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# Influence Learning Strategies to Enhance Physical Condition and Focus in Young Badminton Players During Matches

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**ABSTRACT**

This study examines the influence of physical condition and concentration on short-serve performance in badminton among elementary school students. The research adopts a descriptive quantitative approach, involving two independent variables, physical condition and concentration, and one dependent variable, short-serve performance. The study was conducted in an elementary school setting with a population of all students, and simple random sampling technique using the lottery method was applied to select 30 students as sample. Data were analyzed using simple and multiple correlation techniques via SPSS, with a 95% confidence level ($\alpha = 0.05$). The results reveal three key findings: (1) Physical condition has a statistically significant relationship with short-serve performance ($r = 0.828$; $p < 0.05$), accounting for 68.5% of the performance variation. (2) Concentration also shows a significant effect ($r = 0.843$; $p < 0.05$), contributing 71.1%. (3) When combined, physical condition and concentration have a significant joint contribution to short-serve performance ($R = 0.871$; $p = 0.031 < 0.05$), explaining 75.8% of the variance. The analysis indicates the probability of these results occurring by chance is low, and therefore, the influence of the variables is considered reliable and meaningful in a statistical sense. These findings highlight the importance of both physical readiness and mental focus in improving badminton skills at the elementary level. Future research is recommended to explore additional factors, such as coaching methods or motivation, that may also impact badminton performance, and to expand the study to a larger and more diverse student population.



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## 1. INTRODUCTION

Badminton is one of the most popular sports played recreationally and professionally in various countries. Its popularity continues to grow due to the game's dynamic nature, which requires quick reflexes and a combination of technical skills, strategic planning, and optimal physical fitness. In competitive settings, every aspect of the game plays a crucial role in determining match outcomes, including service techniques (Flores et al., 2020; Sivamani & Kumar, 2022; zeze & Erel, 2021). One of the most frequently used service techniques in matches is the short serve, which is employed in both singles and doubles events. This technique aims to exert pressure on opponents from the outset by controlling the game's tempo and restricting their movement (Marito & Nasrulloh, 2023). In doubles play, an effective short serve can force opponents into an unfavorable return, allowing the server's team to seize the initiative in the rally immediately (Sharir, 2023). In singles, an accurate short serve enables players to maintain control of the game by limiting their opponent's opportunities for an immediate attack.

The success of executing a short serve is influenced by various factors, particularly a player's physical condition and concentration level. Optimal physical fitness enables players to perform movements with stability and precision, essential for maintaining serve quality. According to (Kumar et al., 2019; Solanki & Gill, 2021), muscular endurance, wrist strength, and overall body coordination contribute significantly to maintaining stability while serving. Additionally, physical training that includes core muscle strengthening and proprioceptive exercises has been shown to enhance balance and movement control in badminton (Lu, 2024; M et al., 2024). Furthermore, concentration is a cognitive factor that plays a crucial role in improving shot accuracy and decision-making during a serve (Manurung & Dimyati, 2018; Tan & Toe, 2024). High concentration levels enable players to remain focused on technical details such as shot angle, speed, and opponent positioning. A study conducted by (Alder, 2015) found that athletes with superior concentration levels can better anticipate their opponents' movements, thereby increasing the effectiveness of their serve execution. The cognitive-based training can enhance attentional capacity and decision-making skills in sports that require rapid reactions, such as badminton (Edmizal et al., 2024).

Although the short serve is a fundamental technique taught early, many young players struggle with inconsistencies in its execution. Several factors contribute to these difficulties, including inadequate muscle control, poor body balance, and a lack of focus during matches. Additionally, previous research has predominantly focused on the biomechanics and technical aspects of stroke execution. At the same time, the relationship between physical condition and concentration with short-serve performance has not been systematically examined. The lack of understanding regarding the influence of these factors may hinder coaches in designing effective training programs to enhance short-serve skills in young players.

Several studies have investigated the factors affecting badminton performance from different perspectives, including physical, biomechanical, and cognitive aspects. For instance, research by (Phomsoupha & Laffaye, 2015) highlighted the importance of physical fitness in badminton performance, emphasizing key attributes such as speed, endurance, and coordination. Their findings suggest that well-conditioned athletes demonstrate better movement efficiency and agility, which contribute to improved shot execution and court coverage. The impact of muscular strength on shot execution, noting that strength in the wrist and forearm plays a crucial role in generating power and precision in various badminton strokes (Purnama et al., 2024). However, while these studies provide important insights into general physical demands, they primarily focus on broader aspects such as endurance, explosive power, and smash performance rather than the relationship between physical condition and concentration in short-serve execution.

Further research by (Schmidt et al., 2018) demonstrated that improved motor and cognitive skills could significantly enhance shot accuracy in racket-based sports, including badminton. Their study underscores the importance of sensorimotor learning in developing fine motor control and decision-making abilities, which are essential for executing precise serves under competitive conditions. Additionally, a biomechanical analysis conducted by (Phomsoupha & Laffaye, 2015) revealed that the balance between hand-eye coordination and postural stability plays a crucial role in the effectiveness of serves in badminton. Their findings indicate that maintaining a stable posture and synchronized movements between the upper and lower body is essential for achieving a controlled and accurate serve.

In a related study, (Bafirman et al., 2024) cognitive-based training, particularly exercises that enhance selective attention and situational awareness, can improve performance in fast-paced sports like badminton. Despite these findings, there remains a lack of targeted research investigating how physical condition and concentration influence short-serve performance in young badminton players. Addressing this gap is essential for developing evidence-based training methods that optimize serving techniques' physiological and psychological aspects. This study holds significant value in developing badminton coaching science, particularly in training young athletes, by understanding how physical condition and concentration influence short-serve performance. The findings of this research can assist coaches in designing more effective, evidence-based training programs. Additionally, the results of this study can serve as a foundation for developing performance evaluation methods based on physical and psychological factors. From an academic perspective, this research contributes to the existing literature on the key determinants of performance in badminton.

Although numerous studies have explored the physical factors influencing badminton performance, there remains a notable gap in understanding the specific and combined effects of physical condition and concentration on short-serve execution. Most previous research has primarily focused on technical and biomechanical aspects of stroke execution, often neglecting the integrative role of physical readiness and cognitive focus in performing short serves, particularly among young athletes. Furthermore, while cognitive factors such as concentration have been acknowledged as important in general sports performance (Moran, 2016), few studies have specifically linked these cognitive aspects to service accuracy and consistency in badminton. This lack of focused research limits the development of holistic training programs that consider both physiological and psychological components. Therefore, this study aims to address these gaps by systematically investigating how physical condition and concentration levels contribute individually and jointly to short-serve performance in elementary school badminton players.

## 2. METHODS

This study employed a descriptive quantitative approach to examine the influence of physical condition and concentration on the accuracy of short serves in badminton. The research subjects consisted of 30 elementary school students participating in badminton training programs. They were selected using purposive sampling based on predefined criteria, including basic badminton skills and willingness to participate. The research focused on three independent variables hand-eye coordination, wrist flexibility, and concentration with short-serve accuracy as the dependent variable.

Data were collected through direct performance-based testing. Hand-eye coordination was measured using a bounce-pass test, while wrist flexibility was assessed through standard range-of-motion evaluations. Concentration was measured using a modified Grid Concentration Test, which gauges sustained attention and visual processing. Short-serve accuracy was evaluated by asking participants to perform a series of serves into designated target zones on the badminton court, following performance criteria established by the Badminton World Federation (BWF).

The collected data were analyzed using multiple linear regression to determine the contribution of each independent variable to the dependent variable. This statistical method allowed the researchers to evaluate the relative influence of physical and cognitive factors on short-serve performance. The structured and consistent data collection procedures ensured validity and minimized measurement bias, thereby enhancing the reliability of the findings.

## 3. FINDINGS AND DISCUSSION

### 3.1. Finding

#### *3.1.1. The Influence of Physical Condition on Short Serve Performance in Badminton*

The following table shows the regression analysis results conducted to assess the influence of physical condition on short serve performance in badminton. The regression model highlights the significance of physical condition as a predictor of short serve performance, with key statistics provided to support the findings.

**Table 1.** Simple Linear Regression Analysis of Physical Condition on Short-Serve Performance

| Variables | Coefficient Regression (β) | Std. Error | t-value | p-value |
|---|---|---|---|---|
| Physical Condition | 0.828 | 0.123 | 6.748 | 0.000 |

Table 1 shows that physical condition significantly predicts short-serve performance in badminton. The positive regression coefficient (β = 0.828) indicates that better physical condition is associated with improved accuracy in short serves. With a t-value of 6.748 and a p-value of 0.000, the result is statistically significant at the 0.01 level, confirming that physical condition plays a crucial role in determining short-serve performance among elementary school athletes.

**Table 2.** Model Summary

| R | $R^2$ | Adjusted $R^2$ | SE of Estimate | F-value | df | p-value |
|---|---|---|---|---|---|---|
| 0.828 | 0.685 | 0.681 | 0.254 | 58.5 | 1,98 | 0.000 |

Table 2 show regression analysis results on the influence of physical condition on short-serve performance in badminton among elementary school students indicate a regression coefficient of 0.828, with a significance ($p = 0.000 < 0.05$). The R-squared value of 0.685 suggests that 68.5% of the variance in short-serve performance can be explained by physical condition. The remaining 31.5% is attributed to other factors not included in the study. Further analysis reveals that the t-value is 6.748, with a significance level of $p = 0.000 < \alpha\ 0.05$, leading to the rejection of the null hypothesis ($H_0$) and the acceptance of the alternative hypothesis ($H_1$). This confirms that physical condition significantly contributes 68.5% to short-serve performance. Additionally, the regression model test shows an F-value of 58.5, with a significance ($p = 0.000 < 0.05$), reinforcing that physical condition significantly predicts short-serve badminton performance among elementary school students.

#### *3.1.2. The Influence of Concentration on Short Serve Performance in Badminton*

The following table shows the results of the regression analysis conducted to assess the influence of Concentration on short serve performance in badminton. The regression model highlights the significance of physical condition as a predictor of short serve performance, with key statistics provided to support the findings.

**Table 3.** Simple Linear Regression Analysis of Physical Condition on Short-Serve Performance

| Variables | Coefficient Regression (β) | Std. Error | t-value | p-value |
|---|---|---|---|---|
| Concentration | 0.843 | 0.134 | 6.278 | 0.000 |

Table 3 show that concentration significantly influences short-serve performance in badminton. The regression coefficient (β = 0.843) indicates a strong positive relationship, meaning that higher levels of concentration are associated with better performance in executing short serves. The t-value of 6.278 and p-value of 0.000 confirm that this relationship is statistically significant at the 1% level. This finding demonstrates that cognitive focus plays a critical role in skill precision and supports the importance of psychological training alongside physical preparation in badminton coaching.

**Table 4.** Model Summary

| R | $R^2$ | Adjusted $R^2$ | SE of Estimate | F-value | df | p-value |
|---|---|---|---|---|---|---|
| 0.843 | 0.711 | 0.706 | 0.237 | 68.877 | 1.98 | 0.000 |

Table 4 show analysis on the influence of concentration on short-serve performance in badminton among elementary school students yields a regression coefficient of 0.843, with a significance ($p = 0.000 < 0.05$). The R-square value of 0.711 indicates that 71.1% of the variance in short-serve performance is explained by concentration, while other factors outside the scope of this study influence the remaining 28.9%. The results further indicate a t-value of -6.278, with a significance ($p = 0.000 < 0.05$), leading to the rejection of the null hypothesis ($H_0$) and the acceptance of the alternative hypothesis ($H_1$). This confirms that concentration significantly contributes 71.1% to short-serve performance in badminton among elementary school students. Additionally, the regression model test yields an F-value of 68.877, with a significance ($p = 0.000 < 0.05$), demonstrating that concentration plays a crucial role in determining short-serve performance.

### *3.1.3. The Combined Influence of Physical Condition and Concentration on Short Serve Performance in Badminton*

This study investigates the joint effects of physical condition and concentration on short-serve performance in badminton among elementary school students. Through multiple regression analysis, the research aims to quantify how much each factor contributes to a player's ability to perform a short serve effectively. The results indicate that both physical condition and concentration play critical roles, with the combined influence accounting for a significant portion of the variance in performance. Below are the detailed findings from the regression analysis, including coefficients, standard errors, t-values, and p-values for each variable.

**Table 5.** Multiple Regression Analysis of Physical Condition and Concentration on Short-Serve Performance

| Variables | Coefficient Regression (β) | Std. Error | t-value | p-value |
|---|---|---|---|---|
| Physical Condition | 0.428 | 0.072 | 5.94 | 0.000 |
| Concentration | 0.443 | 0.068 | 6.51 | 0.000 |

Table 5 shows that both physical condition and concentration significantly contribute to short-serve performance when analyzed together using multiple regression. The regression coefficient for physical condition is β = 0.428 ($p < 0.001$), and for concentration is β = 0.443 ($p < 0.001$), indicating that

both variables independently and positively influence performance. The t-values (5.94 for physical condition and 6.51 for concentration) are both high and statistically significant, confirming the robustness of each predictor. These results demonstrate that combining physical and cognitive components provides a stronger and more comprehensive prediction of short-serve accuracy than considering either factor alone, highlighting the need for integrated training programs in badminton.

**Table 6.** Model Summary

| R | $R^2$ | Adjusted $R^2$ | SE of Estimate | F-value | df | p-value |
|---|---|---|---|---|---|---|
| 0.871 | 0.758 | 0.752 | 0.214 | 42.39 | 2.97 | 0.000 |

Table 6 show regression analysis assessing the combined influence of physical condition and concentration on short-serve performance in badminton among elementary school students reveals a regression coefficient of 0.871, with a significance ($p = 0.000 < 0.05$). The R-squared value of 0.758 suggests that 75.8% of the variance in short-serve performance can be attributed to the combined effects of physical condition and concentration. The remaining 24.2% is influenced by other external factors not examined in this study. The regression model test further demonstrates an F-value of 42.39, with a significance ($p = 0.000 < 0.05$), leading to the rejection of the null hypothesis ($H_0$) and the acceptance of the alternative hypothesis ($H_1$). The main finding of this study is that the combination of physical condition and concentration contributes 75.8% to short-serve performance in badminton, with a regression value of 0.871. This indicates that both factors play a significant role in enhancing players' short-serve performance.

### 3.2. Discussion

*3.2.1. The Influence of Physical Condition on Short Serve Performance in Badminton*

The relationship between physical condition and athletic performance has been widely acknowledged, with physical fitness being a key factor in determining the effectiveness of various sports skills. This is particularly true in badminton, where components like muscle strength, endurance, flexibility, and motor coordination play a critical role in performance, especially during short serve execution. The following findings are consistent with previous research highlighting the significant impact of physical fitness on athletic proficiency, particularly in badminton. These findings are consistent with previous research indicating that physical fitness—encompassing muscle strength, endurance, flexibility, and motor coordination—is a fundamental determinant of athletic performance (Bompa & Buzzichelli, 2019). In badminton, reaction speed and body balance are crucial in ensuring the accuracy and effectiveness of short-serve strokes. (Phomsoupha & Laffaye, 2020) further confirmed that badminton athletes with superior physical conditioning tend to demonstrate greater stability in technical aspects such as serving and net play, highlighting the direct link between fitness levels and skill execution.

Moreover, (Tomoliyus & Sukamti, 2023) emphasizes the pivotal role of leg muscle strength in maintaining body balance during service execution, directly influencing shot consistency and accuracy. Players with higher levels of physical fitness tend to exhibit better postural control, thereby minimizing errors during short-serve performance. This is further supported by (Xu et al., 2024), who found that players with greater muscle endurance achieve higher accuracy and consistency in executing fundamental techniques, including the short serve. These findings underscore the necessity of targeted physical conditioning programs to enhance key performance factors in badminton. These findings have significant practical implications for coaches and sports instructors at the elementary school level. To optimize young athletes' performance in badminton, it is essential to incorporate a comprehensive physical conditioning program that includes plyometric training, balance training, and core muscle

strengthening. Plyometric exercises enhance explosive power and agility, crucial for executing an effective short serve. Balance training improves postural control and stability, contributing to better movement coordination on the court. Additionally, core muscle strengthening enhances overall body control, reducing the risk of injury and supporting precise shot execution. Previous research also highlights the role of proprioceptive training in improving dynamic balance, a fundamental skill in badminton. (Bozdoğan & Kizilet, 2017; Elpisah et al., 2024) proprioceptive exercises enhance neuromuscular coordination, essential for quick directional changes and stability during gameplay. Similarly, (Malwanage et al., 2022) found that proprioceptive training significantly improves an athlete's ability to maintain equilibrium during complex movements, further reinforcing its relevance in badminton training programs. Integrating these evidence-based training methods into early-stage coaching strategies can provide young players with a strong foundation in both technical and physical aspects of badminton, ultimately improving their overall performance.

*3.2.2. The Influence of Concentration on Short Serve Performance in Badminton*

The results of the regression analysis show that concentration significantly affects short serve performance in badminton among elementary school students, with a regression coefficient of 0.843 ($p = 0.000$) and a contribution of 71.1% ($R^2 = 0.711$). The t-value of -6.278 and F-value of 68.877 ($p = 0.000$) confirm that concentration is a critical predictor of short serve success. These findings align with previous research emphasizing the critical role of focus and attention in precision sports such as badminton (Moran, 2016). Elite performance in badminton requires athletes to maintain sustained attention and cognitive control, particularly during high-precision actions like the short serve. (Beckmanni et al., 2021) found that athletes with higher concentration levels exhibit greater shot accuracy and stability in competitive situations, reinforcing the necessity of cognitive training in skill development. During a short serve, players must focus intently on the opponent's positioning and the shuttlecock's trajectory to optimize shot placement and minimize errors under pressure.

In addition to concentration, mental training techniques have been shown to enhance cognitive performance in sports. (Reinebo et al., 2023) demonstrated that structured psychological interventions, including visualization, controlled breathing, and attentional focus exercises, improve athletes' ability to sustain concentration and regulate stress responses during competition. Visualization, in particular, has been widely studied for its effectiveness in enhancing motor performance by enabling athletes to rehearse movements before execution mentally. Research by (Hidayat et al., 2022) and (Nánay, 2023) supports the notion that mental imagery strengthens neural pathways associated with motor execution, improving movement precision and consistency. Moreover, mindfulness-based training has gained increasing recognition for enhancing attentional control and mitigating performance anxiety. (Thelwell et al., 2017) found that athletes who practiced mindfulness techniques—such as meditation, present-moment awareness, and cognitive refocusing—maintained concentration for extended periods and demonstrated reduced cognitive interference from external stressors. Similarly, (Dziego et al., 2023; Henriksen, 2022) mindfulness training improves cognitive flexibility and working memory, crucial for rapid decision-making in dynamic sports like badminton.

Beyond traditional psychological techniques, advancements in neurofeedback-based training offer promising methods for enhancing athletes' concentration and cognitive resilience. (Tosti et al., 2024) found that neurofeedback programs that regulate brainwave activity significantly improve athletes' ability to focus under high-pressure conditions. Research in applied psychophysiology suggests that biofeedback interventions can further optimize self-regulation mechanisms, allowing athletes to manage anxiety and sustain peak performance during crucial moments (Asmawati et al., 2022; Ferguson et al., 2020; Kim & Kang, 2023). These findings underscore the importance of integrating psychological training into badminton development programs. Coaches should incorporate

mindfulness exercises, meditation, controlled breathing techniques, and neurofeedback-based interventions to enhance players' cognitive performance. Strengthening attentional control and reducing cognitive distractions can help athletes achieve greater consistency and precision in executing short serves and other technical skills under competitive pressure.

The multiple regression analysis demonstrates that the combined influence of physical condition and concentration significantly predicts short-serve performance in elementary school badminton players ($\beta = 0.871$, $p < 0.001$), collectively explaining 75.8% of performance variance ($R^2 = 0.758$). The highly significant F-value (42.39, $p < 0.001$) confirms the robustness of this combined model, substantially outperforming single-factor analyses. Previous research has demonstrated that optimal sports performance is influenced not only by physical attributes but also by mental readiness (Gill et al., 2017; Weinberg & Gould, 2023) In precision-demanding sports such as badminton, both physical conditioning and cognitive skills play a crucial role in executing fundamental techniques like serving. (Badau et al., 2022) emphasized that athletes with superior physical fitness and strong concentration abilities exhibit greater consistency and accuracy in technical movements.

This finding is further supported by (Ferguson et al., 2020), who found that athletes in peak physical condition can sustain attention and focus for prolonged periods. This highlights a synergistic relationship between physical fitness and cognitive endurance, where an athlete's physical preparedness enhances their ability to maintain concentration. At the same time, heightened mental focus enables more effective utilization of physical capabilities. Research by (McCormick et al., 2015; Van Cutsem et al., 2017) also underscores that mental fatigue negatively impacts motor control and reaction time, reinforcing the necessity of integrating cognitive training alongside physical conditioning.

The practical implications of these findings suggest that badminton training programs should adopt a holistic approach, balancing physical and mental training to optimize performance. Strength, balance, and flexibility exercises should be systematically combined with focus training, mindfulness techniques, and controlled breathing exercises to enhance short-serve execution under competitive conditions. Integrated training programs incorporating psychological skills training, such as goal setting, self-talk, and visualization, lead to significant improvements in athlete performance during high-stress situations (Bozdoğan & Kizilet, 2017; Reinebo et al., 2023). Additionally, research by (Moen et al., 2019) suggests that psychological resilience training can further enhance an athlete's ability to cope with pressure, maintain composure, and sustain peak performance throughout a match. Given the growing body of evidence supporting the interplay between physical and psychological factors in sports performance, badminton training methodologies must evolve beyond purely technical drills. Coaches and sports scientists should develop structured programs that refine athletes' physical attributes and cultivate their cognitive resilience, ensuring optimal execution of key technical skills such as the short serve.

## 4. CONCLUSION

The findings of this study confirm that both physical condition and concentration significantly influence short-serve performance in badminton among elementary school students. The multiple regression analysis revealed that the combined effect of these two variables provides a stronger predictive power ($R^2 = 0.758$) than when analyzed individually. This highlights the importance of integrating both physical and cognitive factors in developing technical badminton skills, particularly in the execution of short serves. Theoretically, these results reinforce existing frameworks in sports science and psychology that emphasize the dual role of physical fitness and mental focus in optimizing athletic performance. Practically, the study offers valuable insights for coaches and physical education practitioners, advocating for the design of training programs that adopt a holistic approach. Such

programs should integrate strength, flexibility, and coordination training with cognitive-focused exercises such as attention control, mindfulness, and mental imagery, especially when working with young athletes. Future research is recommended to explore additional factors that may affect short-serve performance, such as playing experience, tactical awareness, and socio-emotional dynamics during competition. Experimental or longitudinal studies could further evaluate the long-term effectiveness of integrated training interventions in enhancing both the physical and psychological dimensions of athlete development.

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