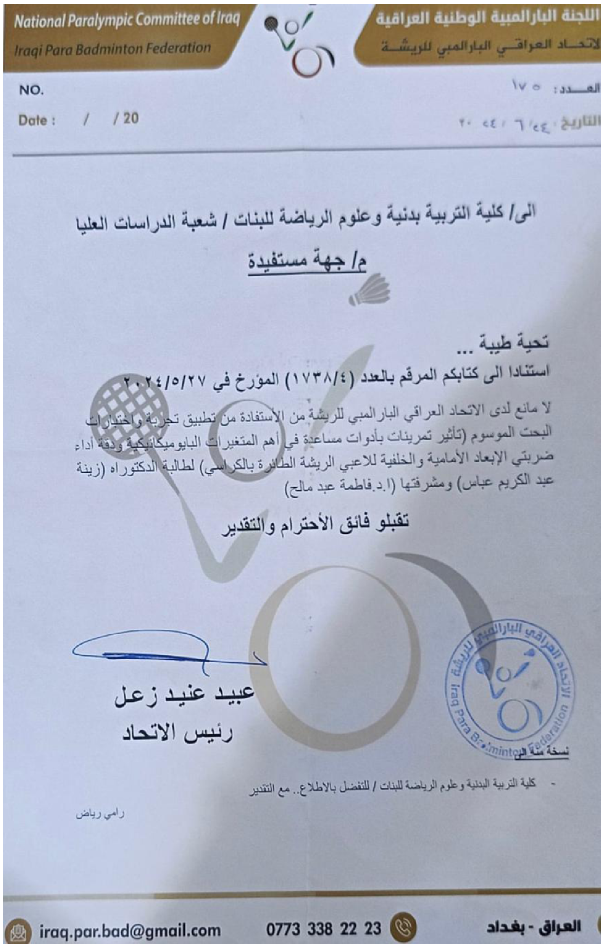
Appendix: Beneficiary Institution of the Study


National Paralympic Committee of Iraq
Iraqi Para Badminton Federation
اللجنة البارالمبية الوطنية العراقية
الاتحـــاد العراقـــي البارالمبي للريشـــة

NO. العـــدد: ١٧٥
Date: / / 20 التاريخ: ٢٠٢٤/٦/٤

الى/ كلية التربية بدنية وعلوم الرياضة للبنات / شعبة الدراسات العليا

م/ جهة مستفيدة

تحية طيبة ...

استنادا الى كتابكم المرقم بالعدد (١٧٣٨/٤) المؤرخ في ٢٠٢٤/٥/٢٧

لا مانع لدى الاتحاد العراقي البارالمبي للريشة من الاستفادة من تطبيق تجربة واختبارات البحث الموسوم (تاثير تمرينات بأدوات مساعدة في أهم المتغيرات البايوميكانيكية ودقة أداء ضربتي الإبعاد الأمامية والخلفية للاعبي الريشة الطائرة بالكراسي) لطالبة الدكتوراه (زينة عبد الكريم عباس) ومشرفتها (ا.د.فاطمة عبد مالح)

تقبلو فائق الأحترام والتقدير

عبيد عنيد زعل
رئيس الاتحاد

نسخة منه الى
- كلية التربية البدنية وعلوم الرياضة للبنات / للتفضل بالاطلاع.. مع التقدير

رامي رياض

iraq.par.bad@gmail.com 0773 338 22 23 العراق - بغداد

To: College of Physical Education and Sport Sciences for Women / Postgraduate Studies Division
Subject: Beneficiary Entity

Greetings,

With reference to your official letter No. (4/1738), dated 27/5/2024, the Iraqi Para-Badminton Federation has no objection to the implementation of the experimental procedures and tests related to the doctoral research titled:
"The Effect of Exercises Using Assistive Tools on Key Biomechanical Variables and the Accuracy of Performing Forecourt and Backcourt Shots in Wheelchair Badminton Players",
conducted by PhD candidate Zina Abdul Kareem Abbas under the supervision of Prof. Dr. Fatima Abed Malih.

With sincere respect and appreciation,

Obaid Aneed Zaal
President of the Federation

Statistician: Asst. Lect. Sarmad Saad Hameed
Linguistic Reviewer: Asst. Prof. Dr. Nizar Banyan Shamkali
Sample: Players of the Iraqi National Wheelchair Badminton Team