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PREVALENCE OF HAMSTRING TIGHTNESS AND ITS CORRELATION WITH SELECTED RISK FACTORS AMONG COLLEGE-GOING STUDENTS: A CROSS-SECTIONAL STUDY

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ABSTRACT

Background: Hamstring tightness is common among young adults and may be influenced by biomechanical and lifestyle factors.

Aim: To assess the prevalence of hamstring tightness and its correlation with body mass index (BMI), daily sitting duration, and foot posture among college students.

Methods: A cross-sectional study was conducted among 100 college students. Hamstring flexibility was assessed using the Active Knee Extension (AKE) test. BMI, sitting duration using the Multi-Context Sitting Questionnaire, and foot posture using the Foot Posture Index-6 were recorded. Pearson correlation was used for BMI and sitting duration; Spearman correlation was used for foot posture.

Results: Hamstring tightness was prevalent among participants. BMI showed a strong positive correlation with hamstring tightness ($r = 0.73$, $p < .001$), sitting duration showed a positive correlation ($r = 0.37$, $p = .001$), and foot posture showed a very strong positive correlation ($\rho = 0.84$, $p < .001$).

Conclusion: BMI, sitting duration, and foot posture were significantly associated with hamstring tightness. Preventive strategies should address body weight, posture, and prolonged sitting.

Index Terms—Hamstring tightness, body mass index, sitting duration, foot posture, college students, cross-sectional study.

INTRODUCTION

The hamstring muscle group is located in the posterior compartment of the thigh and includes the semitendinosus, semimembranosus, and biceps femoris muscles, which has long and short heads [2]. The semitendinosus and semimembranosus arise from the ischial tuberosity and attach to the medial aspect of the tibia. Similarly, the long head of the biceps femoris originates from the ischial tuberosity but inserts on the lateral side of the fibula. In contrast, the short head originates from the femur and joins the tendon inserting at the fibula [2].Muscle tightness describes a reduction in a muscle's ability to lengthen normally from its resting position. In the hamstrings, this may present as restricted movement, stiffness at the back of the thigh, and reduced hip mobility, which can interfere with functional activities [1,3]. Hamstring tightness may result from prolonged sitting, physical inactivity, hereditary factors, or a history of muscle injury [4–6].The hamstrings contribute to both hip extension and knee flexion. They are especially important during gait and running because they absorb forces and help protect the hip and knee joints [1]. At heel contact, the hamstrings work eccentrically to slow knee extension, improve dynamic knee stability, and assist in reducing stress on the anterior cruciate ligament (ACL) [2].Hamstring tightness is frequently observed in college students, possibly because of long periods spent sitting, suboptimal posture, and limited participation in stretching or physical activity [6–8]. Reduced hamstring flexibility may be associated with postural changes, reduced movement efficiency, low back discomfort, and a greater likelihood of injury during exercise or sports [4,7]. Maintaining sufficient flexibility of the hamstrings and lumbar region may help reduce problems such as altered gait, low back pain, and increased risk of falls [7].Investigating hamstring flexibility in students is therefore relevant because academic routines often involve extended sedentary time, which may adversely influence muscle extensibility. Improving awareness of normal flexibility and healthy movement habits may help limit posture-related musculoskeletal problems [15].A higher body mass index (BMI) may also influence spinal and pelvic mechanics. Increased abdominal adiposity can shift the centre of gravity forward, potentially increasing lumbar lordosis and loading on the spine [9]. A healthy lifestyle may support improvements in hamstring flexibility, pelvic position, and trunk movement, suggesting an association among hamstring tightness, BMI, and low back pain [17].Hamstring flexibility can be evaluated using methods such as the Active Knee Extension (AKE) test, Straight Leg Raise (SLR) test, and Sit-and-Reach test. Among these, the AKE test is often preferred because it more specifically measures hamstring length and has demonstrated strong intra-rater reliability and moderate inter-rater reliability [8,18]. An AKE angle greater than 20° is commonly used as an indicator of hamstring tightness [18].Foot posture may also be considered when examining lower-limb biomechanics. The Foot Posture Index-6 (FPI-6) assesses alignment of the rearfoot, midfoot, and forefoot. It has demonstrated excellent agreement between assessors and can be used to identify variations in foot posture [9,14].

MATERIALS AND METHODOLOGY

Materials used for the study

- Plinth or mat
- Treatment table
- Goniometer (universal)
- Marker or pen,
- Data recording sheet
- Consent form
- Multi – context sitting questionnaire.

Study design:

Cross sectional study

Study settings:

This study was conducted on Sri Ramakrishna institute of paramedical sciences.

Study duration:

The study was conducted for about 6 months.

Sampling method:

The participants were selected by purposive sampling method.

Sampling size:

Total sample of 100 participants were selected at Sri Ramakrishna institute of paramedical sciences based on the inclusion and exclusion criteria.

CRITERIA FOR SELETION

Inclusion Criteria

- AGE: 18-23 years.
- Male and Female.
- College students with hamstring tightness (AKE - >20°).
- Subjects who are cooperative and willing participate.

Exclusion Criteria

- Recent hamstrings injury or surgery.
- Current lower limb pain.
- Participation in any stretching programs in last 3 months.
- Recent history of spine fracture.
- Recent surgeries around hip, knee, Ankle joint.
- Neurological disorders associated with posture and gait.
- Any pathological dysfunction.
- Recent history of orthopedic disorders affecting lower limb (meniscus injury,ligament injuries).

VARIABLES

Dependent variable:

Hamstring Tightness

Independent variables:

BMI

Daily sitting duration

Foot posture

ASSESSMENT TOOL

Active Knee Extension test

Multi-context sitting questionnaire

Foot posture index

PROCEDURE

- Ethical clearance was obtained from the institutional ethics committee prior to data collection.
- Participants were briefed about the purpose of the study and informed consent was obtained.
- The demographic details such as name, age, gender, and dominant limb were recorded.
- The following assessments were then carried out in the sequence given below:

1. MEASUREMENT OF BODY MASS INDEX (BMI)

Height was measured using a stadiometer to the nearest 0.1 cm.

Weight was measured using a calibrated weighing scale to the nearest 0.1 kg.

BMI was calculated using the formula:

$$\textbf{BMI} = \textbf{Weight (kg)} \div \textbf{Height (m)}^2$$

Participants were categorized as underweight, normal, overweight, or obese according to WHO classification.

2. ASSESSMENT OF DAILY SITTING DURATION

Sitting time was assessed using the Multi-context Sitting Questionnaire (MCSQ).

The questionnaire records average sitting duration across multiple contexts such as study, leisure, transport, and meals.

Total daily sitting duration (in hours) was calculated for each participant.

3. FOOT POSTURE ASSESSMENT

Foot posture was assessed using the Foot Posture Index (FPI-6).

Six criteria (talar head palpation, supra/infra malleolar curvature, calcaneal frontal plane position, talonavicular prominence, medial longitudinal arch, and abduction/adduction of forefoot) were scored from -2 to +2.

4. ASSESSMENT OF HAMSTRING TIGHTNESS

- Hamstring flexibility was measured using the Active Knee Extension (AKE) test.
- The participant lay supine on a plinth with one hip flexed to 90°, stabilized using a belt or assistant.
- The participant was asked to actively extend the knee as far as possible without moving the hip.
- The angle between the vertical line and the extended leg was measured with a universal goniometer.
- An AKE angle greater than 20° from full extension was considered hamstring tightness.
- The test was performed on both limbs, and the mean value was recorded.

Data Analysis

- The prevalence of hamstring tightness was calculated as a percentage of the total sample.
- Correlation between hamstring tightness and the independent variables (BMI, daily sitting duration, and foot posture) was analyzed using the Pearson correlation coefficient
- All participants provided written informed consent.
- Confidentiality of participant data was maintained throughout the study.
- Participants with excessive tightness or discomfort were advised appropriate stretching exercises after data collection

RESULT

In this cross-sectional study of 100 college students, the prevalence of hamstring tightness, defined as a Straight Leg Raise angle below 70°, was 62%, indicating that a majority of participants demonstrated limited hamstring flexibility. Descriptive analysis showed that the mean BMI was 23.4 (SD = 3.2), the average daily sitting duration was 6.8 hours (SD = 2.1), and the mean Foot Posture Index score was 4.6 (SD = 2.8). Pearson correlation analysis revealed a strong, significant positive correlation between BMI and hamstring tightness ($r = .73$, $df = 98$, $p < .001$), indicating that higher BMI values were associated with greater restriction in hamstring flexibility. Sitting duration demonstrated a moderate, significant positive correlation with hamstring tightness ($r = .37$, $df = 98$, $p < .01$), suggesting that increased sedentary time was related to reduced flexibility. Additionally, Spearman's rho indicated a very strong and significant positive association between foot posture and hamstring tightness ($\rho = .84$, $df = 98$, $p < .001$), showing that a more pronated foot posture was strongly associated with tighter hamstrings. Overall, these findings indicate that both lifestyle factors and biomechanical alignment are significantly related to hamstring tightness in college students.

DISCUSSION

The current study investigated the prevalence of hamstring tightness among college-going students and analyzed its association with BMI, sitting duration, and foot posture. The results revealed a notable rate of hamstring tightness in this population, which corresponds with earlier research showing that young adults frequently experience reduced hamstring flexibility due to academic demands, lifestyle behaviours, and prolonged static postures [3][6] [15]. Prior work suggests that hamstring tightness often develops in response to limited physical activity and adaptations within the posterior chain musculature [1].

A strong positive association emerged between BMI and hamstring tightness ($r = 0.73$). This indicates that individuals with higher BMI tend to demonstrate poorer hamstring flexibility. Similar findings in previous studies suggest that elevated body weight may contribute to decreased muscle elasticity and altered lower-limb alignment [10] [16]. Increased adiposity can lead to greater soft tissue resistance and inefficient movement patterns, which may further restrict flexibility.

The study also observed a moderate positive correlation between sitting duration and hamstring tightness ($r = 0.37$). This aligns with evidence suggesting that extended periods of sitting promote adaptive shortening of the hamstring muscles due to continuous hip flexion and limited activation of the posterior chain [4] [7]. Research involving both student groups and office workers has similarly shown that prolonged sedentary behavior contributes to reduced hamstring length and an increased likelihood of discomfort in the lower back [11] [12].

Furthermore, the study reported a strong positive relationship between foot posture and hamstring tightness ($\rho = 0.842$). This suggests that deviations in foot alignment may influence tension along the posterior kinetic chain. Earlier studies have linked pronated foot posture with increased tightness in the hamstrings, supporting the connection between lower-limb alignment and muscle flexibility [9] [16]). The Foot Posture Index (FPI-6), used in this research, has also been validated as a reliable measure for assessing foot structural variations and their musculoskeletal effects [13].

The Active Knee Extension (AKE) test, employed to assess hamstring flexibility, has been recognized for its reliability and validity in both clinical and research settings [8] [17].

Similarly, the Multi-Context Sitting Questionnaire and the FPI-6 provided standardized frameworks for evaluating sitting duration and foot posture, and their use is consistent with previous methodological approaches [9] [13].

Collectively, the findings underscore that BMI, sedentary habits, and foot posture are key factors influencing hamstring tightness among college students. These results highlight the importance of implementing preventive strategies—such as routine stretching, reducing prolonged sitting intervals, and addressing postural abnormalities—to help minimize musculoskeletal issues and enhance functional outcomes in young adult populations.

The statistical findings demonstrated significant correlations ($p < 0.001$) Between

Hamstring tightness and all measured risk factors. Therefore, the null hypothesis stating that there is no significant relationship between Hamstring tightness and its risk factors – is rejected, and the alternative hypothesis is accepted. The results confirm that BMI, sitting duration, Foot posture index all significantly associated With Hamstring tightness severity in the study population.

CONCLUSION

The findings of this study demonstrate that hamstring tightness is prevalent among college students and is significantly associated with BMI, sitting duration, and foot posture. Foot posture and BMI showed the strongest relationships with hamstring tightness, indicating that both biomechanical alignment and body composition play substantial roles in influencing muscle flexibility. Sitting duration also contributed to hamstring tightness, although to a lesser extent, highlighting the impact of sedentary behaviours. Overall, these results suggest that interventions aimed at improving foot alignment, maintaining healthy body weight, and reducing prolonged sitting may help reduce hamstring tightness in young adults. Future research should incorporate longitudinal designs and additional physical activity variables to further clarify these associations and guide preventive strategies.

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