

Influence of prolonged sitting time on development of hamstring muscle tightness in desk job employees

Madhubabu Kothapalli

Preventa Curo - Centre for Workplace Healthcare & Research, Nanakramguda, Hyderabad, India

Abstract

Background. Prolonged sitting has been identified as a potential risk factor to develop hamstring muscle tightness. In six to eight hours of sitting, hamstring muscles undergo degenerative and atrophic tissue changes which leads to shortening, tightness and reduced flexibility.

Aims. The aim of this study is to investigate influence of prolonged sitting on the development of hamstring muscle tightness in desk job employees.

Methods. In this cross sectional study 150 (75 men and 75 women) desk job employees were included. Active Knee Extension (AKE) test performed to measure popliteal angle. A universal goniometer used to measure the range.

Results. This study results showed that out of 150 participants 78 (52%) subjects presented with hamstring tightness. There was a statistically significant association between AKE test score and sitting time ($p = 0.00$), and a low positive correlation found between AKE score and sitting time ($r = 0.31$).

Conclusions. Hamstring tightness can be observed in the majority of the studied population. Prolonged sitting can be a potential risk factor to develop hamstring tightness in desk job employees.

Keywords: hamstring tightness, prolonged sitting, active knee extension test, desk job employees.

Introduction

The hamstring muscle attaches to the pelvic bone and is involved in pelvis and lumbar vertebra movements. When the hamstring muscle gets shortened, it can alter the movements of the pelvis and lower back during functional activities (Moon et al., 2023; Alschuler et al., 2009; Marshall et al., 2010).

Muscle tightness can occur due to reduced ability to deform and decreases joint range of motion. Hamstrings also such muscles, they can develop tightness and reduce knee joint range of motion due to many factors. If hamstring muscles are not able to achieve knee extension range above 160 degrees, while hip flexed at 90 degrees then it is said to be as hamstring tightness (Jabbar et al., 2021).

Hamstrings are a group of muscles in which the flexibility inhibition is very common in both the general and athletic population (Yadav et al., 2020). Tight hamstring muscles can limit anterior pelvic tilt while forward bending and creates excessive stress on muscles and ligaments in the lumbar region. Thus tightness in hamstring muscles could be risk factor for developing low back pain and other postural changes (Fatima et al.,

2017; Bhagyashree & Deepak., 2018; Reis & Macedo, 2015; Kanishka et al., 2019; Tiwari et al., 2015).

Many jobs in modern society require prolonged hours of sitting at work which can affect the flexibility of muscles (Fatima et al., 2017). In six to eight hours of sitting, hamstring muscles undergo degenerative and atrophic tissue changes. These changes lead to shortening, tightness and reduced flexibility of hamstring muscles (Rakholiya et al., 2021). The severe hamstring tightness causes chronic health problems like low back pain, sacroiliac joint pain and spondylolisthesis (Shukla & Patel, 2021; Mistry et al., 2014).

Prolonged sitting has been identified as a potential risk factor for developing hamstring tightness. Most of the modern workplaces require long hours of sitting at a desk which can easily affect muscle flexibility (Inoue et al., 2015; Mistry et al., 2014; Rakholiya et al., 2021; Shukla & Patel, 2021; Fatima et al., 2017; Yadav et al., 2020; Jabbar et al., 2021; Bhagyashree & Deepak. 2018; Batool et al., 2019).

Hypothesis

Based on the literature review we hypothesized that prolonged sitting could be a risk factor to develop

Received: 2023, October 17; *Accepted for publication:* 2023, October 25

Address for correspondence: Preventa Curo - Centre for Workplace Healthcare & Research; Ground floor, Block B, Qcity, Nanakramguda, Hyderabad, PC-500032, India

E-mail: Madhubabu@preventacuro.com

Corresponding author: Madhubabu Kothapalli; Madhubabu@preventacuro.com

https://doi.org/10.26659/pm3.2023.24.4.182

hamstring tightness in people who work long hours of time at office desks. This study findings might be helpful to prevent work-related musculoskeletal problems. This study is also helpful to create awareness about lack of normal muscular flexibility in desk job employees.

The aim of this study is to investigate the influence of prolonged sitting on the development of hamstring muscle tightness in desk job employees.

Material and methods

Ethical considerations

All the subjects participated voluntarily and explained about study procedure prior to the start of the study. An informed consent was obtained from all the participants. The institutional review board approved this study.

a) Period and place of the research

This cross sectional study was conducted at Preventa Curo-Workplace Healthcare Center located in Q City Tech Park, Hyderabad in India. The study was conducted for three months from February 2023 to April 2023.

b) Subjects and groups

The study was carried out in a consecutive sample method, recruited 150 office employees (75 men and 75 Women) from various companies within the Tech park. The study groups range from 22-45 years. All the participants were well explained about study procedures and any questions or concerns have been addressed. A no-objection form was read and signed by each subject prior to the study.

The participants included in this study were full time office employees with sitting time not less than 6 hours in a day. The selected subjects had no musculoskeletal injuries in the last six months from study period.

The participants were excluded if they had any history of recent musculoskeletal health problems, cardiovascular problems, neurological issues, spinal deformities, pregnancy and any kind of lower limb surgical procedures. The individuals who were involved in professional sports training and athletics were also excluded from this study.

c) Applied test

The Active Knee Extension (AKE) test is an objective

measurement test for hamstring muscle length, first described by Gajdosik & Lusin (1983). In this test, the subject was in supine position. The subject was instructed to flex hip at an angle of 90° and the contra-lateral limb was stabilized on the couch with knee full extension. Now the subject was asked to extend his/her leg at the knee joint. The end position of knee extension was held for 5 seconds and popliteal angle was measured using a universal goniometer. The end position of knee extension was determined by the criterion of pain in hamstring muscles. The AKE test was used to measure for both left and right knees and then mean value was recorded. The AKE test score of 20° and less than 20° considered to be hamstring tightness (Fatima et al., 2017; Reis et al., 2015; Hamid et al., 2013; Neto et al., 2015)

Data Collection

Anthropometric measurements like weight, height and Body Mass Index (BMI) were measured. Body weight was measured to the nearest of 100 grams with a weighing scale (Omron HN 286). A stadiometer (Stadiometer - Prime surgical) calibrated from 20-210 cm was used to measure height of each subject to the nearest of 1 mm. BMI was estimated by dividing weight in Kilograms by height in square meters.

d) Statistical processing

Data analysis was performed with use of JASP, version 0.16.2.0. The statistical significance level is set at $p < 0.05$. Mean and standard deviations used to summarize continuous variables and percentage and frequencies used to describe categorical variables. The association between prolonged sitting and hamstring muscle tightness was estimated with Pearson correlation.

Results

A total 150 desk job employees participated in this study, in which 75 (50%) were men and 75 (50%) were women. The basic demographic data was shown in Table I. The results of Table II show that 52% (men - 49.3% and women - 51.6%) of the subjects had AKE score more than 20° which is indicative of hamstring tightness.

Table I
Demographic data of subjects presented in Mean ± SD and range.

Indicators	Men				Women			
	Age	Weight	Height	BMI	Age	Weight	Height	BMI
Mean ± SD	29.49±5.3	82.01±11.59	1.74±0.05	26.94±4.45	29.72±5.13	71.61±11.34	1.63±0.19	26.01±4.36
Minimum	22	55	1.60	19.13	22	62	1.64	18.96
Maximum	45	101	1.73	36.21	45	108	1.85	38.51

BMI = Body Mass Index, SD = Standard Deviation.

Table II
Association between sitting time and Active Knee Extension (AKE) score.

Indicators	Time	AKE Score 'n' (%)		AKE Mean ± SD	P
		≤ 20°	> 20°		
Men	7 - 9	38 (50.6%)	37 (49.3%)	34.66 ± 17.91	0.00*
Women	7 - 9	34 (45.3%)	41 (54.6%)	36.98 ± 20.04	0.01*
Overall	7 - 9	72 (48%)	78 (52%)	35.82 ± 18.98	0.00*

* indicates significance at $P < 0.05$.

A low positive correlation was found between sitting time and AKE score ($r = 0.31$ and $p = 0.00$) in overall study population as well as individual category (men: $r = 0.33$ & $p = 0.00$ and Women: $r = 0.29$ & $p = 0.01$).

The mean value of AKE score in the study population was observed as 35.82 ± 18.98 with the 7-9 hours of sitting time.

Discussion

The results of this study show a relatively medium range of prevalence (48%) of hamstring tightness in desk job employees. Women population has shown slightly higher hamstring tightness than men (Women - 54.6% and men - 49.3%) and the reason might be culturally less involvement of women in sports and extracurricular activities.

In a study conducted by Mehreen Jabbar (Jabbar et al., 2021) in administrative staff also found the medium level prevalence rate (44.5%) which is similar to our study findings. Whereas, Kanishka GK found a high prevalence rate (83.4%) of hamstring tightness among sewing machine operators (Kanishka et al., 2019). This greater prevalence rate might be due to more physical work demands on lower limbs in Sewing machine operators unlike desk job employees.

This study hypothesized that prolonged sitting hours could be a possible risk factor for developing hamstring tightness among desk job employees. The results found significant low positive Pearson correlation between AKE score and sitting time of 7-9 hours ($r = 0.31$ and $p = 0.00$). In the present study, it was observed that prolonged sitting can increase hamstring tightness. Similarly, few other studies also found the positive association between sitting time and hamstring tightness (Fatima et al., 2017; Bhagyashree & Deepak., 2018; Reis & Macedo, 2015; Kanishka et al., 2019).

On the other hand, the study by Arab AM conducted in 508 subjects with age groups of 20 -65 years, found no impact of work environment on hamstring tightness (Arab & Nourbakhsh, 2014). The reason for this difference in findings might be a bigger sample size and larger range of age groups from 20-65 years.

Limitations of the study

Small sample size and methodologically cross sectional study cannot establish prolonged sitting as a primary cause to develop hamstring tightness. Many other etiological factors are not considered due to complexity of elimination problems. Future research requires a large sample size to get deep insight about cause-effect relationships.

Conclusions

1. Modern workplaces require long hours of sitting at a desk and prolonged sitting can be a potential risk factor to develop hamstring tightness.

2. Our study has found that prolonged sitting has positive association with hamstrings tightness in both men and women.

3. We conclude that long hours of sitting may be a

contributing factor to develop hamstring tightness in desk job employees.

4. This study findings may be helpful to prevent work-related musculoskeletal problems in office workers.

Conflict of interests

No conflict of interests

Acknowledgement

The author would like to thank all the employees from Q City tech park who volunteered for this study.

References

- Alschuler KN, Neblett R, Wiggert E, Haig AJ, Geisser ME. Flexion-relaxation and clinical features associated with chronic low back pain: A comparison of different methods of quantifying flexion-relaxation. *Clin J Pain.* 2009;25(9):760-766. doi: 10.1097/AJP.0b013e3181b56db6.
- Arab AM, Nourbakhsh MR. Hamstring muscle length and lumbar lordosis in subjects with different lifestyle and work setting: comparison between individuals with and without chronic low back pain. *J Back Musculoskelet Rehabil.* 2014;27(1):63-70. doi: 10.3233/BMR-130420.
- Batool F, Muaaz F, Tariq K, Sarfraz N. Relationship of Chronic LBP (Low Back Pain) with Hamstring Tightness in Professionals. *J Liaquat Uni Med Health Sci.* 2019;18(03):236-240. doi:10.22442/jlumhs.191830634.
- Bhagyashree K, Deepak A. Prevalence and severity of hamstring tightness among college students: a cross sectional study. *Int J Clin Biomed Res.* 2018; 4(2):65. DOI:10.5455/ijcbr.2018.42.14.
- Fatima G, Qamar MM, Ul Hassan J, Basharat A. Extended sitting can cause hamstring tightness. *Saudi J Sports Med* 2017;17(2):110-114. DOI: 10.4103/sjms.sjms_5_17.
- Gajdosik R, Lusin G. Hamstring muscle tightness. Reliability of an active-knee-extension test. *Phys Ther.* 1983;63(7):1085-1090. doi: 10.1093/ptj/63.7.1085.
- Hamid MS, Ali MR, Yusof A. Interrater and Intrarater Reliability of the Active Knee Extension (AKE) Test among Healthy Adults. *J Phys Ther Sci.* 2013;25(8):957-961. doi: 10.1589/jpts.25.957.
- Inoue G, Miyagi M, Uchida K, Ishikawa T, Kamoda H, Eguchi Y, Orita S, Yamauchi K, Takaso M, Tsuchiya K, Takahashi K, Ohtori S. The prevalence and characteristics of low back pain among sitting workers in a Japanese manufacturing company. *J Orthop Sci.* 2015;20(1):23-30. doi: 10.1007/s00776-014-0644-x.
- Jabbar M, Mustansar A, Arif S, Ayub T. Prevalence of Hamstring Tightness Due to Prolonged Sitting Among Administrative Staff of Government College University, Faisal Hospital and Commissioner Of Faisalabad. *Pakistan J Phys Ther (PJPT).* doi: 10.52229/pjpt.v4i1.994.
- Kanishka GK, Sandamali H, Weerasinghe I, Binduhewa L, Dilshara C, De Silva C, Silva D, Balasuriya A. Prevalence of hamstring tightness and associated factors among sewing machine operators. *Ceylon J Med Sci.* 2019; 56(1):24-31. DOI: <https://doi.org/10.4038/cjms.v56i1.4957>.
- Marshall PW, Mannion J, Murphy BA. The eccentric, concentric strength relationship of the hamstring muscles in chronic low back pain. *J Electromyogr Kinesiol.* 2010;20(1):39-45. doi: 10.1016/j.jelekin.2009.04.005.
- Mistry GS, Vyas NJ, Sheth MS. Comparison of hamstrings flexibility in subjects with chronic low back pain versus normal individuals. *J Clin Exp Res.* 2014; ; 2:85-88.

- Moon KY, Park DC, Kim WD, Shin D. Association Between Hamstring Shortness and Asymmetry, Pain Intensity, Disability Index, and Compensatory Lumbar Movement in 60 Patients with Nonspecific Chronic Low Back Pain. *Med Sci Monit.* 2023; 29:e939657. doi: 10.12659/MSM.939657.
- Neto T, Jacobsohn L, Carita AI, Oliveira R. Reliability of the Active-Knee-Extension and Straight-Leg-Raise Tests in Subjects With Flexibility Deficits. *J Sport Rehabil.* 2015;24(4):2014-2020. doi: 10.1123/jsr.2014-0220.
- Rakholiya, D.P., Patel, D.H., Ridhi, D., & Patel. Effect of prolong sitting on hamstring flexibility on schoolchildren: An observational study. *International Journal of Applied Research* 2021; 7(1): 348-353.
- Reis JFJ, Macedo AR. Influence of Hamstring Tightness in Pelvic, Lumbar and Trunk Range of Motion in Low Back Pain and Asymptomatic Volunteers during Forward Bending. *Asian Spine J.* 2015; 9(4):535-540. doi: 10.4184/asj.2015.9.4.535.
- Shukla M, Patel P. Correlation of Hamstring Flexibility with Sitting Hours and Physical Activity among Physiotherapy Students. *Journal of Pharmaceutical Research International,* 2021;33(40A):282:287. doi: 10.9734/jpri/2021/v33i40A32245.
- Tiwari M, Saurabh. Supine or standing hamstring stretch: which is effective for flexibility? a comparative study towards analysis of a mystery. *Indian J Clin Anat Physiol* 2015; 2(1):46-50.
- Yadav R, Basista R. Effect of prolonged sitting on hamstring muscle flexibility and lumbar lordosis in collegiate student. *Int J Health Sci Res.* 2020; 10(9):280- 289.