INDONESIAN JOURNAL OF RESEARCH IN PHYSICAL EDUCATION, SPORT, AND HEALTH
e-ISSN: 2986-8831
Vol. 4 No 1, April 2026
Research Article

# Analysis of stance position on the accuracy of forehand and backhand strokes in beginner table tennis players

Azzahra Julia Putri Anjani[1], Mochamad Yamin Saputra[2], Geraldi Novian[3]*
[1,2,3] Study Program of Sport Physical Coaching, Faculty of Sport and Health Education, Universitas Pendidikan Indonesia, Bandung, 40154, West Java, Indonesia

*Corresponding author, email: geraldi.novian@upi.edu

ABSTRACT
Background: This study was motivated by the low accuracy of forehand and backhand strokes among beginner table tennis players, which is due to unstable stance positions and poor balance during ball striking. Objective: This study aims to analyze the relationship between stance position and the accuracy of forehand and backhand strokes among beginner table tennis players. Methods: This study used a descriptive correlational design with 7 beginner table tennis athletes. The research instruments were forehand and backhand accuracy tests using the multiball method and stance position analysis through video recordings, analyzed using the Kinovea application. Data analysis was performed using descriptive statistics, normality tests, and correlational tests. Result: The results showed a tendency between stance position and forehand and backhand accuracy, both separately and in combination, but the relationship did not show strong statistical significance. Conclusion: This study concluded that stance position plays an important role as a technical foundation. However, it is not yet a dominant factor in determining the accuracy of beginner table tennis players' strokes. The researchers suggest that training for beginner table tennis players should emphasize structured basic stance training and utilize motion analysis to improve stroke accuracy.

**ARTICLE HISTORY**
Received January 11, 2026
Accepted March 22, 2026
Published April 01, 2026
**KEYWORDS**
Backhand; forehand; kinovea; stance position; table tennis.

## Introduction

Table tennis is a sport that is widely enjoyed by Indonesians from all walks of life, from young people to adults. However, most beginners and amateurs find it difficult to improve their table tennis skills without scientific instruction (Ren et al., 2019). This makes table tennis one of the most popular sports in the world because it is easy to play and has no age restrictions (Asri et al., 2017). In practice, table tennis is played on a table, where the ball is bounced, and the ball that is hit must pass over the net installed above the table (Sahabuddin, 2019). Important events in table tennis that determine the course of the game after the serve are the ball's bounce and the touch of the net (Voeikov et al., 2020). The forms of competition in table tennis include singles, women's doubles, men's doubles, mixed doubles, and team matches (Cong, 2023). This sport requires players to possess both good physical and mental abilities to achieve optimal performance (Shukur et al., 2022).

In table tennis, victory can be achieved by managing the game effectively and consistently scoring points. Therefore, to achieve victory, athletes are not only required to master stroke techniques but also to have a stable footing and be ready to move, because physical readiness before hitting the ball greatly affects reaction speed and stroke accuracy (Li, 2022). Additionally, there are four fundamental techniques that players must master to achieve optimal performance, namely strokes, grip, stance, and footwork (Suhermon et al., 2025). In competitive sports, it is common knowledge that scoring points is greatly influenced by an athlete's ability to execute strong, stable, and consistent forehand strokes. A good forehand stroke allows athletes to control the game and create opportunities to win rallies (Kwon

et al., 2017). However, in this study, the author highlights stance position and the accuracy of forehand and backhand strokes.

Stance position is the most crucial aspect in table tennis, as it serves as the foundation for balance and readiness before hitting the ball. The right stance, particularly the positioning of the feet in relation to the ball, is a crucial element in supporting effective playing technique (Caprioli et al., 2025). Suboptimal mastery of stance position can lead to delayed reactions and reduced accuracy, particularly among beginner athletes still developing their basic techniques. Research by Setiawan (2016) shows that suboptimal basic techniques, including stance position, can affect stroke accuracy. Therefore, stance position not only serves as the starting position but also plays a key role in supporting the accuracy of forehand and backhand strokes (Shao et al., 2020; Wong et al., 2020).

In addition to stance position, forehand and backhand strokes play a very important role because these two techniques are the most frequently used strokes for attacking and defending during table tennis matches (Hidayat & Falaahudin, 2024). Mastering forehand and backhand attack techniques is a crucial foundation for learning table tennis and supports practical playing skills (Huang & Hongseanyatham, 2025). Good forehand and backhand skills are crucial to overall table tennis accuracy, meaning players who have mastered these two techniques can play stably and consistently (Santoso et al., 2025). In addition, in terms of swing power or distance, forehand strokes are stronger than backhand strokes. In table tennis, the swing and ball-hitting movements are basic techniques that determine the quality of the stroke. This process involves coordination of overall body movement to produce controlled strokes, both in terms of direction and accuracy (Chen et al., 2025). Therefore, this study, which highlights the stance position and the accuracy of forehand and backhand strokes, is crucial in determining the extent to which a player's stance position contributes to stroke accuracy and table tennis performance.

The study found that the standing position plays an important role in determining stroke accuracy in table tennis. A previous study shows that suboptimal basic techniques, including the standing position, can affect stroke accuracy (Setiawan, 2016). Furthermore, this study suggests that forehand and backhand strokes have a direct impact on table tennis performance, as these are the most dominant strokes used in a match (Hidayat & Falaahudin, 2024). Therefore, standing position and the accuracy of forehand and backhand strokes are interrelated variables that are important to study in order to improve the performance of table tennis athletes.

There is still little literature specifically discussing this issue. Most previous studies have focused more on stroke techniques rather than on standing positions. Therefore, this research is needed to provide certainty for athletes and serve as a new reference in the world of table tennis, which previously seemed incomplete. In addition, little research has been done on this topic, so this research is ultimately an important step in advancing the world of table tennis.

## Method

### Research Design

This study employed a descriptive correlational design to examine the relationship between body position and the accuracy of forehand and backhand strokes, using field-collected data. The instruments used included accuracy tests for forehand and backhand strokes and video analysis with Kinovea software.

### Participants

The subjects of this study were seven active beginner-level athletes, consisting of three males and four females. All athletes had 1–2 years of table tennis training experience, had never participated in official competitions, and trained at the same club, resulting in a relatively homogeneous skill level.

## Ethical Approval Statement

Ethical approval for this research was granted by Universitas Pendidikan Indonesia under approval letter number 133/UN40.A6/PK.03.03/2025. The study was conducted in accordance with the principles of the Declaration of Helsinki. All participants provided written informed consent prior to their participation in the study.

## Research Instruments

The first tool is Forehand and Backhand Accuracy Skills, a measurement tool designed to objectively and systematically assess the accuracy of table tennis players' strokes (Kadeira & Hafidz, 2021). This tool allows for objective, controlled assessment of stroke accuracy and has been shown to meet high validity and reliability criteria, making it suitable for evaluating stroke accuracy. The content validity test results showed a Content Validity Ratio (CVR) of 0.99, indicating that this tool has a very high level of content suitability and is suitable for measuring table tennis stroke accuracy. Meanwhile, the reliability test results yielded a coefficient of 0.95, indicating excellent measurement consistency. Therefore, the tool used in this study is declared valid and reliable, capable of providing accurate and consistent data in measuring the accuracy of forehand and backhand drive strokes by table tennis athletes (Kadeira & Hafidz, 2021).

This tool was given to subjects twice during the same data collection session. Subjects performed forehand and backhand strokes toward the opponent's table, which had been marked with previous scores, for 30 seconds. After that, the subject was given a 2-minute break, then performed a second trial using the same protocol (Kadeira & Hafidz, 2021). Test evaluation was conducted by counting the number of balls that successfully landed in each scored target area on the table. Each ball that bounced within that area was assigned a score according to the predetermined scoring categories. The scores from each trial were then summed or averaged to obtain the final accuracy scores for each subject's forehand and backhand strokes. After that, the best score was used in the data analysis. An illustration of this tool is shown in Figure 1.

The next tool is video analysis using Kinovea. Research data was collected by recording videos of athletes performing forehand and backhand accuracy skills, which were then transferred to a laptop and analyzed using the Kinovea application. This application enables assessments based on previously compiled biomechanical motion analysis indicators. Each indicator is evaluated via video, and the scores obtained are added and entered into an assessment formula; the final results are then classified according to predetermined criteria (Alkhawaldeh, 2022).

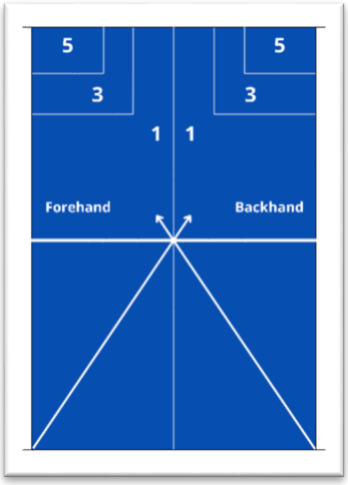


Figure 1. Forehand and Backhand Accuracy Skills.

Table 1. Implementation of Forehand and Backhand Accuracy Procedures

| No | Activity | Implementation Procedures |
|---|---|---|
| 1 | Preparation of tools | Prepare the camera, tripod, laptop, and Kinovea application. |
| 2 | Starting Position | The athlete stands in the ready position with the specified basic stance. |
| 3 | Camera Positioning | The camera is placed to the right of the athlete (sagittal plane), 3 meters away, at a height of 1 meter. |
| 4 | Test administration | Athletes perform 2 sets of forehand and backhand shots using multiball feeds consistently for 30 seconds, then rest for 2 minutes/set. |
| 5 | Data collection | The data obtained from each experiment was the number of balls that bounced in each previously marked score category. |
| 6 | Video analysis | The video was imported into the Kinovea application to measure leg width, knee angle, and body tilt. |

Based on Table 1, the research procedure was carried out systematically, starting from equipment preparation to movement analysis using the Kinovea application. Although some of the reference articles used only analyzed forehand strokes, measurement principles such as observing standing position, placing the camera on the sagittal plane at a controlled distance and height, and using biomechanical indicators are still relevant for analyzing backhand strokes, as both strokes start from a basic position that requires balance and body stability. The tests were conducted in 2 sets of 30 seconds using the multiball method to maintain stroke consistency, and the selection of the best strokes aimed to obtain representative data on foot width, knee angle, and body tilt as indicators of standing position.

The stance position measurement was carried out through video recording analyzed using the Kinovea application to obtain objective angle and distance data. The camera was placed in a posterior position with a tripod at a fixed distance and height so that all movements of the athlete's legs and body were clearly recorded. The recording was taken while the athlete performed forehand and backhand strokes during multiball training, with the ball fed consecutively and consistently. The video was then transferred to a laptop for analysis, including measuring the distance between the feet and the balance of the body during the preparation and execution of the stroke. In addition, the athlete's balance was observed by their ability to maintain positional stability without losing balance while receiving consecutive balls.

### Data Analysis

The results of the analysis of standing positions on the accuracy of forehand and backhand strokes of beginner table tennis players provide an overview of the standing positions used by athletes and their stroke accuracy levels. The data used in this study are kinematic, as the analysis focuses on observing the athletes' body positions, specifically the distance between their feet in the stance position during forehand and backhand strokes.

## Results and Discussion

### Results

The analysis results provide an overview of the stances used by beginner table tennis players and the accuracy of their forehand and backhand strokes. In this study, the analysis focused solely on the stance variable, represented by the distance between the feet during a stroke. The presentation of this data aims to provide an initial overview of the characteristics of stance position and stroke accuracy performance before analyzing the relationship between these two research variables. The test results are shown in Table 2.

Based on Table 2, the data presented are the actual measurement results for the forehand and backhand stance positions and the number of accurate strokes in each score category (1, 3, and 5). The data show the frequency of successful strokes by athletes on each target and have not been multiplied

by the score value of each category. Next, the number in each score category is multiplied by the corresponding score value, then added together to obtain the total forehand and backhand shot accuracy score. The results of this data processing are used in the next stage of analysis.

Table 2. Data Analysis of Stance Position on Forehand and Backhand Accuracy

| Sample | Stance Position Forehand (cm) | Score Forehand (Rep) | | | Stance Position Backhand (cm) | Score Bakchand (Rep) | | |
|---|---|---|---|---|---|---|---|---|
| | | 1 | 3 | 5 | | 1 | 3 | 5 |
| A1 | 101.86 | 12 | 5 | 2 | 101.19 | 16 | 8 | 2 |
| A2 | 98.17 | 7 | 4 | 0 | 98.75 | 22 | 2 | 0 |
| A3 | 103.71 | 21 | 5 | 3 | 100.33 | 28 | 11 | 2 |
| A4 | 100.32 | 8 | 16 | 4 | 107.00 | 25 | 17 | 7 |
| A5 | 100.44 | 10 | 2 | 22 | 108.29 | 4 | 39 | 8 |
| A6 | 60.84 | 12 | 16 | 5 | 101.73 | 5 | 36 | 0 |
| A7 | 133.77 | 12 | 8 | 20 | 119.69 | 10 | 13 | 4 |

Table 3. Calculation Results Data between Repetitions and Points

| Sample | Stance Position (cm) | Forehand | Backhand |
|---|---|---|---|
| A1 | 101.86 | 37 | 50 |
| A2 | 98.17 | 19 | 28 |
| A3 | 103.71 | 51 | 71 |
| A4 | 100.32 | 76 | 111 |
| A5 | 100.44 | 126 | 161 |
| A6 | 60.84 | 85 | 113 |
| A7 | 133.77 | 136 | 69 |

Based on Table 3, the data presented are the results of data processing: the accuracy scores for forehand and backhand strokes, multiplied by the point values for each category, and summed for each sample. This table shows the variation in stroke accuracy scores between samples, both for forehand and backhand strokes. In general, several samples with stance position values close to the average range achieve higher accuracy scores, such as A5 and A7 for forehand strokes and A4 and A5 for backhand strokes. Conversely, some samples with extreme or deviant stance position values show lower or inconsistent accuracy scores.

Table 4. Descriptive Statistics

| Variable | Minimum | Maximum | Average ± Standard Deviation |
|---|---|---|---|
| Stance Position | 60.84 | 133.77 | 99.87 ± 21.19 |
| Forehand Stroke | 19.00 | 136.00 | 75.71 ± 43.92 |
| Backhand Stroke | 28.00 | 161.00 | 86.14 ± 45.00 |

Based on Table 4, the stance position variable has a minimum value of 60.84, a maximum value of 133.77, an average of 99.87, and a standard deviation of 21.19, indicating variation in position between samples, even though most are around the average. The forehand stroke accuracy variable ranges from 19.00 to 136.00, with an average of 75.71 and a standard deviation of 43.92, indicating that forehand stroke ability between samples still varies considerably. Meanwhile, backhand stroke accuracy ranges from 28.00 to 161.00, with an average of 86.14 and a deviation of 45.00, indicating that, in general, backhand stroke values are higher than forehand stroke values. However, the level of data dispersion is

also relatively large. Overall, these descriptive statistical results show the diversity of data characteristics across all research variables.

Table 5. Normality Test Results

| Variable | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistics | df | Sig. | Statistics | df | Sig. |
| Stance Position | 0.325 | 7 | 0.024 | 0.832 | 7 | 0.083 |
| Forehand Stroke | 0.160 | 7 | 0.200* | 0.946 | 7 | 0.698 |
| Backhand Stroke | 0.203 | 7 | 0.200* | 0.958 | 7 | 0.800 |

Based on Table 5, the results of the normality tests above indicate that the tests used were the Kolmogorov-Smirnov and Shapiro-Wilk tests. Given that the sample size was 7 ($n < 50$), the Shapiro–Wilk test was used as the primary test for assessing normality. The Shapiro-Wilk test results show that the stance position variable has a significance value of 0.083 ($p > 0.05$), and the forehand stroke accuracy variable is 0.698 ($p > 0.05$). The backhand stroke accuracy variable is 0.800 ($p > .05$). Thus, it can be concluded that all research variables are normally distributed, so that the data meet the requirements for parametric statistical analysis in the next stage.

Table 6. Correlation Test Results

| Variable | Correlation Value (r) | Sig. (p-value) | Description |
|---|---|---|---|
| Stance Position - Forehand Stroke | 0.293 | 0.524 | $H_0$ accepted |
| Stance Position - Backhand Stroke | -0.281 | 0.542 | $H_0$ accepted |
| Stance Position - Forehand & Backhand Stroke | 0.679 | 0.093 | $H_0$ accepted |

Based on Table 6, the correlation test results showed that the relationship between stance position and forehand stroke accuracy obtained a correlation value of $r = 0.293$ with a significance value of $p = 0.524$ ($p > 0.05$), indicating that the relationship was not statistically significant. The coefficient of determination (R Square = 0.086) showed that stance position contributed only 8.6% to forehand stroke accuracy. Furthermore, the relationship between stance position and backhand stroke accuracy produced a correlation value of $r = -0.281$ with $p = 0.542$ ($p > 0.05$), indicating no significant relationship, with an R Square value of 0.079 or a contribution of 7.9%. Meanwhile, the combined relationship between stance position and forehand and backhand stroke accuracy showed a correlation value of $r = 0.679$ with $p = 0.093$ ($p > 0.05$). Although the relationship was not statistically significant, the R Square value of 0.461 indicated that stance position contributed approximately 46.1% to the overall variation in combined stroke accuracy.

## Discussion

### The Relationship between Stance Position and Forehand Stroke Accuracy in Beginner Table Tennis Athletes

The results of this study indicate that foot position does not have a consistent effect on forehand accuracy in beginner table tennis players. This finding is inconsistent with studies that state that initial body posture has a significant contribution to the technical performance of table tennis strokes (Wong et al., 2020). This inconsistency indicates that at the beginner level, mastery of basic techniques and movement coordination are still more dominant factors than foot position. Therefore, the role of foot position in beginner athletes has not shown a consistent contribution, as it does in experienced athletes.

The forehand stroke is one of the most frequently used techniques to start a rally and plays a strategic role in providing a tactical advantage from the start of a table tennis match (Muzakir et al., 2025). However, in novice athletes, the consistency of forehand execution is still influenced by unstable dynamic balance, which affects the accuracy and control of the shot (Stathopoulos et al., 2024). In

addition, improper standing position, especially in terms of width and foot placement, can affect the control of the body's center of gravity, which impacts the stability of movement when performing a forehand shot (Farrahi et al., 2019). These findings are consistent with a study by Setiawan (2016), which showed that limitations in mastering basic techniques, including the standing position, can hinder optimal development of stroke accuracy in novice athletes. Therefore, this study suggests that stance is not yet a dominant factor in determining forehand stroke accuracy in novice athletes.

The Relationship Between Stance Position and Backhand Stroke Accuracy in Beginner Table Tennis Athletes

The results of this study indicate that foot position does not have a significant relationship with backhand accuracy in beginner table tennis players. These results suggest that foot position is not yet a major determinant of backhand accuracy at the early stages of learning technique. These findings differ from those of a study (Zhu et al., 2023), which emphasized the importance of weight distribution in forehand strokes, suggesting that the standing position may also affect backhand stroke accuracy, although the movement mechanisms differ. This difference in results may be because beginner athletes are unable to utilize their standing position to support their stroke movements optimally.

In novice athletes, the accuracy of backhand strokes is more influenced by arm coordination, wrist control, elbow angle, and swing timing than by starting position (Sanusi et al., 2021). This is supported by Hassan (2025), who states that the accuracy of backhand strokes is more determined by the quality of upper body coordination than by the starting stance. This shows that beginner athletes still rely more on mastering specific movement techniques than on overall optimization. Therefore, the results of this study indicate that in beginner table tennis athletes, specific technical variables are more dominant than standing position in determining the accuracy of backhand strokes.

The Relationship between Stance Position and the Accuracy of Forehand and Backhand Strokes in Beginner Table Tennis Athletes

Combined, stance position shows a tendency to contribute to the accuracy of forehand and backhand strokes, indicating that basic balance remains the foundation of technique in table tennis. Stroke training that emphasizes hitting frequency and ball placement to specific targets allows athletes to become accustomed to directing strokes consistently (Kadeira & Hafidz, 2021). However, previous research indicates that studies on the relationship between body posture and stroke accuracy remain limited, especially among novice athletes whose motor control and competitive experience are not yet stable (Wong et al., 2020). In addition, although training in dynamic game conditions is effective for improving technical readiness and movement response (Bayani et al., 2024), at the beginner stage, the integration of balance, coordination, and stroke accuracy has not yet developed optimally. This explains why in this study, the contribution of stance position has not shown strong consistency, because the factors of experience and technical adaptation still play a role as supporting variables.

In this study, stance position analysis was conducted using the Kinovea application to provide a more objective, measurable evaluation of movement. This application enables detailed video analysis through motion-slowdown features, angle measurements, and the documentation of results as material for exercise evaluation. Using these measurements, the stance position during forehand and backhand strokes can be analyzed systematically, allowing the relationship with stroke accuracy to be interpreted scientifically. In addition, its ease of access and availability for free make Kinovea a practical and efficient tool in sports biomechanics analysis (Putra et al., 2025).

When compared to findings in badminton, which emphasize the importance of technique, physical condition, tactics, and mental preparedness in supporting performance (Fauzan et al., 2021), this study shows that in table tennis, this integration is also reflected in the readiness of the body's basic position before striking the ball. Although they come from different sports, both are racket sports that require coordination, balance, and quick decision-making under pressure. In the context of this study,

stance position not only plays a biomechanical role but is also related to the athlete's cognitive readiness to respond to the direction and speed of the ball. Therefore, structured training not only improves technical skills but also supports concentration and movement control, which in turn affect stroke accuracy (Pathonah et al., 2024). This study makes an empirical contribution to the field of table tennis biomechanics by demonstrating that, at the beginner level, no significant relationship exists between stance position and shot accuracy; therefore, this study emphasizes the importance of considering other technical factors and aspects of motor coordination in improving table tennis shot performance.

Limitations of Study

This study has limitations because the analysis focused solely on stance position, measured by the distance between the athlete's feet, without considering other kinematic variables such as joint angles, movement timing, and arm swing velocity, which can also influence stroke accuracy. Therefore, future research is recommended to include a more comprehensive kinematic analysis involving both the upper and lower extremities, thereby providing a more complete understanding of the biomechanical factors contributing to the accuracy of forehand and backhand strokes in table tennis.

## Conclusions

This study aims to analyze the relationship between stance and the accuracy of forehand and backhand strokes among beginner table tennis players. The results indicate that stance has a weak correlation with forehand and backhand shot accuracy. Correlation analysis shows that stance contributes only slightly to variations in shot accuracy among beginner players. Although stance is an important fundamental technique that supports balance and body stability during play, it does not significantly determine the accuracy of forehand and backhand shots. These findings suggest that other factors, such as technical proficiency, coordination, ball contact timing, and training experience, may play a more dominant role in determining stroke accuracy. Therefore, training programs for beginner table tennis players should not only emphasize stance but also focus on improving stroke technique and motor coordination to enhance forehand and backhand stroke accuracy.

## Authors' contributions

AJPA contributed to the research conceptualization, study design, data collection, data analysis and interpretation, manuscript writing, critical revision of the article, and final approval of the manuscript. MYS contributed to the research conceptualization, manuscript writing, critical revision of the article, and final approval of the manuscript. GN contributed to the research conceptualization, data collection, manuscript writing, critical revision of the article, and final approval of the manuscript. All authors reviewed and approved the final version of the manuscript.

## Acknowledgment

The authors gratefully acknowledge the participation of the beginner table tennis athletes and coaches involved in this study. The authors also thank all parties who supported the data collection process and contributed to the completion of this research.

## Competing interests

The authors declare no competing interests.

## AI Disclosure Statement

During the preparation of this manuscript, the authors used DeepL Translate in combination with Google Translate and Grammarly to support translation, grammar checking, and language refinement. All generated outputs were carefully reviewed and edited by the authors to ensure accuracy, clarity, and adherence to academic standards. The authors take full responsibility for the content of this manuscript.

## Data Availability Statement

The empirical data supporting the findings of this study are contained within the manuscript and its supplementary materials. Additional detailed datasets or raw data used for the structural equation modeling are available from the corresponding author upon reasonable academic request.

## Funding

This research did not receive external funding.

## Publisher's Note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors, and the reviewers. Any product that may be evaluated in this article, or a claim its manufacturer may make, is not guaranteed or endorsed by the publisher.

## References

Alkhawaldeh, I. M. (2022). The Effect of Selected Kinematic Variables on the Accuracy of Topspin Forehand among Table Tennis Players. *International Journal of Human Movement and Sports Sciences, 10*(2), 217–223. [Crossref]

Asri, N., Soegiyanto, S., & Mukaromah, S. B. (2017). Pengaruh Metode Latihan Multiball dan Koordinasi Mata Tangan terhadap Peningkatan Keterampilan Forehand Drive Tenis Meja. *Journal of Physical Education and Sport Universitas Negeri Semarang, 6*(2), 179–185. [Crossref]

Bayani, S. N., Komarudin, K., Saputra, M. Y., & Novian, G. (2024). Meningkatkan Percaya Diri Atlet Intelektual Rendah Pada Cabang Olahraga Open-Skill Melalui Latihan Kognisi. *Jambura Journal of Sports Coaching, 6*(2), 84–97. [Crossref]

Caprioli, L., Campoli, F., Romagnoli, C., Cariati, I., Edriss, S., Padua, E., Bonaiuto, V., & Annino, G. (2025). Three Reasons for Playing the Tennis Forehand in Square Stance. *Journal of Functional Morphology and Kinesiology, 10*(2), 1–16. [Crossref]

Chen, Z., Zhao, T., Shen, Y., Ren, S., & Sun, L. (2025). The effects of muscle fatigue on shoulder proprioception and forehand stroke accuracy in Chinese elite table tennis athletes. *BMC Sports Science, Medicine and Rehabilitation, 17*(1), 199. [Crossref]

Cong, X. (2023). The Impact of Table Tennis on Public Health. *Highlights in Science, Engineering and Technology, 54*, 420–425. [Crossref]

Farrahi, V., Niemelä, M., Kangas, M., Korpelainen, R., & Jämsä, T. (2019). Calibration and validation of accelerometer-based activity monitors: A systematic review of machine-learning approaches. *Gait & Posture, 68*(July 2018), 285–299. [Crossref]

Fauzan, H. A., Komarudin, K., Tafaqur, M., & Novian, G. (2021). Meningkatkan Kepercayaan Diri dan Hasil Pukulan Dropshot Melalui Latihan Self-Talk pada Cabang Olahraga Bulutangkis. *Journal of Sport Coaching and Physical Education, 6*(2), 121–139. [Crossref]

Hassan, A. A. (2025). Selected Biomechanical Variables and Their Relationship with the Accuracy Index of the Forehand Topspin Stroke Among Table Tennis Players of Khanaqin Sports Club. *Pubmedia Jurnal Pendidikan Olahraga, 3*(1), 1–13. [Crossref]

Hidayat, W., & Falaahudin, A. (2024). Comparison Between Forehand and Backhand Stroke Techniques in the Accuracy of Strikes Among Extra-Curricular Table Tennis Students at State Senior High School 1 Sedayu. *Education Achievement: Journal of Science and Research, 5*(1), 125–133. [Crossref]

Huang, Z., & Hongseanyatham, P. (2025). Effects of Using Virtual Reality Technology on Forehand and Backhand in Table Tennis. *International Journal of Sociologies and Anthropologies Science Reviews, 5*(1), 407–418. [Crossref]

Kadeira, R., & Hafidz, A. (2021). Pengaruh Latihan Multiball terhadap Ketepatan Sasaran Pukulan Forehand dan Backhand Drive pada Atlet Tenis Meja Makota Malang. *Jurnal Prestasi Olahraga, 4*(6),

114–120. [Crossref]
Kwon, S., Pfister, R., Hager, R. L., Hunter, I., & Seeley, M. K. (2017). Influence of tennis racquet kinematics on ball topspin angular velocity and accuracy during the forehand groundstroke. *Journal of Sports Science and Medicine, 16*(4), 505–513. [Crossref]
Li, X. (2022). Biomechanical analysis of different footwork foot movements in table tennis. *Computational Intelligence and Neuroscience, 2022*(1), 9684535. [Crossref]
Muzakir, M. R., Sunaryadi, Y., & Saputra, M. Y. (2025). The Effect of Slice Service Training on The Accuracy of Tennis Service Hit. *Journal of Physical Education, Sport, Health and Recreations, 14*(2), 748–752. [Crossref]
Pathonah, A. N., Komarudin, K., Saputra, M. Y., & Novian, G. (2024). Life Kinetic Training and Accuracy of Overhead Lob Strokes of Badminton Athletes. *Competitor: Jurnal Pendidikan Kepelatihan Olahraga, 16*(2), 410–416. [Crossref]
Putra, S. D. A., Mulyana, M., & Saputra, M. Y. (2025). Penggunaan Teknologi Kinovea dalam Mengukur Kecepatan Tendangan Sabit Hasil Latihan Plyometric Bentuk Split Jump dan Single Leg Bound. *Jurnal Dunia Pendidikan, 6*(3), 962–973. [Crossref]
Ren, Y., Huang, Z., Guo, Y., Wu, J., & Sun, Y. (2019). Kinematic characteristics of backhand block in table tennis. *ACM International Conference Proceeding Series, August 2019*, 41–45. [Crossref]
Sahabuddin, S. (2019). Analisis Antropometrik Dan VO 2 Max Dengan Prestasi Pemain BKMF. *SPORTIVE: Journal of Physical Education, Sport and Recreation, 2*(2), 128–143. [Crossref]
Santoso, R. A., Barlian, E., Haryanto, J., & Lesmana, H. S. (2025). Kemampuan Pukulan Forehand dan Backhand Push Siswa SMK Negeri 2 Sarolangun terhadap Ketepatan Tenis Meja. *Jurnal Pedagogik Olahraga, 11*(02), 462–468. [Crossref]
Sanusi, K. A. M., Mitri, D. Di, Limbu, B., & Klemke, R. (2021). Table Tennis Tutor : Forehand Strokes Classification Based on Multimodal Data and Neural Networks. *Sensors, 21*(9), 1–18. [Crossref]
Setiawan, M. N. I. (2016). Ketepatan Pukulan Forehand Dan Backhand Tenis Meja Aliyah Negeri Se Kabupaten Bantul Daerah Istimewa Yogyakarta. *Jurnal Pendidikan Jasmani Kesehatan Dan Rekreasi, 5*(12), 1–13. [Crossref]
Shao, S., Yu, C., Song, Y., Baker, J. S., Ugbolue, U. C., Lanzoni, I. M., & Gu, Y. (2020). Mechanical character of lower limb for table tennis cross step maneuver. *International Journal of Sports Science & Coaching, 15*(4), 552–561. [Crossref]
Shukur, L. H., Jalal, A., & Zighair, R. M. (2022). the Effect of the Learning Model Together Using Auxiliary Tools in Developing the Accuracy of the Forehand Stroke in Table Tennis. *Revista Iberoamericana de Psicologia Del Ejercicio y El Deporte, 17*(1), 36–39. [Crossref]
Stathopoulos, A., Petridou, A., Kantouris, N., & Mougios, V. (2024). A comparison of leg muscle oxygenation, cardiorespiratory responses, and blood lactate between walking and running at the same speed. *Sports, 12*(2), 48. [Crossref]
Suhermon, S., Arisman, A., Hendryanto, F., Siska, S., Sujae, I. H., Haryanto, J., Indah, D., & Hamdan, M. N. (2025). Development of the forehand drive instrument in table tennis. *Jurnal Patriot, 7*(3), 122–128. [Crossref]
Voeikov, R., Falaleev, N., & Baikulov, R. (2020). TTNet: Real-time temporal and spatial video analysis of table tennis. *IEEE Computer Society Conference on Computer Vision and Pattern Recognition Workshops, 2020-June*, 3866–3874. [Crossref]
Wong, D. W., Lee, W. C., & Lam, W. (2020). Biomechanics of Table Tennis: A Systematic Scoping Review of Playing Levels and Maneuvers. *Applied Sciences, 10*(15), 2–21. [Crossref]
Zhu, R., Yang, X., Chong, L. C., Shao, S., Istvan, B., & Gu, Y. (2023). Biomechanics of Topspin Forehand Loop in Table Tennis : An Application of OpenSim Musculoskeletal Modelling. *Healthcare, 11*, 2–12. [Crossref]