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The Relationship Between Leg Muscle Power and Long Jump Results in PJKR FIKK UNM Students

Suriah Hanafi[1]

{suriah.hanafi@unm.ac.id[1]}

Universitas Negeri Makassar, Jl. Wijaya Kusuma No.14, Banta-Bantaeng, Kec. Rappocini, Kota Makassar, Sulawesi Selatan 90222[1]

Abstract. This study aims to analyze the relationship between leg muscle power and long jump results in Physical Education, Health, and Recreation (PJKR) students of the Faculty of Sport and Health Sciences (FIKK) of Makassar State University (UNM). The Pearson product-moment correlation method involved 40 PJKR students from the 2023-2024 intake (male n=25, female n=15; aged 19-22 years) as a purposive sample. Test instruments: vertical jump (Sargent Jump Test) for leg muscle power (cm), long jump IAAF standard squat style (meter). Test procedures: 15-minute warm-up, 3 trials/tests with 3-minute recovery, the average value was analyzed. The results showed leg muscle power M=42.8 cm (SD=6.2), long jump M=5.12 m (SD=0.45), correlation coefficient r=0.72 ($p<0.001$; very strong positive). The determination of $R^2 = 51.8\%$ indicates that leg muscle power contributes 51.8% to the long jump. The gender t-test is significant ($p = 0.002$). The conclusion of the study is that there is a very strong positive relationship between leg muscle power and long jump results of PJKR FIKK UNM students, with a significant contribution to the development of the athletics curriculum.

Keywords: leg muscle power, long jump, Pearson correlation, PJKR students, FIKK UNM

1 Introduction

Leg muscle power is a key biomechanical factor in long jump performance, contributing 45-65% of the variation in jump distance through force production and takeoff velocity. Physical Education (PJKR) students at the Faculty of Public Health, Universitas Negeri Malang (FIKK), are required to develop this competency to effectively teach athletics.

Biomechanically, leg muscle power plays a key role in determining long jump distance because it generates force production and takeoff velocity. Chu (1998) explains that explosive leg ability determines how quickly an athlete can transfer energy vertically and horizontally during the takeoff. Bompa & Haff (2009) assert that more than half of the variation in horizontal jump performance stems from the body's capacity to generate force quickly (rate of force development). This theory explains why leg power is a primary focus in long jump performance analysis, particularly for physical education students who require a strong physical foundation for teaching competencies and demonstrating technique.

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Correspondence author: First Author/Second Author/Third Author, Medan State University, Indonesia.
Email:

From a motor learning perspective, long jump ability is influenced by the integration of strength, coordination, stability, and technical skills in the takeoff, takeoff, flight, and landing phases. Schmidt & Lee (2019) stated that complex skills like the long jump require a foundation of biomotor capacity, particularly strong leg power, to produce efficient movement patterns. Physical Education (PJKR) students at the Faculty of Sports and Community Service (FIKK) at the State Islamic University of Muhammadiyah Malang (UNM) who will teach athletics must master this skill as part of their professional competency. Therefore, understanding the contribution of leg power to long jump performance is important not only for academic purposes but also for assessing students' readiness as future teachers.

Various previous studies have shown a strong to very strong relationship between leg muscle power and long jump ability. Minallah (2017) reported a correlation of r=0.599 between explosive power and long jump performance in coaching students. Widodo (2023) found that leg length and power significantly contributed to long jump distance in PJKR students. Another finding from Kramer (2019) showed a correlation of r=0.68 between explosive leg power and long jump ability in PKO UNM students. These findings confirm that leg muscle power is a significant predictor, and Syria Hanafi's study provides additional evidence with a higher correlation (r=0.72), broadening the empirical foundation in the context of PJKR students at the Faculty of Sport and Community Service (FIKK) at UNM.

Although several studies have been conducted on student athletes, regional athletes, and students from other universities, correlational research specifically measuring the relationship between leg muscle power and long jump performance in PJKR students at the Faculty of Sport and Community Service (FIKK) at UNM remains very limited. Most previous studies used multivariate designs, focused on high school or junior high school students, or tested the effectiveness of specific training interventions. Few studies explicitly capture the magnitude of the correlation using reliable instruments such as the Sargent Jump Test and the IAAF long jump in the context of PJKR students at UNM. This presents a gap in the literature, particularly regarding the need for baseline data for developing an athletics curriculum at the Faculty of Sport and Community Service (FIKK) at UNM.

As a study program that prepares prospective sports teachers, PJKR at the Faculty of Sport and Community Service (FIKK) at UNM requires empirical data on students' biomotor profiles, including leg power as a fundamental competency in teaching athletics. The limited data specific to the Physical Education and Sports Sciences Faculty of the State University of Muhammadiyah Malang (FIKK UNM), coupled with indications of heterogeneity in student abilities (CV power >14% in initial observations), demonstrate the need for more targeted research. By providing a strong correlation (r=0.72) and a determinant contribution of 51.8%, this study is crucial for developing learning programs, identifying students in need of remedial training, and providing a reference for regional benchmarks in long jump instruction.

The PKO UNM study found a correlation between leg power and balance with the long jump at r=0.68 ($p<0.05$). A physical component study showed a correlation between leg strength and the long jump at r=0.599. PKO FIK UNM contributed 42.3% to explosive power in the long jump.

The vertical jump (Sargent Test) reliably measures leg power (r=0.89-0.94). The PJKR standard: power >45 cm is very good, and the men's long jump is >5.5 m. Anthropometric factors such as leg length modify this relationship.

Specific data on PJKR FIKK UNM is limited, despite being a sports center in South Sulawesi. Initial observations: heterogeneity in power (CV>14%) due to variations in experience.

The majority of multivariate or student studies lack specific bivariate correlations between PJKR UNM students. Research gap: magnitude of the relationship between leg power and long jump for targeted curriculum.

2 Method

Research Design

This is a correlational study with a cross-sectional design to test the linear relationship between leg muscle power (independent variable) and long jump results (dependent variable).

Subjects/Participants

Population: 150 Physical Education and Training (PJKR) students from 2023-2024, with a purposive sample size of 40 (25 males, 15 females): in their 4th-6th semester, healthy, with at least 1 year of athletic experience. Informed consent and pre-test medical clearance were obtained.

Research Instruments

Leg Muscle Power: Sargent Vertical Jump Test (jump height in cm, reliability r=0.92).

Long Jump: Squat style, IAAF standard (distance in meters, reliability r=0.95). 10m tape measure, takeoff board marker.

Research Procedures

Test: November 25, 2025, 8:00-11:00 a.m. WITA, FIKK UNM Tartan Field. 15-minute dynamic warm-up. Sequence: vertical jump (3 trials), long jump (3 trials) with a 3-minute recovery period. Three examiners (inter-rater r=0.93). Optimal conditions (25°C, no wind).

Data Analysis Techniques

Descriptive statistics: mean, SD, CV. Pearson correlation (Kolmogorov-Smirnov normality p>0.05). Gender t-test. Simple regression. SPSS 26.0, alpha=0.05. Correlation criteria: 0.80-1.00 very strong; 0.60-0.79 strong.

3 Result

Results

Variable Description

Tabel 1. Descriptive Statistics of Variables (N=40)

Variable	Mean	SD	Min	Max	CV%	Categori
Leg Power (cm)	42,8	6,2	32,5	58,1	14,5	Enough
Long Jump (m)	5,12	0,45	4,21	6,02	8,8	Good

Table 2. Correlation between Leg Power and Long Jump

Variable	Leg Power	Long jump	r	p	R^2
Leg Power	(1)	0,72**	-	-	-
Long jump	0,72**	(1)	-	-	51,8%

Note: **p<0.001 (very strong positive). Normality: KS power=0.12 (p=0.18); KS jump=0.09 (p=0.25).

Gender t-test: male power M=46.2 cm > female power M=36.4 cm (t=5.82, p=0.002); male jump 5.48 m > female jump 4.52 m (t=7.14, p<0.001).

The results of this study describe the leg muscle power profile and long jump ability of 40 PJKR FIKK UNM students from the 2023–2024 intake. Based on the Sargent Vertical Jump test, the average leg muscle power of the students was 42.8 cm (SD = 6.2), categorized as sufficient. The minimum value obtained was 32.5 cm and the maximum was 58.1 cm. The relatively high variability (CV = 14.5%) indicates that power capabilities differ significantly among students, influenced by differences in training experience, exercise habits, and physical condition.

For the second variable, the IAAF standard squat long jump, the average jump distance was 5.12 meters (SD = 0.45), which is considered good. The range of jumps ranged from 4.21 meters to 6.02 meters, with lower variability (CV = 8.8%) compared to leg muscle power. This indicates that students' long jump performance was more stable than their power vertical jump performance.

A Pearson correlation test showed a very strong and significant relationship between leg muscle power and long jump performance, with a coefficient of $r = 0.72$ ($p < 0.001$). The determination value of $R^2 = 51.8\%$ indicates that leg muscle power explained 51.8% of the variation in long jump performance, with the remainder influenced by other factors such as leg length, starting stride rhythm, takeoff angle, and takeoff technique.

Analysis of gender differences using a t-test showed significant results, with male students having higher leg power (M = 46.2 cm) than female students (M = 36.4 cm), as well as better long jump distances (males = 5.48 m; females = 4.52 m). These findings are consistent with the

physiological characteristics between males and females, particularly differences in muscle mass and explosive force generation.

Overall, the results of this study indicate that PJKR students possess good long jump ability, but their leg muscle power is still in the adequate category. Therefore, improving it through plyometric training programs is a crucial need in developing an athletics curriculum.

4 Discussion

A very strong correlation ($r=0.72$) ($p<0.001$) was consistent with the UNM PKO (Education and Development Program) r=0.68, leg strength r=0.599, and high jump leg power r=0.815. Determination explained 51.8% of the long jump variance through takeoff velocity.

Adequate power (42.8 cm) was consistent with non-elite students, while good jump (5.12 m) was superior to junior high school students. Gender differences were significant due to muscle mass. High CV power (14.5%) indicated training heterogeneity.

The linear relationship supports the specificity principle: leg power is specific to horizontal jump. Regression implications: +1 cm power = +0.012 m jump.

The findings of this study indicate that leg muscle power has a very strong relationship with long jump results ($r=0.72$), corroborating previous literature. The UNM PKO study reported by Kramer (2019) found a correlation of $r = 0.68$, while Minallah (2017) reported a correlation of leg strength with long jump results of high school students of $r = 0.599$. This similarity in patterns confirms that vertical and horizontal force production through leg power is the dominant biomechanical factor in determining jump distance. Therefore, the results of this study not only support previous findings but also strengthen the evidence that PJKR students require optimal power capacity for good long jump performance.

The contribution of leg power, at 51.8%, to the variation in long jump performance is quite high compared to other studies. Widodo (2023) only found a 38% contribution in a sample of UNG students, while Suryawan (2012) reported a 41% contribution in elementary school students. This difference in contribution reflects the characteristics of the Syrian Hanafi study sample, where the distribution of leg power data was relatively high (CV = 14.5%), thus providing greater predictive room for determining jump performance. This reinforces the principle of specificity, which states that the long jump activity relies heavily on explosive leg strength to generate takeoff speed.

The significant differences between men and women in leg power (46.2 cm vs. 36.4 cm) and long jump results (5.48 m vs. 4.52 m) support the physiological theory that lower extremity muscle mass and type II fiber percentage are more dominant in men (Chu, 1998). Research by Fauqi (2021) also shows that explosive power is strongly related to takeoff ability in male athletes, while the effect is less pronounced in female athletes due to differences in body composition. These research findings emphasize the urgency of developing different training programs for men and women, particularly in plyometric volume and explosive training intensity.

The relatively high variability in leg muscle power (CV = 14.5%) indicates heterogeneity in the training experience of PJKR students. This aligns with the initial observation in the manuscript that variation in ability is caused by differences in students' athletic experience. Jayadi's (2022) research found that students with a specific sports background had better neuromuscular

adaptation than non-athlete students. Therefore, long jump ability in UNM students is influenced not only by leg power but also by previous physical activity history, training frequency, and the variety of techniques mastered.

Based on the very strong correlation findings, this study confirms that strengthening leg power should be a priority in athletics curriculums. Zainuddin's (2024) research showed that programmed plyometric training can significantly improve long jump results after eight weeks. Therefore, the results of Syria Hanafi's research provide an empirical basis for the FIKK UNM to systematically incorporate vertical jump, bounding, and squat jump training into lectures. Furthermore, the data obtained on the power-long jump relationship can serve as a regional benchmark to measure student development from year to year.

Scientific contribution: first magnitude correlation between PJKR FIKK UNM. Practical implications: prioritizing plyometric vertical jump in athletics courses, and screening for remedial talent.

Limitations: small sample, cross-sectional (weak causality), no control for leg length/balance, gender imbalance.

5 Conclusion

Based on the analysis, this study concluded that leg muscle power has a very strong and significant relationship with the long jump results of PJKR FIKK UNM students, with a correlation coefficient of $r = 0.72$ ($p < 0.001$). This finding indicates that the higher the explosive ability of the leg muscles, the more optimal the resulting jump distance. The high determination value of $R^2 = 51.8\%$ indicates that more than half of the variation in long jump performance is influenced by leg muscle power, while the remainder can be influenced by other biomechanical factors such as leg length, takeoff technique, starting speed, coordination, and training experience.

Descriptively, the students' leg muscle power level is in the adequate category (M = 42.8 cm), while their long jump ability is in the good category (M = 5.12 m). The significant differences between male and female students in both variables highlight the influence of physiological characteristics such as muscle mass, hormonal levels, and explosive capacity, which naturally differ between genders. Furthermore, the high CV value for leg power (14.5%) indicates significant heterogeneity in ability within the student group, indicating the need for more structured and individualized training interventions.

From a biomechanical theory perspective, the results of this study reinforce the concept that takeoff velocity, a primary determinant of long jump distance, is significantly influenced by the explosive capacity of the leg muscles. This finding is consistent with previous research reporting that leg explosive power contributes between 40–65% to long jump results. Thus, leg muscle power is not merely a supporting factor but a primary determinant of long jump performance and should be a priority in student athletic development.

This research makes an important contribution to the development of the athletics curriculum and learning at the PJKR FIKK UNM. The empirical data obtained can be used as a baseline for student skills, as a basis for developing plyometric training programs, improving the quality of athletics courses, and as a tool to identify students in need of remedial training. Training

programs that emphasize vertical jump, bounding, and other explosive drills have the potential to directly improve students' long jump performance. For further research, it is recommended that a multivariate analysis be conducted involving additional variables such as leg length, starting speed, core strength, takeoff technique, and sprint speed. Longitudinal research with a larger sample size is also needed to observe the development of student abilities from semester to semester and to evaluate the effectiveness of the training program implemented in the curriculum. Therefore, the results of this study are expected to provide a foundation for improving the quality of athletics learning at UNM and other sports education institutions.

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