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Correlation Between Gluteal Muscle Strength, Agility, and Power in Recreational Male Football Players : A Pilot Study

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Abstract: Football is a sport that demands speed, agility, power, and quick directional changes, all of which rely on strong lower limb mechanics and muscular support. The gluteus maximus and medius are especially important as they provide hip stability and generate force for sprinting, jumping, and kicking. Weakness in these muscles can reduce movement efficiency and increase injury risk. While their importance has been highlighted in elite players, their role in recreational footballers is less well understood. This study aimed to investigate the relationship between gluteal muscle strength, agility, and lower limb power in male recreational football players. Twenty-five players aged 18–25 years were recruited using purposive sampling. Gluteus maximus and medius strength was assessed with a hand-held dynamometer, agility was tested with the T-test, and power was measured using the single-leg horizontal jump, with all procedures conducted under standardized conditions. The findings revealed strong associations between gluteal strength and performance. Greater gluteus maximus strength correlated with faster agility times (r = −0.844 right, −0.774 left; p < 0.001) and higher power output (r = 0.844 right, 0.796 left; p < 0.001). Similarly, stronger gluteus medius muscles were linked to improved agility (r = −0.793 right, −0.856 left; p < 0.001) and power (r = 0.734 right, 0.793 left; p < 0.001). A strong negative correlation was also observed between agility time and power (r = −0.857; p < 0.001), indicating that players with more explosive power performed better in agility tasks. In conclusion, stronger gluteal muscles were associated with better agility and power in recreational footballers, underlining the importance of incorporating gluteal strengthening into training and rehabilitation programs to optimize performance and reduce injury risk.

Keywords: Gluteal muscle strength, Agility, Lower limb power, Recreational football, Injury prevention

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INTRODUCTION

Football is a sport characterized by repeated bouts of sprinting, jumping, and rapid directional changes, requiring optimal lower-limb mechanics and high neuromuscular efficiency. These explosive actions rely heavily on the gluteus maximus (GM) and gluteus medius (GMed), which contribute to hip stability, force generation, and efficient kinetic chain function. Insufficient gluteal strength not only reduces performance capacity but also increases susceptibility to lower-limb injuries through altered biomechanics and compensatory movement patterns [1,2].

Although the role of gluteal strength in professional athletes is well documented, research in recreational footballers is comparatively sparse. Recreational football has gained popularity worldwide as a health-

promoting activity, yet participants often lack structured strength and conditioning programs [3]. This raises concerns about movement efficiency and injury prevention in this group. Recent evidence suggests that inadequate hip abductor and extensor strength is associated with impaired sprinting, reduced change-of-direction performance, and greater injury risk [4,5]. Furthermore, deficits in GMed function have been linked with compromised pelvic stability, leading to altered kinematics during high-intensity movements [2,6].

Targeted strengthening of the gluteal muscles has been shown to improve jump performance, sprint ability, and neuromuscular control in football and other multidirectional sports [7,8]. These adaptations enhance postural stability and explosive power, both of which are critical for football-specific tasks such as tackling, kicking, and rapid accelerations. While such findings are encouraging, most available data come from elite or youth academy athletes [9,7,10], leaving a notable gap in understanding the relevance of gluteal strength to agility and power in recreational male football players.

To address this gap, the present study investigates the correlation between gluteal muscle strength, agility, and lower-limb power in recreational football players. By focusing on a non-elite population, this work aims to provide physiotherapists, coaches, and trainers with evidence-based insights for developing community-level interventions that can enhance performance and minimize injury risk.

RESEARCH METHODOLOGY

This cross-sectional study was carried out between May 2024 and May 2025 in Mangaluru, India, with the aim of examining how gluteal muscle strength relates to agility and lower-limb power in recreational male football players. Approval for the study was obtained from the Institutional Ethics Committee of A. J. Institute of Medical Sciences, Mangaluru, and all players provided written informed consent prior to participation.

Participants

A total of 25 male recreational football players aged 18–25 years were recruited using purposive sampling. To be eligible, players were required to have a normal BMI (18.5–24.9), no history of lower-limb injury in the preceding six months, and participate in football training at least three days per week for a minimum of 120 minutes in total. Players were excluded if they had a history of hip, knee, or ankle surgery, any neurological or vestibular disorder, musculoskeletal conditions affecting lower-limb function, or if they were professional footballers.

Outcome Measures

Gluteal Muscle Strength was assessed using a hand-held dynamometer (HHD), a device shown to be both reliable and valid for hip muscle testing [11,12]. For gluteus maximus assessment, participants lay prone with the test knee flexed to 90°, and the dynamometer was placed on the distal third of the posterior thigh. For the gluteus medius, players were positioned side-lying with the hip slightly abducted, and resistance was applied 5 cm above the lateral knee joint. In both tests, participants were asked to push maximally against the device for five seconds. Three trials were performed, and the average of the best two readings was recorded.

Agility was measured using the T-test, a widely used and validated protocol for change-of-direction speed in athletes [13,14]. Players sprinted forward 10 m, shuffled laterally 5 m to the right and left while touching cones, and then backpedaled 10 m to the start line. Timing was recorded with a stopwatch, and the fastest of three attempts was considered.

Lower-Limb Power was evaluated using the single-leg horizontal jump (SLHJ) test, which is recognized as a valid and reliable measure of explosive leg power [15,16]. After a standard warm-up consisting of jogging and dynamic drills, players stood on their preferred testing leg with hands on hips, bent slightly at the knee, and jumped forward as far as possible, landing on both feet. Distance was measured to the nearest 0.01 m, and the mean of the two best out of three trials was used for analysis.

Procedure

All participants followed the same standardized protocol. Testing sessions began with a five-minute dynamic warm-up, followed by assessments in the same order for every player: First gluteal muscle strength, second agility, and third power. A rest interval of at least 60 seconds was given between trials to minimize fatigue and ensure consistency.

Statistical Analysis

Data were processed using SPSS version 20.0 (IBM Corp., Armonk, NY). Descriptive statistics (mean ± standard deviation) were calculated for demographic and performance data. Relationships between gluteal strength, agility, and power were examined using Karl–Pearson's correlation coefficient. Statistical significance was set at $p < 0.05$.

Theory And Calculation

The gluteus maximus and medius are central to hip stability, pelvic control, and explosive lower-limb function. The GM provides hip extension torque for sprinting and jumping, while the GMed ensures pelvic alignment during single-leg actions. Weakness in these muscles disrupts movement efficiency and increases injury risk [1,2,5].

Agility, defined as rapid acceleration, deceleration, and change of direction, relies on both strength and neuromuscular control. Stronger gluteal activation reduces ground-contact time and enhances directional speed [4,6]. Similarly, lower-limb power expressed as the product of strength and contraction velocity depends on efficient gluteal force transfer, particularly during jumping and horizontal propulsion [10,8].

In this study, gluteal strength was measured using a hand-held dynamometer, agility with the T-test, and power through the single-leg horizontal jump. Pearson's correlation coefficient was applied to test whether stronger gluteal muscles predict faster agility times and greater jump distances, thereby translating theoretical assumptions into practical evidence.

Mathematical Expressions And Symbols

On the basis of the study conducted by Takuya Sanoda et al, a Correlation between gluteal muscle strength and agility was observed as 0.6. Considering a confidence level of 95% and power of 90%, the estimated sample size is 25

$$N = \left[\frac{(Z\alpha + Z\beta)}{C}\right]^2 + 3 \qquad \text{where} \quad C = 0.5 * \ln\left[\frac{1+r}{1-r}\right]$$

1. Zα [Critical value at 95% Confidence level] =1.96

2. Zβ [90 % Power] =1.28

3. r [correlation] = 0.6

4. ln [logarithm

RESULT AND DISCUSSION

The present study demonstrated strong associations between gluteal muscle strength and functional performance in recreational football players. Greater gluteus maximus and medius strength correlated positively with single-leg horizontal jump distance and negatively with agility test times, indicating that stronger gluteal muscles enhance both power generation and directional speed. Additionally, agility and power were strongly linked, reinforcing their interdependent role in football performance.

These findings align with recent evidence highlighting the importance of hip muscle function in multidirectional sports. Królikowska et al. (2023) reported that hip abductor–adductor strength balance is crucial for sprint efficiency, while Ulloa et al. (2022) emphasized reduced hip strength as a predictor of lower-limb injury. Similarly, Gallego-Izquierdo et al. (2020) found that gluteal-specific strengthening improved vertical jump height, supporting the present result that greater hip extension force contributes to explosive power.

The novelty of this study lies in examining recreational football players, a group often overlooked in sports science research. Unlike professional athletes, recreational players usually lack structured strength and conditioning programs, making them more vulnerable to inefficient biomechanics. Our results suggest that even in this population, gluteal strength plays a decisive role in agility and power, underlining its importance in both performance enhancement and injury prevention.

In view of recent developments, these findings highlight the need to incorporate gluteal strengthening into community-level training routines. Such interventions could not only optimize movement efficiency but also reduce the high rate of lower-limb injuries commonly reported in football. Future research should expand on these results by including larger samples, female players, and electromyographic analyses to better understand activation patterns during sport-specific tasks.

Table 1: Correlation between right gluteus maximus and agility

		Agility (sec)
Gluteus maximus (Right)	r value	.844**
	p value	.000

	N	25

A strong and statistically significant negative correlation was found between right gluteus maximus strength and agility performance time (r = –0.844, p = 0.000, N = 25).

Table 2: Correlation between the right gluteus maximus and power

		Power (m)
Gluteus maximus (Right)	r value	.844**
	p value	.000
	N	25

A strong and statistically significant positive correlation was observed between right gluteus maximus strength and power (in meters) (r = 0.844, p = 0.000, N = 25).

Table 3: Correlation between left gluteus maximus and agility

		Agility (sec)
Gluteus maximus (Left)	r value	-.774**
	p value	.000
	N	25

A strong and statistically significant negative correlation was found between left gluteus maximus strength and agility time (r = -0.774, p = 0.000, N = 25).

Table 4: Correlation between left gluteus maximus and power

		Power (m)
Gluteus maximus (Left)	r value	.796**
	p value	.000
	N	25

There was a strong and statistically significant positive correlation between left gluteus maximus strength and power performance (r = 0.796, p = 0.000, N = 25).

Table 5: Correlation between right gluteus medius and agility

		Agility (sec)
Gluteus medius (Right)	r value	-.793**
	p value	.000
	N	25

There was a strong and statistically significant negative correlation between right gluteus medius strength and agility performance (r = -0.793, p = 0.000, N = 25).

Table 6: Correlation between right gluteus medius and power

		Power (m)
Gluteus medius (Right)	r value	.734**
	p value	.000
	N	25

There was a strong and statistically significant positive correlation between right gluteus medius strength and power performance (r = 0.734, p = 0.000, N = 25).

Table 7: Correlation between left gluteus medius and agility

		Agility (sec)
Gluteus medius (Left)	r value	-.856**
	p value	.000
	N	25

There was a strong and statistically significant negative correlation between left gluteus medius strength and agility time (r = -0.856, p = 0.000, N = 25).

Table 8: Correlation between left gluteus medius and power

		Power (m)
Gluteus medius (Left)	r value	.793**
	p value	.000
	N	25

There was a strong and statistically significant positive correlation between left gluteus medius strength and power (r = 0.793, p = 0.000, N = 25).

Table 9: Correlation between agility and power

		Power (m)
Agility	r value	-.857**
	p value	.000
	N	25

A strong negative correlation was observed between agility performance and power (r = -0.857, p = 0.000, *N* = 25).

CONCLUSIONS

This study examined the relationship between gluteal muscle strength, agility, and lower-limb power in recreational football players, and the findings confirmed that stronger gluteus maximus and medius muscles are closely associated with improved agility performance and greater power output. These outcomes emphasize the essential role of the gluteal muscles in stabilizing the pelvis, supporting efficient biomechanics, and producing the explosive hip extension required for sprinting, jumping, and rapid directional changes that are fundamental to football.

The significance of this work lies in its focus on recreational players, who represent a large group of participants yet often lack structured strength and conditioning programs. In this population, deficits in gluteal strength may compromise both performance and safety, making the results highly relevant for community-level training and rehabilitation strategies. By demonstrating a clear association between hip strength and functional performance, this research highlights the importance of integrating targeted gluteal strengthening exercises into conditioning programs to improve movement efficiency, enhance explosive actions, and reduce the risk of lower-limb injuries.

Despite its contributions, the study has certain limitations. The sample size was modest and restricted to young male players, which limits the applicability of findings across genders and age groups. Moreover,

only isometric strength was assessed, without exploring dynamic muscle activity or movement patterns. Future studies should expand on these aspects by including larger and more diverse cohorts and employing methods such as electromyography to provide deeper insight into gluteal activation during sport-specific tasks. Long-term training interventions would also help determine whether strengthening programs produce lasting improvements in agility and power.

Overall, the results of this study underline the biomechanical importance of the gluteal muscles in football performance and suggest practical applications for physiotherapists, trainers, and coaches. By prioritizing hip muscle conditioning, it is possible to support both performance enhancement and injury prevention in recreational players, thereby promoting safer and more effective participation in the sport

STUDY LIMITATIONS

The study was conducted on a relatively small group of young male recreational football players, which limits the wider applicability of the findings to different age groups, female players, or professional athletes. Strength assessment was limited to isometric measures, and dynamic muscle activity was not captured. Although the T-test and single-leg horizontal jump are established field tests, performance could have been influenced by factors such as motivation or fatigue. The cross-sectional design also restricts causal interpretation, yet the observed associations provide a meaningful basis for future longitudinal and interventional research.

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COMPETING INTERESTS

There are no financial or personal relationships that could inappropriately influence this research

ETHICAL APPROVAL

Institutional Ethics Committee of A. J. Institute of Medical Sciences, Mangaluru, India (Approval Ref. No: AJEC/REV/142/2024)

INFORMED CONSENT

Written informed consent was obtained from all participants prior to their inclusion in the study

ANIMAL RIGHTS

No animals were involved in this research

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