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Relationship between strength, coordination, and balance to underhand service in amateur volleyball players' teenage

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Abstract

This research is motivated by the problem of serving down where there are students who do not reach the opponent's field, are not on target, and look unbalanced when making the transition of motion, so there needs to be a discussion to see these problems. This study aimed to the contribution of arm muscle power to the underhand carrier, coordination of hand-eye to the underhand carrier, and stability of the underhand carrier inside the volleyball sport in contributors of Senior High School Muhammadiyah three Palembang. The type of research is quantitative with a correlation design and uses a sampling technique changed into a sampling method. In contrast, all participants of the populace were used as samples, totaling fifty-eight, including 31 guys and 27 women. A push-up test measures instruments. Arm muscle strength and coordination are measured using eye and hand coordination instruments, balance is measured using a Dynamic balance test, and an underhand serve test is used to determine volleyball underhand serve. Data analysis techniques using simple and multiple correlation tests and correlation assessments at the SPSS Model 26 program. The research results show the correlation between arm muscle strength, hand-eye coordination, balance, and underhand serve from a significant value of 0.00, and the value of R = 0.921 is perfectly correlated. This study suggests the contribution of arm muscle power, eye-hand coordination, and stability to floor carrier in volleyball in students.

Keywords: Strength, coordination, balance, underhand service.

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INTRODUCTION

Volleyball is one of the sports of achievement that is being improved in Indonesia (Ahdan et al., 2020). The underhands serve is the least difficult serve and is mostly done by junior players. The characteristic of serving

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strokes is to bounce, so receiving the ball from this serve is very easy for players with high skills. Volleyball underhand service techniques require physical and psychological aspects, including arm muscle strength, muscle explosiveness, and coordination (Willy et al., 2020).

The results of observations on the field, through observations made at Senior High School Muhammadiyah 3 Palembang, can show that there are several problems, such as the ability to serve under the student's volleyball is still not good, it can be seen when students serve down, the ball that is hit concerns the net and is not directed to the opponent's court boundary line box and when serving down is not according to the rules, namely the ball is bounced high than when the ball falls the ball is hit. Field observations were carried out on high school students because of problems with volleyball material, especially the underhand serve. The main reason for this research is to discover the cause of these problems (Muslimin et al., 2020). Many students are careless when underhand serve, students still cannot balance every movement made, and students still cannot concentrate fully when serving down, which results in the ball often going off the court, students are seen not to be able to coordinate between the eyes of the hand and the lack of balance when hitting the underhand serve so that the results of the serve are not on target, then based on the results of observations it appears that the service does not cross the net so this is assumed to be a lack of arm muscle ability.

Factors that affect decreased servicing potential include arm muscle strength, hand-eye coordination, and balance. Volleyball is influenced by several components, one of which is muscle strength, namely arm muscle strength (Betna, Yanse et al., 2020). Arm muscle strength is used to swing so as to provide encouragement when going to serve under the ball (Ertanto et al., 2021), and underhand serve movement arm muscle strength plays a very important role in being able to hit a volleyball service as expected, namely, the speed of the ball remains fast and hard. Hence, the movement requires strength that comes from a collection of arm muscles (M. et al., 2019), the underhand serve requires skills for setting or

processing the ball, both the direction or purpose and the target, the rate of movement of the ball, the required movement power or strength towards the ball by swinging with the strength of the hand muscles (Handayani & Sari, 2023), with good arm muscle strength has a positive impact related to the use of power in performing a stroke. When hitting the ball, greater strength and energy will be more beneficial (Nurjana, 2021).

Hand-eye coordination is a cognitive skill complex and should guide our hand movements based on visual stimuli and feedback, difficulties in hand-eye coordination can adversely affect the performance and learning of any motor gesture, especially in volleyball serve, because during the underhand serve, good hand eye coordination is needed when hitting the ball and choosing the target of the serve (Addivinola et al., 2021), underhand serve of a volleyball game requires eye-hand coordination for example before the movement of hitting the ball during the underhand serve, the eyes must point to the target or the intended object, besides that the eyes and hands need to be coordinated when the hand is swung towards the ball so that it fits the ball (Ertanto et al., 2021) in this case the coordination of the eyes of the hands is a component where the body is able to coordinate movements between several movements into one complex movement in underhands serve volleyball game (Ibrohim et al., 2022).

Dynamic balance, pelvic stability, and torso control are necessary for a good landing, therefore, core strengthening plays an important role for pelvic and torso stability at the time of volleyball underhand serve (Agustina et al., 2022), and where during service movement there will be a transfer of body weight point forward which disrupts body stability so that good balance is needed to be able to maintain good body position (Ertandi et al., 2018).

This observation discusses provider accuracy with hand-eye coordination and stability. Therefore, conducting behavior studies on stability and hand-eye coordination at the capacity to serve down, particularly in volleyball, is essential. Primarily based totally on an

overview of preceding studies, it may be concluded that there are different variables and former studies that connect three variables directly, specifically stability, arm muscle strength, and hand-eye coordination, to the outcomes of the underhand provider have now no longer been seen, it is far essential to behavior studies to discover the connection among stability, arm muscle strength, and hand-eye coordination. Based on the above background, it is far essential for behavior studies to observe the contribution of arm muscle strength, hand-eye coordination, and stability to the capacity to serve underhand volleyball. This study aimed to see the relationship between arm muscle strength, eye-hand coordination, and stability to the ability to serve underhand in volleyball.

METHOD

This research uses quantitative research, and the method used is the correlation research method. The research population is all Muhammadiyah 3 Palembang High School students totaling 58 consisting of 31 males and 27 females. This research uses a total sampling technique, so the total population is used as a population sample of 58, so the sample in this study is 58 students. The instrument used for arm muscle strength is the up test (Indrakasih et al., 2022), the instruments used to measure eye and hand coordination are the tennis ball catch throw test (Ertanto et al., 2021), the instruments used to measure balance are dynamic balance test (Yang et al., 2024) and the instrument used to determine the results of the underhand serve is volleyball skill test (Winarno, 2018). Data analysis used analytical techniques to test hypotheses, regression tests, and correlation tests to help SPSS version 26.

RESULT

The data results show a perfect correlation between arm muscle strength, hand-eye coordination, balance, and underhand service.

Table 1. Regression test results of arm muscle strength against underhand serve

	Type	Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	31,300	1	31,300	184,970	0.000b
	Residuals	9,476	56	0,169		
	Total	40,776	57			

a. Dependent Variable: Underhand serve
b. Predictors: (Constant), strength

The data shown in Table 1 indicate the outcomes of the regression test. It can be concluded that arm muscle electricity is involved in the underhand serve of the volleyball.

Table 2. Regression test of arm muscle strength against underhand serve

Type	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics		
					R Square Change	F Change	Sig. F Change
1	0.876a	0,768	0,763	.41136	0,768	184.970	0,000

a. Predictors: (Constant), strength

The consequences of statistics desk 2 may be visible. The correlation of arm muscle strength against underhand service shows that there is a strong relationship between arm muscle strength and the results of underhand serve volleyball.

Table 3. Correlation test results of arm muscle strength to underhand serve

		Strength	Service
Strength	Pearson Correlation	1	.876**
	Sig. (2-tailed)		.000
	N	58	58
Service	Pearson Correlation	.876**	1
	Sig. (2-tailed)	.000	
	N	58	58

**. Correlation is significant at the 0.01 level (2-tailed).

The results of the correlation test show that arm muscle strength and underhand service have a relationship. The two tests conducted by researchers showed the same results: the connection between the

variables of arm muscle strength and underhand service and arm muscle strength and underhand serve has a perfect correlation.

Table 4. Eye coordination regression tests the underhand service

	Type	Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	24,500	1	24,500	84,297	0.000b
	Residuals	16,276	56	0,291		
	Total	40,776	57			

a. Dependent Variable: service
b. Predictors: (Constant), Coordination

According to the data shown in Table 4, the variables of hand-eye coordination in opposition to the volleyball underhand serve may be concluded.

Table 5. Regression hand-eye coordination against the underhand service

Type	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	0.775a	0,601	0,594	.53911	0,601	84.297	1	56	0,000

a. Predictors: (Constant), Coordination

The results of Table 5 can be seen in the correlation of hand-eye coordination against the underhand service; it shows that there is a strong relationship between hand-eye coordination and underhand service.

Table 6. Correlation test of hand-eye coordination to underhand service

		Coordination	Down service
Coordination	Pearson Correlation	1	.775**
	Sig. (2-tailed)		.000
	N	58	58
Down service	Pearson Correlation	.775**	1
	Sig. (2-tailed)	.000	
	N	58	58

**. Correlation is significant at the 0.01 level (2-tailed).

The correlation test results showed that the coordination of the hand-eye and the underhand serve has a relationship. The two tests conducted by researchers showed the same results, namely, the connection between the variables of hand-eye coordination and underhand serve and hand-eye coordination and underhand serve has a strong correlation.

Table 7. Balance regression test results against underhand serve

	Type	Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	21,737	1	21,737	63,938	0.000b
	Residuals	19,039	56	0,340		
	Total	40,776	57			

a. Dependent Variable: service
b. Predictors: (Constant), balance

The data in Table 7 suggest that the volleyball backside serve is one of the stability variables.

Table 8. Results of the balance regression test against the underhand service

Type	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	0.730a	0,533	0,525	0,58307	0,533	63.938	1	56	0,000

a. Predictors: (Constant), balance
b. Predictors: (Constant), Coordination

The correlation between balance and underhand service is strong. Then, the researchers conducted a correlation test.

Table 9. Balance correlation test results to Underhand service

		Balance	Underhand serve
Balance	Pearson Correlation	1	.730**
	Sig. (2-tailed)		.000
	N	58	58
Underhand serve	Pearson Correlation	.730**	1
	Sig. (2-tailed)	.000	
	N	58	58

**. Correlation is significant at the 0.01 level (2-tailed).

The correlation coordination of the hand-eye and underhand serve is strong. The results of the two tests were similar, namely the connection between the variables of balance and underhand serve and the coordination of the hands and underhand serve.

Table 10. Regression test results of arm muscle strength, hand-eye coordination, and underhand serve continuity

	Type	Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	34.563	3	11.521	100.136	.000b
	Residuals	6.213	54	.115		
	Total	40.776	57			

a. Dependent Variable: Underhand service
b. Predictors: (Constant), balance, strength, coordination

According to the data shown in Table 10, it is possible to conclude that there are variables of arm muscle strength, hand-eye coordination, and stability towards the volleyball underhand serve.

Table 11. Regression test results of arm muscle strength, hand-eye coordination, and underhand service continuity

Type	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.921a	.848	.839	.33919	.848	100.136	3	54	.000

a. Predictors: (Constant), balance, strength, coordination

The results of data table 11 show that the correlation between arm muscle strength, hand-eye coordination, balance, and underhand service are perfectly correlated.

DISCUSSION

The study results show a relationship between arm muscle strength, hand-eye coordination, and balance in the underhand serve of volleyball. This studies is in keeping with studies Rahmi & Bachtiar, (2020) of the study, there has been a extensive contribution of bodily situation one of the additives of bodily situation is arm muscle energy and volleyball underhand service, Rifaldi & Rahmadani, (2023) there is a contribution of arm muscle strength to the results of volleyball underhand service of student, and Handayani & Sari, (2023) said that there's arm muscle energy and volleyball uderhands serve students, end is just like preceding researchers that the energy of arm muscle tissues in opposition to volleyball`s underhand carrier, the next step is that arm muscle strength can be improved with pull up Hewit, (2018); Sánchez-Moreno et al., (2020); Williamson & Price, (2021) sased on the results of (Yachsie et al., 2023) research, arm muscle strength can be increased with plank training,

followed by (Cho & Choi, 2017); Zahiri et al., (2022) research that plank training can increase core muscles so that plank training is highly recommended to increase arm muscle strength because it does not require any tools. In volleyball, power abilities are considered in phrases of the price of most muscle contraction and especially the connection between muscle power and the rate of muscle contraction (Stojanović et al., 2016).

Based on the results of the study, it was found that there was a strong relationship between hand-eye coordination and arm muscle strength in the volleyball underhand serve research. Boichuk et al. (2017) discovered dependable advantageous interrelations between a complete rating of coordination schooling and the performance of volleyball players in the recreation pastime. This study is in step with studies research by Ibrahim et al. (2022), arm muscle electricity and eye-hand coordination with provider accuracy for athletes". This may be visible from the consequences of evaluating the coefficient tremendous test, particularly R = 0.941. The consequences confirmed that the contribution of bodily circumstance with provider cap potential became tremendous. Next, in the research by Darmawan et al. (2020) on the contribution coordination of eyes with volleyball underhand serve skills, the results were significantly related to the other research on the contribution of hand-eye coordination with the volleyball underhand serve, so for variable coordination with good skills because with a good level of hand-eye coordination will be able to streamline underhand serve skills (Addivinola et al., 2021; Sakthivel & Vaithiyanathan, 2022), hand-eye coordination plays a very important role when the ball is hit and swinging the ball and seeing the target of the serve, of course, it needs good coordination (Khaupshev et al., 2021).

Based on the effects of studies and numerous preceding studies, there is a robust underhand serve and eye-and-hand coordination in the sport of volleyball; it is necessary to conduct training to improve eye-hand coordination. Training that can improve hand-eye coordination with brain gym exercises (Kulkarni & Ramesh Khandale, 2019; Martin-Niedecken &

Schättin, 2020; Sepehrikia et al., 2023) and tennis ball throwing and catching exercise (Pranatahadi & Aditya Nur Aziz, 2020; Szabo et al., 2020; Szabo et al., 2021), relationship between balance to the volleyball underhands serve, balance and the underhand service are strongly correlated. This research aligns with research La Kamadi (2020) contribution of arm muscle strength and eye coordination with the effects of observing a massive stability to volleyball underhand serve. Balance is the ability of a person to control his muscular nerve organs during rapid movements with rapid changes in weight points both in static and more dynamic states and states of dynamic motion (Handayani, 2018). It can be concluded that balance is one of the important factors when underhands serve. Exercises that can improve balance are squats (Jeong & Park, 2022; Ramadurai et al., 2022; Song, 2022). The correlation coefficient obtained for the connection among arm muscle strength, hand-eye coordination, and stability to volleyball underhand suggests a completely best relationship. This can be understood because the movement of pushing or bouncing the ball by swinging both arms forward with a force that suits the needs aims to get the thrust of the ball forward so that the ball moves forward (La Kamadi, 2020). Perform a volleyball underhand serve movement by directing all the sources owned, especially at the arm, which must be coordinated with arm movements to support the ability to play the ball by trying to bounce the ball using the arm as much as possible so that it can determine and direct the ball to be served (Handayani, 2018).

This study found that arm muscle strength, hand-eye coordination, and balance are related to the results of the volleyball underhand serve, so there is a need for effective training to increase arm muscle strength, hand-eye coordination, and balance. This study has limitations in the form of a minimal number of samples, so there is a need for research with a larger number of samples. Further research is suggested to increase the number of samples to more than this research is limited only to looking for the relationship between arm muscle strength, coordination, and balance

to the results of the underhand serve; there is a need for experimental research to prove it.

CONCLUSION

The results of the study found a strong relationship between arm muscle strength, hand-eye coordination, and balance in the underhand serve. Recommendations from this research include the connection among arm muscle electricity outcomes of serving beneath the sport of volleyball. Consequently, education is needed to boost arm muscle electricity, including push-ups and planks. There is additionally total eye coordination and the outcomes of underhand serve in the sport of volleyball, so there needs to be training such as brain gym exercises and throwing tennis ball frames to improve hand-eye coordination. There is also a strong relationship between balance and the results of serving under volleyball, and there needs to be training such as squats to improve balance, with some examples of this exercise, of course, it is hoped that it can improve the results of serving under in the game of volleyball. This study has limitations with a relatively small number of research samples, and samples only ranged after high school age, so further research needs to pay attention to this.

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