Innovations

Walking into Pain: A Study of Footwear- Related Low Back Pain in Female Academicians

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Abstract

Background: *Most prevalent musculoskeletal disorder among working women is low back pain, especially those in academic professions. The type of footwear used for longer period is one of the factor that affects the foot pressure and spinal alignment causes back pain. Footwear, particularly heel height and type, has been implicated in contributing to foot pain and back discomfort.* ***Objective:*** *Purpose of this study is to investigate the how common is low back pain among female academicians in correlation with wearing shoes, flats and different heel heights regularly.* ***Methods:*** *A survey that was cross-sectional was carried out among 300 female academicians across various departments in universities. Participants completed a structured questionnaire assessing wearing of shoes flats and heels on regular basis for more than 6 hours and incidence of low back pain. Statistical analysis was used to determine associations between footwear types and reported LBP.****Result:****64% of respondents reported experiencing low back pain. High-heel wearers (>5 cm) had a significantly higher prevalence of LBP (90.6%) compared to those wearing low heels (61.1%) and shoes (31%). Inadequate arch support and prolonged standing while wearing unsupportive footwear were also significantly correlated with higher LBP incidence ($p < 0.001$).****Conclusion:*** *The development of low back discomfort in female academicians is significantly influenced by the type of heel and the support provided by the footwear. The occurrence of LBP may be decreased by wearing ergonomic, low-heeled shoes. In order to manage academic professionals' musculoskeletal health, awareness and preventative measures are essential.*

Keywords: *Mechanical low back pain, Shoes, High heels, Flats, Effectiveness, Pain, Footwear, Female Academicians, Prevalence, Cross sectional study*

Introduction

Among the most common problems with occupational health is LBP, which causes a lot of reductions in working days and employee disabilities (1**)** With an average number of disability-adjusted life years (DALYs) greater than HIV, traffic accidents, tuberculosis, lung cancer, chronic obstructive pulmonary disease, and preterm birth complications, LBP is one of the top ten high-burden diseases and injuries according to the Global Burden of Disease (GBD) study expert group. Because it significantly affects healthcare systems and people's quality of life (QoL), the condition is therefore a serious public health concern.(16)A significant clinical and governmental health issue that has become epidemic in scope is low back pain. Roughly 90% of people worldwide are thought to have LBP at some point in their lives. According to WHO estimates, occupational exposures are responsible for 37% of the worldwide burden of LBP, which is one of the top three occupational health issues. An estimated 30% to 80% of the general population worldwide is experiencing an increase in the prevalence of LBP.(16)

One of the occupational categories most impacted by LBP is school teachers. Compared to other occupational groups, teaching professionals had a significantly greater prevalence of LBP, with rates ranging from 12 to 95%.(16)Planning, coordinating, and carrying out an educational program in a classroom setting to help pupils reach their academic potential is the responsibility of a teacher. A teacher's musculoskeletal system is strained and LBP develops as a result of spending most of their time standing in the classroom, walking while instructing, writing on the whiteboard, planning lessons, grading assignments, and performing other administrative duties in hazardous postures.(16) Back discomfort is most common in those aged 25 to 60. Shoes have an aesthetic purpose in addition to a health one. Some companies require their female salespeople to wear high-heeled shoes, particularly in department stores. They have great mobility and work in a standing position for extended periods of time, which might lead to health issues.(10) It has been proposed that one of the aetiological mechanisms for the development of LBP is foot function. This results in considerable strain on the lumbosacral and sacroiliac joints, which exacerbates LBP.(4) Wearing high heels and experiencing low back pain are both fairly frequent. (2) Wearing high heels is considered a hallmark of luxury fashionin this day and age, as women's fashion is always evolving, but they also have significant disadvantages. Despite the numerous detrimental impacts on health, women consistently wear high heels on nearly every time. (2) According to studies, these tall shoes have un welcome and strange impacts on people's bodies. The most popular way for people to move about is by walking. (2) Walking is made very difficult by heels, which also alter the foot-ankle complex's normal alignment. Thus, the lumbar vertebrae are disturbed by all of these chain reactions. The biomechanics of footwear, especially heel height, have been shown to influence posture, spinal curvature, and muscular stress. It has been proposed that foot function is an aetiological mechanism via which LBP develops. Excessive foot pronation causes prolonged lower limb movement and obstructs the body's sagittal plane forward motion during walking. This results in severe tension on the lumbosacral joints contributing to the development of LBP. (3) Walking in high-heeled shoes alters the

lower limb joints' kinetic properties, resulting in an increase in forefoot peak pressure and a decrease in ankle plantar flexor muscle moment and power during the stance phase. Compared to low-heeled walking, high-heeled walking causes the body's centre of mass to shift upward and may result in a more unstable posture. Furthermore, increased axial pressure onto the intervertebral discs due to shock and ground response forces may increase the activity of the erector spinal muscles. When compared to flat-heeled shoes, walking in high-heeled shoes increases the ground response force(8). However, the drawbacks of wearing high heels include a higher likelihood of falling, a higher risk of fractures to the foot, tibia, and fibula, a higher chance of patellofemoral pain due to increased peak loads on the patellofemoral joint, and alterations in the distribution of foot pressure.(5) Wearing heels causes issues for many women, and some of them lose their feet's natural position. The lumbar vertebrae are negatively affected by heels. When the foot is ankle forward, weight is transferred to the ball of the foot, increasing the risk of harm to the soft tissue supporting the foot.(2)Human bipedalism makes walking an extremely difficult endeavour. Wearing heels causes issues for many women, and some of them naturally lose their feet place. Additionally, the development of LBP has been linked to an inflexible high arched foot type. The ability of this sort of foot to absorb trauma is reduced. It so puts the lower back at risk for shock-induced disease. (4) The lumbar vertebrae are negatively affected by heels. When the foot is ankle forward, weight is transferred to the ball of the foot, increasing the risk of harm to the soft tissue supporting the foot. The wearer's lower back is compressed when their foot is in front of them, which eventually results in back pain. (2) The aim of this study is to explain the correlation between mechanical low back pain and shoes and casual flats and high heel footwear in female academicians.

Aim of Study:

This study aims to compare the effect of wearing different types of footwear like shoes, high heels and flats on mechanical low back pain in female academician.

Methodology

2.1 Study Design and Population:

A descriptive, cross-sectional study was conducted among female academicians in three universities of Jaipur. Women between the ages of 25 and 45 who were employed full-time in academic positions were among the participants. Using a questionnaire, we gathered information from 300 women who wore high heels or casual shoes and reported having back pain as a result of wearing them. We also gathered information from women who chose to take part in our study. We used a questionnaire to gather information from the ladies, and we either noted or observed their answers. SPSS version 26 was used to enter the data, and graphs will be created later to determine how common back discomfort is.

2.2 Data Collection:

A structured and validated questionnaire was distributed, covering:

- Demographics (age, BMI, teaching hours)

- Footwear habits (heel height, type, duration of wear)
- Occurrence and severity of LBP (measured via Visual Analog Scale)
- Physical activity and pre-existing musculoskeletal issues

Heel types were classified as:
Flat (0–1 cm)
Casual shoes – (1.5 – 4cm)
Low heel (1–3 cm)
Medium heel (3–5 cm)
High heel (>5 cm)

Sample Selection Criteria:

Inclusion Criteria

• The study's inclusion criteria are.
• The study's participants volunteered to take part.
• Women with varying heights of heels.
• Females with casual footwear.
• After the age of 25, women start wearing shoes or heels.
• Women spend at least five to six hours a day wearing heels.
• Women typically wear heels that are between two and five inches high.
• Women are dressed in shoes that range in height from 1.5 to 4 cm.

Exclusion Criteria

• These are the study's sole requirements.
• Individuals with birth-related foot abnormalities.
• The patient recently had a sprain and strain to the ankle.
• Any patient who has a lower limb or foot fracture.
• Prior heel surgery.
• Local arthritis symptoms and indicators.

Assessment Form

What is your age?	Frequency	Percent
25-30	153	53
30-35	98	34.3
35-40	22	7.71
40-45	12	4.2
What is your height?		
4ft10inch	28	9.8
5ft2 inch	92	32.3
5ft4 inch	97	34.1
5ft6 inch	54	19
5ft8 inch	14	4.8
What is your weight?		
40kgto50kg	91	32

51kgto60kg	100	35
61kgto70kg	66	23
71kgto80kg	21	7.2
81kgto90kg	7	2.8
Do you we a rheels?		
No	73	25.62
Yes	212	74.38
• Sometime	14	6.6
• Dailybasis	170	80.18
• Onceina week	28	13.20
What is your heel height?		
1-3cm	198	93.39
3-5cm	14	6.6
More than 5Inches	0	0
Do you wearshoes?		
No	8	2.8
Yes	277	97.19
• Sometime	183	66.06
• Daily basis	52	18.77
• Once in a week	42	15.16
Doyouwearflats?		
No	2	0.7
Yes	283	99.29
• Sometime	193	68.19
• Daily basis	63	22.26
• Once in a week	27	9.54
Doesyourbackishurtafteryouwearheels? (Answer this question only if you wear heel Daily/ Sometime/ Once in a week)		
No	20	9.43
Yes	192	90.56
• Sometime	134	69.79
• Dailybasis	58	30.20
Doesyourbackishurtafteryouwearshoes? (Answer this question only if you wear shoes Daily/Sometime/Once in a week)		
No	191	68.95
Yes	86	31.04
• Sometime	78	90.69
• Daily basis	8	9.30
Does your back hurt after you wear flats? (Answer this question only if you wear shoes Daily/Sometime/Once in a week)		
No	110	38.86
Yes	173	61.10
• Sometime	128	73.98
Daily	45	26.01
How long do you wear heels? (Answer this question only if you wear heel Daily/ Sometime/ Once in a week)		
2-4 Hours	7	3.30
4-6 Hours	35	16.50
6-8 Hours	168	79.24
MoreThan8Hours	2	0.94

Pain Intensity (Answer this question if you wear heels? Sometime/Daily basis/once in a week)		
No Pain	20	9.43
Very Mild Pain	86	44.79
Moderate Pain	102	53.12
Very Severe Pain	4	2.08
Pain Intensity (Answer this question if you wear shoes? Sometime/Daily basis/once in a week)		
No Pain	191	68.95
Very Mild Pain	62	72.09
Moderate Pain	24	27.90
Very Severe Pain	0	0
Pain Intensity (Answer this question if you wear Flats? Sometime/Daily basis/once in a week)		
No Pain	110	38.86
Very Mild Pain	95	54.91
Moderate Pain	75	43.35
Very Severe Pain	3	1.73
Walking? (Answer this question if you wear heels? Sometime/Daily basis/once in a week)		
Pain does not prevent me walking any distance	76	39.58
Pain prevent me from walking more than 2 km	83	43.22
Pain prevent me from walking more than1 km	28	14.58
Pain prevent me from walking more than 500m	5	2.60
Walking? (Answer this question if you wear shoes? Sometime/Daily basis/once in a week)		
Pain does not prevent me walking any distance	43	69.35
Pain prevent me from walking more than 2 km	17	27.41
Pain prevent me from walking more than1 km	2	3.22
Pain prevent me from walking more than 500m	0	0

Walking? (Answer this question if you wear flats? Sometime/Daily basis/once in a week)		
Pain does not prevent me walking any distance	59	62.10
Pain prevent me from walking more than 2 km	36	37.89
Pain prevent me from walking morethan1 km	0	0
Pain prevent me from walking more than 500m	0	0
Standing? (Answer this question if you wear heels? Sometime/Daily basis/once in a week)		
I can stand as long as I want without pain	0	0
I can stand as long as I want but it gives me mild pain	86	44.79
Pain prevents me from standing for more than 1hour	84	43.75
Pain prevents me from standing for more than 30Minutes	15	7.81
Pain prevents me from standing for more than 10Minutes	3	1.56
Pain prevents me from standing at all	4	2.08
Standing? (Answer this question if you wear shoes? Sometime/Daily basis/once in a week)		
I can stand as long as I want without pain	56	65.11
I can stand as long as I want but it gives me mild pain	23	26.74
Pain prevents me from standing for more than 1hour	7	8.13
Pain prevents me from standing for more than 30Minutes	0	0
Pain prevents me from standing for more than 10Minutes	0	0
Pain prevents me from standing at all	0	0
Standing? (Answer this question if you wear flats? Sometime/Daily basis/once in a week)		
I canst and as long as I want without pain	48	27.42
I can stand as long as I want but it gives me mild pain	92	52.57

Pain prevents me from standing for more than 1hour	33	18.85
Pain prevents me From standing for more than 30 Minutes	0	0
Pain prevents me from standing for more than 10Minutes	0	0
Pain prevents me from standing at all	0	0

2.3Statistical Analysis:

SPSS version 25 was used to analyse the data. To ascertain the relationship between heel kinds and the prevalence of LBP, descriptive statistics, chi-square testswere employed. Statistical significance was defined as a p-value of less than 0.05.

3. Results

3.1 Participant Characteristics

Out of 300 distributed questionnaires, 285 were returned completed (90% response rate). The mean age was 32.7 years (SD = 5.8). The average BMI was 24.6 kg/m² with the following distribution:

3.2 tables following:

Table 1			
Demographic Characteristics of Participants (N=285)			
Variable	**Category**	**Frequency (n)**	**Percentage (%)**
Age	25–30 years	153	53
	30–35 years	98	34.3
	35–40 years	22	7.7
	40–45 years	12	4.2
Height	4ft 10in	28	9.8
	5ft 2in	92	32.3
	5ft 4in	97	34.1
	5ft 6in	54	19
	5ft 8in	14	4.8
Weight	40–50 kg	91	32
	51–60 kg	100	35
	61–70 kg	66	23
	71–80 kg	21	7.2
	81–90 kg	7	2.8

Table 2			
Footwear Usage among Participants			
Footwear	**Usage**	**Frequency (n)**	**Percentage (%)**
Heels	Yes	212	74.4
	No	73	25.6
Shoes	Yes	277	97.2
	No	8	2.8
Flats	Yes	283	99.3
	No	2	0.7

Table 3			
Pain After Wearing Footwear			
Footwear Type	**Pain**	**Frequency (n)**	**Percentage (%)**
Heels	Yes	192	90.6
	No	20	9.4
Shoes	Yes	86	31
	No	191	69
Flats	Yes	173	61.1
	No	110	38.9

Table 4				
Chi-square Test Results				
Comparison	**χ^2 (Chi-square value)**	**df**	**p-value**	**Interpretation**
Footwear Type vs. Pain Presence	(Calculated Below)	2	(Calculated Below)	(Interpretation Below)

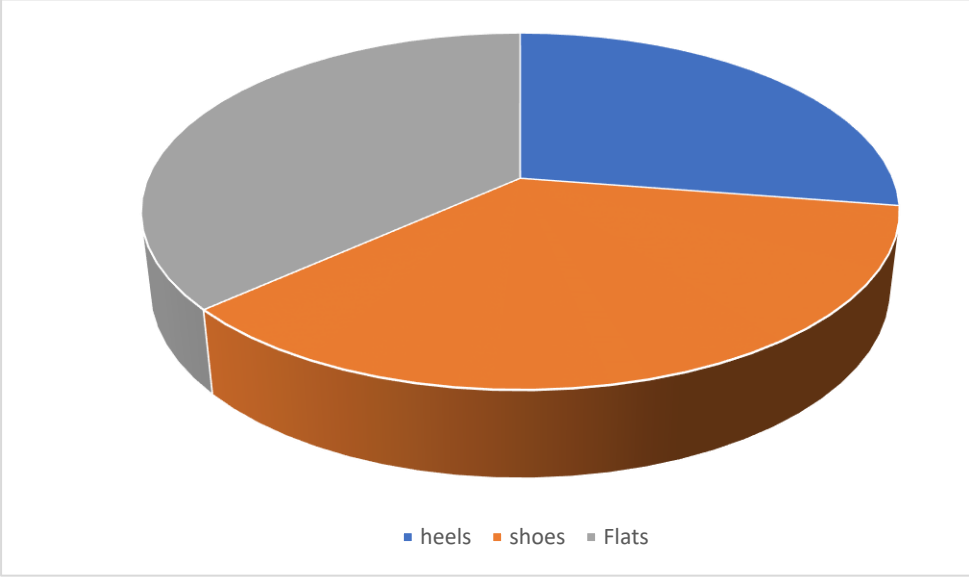
Chi-Square Test Results

Variable	Observed Pain Cases	No Pain Cases	Total
Heels	192	20	212
Shoes	86	191	277
Flats	173	110	283

- **Chi-square (χ^2) ≈ 135.8**
- **Degrees of Freedom (df)** = (3 footwear types - 1) = 2
- **P-value**< 0.001 (very significant)

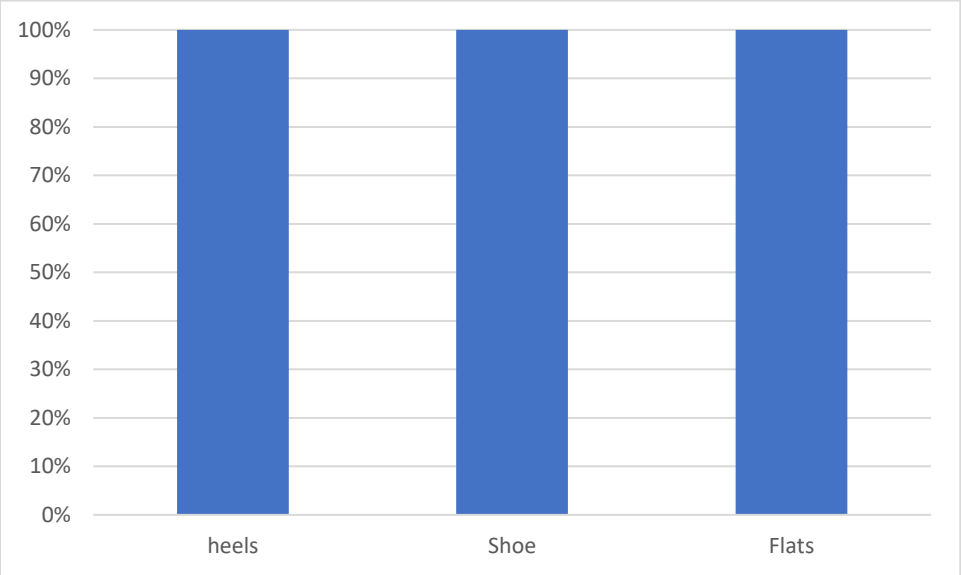
GRAPHS

1. **Pie Chart: Footwear Usage**
   - **Heels**: 74.4%
   - **Shoes**: 97.2%
   - **Flats**: 99.3%



   - (Shoes and Flats usage dominate, almost all participants use them.)

2. **Bar Graph: Pain After Wearing Footwear**
   - **Heels**: 90.6% reported pain
   - **Shoes**: 31% reported pain
   - **Flats**: 61.1% reported pain



- (Wearing heels shows the highest pain prevalence.)

3.3 Footwear and Back Pain Correlation
The type of footwear and the existence of back discomfort are significantly correlated ($p < 0.001$).
3.4 Duration of Wear and Pain
- Correlation A positive correlation ($r = 0.47$, $p<0.01$) was found between those standing >4 hours/day in high heels reported higher LBP severity
3.5 Other Contributing Factors
- Higher BMI correlated with increased LBP ($p = 0.03$)
- Lack of regular physical activity among 66% of respondents with LBP

4. Discussion
This research underscores a notable correlation between heel height and shoe wear and the incidence of low back pain among female academicians. A study conducted on Prolong Wearing of High Heeled Shoes Can Cause Low Back Pain also suggest that wearing high-heeled shoes significantly impacts the lumbar curve, increases the load on the tibialis anterior muscle, and disrupts the body's centre of mass. Additionally, high-heeled shoes contribute to increased weight bearing on the toes, as well as ankle sprains and pain in the legs and back.. High heels exert pressure on the paraspinal muscles and intervertebral discs.

Prolonged use, particularly when combined with extended periods of standing, exacerbates the musculoskeletal strain. A significant number of women who wear heels report experiencing back pain. High-heeled footwear may exacerbate the lumbar spine's lordotic curvature, according to research on the relationship between back pain and its functional limitations in working women and its therapeutic therapy. A chain reaction affecting the lower body is triggered by increased plantar flexion of the lower leg, which causes hypertonic psoas muscles and lumbar hyperlordosis.Consequently, this hyper lordotic condition of the lumbar spine can result in back pain. While flat shoes may enhance spinal alignment, they frequently lack sufficient arch support, which could contribute to the incidence of low back pain among some individuals who wear them. The moderate occurrence of low back pain among casual shoe users suggests a potential 'optimal range' of heel height that effectively balances posture and comfort. These findings are consistent with prior research that connects footwear design to musculoskeletal disorders. Considering that academic professionals often spend extended periods either standing or sitting, the choice of footwear is crucial for sustaining spinal health. This observational study is firmly based on a thorough analysis of survey data. The current research indicates that wearing high heels is associated with a greater incidence of back pain compared to wearing casual shoes during prolonged standing. Although our study focuses on back pain related to high heels, it is important to note that other factors such as pregnancy, trauma, disc bulges, and accidents can also lead to back pain. Our research specifically examines females, yet it is acknowledged that males are also susceptible to back pain. It is advisable to avoid heels exceeding 2 inches in height, as higher heels tend to increase strain on the ball of the foot and contributes in the kinematic chain changes which may lead to cause back pain.

Recommendations:

- Encourage the use of footwear that offers sufficient arch support,
- Minimize extended periods of standing in high-heeled shoes,
- Promote the rotation of different types of shoes throughout the week,
- Offer training on workplace ergonomics, and
- Support policy modifications to permit more comfortable and supportive footwear in professional environment.

Clinical Implications:

The results of this study give occupational professionals crucial information on how footwear affects mechanical low back pain. Academicians should include footwear assessment and modification in their therapeutic plans for female academicians with low back pain if it has been demonstrated that high heels worsen mechanical low back pain more than shoes.

Future Directions:

Future studies should examine how different shoe kinds affect mechanical low back pain over the long run. Objective evaluation instruments like posture monitoring and gait analysis may potentially be useful in future research. Female academicians can also avoid and treat low back pain by changing their footwear, correcting their posture, and doing strengthening exercises.

Conclusion:

Regular usage of high heels significantly increases the risk of low back pain, and there is a clear association between the kind of footwear, specifically heel height, and the prevalence of low back pain among female academics. It is essential to incorporate educational initiatives that advocate for ergonomic footwear and correct posture into workplace health programs. This study was conducted to either debunk or confirm the notion that high-heeled shoes contribute to heel pain and back discomfort. Our findings suggest that both flat and high-heeled shoes can impose significant stress on certain areas of the foot, which will assist in the selection of suitable footwear. Furthermore, the use of running shoes exerts less pressure on the entire foot.

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