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The contribution of leg muscle power and eye-foot coordination to the accuracy of futsal shooting of students

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The contribution of leg muscle power and eye-foot coordination to the accuracy of futsal shooting of students

Research Article

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Abstract.

Background Shooting accuracy is a fundamental skill in futsal, yet preliminary observations at State Junior High School 35 Pekanbaru showed that students still demonstrate low shooting performance, indicated by weak ball power, inaccurate ball direction, and poor foot–ball contact. These symptoms suggest inadequate leg muscle power and insufficient eye–foot coordination, which may inhibit students' ability to perform accurate shots.

Objectives This study aims to analyze the contribution of leg muscle power and eye–foot coordination to futsal shooting accuracy among students at State Junior High School 35 Pekanbaru.

Methods This research employed a multiple-correlation design involving 15 students selected through total sampling. Leg muscle power was measured using the standing broad jump test, eye–foot coordination was assessed with a coordination test, and shooting accuracy was evaluated through a futsal shooting test. Data were analyzed using simple and multiple correlation techniques.

Results The findings show that leg muscle power significantly contributes to shooting accuracy (r = 0.799; contribution = 63.84%). Eye–foot coordination also shows a significant contribution (r = 0.615; contribution = 37.82%). Simultaneously, both variables provide a substantial combined contribution to shooting accuracy (r = 0.800; contribution = 64%).

Conclusion In conclusion, leg muscle power and eye–foot coordination are decisive determinants of students' futsal shooting accuracy. The study contributes to educational practice by emphasizing the need for targeted physical and coordination training to support students' motor skills development, thereby enhancing their confidence, engagement, and overall well-being through sports participation.

Keywords: leg muscle power, eye-foot coordination, shooting accuracy, futsal.

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INTRODUCTION

Futsal continues to grow as an enjoyable and constructive sport for beginners, amateurs, and professional athletes (Sumantri et al., 2023). Its rapid development has made it increasingly popular among various age groups, including junior high school students. As the sport evolves, futsal offers not only entertainment but also opportunities to develop physical fitness, coordination, and fundamental motor skills. Mastery of basic technical skills is considered a key requirement for achieving success in futsal, as these abilities enable players to perform kicks that penetrate the opponent's defense and create goal-scoring opportunities (Suryadi, 2022; Suryadi et al., 2023).

Basic techniques serve as the foundation of movement skills that every athlete must master, requiring continuous and consistent practice (Rubiyatno et al., 2023). In futsal, almost all parts of the body are involved, but the legs play the most dominant role (Rozi et al., 2023). Players must master essential techniques such as kicking, dribbling, ball control, heading, tackling, and shooting, with shooting being a particularly important skill because it determines the likelihood of scoring goals. Given its complexity, shooting requires precise foot-to-ball contact to ensure that the ball travels accurately toward the target.

However, observations at State Junior High School 35 Pekanbaru show that students' futsal shooting skills remain low. During physical education classes, their shots often lack power, fail to reach the goal, and miss the target due to inaccurate foot placement and insufficient foot-to-ball coordination.

These limitations suggest underdeveloped eye-foot coordination and inadequate physical fitness, both of which are essential for executing accurate and powerful shots. This condition highlights the need for systematic training interventions tailored to improving students' motor abilities.

A substantial body of literature emphasizes the importance of leg muscle power and eye-foot coordination in determining shooting performance. Leg muscle power, defined as the combination of strength and speed executed simultaneously in a movement (Puncreobutr & Promputh, 2016), plays a crucial role in producing strong and fast shots that are difficult for goalkeepers to stop. Explosive power is essential to generate maximum force within a short period (Saryono et al., 2022), and it enables players to respond effectively to varying game situations (Ardiansyah, 2020; Rosita, 2019). Training leg muscle power helps players produce stronger and more controlled shots by enhancing the reactive force generated when pushing against the ground.

Likewise, eye-foot coordination is a complex biomotor ability involving synchronization between visual focus and lower-limb movement (Ngurah Adi Santika & Agung Cahya Prananta, 2022). Coordination integrates multiple systems, including nerves, muscles, joints, and perceptual processes, to ensure efficient and accurate movement (Syafi'i & Setiawan, 2019). In futsal, good eye-foot coordination significantly increases shot accuracy, while poor coordination leads to mistimed, weak, or off-target shots (Bezerra-Santos et al., 2023). Coaches must therefore emphasize coordination-specific training to enhance players' performance.

Although previous studies have examined leg muscle power and coordination separately, research assessing the combined contribution of these two variables to shooting accuracy among junior high school students remains limited. Most existing studies focus on adult or trained athletes, leaving a gap in understanding how these physical factors operate in younger populations who are still developing their motor abilities. This gap forms the novelty of the present study, which seeks to analyze the individual and simultaneous contributions of leg muscle power and eye-foot coordination to futsal shooting accuracy at State Junior High School 35 Pekanbaru.

Based on the theoretical framework and observed problems, this study proposes three hypotheses: (1) leg muscle power contributes to shooting accuracy in futsal; (2) eye-foot coordination contributes to shooting accuracy in futsal; and (3) both variables jointly contribute to shooting accuracy among students at SMPN 35 Pekanbaru. Addressing these hypotheses is expected to provide empirical evidence that supports the design of more effective physical education programs, ultimately enhancing students' motor competence, confidence, and overall well-being through constructive sports participation.

METHOD

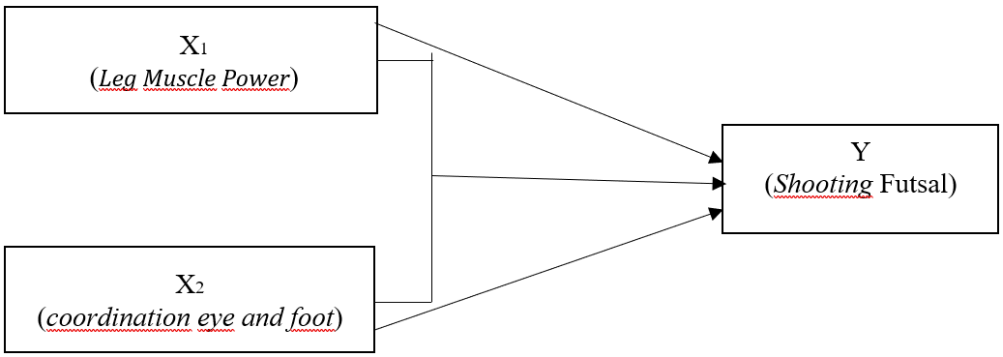
Participants

The population of this research consists of students of at State Junior High School 35 Pekanbaru, totaling 15 students. The sampling technique used was saturated sampling. According to Sugiyono, (2019), saturated sampling is when all members of the population are taken as samples. Based on this explanation, the sample in this study is the 15 students of at State Junior High School 35 Pekanbaru.

Research Design

This type of research was conducted using a correlational research design. Correlational research is a statistical tool that can be used to compare the measurement results of two different variables in order to determine the degree of relationship between these variables (Arikunto, 2009). In this study, eye-foot coordination is designated as variable "X", while futsal shooting ability is designated as variable "Y". The research design can be illustrated as follows Figure 1.

The research instrument was designed specifically for the purpose of this study and will not be used in other research. The uniqueness of each research object requires the researcher to design the instrument independently. The structure of the instrument for each study is not always the same as that of other studies, as each study has its own objectives and different mechanisms. The research instrument used in this study is as follows:



Description: **X1** : (Leg Muscle Power) **X2** : (Eye–Foot Coordination) **Y** : (Futsal Shooting Accuracy)

Figure 1. Research Design of Causal Relationship

The measurement of leg muscle power was conducted using the Standing Broad Jump test as described by Widiastuti (2017). This test aims to assess the explosive power of the lower limbs using a measuring tape to record the jumping distance and a flat, safe landing area with a clearly marked take-off line. The procedure begins with the subject standing behind the starting line with feet positioned shoulder-width apart. The jump is executed with a two-foot take-off and landing, supported by an arm swing and knee bend to maximize explosive force. The recorded score is the farthest distance achieved with a stable two-foot landing without falling backward. The test is performed three times, and the best score is taken as the final result. Distance is measured from the take-off line to the nearest point of landing at the back of the heels.

Figure 2. Tes Standing Broad Jump

The eye–foot coordination test follows the procedure developed by Winarno (2006). This test aims to measure the athlete's (testee's) visual–motor coordination. The required equipment includes chalk or tape for marking boundary lines, forms and writing tools, three circular paper targets with a diameter of 65 cm placed at a height of approximately 1.25 meters based on the testee's condition, and a three-meter boundary tape placed in front of the participant. The distance between the participant and the target is 2 meters. The procedure begins by attaching the targets to the wall and drawing a line 2 meters from the wall. The athlete stands behind the line and performs a sequence of movements using the selected foot: tossing the ball upward, kicking it toward the target, juggling the rebounding ball before it touches the ground, and finally catching it again. Before the actual test, the athlete is given the opportunity to practice. A trial is considered successful if the kicked ball hits the target, the rebounding ball is juggled, and then successfully caught. The athlete is not allowed to juggle or catch the ball in front of the boundary line. Each participant performs 10 repetitions with the right foot and 10 repetitions with the left foot.

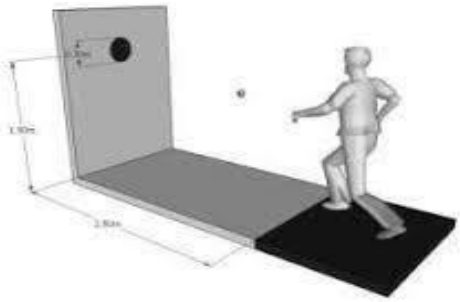


Figure 3. Eye–foot coordination test

The measurement of futsal shooting accuracy used the Bobby Charlton Shooting Test as described by Facthan (2017). In this test, the goal area is divided into six scoring zones. The upper corners are assigned 40 points each, the lower corners 50 points each, the upper middle section 20 points, and the lower middle section 10 points. Each player is given four attempts to shoot the ball toward the goal. The shooting distance is adjusted according to the player's ability but may not be closer than the penalty spot. Moreover, each player is allotted 15 seconds to complete all four shots. The final score is determined by the total points accumulated from all attempts based on the zones successfully hit.

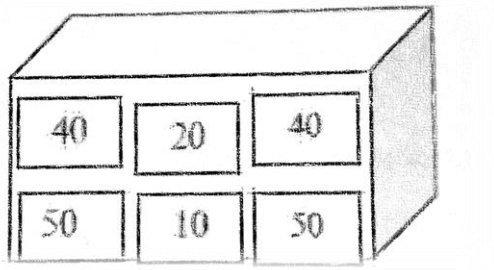


Figure 4. Shooting Test (Facthan, 2017)

Data Analysis

The correlation analysis technique used is the Product Moment Correlation as stated by Sugiyono (2010:222), as follows:

$$R_{y.x_1x_2} = \sqrt{\frac{r^2_{yx_1} + r^2_{yx_2} - 2r_{yx_1}\, r_{yx_2} r_{x_1x_2}}{1 - r^2_{x_1x_2}}}$$

Explanation

1. Ry·x1x2 = multiple correlation coefficient between variable Y and variables X1 and X2
2. rx1yr_{x_1 y}rx1y = correlation coefficient between X1 and Y
3. rx2yr_{x_2 y}rx2y = correlation coefficient between X2 and Y
4. rx1x2r_{x_1 x_2}rx1x2 = correlation coefficient between X1 and X2

Meanwhile, to provide an interpretation of the strength of the relationship, the researcher refers to Sugiyono (2010) as follows Table 1.

Table 1. Interpretation of the Strength of the Relationship

Value	Category
Less than 0.00–0.199	Very Low
Between 0.20–0.399	Low
Between 0.40–0.599	Moderate
Between 0.60–0.799	Strong
Between 0.80–1.000	Very Strong

To determine the contribution of leg muscle power and eye–foot coordination to futsal shooting accuracy at at State Junior High School 35 Pekanbaru, the coefficient of determination is calculated using the following formula.

RESULTS AND DISCUSSION

Results

This research discusses the contribution of leg muscle power and eye–foot coordination to the futsal shooting performance of students at State Junior High School 35 Pekanbaru. The variables in this study are: leg muscle power, denoted as X1, and eye–foot coordination, denoted as X2, as the independent variables; while the futsal shooting performance of the students at State Junior High School 35 Pekanbaru, denoted as Y, serves as the dependent variable. The results of the data obtained after conducting the research can be seen in the following description.

Based on the results of the leg muscle power test (X_1) using the standing broad jump on students of State Junior High School 35 Pekanbaru, the minimum score obtained was 126 and the maximum score was 175, with a mean value of 154.93, indicating that, in general, the students' leg muscle power ability falls within the good category. The median score of 155 suggests that half of the students achieved scores

above this number, while the mode score of 164 represents the most frequently occurring value. Meanwhile, the standard deviation (STDV) of 13.82 indicates a moderately wide variation between the lowest and highest scores within the sample group of 15 students.

Furthermore, based on the frequency distribution of the leg muscle power test results of State Junior High School 35 Pekanbaru students, it can be seen that most students fall into the two highest interval groups, namely 145.60–155.39 and 165.20–175.00, each with a relative frequency of 26.67%. A total of 20.00% of students are in the intervals 135.80–145.59 and 155.40–165.19, while only 6.67% of students scored in the lowest interval, 126.00–135.79. This distribution indicates that the majority of students have leg muscle power ability within the upper–middle category, with score concentrations clustering around and above the mean value. For further details, see the following Table 2.

Table 2. Frequency Distribution of Leg Muscle Power Test Results

No	Interval			Absolute Frequency	Relative Frequency
1	126,00	-	135,79	1	6,67%
2	135,80	-	145,59	3	20,00%
3	145,60	-	155,39	4	26,67%
4	155,40	-	165,19	3	20,00%
5	165,20	-	175,00	4	26,67%
Total				15	100%

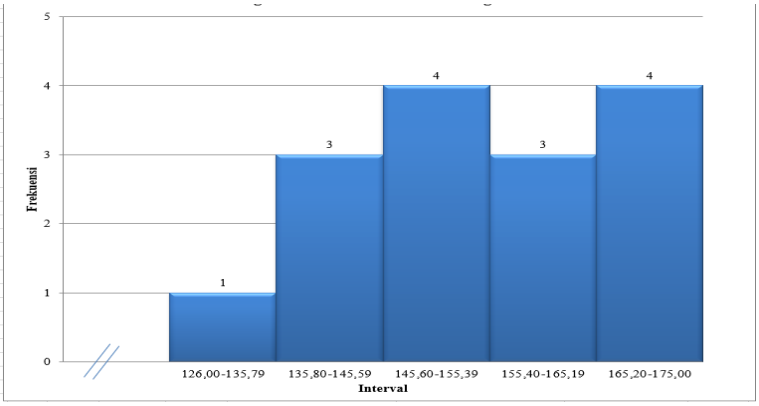


Figure 5. Histogram of Leg Muscle Power (X1)

Based on the results of the eye–foot coordination test (X_2) of State Junior High School 35 Pekanbaru students, the minimum score obtained was 1 and the maximum score was 5, with a mean value of 3.93, indicating that, in general, the students' eye–foot coordination falls within the good category. The median score of 4.00 signifies that half of the students scored equal to or above this value, while the mode of 5.00 shows that the most frequently occurring score was the highest value. The standard deviation (STDV) of 1.22 indicates a relatively low to moderate variation among the 15 students who were included in the research sample.

Based on the frequency distribution of the eye–foot coordination test results of State Junior High School 35 Pekanbaru students, it is shown that the majority of students achieved the highest score, 5, with a relative frequency of 40.00% or a total of 6 students. Furthermore, 5 students (33.33%) scored 4, while 2 students (13.33%) scored 3. Only 1 student (6.67%) obtained a score of 2, and another 1 student (6.67%) achieved a score of 1. This distribution demonstrates that most students have good to very good levels of eye–foot coordination, with the highest concentration of scores at the maximum value. For more details, see the following Table 3:

Table 3. Frequency Distribution of Eye–Foot Coordination (X2)

No	Interval	Absolute Frequency	Relative Frequency
1	1	1	6,67%
2	2	1	6,67%
3	3	2	13,33%
4	4	5	33,33%
5	5	6	40,00%
Total		15	100%

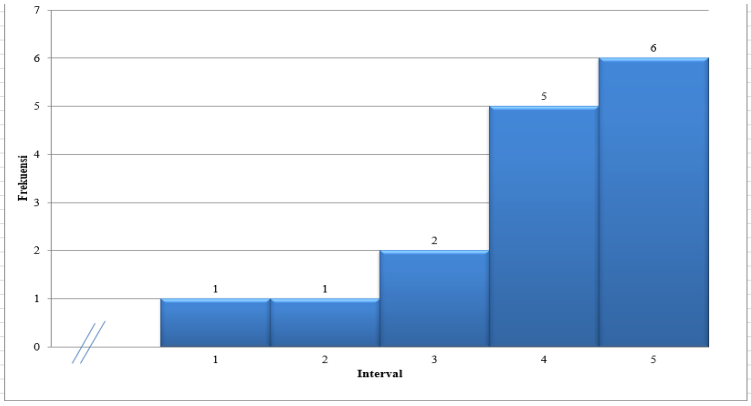


Figure 6. Histogram of Eye-Foot Coordination

Based on the futsal shooting test results (Y) of State Junior High School 35 Pekanbaru students, the maximum score obtained was 200 and the minimum score was 70, with an average (mean) score of 128.00, indicating that in general the students' shooting ability falls into the fairly good category. The median score of 120 shows that half of the students scored at or above this value, while the mode of 100 indicates the score that appeared most frequently. The standard deviation (STDEV) of 36.88 shows a relatively large variation among the scores obtained from the 15 student samples.

Based on the frequency distribution of the futsal shooting test results of State Junior High School 35 Pekanbaru students, it can be seen that most students fell within the interval of 96.00–121.99, with a relative frequency of 40.00% or 6 students. Meanwhile, in the interval of 148.00–173.99 there were 3 students (20.00%), and 2 students each (13.33%) were in the intervals of 70.00–95.99, 122.00–147.99, and 174.00–200.00. This distribution indicates that the majority of students' shooting ability tends to fall within the moderate category, with a small proportion of students demonstrating either low or very high ability. For more details, see the following Table 4:

Table 4. Frequency Distribution of Futsal Shooting Results

No	Interval			Absolute Frequency	Relative Frequency
1	70,00	-	95,99	2	13,33%
2	96,00	-	121,99	6	40,00%
3	122,00	-	147,99	2	13,33%
4	148,00	-	173,99	3	20,00%
5	174,00	-	200,00	2	13,33%
Total				15	100%

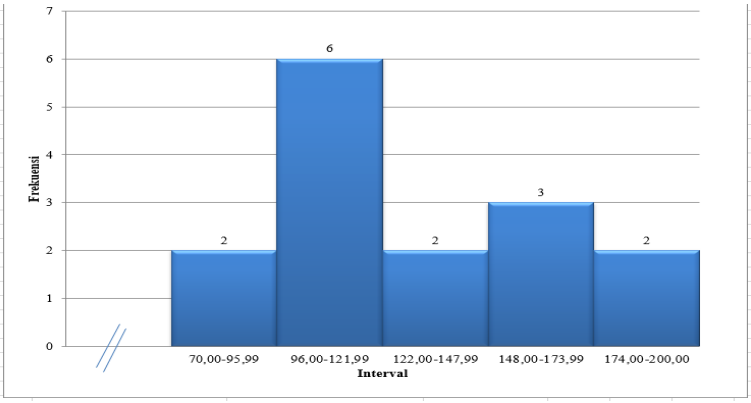


Figure 7. Histogram of the Distribution of Futsal Shooting Results

Table 5. Correlation Test Results

No	Variable	r (Calculated)	r (Table, 5%)	Significance	Contribution(%)
1	Leg Muscle Power (X_1) → Shooting Accuracy (Y)	0.799	0.514	Significant	63.84%
2	Eye–Foot Coordination (X_2) → Shooting Accuracy (Y)	0.615	0.514	Significant	37.82%

3	$X_1 + X_2$ (Simultaneously) → Shooting Accuracy (Y)	0.800	0.514	Significant	64%

Discussion

The findings of this study show that leg muscle power has a significant contribution to futsal shooting accuracy, indicated by the correlation value of $r_{(}$calculated$_{)}$ = 0.799 which exceeds $r_{(}$table$_{)}$ = 0.514 at the 5% significance level. This suggests that the greater the explosive power of a student's leg muscles, the higher their shooting accuracy tends to be. Explosive leg strength enables players to generate sufficient force while maintaining control during ball contact, allowing the ball to be directed with precision. This aligns with prior studies which emphasize that leg muscle power is a key determinant of kicking performance in football and futsal (Alpyan, 2020; Burhaein et al., 2020; Setiawan & Jatra, 2025). Leg muscle power plays a critical role in producing both speed and accuracy during shooting actions. In futsal, shooting requires rapid force production, enabling the ball to be propelled at high velocity while maintaining directional control. This supports the theory that explosive power significantly enhances shot quality by optimizing force transmission at the moment of impact (Handoko & Bagaskoro, 2021). The contribution rate of 63.84% indicates that more than half of the variation in shooting accuracy is explained by differences in leg muscle power (Setiawan & Jatra, 2025).

This finding implies that training programs emphasizing explosive leg movements—such as plyometric drills, squat jumps, and resisted sprints—may significantly enhance shooting performance among students (Abdullah & Abdullah, 2025; Suniga et al., 2025). Similar research confirms that athletes with strong lower-limb explosiveness not only generate higher ball speed but also maintain balance and body stability, which directly supports shooting accuracy (Haniyyah et al., 2025; Yogi et al., 2023). Therefore, leg muscle power serves as a foundational physical component that should be prioritized in futsal training (Ardiansyah, 2020; Rosita et al., 2019). However, this study also acknowledges that leg power alone does not fully determine shooting performance; other variables such as coordination, movement technique, and perceptual decision-making also contribute significantly.

The results reveal that eye–foot coordination has a significant contribution to shooting accuracy, with a correlation of $r_{(}$calculated$_{)}$ = 0.615 > $r_{(}$table$_{)}$ = 0.514, contributing 37.82% to shooting performance. Eye–foot coordination is essential because shooting involves synchronizing visual perception with precise foot movement. Good coordination allows players to determine the optimal contact point on the ball, regulate kicking force, and control ball direction. This aligns with motor control theories which state that coordination is a fundamental determinant of complex sport skills (Schmidt & Lee, 2019).

Although the contribution is substantial, its magnitude (37.82%) indicates that coordination alone cannot produce optimal shot outcomes without adequate leg power or correct basic technique. This is consistent with findings from previous research showing that coordination interacts with strength, technique, and perceptual skills to influence performance in kicking sports (Amrullah et al., 2020). In futsal, eye–foot coordination also influences ball control, body alignment, and accuracy during high-speed situations (Rosita, 2019; Rosita et al., 2019). Thus, coaches should include coordination-focused training such as target-based passing drills, juggling variations, and accuracy shooting exercises. Enhancing visual-motor synchronization helps students improve control over ball trajectory and develop more efficient shooting mechanics.

The simultaneous analysis demonstrates that leg muscle power and eye–foot coordination jointly contribute significantly to shooting accuracy, evidenced by a multiple correlation of r = 0.800 with a contribution of 64%. This means that nearly two-thirds of the variation in shooting performance can be explained by the combined influence of these two variables. The remaining 36% is attributed to factors such as shooting technique, concentration, tactical awareness, playing experience, and psychological readiness. These findings affirm that shooting in futsal is a multidimensional skill involving both physical and coordinative components. Prior research also highlights that successful shooting performance emerges from the interaction between strength, coordination, and biomechanical efficiency (Fahad & Mohammed, 2024; García-Angulo & García-Angulo, 2018). Strength without coordination results in powerful but inaccurate shots; conversely, coordination without adequate strength leads to accurate but weak shots. Thus, integrating both elements is essential for effective shooting (Doewes et al., 2022; Naser et al., 2017).

The implications of these findings are substantial for training design. Coaches should incorporate integrated training strategies that simultaneously develop power and coordination, such as high-speed

shooting drills targeting specific zones of the goal. Progressive training—starting from low-intensity accuracy drills to high-intensity power shots—helps students develop the necessary physical and perceptual skills efficiently while minimizing injury risk. Regular assessments of both leg muscle power and coordination should also be conducted to monitor progress and individualize training loads. These results are particularly relevant for physical education settings and youth athlete development programs, where foundational physical abilities act as the basis for long-term sport skill acquisition.

Limitations

Despite producing valuable insights, this study has several limitations. First, the sample size was relatively small (15 students), which may limit the generalizability of the findings. Larger and more diverse samples across different schools or age groups would strengthen external validity. Second, the study employed a correlational design, meaning causality cannot be fully established; experimental or longitudinal designs would provide stronger evidence regarding training effects. Third, only two predictor variables—leg muscle power and eye–foot coordination—were examined, whereas shooting accuracy is influenced by many other factors such as biomechanical technique, decision-making, psychological readiness, and game situation variables (e.g., pressure, defender proximity). Lastly, the testing environment occurred under controlled conditions, which may differ from real match situations where fatigue, speed of play, or tactical constraints influence shooting performance.

CONCLUSION

The findings of this study demonstrate that leg muscle explosive power plays a significant role in determining futsal shooting accuracy among students of State Junior High School 35 Pekanbaru. The strong correlation coefficient (r = 0.799) and a contribution of 63.84% indicate that higher levels of leg explosive power are directly associated with improved shooting precision. This result reinforces the notion that the strength and speed of muscular contraction in the lower limbs serve as key determinants in generating powerful, stable, and well-directed shots. In addition, eye–foot coordination also shows a significant contribution to shooting accuracy, as evidenced by a correlation coefficient of r = 0.615 and a contribution of 37.82%. These findings highlight the importance of integrating visual perception with motor execution in controlling the point of contact, shot direction, and overall consistency. Students with better coordination are more capable of maintaining movement stability, enabling them to perform shots with greater accuracy. Collectively, leg muscle explosive power and eye–foot coordination contribute 64% to the variance in futsal shooting accuracy. This indicates that shooting performance is determined not only by physical capacity but also by coordinated motor skills that support precision and control. Therefore, the combination of lower-limb explosiveness and visual–motor coordination can be considered dominant factors influencing students' shooting performance. These empirical results provide an important foundation for designing more integrated training programs that emphasize both explosive strength development and coordination enhancement in school-based futsal learning. Future research is recommended to include additional variables such as psychological factors, game-sense abilities, technical mastery, and movement biomechanics to provide a more comprehensive understanding of factors influencing futsal shooting accuracy. Expanding the sample size, utilizing advanced measurement tools, and applying longitudinal designs may further enhance the validity and generalizability of subsequent studies.

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AUTHOR CONTRIBUTION STATEMENT

AJ contributed to the conception, design, data collection, analysis, and drafting of the manuscript. RJ and PJR supervised the research process, provided methodological guidance, validated the data analysis, and reviewed the final manuscript. Both authors approved the final version of the article.

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