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Physical Activity Level and Pain Incidence in Women Wearing High Heeled Shoes

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Abstract
This study was planned to investigate physical activity level and pain incidence in women who wear high heeled shoes (HHS) during the day. The study included 40 women wearing shoes with heels of 5 cm and above, with an average age of 30.95 ± 5.85. Demographic data of the participants were recorded. Foot and low back pain during movement and at rest were evaluated using Visual Analog Scale (VAS). Physical activity level of the participants was measured with International Physical Activity Questionnaire-Short Form (IPAQ-SF).As a result, 67,5% and 50% of participants had low back pain at rest and during movement respectively (mean: 3,43±3,18 at rest, 2,43±3,05 in movement) and 60% and 75% of participants had foot pain at rest and during movement respectively (mean:2,48±2,30 at rest, 3,08±2,47 in movement). Physical activity level of participants was $\bar{x}$= 726.51 ± 902.79 which indicates moderate level of activity. There was a significant correlation between Body Mass Index (BMI) and foot pain at rest ($r = 0,336 p<0.05$). No significant relationship was found between the physical activity level of the participants and pain level ($p > 0.05$). It was observed that women wearing high-heeled shoes had foot and low back pain at rest and during movement, but there was no relationship between physical activity level and pain level. We recommend foot rehabilitation programs to reduce the negative effects of high heeled shoes.
Key words: *high heeled shoes, physical activity, pain intensity*.

Introduction

The foot is the part of the human body that is in contact with the ground which transmits body weight to the ground and provides mobilization and is a dynamic part of the body that provides bipedal activities (1).The foot has been a subject of interest for researchers working in clinical and industrial fields for years due to its complex structure and functional properties (1).

High-heeled shoes (HHS) are defined as shoes with a higher heel than toes, and it has been reported that high-heeled shoes are considered a symbol of sexuality, gender, class or degree (2). Today, the proportion of women who regularly wear HHS varies between 37% and 69% (3). Studies have found that HHS have many negative effects with the change of body center of gravity and forces affecting the joints. These effects increase the risk of many diseases such as pain, knee, hip and spine joint problems (4).

Recent studies have shown that HHS can change the natural posture of the ankle joint and have significant effects on balance, posture, gait kinematics and foot stability (5-7). Changes n the ankle, such as a decrease in the range of active joint motion causes more effort to be spent during walking activity (6). Prolonged standing of the foot in plantar flexion causes change and pain not only in the ankle and knee joints, but also in the pelvis and spine (5). Studies have shown that wearing HHS for a long time is a potential risk factor for patella femoral pain syndrome and is reported to be the main source of permanent lower extremity pain (8,9). Additionally, HHS reduces the foot contact area of the foot, affect the balance negatively, change the center of gravity and increase the risk of falling (10).

Physical activity is defined as a behavior that involves human movement, including increased energy expenditure and improved physical fitness (11). Evidence gleaned from studies has demonstrated the benefit of physical activity on a wide-range of health outcomes in adults, including improved cognition, reduced chronic diseases and regular physical activity promotes health and prevents morbidity and mortality in older adults (12).The importance of physical activity in musculoskeletal system problems has been proven by studies (13).The relationship between musculoskeletal pain in women wearing HHS and the level of physical activity is unknown.

So, this study aimed to investigate physical activity level and pain level in women who wear heels for a long time during the day. We hypothesized that high physical activity level can affect pain level in women wearing HHS.

Material and Method

Data collected by face-to-face interview with women wearing HHS. Criteria for inclusion in the study; being between the ages of 20 and 40, wearing HHS with a height of 5 cm and above more than 6 hours a day. Those with congenital or subsequent orthopedic or neurological anomalies in the lower extremities, those with a history of foot related surgery, wearing padded shoes, and any participants who received any treatment related to the foot during the study were excluded from the study.

This study planned and conducted following ethical principles for medical research involving human subjects according to the Declaration of Helsinki. This study was also conducted in a manner that minimizes possible harm to human rights. All participants gave their informed consent to participate.

Participants' information like height, age, weight, body mass index (BMI), alcohol and smoking habits, occupation, working time, sitting time, and standing time were recorded with the socio-demographic information form. Women who volunteered to participate in the study signed an informed consent form. International Physical Activity Questionnaire (IPAQ) was used to determine the level of physical activity and Visual Analogue Scale (VAS) was used to assess pain level at low back and foot.

Outcome Measurements

Physical Activity Level: The physical activity level of participants in the last 7 days in daily life was measured using International Physical Activity Questionnaire-Short form (IPAQ-SF) (14). It consists of 7 questions in total. First 2 questions give us information about the level of high-intensity activity, 3rd and 4th questions give information about moderate physical activity, 5th and 6th questions give information about the amount of walking lasting more than 10 minutes and sitting time information is given in the 7th question. The amount of high intensity activity is calculated as 8 metabolic equivalent of task (MET), the amount of moderate intensity activity as 4 MET, and the amount of walking as 3.3 MET. The total MET value gives us the physical activity level of the person. The Turkish validity and reliability of the questionnaire was conducted by Sağlam et al (15).

Pain Intensity: Pain intensity at low back region and foot during movement and rest were evaluated using the Visual Analogue Scale (VAS). With this scale, the pain intensity of patients is converted into a numerical line on a horizontal line and evaluated between 0-10 (pain absence-unbearable pain) (16). Patients mark the severity of pain they feel on the line.

Statistical Analysis. Power analysis for the study was done with the G * Power 3.1.9.2.Package program. According to the results of the power analysis, a sample of 40 people was considered suitable for this study to achieve 95% power with an effect size of 0.5. While analyzing the socio demographic data obtained from the participants, frequency (F) and percentage (%) values were used. The Spearman test was used to examine the relationship between women's work, sleep and high-heeled shoe wearing durations and pain values, and to determine correlations between women's physical activity levels and pain intensity values.

Results

In this study, a total of 40 participants were evaluated. The average height of the women participating was 162.75 ± 5.81 cm, the average body weight was 60.95 ± 11.70 kg and the body mass index values were 23.09 ± 4.68 kg/m^2. 92.0% of the women were found to have dominant right extremities. Socio demographic characteristics of the participants are shown at Table 1.

When the average values of VAS are examined, we found that participants had foot pain and low back pain regularly. 67.5% and 50% of participants had low back pain at rest and during movement respectively and 60% and 75% of participants had foot pain at rest and during movement respectively. The foot pain at rest was $\bar{x}$= 2.48 ± 2.30, foot pain in motion was $\bar{x}$= 3.08 ± 2.47, low back pain at rest was $\bar{x}$= 3.43 ± 3.18 and low back pain in motion was $\bar{x}$= 2.43 ± 3.05 Descriptive statistics about the foot and low back pain of the participants are given in Table 2.

When the correlations between BMI, the duration of sleep, duration of wearing HHS and heel high were examined, it was found that there was a statistically significant correlation between BMI values and VAS (foot pain at rest) of the women participating in the study (r = 0,336, p = 0,034) (Table 3).

Table 1**.** Distribution of socio demographics of the sample.

Variable	Number (n)	Percentage (%)
Age (yrs)		
29 years and under	18	45,00
Between 30-39	16	40,00
40 years and above	6	15,00
Mean Age ± SD (yrs)	30,95±5,85	
Education Level		
Middle school / High School	12	30,00
University	28	70,00
Occupation		
Tourism	25	62,50
Banker / Accountant	13	32,50
Other	2	5,00
Chronic Disease		
Yes	3	7,50
No	37	92,50
Medication		
Yes	3	7,50
No	37	92,50
Alcohol Usage		
Yes	21	52,50
No	19	47,50
Smoking		
Yes	17	42,50
No	23	57,50
Exercise Quantity		
None	20	50,00
Low	7	17,50
Moderate	11	27,50
High	2	5,00

Table 2.Participants' foot and back pain values. (n=40)

VAS	Mean	Min	Max
Foot Pain at Rest	2,48±2,30	0	10
Foot Pain in Movement	3,08±2,47	0	8
Low Back Pain at Rest	3,43±3,18	0	10
Low Back Pain in Movement	2,43±3,05	0	9

VAS: Visual Analog Scale

Table3.Correlations between the participants' body mass index, sleep and high-heeled shoe wearing durations and pain levels. (n=40)

VAS		BMI	Sleep Duration	Duration of Wearing HHS	Heel Height
Foot Pain at Rest	r	0,336	-0,137	-0,167	-0,059
	p	0,034*	0,401	0,303	0,719
Foot Pain in Movement	r	0,227	-0,078	-0,095	-0,058
	p	0,158	0,633	0,561	0,721
Low Back Pain at Rest	r	-0,029	-0,342	-0,200	-0,223
	p	0,860	0,031*	0,217	0,166
Low Back Pain in Movement	r	-0,080	0,010	-0,197	-0,208
	p	0,625	0,949	0,224	0,199

*BMI: Body Mass Index, HHS: High Heeled Shoes, VAS: Visual Analog Scale, *p<0,05*

The women included in the study received $\bar{x} = 726.51 \pm 902.79$ points from IPAQ-SF, the lowest score received was 0 and the highest score was 4158 MET. The results of the correlations between the physical activity values and foot and low back pain values are shown in Table 4.

Table 4.Correlations between physical activity scores and foot and low back pain values

VAS		**IPAQ-SF**
Foot Pain at Rest	r	0,006
	p	0,969
Foot Pain in Movement	r	-0,132
	p	0,415
Low Back Pain at Rest	r	-0,167
	p	0,302
Low Back Pain in Movement	r	-0,056
	p	0,730

*IPAQ-SF: International Physical Activity Questionnaire-Short Form VAS: Visual Analog Scale, *p<0,05*

Discussion and Conclusion

In our study, women wearing HHS were evaluated to determine the physical activity levels and pain levels and also the relationship between these parameters. As a result of the evaluations, it was observed that as the BMI values of women increased, foot pain at rest increased as well. There were no statistically significant correlations between the physical activity values of women and pain values where our hypothesis could not be confirmed.

Our study results revealed that women wearing HHS has some level of foot and low back pain which is a parallel result to many studies in the literature. The use of HHS causes problems such as sprain and foot pain. Williams and Haines investigated the emergency department presentations for injuries that have been directly attributable to wearing HHS during 2006–2010 (17). They found that the majority of people injured were women and the most commonly injured body part was the ankle. Afzal et al. stated that HHS affect the lumbar curve, causing increased weight bearing on toes and leg and back pain. Wearing HHS also affect the stride length, walking speed and abnormal gait patterns (18). In a systematic review which included 18 studies, aimed to conduct the first systematic review regarding the association between HHS wear and musculoskeletal pain and both first-party and second-party injury. HHS were shown to be associated with musculoskeletal pain and first-party injury (19). In a recent study, Jabbar et al. showed that 77.5% of the population in their study complaint of forefoot pain due to the wearing HHS (20).

In a recent study conducted in 2018, Polat and Yucel showed that 53.12% of women who wore shoes less than 5 cm high and 78.94% of women who wore shoes higher than 5 cm had back, foot and knee pain problems (21). Nadeem et al., observed the relationship between the use of high-heeled shoes and low back pain and 56% of the participants participated in the study had back pain (22). In our study, in accordance with the literature, it was observed that wearing HHS increased the lower back and foot pain.

In our study, it was seen that as the participants' body mass index increased, foot pain increased. Tanamas et al. examined the relationship between obesity and foot pain in their study and determined that there was a positive relationship between BMI and foot pain (23). In another study done by Walsh et al. stated that as the body weight increases, the functions of the foot are limited, the foot pressure increases and by that the foot pain increases (24). These results are parallel to the results that we found in our study.

When the results of our study were examined, it was observed that low back pain decreased as sleep duration increased. Mammadov in his study did not find a statistically significant relationship between sleep quality and sleep score and level in patients with chronic low back pain (25). Harkness et al. stated that poor standing posture can be a risk factor for low back pain in the workplace (26). Studies indicated that posture deviates from the neutral position in standing posture and increases the risk of developing low back pain (27,28).

Physical activity level of our participants was moderate but did not have any relations on pain level. Although the physical activity level has been shown to be valuable in musculoskeletal problems, the results of our study were not compatible with this. However, the pain level of our study group was not high which might have caused this result. We could not find any study in the literature which investigated physical

activity level of women wearing HHS. Only one study investigated the relationship between physical activities level and the shaping of the feet and examined the relationship between hallux valgus angle and the type of footwear chosen. In their study Bac et al. found no correlation between the hallux valgus angle and the type of footwear chosen in their research groups and no relationship between physical activity level and transverse arch foot was found (29).

We think that our study has some limitations. In the assessment of pain, algometer can be preferred instead of the VAS which gives objective results. The question of "how many years have you used high-heeled shoes?" can also be added which may affect foot and low back pain of the women. A control group including women not wearing HHS to compare can also strengthen the study. Future studies with bigger population and better methodological properties are suggested.

In conclusion, it was observed in our study that women wearing HHS had foot and low back pain. In addition to the fact that there is no significant relationship between physical activity level and foot and low back pain, considering the negative relationship between BMI and foot pain, we suggest that women wearing HHS should keep their BMI within normal limits by performing regular physical activity.

Ethics Committee Approval. Ethics committee approval was received from the Ethics Committee of the University of Lefke (Ethics committee No: UEK / 07/01/12/1718/2). Conflict of Interest: The authors have no conflicts of interest to declare. Financial Disclosure: The authors declared that this study has received no financial support.

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