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ASSESSMENT OF PHYSICAL PERFORMANCE AMONG YOUNG ADULTS WITH HAMSTRING TIGHTNESS: A DESCRIPTION CROSS-SECTIONAL SURVEY

Original Research

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ABSTRACT

Background: Hamstring flexibility plays a crucial role in maintaining optimal musculoskeletal function, particularly in active and sedentary populations. Tightness in the hamstring muscle group can significantly reduce joint mobility, impair physical performance, and predispose individuals to a range of postural and mechanical dysfunctions. In young adults, such impairments often remain unnoticed until functional limitations arise, emphasizing the importance of early identification and performance assessment.

Objective: To evaluate the impact of hamstring tightness on physical performance in young adults using gait speed and the 30-second sit-to-stand test.

Methods: A descriptive cross-sectional survey was conducted between March 2022 and June 2023 in Rawalpindi and Islamabad. A total of 384 participants aged 18–25 years were recruited using non-probability purposive sampling. Inclusion criteria required a minimum 15° reduction in active knee extension with the hip in 90° flexion. Exclusion criteria included any recent (within 2 months) surgery of the lower back or limbs, history of hamstring injury within the past 2 years, or underlying neurological, musculoskeletal, or cardiovascular conditions. Data collection involved a self-structured questionnaire, the Active Knee Extension Test (AKET), and physical performance assessments via the 4-meter Gait Speed and 30-Second Sit-to-Stand tests. SPSS version 21 was used for statistical analysis.

Results: Among 384 participants, 290 (75.5%) met the criteria for hamstring tightness (AKET-positive). The sample had an equal gender distribution (145 males, 145 females) with a mean age of 20.84 ± 1.77 years. Of these, 259 (89.3%) showed bilateral hamstring tightness. Gait speed analysis showed that 222 (76.5%) had high functioning gait (>1.1 m/s), 53 (18.3%) had mean gait (0.7–1.1 m/s), and 15 (5.2%) exhibited low gait speed (<0.7 m/s). Sit-to-stand results revealed 19 (6.5%) with great performance (≥19 reps), 241 (83.1%) with average performance (10–18 reps), and 30 (10.3%) with poor performance (<9 reps).

Conclusion: Hamstring tightness among young adults showed minimal influence on gait speed but demonstrated a moderate impact on lower limb function and endurance during repetitive movements such as the 30-second sit-to-stand test, highlighting the need for early screening and preventive flexibility interventions.

Keywords: Active Knee Extension, Gait Speed, Hamstring Tightness, Physical Performance, Young Adults.

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INTRODUCTION

Flexibility is a foundational component of musculoskeletal health, enabling individuals to perform everyday functional tasks with biomechanical efficiency and a reduced risk of injury (1). Among the critical muscle groups involved in these activities are the hamstrings, which lie at the posterior aspect of the thigh and play an essential role in facilitating movements such as walking, running, sitting, and standing (2). Comprising the biceps femoris, semitendinosus, and semimembranosus, the hamstrings are responsible for knee flexion and hip extension, functioning synergistically with the quadriceps to maintain joint stability and coordinated movement (3). These muscles are anatomically protected by skin, subcutaneous fat, and fascial layers, yet remain vulnerable to tightness and dysfunction, especially when exposed to adverse biomechanical and lifestyle factors (4). The elasticity and extensibility of the hamstrings are essential for optimal performance and injury prevention. Regular physical activity and targeted flexibility routines, including practices like yoga, are known to preserve muscle pliability and support long-term musculoskeletal well-being (1). Conversely, limited hamstring flexibility has been implicated in a host of functional limitations and injury patterns. Restricted extensibility may impair mobility, alter gait mechanics, and contribute to compensatory dysfunctions such as anterior cruciate ligament (ACL) injuries and lower back disorders (1,3). Biomechanical imbalances stemming from hamstring tightness can reduce stride length, disturb postural alignment, and elevate the risk of musculoskeletal disorders, particularly in the lumbar region (3,5). These imbalances are often the result of sedentary behavior, prolonged sitting, aging, or repetitive strain, all of which contribute to decreased elasticity and altered pelvic positioning (5).

Notably, tight hamstrings can trigger a cascade of secondary problems, including lumbar kyphosis, sciatica, disc herniation, and loss of lumbar lordosis, placing significant stress on the spinal structures (5,6). In athletes and active individuals, inadequate flexibility may also lead to patellofemoral pain syndrome, impaired balance, and compromised lower limb performance, thereby affecting overall functional mobility and increasing fall risk (3,6,7). These wide-ranging implications highlight the importance of early identification and conservative management strategies to preserve functional capacity and prevent injury progression. A variety of conservative interventions—ranging from stretching and strengthening protocols to manual therapies and neuromuscular modalities—are employed to manage hamstring tightness and restore optimal function (1,8). The efficacy of such interventions is often assessed through clinical tools that evaluate muscle extensibility and lower limb performance. The Active Knee Extension Test (AKET) is widely recognized for assessing hamstring length and flexibility, while the 30-Second Sit-to-Stand Test and gait speed assessments provide insight into lower limb strength, balance, and mobility, all of which are susceptible to decline in the presence of hamstring dysfunction (9). Although young adults between 18 and 39 years generally represent a population at peak physical capacity, they are not immune to musculoskeletal impairments, particularly those resulting from fatigue, poor posture, and overuse in both athletic and occupational settings (2,4,7). Despite their high activity levels, this group often lacks structured assessment and preventive strategies for muscle imbalances, leaving them vulnerable to avoidable injuries and performance limitations. Given this background, the present study aims to evaluate physical performance in young adults with hamstring tightness by utilizing the Active Knee Extension Test, the 30-Second Sit-to-Stand Test, and gait speed analysis. The objective is to identify potential limitations in strength, flexibility, and functional mobility that may be associated with hamstring tightness, thereby supporting the development of preventive and rehabilitative strategies tailored to this age group (10).

METHODS

This cross-sectional descriptive study was conducted between March 2022 and June 2023 to evaluate the impact of hamstring tightness on physical performance in young adults. The study population included healthy male and female individuals aged 18 to 25 years residing in Rawalpindi and Islamabad. Ethical approval was obtained from the Ethical Review Committee of Foundation University School of Health Sciences (FF/FUMC/215-245/Phy/22), and written informed consent was secured from all participants prior to enrollment. Participants were included if they demonstrated a minimum reduction of 15 degrees in active knee extension with 90-degree hip flexion, indicating hamstring tightness. Individuals were excluded if they had undergone surgery involving the lower back or lower extremity within the past two months, or had any neurological, cardiovascular, or musculoskeletal disorders, including a history of hamstring strain or dysfunction within the past two years. The sampling method employed was non-probability convenience sampling. Using Raosoft sample size calculator, the required sample was determined to be 384, based on a population size of 987,036, a 5% margin

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of error, 95% confidence interval, and a 50% response distribution. Data collection was performed in the Multidisciplinary Laboratory of Foundation University College of Physical Therapy. A self-structured questionnaire was administered to record demographic details such as age, sex, address, and presence of chronic illnesses. Participants then underwent the Active Knee Extension Test (AKET) to assess the extensibility of the hamstring muscles. This test, which has excellent intra- and inter-rater reliability (ICC = 0.89), was performed by asking participants to lie supine while maintaining 90 degrees of hip and knee flexion. A goniometer was placed laterally at the knee, and participants were instructed to actively extend the knee as far as possible. A 90-degree goniometric reference was considered as 0, with further extension recorded relative to this baseline (10,11).

Subjects who exhibited shortened hamstrings, as identified by the AKET, were further evaluated using the 4-meter Gait Speed Test and the 30-Second Sit-to-Stand Test. The Gait Speed Test was utilized to measure functional mobility, and was conducted over an 8-meter path. The first and last 2 meters were excluded to account for the acceleration and deceleration phases, respectively, with only the central 4 meters used for analysis. Participants were asked to walk at a natural pace while the time to traverse the central distance was recorded. Gait speed was then calculated by dividing the distance (4 meters) by the time in seconds (12). To assess lower limb strength and endurance, the 30-Second Sit-to-Stand Test was performed. Participants were instructed to sit on a standard chair with their arms crossed over their chest and their back against the backrest. They were then asked to stand up and sit down as many times as possible within a 30-second interval, with the total number of repetitions recorded (13). Data were entered and analyzed using the Statistical Package for Social Sciences (SPSS) version 21. Descriptive statistics including means and standard deviations were calculated for continuous variables, while frequencies and percentages were used for categorical data. Tables and charts were employed to present the findings visually.

RESULTS

Out of the total calculated sample size of 384, data were successfully collected from 290 young adults aged between 18 and 25 years from Rawalpindi and Islamabad. The gender distribution was equal, with 145 males (50%) and 145 females (50%). The mean age of the participants was 20.8 ± 1.77 years. The presence of hamstring tightness was assessed using the Active Knee Extension Test. All 290 participants (100%) met the criteria for hamstring tightness. Among them, 259 individuals (89.31%) exhibited bilateral hamstring shortening, while 22 (7.58%) and 9 (3.10%) had positive findings on the left and right side, respectively. Functional mobility was evaluated using the gait speed test. Among the 290 participants, 222 individuals (76.55%) demonstrated high functional mobility with a gait speed greater than 1.1 m/s. A total of 53 individuals (18.27%) fell into the average gait speed category (0.7–1.1 m/s), while 15 participants (5.17%) were classified under the low gait speed category (less than 0.7 m/s). Bilateral hamstring tightness was predominant across all gait speed groups. In terms of lower limb endurance and strength, assessed using the 30-Second Sit-to-Stand Test, 19 participants (6.55%) were classified in the "great" performance category (≥19 repetitions), while 241 (83.10%) showed "average" performance (10–18 repetitions), and 30 participants (10.34%) demonstrated "poor" performance (<9 repetitions). Notably, the majority of participants with bilateral hamstring tightness fell into the average performance range. To assess the statistical significance of the observed associations between hamstring tightness and physical performance levels, chi-square tests were conducted. The relationship between hamstring tightness (categorized by side: right, left, or both) and gait speed categories (high, mean, low) did not reach statistical significance ($\chi^2 = 1.70$, df = 4, p = 0.7905), indicating no significant association between the side of hamstring tightness and gait performance. Similarly, the association between hamstring tightness and performance in the 30-Second Sit-to-Stand Test was also statistically non-significant ($\chi^2 = 4.09$, df = 4, p = 0.3939). These findings suggest that while hamstring tightness was prevalent across the sample.

Table 1: Gait Speed with Physical Performance Level and positive Active Knee Extension Test

Cross-tabulation for gait speed with physical level with positive AKET				
	Positive Active Knee Extension Test			Total
Gait speed with Physical performance level	Right	Left	Both	
High Functioning Gait Speed (>1.1m/s)	7	15	200	222 (76.55%)
Mean Gait Speed (0.7- 1.1m/s)	2	5	46	53 (18.27%)
Low Gait Speed (0.7m/s)	0	2	13	15 (5.17%)
Total	**9**	**22**	**259**	**290 (100%)**

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Table 2: 30-Second Sit to Stand Physical Performance with Positive Active Knee Extension Test

		Great (19 Reps or more)	Average (10 -18 reps)	Poor (Less than 9 reps)	TOTAL
Positive Active Knee Extension Test	Right	0	9	0	9
	Left	3	16	3	22
	Both	16	216	27	259
Total		**19 (6.55%)**	**241 (83.10%)**	**30 (10.34%)**	**290 (100%)**

Table 3: Inferential Statistics Assessing Association Between Hamstring Tightness and Physical Performance Measures

Test	Chi-Square Value	Degrees of Freedom	P-Value
Gait Speed vs AKET	1.70	4	0.7905
Sit-to-Stand vs AKET	4.09	4	0.3939

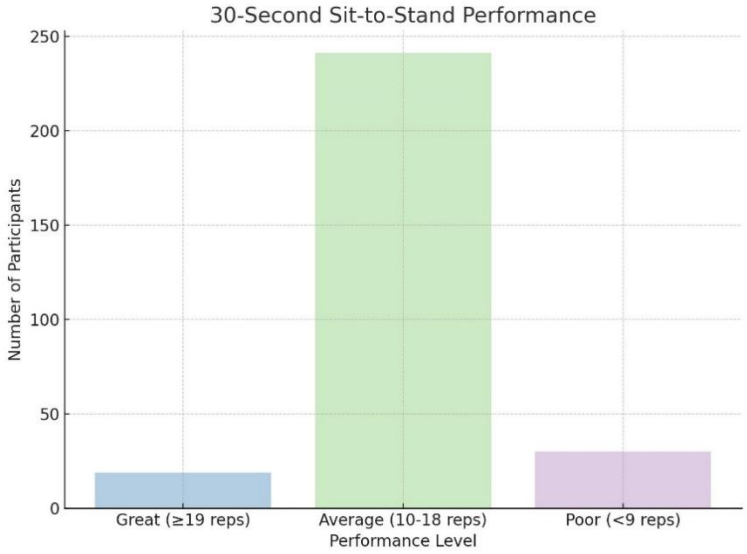

Figure 1 30-Second sit-to-Stand Performance

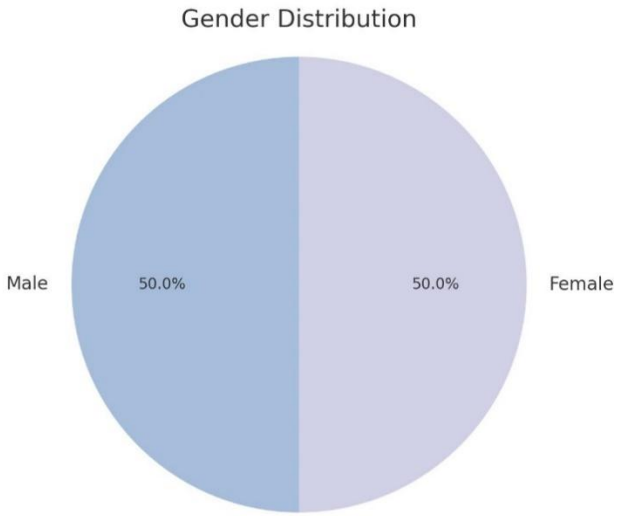

Figure 2 Gender Distribution

DISCUSSION

The present study aimed to assess the relationship between hamstring tightness and physical performance among young adults, using the Active Knee Extension Test (AKET) to evaluate flexibility, and gait speed and 30-second sit-to-stand tests to assess functional mobility and lower limb strength. The findings revealed a high prevalence of hamstring tightness in the study population, with bilateral involvement observed in the majority of cases. While gait speed showed only a mild variation among participants with hamstring tightness, a more pronounced impact was evident in the sit-to-stand test, highlighting reduced endurance and lower limb functional capacity. These findings are consistent with prior research indicating that prolonged sitting and sedentary lifestyles contribute to hamstring shortening and diminished musculoskeletal performance (14). The current study strengthens this evidence by linking reduced flexibility with measurable limitations in performance-based outcomes. The inclusion of the sit-to-stand test provided additional insight into muscular endurance and functional strength, aligning with previous research that validated its use as a sensitive indicator of physical functioning in young and older populations (15). While AKET was used as the primary tool to measure hamstring tightness, the multifaceted nature of hamstring flexibility suggests that incorporating complementary assessments such as the passive straight leg raise (PSLR) or V-sit-and-reach may offer a more holistic evaluation, as prior comparative studies have demonstrated variable associations between these tests (16). Despite the use of gait speed as a standard measure of functional mobility, the present study supports the view that gait speed may have limited sensitivity in capturing the nuanced effects of hamstring tightness, especially in a young, high-functioning cohort (17). Nonetheless, the observed differences in gait categories warrant attention, particularly as gait speed remains a

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widely accepted marker for general physical performance. It is noteworthy that the study did not include direct measures of balance or agility; however, recent findings suggest that hamstring tightness may have limited correlation with such parameters (18), further supporting the decision to focus on strength and endurance rather than balance-related tasks.

Unlike intervention-based studies that reported improvements in hamstring flexibility following static stretching protocols, this study was observational in nature, aiming to assess baseline physical performance without therapeutic input (19). As such, it provides a realistic snapshot of the functional implications of hamstring tightness in a non-clinical, young adult population. Though the study did not explore laterality or gender-specific trends in hamstring flexibility, existing literature suggests potential sex-based asymmetries that could be examined in future research (20,21). Furthermore, while the role of body mass index (BMI) in muscular flexibility remains debated, it was not evaluated in the current analysis, limiting interpretation of its influence on muscle elasticity and joint mobility (22). One of the strengths of this study lies in its use of reliable and reproducible assessment tools in a well-defined age group. The use of standardized protocols, combined with objective performance tests, allowed for a structured evaluation of musculoskeletal function. However, the cross-sectional nature of the study limits causal interpretation, and the absence of inferential associations between performance measures and demographic variables such as gender, BMI, or activity level reduces the granularity of the analysis. Additionally, the exclusive reliance on non-probability sampling may introduce selection bias, affecting generalizability of the results to broader populations. In conclusion, the study highlights that hamstring tightness is common among young adults and may not drastically impair gait but does contribute to reduced strength and endurance, particularly in repetitive functional tasks such as sit-to-stand transfers. These findings suggest a need for early identification of individuals at risk of developing hamstring tightness and encourage the incorporation of flexibility and strengthening routines into preventive health strategies for young adults. Future studies should consider longitudinal follow-up, gender-based analysis, and incorporation of multiple flexibility assessment tools to deepen the understanding of musculoskeletal dynamics in this age group.

CONCLUSION

This study concluded that while hamstring tightness among young adults did not significantly compromise overall gait speed, it moderately influenced lower limb functional performance, particularly during repetitive activities like sit-to-stand transitions. These findings underscore the importance of recognizing hamstring flexibility as a contributing factor to muscular endurance and movement efficiency, even in a high-functioning population. The results support the integration of early screening and targeted flexibility interventions to prevent long-term functional limitations associated with muscular tightness in physically active and sedentary young adults alike.

AUTHOR CONTRIBUTION

Author	Contribution
Mah Noor	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Nida Mushtaq Kayani	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Sana Bashir	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Asra Shahzad	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Marryam Iftikhar	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Muhammad Talha Zubair	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published
Zahida Ramzan	Contributed to study concept and Data collection Has given Final Approval of the version to be published
Bakhtawar Shaheen	Writing - Review & Editing, Assistance with Data Curation
Manahil Shahid*	Writing - Review & Editing, Assistance with Data Curation

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