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The Impact of Wrist Flexibility, Eye-Hand Coordination, and Motivation on Long-Service Skills in Badminton

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ABSTRACT

The type of research is Ex Post Facto, using the Descriptive Analysis Path. The population of this study is all Badminton athletes of PB. Pacific Polman Regency in Makassar. The research sample is a total sampling of 20 athletes. The subjects of the study were Badminton Athletes of PB. Pacific Polman Regency. The results of the study (1). There is a direct influence of sig. Wrist flexibility on long-service stroke skills in badminton athletes of PB. Pacific Polman Regency with a value of r = 0.845 with sig. (p) = 0.000 <0.05. (2) There is a direct influence of hand-eye coordination which is sig. on long-service stroke skills in badminton athletes of PB. Pacific Polman Regency with a value of r = 0.786 with sig. (p) = 0.000 <0.05. (3) There is a direct influence of motivation on long-service stroke skills in badminton athletes of PB. Pacific Polman Regency with a value of r = 0.728 with sig. (p) = 0.000 < 0.05. (4) There is an indirect effect of sig. Wrist flexibility and hand-eye coordination together on long-service stroke skills in badminton athletes of PB. Pacific Polman Regency with a value of r = 0.894 with sig. (p) = 0.000 < 0.05. (5) There is an indirect effect of sig. Wrist flexibility and motivation on long-service stroke skills in badminton athletes of PB. Pacific Polman Regency with a value of r = 0.646 with sig. (p) = 0.000 < 0.05. (6) There is an indirect effect of sig. Hand-eye coordination and motivation on long-service stroke skills in badminton athletes of PB. Pacific Polman Regency with a value of r = 0.908 with sig. (p) = 0.000 < 0.05.(7) There is a significant indirect effect of wrist flexibility, eye-hand coordination and motivation on long-service skills in badminton for PB. Pacific athletes, Polman Regency, with a value of R = 0.738 with sig. (p) = 0.002 < 0.05.

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A. Conception and design of the study;
B. Acquisition of data;
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INTRODUCTION

Sports achievement is an important indicator for a nation, reflecting the dignity and honour both individually and collectively (Ministry of Youth and Sports of the Republic of

Indonesia, 2023). In the context of Indonesia, badminton has become one of the most prominent and successful sports at the international level (Badminton World Federation, 2023). The success of Indonesian badminton athletes in various tournaments, both at the ASEAN, Asia, and world levels, shows the great potential of this nation in the field of sports (Supriyanto, 2022).

However, amidst impressive achievements at the national level, the condition of badminton in West Sulawesi shows significant challenges. Although badminton is a popular sport and is widely loved by the public, the achievements of athletes from this province at the national level are still far from expectations (Rahman, 2021). This can be seen from the less-than-satisfactory results in various national championships, where West Sulawesi athletes often lose to athletes from other provinces (Sari, 2020).

The factors that influence the achievements of badminton athletes in West Sulawesi are very complex. Lack of structured coaching, suboptimal training methods, and lack of adequate facilities and infrastructure are some of the main obstacles (Hidayat, 2022). In addition, funding support and the quality of coaches also play an important role in developing athlete abilities (Yulianto, 2023). Without serious attention to these aspects, it is difficult for athletes to achieve the desired achievements.

The physical and mental condition of athletes is also a crucial factor in achieving success (Prasetyo, 2021). Badminton athletes are required to have a prime physical condition, considering that this game involves various complex movements that require speed, agility, and endurance (Lestari, 2022). Therefore, a well-planned and programmed training program is needed to improve the physical abilities and basic techniques of athletes (Setiawan, 2020).

One of the most important basic techniques in badminton is serving. The ability to serve well can determine an athlete's success in a match (Wibowo, 2023). However, many athletes in West Sulawesi still have difficulty mastering this technique, which affects their performance on the field (Nuraini, 2021). In-depth research on serving techniques, including factors that influence serving ability, is needed to improve athlete performance.

Amidst the existing challenges, there is great potential to develop badminton in West Sulawesi. With the many badminton clubs that exist, such as PB Mandar and PB Pacific, as well as high interest from the community, there is an opportunity to create a more effective development program (Hidayat, 2022). Through cooperation between the government, coaches, and the community, badminton achievements in West Sulawesi can be improved.

Wrist flexibility refers to the ability of the wrist joint to move in various directions with a good level of flexibility (Suparman & Hasbillah, 2021). This involves extension and flexion movements as well as side movements (ulnar deviation and radial deviation) (Kusnedi & Johor, 2019; Nurjamal et al., 2019). Eye-hand coordination is the ability to integrate visual information received by the eyes with hand movements (Setiawan et al., 2020)(H et al., 2024). With hand-eye coordination, the position of the shuttlecock can be quickly responded to with precise hand movements (Difa et al., 2022; Yudhaprawira, 2018).

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Motivation is an internal or external drive that drives an individual to perform an action or achieve a certain goal (Saleh & Saleh, 2019). In the context of sports, motivation plays a crucial role in determining how much effort and commitment an athlete puts into training and competition (Sulastri & Masriqon, 2021; Winoto, 2015). Long serve in badminton is a basic technique used to start the game or return the shuttlecock to the opponent's area to create pressure and control the game. This serve is done by directing the shuttlecock to the back of the opponent's court, forcing the opponent to move back and making it difficult to counterattack (Riolin, 2019).

Therefore, this study aims to explore the effect of wrist flexibility, motivation, and eye-hand coordination on the basic skill of long serve in badminton. By understanding these factors, it is hoped that a more effective training program can be designed to improve the performance of badminton athletes in West Sulawesi (Supriyanto, 2022).

METHODS

This study uses a quantitative approach with descriptive and analytical designs. This type of research aims to measure the effect of independent variables (wrist flexibility, eye-hand coordination, and motivation) on the dependent variable (long-service skills) in badminton athletes. Population: All badminton athletes registered at PB. Pacific Polewali Mandar Regency. Sample: 20 athletes were selected by purposive sampling based on certain criteria, such as level of experience and frequency of training. This study uses a path analysis design to test the relationship between independent and dependent variables.

The formulation of the problem includes 1) Is there a direct effect of wrist flexibility on long-service skills? 2) Is there a direct effect of eye-hand coordination on long-service skills in badminton? 3) Is there a direct effect of motivation on long-service skills? 4) Is there a direct effect of wrist flexibility and eye-hand coordination on long-service skills? 5) Is there an indirect effect of wrist flexibility and motivation on long-service skills? 6) Is there an indirect effect of eye-hand coordination and motivation on long-service skills? 7) Is there a direct influence of wrist flexibility, hand-eye coordination and motivation on long-service skills?

Path analysis will help in understanding the direct and indirect effects of wrist flexibility, eye-hand coordination, and motivation on long-serve skills. Research Instruments: Wrist Flexibility is measured using flexibility tests such as reach tests or flexibility tests using certain measuring devices. Eye-hand coordination is measured through tasks that test fine motor control and accuracy in directing objects, such as throwing and catching balls. Motivation is tested using a validated questionnaire to measure the level of motivation of athletes in training and competing. Long Serve Skills: Assessed through direct observation while performing long serves in training or matches.

The data obtained will be analyzed using statistical software such as SPSS or AMOS. Path analysis will be conducted to test the influence model and relationships between variables. Validity and reliability tests of the instrument will also be conducted before further analysis. The results of the path analysis will provide information on the coefficient of influence of each variable on long-serve skills.

RESULTS AND DISCUSSION

Table 1.
Descriptive analysis of wrist flexibility data, eye-hand coordination, and motivation towards long-service skills in badminton games of PB. Pacific athletes, Polman Regency

Statistical Value	Wrist Flexibility (X1)	Hand-eye Coordination (X2)	Motivation (X3)	Long-service Skill (Y)
N	20	20	20	20
Mean	67.60	15.95	138.10	32.85
Median	67.50	16.00	137.50	32.50
Std. Dev.	7.37	2.48	8.86	4.88
Varians	54.36	6.15	78.51	23.82
Range	30.00	11.00	34.00	20.00
Min.	52.00	11.00	120.00	22.00
Mak.	82.00	22.00	154.00	42.00
Sum	1352.00	319.00	2762.00	657.00

Based on the summary of the results of the descriptive analysis of the data in the table above, it can be described as follows:

For wrist flexibility data from 20 students, the number of samples obtained an average value (mean) of 67.60, a median of 67.50, Std. Deviation of 7.37, variance of 54.36, range of 30.00, minimum value of 7.00, maximum value of 82.00, and sum value of 1352.00.

For hand-eye coordination data from 20 students, the number of samples obtained an average value (mean) of 15.95, a median of 16.00, Std. Deviation of 2.48, variance of 6.16, range of 11.00, minimum value of 11.00, maximum value of 22.00, and sum value of 319.00.

For motivation data from 20 students, the sample size obtained an average value (mean) of 138.10, a median of 137.50, Std. Deviation of 8.86, a variance of 78.51, a range of 34.00, a minimum value of 120.00, a maximum value of 154.00, and a sum value of 2762.00. For Long-service skill data from 20 students, the sample size obtained an average value (mean) of 32.85, a median of 32.50, Std. Deviation of 4.88, a variance of 23.81, a range of 20.00, a minimum value of 22.00, a maximum value of 42.00, and a sum value of 657.00.

Table 2.
Normality test of wrist flexibility data, hand-eye coordination, and motivation with long-service skills

Statistical Value	Wrist Flexibility (X1)	Hand-eye Coordination (X2)	Motivation (X3)	Long-service Skill (Y)
N	20	20	20	20
Absolute	0.125	0.158	0.094	0.107
Positive	0.125	0.136	0.094	0.107
Negative	-0.085	-0.158	-0.092	-0.102
Kolmo-Smirnov Z	0.125	0.158	0.094	0.107
Asymp. Sig.	0.200	0.200	0.200	0.200

Based on the table, which is a summary of the results of the data normality test on each research variable, it can be described as follows:

a. In the normality test of wrist flexibility data, the Kolmogorov-Smirnov Z value was obtained = 0.125 with probability (P) = 0.200 > 0.05. Thus, wrist flexibility was obtained and was normally distributed.

b. In the normality test of hand-eye coordination data, the Kolmogorov-Smirniv Z value was obtained = 0.158 with probability (P) = 0.200 > 0.05. Thus, the hand-eye coordination obtained was normally distributed.
c. In the normality test of motivation data, the Kolmogorov-Smirnov Z value was obtained = 0.094 with probability (P) = 0.200 > 0.05. Thus, the motivation obtained was normally distributed.
d. In the normality test of the Long-service skill data, the Kolmogorov-Smirnov Z value was obtained = 0.107 with probability (P) = 0.200 > 0.05. Thus, the Long-service skill obtained was normally distributed.

Table 3.
Correlation of wrist flexibility to long-service skills

Variable	N	r	P	Sig.
Wrist Flexibility (XI) Long-service Skill (Y)	20	0.845	0.000	Sig.

Based on the table above, the correlation obtained is r-count value = 0.845 (P <0.05), meaning there is a significant relationship between wrist flexibility and long-service skills in PB. Pacific athletes, Polman Regency. Influence of Wrist Flexibility: Research shows that there is a direct influence of wrist flexibility on the long-service skills of PB. Pacific athletes, Polman Regency, by 84.5%. Good flexibility allows athletes to execute service techniques more effectively, provide positive psychological encouragement, and increase motivation. The quality of flexibility is influenced by the elasticity of muscles, tendons, ligaments, and psychological factors so that it can improve athlete performance in badminton.

Table 4.
Correlation of Hand Coordination to Long-service Skills

Variable	N	r	P	Sig.
Hand Coordination (X2) Long-service Skill (Y)	20	0.786	0.000	Sig.

Based on the table above, it can be seen that the results of the correlation calculation obtained the calculated r-value = 0.786 (P <0.05), meaning that there is a significant effect of eye-hand coordination on long-service skills in PB. Pacific Athletes, Polman Regency. Effect of Eye-Hand Coordination: Eye-hand coordination has a direct effect on long-service skills by 78.6%. Without good coordination, a player will have difficulty directing the shuttlecock, which can result in ineffective service. Athletes need to integrate wrist flexibility and eye-hand coordination to achieve maximum results in long-service.

Table 5.
Correlation of Motivation to Long-service Skills

Variable	N	r	P	Sig.
Motivation (X3) Long-service Skills (Y)	20	0.728	0.000	Sig.

Based on the table above, it can be seen that the results of the correlation calculation obtained the r value obtained = 0.728 (P <0.05), meaning that there is a significant influence of motivation on long-service skills in PB. Pacific athletes, Polman

Regency. Influence of Motivation: Motivation has an influence of 72.8% on long-service skills. Motivation functions as a driver of enthusiasm and commitment of athletes in training. In the context of badminton, motivation must be combined with other physical factors, such as wrist flexibility and eye-hand coordination, to achieve the desired skills.

Table 6.
Regression of Wrist Flexibility, Hand Coordination on Long-service Skills

Variable	N	R Square	P	Sig.
Wrist Flexibility (X1) Hand-Eye Coordination (X2) Long Serve Skill (Y)	20	0.798	0.000	Sig.

Based on the table above, it can be seen that the results of the regression calculation using the r regression test are presented as follows: Significant test. or significance of regression using the F regression test obtained Fcount = 21.126 (P <0.05), then H0 is rejected H1 is accepted. The Effect of Wrist Flexibility and Eye-Hand Coordination: The combination of wrist flexibility and eye-hand coordination contributes 79.8% to long-service skills. Both must be integrated to ensure that the service is effective and can make it difficult for the opponent. The synergy between these two components is very important in the implementation of service techniques.

Table 7.
Regression of Wrist Flexibility and Motivation on Long-service Skills

Variable	N	R Square	P	Sig.
Wrist Flexibility (X1) Motivation (X3) Long-service Skills (Y)	20	0.646	0.002	Sig.

Based on Table 7 above, it can be seen that the results of the regression calculation using the r regression test obtained a value of r = 0.646. This means that there is a significant influence of wrist flexibility and motivation on long-service skills in badminton games for PB.Pacific athletes in Polman Regency. The Effect of Wrist Flexibility and Motivation: Research shows that wrist flexibility and motivation simultaneously play an important role in long-service skills, with a contribution of 64.6%. Athletes must pay attention to both of these aspects to be able to carry out effective and competitive services in badminton games.

Table 8.
Regression of Hand Coordination and Motivation on Long-service Skills

Variable	N	R Square	P	Sig.
Hand-Eye Coordination (X2) Motivation (X3) Long Serve Skill (Y)	20	0.908	0.000	Sig.

Based on Table 8 above, it can be seen that the results of the regression calculation using the r regression test obtained a value of = 0.908 where P (0.000 <0.05), then H0 is rejected H1 is accepted. The Influence of Eye-Hand Coordination and Motivation: The combination of eye-hand coordination and motivation has a significant influence on long-service skills, with a contribution of 90.8%. Both need to be combined in each movement execution to increase the effectiveness of the service, indicating that physical and psychological conditions support each other in achieving the desired skills.

Table 9.
Regression of Wrist Flexibility, Hand-eye Coordination, and Motivation on Long-service Skills

Variable	N	R Square	P	Sig.
Wrist Flexibility (X1) Hand-Eye Coordination (X2) and Motivation (X3) Long-service Skills (Y)	20	0.798	0.000	Sig.

Based on Table 9 above, it can be seen that the results of the regression calculation using the r regression test obtained an R square value of 0.798 using the F regression test obtained Fcount = 21.126 where (P = 0.000 < 0.05). Joint Influence of Wrist Flexibility, Eye-Hand Coordination, and Motivation: Wrist flexibility, eye-hand coordination, and motivation together contributed 79.8% to long-service skills. These three components must support each other to improve athlete performance in badminton, indicating that achievement cannot be achieved separately but requires harmonious integration between physical and psychological aspects.

CONCLUSION

Based on the data analysis that has been done, it can be concluded that:

1. There is a significant direct effect of wrist flexibility on long-service skills in badminton games of PB. Pacific athletes, Polman Regency.
2. There is a significant direct effect of hand-eye coordination on long-service skills in badminton games of PB. Pacific athletes, Polman Regency.
3. There is a significant direct effect of motivation on long-service skills in badminton games of PB. Pacific athletes, Polman Regency.
4. There is a significant direct effect of wrist flexibility and hand-eye coordination on long-service skills in badminton games of PB. Pacific athletes, Polman Regency.
5. There is a significant indirect effect of wrist flexibility and motivation on long-service skills in badminton games of PB. Pacific athletes, Polman Regency.
6. There is a significant indirect effect of hand-eye coordination and motivation on long-service skills in badminton games of PB. Pacific athletes, Polman Regency.
7. There is a significant indirect effect of wrist flexibility, hand-eye coordination and motivation on long-service skills in badminton games of PB. Pacific athletes, Polman Regency.

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