Jambura Health and Sport Journal
Vol. 7, No. 2 Agustus 2025
p-ISSN: 2654-718X, e-ISSN: 2656-2863

HUBUNGAN OTOT TUNGKAI, OTOT PUNGGUNG, DAN OTOT LENGAN DENGAN HASIL LEMPARAN DALAM SEPAK BOLA

RELATIONSHIP BETWEEN LEG MUSCLES, BACK MUSCLES, AND ARM MUSCLES WITH THROWING RESULTS IN FOOTBALL

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ABSTRAK

Keterampilan dasar merupakan faktor penting yang dapat menunjang penampilan dan prestasi pemain. Salah satu teknik penting dalam sepak bola adalah lemparan ke dalam, yang memiliki fungsi strategis dalam permainan. Penelitian ini bertujuan untuk mengetahui bagaimana otot-otot tertentu mempengaruhi hasil lemparan sepak bola. Metode penelitian ini menggunakan Pendekatan deskriptif kuantitatif, Peserta dalam penelitian 24 pemain sepak bola Terang Bangsa umur 15-18 tahun yang dipilih melalui metode *purposive sampling*. Hasil penelitian menyatakan kekuatan otot lengan memiliki koefisien standarisasi tertinggi, yaitu 0,575. kekuatan otot punggung memiliki koefisien standarisasi sebesar 0,418, yang juga menunjukkan pengaruh yang cukup signifikan. kekuatan otot tungkai memiliki koefisien standarisasi yang sangat rendah, yaitu 0,018. meskipun dalam penelitian ini otot tungkai memiliki koefisien standarisasi yang sangat, penting untuk mempertimbangkan bagaimana kondisi fisik secara keseluruhan dan program latihan dapat lebih mengoptimalkan hasil ini.

Kata Kunci: otot tungkai, otot punggung, otot lengan, lemparan ke dalam, sepak bola

ABSTRACT

Basic skills are important factors that can support the appearance and achievement of players. One of the important techniques in football is the throw-in, which has a strategic function in the game. This study aims to determine how certain muscles affect the results of football throws. This research method uses a quantitative descriptive approach. Participants in the study were 24 Terang Bangsa football players aged 15-18 years who were selected through a purposive sampling method. The results of the study stated that arm muscle strength had the highest standardization coefficient, which was 0.575. Back muscle strength had a standardization coefficient of 0.418, which also showed a significant effect. Leg muscle strength had a very low standardization coefficient, which was 0.018. Although in this study the leg muscles had a very standardization coefficient, it is important to consider how the overall physical condition and training program can further optimize these results.

Keywords: *leg muscles, back muscles, arm muscles, throw-in, football*

Diterima : April 2025
Disetujui : Juli 2025
Tersedia Secara *Online* 2 Agustus 2025

Introduction

The younger generation will determine the progress of Indonesian football today and in the future (Zainuddin, AM, et al., 2022; Zainuddin, Usman, et al., 2022). Maximum success can be achieved with structured coaching from early to adult (Hidayah et al., 2023; Nailufar & Hartono, 2022; Susanto et al., 2019) . A player's performance and achievements can be supported by basic skills (Agustian et al., 2022; Aprilianto et al., 2022; Saputra & Aziz, 2020). Acquiring proficiency in basic skills such as kicking, dribbling, heading, and throwing is essential to improving the quality of players (Jud et al., 2022; Mappaompo, 2024; Ruslan Ruslan et al., 2023). Therefore, a training program that emphasizes the basic abilities of the players is needed.

The tactics of the game of football have evolved very quickly as a result of the players' personal skills and game strategy (Goes et al., 2021; Indra & Marheni, 2020). Strategies and game tactics that become the strategy that dominates the player to attack the opponent's defense must be developed by the coach and the player (Matos et al., 2023; Wildan et al., 2024; Yudanto & Nurcahyo, 2020). Throw-ins are one of the basic skills of football that play a strategic role in the game, and have become a key component in the development of Indonesian football, especially in the last three years, as an attack that challenges opponents' defenses. This tactic can be used to develop an attack or create scoring opportunities in addition to returning the ball to the field of play after leaving the sideline (Munawar et al., 2024; Putra et al., 2024).

Pretama Arhan, a player of the Indonesian Senior National Team, is one example of a player who can throw inside to the front of the goal and score a goal, making the throw-in in football almost the same as a corner. Long and accurate throws are produced by a combination of muscle strength, body coordination, and basic technique, all of which affect the success of the throws into (Farhanto et al., 2021; Tuquet et al., 2021). The coordination of actions and muscle continuity gives the best results when players make throws into the football.

The variables that influence throws in football have been the subject of several previous studies. The relationship and impact of one muscle on the outcome of throws in football has been the subject of particular research. As research (Ruslan et al., 2023)(Zainuddin et al., 2022) The arm and abdominal muscles have an important connection to perform the throw-in. However, other studies also say that foot technique affects the outcome of throws (Farhanto et al., 2021). This makes the question for the author, is there also a relationship between the leg muscles and the results of throwing?

However, several biomechanical studies have examined the importance of muscle strength in various sports activities, such as throwing a ball in other sports such as handball and basketball. For example, a study by (Pratama & Alficandra Alficandra, 2024) shows that arm muscles and leg muscles have a great influence on throwing performance in handballs. However, similar research in the context of football is still limited, especially in analyzing the specific relationship between leg muscles, back muscles, and arm muscles with the result of throwing in.

The study intends to close the gap by examining the different contributions of leg

muscles, back muscles, and arm muscles to throw-in performance in football. The authors identified gaps in previous studies, specifically the lack of research that specifically explored the relationship between the main muscle groups involved in throwing into football.

The study included leg muscle strength, which had not been covered in previous studies. By assessing and comparing the strength of the muscles, legs, arms, and back with the results of throws in, this study can provide a new perspective on the physical components that should be the focus of the training of football players. This study aimed to investigate the relationship between the strength of the leg, arm, and back muscles and the results of throwing into a football. In addition, the results of this study can help coaches create more efficient training plans to improve throwing abilities in players.

Method

A descriptive quantitative method was used in this study combined with a correlation approach (Paryadi et al., 2023). Participants in this study were 24 Terang Bangsa football athletes aged 15-18 years who were selected by purposive sampling. This study conducted observations and tests to collect data. The variable leg dynamometer test is used for leg muscle tests, 60-second push-ups are used for arm muscle tests, back dynamometer is used for back muscle tests, and inward throw distance test is used to measure the result of throws in using a size 5 ball using ball throw distance measurement. The tests included in this study have been standardized and have been used before. Multiple regression and correlation tests, which have previously passed normality and homogeneity tests, are used in the data analysis approach.

Result

Below the results of the data description, which includes minimum, maximum, average, standard deviation, and correlation analysis with Pearson product moments, will be presented below:

Table 1. Data Description Results

	N	Minimum	Maximum	Mean	Std. Deviation
Leg Muscles	24	100,0	202,0	148,985	26,5457
Back Muscles	24	87,0	204,0	131,888	26,1669
Arm Muscles	24	49	61	58,13	3,139
Throw-In	24	23,30	31,00	28,0271	1,59837

Table 2. Results of Leg Muscle Analysis with Deep Throws

		Leg Muscles	Throw In
Leg Muscles	Pearson Correlation	1	,789**
	Sig. (2-tailed)		,000
	N	24	24
Throw-in	Pearson Correlation	,789**	1
	Sig. (2-tailed)	,000	
	N	24	24

Based on table, above, the significance value is known to be as low as 0.000 <0.05, meaning that there is a significant or meaningful relationship between the variable Leg Muscle and throwing into football.

Tegel 3. Back Muscle Results with Throw-In

		Back Muscles	Throw-In
Back Muscles	Pearson Correlation	1	,817**
	Sig. (2-tailed)		,000
	N	24	24
Throw-In	Pearson Correlation	,817**	1
	Sig. (2-tailed)	,000	
	N	24	24

Based on table, above, the significance value is known to be as low as 0.000 <0.05, meaning that there is a significant or meaningful relationship between the Back Muscle variable and Throws into the football.

Table 4. Arm Muscle Results with Throw-In

		Arm Muscles	Throw-In
Arm Muscles	Pearson Correlation	1	,869**
	Sig. (2-tailed)		,000
	N	24	24
Throw-In	Pearson Correlation	,869**	1
	Sig. (2-tailed)	,000	
	N	24	24

Based on table, above, the significance value is known to be as low as 0.000 <0.05, meaning that there is a significant or meaningful relationship between the Arm Muscle variable and the Throw Into the Football.

Table 5. Results of Multiple Linear Regression Analysis

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	7,479	3,137		2,384	,027
Leg Muscles	,001	,010	,018	,111	,913
Back muscles	,026	,009	,0418	2,981	,007
Arm Muscles	,293	,069	,575	4,267	,000

Based on table, above, it is known that the significance value of the influence of independent, namely the leg muscles on the dependent variable, namely the ability to throw into the football is 0.913 >0.05, so that the hypothesis is rejected or insignificant. The significance

value of the independent variable runner, namely the back muscle in the dependent variable, namely the ability to absorb into football is 0.007 <0.05, so that the hypothesis is accepted or significant. The significance value of the influence of the independent variable, namely the arm muscles on the dependent variable, namely the ability to throw into the football, is 0.000 <0.05, so the hypothesis is accepted or significant. The results above stated that the leg muscles had no effect on the ability to throw into the football and the back muscles and arm muscles affected the ability to throw into the football.

Discussion

Based on the results of linear regression analysis, it can be concluded that there is a significant correlation between the results of football throws and the strength of the back and arm muscles. The strength of the back muscles has a regression coefficient of 0.026 with a significance value of 0.007 ($p < 0.05$), indicating that any increase in the strength of the back muscles will increase the yield of the throws in. This can be explained by the fact that the back muscles play an important role in stabilizing the body and providing additional strength when throwing. Strong back muscles allow players to generate more power and maintain balance during the throwing process (Ruslan Ruslan et al., 2023).

Meanwhile, arm muscle strength had a regression coefficient of 0.293 with a significance value of 0.000 ($p < 0.05$), indicating that arm muscles were the factor that had the greatest influence on the outcome of throws. The strength in the arm muscles allows the players to throw the ball faster and farther, thus increasing the effectiveness of the throw inside. This is in line with the throw-in mechanism that requires arm muscle strength to move the ball quickly and accurately.

On the other hand, the strength of the leg muscles did not show a significant influence on the outcome of the inward throw. A regression coefficient of 0.001 with a significance value of 0.913 ($p > 0.05$) indicates that leg muscle strength does not have a significant influence on the outcome of the throw. This may be because throws rely more on upper body strength, specifically the back and arm muscles, while the leg muscles play a more important role in other activities such as running or kicking a ball.

Of the three variables analyzed, the arm muscles had the highest standardization coefficient, which was 0.575. This shows that the arm muscles contribute the most to the variation in the inward throw results. Meanwhile, the strength of the back muscles has a standardized coefficient of 0.418, which also shows a significant influence. On the other hand, leg muscle strength had a very low standardization coefficient, which was 0.018, which further strengthened the finding that leg muscles did not have a significant influence in the context of inward throwing.

Additionally, while these findings highlight the important role of upper body strength in improving inward throw performance, it's important to consider how overall physical condition and exercise programs can further optimize these outcomes. For example, combining exercises that improve core stability has the potential to increase back and arm strength, resulting in more

effective throws. A study in volleyball athletes showed that there is a strong correlation between muscle coordination and performance outcomes, suggesting that integrated strength training can yield great benefits across a variety of sports disciplines (Joni et al., 2024). Additionally, understanding the biomechanics of throwing techniques can provide insights into refining players' skills, ensuring that they use their muscular abilities effectively during the game. This holistic approach emphasizes not only isolated strength, but also synergy among different muscle groups to achieve the best athletic performance.

These findings provide benefits for football coaches and players. To improve the performance of the throw-in, the coach can focus on exercises to improve the strength of the arm and back muscles. Exercises such as push-ups, bench presses, and back exercises can be effective options to increase the strength of those muscles (Abu Talip et al., 2021). This combination of exercises not only builds muscle mass, but also improves endurance and overall body stability. Meanwhile, exercises for leg muscles may need to be directed to other, more relevant activities, such as running or kicking a ball.

Although leg muscle strength is insignificant in influencing throws, this does not mean that leg muscles are not important in the overall game of football. The leg muscles still play a crucial role in other activities such as sprinting, jumping, and kicking (Zabaloy et al., 2022). Therefore, the training program still needs to consider the balance between the strength of the legs, back, and arm muscles to optimize the player's overall performance.

This research also opens up opportunities for further study. For example, further research may explore other variables that might affect the outcome of an inward throw, such as throwing technique, body flexibility, or psychological factors. In addition, studies with larger and more diverse variables and samples can also be conducted to strengthen the generalization of these findings.

Overall, the results of this analysis showed that the strength of the back muscles and the arm muscles had a significant relationship with the outcome of throwing into the football, while the strength of the leg muscles did not exert a significant influence. These findings can serve as a reference for coaches and players in developing more efficient training programs to improve their throwing ability.

Conclusion

Based on the results of the study, it was found that (1) there was a significant relationship between the strength of the back muscles and the arm muscles with the result of throwing into a football (2) the strength of the leg muscles did not show a significant influence on the result of throwing in. Based on the results, the arm muscles have the highest standardization coefficient, which is 0.575. The strength of the back muscles has a standardized coefficient of 0.418, which also shows a significant influence. The strength of the leg muscles had a very low standardization coefficient, which was 0.018, which further strengthened the finding that the leg muscles did not have a significant influence in the context of an inward throw. While these findings highlight the important role of upper body strength in improving inward throw

performance, it's important to consider how overall physical condition and exercise programs can better optimize these outcomes.

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