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The Interrelationship Between Integrated Posterolateral Hip Stabilizer Strength and Dynamic Lateral Functional Agility in Healthy Young Adult Females: An Expanded Pilot Inquiry

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ABSTRACT

This pilot study aimed to elucidate the intricate relationship between the composite strength of posterolateral hip stabilizers and lateral functional agility in healthy young adult females. Employing the Hip Stability Isometric Test (HipSIT) and the Side-Hop Test (SHT), the research explored whether three-dimensionally assessed hip strength could be a meaningful predictor of lateral movement proficiency. A total of 11 participants underwent standardized assessment protocols, and a statistically significant inverse correlation ($r = -0.725$, $p < 0.02$) was found. These findings underscore the utility of multidimensional hip strength assessments in predicting athletic performance and suggest practical applications in preventive rehabilitation.

Keywords: *Hip strength, HipSIT, Side-Hop Test, leg function, functional performance*

1. INTRODUCTION

Optimal biomechanics of the lower extremity—particularly in tasks requiring rapid deceleration, lateral redirection, and single-leg stability—are fundamentally dependent on the neuromuscular integrity of the hip complex. Within this complex, the posterolateral muscle group, encompassing the gluteus medius, gluteus maximus, and deep external rotators, is essential in resisting excessive femoral adduction and internal rotation, which are commonly associated with dynamic valgus and lower extremity pathomechanics [1–5]. Despite the foundational role these muscles play in athletic function and injury resistance, current clinical evaluation methods often fail to capture the synergistic, multiplanar demands placed on the hip during real-world movement.

Traditional approaches to strength assessment, such as isokinetic dynamometry and manual muscle testing, frequently isolate muscle groups along single planes of movement. While useful in controlled research contexts, such methods may inadequately reflect the true functional capabilities of the hip stabilizers during dynamic tasks. The Hip Stability Isometric Test (HipSIT), however, offers a novel alternative—providing an isometric strength assessment in a composite position that engages multiple hip stabilizers across three-dimensional vectors [6,7]. Simultaneously, the Side-Hop Test (SHT) measures lateral functional agility and has been validated as a proxy for neuromuscular control, postural equilibrium, and rehabilitation readiness [8,9].

In this study, we hypothesize that higher performance in the HipSIT—reflecting superior posterolateral hip control—would correlate inversely with completion time in the SHT, indicating enhanced agility and neuromuscular efficiency. By isolating a specific demographic of healthy young adult females, this study seeks to reduce variability related to sex-based anatomical and physiological differences, thereby clarifying the strength-performance relationship in a more controlled context.

2. METHODS

2.1 Participants

Twenty female individuals aged 18–40 were initially recruited through open call advertisements. After a detailed health screening, only those who met the following inclusion criteria were selected: (1) no reported injuries to the lower extremity

in the past six months; (2) absence of professional or collegiate-level athletic participation; (3) not menstruating on the day of testing. Participants were excluded if they had a history of neurologic disorders, prior lower limb surgeries, or musculoskeletal abnormalities. Eleven subjects met all criteria and were enrolled. The dominant leg was operationally defined as the leg used preferentially to kick a ball.

2.2 Testing Protocols

Testing was conducted in a standardized laboratory environment to ensure consistent ambient temperature, lighting, and minimal external distractions. All tests were scheduled between 13:00 and 15:00 to minimize circadian influences on strength and agility performance. Participants were required to complete a 10-minute warm-up consisting of dynamic movements, balance drills, and light aerobic activity.

2.2.1 Anthropometric Measures

Body height and weight were measured using a stadiometer and calibrated digital scale, respectively. Body composition data, including body fat percentage and skeletal muscle mass, were obtained using the InBody 570 (Biospace, South Korea), a multi-frequency bioelectrical impedance analyzer.

2.2.2 Hip Strength Measurement

Posterolateral hip strength was evaluated using the HipSIT. Participants lay in a lateral recumbent position with the test leg superior. The hip was positioned at 45° flexion and 20° extension, and the knee was flexed to 90°. A microFET2 dynamometer was affixed via a strap 5 cm lateral to the lateral joint line of the knee. Participants were instructed to exert maximal isometric force for five seconds. One familiarization trial preceded two testing trials, each separated by a 30-second rest period. Peak force values were normalized by dividing the measured force (kgf) by the participant's body weight (kg)(figure 1).

Figure 1. Hip Stability Isometric Test(HipSIT)

2.2.3 Lateral Functional Agility Test

The SHT was used to assess lateral agility and dynamic control. Participants performed 10 consecutive lateral jumps using their dominant leg across a 30 cm width marker. Completion time was recorded in hundredths of a second. Trials were deemed invalid if the non-dominant foot contacted the ground, the participant lost balance, or failed to complete the lateral hop distance. Invalid trials were repeated following a 1-minute rest [15-17].

2.3 Data Analysis

Data were analyzed using SPSS Statistics v25 (IBM Corp., Armonk, NY). Descriptive statistics (mean ± SD) were calculated for all variables. Data normality was confirmed via the Shapiro-Wilk test. Pearson correlation analysis was employed to evaluate the association between HipSIT performance and SHT time. Correlation strength was interpreted as follows: weak ($r < 0.3$), moderate ($0.3 \leq r < 0.5$), strong ($r \geq 0.5$). Statistical significance was set at $\alpha = 0.05$ [18].

3. RESULTS

Participant demographics are detailed in Table 1. The mean HipSIT value was 0.38 ± 0.10 kgf/kg, and the mean SHT completion time was 27.30 ± 9.90 seconds. A statistically significant strong inverse correlation was observed between HipSIT scores and SHT times ($r = -0.725$, $p < 0.02$), demonstrating that greater posterolateral hip strength is associated with superior lateral movement efficiency(figure 2).

Table 1. General characteristics of the subjects

Variable	Mean±SD
Age (years)	28.20±3.04
Height [14)]	160.90±6.62
Mass (kg)	57.04±6.45
BMI (kg/m²)	22.13±1.48

Values are presented as mean ± standard deviation, BMI: body mass index.

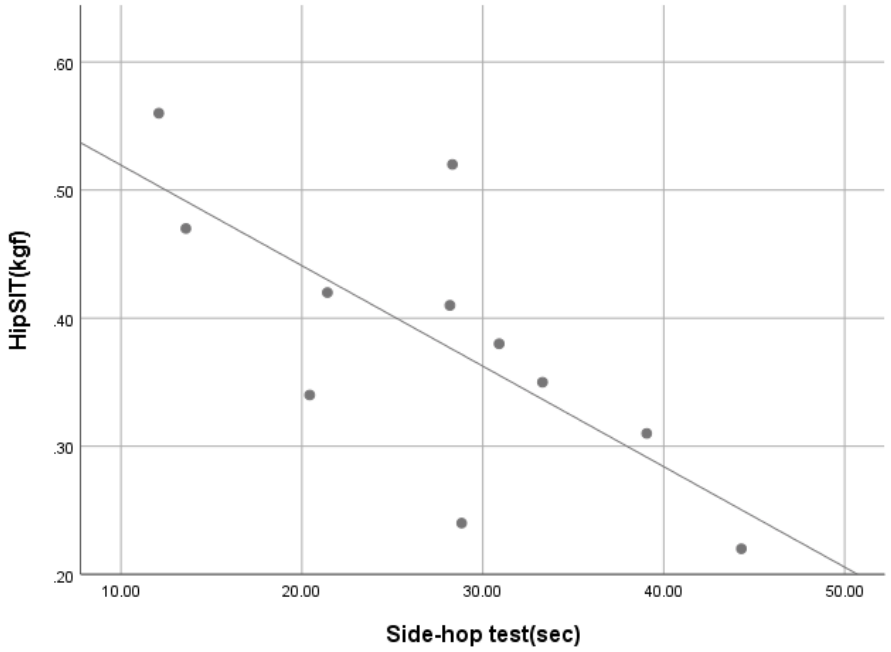

Figure. 2 Correlation between HipSIT and SHT

4. DISCUSSION

The findings from this pilot investigation provide compelling evidence for the biomechanical and neuromuscular interdependence between proximal hip strength and distal functional agility. Specifically, individuals who demonstrated greater composite posterolateral hip strength completed the lateral agility task more efficiently, indicating enhanced neuromuscular synchronization and joint stabilization capabilities. This is consistent with prior research suggesting that increased gluteal activation contributes to better control of frontal and transverse plane knee motion during high-demand tasks [10,19].

The HipSIT appears particularly well-suited to reflect functional movement strength due to its ability to simultaneously activate hip abductors, extensors, and external rotators under a controlled isometric condition. By engaging multiple stabilizers in a positionally relevant manner, the HipSIT provides a realistic depiction of how these muscles perform under sport-like mechanical constraints [6,7].

Female-specific biomechanical patterns—such as increased knee valgus angles during landing and cutting—underscore the relevance of proximal strength for injury prevention in this population [20–24]. Given that anterior cruciate ligament (ACL) injuries occur at disproportionately high rates in women, largely due to insufficient neuromuscular control and proximal

instability, the findings of this study highlight the potential utility of HipSIT as both a diagnostic and prescriptive tool in female athletes.

Moreover, the integration of HipSIT into pre-season screening or rehabilitation programs could serve as an effective method for identifying individuals at elevated risk for injury or performance deficits. The practicality and efficiency of this test make it ideal for large-scale field applications and clinical practice [25].

Nevertheless, certain limitations must be acknowledged. The sample size was relatively small, and all participants were healthy, limiting generalizability to clinical or older populations. Additionally, the study did not examine contributions from other kinetic chain components, such as ankle proprioception or core stability, which may have influenced agility performance. Future research should incorporate motion capture technology, muscle activation profiling, and kinetic force platforms to provide a more granular understanding of the interplay between strength and movement quality.

5. CONCLUSION

This expanded pilot study underscores the significance of composite posterolateral hip strength in predicting dynamic lateral agility among healthy young adult females. The strong inverse correlation identified between HipSIT and SHT performance supports the clinical and athletic application of multidimensional strength assessments. These findings advocate for the inclusion of HipSIT in injury prevention, rehabilitation, and sport performance evaluation protocols, particularly for populations with elevated valgus mechanics or neuromuscular deficits.

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