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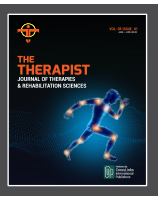

Original Article

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Impact of Prolonged Sitting on Hamstring Flexibility and Lower Extremity Function in University Students

Nida Khalid[1], Taimoor Ahmad[1*], Sana Tauqeer[1], Nimra Raza Mir[1], Inzamam Hussain[1], Muhammad Qasim[1], Hamza Javid[1] and Hammad Shakeel[2]

[1]University Institute of Physical Therapy, The University of Lahore, Lahore, Pakistan
[2]Prime Physio, England, United Kingdom

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***Corresponding Author:**
Taimoor Ahmad
University Institute of Physical Therapy, The University of Lahore, Lahore, Pakistan
taimoor121214@gmail.com

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ABSTRACT

Sedentary lifestyle is a usual practice among college students because of the academic requirements and screen time. This sedentary life can have an undesirable impact on hamstring and lower extremity performance, which can cause musculoskeletal problems. **Objectives:** To identify the effects of sitting on the Hamstring flexibility and lower extremity functionality of university students. **Methods:** A cross-sectional study was conducted at the University of Lahore, which included 194 students aged 18-28 years, both male and female, who engaged in prolonged sitting for at least four hours daily. Structured questionnaire including demographic details and Lower Extremity Functional Scale (LEFS) used for data collection. Hamstring flexibility was assessed using the Straight Leg Raise (SLR) test and the Active Knee Extension (AKE) test. Data were analyzed using SPSS-23. **Results:** The prolonged sitting and sitting position have a significant influence on hamstring flexibility and lower extremity performance. Most of the participants spent more than 10 hours a day sitting, 60.8% of them always sat cross-legged, and 58.2% did not put their feet on the floor when sitting. The majority of them did not have stretching exercises (86.1%) during the working period. Foot contact during sitting was strongly positively related to both hamstring tests of flexibility, SLR ($p<0.001$) and AKE ($p<0.001$). **Conclusions:** The prolonged sitting, especially with young people using laptops, was identified to contribute to tight hamstrings, substandard flexibility, and anterior head posturing. Regular breaks and proper sitting poses, including feet on the ground, are some of the measures that could save musculoskeletal integrity and avoid related dysfunction.

INTRODUCTION

Spending the majority of time sitting, which is another typical behaviour of university students because of schoolwork and screen time, keeps hip joints and knees in a flexed position [1, 2]. This may cause overtime adaptation of muscles of the hamstrings to shorten, thereby decreasing their flexibility [3, 4]. The hamstrings are muscles of the posterior thigh that include semitendinosus, semimembranosus, and biceps femoris, and which run both over the hip and knee joints and down to the tibia and fibula. Knee flexion and hip extension are their main activities [5-7]. Clinical definition According to the clinical definition, hamstring tightness refers to the inability to flex the knee to an extension position more than 20 degrees with the hip flexed to 90 degrees [8, 9]. This causes a restriction of the ability of the muscles to extend, which might result in discomfort or pain in the posterior thigh, hip, and knee. Moreover, the decrease in hamstring flexibility adversely affects the alignment of the pelvis as it facilitates a posterior pelvic tilt, which disturbs the normal lumbar position and the spinal alignment. These biomechanical changes can impair mobility and muscle performance, increase the risk of injury, and are often linked to the development of low back pain [10, 11]. Hamstring tightness may interfere with the functioning of the joints and lead to the development of spinal misalignments, and, consequently, low back pain [12].

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Sedentary postures, which often occur in most working places and in schools, are a factor that leads to tightening of hamstrings. Such an inactive way of life, as well as other causes such as obesity and physical inactivity, worsens the situation [13-15]. The AKE test has been regarded as the most specific and reliable in measuring hamstring tightness since it involves only knee movement, but no hip rotation [16]. This working test is carried out in a painless scale of movement and is considered as being safer and more precise than the SLR test, as it includes both hip and knee movement and might not be as accurate as this test [17]. Although the SLR test is widely used, it is not specific due to its combination of both hip and knee joint movement, and as such, it is not as accurate in measuring hamstring tightness [18]. Conversely, the AKE test dwells on knee movement that gives a better examination of hamstring flexibility [19]. A lack of hamstring flexibility may cause different musculoskeletal problems, with lower back pain being one of them, as tight hamstrings may influence pelvic tilt and lead to abnormal postures, including flattened back or posterior pelvic tilt [20]. The experiments mentioned above demonstrated high activity and low sitting group with 6.1° more passive hip extension resulting in tightness of hamsatring muscle [21-23]. The level of awareness about the significance of flexibility can lessen the occurrence of complications such as low back pain and enhance overall musculoskeletal abilities.

No intervention component was involved to test the preventive strategies, and physical activities were not standardized, which could confound the results. Findings are restricted to the 18-35 age group and cannot be extrapolated to other demographics. This study aims to assess the impact of prolonged sitting on hamstring flexibility and lower extremity function in university students.

METHODS

This cross-sectional study was conducted at the University of Lahore from August 2025 to November 2025. Data were collected after obtaining written informed consent from all participants, in accordance with the ethical principles outlined in the Declaration of Helsinki. The required sample size was calculated using Open Epi version 3.01 for correlation studies, assuming a moderate effect size (r=0.30), 95% confidence level, and 80% statistical power. The minimum required sample was 138 participants. To account for possible non-response and incomplete data, a total of 194 participants were recruited using a convenience sampling technique [1]. The selected participants were male and female students aged 18-35 years with an occurrence of prolonged sitting daily (4 or more hours a day) [23]. Excluded were individuals with a history of sprains or strains around the knee/hip, recent surgeries involving hip/knee joints, any recent fracture, a neurological disorder, or musculoskeletal condition of the lower limbs [23]. Data were obtained by using the structured questionnaire containing demographic data and the Lower Extremity Functional Scale (LEFS) to measure lower limb functionality. The Lower Extremity Functional Scale (LEFS) consists of 20 items assessing difficulty in performing daily activities. Each item is scored from 0 (extreme difficulty/unable to perform) to 4 (no difficulty), with a total possible score of 80. Lower scores indicate greater functional limitation [24]. The evaluation of hamstring flexibility involved two clinical tests that used the Straight Leg Raise (SLR) test and the Active Knee Extension (AKE) test. During the SLR test, the patient lay supine as the examiner passively extended the long leg until vigorous resistance was encountered. The angle at the hip joint was measured using a goniometer; less than 70* indicated tightness of the hamstring or sciatic nerve [25]. In the case of the AKE test, the subjects were placed in a supine position with hips and knees in a 90-degree flexion and told to actively extend the knee until they felt a stretch in the hamstrings. The knee angle was assessed with a universal goniometer; a value below 20° of full extension was reported to be a sign of hamstring tension [26]. The process was done using standardized guidelines, and the measurement was made twice [11].

SPSS version 26.0 was used to analyze the data. Categorical data were reported as frequencies and %ages, and continuous data as means and standard deviations. Spearman correlation was used to correlate the sitting time group and the AKE and SLR (Hamstring flexibility tests). As well use of cross-tabulation to determine the relationship between the contact of feet with the sitting floor and lower limb functioning using LEFS scores ($p<0.05$).

RESULTS

The general description of the population mentioned showed that the most representatives were aged 2327 years (42.8%), followed by the age group of 18 22 years (33.5%), and the youngest population was 3235 years old (5.7%). The %age of females was higher (53.1) in comparison with that of males (46.9). The average body height was 1.69 ± 0.09 meters, and the average body weight was 67.77 ± 14.39 kg. According to BMI categories, 14.95% of the sample size were underweight, 40.21 %with normal BMI, and an enormous 87% were overweight. Behavioral and postural measures indicated that 47.4 % of people sat on chairs with backrests, 27.8 % used a sofa, and 24.7 % sat on chairs that did not have backrests. A sizeable %age of 58.2 of them have stated that their feet never touched the floor when seated. The majority of them (56.2%) did not have breaks during working hours, and 86.1 % did not

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engage in stretch exercises between duties. Nevertheless, 75.3 % had some form of physical activity, and almost half of them (46.4 %) did it for less than 10 minutes a day. Also, 60.8 % indicated cross-legged sitting (Table 1).

Table 1: Descriptive Statistics of Age

Variables		Frequency (%)
Age	18-22 Years	65 (33.5%)
	23-27 Years	83 (42.8%)
	28-31 Years	35 (18.0%)
	32-35 Years	11 (5.7%)
Gender	Male	91 (46.9%)
	Female	103 (53.1%)
BMI	Underweight	29 (14.95%)
	Normal	78 (40.21%)
	Overweight	87 (44. 85%)
Furniture	Chair without a Backrest	48 (24.7%)
	Chair with a Backrest	92 (47.7%)
	Sofa	54 (27.8%)
Touch The Floor	Yes	81 (41.8%)
	No	113 (58.2%)
Breaks	Yes	85 (43.8%)
	No	109 (56.2%)
Stretching	Yes	27 (13.9%)
	No	167 (86.1%)
Physical Activity	Yes	146 (75.3%)
	No	48 (24.7%)
Duration of Physical Activity	No Physical Activity	48 (24.74%)
	Less Than 10 Minutes	42 (21.65%)
	10-30 Minutes	57 (29.4%)
	More Than 60 Minutes	47 (24.2%)
Position	Yes	118 (60.8%)
	No	76 (39.2%)

The results showed, according to functional assessment, determined by the Lower Extremity Functional Scale (LEFS), the proportion of mild to moderate, minor to minimal, severe, and moderate limitations was 31.4 %, 24.7 %, 22.2 %, and 21.6 %, respectively. Clinical measures of functional mobility revealed an average passive angle position of 61.88 ± 11.51 (Straight Leg Raise assessment) and a passive distinctive 16.48 ± 7.10 (Active Knee Extension assessment), which suggested the factor of tight hamstrings in this group (Table 2).

Table 2: Descriptive Statistics of Tests (n=194)

Variables		Mean ± SD	Frequency (%)
LEFS	Severe Functional Limitations	–	43 (22.2%)
	Moderate Functional Limitations	–	42 (21.6%)
	Mild to Moderate Functional Limitations	–	61 (31.4%)
	Minimal Functional Limitations	–	48 (24.7%)
SLR	–	61.87 ± 11.51	–
AKET	–	16.48 ± 7.099	–

Spearman's correlation analysis demonstrated a very strong positive correlation between sitting hours and Straight Leg Raise (r=0.926, p<0.001), and a strong positive correlation with the Active Knee Extension test (r=0.641, p<0.001) (Table 3).

Table 3: Spearman's Correlation Between Sitting Hours and AKET and SLR (n=194)

Variables	r	p-value
Sitting Hours		
Straight Leg Raise	0.000	0.926**
Active Knee Extension Test	0.000	0.641**
Feet Touch Floor While Sitting	<0.001	0.844**

The magnitude of correlation was interpreted according to Cohen's criteria (small = 0.1, moderate = 0.3, large ≥ 0.5) (Table 4).

Table 4: Correlation Between Foot Contact While Sitting and LEFS(a) (n=194)

LEFS Category	Physical Activity Duration				p-value
	No Physical Activity	Less than 10 Minutes	10–30 Minutes	Mild	
Severe	27 (62.8%)	16 (37.2%)	0 (0%)	0 (0%)	0.001
Moderate	11 (26.2%)	25 (59.5%)	6 (14.3%)	0 (0%)	
Mild to Moderate	0 (0%)	4 (6.6%)	57 (93.4%)	0 (0%)	
Mild	0 (0%)	0 (0%)	0 (0%)	48 (100%)	

The findings focused on Foot contact during sitting, which was significantly correlated to several variables. No gender-based differences were reported (p=0.321), yet the BMI was significantly correlated (p=0.023), and underweight individuals were more likely to have proper foot contact. Better foot contact with the floor was observed among participants who did not sit with their legs crossed (p=0.001), took breaks during work (p=0.001), and spent more time in physical activity (p=0.001). The furniture used was also significantly correlated (p=0.001); the persons sitting on sofas had the highest value of foot contact, whereas those choosing chairs with backrests had the least value. The implications of these findings imply that posture, physical activity, and seating ergonomics are very important in the preservation of ideal lower extremity functioning (Table 5).

Table 5: Correlation Between Foot Contact While Sitting and LEFS(b)

Variables	Foot Touching Floor		p-value
	Yes (%)	No (%)	
Gender			
Male	36 (39.6%)	55 (60.4%)	0.321
Female	45 (43.7%)	58 (56.3%)	
BMI			
Underweight	17 (58.6%)	12 (41.4%)	0.023
Normal	30 (38.5%)	48 (61.5%)	
Overweight	34 (39.1%)	53 (60.9%)	

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Cross-legged Sitting			
Yes	45 (38.1%)	73 (61.9%)	0.001
No	36 (47.4%)	40 (52.6%)	
Breaks During Work			
Yes	81 (95.3%)	4 (4.7%)	0.001
No	0 (0%)	109 (100%)	
Physical Activity Duration			
No Physical Activity	25 (52.1%)	23 (47.9%)	0.001
Less than 10 minutes	31 (73.8%)	11 (26.2%)	
10–30 minutes	18 (31.6%)	39 (68.4%)	
More than 60 minutes	7 (14.9%)	40 (85.1%)	
Sitting Furniture			
Chair with Backrest	0 (0%)	48 (100%)	0.001
Stool	30 (32.6%)	62 (67.4%)	
Sofa	51 (94.4%)	3 (5.6%)	

DISCUSSION

The current study aimed to investigate the impact of prolonged sitting on hamstring flexibility and lower extremity function in university students. Many respondents (56.2%) did not have breaks during sitting, and 86.1% participants said they were not involved in any form of stretching exercises. These actions may be the underlying cause of the hamstring inflexibility in the mean Straight Leg Raise (SLR) angle of 61.88° ± 11.51°, which was lower than the normal range of flexibility (≥80°). Likewise, the Active Knee Extension (AKE) test recorded an average flexion of 16.48°C ± 7.10°C, which showed further hamstring tightness in a significant number of the samples. The results of this research indicate that there is a strong relationship between lengthy sitting and low hamstring flexibility. Causality is, however, not possible because of the cross-sectional design. These findings reveal that there is a correlation and not a cause-and-effect relationship. Moreover, the functional effect of sitting was also present in the Lower Extremity Functional Scale (LEFS) scores, which had an average score of 41.99 ± 20.84. These scores indicate that the participants have functional limitations, though they do not have musculoskeletal conditions diagnosed. It is noteworthy that cross-legged sitting (60.8%) and feet unsupported when in a sitting position (58.2%) were postural behaviors that were prevalent among the subjects. The present study correlates with the past studies, including that conducted by Perveen *et al.* in determining the high prevalence of hamstring tightness among university students [27]. The findings of the present research exhibit low flexibilities of SLR and AKE, which proves that long hours of sitting are connected with hamstring shortening. Also, your results indicated that most respondents perform long periods of sitting without taking a break or stretching, which confirms the argument by Zawadka *et al.* that sedentary behavior is a cause of muscle tightness and postural problems [28]. The current research determined that a large proportion of the respondents failed to keep their feet on the ground when sitting and also exhibited bad posture practices (e.g., cross-legged sitting), which could be a contributory factor to the lumbar curvature variation. The measurements of hamstring flexibility of participants facilitate the fact that prolonged sitting results in a change of the spinal position and reduction of muscle elasticity, as in the works by Perveen *et al.* [27]. The findings made in the present research closely coincide with the existing literature because, as T.A.C. Plandowska *et al.* stated, sitting during long periods of time leads to a sedentary lifestyle, and the specified position may lead to the passive stiffness of the spine and the lack of mobility of the lumbar region [29]. In addition, the relationship between lowering flexibility and impairment of functions mentioned by Yadav and Basista was proven by the limitations that were observed in the mobility and daily functioning of the participants. Recent studies not only support but also expand on existing evidence that prolonged sitting and poor posture are causes of hamstring tightness [23]. The present research offers valuable information to the existing dilemma, discussing the causal relation between low back pain (LBP) and poor sitting habits. Although the literature introduces two opposite points of view, one of which states that there is a strong connection between sedentary behavior and LBP, and the other one doubts or opposes such a connection, the results of the current study give more support to prove the validity of the former opinion. In particular, the analysis discovered a significant correlation between prolonged sitting and the changes in lumbar lordosis and a high percentage of hamstring tightness in university students. The current research is based on behavioral patterns and sitting time as the contributing factors to LBP, compared to the results of studies that can explain LBP by age, gender, or body composition as the main factors. Although the study itself does not quantify the level of pain, the physiological indicators that it identifies provide a powerful argument that improper sitting position and increased sedentary lifestyle are crucial risk factors for future musculoskeletal pain, such as LBP. Dehcheshmeh *et al.* concluded that sitting position is one of the factors that lead to lumbar flexion and past strain on the spinal structures. Similar to the existing literature, the present research established that when one sits in slouched or unsupported postures, the lumbar spine becomes passively stiff and the overall spinal movement becomes limited [30].

Although it had advantages, the study was limited in a number of ways. To begin with, the research did not cover a wide scope of university students, and that is why one cannot generalize the findings to other groups, such as

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adolescents, the elderly, and practitioners. Further, the influence of the difference in the amount of physical activity during the participation was not controlled, and hence, might have affected the outcomes of hamstring flexibility and lower limb functionality. Future studies should also have a wider population sample and more longitudinal designs, which could be employed to get the long-term implications. Evidence will be enhanced through a multi-center study in a wide range of populations, dose response study, and standardized physical activity controls to identify critical thresholds of sitting to make recommendations in the area of public health.

CONCLUSIONS

As this research would show, young people who spend a significant amount of time sitting down to work or using laptops will have a higher rate of hamstring tightness, which makes them less flexible and develops forward head position. The ability to take regular breaks during sitting is also necessary to keep the posture correct, promote overall health, and avoid complications.

Authors' Contribution

Conceptualization: NK
Methodology: MQ, HJ
Formal analysis: IH
Writing and Drafting: TA, ST, NRM
Review and Editing: NK, TA, ST, NRM, IH, MQ, HJ, HS

All authors approved the final manuscript and take responsibility for the integrity of the work.

Conflicts of Interest

All the authors declare no conflict of interest.

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