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Original Article

Concentration, eye coordination and agility: How they influence badminton playing skills

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Abstract
Badminton is a demanding sport where players need to channel their attention to the game, emphasizing the necessity for athletes to concentrate on a particular object within the expansive playing area. The ability to maintain focus, coordinate eye movements effectively, and exhibit agility are crucial components in achieving success in the sport of badminton. The research involves an analysis of how these factors interrelate and contribute to the overall proficiency of players in executing various badminton techniques. The research used quantitative analysis with the path analysis approach. The sampling technique used was saturated sampling, which included 30 people from the entire population. The instruments used for this study were the Illinois agility test, throwing and catching balls for eye-hand coordination, grid concentration exercise, and the Badminton Skills Diagnostic Model. The data were analyzed using the SPSS version 26 application. The results showed that (1) concentration has a significant impact on badminton skills, with a significant mark of 0.000 < 0.05, (2) coordination eye-hand has a significant impact on badminton skills, with a significant mark of 0.000 < 0.05, and (3) agility has a significant impact on badminton skills, with a significant mark of 0.000 < 0.05. Furthermore, the results showed that concentration was influential by 39.9%, coordination eye-hand was influential by 28.36%, and agility was influential by 32.25%. It can be concluded that there is a significant influence of agility, coordination eye-hand, and concentration on the development of badminton skills in students. The findings provide practical implications for the training and development of badminton players, emphasizing the importance of including exercises specifically designed to improve concentration, eye coordination and agility. With a better understanding of these factors, coaches can design more effective training programs to improve badminton playing skills and achieve maximum performance in competition.
Keywords: Concentration, coordination eye hands , agility , skill playing , badminton

Introduction

Sport is a physically able activity that can be done by all age groups, without exception for the elderly (Suryadi et al., 2022). The activities that improve physique through sports are one method for guarding the fitness of the body (Khairuddin et al., 2022; Mashud et al., 2024; Rubiyatno et al., 2023), which is important for being in good condition (Pamungkas et al., 2022). A number of studies have also disclosed that good exercising, whether it be of low, medium, or high intensity, has a positive influence on physical fitness (Pelamonia & Puriana, 2023; Rozi et al., 2023; Samodra, 2020). This has been proven by someone's physical fitness (Suryadi, Suganda, Sacko, et al., 2023). Good physical condition is very much needed by both sportsmen and the general public (Hardinata et al., 2023; Antara et al., 2023). Besides, physical condition plays an important role in achieving good performance in different sports, not only in badminton (Supriatna et al., 2023; Suryadi, Yanti, et al., 2023). (Bafirman & Wahyuri, Sujana, 2019) stated that in the game of badminton, it is important for athletes to have a good physical condition because it is related to the mastery of playing skills.

In game badminton success Achievement is largely determined by playing skills. A player's ability in a match or competition is determined by four factors: physical, technical, tactical, and mental conditions (Hardinata et al., 2023). Good badminton technique includes the correct racket holding technique and good footwork (Yu & Mohamad (Yu & Mohamad, 2022). Physical conditioning is composed of various components such as endurance, strength, explosive power, speed, flexibility, agility, balance, poise, and coordination (Bafirman & Wahyuri, Sujana, 2019). These components can also affect power to hit, explosive power like in a jump smash, speed to control the court area with footwork, flexibility of waist, legs, and hands in performing badminton techniques. Complete physical conditioning components support badminton playing skills (Nugroho et al., 2021).

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In addition, tactics and strategy play an important role in developing skills, allowing players to outwit their opponents in the game. Mental components, including concentration, are also significant factors that affect playing skills. Lack of concentration can reduce the accuracy of shots, making the game less effective and challenging for the player's opponent. By mastering the right strokes, game tactics, and strategies, players can attain a high level of badminton playing skill. They can also position themselves in particular areas to return the shuttlecock to the opponent's court efficiently (Alsaudi, 2020). Badminton playing skills consist of a series of coordinated technical movements in the game. These skills require regular practice to develop effective and efficient movements (Halim et al., 2023). Good playing skills are essential for a successful badminton game (Azhari et al., 2022). A study stated that planned and organized movements lead to optimal results in badminton (Donie, Yudi et al., 2020), by implementing planned movements, your badminton skills can be maximized (Candra et al., 2017).

Badminton is a fast-paced game that requires good balance and agility (Rusdiana et al., 2023). Agility allows players to change direction quickly without losing balance (McNeil et al., 2019). Having good agility supports the effectiveness of badminton skills (Nurafiati et al., 2023). Factors that influence agility include biomotor components, body type, age, gender, body weight, and fatigue (Mylsidayu & Kurniawan Febi, 2015), meaning that each person may have different levels of agility. Agility involves mastering the playing area, quickly reacting to the shuttlecock's unpredictable direction without losing balance, and maintaining body posture for precise coordination of movements and accurate shots. Complete physical conditioning components support badminton playing skills (Nugroho et al., 2021).

Success of a player is not only determined by physical strength and game technique, but also by mental abilities such as concentration, eye coordination, and agility. Concentration is the ability to focus the mind on something without being affected by external or internal distractions. Concentration refers to the directed and undistracted focus of the mind, while eye coordination involves the ability to effectively control eye movements in response to the movement of the ball (Halim et al., 2023). In the context of playing badminton, high concentration is essential to follow the fast movement of the ball, plan strategies, and make decisions quickly. A player who is able to maintain a high level of concentration can have faster reactions and be able to anticipate the opponent's movements. Previous research has shown that mental factors such as concentration can affect athletes' performance in various sports, including badminton. Speed and accuracy in responding to game situations are very important, and this is closely related to the ability of concentration and eye coordination (Alsaudi, 2020). In addition, agility as a physical element also plays a crucial role in the execution of specific techniques and movements in badminton.

Eye coordination involves engaging the eyes to follow the movement of an object, in this case, a badminton ball. The ability of the eyes to precisely track the movement of the ball allows players to accurately assess the speed and direction of the ball, which is important in decision-making and technique execution (Halim et al., 2023). Good eye coordination also supports a player's ability to recognize the opponent's pattern of play and adjust their strategy accordingly. An examination focused on table tennis underscored the impact of eye-hand coordination, a vital physical aspect, on achievement motivation, and psychological facets within the sport. Effective eye-hand coordination entails synchronized movements of all limbs, complemented by other physical attributes (Razali et al., 2023). Possessing robust strength and speed skills alone is insufficient for mastering backhand driving techniques in the absence of adequate eye-hand coordination. This implies a direct association between eye-hand coordination and achievement motivation.

Agility, on the other hand, includes the ability to execute body movements quickly and precisely (Preeti et al., 2019). There are several benefits to agility, including coordinating multiple movements, making it easier to master advanced techniques, effective and efficient movements, and helping to implement movement techniques (Alsaudi, 2020). From the quote above, it can be understood that agility is a person's ability to change body direction in the shortest possible time without losing balance. Therefore, agility is a crucial aspect of physical condition in the game of badminton, a sport that requires speed and high balance. Without agility, athletes will struggle to control the playing field, as their opponents' shots are fast and challenging to respond to (Faber et al., 2014; Umar et al., 2023). Agility refers to the body's ability to execute movements quickly, precisely, and efficiently. In badminton, agility is required in performing technical movements such as jumps, strokes, and position shifts. Players who have a good level of agility will be able to execute these movements more agilely, allowing for better execution of techniques and quicker responses to changing game conditions (Halim et al., 2023).

The game of badminton is synonymous with movements, strokes, and direction. Furthermore, studies disclose that hand-eye coordination is defined as a harmonious relationship of mutual influence between muscle groups during work, demonstrated with various levels of skill (Halim et al., 2023; Haryanto et al., 2023). The statement further discloses that coordination is a combination of muscle, bone, and joint contractions in performing a movement. Therefore, coordination abilities are closely related to other motor abilities such as balance, speed, accuracy, and hand-eye coordination (Samodra et al., 2023). The level of coordination, whether a person's movement skills are good or not, will be seen when carrying out the movement (Saputra et al., 2023). This is strengthened by the latest study which reveals that with good hand-eye coordination, there will be support

for good performance as well (Suryadi, Suganda, Samodra, et al., 2023). From the quote above, we can understand that hand-eye coordination is a crucial part of skills, especially in playing games. Hand-eye coordination allows for seamless movement and execution of punches simultaneously. An athlete with good coordination in badminton will be able to perform skills perfectly, easily, and quickly, even when learning new skills (Saputra et al., 2023; Suryadi, Suganda, Samodra, et al., 2023).

Badminton players have to focus in the game because athletes have to focus on certain objects which are very broad in scope, which is called concentration. Concentration is the ability to focus attention on a task without being distracted by internal or external stimuli, while implementation refers to broad dimensions and focusing on certain tasks (Wulf & Lewthwaite, 2016). So it can be understood that concentration is the ability to focus and maintain attention on a task or activity without being distracted by rapidly changing environmental conditions. With the athlete's concentration, the shuttlecock's shot and goal will be created (Halim et al., 2023). The type of concentration is determined by two things, namely breadth (widening and narrowing) and direction (inward and outward) (Pamungkas et al., 2022). Widespread concentration is a person's condition in receiving several events (stimuli) simultaneously. This happens when athletes have to be aware of and sensitive to changes in the competition environment which usually interfere with their concentration.

Based on the results of the introduction through observation at one of the athletes' gathering places, West Sumatra badminton at Padang State University, researchers found a problem where athletes were less agile and often lost their balance in mastering the playing area. In addition, the precision of the movement between the stroke and the touch is not precise, resulting in a failure to determine the direction of the shuttlecock's aim. In badminton, besides treatment exercise, it turns out that a supporting factor is very required for supporting performance (Pamungkas et al., 2022; Shapie et al., 2023). A study also says that the lack of concentration in the game makes the accuracy of shots in badminton playing skills not on target (Niyati Mukesh et al., 2021). This statement is strengthened by the latest research that reveals that agility, hand-eye coordination, and concentration need to be considered in the game of badminton (Halim et al., 2023).

Badminton playing skills are suspected to have a direct and indirect relationship and there may be no relationship at all between the variables. This becomes the basis for researchers to further research and carry out research steps, with the aim of proving the influence of agility, hand-eye coordination, and concentration on badminton playing skills. By combining concentration, eye coordination and agility, a badminton player can achieve an optimal level of skill. In-depth research into the influence of these three aspects on badminton playing skills is expected to provide a better understanding of how players can optimize their potential, while assisting coaches in designing more effective training programs. Therefore, this research is important to bridge the knowledge gap and contribute to the holistic development of quality badminton athletes.

Materials and methods.

Study Participants

The population within the scope of this research was 30 badminton athletes, who were students at Padang State University. The participants in the study included a research team consisting of 3 people, 3 judges, and 30 athletes. The sampling technique used in this study was saturated sampling, where samples were taken from the entire population of 30 athletes.

Study Organization

The method used in this research was a quantitative method using a path analysis approach. This involved using a structural equation model to examine the causal relationship between the dimensions of concentration (X1), agility (X2), hand-eye coordination (X3), and badminton playing skills (Y). The analysis depended on the strength and weakness of the theory underlying the hypothetical model. Several research instruments were utilized including: 1) Badminton Skills Diagnostic Model (BSDM) test instrument for skills testing, 2) Ilionis agility test instrument for agility testing, 3) throwing ball catching test instrument for hand-eye coordination testing, and 4) grid test instrument for concentration testing.

This study was conducted to determine if there is a direct impact immediately, and if there is no direct immediate effect of an independent variable on a dependent variable, using the Path Analysis method, as illustrated below.

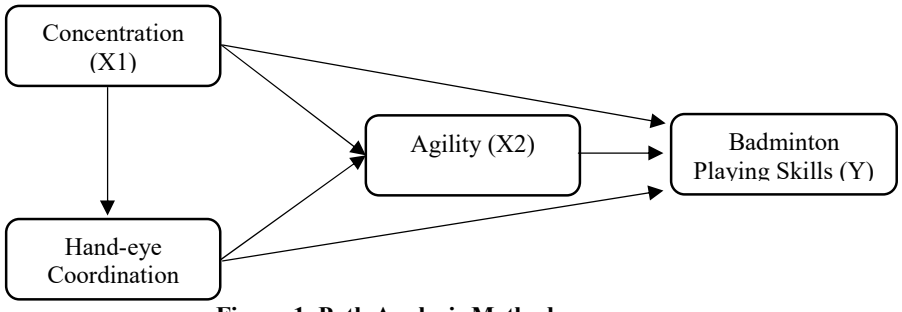

Figure 1. Path Analysis Method

Statistical analysis

Before testing the hypothesis, the analysis requirements were checked, including: (1) data description, (2) tests to meet analysis requirements, such as homogeneity test, normality test, regression linearity test, and regression significance test, and (3) path analysis, which included model testing and hypothesis testing. The hypothesis testing aimed to determine the influence of agility, hand-eye coordination, and concentration. The t-test was used to test the significance of the hypothesis. The hypothesis testing employed the Two-Way ANOVA test with a significance level of $\alpha = 0.05$. The statistical analysis was conducted using the SPSS version 26 program.

Results

The research conducted on 30 badminton athletes at Padang State University provided information about their concentration, agility, hand-eye coordination, and badminton playing skills. The descriptive data showed that the mean value of concentration was 11.12, agility was 10.97, hand-eye coordination was 18.47, and badminton playing skills was 24.40. Table 1 presents the obtained results.

Table 1. Descriptive Results of Concentration , Agility , Hand-Eye Coordination and Badminton Playing Skills

Results	Concentration (X1)	Agility (X2)	Hand-eye Coordination (X3)	Badminton Playing Skills (Y)
N	30	30	30	30
Mean	11,12	10.97	18.47	24.40
Median	10.91	11	20	23
Std. Deviation	1.06	1.58	3.32	4.02
Range	4.19	6.00	13.00	15.00
Minimum	9.40	8.00	10.00	18.00
Maximum	13.59	14.00	23.00	33.00

Table 2. Test Shapiro-Wilk Normality

Results	Statistics	df	Sig.
Concentration (X1)	0.941	30	0.096
Agility (X2)	0.949	30	0.155
Hand-eye Coordination (X3)	0.720	30	0.063
Badminton Playing Skills (Y)	0.909	30	0.114

The normality test results presented in Table 2 showed $p > 0.05$ for the entire data, indicating that the data was normally distributed. Therefore, further hypothesis testing could be conducted.

Table 3. Test Linearity Badminton Playing Skills and Concentration

Results	Linearity	Sum of Squares	df	Mean Square	F	Sig.
Badminton Playing Skills * Concentration	(Combined)	456,533	25	18,261	5,767	0.050
	Linearity	112,845	1	112,845	35,635	0.004
	Deviation from Linearity	343,688	24	14,320	4,522	0.076

Table 4. Test Linearity Badminton Playing Skills and Agility

Results	Linearity	Sum of Squares	df	Mean Square	F	Sig.
Badminton Playing Skills * Agility	(Combined)	164,067	6	27,344	2,061	0.098
	Linearity	102,306	1	102,306	7,712	0.011
	Deviation from Linearity	61,760	5	12,352	0.931	0.479

Table 5. Test Linearity Badminton Playing Skills and Hand-eye Coordination

Results	Linearity	Sum of Squares	df	Mean Square	F	Sig.
Badminton Playing Skills * Hand-eye Coordination	(Combined)	176,033	7	25,148	1,887	0.121
	Linearity	85,101	1	85,101	6,386	0.019
	Deviation from Linearity	90,932	6	15,155	1,137	0.374

The linearity test results (Table 3, Table 4, and Table 5) revealed no significant deviations from linearity for concentration, agility, hand-eye coordination, and badminton playing skills data ($p > 0.05$), indicating that the data can be considered linear.

Table 6. Hypothesis Test for Variable X1

ANOVA [a]

Model		Sum of Squares	df	Mean Square	F	Sig .
1	Regression	992,350	1	992,350	21,176	,000 [b]
	Residual	2952,265	63	46,861		
	Total	3944,615	64			

a. Dependent Variable : Y

b. Predictors : (Constant), X

Table 6 shows a significant difference ($p < 0.05$) between agility and badminton playing skills, indicating an influence of agility on the badminton playing skills of Padang State University students.

Table 7. Hypothesis Test for Variable X2

ANOVA [a]

Model		Sum of Squares	df	Mean Square	F	Sig .
1	Regression	982,350	1	982,350	19,176	,000b
	Residual	2952,265	63	46,861		
	Total	3944,615	64			

a. Dependent Variable : Y

b. Predictors : (Constant), X

Similarly, Table 7 shows a significant difference ($p < 0.05$) between hand-eye coordination and badminton playing skills, suggesting an influence of hand-eye coordination on the badminton playing skills of Padang State University students.

Table 8. Hypothesis Test for Variable X3

ANOVA [a]

Model		Sum of Squares	df	Mean Square	F	Sig .
1	Regression	972,350	1	972,350	20,176	,000b
	Residual	2852,265	63	46,861		
	Total	3944,615	64			

a. Dependent Variable : Y

b. Predictors : (Constant), X

Furthermore, Table 8 presents a significant difference ($p < 0.05$) between concentration and badminton playing skills, indicating an influence of concentration on the badminton playing skills of Padang State University students.

To further strengthen the results and measure the significance of students' skill improvement after learning, the N-Gain test was conducted. The N-Gain test compared the difference between each variable, showing the improvement in abilities after learning.

Table 9. N-Gain Test

Variable	Ngain
Agility	**32.25 %**
Hand Eye Coordination	**28.36 %**
Concentration	**39.9 %**

The data revealed differences in improvement in badminton playing skills. The agility variable contributed to 32.25% improvement, hand-eye coordination contributed to 28.36% improvement, and concentration contributed to 39.9% improvement. Therefore, it can be concluded that agility, hand-eye coordination, and concentration significantly influence badminton playing skills.

Discussion

The aim of this study was to prove the influence of agility, hand-eye coordination, and concentration on badminton playing skills. The results of the study provide information that concentration, hand-eye coordination, and agility have an influence on badminton skills. These results are evident from the higher F-value compared to the F-table and the significant p-value. Study relevant give proof information that concentration give significant influence, besides that also on coordination eye hand and results agility also showing influence on skills play badminton (Halim et al., 2023).

The results also indicate a significant improvement in badminton playing skills. Previous studies have also shown a significant relationship between endurance and agility with badminton skills. Additionally, exercises that improve dexterity have been shown to enhance game performance. Training models using media-based methods have also proven effective in badminton training. Proven with training models media- based can become possible methods applied in training badminton (Khaeroni & Hariyanto, 2022). Based on review the give description that dexterity inside game badminton of course very required, where this can also facilitate the placement of shuttlecock. With such a specific stroke technique, players must have the speed to move to chase the shuttlecock so that it does not fall in the area. So that player badminton will can return shuttlecock area his opponent .

Furthermore, the study reveals a significant relationship between hand-eye (Mohamed Shapie, 2018), and wrist flexibility with short service ability in badminton. The coordination of hand-eye and specific exercise methods for service play have shown a significant influence. This is further supported by evidence of the influence of hand-eye coordination on badminton skills. It can be concluded that good hand-eye coordination enhances badminton playing skills.

Study furthermore prove it turns out coordination eye hand and flexibility wrist hand own significant relationship to ability service short badminton (Nurafiati et al., 2023). Coordination hand-eye and method exercise to service in play hair parry showing significant influence (Triansyah et al., 2023). Results getting sicker strengthened study by (Halim et al., 2023)with evidence of the influence of hand eye coordination on badminton skills. Based on opinion the so Can said that should coordination hand-eye have strong relationship with skills play badminton. So it can be said that if the badminton player's hand-eye coordination ability is good, then the badminton player's playing skills will also be good.

Study also express so that you can reach maximum performance in game badminton skills very required , by Because that every athlete or player must own skills base game badminton (Al-Selmi et al., 2019). Where method internal imagery mental exercises can increase backhand serve _ short , results This showing more influence good compared to with external imagery mental (Victory Manurung & Dimyati, 2019). Furthermore exercise strength and flexibility combined with session training skills give enhancement skills badminton, where are the results this also showing more good compared to control (Pooja Beniwal, Rajesh Dhauta, 2023). Proof the strengthen that method planned practice will give good impact against enhancement skills badminton, so matter This can become points important in game .

It is important to note that concentration also has an influence on badminton skills, as supported by previous studies. In addition, the study highlights the need to consider inhibiting and supporting factors in badminton training. Athletes in tennis have shown better performance in concentration compared to table tennis and badminton. Study other research found results that strength grip hands , flexibility wrist hands , and coordination hand-eye showing enhancement skills forehand (Aziz et al., 2023; Maulana et al., 2023).

However need understood Also that concentration in study this also give influence to Skills badminton . Statement this also strengthened by study (Halim et al., 2023). With so so in game badminton need pay attention to inhibiting factors And supporters, so can become consideration in apply exercise in the future . Based on opinion (Bastug, 2018) that athlete tennis more succeed in performance concentration compared to athlete tennis table and hair parry .

Conclutiosns

This research unequivocally demonstrates the substantial impact of concentration, eye coordination, and agility on badminton playing skills. These findings enhance our comprehension of the underlying factors contributing to success in the sport, emphasizing the significance of concurrent development of mental and physical attributes. Enhanced concentration was revealed to enhance a player's responsiveness to on-court events and decision-making abilities. Players maintaining optimal concentration possess an advantage in grasping the game's dynamics and adeptly anticipating changing scenarios.

Improved eye coordination positively influences the precision of a player's movements, particularly in tracking and responding to the ball's trajectory. A well-trained eye enables precise assessment of the ball's speed and direction, facilitating smarter decision-making and refined technique execution. Elevated agility significantly contributes to a player's technical prowess. Executing badminton-specific movements with agility and precision heightens the efficiency and effectiveness of shots and overall court movement.

Given the notable impact of concentration, eye coordination, and agility on badminton playing skills, the practical implications are evident. However, a limitation of this study lies in its inability to control the activities undertaken by the sample before the measurements. Designing targeted training programs to enhance these aspects could serve as a pivotal factor in fostering the development of elite badminton athletes. It is recommended for further research to focus on developing training programs that target concentration, hand-eye coordination, and agility to enhance badminton playing skills.

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