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Research Article

The influence of lower-body explosive power, speed, and eye-foot coordination on long jump performance: A path analysis study

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ABSTRACT
Background: Long jump performance is influenced by various physical and coordinative components, particularly lower-body explosive power, running speed, and eye-foot coordination. However, limited studies have simultaneously examined the predictive relationships among these variables using a path analysis model among university students in physical education programs. Objective: This study aimed to analyze the direct and indirect predictive relationships among lower-body explosive power, speed, eye-foot coordination, and long jump performance. Methods: This study employed a quantitative, cross-sectional, correlational design with path analysis. The sample consisted of 30 students selected using a total sampling technique. Data were collected using standardized physical performance tests, including the wall pass test for eye-foot coordination, the vertical jump test for lower-body explosive power, the 100-meter sprint test for speed, and the squat-style long jump test for long jump performance. Data analysis was conducted using IBM SPSS Statistics version 26, including normality and linearity testing and path analysis. Result: The findings revealed that eye-foot coordination had a significant direct relationship with speed ($p < 0.001$), while lower-body explosive power demonstrated the strongest significant direct relationship with long jump performance ($\beta = 0.593$; $p < 0.001$). Eye-foot coordination also showed a significant direct relationship with lower-body explosive power ($\beta = 0.397$; $p = 0.030$). However, speed did not significantly predict long jump performance directly ($\beta = 0.014$; $p = 0.936$). The coefficient of determination ($R^2 = 0.537$) indicated that eye-foot coordination, lower-body explosive power, and speed collectively explained 53.7% of the variance in long jump performance. Conclusion: In conclusion, lower-body explosive power emerged as the strongest predictor associated with long jump performance, while eye-foot coordination contributed both directly and indirectly through speed and explosive power. These findings suggest that long jump training programs should prioritize the development of explosive lower-body power and coordination to improve athletic performance.

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Eye-foot coordination; long jump performance; lower-body explosive power; path analysis; speed.

Introduction

Sports serve a variety of purposes, including entertainment and maintaining physical health and fitness, whether played individually or on a team (Pramono et al., 2025; Santos-Pastor et al., 2022; Shur et al., 2021). Participating in sports has significant health benefits, strengthening the body and improving overall health and well-being. The long jump is a movement in which one jumps forward and upward to keep one's center of gravity in the air for as long as possible, achieved by quickly pushing off (Aloui et al., 2021; Shuai et al., 2025; Sortwell et al., 2024). This athletic ability is influenced by various factors, including leg explosive power and running speed (Bai et al., 2024; Paturusi, 2023). It is crucial to assess these physical qualities in junior high school students to identify and nurture young athletes with the potential to excel in long jump competitions (Baker et al., 2025; Severin et al., 2025).

The coordination of eye and foot movements, as well as leg muscle power and speed, significantly impacts long jump performance. Research indicates that effective lower-body explosive power and precise coordination are critical for maximizing takeoff velocity and overall jump distance (Deng et al., 2025; Tai et al., 2026). The following sections elaborate on these key aspects. Several factors can influence the speed and explosive power of the lower-body explosive power. A person's speed may be affected by gender, physical training, body weight, distance traveled, and athletic experience. Therefore, if an individual has proportional body weight and adequate training and experience, their speed will be optimal.

Additionally, training methods influence the strength of lower-body explosive power (Chen et al., 2024; Fossmo & Van Den Tillaar, 2022; Schoenfeld et al., 2021). In other words, athletes who use effective training methods tend to have strong lower-body explosive power. Therefore, coaches and athletes need to consider these factors to achieve optimal results. In recent years, previous researchers have investigated the influence, relationship, and contribution of leg muscle speed and power to success in sports, particularly the long jump (Lai et al., 2026; Octaviani & Nurrochmah, 2025; Pietraszewski et al., 2025). One study analyzed the relationship between running speed and lower-body explosive power in squat-style long jump results using a correlational survey (Lin et al., 2023). The instruments used included a 30-meter running speed test, a standing broad jump test to measure lower-body explosive power, and a squat-style long jump test. The data from these tests were analyzed using correlation techniques. Of the 30 students who participated, the analysis indicated a significant correlation among running speed, lower-body explosive power, and squat-style long-jump results.

Based on the author's observations, the long jump test was poorly performed. This was evident from the distance of the students' jumps, which were close to the takeoff board. Additionally, some students did not perform the test correctly. For example, some students did not step on the takeoff board at takeoff, and some did not align their feet at landing. The students' suboptimal takeoff speed probably caused this. Additionally, the students' motor coordination was suboptimal. This was evident in their difficulty balancing their speed and placing their feet with a fast and precise rhythm on the takeoff board.

The long jump is an athletics event. This study provides knowledge, skills, and values related to the long jump. Through the study of the long jump, athletes are expected to gain more knowledge, skills, and attitudes that will help them improve and achieve more in the future. The goal of the long jump is to achieve the longest possible distance. As its name suggests, it involves jumping. It is done by jumping. This is done by using one foot on the jump board.

Leg muscle power is a primary factor in long jump success (Candra et al., 2025). Studies show that exercises such as single-leg depth jumps can significantly enhance leg muscle power and improve long jump ability (Saleh et al., 2024). The vastus lateralis (VAS), soleus (SOL), and gluteus maximus (GMAX) are crucial muscles that contribute to vertical velocity during takeoff. VAS alone accounts for 33% of the increase in vertical center of mass velocity (Yang et al., 2023). Maximizing jump performance requires coordination between leg muscles. Research shows that effective jump execution requires intermuscular coordination, particularly among key muscle groups (Rong et al., 2025; Wang et al., 2024). The relationship between kinematic parameters, such as takeoff angle and speed, highlights the importance of coordination for achieving optimal jump distances. Running speed prior to takeoff is closely linked to jump performance. Higher initial speeds are associated with better outcomes, highlighting the importance of developing sprinting capabilities alongside leg strength (Donaldson et al., 2025; Van Hooren et al., 2024). Although focusing on leg power and coordination is important, it is also crucial to consider that factors such as technique and psychological readiness can influence long jump performance. Since these elements can vary among athletes, a multifaceted training approach is necessary for optimal results.

Previous studies have demonstrated that lower-body explosive power, running speed, and coordination contribute to long jump performance. Sistiasih et al. (2024) examined the relationship between running speed and lower-body explosive power using correlational analysis and found significant associations with long-jump performance. Similarly, Purba et al. (2024) reported that speed and explosive leg power jointly influenced jump performance among athletes. Other studies mainly focused on biomechanical or training interventions, such as plyometric exercises and takeoff mechanics, to improve jump distance (Huang et al., 2024; Ramirez-Campillo et al., 2022). However, most previous studies analyzed these variables separately or only investigated simple relationships between two variables. Limited research has examined the simultaneous direct and indirect effects of lower-body explosive power, speed, and eye-foot coordination within a comprehensive causal framework. In addition, studies involving university students in physical education programs remain scarce, particularly in the Indonesian higher education context. Therefore, this study addresses the existing research gap by employing path analysis to investigate the complex interactions among lower-body explosive power, speed, and eye-foot coordination in predicting long jump performance. The novelty of this study lies in the development of an evidence-based predictive model that simultaneously explains both direct and indirect relationships among physical and coordinative variables, providing a more comprehensive understanding of long jump performance among PJKR UPMI students.

This study aimed to determine and analyze the direct and indirect effects of lower-body explosive power, speed, and eye-foot coordination on long jump performance among students of the Physical Education, Health, and Recreation Program at Universitas Pembinaan Masyarakat Indonesia (UPMI). In addition, this study contributes to the development of sports science by providing an evidence-based causal model that explains the simultaneous relationships among physical and coordinative factors influencing long jump performance. The findings are expected to enrich the theoretical understanding of athletic performance and serve as a reference for developing more effective training programs in physical education and sports coaching.

Method

Research Design

This study employed a quantitative approach with a verification research design. The quantitative approach was used to test hypotheses by analyzing numerical data with statistical techniques. Verification research aims to determine causal relationships (cause-and-effect) among variables through hypothesis testing formulated in advance.

The research design used in this study is a correlational predictive design, which aims to analyze both direct and indirect effects of independent variables on the dependent variable. The analytical model used is path analysis, an extension of multiple linear regression that examines more complex causal relationships among variables.

Participants

The study population consisted of 30 students from the Physical Education, Health, and Recreation (PJKR) Program at Universitas Pembinaan Masyarakat Indonesia (UPMI). Since the total population was relatively small, all members were included as research participants using a total sampling (saturated sampling) technique. This approach ensured that all students were represented equally in the study and minimized sampling bias. The sample size was considered adequate for path analysis involving four observed variables in this study.

Ethical Approval Statement

Ethical approval for the study was granted by the Research Ethics Committee of Universitas Pembinaan Masyarakat Indonesia (UPMI). Participation was voluntary, and participants were informed of their right to withdraw at any time without penalty.

Procedures

The instruments used in this study were standardized physical performance tests commonly applied in sports science research and have demonstrated acceptable validity and reliability in previous studies. Prior to data collection, all participants were informed about the objectives, procedures, benefits, and potential risks of the study. Written informed consent was obtained from all participants, and participation was voluntary. Participant confidentiality and anonymity were maintained throughout the study. Ethical approval for this research was granted by the institutional research ethics committee of Universitas Pembinaan Masyarakat Indonesia (UPMI).

Data collection was conducted on the university sports field under standardized outdoor testing conditions. Before performing the tests, all participants completed a 10–15-minute warm-up session consisting of stretching and light running exercises to minimize the risk of injury and ensure physical readiness.

The testing procedures were carried out sequentially. First, participants completed the wall pass test to assess eye-foot coordination by kicking and receiving the ball against a wall within a specified time limit; the total number of successful repetitions was recorded. Second, lower-body explosive power was measured using the vertical jump test. Each participant performed three jump attempts, and the highest score was recorded in centimeters. Third, running speed was assessed using a 100-meter sprint test: participants performed one maximal sprint, and completion time was recorded in seconds with a stopwatch. Finally, long jump performance was measured using the squat-style long jump test. Participants were given three attempts, and the farthest jump distance was recorded in meters. After all data were collected, the results were tabulated and analyzed using SPSS software. Data analysis included prerequisite tests for normality and linearity, followed by path analysis to examine the direct and indirect relationships among the research variables.

Research Instruments

The instruments used in this study were standardized physical performance tests commonly used in sports science research and have demonstrated acceptable validity and reliability. The wall pass test was adopted from Pasaribu (2020) to measure eye-foot coordination. Previous studies reported validity and reliability coefficients of 0.72 and 0.81, respectively. The vertical jump test was used to measure lower-body explosive power and was adapted from Pasaribu (2020). The instrument has demonstrated validity (0.78) and reliability (0.93). The 100-meter sprint test was used to assess running speed and referred to Pasaribu (2020). Previous reports indicated validity and reliability coefficients of 0.84 and 0.91, respectively. Long jump performance was measured using the squat-style long jump test adapted from Pasaribu (2020). The instrument showed validity and reliability coefficients of 0.79 and 0.88, respectively.

Data Analysis

Data were analyzed using IBM SPSS Statistics version 26. Descriptive statistics were first used to summarize the research data. Prior to hypothesis testing, prerequisite analyses, including normality and linearity tests, were conducted to ensure that the data met the assumptions for parametric analysis. The Kolmogorov–Smirnov test was used to assess data normality, while linearity testing was performed to examine linear relationships among variables.

Furthermore, path analysis was employed to examine the direct and indirect effects among lower-body explosive power, speed, eye-foot coordination, and long jump performance. The coefficient of determination (R^2) was also calculated to determine the proportion of variance in long jump performance explained by the predictor variables. All statistical analyses were conducted using a significance level of 0.05.

Results and Discussion

Results

The results of this study were primarily tested using normal testing. Data health is key and must be addressed before regression. Normality tests determine if the data is normally distributed. This test uses the Kolmogorov-Smirnov test.

Table 1. Normality Test Result

Variable	Kolmogorov–Smirnov Z	Sig. (2-tailed)	Interpretation
Unstandardized Residual	0.685	0.736	Normally Distributed

As shown in Table 1, the normality test indicated that the residual data were normally distributed, as evidenced by the Kolmogorov–Smirnov significance value of 0.736, which was higher than the 0.05 threshold. This result confirms that the normality assumption for the path analysis model was fulfilled.

Table 2. Linearity Test Results

Variable Relationship	F Linearity	Sig. Linearity	Sig. Deviation from Linearity	Interpretation
Eye-foot coordination and long jump performance	13.773	0.001	0.438	Linear
Lower-body explosive power and long jump performance	31.178	0.000	0.534	Linear
Speed and long jump performance	11.109	0.003	0.463	Linear

As shown in Table 2, all variables demonstrated significant linear relationships with long jump performance, as indicated by significant linearity values ($p < 0.05$) and non-significant deviation from linearity ($p > 0.05$). Among the tested variables, lower-body explosive power showed the strongest linear association ($F = 31.178$; $p < 0.001$), suggesting a greater contribution to long jump performance than eye-foot coordination and speed.

As shown in Table 3, lower-body explosive power emerged as the strongest predictor of long jump performance ($\beta = 0.593$, $p < 0.001$), highlighting its major contribution to jumping ability. Eye-foot coordination also showed significant effects on speed ($\beta = 0.593$, $p < 0.001$) and lower-body explosive power ($\beta = 0.397$, $p = 0.030$). However, speed did not significantly influence long jump performance directly ($\beta = 0.014$, $p = 0.936$), indicating that explosive power may play a more dominant role than running speed in determining performance outcomes.

Table 3. Direct Effect Analysis of the Path Model

Path Relationship	Standardized Beta (*β*)	t-value	p-value	Interpretation
Eye-foot coordination → Speed	0.593	4.287	< 0.001	Significant
Eye-foot coordination → Lower-body explosive power	0.397	2.286	0.030	Significant
Lower-body explosive power → Speed	0.256	1.794	0.084	Not Significant
Lower-body explosive power → Long jump performance	0.593	4.918	< 0.001	Significant
Speed → Long jump performance	0.014	0.081	0.936	Not Significant
Eye-foot coordination → Long jump performance	0.327	1.965	0.060	Not Significant

As shown in Table 4, lower-body explosive power showed the largest total effect on long jump performance (0.597), confirming its dominant contribution to performance outcomes. Eye-foot coordination also demonstrated a relatively strong total effect (0.486), mainly through its indirect influence via lower-body explosive power (0.151), rather than through speed (0.008). These findings suggest that explosive power acts as the primary mediating factor linking coordination ability to long jump performance.

Table 4. Indirect Effect and Total Effect Analysis

Path Relationship	Indirect Effect	Total Effect
Eye-foot coordination → Long jump performance	0.159	0.486
Lower-body explosive power → Long jump performance	0.004	0.597
Eye-foot coordination → Speed → Long jump performance	0.008	0.008
Eye-foot coordination → Lower-body explosive power → Long jump performance	0.151	0.151

Hypothesis testing was conducted using path analysis to examine the predictive relationships among eye-foot coordination, lower-body explosive power, speed, and long jump performance. The results demonstrated that eye-foot coordination had a significant direct relationship with speed ($\beta = 0.593$; $p < 0.001$) and lower-body explosive power ($\beta = 0.397$; $p = 0.030$). Lower-body explosive power also showed a significant direct relationship with long jump performance ($\beta = 0.593$; $p < 0.001$). However, lower-body explosive power did not significantly predict speed ($\beta = 0.256$; $p = 0.084$). Similarly, speed did not significantly predict long jump performance ($\beta = 0.014$; $p = 0.936$). Eye-foot coordination also did not demonstrate a statistically significant direct relationship with long jump performance ($\beta = 0.327$; $p = 0.060$). The indirect effect analysis indicated that eye-foot coordination contributed indirectly to long jump performance through lower-body explosive power and speed. Among all predictor variables, lower-body explosive power was the strongest predictor of long jump performance. The coefficient of determination ($R^2 = 0.537$) indicated that the predictor variables collectively explained 53.7% of the variance in long jump performance.

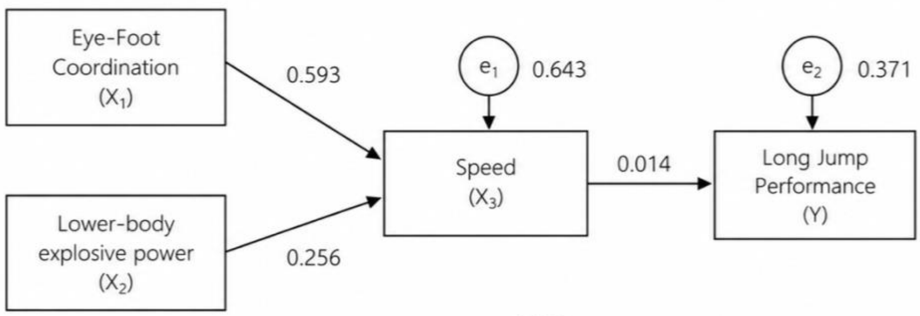

Figure 1. Structural Model of the Direct Effects of Eye-Foot Coordination and Lower-body explosive power on Speed and Long Jump Performance

Figure 1 illustrates an initial structural model depicting the direct relationship between eye-foot coordination, lower-body explosive power, speed, and long jump performance. This model indicates that eye-foot coordination has a significant direct effect on speed ($\beta=0.593$; $p<0.001$) and lower-body explosive power ($\beta=0.397$; $p=0.030$). Furthermore, lower-body explosive power was identified as the strongest direct predictor of long jump performance ($\beta=0.593$; $p<0.001$). However, path analysis results within this model also indicated that speed did not have a significant direct effect on long jump performance ($\beta=0.014$; $p=0.936$)

Table 5. Coefficient of Determination (R Square)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.733	0.537	0.502	1.786

As shown in Table 5, the coefficient of determination ($R^2 = 0.537$) indicates that 53.7% of the variance in long jump performance can be explained by the variables included in the model.

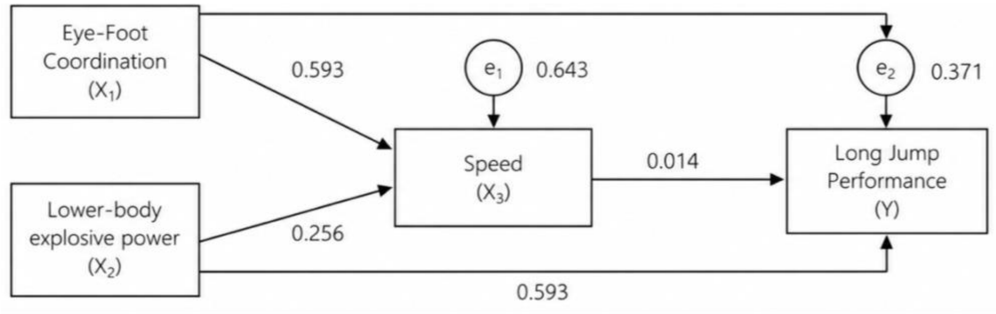

Figure 2. Path Analysis Model Showing Direct and Indirect Effects among Eye-Foot Coordination, Lower-body explosive power, Speed, and Long Jump Performance

Figure 2 presents the final path analysis model, which illustrates the predictive relationships—both direct and indirect—between eye-foot coordination, lower-body explosive power, speed, and long jump performance. This model indicates that lower-body explosive power has the strongest direct influence on long jump performance ($\beta = 0.593$; $p < 0.001$). Meanwhile, eye-foot coordination makes a significant indirect contribution to long jump performance, primarily through lower-body explosive power (indirect effect = 0.151). In contrast, the contribution via speed was found to be statistically insignificant.

Discussion

The findings of this study demonstrated that lower-body explosive power was the strongest predictor of long jump performance among PJKR UPMI students. Eye-foot coordination showed significant direct relationships with speed and lower-body explosive power, indicating its important role in supporting movement efficiency and physical performance. However, speed did not directly predict long jump performance. In addition, eye-foot coordination did not demonstrate a statistically significant direct effect on long jump performance, although it contributed indirectly through lower-body explosive power and speed. These findings suggest that explosive muscular power plays a more dominant role than speed alone in determining long jump outcomes among university students.

Although eye-foot coordination did not show a statistically significant direct effect on long jump performance in this study ($\beta = 0.327$; $p = 0.060$), coordination remains theoretically important in supporting effective jumping mechanics. The influence of eye coordination on long jump performance is associated with visual regulation and peripheral vision. Studies show that effective visual coordination can increase jump distance by enabling athletes to optimize their approach and takeoff mechanics. Restricting peripheral vision may decrease jump performance (Guo et al., 2026), while maintaining posture and stability is crucial for effective jumping mechanics, with peripheral vision playing an important role in this process (Guzmán-Muñoz et al., 2026). Long jumpers use visual cues to adjust their stride patterns as they approach the takeoff board. Eye-foot coordination may therefore indirectly contribute to long jump performance by influencing lower-body explosive power and movement efficiency during the approach and takeoff phases. Athletes with better coordination are generally more capable of regulating stride rhythm, maintaining body balance, and optimizing foot placement before takeoff. Therefore, coordination should still be considered an important component in long jump training, particularly when integrated with explosive power development.

Long jumpers use visual cues to adjust their stride patterns as they approach the takeoff board. Increased visual regulation correlates positively with jump distance because it enables optimal foot placement and velocity management (Bradshaw & Aisbett, 2006). Athletes who can effectively regulate their stride visually can make necessary adjustments without sacrificing speed. This is vital for maximizing jump distance (Torralba et al., 2017). Training methods that enhance visual coordination, such as incorporating visual targets during run-throughs, can improve athletes' performance by simulating the visual demands of competitive jumping (Dingirdan Gultekinler et al., 2025; Grosso et al., 2024). Conversely, although eye-foot coordination is important, some athletes rely on muscle memory and physical conditioning to compensate for visual impairments. This suggests that training can focus on the physical aspects of jumping performance.

The impact of lower-body explosive power on long jump performance is substantial, as demonstrated by studies showing a correlation between explosive leg strength and jump performance. Research indicates that increased lower-body explosive power directly enhances long jump performance, underscoring the importance of targeted training (Nakai et al., 2024; Octaviani & Nurrochmah, 2025; Sarfabadi et al., 2023). Another study found that exercises such as single-leg depth jumps significantly improved lower-body explosive power and long jump performance in female athletes, demonstrating the effectiveness of targeted training regimens (Zhao et al., 2025). The combination of speed and explosive lower-body explosive power significantly influences long jump performance, with high correlation coefficients indicating that both factors are crucial for optimal performance (Mamajonov et al., 2026). Additionally, a study involving junior high school students found that both lower-body explosive power and running speed contribute positively to long jump performance, underscoring the multifaceted nature of athletic performance (Syafir et al., 2025). Although studies consistently demonstrate a positive correlation between lower-body explosive power and long jump performance, other factors, such as technique and overall athletic conditioning, should also be considered, as they can play a critical role in performance outcomes. There is a strong correlation between approach speed and long jump performance ($r = 0.72$), indicating that faster run-up speeds are associated with greater jump distances. Athletes must balance increasing vertical velocity while minimizing loss of forward speed at takeoff for optimal performance (Ma, 2021; Zhang et al., 2025). While explosive power and speed are vital, technique and training also play crucial roles in maximizing long jump results. Athletes may benefit from strength training programs that focus on the key muscle groups identified.

Previous studies have highlighted the important role of speed in improving long jump performance, particularly through increased run-up velocity and takeoff efficiency (Wu et al., 2025; Zhu et al., 2025). A faster approach speed is generally associated with greater jump distance because it contributes to greater momentum before takeoff (Ma et al., 2025). Absolute speed training, particularly in the takeoff area, has also been associated with improved run-up performance, which is essential for maximizing jump distance (Bangsbo et al., 2025). However, the present study found that speed did not have a statistically significant direct effect on long jump performance. Differences in participant characteristics and performance level may explain this inconsistency. Unlike elite athletes, the participants in this study were university students who may not yet possess optimal sprint mechanics, takeoff technique, or force-transfer ability during jumping. Running speed alone may not be sufficient to produce better jump performance without adequate lower-body explosive power and technical coordination. Interestingly, Lin et al. (2023) also reported that although speed is important in long jump performance, the relationship may not always be linear, suggesting that excessive emphasis on speed without proper technique and explosive power could lead to suboptimal performance. These findings suggest that explosive muscular power and movement coordination may play a more dominant role than sprint speed in determining long jump outcomes in non-athlete populations.

The jumper then uses their body positioning and technique to maximize the distance traveled during the floating phase before landing. Long jump is an athletic sport that requires a specific set of skills and physical attributes for optimal performance (Saemi et al., 2024). Factors that contribute to long jump ability include speed, strength, and lower-body explosive power. Speed refers to the athlete's ability to run quickly and change direction efficiently. Strength refers to the maximum force a muscle or muscle group can generate (Sun et al., 2025). Studies have shown that an external focus of attention during jumps enhances performance, leading to greater distances compared to an internal focus (An & Wulf, 2024; Liu et al., 2024). This suggests that athletes' attention can influence their coordination and overall speed. While coordinating eye and foot movements is essential for optimizing long jump speed, excessive focus on visual cues can lead to overthinking and hinder performance.

The findings indicate that lower-body explosive power was the strongest predictor of long jump performance, whereas speed did not show a significant direct effect. This result suggests that lower-body explosive power plays a more dominant role than running speed alone in determining jump distance among PJKR students. One possible explanation is that students may possess adequate sprinting ability but still lack optimal takeoff mechanics and explosive force production during the jumping phase. In long jump performance, speed without effective force transfer at takeoff may not significantly contribute to jump distance.

Furthermore, eye-foot coordination demonstrated both direct and indirect effects on long jump performance through lower-body explosive power and speed. This finding highlights the importance of motor coordination in regulating stride rhythm, body balance, and foot placement accuracy during the approach and takeoff phases. Athletes with better coordination are generally better at synchronizing movement patterns, leading to improved technical execution.

The insignificant direct effect of speed on long jump performance may also be influenced by the relatively small sample size and the non-athlete characteristics of participants. Unlike elite athletes, university students may not yet possess highly developed sprint mechanics and takeoff efficiency, causing running speed to contribute less significantly to performance outcomes.

Although this study focused on lower-body explosive power, speed, and eye-foot coordination, long jump performance is also influenced by several other important variables. Technical factors, such as takeoff angle, body posture during flight, landing technique, and stride adjustment before takeoff, may substantially affect jump distance. Athletes with proper technique can maximize momentum transfer and improve overall performance even if their physical capacity is moderate.

Psychological factors may also influence performance outcomes. Motivation, concentration, self-confidence, competitive anxiety, and mental readiness can affect athletes' movement execution and decision-making during jumping activities (Conde-Ripoll et al., 2024). A study of volleyball players also found that wearing high-heeled shoes affects vertical jump performance (Olivar et al., 2024). Participants with high confidence and focus are more likely to perform consistently in testing situations. Therefore, long jump achievement should be understood as a multidimensional performance outcome involving physical, technical, biomechanical, and psychological components simultaneously.

Limitations of Study

This study has several limitations that should be acknowledged. First, the sample size was relatively small and limited to students from one university, which may reduce the generalizability of the findings to broader athletic populations. Second, this study examined only selected physical and coordinative variables, omitting biomechanical, anthropometric, and psychological factors that may also contribute significantly to long jump performance. Third, the use of field-based measurements and manual timing instruments may have introduced measurement bias and reduced precision compared to laboratory-based assessments. Finally, the cross-sectional design limits the ability to establish stronger causal relationships among variables over time.

Future studies are recommended to involve larger and more diverse samples, including professional athletes and students from multiple institutions, to improve external validity. Researchers should also incorporate additional variables such as jump biomechanics, anthropometric characteristics, training intensity, and psychological readiness to develop a more comprehensive model of long jump performance. Furthermore, longitudinal or experimental research designs are recommended to more accurately examine causal relationships and evaluate the effectiveness of specific training interventions to improve explosive power, coordination, and jumping technique.

Conclusions

This study demonstrated that lower-body explosive power is the strongest factor influencing long jump performance among PJKR UPMI students. Eye-foot coordination also contributed significantly, both directly and indirectly through speed and lower-body explosive power, whereas speed alone did not show a significant direct effect on long jump performance. Collectively, the variables explained 53.7% of the variance in long jump ability. These findings imply that long jump training programs should prioritize the development of explosive leg strength and coordination exercises to improve athletic performance. Coaches and physical education instructors are encouraged to implement integrated training programs combining strength, coordination, and technical jumping exercises. Future research is recommended to involve larger samples and additional variables such as biomechanics, psychological factors, and jumping techniques to obtain a more comprehensive understanding of long jump performance.

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Authors' contributions

AFN and IS contributed to the research concept and design, collection and/or assembly of data, data analysis and interpretation, writing the article, critical revision of the article, and final approval of the article.

Competing interests

The authors declare no competing interests.

AI Disclosure Statement

During the preparation of this manuscript, the author used Grammarly to improve grammar and language clarity. All results have been critically reviewed, verified, and edited by the author to ensure scientific accuracy, clarity of presentation, and compliance with academic standards. The author takes full responsibility for the integrity and content of this manuscript.

Data Availability Statement

The data supporting the findings of this study are available upon request to the corresponding author. The data are not publicly available to protect the privacy of the study participants.

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