



A Cross-Sectional Study Determining Pain in Lower Back and Calf Muscles among Females Due to High Heel Shoe Wear

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ABSTRACT

Objective: To determine pain in lower back and calf muscles among females due to high heels shoe wear. **Methodology:** A sample size of 87 females working women and students were recruited on the basis of the purposive sampling technique. Participants were requested to wear 5 cm stiletto high heels and they were asked to walk on treadmill at the pace of 4km/hr for 20 minutes. Modified McGill Questionnaire for pain measurement was used as a tool before and after test data collection. **Results:** In this study observation of muscular pain was significant in lower limb and lower back muscles due to high heels i.e. 29.6% and 24.7% respectively. **Conclusion:** Back and lower limbs musculature pain contribute only 8.6% whereas, only back pain had been observed in 9.9%. Paired sample t-test was used to determine pain before and after test was significant with p-value 0.000.

Keywords: Musculoskeletal pain (MSK pain), McGill Questionnaire, High heel shoe wear, Lower back pain (LBP), Calf muscles

INTRODUCTION

Musculoskeletal pain, predominantly lower back pain exclusively types of chronic pain. Lower back pain is a progressive problem with an occurrence that is the highest in the third decade of life globally [1]. It was observed that lower back pain has become a considerable problem all over the world, while female of aged 40-80 years encounters highest number of incidence amongst others. The systemic review illustrates that the mean \pm SEM point prevalence of pain in lower back was estimated to be $11.9 \pm 2.0\%$, and the 1-month prevalence was estimated to be $23.2 \pm 2.9\%$ [2]. The stressful sensation often triggered by intense or detrimental aggravations is termed as pain [3]. Pain can be visualized as a fitness and health dare for a variety of noteworthy reasons [3,4]. Pain is perceived more among females than males [5].

High-heeled shoes are the influential symbol of modern female and women prefers to wear them, therefore, they are causing various musculoskeletal problems and exaggeration of prototypical feminine gait and risk of fall. The possible effect of wearing high heels on women's wellbeing had been stated in health setups for over 50 years and it is declared that footwear is the chief source of foot disorders [6].

Researchers have proposed that the usage of high heels can put into the sequence of back pain, knee pain, an augmented vulnerability towards degenerative knee osteoarthritis, lower back pain due to deviation in lumbar lordosis, and changes in gait, such as mobility and walking speed [7]. Extreme use of high-heeled shoes raises plantarflexion and leads to inadequate gastrocnemius and soleus elasticity, main antagonist, the tibialis anterior (TA) undergo changes, which, however, are debatable [8].

Russell, et al., stated that high heels shoe wears do not disturb lumbar lordotic curvature in vertical posture [9]. Even with these results, the effects of heel heights on lumbar lordosis and thoracic kyphotic curvature remains debatable specifically during gait. They investigated the role of inexperienced wearers with experienced wearers, on

the kinematics of the pelvis and spine while walking in shoes with different heel heights. They concluded that most people in standing position with high-heeled shoes did not disturb lumbar curvature [10,11].

In 2014 a descriptive analysis was conducted from biomechanical viewpoint showed that high heels rooted subjectively consistent modifications in the neuromechanics [8]. High heel shoe wears affects the ergonomics, kinematics, and kinetics of body structures such as from spine to toes in conditions like hallux valgus and osteoarthritis, both musculoskeletal disorders are more prevalent in women than men [12,13].

Wagner in 2012 specified using high-heeled shoes for walking usually result in venous complaints like fatigue, pain, and heaviness in legs. It was assumed, women using different types of high-heeled shoes confronted with decrease in venous return in comparison to standard values when they are barefoot. Following Four situations were repeated for assessment: barefoot (0 cm), medium heels (3.5 cm), stiletto high heels (7 cm), and platform high heels (7 cm). Pressure cuff was positioned on the calf muscles of the subjects to assess volumes. Muscle pump function decreased in case of high heel, which results in reduced EF and increased RVF values. The constant use of high heels results in aggravated venous hypertension in the lower limbs and may signify a contributing factor of venous disease symptoms [14].

Walaa, et al., detected that wearing high-heeled shoes (HHS) was described to fatalistically influence various parts of body structures. The significance of this study comes from the aspect that the position of the knee joint was stated to critically affect torque productivity of the calf muscle in persons who were not wearing high heels. Walaa took 24 healthy ladies who have never experienced any major neurological or musculoskeletal disorders. The subject was divided into two groups, High heel users and the control group. The results suggest that in habitual high heel users knee flexion has more effect on plantar flexion torque as compared to those non-users in which knee flexion has less effect on plantar flexion torque. By the long term use of high heeled shoes, the contractile action of soleus 5698 muscle could be more affected than the gastronomies muscle [15].

METHODOLOGY

A cross-sectional study was conducted. Data was collected from University of Lahore. Study was completed in four months. Purposive sampling technique was used to obtain the sample. 87 Young females were taken in the study out of which 81 completed the follow-up and 6 left the study. Young females having age between 18-32 years working women and students having no history of sprain, fracture and musculoskeletal disorder were included in the study. Exclusion criteria involve females having any postural deformity, congenital problem or having symptoms of radiating back pain. Young females who were not willing to fill questionnaire were also excluded. Patients who were unfit or unable to finish the questionnaire were also excluded. Pain was determined by using Visual analogue scale questionnaire (VAS). The data was analyzed using SPSS 21 version. Mean and Standard deviation expressed for continuous variables whereas frequency, tables, and percentage expressed for qualitative variables. 5 cm stiletto high heels shoe wear were used while walking on treadmill at 4km/hr pace for 20 minutes. The pain was observed after 10 minutes rest on numeric pain scale. For pain measurement, Modified McGill Questionnaire was used as a tool before and after test data collection.

RESULTS

The results were analyzed on SPSS version 21. For frequency and percentage, descriptive statistics were used and for correlation between pain before test and after test in high heels, Paired sample t-test was used. Out of 87 Women, 6 dropped out leaving 81 for analysis. Our study observation of muscular pain was mainly in foot, lower limb and lower back muscles due to high heels i.e. 29.6% and 24.7% respectively. Back and lower limbs musculature pain contribute only 8.6% whereas, only back pain had been observed in 9.9% (Table 1). High heels were responsible for soreness in foot and lower limb causing venous insufficiency in calves muscle. Lower Back muscles are also compromised due to increase in lumbar curvature (Figure 1).

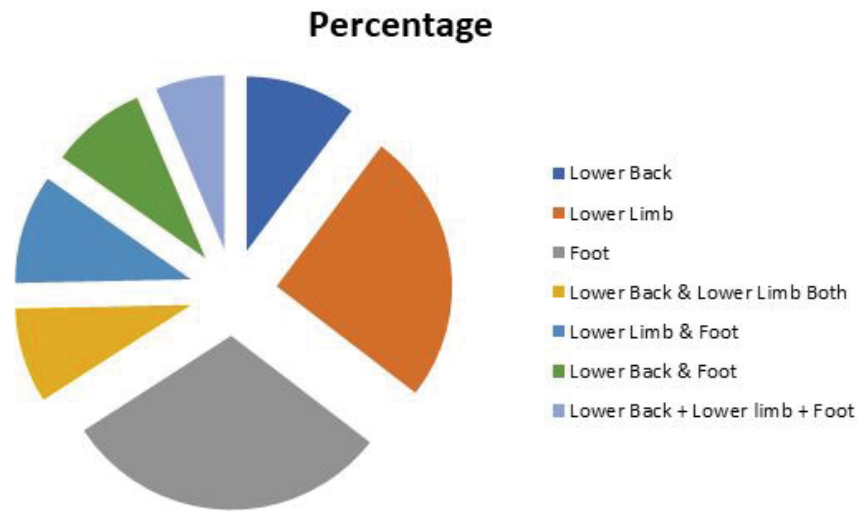


Figure 1 Percentage distribution of pain with high heels

Table 1 Frequency and percentage distribution of pain with high heels

Test Pain Area	Frequency	Percentage
Lower Back	8	9.90%
Lower Limb	20	24.70%
Foot	24	29.60%
Lower Back and Lower Limb Both	7	8.60%
Lower limb and Foot	8	9.90%
Lower Back and Foot	5	8.60%
Lower Back+Lower limb+Foot	5	6.20%
Total	81	100.00%

Table 2 Paired sample t-test

Pair 1	Paired Differences				
	Mean	Standard Deviation	t	df	Sig. (2-tailed)
Pain before test and after test in high heels	-2.74074	2.52378	-9.774	80	0

Table 3 Paired samples correlations

Pair 1	N	Correlation	Sig.
Pain before test and pain after test in high heels	81	0.33	0.003

Tables 2 and 3 showed that high heels users also have pain before test and experience pain after a walk on treadmill in high heels. There was a significant difference seen between the pair.

DISCUSSION

The purpose of doing this research was to find out the occurrence of muscular pain in youthful females because of high heels shoes by notifying its frequency. To the top of the author’s understanding that there were inadequate studies conducted regarding muscular ache because of choosing wrong footwear. Supplementary facts were taken enthusiastically. The incidence of pain due to wearing high heels contrarily to flat sandals was increasingly high at graph showing p-value=0.000 notably, but as per author’s opinion, there may be other causes related to it for. e.g. sedentary lifestyle, lack of muscle endurance, etc.

Wagner, et al., concluded that the venous function is altered by wearing high heel shoes. An essential factor of life which affects and improve the quality of life and health factors are ergonomics which study people’s efficiency in their working environment Factors such as prolonged period of standing, shoe wear quality, and working environment conditions may affect one’s individual health [14]. Broadly high heeled shoes had been connected as a probable reason for the uppermost incidence of osteoarthritis occurring in women [16]. There were gait changes significantly

seen linked with increasing heel height and increased weight. Shoes with heel heighted significantly decrease walking speed but walking speed was not affected by increased weight [17].

Another author named Lee, et al., Determined from his study that wearing high heels creates stress on the lumbar spine which results in prominent deviation of the normal curve of lumbar spine which creates more compression on the lumbar spine by increasing deviation of lumbar lordosis. The center of the body mass is affected by wearing high heel shoes, causing the upper half of a woman's body to bear more weight than normal. As a result it's become harder for erector spine muscles to work properly in and to compensate for abnormal posture [18].

CONCLUSION

It was concluded by the results of the study that there was a pervasiveness of muscular pain in youthful females due to high heels shoes. But there were certain limitations in this study which are as follows:

- The Sample was undersized
- The participants were mainly students out of a selected population due to accessibility constraint
- BMI was not considered as a variable in this study
- There was only a single investigator
- The author recommended that:
- The sample should be outsized enough
- Connected risk factors among the youthful population must also be assessed
- Posture estimation should also be done

DECLARATIONS

Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

REFERENCES

- [1] Cardoso, Jefferson Paixão, et al. "Prevalence of musculoskeletal pain among teachers." *Revista Brasileira de Epidemiologia*, Vol. 12, No. 4, 2009, pp. 604-14.
- [2] Hoy, Damian, et al. "A systematic review of the global prevalence of low back pain." *Arthritis and Rheumatism*, Vol. 64, No. 6, 2012, pp. 2028-37.
- [3] "Pain as a Public Health Challenge." Ed. Rona briere. *Relieving Pain in America*. Washington (DC): National Academies Press (US), 2011. p. 19.
- [4] Royster, Marcene Blakey. "See me, hear me: Perspectives of African American men on providers of health care." The University of Texas at Dallas, 2015.
- [5] Korkmaz, Nilufer Cetisli, Uğur Cavlak, and Emine Aslan Telci. "Musculoskeletal pain, associated risk factors and coping strategies in school teachers." *Scientific Research and Essays*, Vol. 6, No. 3, 2011, pp. 649-57.
- [6] Laurianngreene, Robert A Greene. "Risk factors for musculoskeletal disorders." *Save Your Hands*. Ed. Richard W Goggins and Janet M Peterson. USA: Body of Work Books, 2008. pp. 18-22.
- [7] Barton, Christian J., Julia A. Coyle, and Paul Tinley. "The effect of heel lifts on trunk muscle activation during gait: a study of young healthy females." *Journal of Electromyography and Kinesiology*, Vol. 19, No. 4, 2009, pp. 598-606.
- [8] Johanson, Marie A., et al. "Effect of heel lifts on plantarflexor and dorsiflexor activity during gait." *Foot and Ankle International*, Vol. 31, No. 11, 2010, pp. 1014-20.
- [9] da Costa, Bruno R., and Edgar Ramos Vieira. "Risk factors for work-related musculoskeletal disorders: a systematic review of recent longitudinal studies." *American Journal of Industrial Medicine*, Vol. 53, No. 3, 2010, pp. 285-323.

- [10] Karen J. Berkley. "Sex differences in pain." *Behav Brain Sci*, Vol. 20, 1997, pp. 371-80.
- [11] www.nimh.nih.gov/health/statistics/prevalence/
- [12] Ekman, A., et al. "Gender differences in musculoskeletal health of computer and mouse users in the Swedish workforce." *Occupational Medicine*, Vol. 50, No. 8, 2000, pp. 608-13.
- [13] Barton, Christian J., Daniel Bonanno, and Hylton B. Menz. "Development and evaluation of a tool for the assessment of footwear characteristics." *Journal of Foot and Ankle Research*, Vol. 2, No. 1, 2009, pp. 1-12.
- [14] Tedeschi Filho, Wagner, et al. "Influence of high-heeled shoes on venous function in young women." *Journal of Vascular Surgery*, Vol. 56, No. 4, 2012, pp. 1039-44.
- [15] Walaa H Elsayed, and Ahmed T Farrag. Effects of long-term use of high heels on knees flexion on calf muscles isokinetic strength. *ResearchGate*, Vol. 1, No. 1, 2015, pp. 1-3.
- [16] Titchenal, Matthew R., et al. "Effects of high heel wear and increased weight on the knee during walking." *Journal of Orthopaedic Research*, Vol. 33, No. 3, 2015, pp. 405-11.
- [17] Kerrigan, D. Casey, Jennifer L. Lelas, and Mark E. Karvosky. "Women's shoes and knee osteoarthritis." *The Lancet*, Vol. 357, No. 9262, 2001, pp. 1097-98.
- [18] Lee, Chang-Min, Eun-Hee Jeong, and Andris Freivalds. "Biomechanical effects of wearing high-heeled shoes." *International Journal of Industrial Ergonomics*, Vol. 28, No. 6, 2001, pp. 321-26.