

Is hamstring muscle shortness responsible for low back pain in healthcare professionals?

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Ethics Committee Approval

The study was approved by the ethics committee
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All procedures in this study involving human
participants were performed in accordance with
the 1964 Helsinki Declaration and its later
amendments.

Conflict of Interest

No conflict of interest was declared by the
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Abstract

Background/Aim: Low back pain (LBP) is a highly prevalent pathology affecting more than half of our population. The lumbar region inherently possesses a complex structure; therefore, dozens of causes for the clinical presentation of acute/chronic pain are present. We focused on the impact of hamstring shortness on LBP in healthcare workers/professionals who need to keep medical records and perform invasive procedures while traveling overwhelming distances in relatively small workplaces.

Methods: Our research was designed as a cross-sectional study and was conducted at Beykent University Hospital from March to April 2022. Sixty-two otherwise healthy healthcare workers/professionals aged 25–45 (both male and female) volunteered. Two equal groups with and without LBP were created. Oswestry disability index, Roland–Morris score, Quebec LBP questionnaire, Visual Analog Scale (VAS), active/passive knee extension, sit and reach, and forward bending tests were performed in each group. The collected data were statistically analyzed (confidence interval [CI]=20%; $P<0.05$).

Results: Active/passive knee extension, sit and reach, and toe touch tests were significantly related to Roland–Morris, Quebec, and Oswestry Disability Index questionnaires; thus hamstring muscle shortness was significantly related to chronic low back pain ($P<0.05$). Short hamstring muscle length could accurately reflect the lower test scores obtained by the female participants.

Conclusion: Hamstring muscle shortness could explain a significant proportion of low back pain in healthcare professionals.

Keywords: low back pain, healthcare workers, hamstring shortness

Introduction

Low back pain (LBP) arises for a variety of reasons. Research suggests a 19%–39% rate for LBP in advanced countries and reported up to an 83% lifetime risk of having at least one episode of LBP [1]. Therefore, LBP could be characterized as a typical human problem. It also explains mild to moderate biomechanical disorders caused by micro-trauma and vertical imbalance, which consecutively emerge from a sedentary lifestyle or prolonged non-ergonomic mobilization. A recent meta-analysis emphasized a significant relationship between low back pain and the type of job in which the frequency escalates along with the increase in age [2].

After browsing the literature, we found that this particular situation was previously investigated several times using similar research schemes yet never in terms of a relationship with short hamstring length [3–6]. If unable to compensate via the knee joints, this hamstring shortening will revoke the adequate sagittal balance, tilting it posteriorly, and creating high pressure on posterior spinal structures. According to our hypothesis, medical recording performed while in a sitting posture and frequent paces in a relatively narrow workspace can lead to hamstring muscle shortening, consequently causing back pain.

Studies revealed an escalating pressure distribution within intervertebral discs in these body postures in a specific order: supine followed by sitting straight on a chair, by sitting in a slightly slouched posture on a chair, by erecting straightly up with knees flexed, holding an object manually while maintaining the previous posture, leaning all the way forward with knees extended, and last, taking an object from the ground while maintaining the previous posture [7,8] as shown in Figure 1. Jabbar et al. [6] investigated office workers and found a higher rate (55.5%) of hamstring muscle shortness and extended time spent in a sitting position. Individuals who spent over 6 h in a sitting position exhibited an 83% hamstring muscle tightness. Leaning forward to reach the toes seems simple; nevertheless, it is a complex mechanical synergy between the lumbar region and the hip joint. A sum of a 110-degree angle among the body and lower extremities exists of which 70 degrees originate from the hip joint and the remaining 40 degrees from the lumbosacral region [8,9] as shown in Figure 2.

Our research, on the other hand, focused only on axio-appendicular muscles, particularly on hamstring muscles. We attempted to assess any unfavorable effects caused by hamstring muscle shortness on LBP due to sitting for extended periods. Healthcare workers/professionals possess a high risk of becoming candidates for chronic LBP and are highly susceptible to this problem as they kept working in indoor conditions even throughout the coronavirus 2019 (COVID-19) pandemic.

Figure 1: Intradiscal pressures in various postures [19].

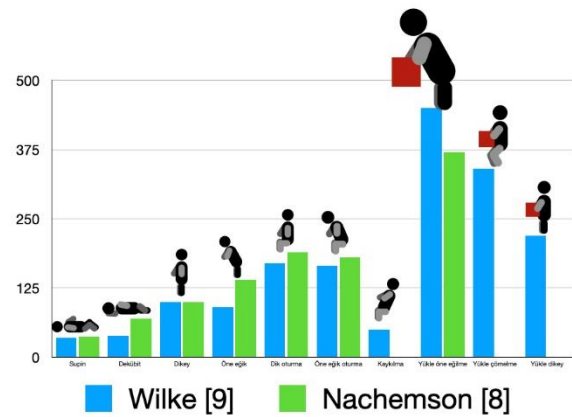
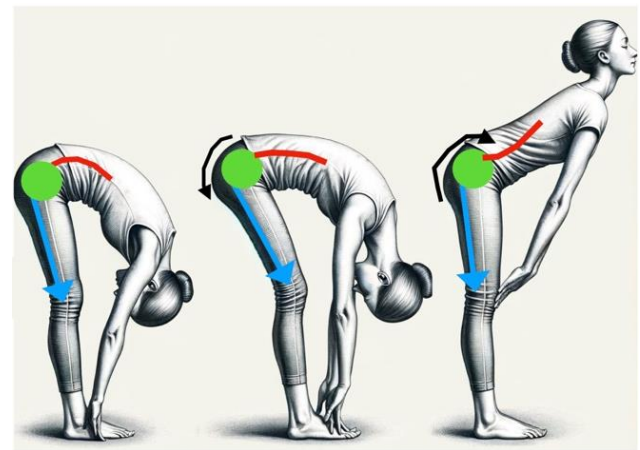


Figure 2: Importance of lumbopelvic rhythm during forward bending. Blue arrow – hamstrings, black arrow – pelvic tilt direction.



Materials and methods

The Yeni Yuzyil University Ethical Committee approval was granted before the commencement of our study (file no: 16.12.2021/43).

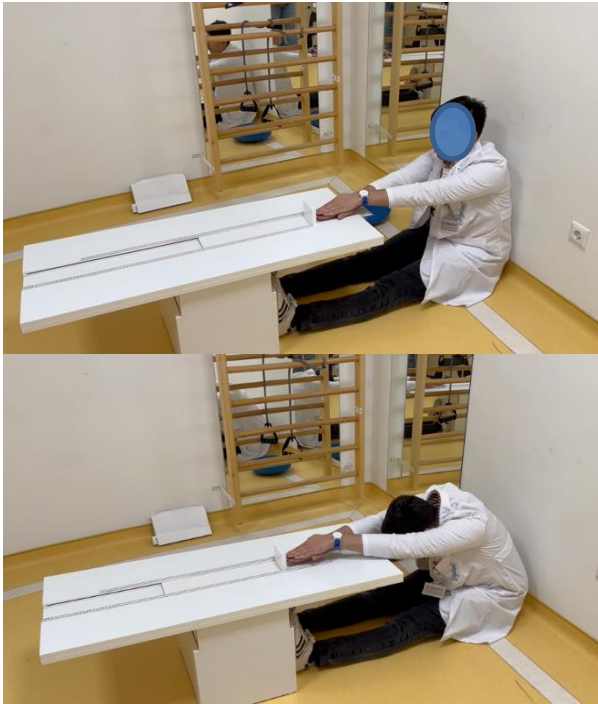
This cross-sectional research was conducted between March and April 2022 at Beykent University, and the study population consisted of 62 healthcare workers of both sexes between 25- and 45-year-olds working at Beykent University Hospital. Volunteers were randomly selected. Two groups were formed. The group with chronic LBP was compared to those with no pain in hamstring shortness. Chronic LBP was accepted as the pain lasted for not less than three days a week and was more protracted than at least three months.

Statistical analysis

Several tests were used to collect data: (1) Visual Analogue Score (VAS), (2) Quebec, Roland–Morris and Oswestry Disability Index (ODI) questionnaires, (3) Active Knee Extension (AKE), (4) Passive Knee Extension (PKE), (5) Sit and Reach (SR), and (6) Toe Reach (TR) tests.

We designed a custom-made modifiable mechanical device, particularly for the SR test (Figure 3). SPSS 25.0 was used for statistical analysis (confidence interval [CI]=20%, $P<0.05$). Levene, Shapiro–Wilk, Kolmogorov–Smirnov, Mann–Whitney-U, Kruskal–Wallis, and Chi-squared tests were applied.

Figure 3: Sit and reach test.



Results

A total of 62 individuals participated in the study, including 24 males and 38 females. Twenty-eight participants met the chronic LBP criteria and 34 were considered control participants (groups 1 and 2, respectively). Roland–Morris ($P=0.032$), ODI ($P=0.017$), SR ($P=0.012$), and TR ($P=0.005$) results presented significant differences between sexes in favor of females indicating a decreased rate of LBP; henceforth, this finding was interpreted as more flexible hamstrings and thus a lower rate of LBP.

A significant distinction between the two main groups (LBP versus normal) in terms of Roland–Morris ($P<0.001$), Quebec ($P<0.001$), ODI ($P<0.001$), AKE ($P<0.001$), PKE ($P<0.001$), TR ($P=0.005$), and SR ($P=0.005$) tests was found; therefore, the results were found to support our hypothesis.

We also compared anthropometric parameters, such as weight, height, leg, foot, and torso length, their proportional varieties, lower extremity circumferences, and other parameters. Several statistical tests were applied, and only one significant relationship could be built concerning LBP or hamstring shortness. A significant ($P=0.008$) positive correlation between PKE and AKE regarding advancing age was noted. Since this was a specific ratio, we concluded that not only did the passive range of motion improve with age, but active motion also deteriorated due to the degraded muscle power. Also, a wide range of people near the upper age limit of our study reported doing yoga, Pilates, and other stretching exercises, which might have contributed to the finding.

Also, the population was divided into three occupation groups: (1) doctors, (2) nurses, and (3) other data managers. No significant differences between these groups were found, indicating that all occupations presented the same weighted risk in terms of LBP.

Discussion

This study originated from an idea of at least 40 years of popularity [10]. Hamstring muscles possess a broad range of functionality over the knee joint and create a posterior tilt on the pelvis due to its origin and insertion [11]. Nevertheless, it has been only a couple of decades that hamstrings were felt to directly correlate to chronic LBP [12]. Similar study designs have already been published [13–15]. However, an adequate investigation of healthcare facility workers in terms of LBP has not been done to date, thus giving added value to our research.

Various epidemiological papers claim a higher rate of chronic LBP than predecessors [1,16]. There is a diversity of culprits such as a sedentary lifestyle, easy access to unhealthy food pumped with high carbohydrates that lacks fibers, low level of exercise and low demand of bipedal movement, consecutively bloating body mass index, which leads to inappropriate and rather non-ergonomic usage of muscles, accordingly, triggering an ache in the vertebral column and paravertebral structures. Although we did not find any relationship between BMI and chronic LBP, we must point out that we didn't have any attendees suffering from obesity. We wouldn't acknowledge the threshold of body mass index (BMI) to trigger the LBP, which is, in fact, out of context.

We included the 18–45 age range to rule out hyper- and hypo-elastic individuals. On the other hand, age 45 is also the upper age limit for ruling out degenerative musculoskeletal diseases that occur in older people. Reference studies used similar ranges for similar physiological features [1,3,5,6].

Figure 2 depicts forward bending through lumbopelvic rhythm during which the hip joint collaborates with the lumbar vertebrae to improve the reaching angle and expedite the movement. Pelvic posterior sagittal tilt eventually leads to vertebral misalignment, called flatback, which appears to be responsible for the exacerbated pressure on the front of the vertebral body and endplates. Considering that intervertebral discs are nourished through these zones, gradual degeneration occurs if flatback is left untreated. A meta-analysis proved this process was prevented by strengthening antagonistic quadriceps muscles [17]. On the other hand, we excluded all patients with severe spondyloarthritis and/or lumbar hernia, which abolished the possibility of our research to investigate these issues as causes of LBP.

Various choices are commercially available for the SR test, yet many of them need to pay attention to the aforementioned anthropometric measures that could induce slightly erroneous results. Therefore, we recruited two specific intertwined rulers and also marked initial and final points in each attendee to obtain the arm's length. We also adjusted the table height, exactly matching their xiphoid processes with -5 , 0 , $+5$, $+10$, and $+15$ cm stakes.

Hamstring muscles are the most susceptible muscles for shortening. Shortening aggravates the flatback, which leads to increased thoracic kyphosis because all motor nerves are attached to the spinal cord after which hamstring shortening causes a flare-up of the shortening in the whole posterior chain of muscles [18].

Some study limitations need to be discussed. Our study was conducted in a private clinic setup, which could differ from

other types of healthcare settings in many aspects, such as working conditions, hours, shifts, work environment, and other parameters. Therefore, these conditions might elicit some or even entirely different outcomes. Several centers with many participants are needed to strengthen the results of our research. Participant numbers might seem ample according to power analysis, but they are not diverse enough to create a pool with various symptoms that could be classified as metadata.

We relied on merely subjective forms and physical examinations in this study. A diagnostic tool, such as magnetic resonance imaging, would aid us in obtaining a more precise evaluation. Since it is a cross-sectional study, it would be satisfactory to include MRI results that could correlate with lumbago.

Conclusion

This study describes a relationship between hamstring muscle shortness and chronic LBP in otherwise healthy healthcare workers. We investigate gender, age, occupation, height, leg length, and weight in terms of hamstring muscle shortness for any relationship with LBP. Perpetual data recording and patient care due to an overwhelming workload and long work hours force healthcare facility workers to sit for prolonged hours in addition to inevitably sedentary leisure time, both of which cause hamstring muscle tightness. Therefore, an action as simple as addressing this issue in these workers would prevent chronic LBP for many healthcare workers and increase their overall welfare.

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