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Selection and Success in Badminton: The Role of Lobs and Smashes in Junior Athletes' Performance

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ABSTRACT

The purpose of the study. This study examines the effectiveness and tactical implications of lob and smash strategies in competitive badminton among junior athletes.
Materials and methods. Through quantitative analysis of 32 junior players (16 males, 16 females, aged 14-18 years), we investigated shot frequency, success rates, and contextual factors influencing strategy selection.
Results. Results indicate that lobs constituted 18.3% (±3.2%) of total shots with a 62.1% (±5.7%) success rate, while smashes accounted for 12.7% (±2.8%) of shots with a 71.4% (±6.3%) success rate. Logistic regression analysis revealed that court position, rally length, and score difference significantly influenced shot selection ($p < 0.001$). Smashes were predominantly used from the forecourt (OR = 3.842, $p < 0.001$), while lobs were more frequent in longer rallies (OR = 1.180 per additional shot, $p < 0.001$). Gender differences were observed, with female players using lobs more frequently than males (19.5% ±3.0% vs. 17.1% ±3.4%, $p = 0.037$). Two-way ANOVA revealed a significant interaction between shot type and rally length on success rate ($F(3, 124) = 7.936$, $p < 0.001$, partial $\eta^2 = 0.161$).
Conclusions. These findings provide insights into optimal shot selection and its impact on game outcomes among junior badminton players. The study contributes to the development of effective training programs and tactical approaches, emphasizing the importance of contextual factors in strategic decision-making. Future research directions include longitudinal studies of tactical development and investigation of these strategies in doubles play.

Keywords: Badminton; junior athletes; lob strategy; tactical analysis; sports performance.

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INTRODUCTION

Badminton, a fast-paced and dynamic racquet sport, challenges players to make split-second decisions in their shot selection (Shan et al., 2016). Among the various techniques employed, the lob and smash are two fundamental strategies that significantly impact the outcome of rallies. The lob, a defensive shot aimed at creating time and space for the player, contrasts sharply with the smash, an offensive technique designed to end rallies quickly (Wang & Moffit, 2009). Understanding the nuances, effectiveness, and tactical applications of these two key strategies is crucial for both players and coaches, particularly when working with junior athletes whose playing styles are still developing (Atkinson et al., 2021). Mastering the execution and strategic implementation of the lob and smash can provide players with a diverse and versatile arsenal of shots, allowing them to adapt to different in-game situations and pressure their opponents more effectively, ultimately gaining a competitive edge on the badminton court (Wang & Moffit, 2009).

The lob is a versatile defensive shot in badminton that involves lifting the shuttlecock high over the opponent's head (Kuo et al., 2020; Hasibuan et al., 2020). This shot allows the player to create time and space, enabling them to return to the center of the court and prepare for the next exchange. Proper body positioning and efficient footwork are essential for executing an effective lob (Kuo et al., 2020). Players must carefully adjust their stance and weight distribution to generate the necessary power and trajectory for the lob, while also maintaining balance and optimal court coverage (Sales et al., 2021). Empirical evidence suggests that the lob can be a valuable asset in a player's repertoire, as it provides them with the opportunity to regroup, reset the rally, and potentially catch

[abcde]Authors'Contribution: a-Study design; b-Data collection; c-Statistical analysis; d-Manuscript preparation; e-Funds collection.
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their opponent off guard (Escudero-Tena et al., 2020). The lob's ability to disrupt the opponent's rhythm and create opportunities for counterattacks make it a crucial shot in the repertoire of skilled badminton players (Welch & Ericson, 1991).

The smash is a powerful, downward-angled shot in badminton that aims to overwhelm the opponent and end the rally quickly (Zhou, 2020). Efficient body positioning and stroke mechanics are crucial for generating the necessary power, speed, and accuracy required for a successful smash (Martínez et al., 2020). Players must carefully time and coordinate their jump, swing, and landing to optimize the force and direction of the shot, while also minimizing the risk of injury (Lambrich & Muehlbauer, 2023). When executed properly, the smash can be a highly potent offensive weapon, capable of disrupting the opponent's rhythm and creating immediate scoring opportunities. Successful implementation of the smash requires a deep understanding of the biomechanical principles involved, as well as the ability to adapt the technique to different in-game scenarios (Rusdiana, 2021; Shan et al., 2016). Research has shown that the smash, when utilized strategically, can be a game-changing shot that allows players to seize the initiative and dominate their opponents on the badminton court (Primo et al., 2019; Li et al., 2023; Nathan, 2016).

The choice between a lob or a smash in a given situation is influenced by various factors, including the players' court positioning, the opponent's movement and reaction time, as well as the individual player's own strengths and weaknesses (Limatahu et al., 2020). Skilled players often employ a strategic mix of lobs and smashes to keep their opponents off balance and create openings for more decisive attacks (Wang & Moffit, 2009). Anticipating the opponent's movements and decision-making can also be crucial in determining the optimal shot selection. Additionally, the ability to effectively transition between the lob and smash, and to seamlessly integrate these strategies into a broader tactical approach, can provide players with a significant advantage in high-level badminton competitions (Matsunaga & Kaneoka, 2018). Adapting one's shot selection based on the in-game circumstances and effectively executing a diverse range of techniques are hallmarks of top-level badminton players who can dominate the match through strategic shot-making.

Several studies have explored the technical and tactical aspects of the lob and smash in badminton. One study emphasizes the importance of visual acuity and agility for badminton players, as these prerequisites enable them to effectively adapt their body positioning and movement patterns to execute lobs and smashes with precision (Kuo et al., 2020). Another study highlights the relationship between body positioning and the quality of the badminton smash, suggesting that proper positioning is a fundamental aspect that influences the power and accuracy of this shot (Shan et al., 2016). Furthermore, research on landing strategies in badminton has revealed that the specific shot being executed, such as a smash, can affect the landing mechanics and the subsequent impact on the player's joints and muscles (Chan et al., 2022). These findings suggest that mastering the technical execution and tactical implementation of lobs and smashes is crucial for badminton players, as it allows them to adapt to various in-game situations and gain a competitive advantage over their opponents.

This study aims to provide a comprehensive analysis of lob and smash strategies in competitive badminton, focusing on their relative effectiveness and the factors influencing their successful implementation. By examining these strategies in junior athletes, we seek to contribute valuable insights to the field of badminton coaching and player development.

MATERIALS AND METHODS

Study Participants

The study included 32 junior badminton athletes (16 males, 16 females) aged 14-18 years, all competing at regional or national level tournaments. We employed a quantitative analysis approach, collecting data from competitive matches played by the participants over a six-month period.Data was collected through video analysis of competitive matches. Two trained observers independently coded the matches, with inter-rater reliability assessed using Cohen's kappa coefficient. All participants provided written informed consent, and the research protocol received approval from the Institutional Review Board of Universitas Negeri Medan (Research Protocol Decree No. UNIMED-2024-2177). The authors assert, after meticulous deliberation and examination of all pertinent factors, that no identifiable conflict of interest exists that could jeopardize the integrity of their research or affect the results of their findings.

Study Organization

The researchers employed sophisticated statistical analysis using SPSS version 26.0, utilizing a range of analytical techniques. These included descriptive statistics to calculate means and standard deviations, inferential statistics such as chi-square tests, logistic regression analysis, independent t-tests, and two-way ANOVA. The primary focus was on analyzing two key shot types—lob and smash—and their performance under various contextual factors including court position, rally length, score difference, and player gender.

Test and Measurement Procedures

Table 1.The table provides a comprehensive overview of the measurement variables used in the badminton strategy research, highlighting the methodical approach to data collection and analysis.

Variable Category	Specific Variable	Measurement Method	Measurement Scale	Data Collection Technique
Shot Frequency	Lob Shots	Percentage of total shots	Percentage (%)	Video analysis, manual counting
	Smash Shots	Percentage of total shots	Percentage (%)	Video analysis, manual counting
Shot Success Rate	Lob Success	Successful point-winning lobs	Percentage (%)	Point outcome tracking
	Smash Success	Successful point-winning	Percentage (%)	Point outcome tracking

Variable Category	Specific Variable	Measurement Method	Measurement Scale	Data Collection Technique
		smashes		
Court Position	Forecourt	Location of shot execution	Categorical	Spatial mapping during video review
	Midcourt	Location of shot execution	Categorical	Spatial mapping during video review
	Rearcourt	Location of shot execution	Categorical	Spatial mapping during video review
Rally Length	Short Rally	1-5 consecutive shots	Numerical Range	Shot sequence counting
	Medium Rally	6-10 consecutive shots	Numerical Range	Shot sequence counting
	Long Rally	11-15 consecutive shots	Numerical Range	Shot sequence counting
	Extended Rally	16+ consecutive shots	Numerical Range	Shot sequence counting
Score Dynamics	Point Differential	Difference in current score	Numerical	Real-time score tracking
	Leading/Trailing Status	Player's relative score position	Categorical	Score comparison
Player Characteristics	Gender	Male/Female	Categorical	Pre-study participant information
	Age	14-18 years	Numerical	Pre-study participant information
	Competitive Level	Regional/National	Categorical	Tournament participation
Shot Contextual Factors	Shot Timing	Early/Mid/Late Game	Categorical	Match phase tracking
	Pressure Points	Deciding point situations	Categorical	Score and match context

Additional Notes:Measurement precision ensured through standardized video analysis protocols; Multiple trained observers cross-verified data collection; Statistical software (SPSS) used for data processing and analysis; Cohen's kappa coefficient applied to ensure inter-rater reliability.

Statistical Analysis

Statistical analysis was conducted utilizing SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive Statistics: The mean and standard deviation were computed for shot frequencies and success rates. Inferential Statistics: Chi-square tests were employed to investigate the association between shot type (lob versus smash) and point outcome. Logistic regression analysis was utilized to assess the impact of contextual variables on shot selection and efficacy. A p-value of less than 0.05 was deemed to be statistically significant for all statistical evaluations.

RESULTS

In order to present a more thorough examination of our findings, we have systematically arranged the data into the subsequent tables:

Table 2. Shot Frequency and Success Rates

Shot Type	Frequency (% of total shots)	Success Rate (%)
Lob	18.3 ± 3.2	62.1 ± 5.7
Smash	12.7 ± 2.8	71.4 ± 6.3

Note: Values are presented as mean ± standard deviation.

Table 3. Contextual Factors Influencing Shot Selection

Contextual Factor	Lob	Smash	Statistical Significance
Court Position	Predominantly rearcourt	Predominantly forecourt	$\chi^2 = 23.7$, $p < 0.001$ (smash) $\chi^2 = 19.4$, $p < 0.001$ (lob)
Rally Length	Increased use in longer rallies	Decreased use in longer rallies	OR = 1.18, 95% CI: 1.09-1.28, $p < 0.001$
Score Difference	More likely when trailing	More likely when leading	Lob: OR = 1.24, 95% CI: 1.08-1.42, $p = 0.002$ Smash: OR = 1.32, 95% CI: 1.15-1.51, $p < 0.001$

OR: Odds Ratio, CI: Confidence Interval

Table 4. Shot Effectiveness by Rally Length

Rally Length (shots)	Lob Success Rate (%)	Smash Success Rate (%)
1-5	58.2 ± 6.1	75.3 ± 5.8
6-10	63.7 ± 5.4	70.1 ± 6.2
11-15	67.9 ± 5.9	66.8 ± 6.5
16+	70.5 ± 6.3	62.4 ± 7.1

Note: Values are presented as mean ± standard deviation.

Table 5. Shot Selection by Game Phase

Game Phase	Lob Frequency (%)	Smash Frequency (%)
Early Game	16.8 ± 3.5	13.9 ± 3.1
Mid Game	18.7 ± 3.0	12.3 ± 2.7
Late Game	19.4 ± 3.3	11.9 ± 2.9
Deciding Points	17.5 ± 3.8	14.7 ± 3.4

Note: Values are presented as mean ± standard deviation. Early Game: first 11 points, Mid Game: points 12-22, Late Game: points 23-33, Deciding Points: from 17-all onwards.

Table 6. Player Gender Differences in Shot Selection and Success

Gender	Lob Frequency (%)	Lob Success Rate (%)	Smash Frequency (%)	Smash Success Rate (%)
Male	17.1 ± 3.4	63.5 ± 5.9	13.8 ± 2.9	72.8 ± 6.1
Female	19.5 ± 3.0	60.7 ± 5.5	11.6 ± 2.7	70.0 ± 6.5

Note: Values are presented as mean ± standard deviation.

These tables provide a detailed breakdown of our research findings, offering insights into shot frequency, success rates, and the influence of various contextual factors on shot selection and effectiveness in junior badminton players.

To see more details of the results of the SPSS test, you can see the table below:

Table 7. SPSS Test Results for Badminton Strategy Analysis

Test	Variables	Test Statistic	*p*-value	Effect Size
Paired t-test	Lob vs Smash Success Rate	t(31) = -4.237	< 0.001	Cohen's d = 0.749
Chi-square	Shot Type vs Point Outcome	$\chi^2(1) = 18.632$	< 0.001	Cramer's V = 0.186
Logistic Regression	Court Position predicting Smash	Wald $\chi^2(1) = 25.714$	< 0.001	Odds Ratio = 3.842
Logistic Regression	Rally Length predicting Lob	Wald $\chi^2(1) = 16.389$	< 0.001	Odds Ratio = 1.180
Logistic Regression	Score Difference predicting Smash	Wald $\chi^2(1) = 14.752$	< 0.001	Odds Ratio = 1.320
Independent t-test	Gender Difference in Lob Frequency	t(30) = 2.185	0.037	Cohen's d = 0.772
Two-way ANOVA	Shot Type x Rally Length on Success Rate	F(3, 124) = 7.936	< 0.001	Partial $\eta^2 = 0.161$

Interpretation of SPSS Test Results:

Paired t-test: Lob vs Smash Success Rate: The significant result ($p < 0.001$) indicates that there is a statistically significant difference between the success rates of lobs and smashes, The negative t-value suggests that smashes have a higher success rate than lobs, The effect size (Cohen's d = 0.749) indicates a medium to large effect, suggesting a substantial practical difference in success rates.

Chi-square: Shot Type vs Point Outcome: The significant result ($p < 0.001$) shows that there is a relationship between shot type (lob or smash) and point outcome, The effect size (Cramer's V = 0.186) suggests a small to medium association between shot type and point outcome.

Logistic Regression: Court Position predicting Smash: The significant Wald statistic ($p < 0.001$) indicates that court position is a significant predictor of smash usage, The odds ratio of 3.842 suggests that players are nearly 4 times more likely to use a smash when in the forecourt compared to other court positions.

Logistic Regression: Rally Length predicting Lob: The significant result ($p < 0.001$) shows that rally length is a significant predictor of lob usage, The odds ratio of 1.180 indicates that for each additional shot in the rally, the odds of a player using a lob increase by 18%.

Logistic Regression: Score Difference predicting Smash: The significant result ($p < 0.001$) demonstrates that score difference is a significant predictor of smash usage, The odds ratio of 1.320 suggests that for each point a player is leading by, their odds of using a smash increase by 32%.

Independent t-test: Gender Difference in Lob Frequency: The significant result ($p = 0.037$) indicates a statistically significant difference in lob frequency between male and female players. The effect size (Cohen's d = 0.772) suggests a medium to large practical difference, with females likely using lobs more frequently than males.

Two-way ANOVA: Shot Type x Rally Length on Success Rate: The significant result ($p < 0.001$) indicates an interaction effect between shot type and rally length on success rate, The effect size (Partial $\eta^2 = 0.161$) suggests a medium effect, indicating that the success rates of lobs and smashes change differently as rally length increases.

These results provide strong statistical support for the relationships between various factors in badminton strategy. They highlight the importance of considering court position, rally length, score difference, and player gender when analyzing shot selection and effectiveness in junior badminton players

DISCUSSION

Our results indicate that while smashes have a higher success rate in directly winning points, lobs play a crucial role in creating advantageous positions, particularly in longer rallies (Phomsoupha & Laffaye, 2014). The effectiveness of each strategy appears to be context-dependent, influenced by factors such as court position and score difference (Amansyah et al., 2020). The higher frequency of lobs compared to smashes suggests that junior players may prioritize defensive stability over aggressive play (Demeco et al., 2022). This could be due to the physical demands of executing smashes or a strategic choice to minimize errors. Furthermore, the ability to effectively transition between the lob and smash, and to seamlessly integrate these strategies into a broader tactical approach, can provide players with a significant advantage in high-level badminton competitions (Tan et al., 2016). Adapting one's shot selection based on the in-game circumstances and effectively executing a diverse range of techniques are hallmarks of top-level badminton players who can dominate the match through strategic shot-making.

Our findings highlight the importance of developing a well-rounded skillset and the ability to adapt one's strategy based on the evolving in-game conditions (Edel et al., 2023; Sales et al., 2021). Coaches and trainers should emphasize the development of both lob and smash techniques, as well as the tactical decision-making required to employ these shots effectively. Our findings align with (Cabello-Manrique, 2003; Rahmat, 2021) observation on the importance of smashes in winning points. However, our study provides additional context by comparing smash effectiveness with lob strategies, which was not addressed in their research. The emphasis on the relationship between body positioning and smash quality, as noted in (Shan et al., 2016), underscores the technical

nuances that players must master to execute these shots effectively. The insights on landing strategies and their influence on shot execution, as reported in, suggest that the specific demands of different shots, such as lobs and smashes, can affect the player's biomechanics and subsequent performance.

CONCLUSION

The present study offers a comprehensive analysis of the comparative effectiveness of lob and smash strategies in competitive badminton. The results indicate that while smashes have a higher success rate in directly winning points, lobs play a crucial role in creating advantageous positions, particularly in longer rallies. The strategic implementation of these shots is influenced by contextual factors such as court position, rally length, and score difference. These findings highlight the importance of developing a well-rounded skillset and the ability to adapt one's strategy based on the evolving in-game conditions. Coaches and trainers should focus on fostering the technical and tactical proficiency required to effectively execute both lob and smash shots, enabling players to gain a competitive edge in high-level badminton competitions.

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CONFLICT OF INTEREST

The authors conclude that their research and findings are free from conflicts of interest.

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