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Investigation of the relationship between foot length, foot pain and function

Ayak uzunluğu, ayak ağrısı ve fonksiyonu arasındaki ilişkinin incelenmesi

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ABSTRACT

Background: This study explores the relationship between foot morphology, foot pain, and functional limitations, focusing on how foot length and gender differences affect these factors. Foot pain is a prevalent issue affecting daily life and is influenced by factors such as foot structure, footwear choices, and gender.
Materials and Methods: . The study involved 218 university students, divided evenly by gender, who completed the Foot Function Index questionnaire, assessing pain, disability, and activity limitations.
Results: Data analyses revealed significant gender differences, with women experiencing more pain and functional limitations than men, possibly due to biomechanical and footwear differences. Chronic disease was also associated with higher levels of pain and limitations, aligning with the literature on chronic health issues' impacts on mobility and quality of life. Other factors, including psychological disorders, smoking, and terrain of upbringing, showed minimal impact on foot health, though footwear choice was notable—those wearing sneakers reported lower pain levels.
Conclusions: The study suggests that foot morphology and gender influence foot pain and function, emphasizing the importance of personalized interventions in footwear design and preventive care to improve foot health outcomes.

Keywords: Foot length, gender differences, foot pain, foot function, biomechanics

ÖZET

Amaç: Bu çalışma ayak morfolojisi, ayak ağrısı ve fonksiyonel kısıtlamalar arasındaki ilişkiyi araştırmakta, ayak uzunluğu ve cinsiyet farklılıklarının bu faktörleri nasıl etkilediğine odaklanmaktadır. Ayak ağrısı günlük yaşamı etkileyen yaygın bir sorundur ve ayak yapısı, ayakkabı seçimi ve cinsiyet gibi faktörlerden etkilenmektedir.
Materyal ve Metot: Çalışmaya, ağrı, sakatlık ve aktivite kısıtlamalarını değerlendiren Ayak Fonksiyon İndeksi anketini dolduran, cinsiyete göre eşit olarak bölünmüş 218 üniversite öğrencisi katılmıştır.
Bulgular: Veri analizleri, muhtemelen biyomekanik ve ayakkabı farklılıkları nedeniyle, kadınların erkeklerden daha fazla ağrı ve fonksiyonel kısıtlamalar yaşadığını ortaya koymuştur. Kronik hastalıklar da, kronik sağlık sorunlarının hareketlilik ve yaşam kalitesi üzerindeki etkilerine ilişkin literatürle uyumlu olarak, daha yüksek düzeyde ağrı ve kısıtlamalarla ilişkilendirilmiştir. Psikolojik bozukluklar, sigara kullanımı ve yetiştirilme tarzı gibi diğer faktörler ayak sağlığı üzerinde çok az etki gösterirken, ayakkabı seçimi dikkat çekicidir; spor ayakkabı giyenler daha düşük ağrı seviyeleri bildirmiştir.
Sonuç: Çalışma ayak morfolojisi ve cinsiyetin ayak ağrısı ve fonksiyonunu etkilediğini öne sürmekte ve ayak sağlığı sonuçlarını iyileştirmek için ayakkabı tasarımı ve önleyici bakımda kişiselleştirilmiş müdahalelerin önemini vurgulamaktadır.

Anahtar Kelimeler: Ayak uzunluğu, cinsiyet farklılıkları, ayak ağrısı, ayak fonksiyonu, biyomekanik

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INTRODUCTION

Foot pain is an important health problem that is common worldwide and seriously affects the quality of life of individuals. Foot pain has a great impact on public health, especially because it limits freedom of movement in daily activities and tends to become chronic. It is known that various biomechanical, environmental and personal factors play a role in the occurrence of foot pain. These factors include variables such as foot structure, foot length, alignment of foot bones, footwear preferences, gender, age and body weight (Sullivan et al., 2015). It is frequently emphasized in the literature that the characteristics of foot structure and foot length directly affect foot function and pain levels of individuals.

Foot length stands out as a fundamental factor affecting the distribution of body weight on the foot. In individuals with long or short feet, the distribution of body weight to the foot area may differ and this may affect foot function. Gender differences also play an important role in the occurrence and perception of foot pain. Differences in biomechanical structure, musculoskeletal system and movement patterns between men and women diversify pain perception and loss of function (Doherty et al., 2019). These biomechanical differences lead to marked differences in the occurrence and level of foot pain in men and women; for example, more frequent pain and functional limitations in female individuals due to foot length reveal that gender is a determining factor in this context.

Differences in foot structure and biomechanical characteristics between men and women have been widely reported in the literature on foot health and functionality. The fact that the foot structure of male individuals is generally wider and longer affects foot function by leading to different pressure distributions in footwear selection, movement patterns and physical activities (Mason, 2022). In contrast, female individuals generally have narrower and shorter feet, and this characteristic becomes evident in their choice of high-heeled and narrow shoes. Women's footwear preferences increase pressure on the foot, leading to more frequent foot pain and loss of function (Telfer, 2023). In addition, the foot structure, posture and musculoskeletal system characteristics of female individuals make them more prone to pain, especially in activities such as prolonged standing or walking.

Understanding the effects of gender differences on foot pain and loss of function is of great importance for individualizing treatment processes and developing gender-specific footwear designs. Designing footwear by taking into account the foot structure, length and biomechanical characteristics of male and female individuals is important not only in terms of aesthetics but also in terms of functional comfort and pain prevention. In this context, gender-specific foot structure analysis can contribute to the development of preventive and therapeutic strategies to improve individuals' quality of life (Leyh, 2022).

The aim of this study was to evaluate the effects of foot length on foot pain and function in men and women. Understanding the biomechanical differences between men and women and the functional consequences of foot structure will allow the development of strategies to improve foot health.

MATERIALS AND METHODS

Our study was conducted on university students between the ages of 17-25 who read the informed consent form and agreed to participate in the study. The study was conducted on 44 male and 174 female participants. For our study, the approval of the Ethics Committee of Malatya Turgut Özal University Interventional Clinical Research Ethics Committee 2024/49 was obtained. Our study was aimed at evaluating healthy foot characteristics, and individuals with deformities or functional disorders in the foot structure were excluded. In order to increase the reliability and efficiency of the study, individuals with hallux valgus, pes planus, pes cavus, hammer toe, talipes equinovarus, tailor's bunion, tarsal tunnel syndrome, previous foot surgeries, trauma history and orthopedic device use were not included in the study and the exclusion criteria of our study were determined. The questionnaire we conducted in our study consists of two parts. In the first part, demographic information was obtained from the individuals.

Demographic information: age, height, weight, gender, presence of chronic diseases, psychological illness, smoking, foot number, whether the place of residence was a province or a district, and whether the terrain where they were born and raised was hilly.

In the second part of the questionnaire, the Foot Function Index questionnaire was applied. The Foot Function Index is a self-completion assessment tool that assesses how foot problems affect the way people live their lives. The questionnaire consists of three main subsections: pain, disability and activity limitation. In each subsection, various questions were limited to the physical difficulties and limitations experienced due to foot problems. The questionnaire assesses the level of pain, difficulties in daily activities and limitations in individuals' mobility. The efficiency and performance of the questionnaire have been proven by the study and are widely used in the assessment of a variety of problems related to foot health. The questionnaire is very easy to answer and assesses a series of questions about their experiences with their feet over

the previous week using a scale of 0 to 10. Higher scores mean more pain, disability and activity limitation. With these features, the Foot Function Index is considered an ideal tool in clinical practice for treatment applications and for monitoring the functional development of individuals. The questions in the questionnaire are answered specifically according to foot complaints The Foot Function Index is widely used for the vital assessment of individuals, especially in foot health-related investigations. The questionnaire allows for a detailed clinical examination of pain and activity intensity (Yalıman, A.,. et al., 2014).

Biostatistical Data Analysis

Qualitative data from the variables included in the study were summarized with a number (percentage). Compliance of quantitative data with normal distribution was evaluated by the Shapiro-Wilk test. Quantitative data were summarized with median (minimum-maximum) and mean± standard deviation. Mann Whitney U test was used to for compare between two independent groups for quantitative variables where appropriate. Sperman Rho correlation coefficient was used to determine whether there was a relationship between variables. A value of $p<0.05$ was considered statistically significant in the statistical analysis. All analyses were performed using IBM SPSS Statistics 26.0 for Windows (New York; USA)

RESULTS

In Table 1, contains detailed descriptive statistics on the demographic and health characteristics of the participants. The gender distribution of the participants included 174 (79.82%) women and 44 (20.18%) men. The birthplaces of the participants were distributed across various provinces, with the highest birth rate coming from Malatya with 39 participants (18.57%), followed by Diyarbakır with 29 participants (13.81%) and Ağrı with 23 participants (10.95%). Although the number of participants from other provinces was lower, the lowest birth rates were from Sinop, Osmaniye, Samsun, Afyonkarahisar, Izmir, Greece, Gambia, Kars, Erzincan, Kayseri, Bitlis, Iğdır and Homs with 1 person each (0.48%).

Regarding the health status of the participants, 206 (94.50%) of them did not have chronic diseases and 12 (5.50%) of them had chronic diseases. In terms of psychological disorders, there were 216 people (99.08%) with no disorders and 2 people (0.92%) with disorders. In terms of smoking, 186 people (85.32%) were non-smokers and 32 people (14.68%) were smokers. Ninety-six (44.04%) of the participants live in the center of a province and 122 (55.96%) live in a district or village of a province. In addition, 87 (39.91%) of the participants stated that they were born and raised in rural and hilly areas, while 131 (60.09%) stated that they grew up in non-rural areas.

Table 1. Descriptive statistics table of demographic variables.

Variables		Number	**Percentage (%)**
Gender	Woman	174	**79.82**
	Man	44	**20.18**
	Adana	5	**2.38**
	Ağrı	23	**10.95**
	Adıyaman	10	**4.76**
	Van	15	**7.14**
	Malatya	39	**18.57**
	Kahramanmaraş	8	**3.81**
	Mardin	6	**2.86**
	Şanlıurfa	13	**6.19**
	Diyarbakır	29	**13.81**
	Mersin	2	**0.95**
	Gaziantep	5	**2.38**
	Muş	4	**1.90**
	Batman	6	**2.86**
	İstanbul	6	**2.86**
	Bingöl	3	**1.43**
	Elazığ	3	**1.43**
	Şırnak	4	**1.90**

Place of birth	Hakkari	4	**1.90**
	Siirt	4	**1.90**
	Giresun	2	**0.95**
	Sinop	1	**0.48**
	Osmaniye	1	**0.48**
	Syria	2	**0.95**
	Hatay	2	**0.95**
	Samsun	1	**0.48**
	Ordu	2	**0.95**
	Afyonkarahisar	1	**0.48**
	İzmir	1	**0.48**
	Greece	1	**0.48**
	Gambia	1	**0.48**
	Kars	1	**0.48**
	Erzincan	1	**0.48**
	Kayseri	1	**0.48**
	Bitlis	1	**0.48**
	Iğdır	1	**0.48**
	Hummus	1	**0.48**
Do you have a chronic disease?	No	206	**94.50**
	Yes	12	**5.50**
Do You Have Psychological Disorders?	No	216	**99.08**
	Yes	2	**0.92**
Do you smoke?	No	186	**85.32**
	Yes	32	**14.68**
Do you live in a town or village in a province?	No	96	**44.04**
	Yes	122	**55.96**
Is your hometown rural and hilly?	No	131	**60.09**
	Yes	87	**39.91**
Do you have a protruding big toe (HALLUKS VALGUS)?	No	197	**90.37**
	Yes	21	**9.63**
Do you wear high heeled shoes a lot?	No.	196	**89.91**
	Yes	22	**10.09**
Which type of shoes do you wear the most?	Sport	205	**94.04**
	Flat Base	13	**5.96**
		Mean±SD	**Median (Min-Max)**
Age		19.97±3.31	19(17-24)
Your height		166.81±8.23	165(150-196)
Your weight		60.88±12.64	58(40-106)
Your foot size		38.64±2.13	38(36-47)
Pain / Left Foot		12.3±14.6	7(0-66)
Pain / Right Foot		12.36±14.68	7.5(0-66)
Disability / Left Foot		12.95±15.11	8(0-86)
Disability /Right Foot		12.85±15.05	8(0-88)
Activity Limitation / Left Foot		3.37±6.46	0(0-35)
Activity Limitation / Right Foot		3.31±6.29	0(0-35)

SD: Standard Deviation, Min: Minimum, Max: Maximum

Considering the findings in Table 2;

Pain/Left Foot: The median value of pain was 9 (range: 0-66) in women and 3 (0-49) in men, and there was no statistically significant difference between the sexes (p=0.222). While the median value of pain was 20 (0-25) in individuals with chronic disease, it was 6.5 (0-66) in those without chronic disease and the difference was not statistically significant (p=0.629). The median value of pain was 13 (0-49) in smokers and 5 (0-66) in non-smokers, and no significant difference was found in terms of smoking (p=0.139). There was no statistically significant difference between those living in towns or villages and those living in cities in terms of pain median value (p=0.555). Although the effect of growing up in a rural or hilly area on pain was not significant, the median value was 8 (0-47) in those who grew up in a rural area and 5.5 (0-66) in others (p=0.718). The median value of pain was 6.5 (0-20) in those with foot protrusion and 7 (0-66) in those without, and no statistically significant difference was found (p=0.533). In addition, there was no significant correlation between the frequency of wearing high heels and pain (p=0.343).

Pain/Right Foot: The median value of pain was 8.5 (0-66) in women and 3.5 (0-49) in men and there was no significant difference between genders (p=0.345). The median value of pain was 21 (0-21) in individuals with chronic disease and 7 (0-66) in those without chronic disease and no significant difference was found (p=0.682). The pain median value was 13.5 (0-49) in smokers and 6 (0-66) in non-smokers and there was no statistically significant difference in terms of smoking (p=0.160). The place of residence and whether the place of growth was hilly or not had no significant effect on pain in the right foot (p>0.05).

Disability/Left Foot: The median value of disability was 9 (0-86) in women and 2.5 (0-52) in men, and a significant difference was found between genders (p<0.001). The median value of inadequacy was 18 (0-86) in individuals with chronic diseases and 7 (0-68) in those without chronic diseases, and a significant difference was found (p=0.055). Smoking and other lifestyle factors had no statistically significant effect on left foot disability (p>0.05)

Disability/Right Foot: When analyzed in terms of gender, the median value of disability was 9 (0-88) in women and 3 (0-46) in men, and a significant difference was observed (p<0.001). The median value of inadequacy was 12.5 (0-88) in individuals with chronic diseases and 7 (0-64) in those without chronic diseases; this difference was not statistically significant (p=0.133). Smoking, place of residence, place of growth and other factors did not have a significant effect on right foot disability (p>0.05).

Activity Limitation/Left Foot: While the median value of activity limitation was 0 (0-35) in women, it was the same value in men and a significant difference was found according to gender (p<0.001). The median value of activity limitation was 5 (0-29) in individuals with chronic disease and 0 (0-35) in those without chronic disease and the difference was significant (p=0.010). Other factors had no significant effect on activity limitation in the left foot (p>0.05).

Activity Limitation/Right Foot: The median value of activity limitation was 0 (0-35) in women and 0 (0-28) in men, and a significant difference was observed between genders (p=0.002). The median value of limitation was 3.5 (0-29) in individuals with chronic disease and 0 (0-35) in those without chronic disease, and no significant difference was found (p=0.081). Other factors had no statistically significant effect on activity limitation in the right foot(p>0.05).

Table 2. The effects of gender, chronic disease, smoking and lifestyle on foot pain, disability and activity limitation.

Variables	Pain/ Left Foot	p	Pain / Right Foot	p	Inadequacy/ Left Foot	p	Inadequacy/ Right Foot	p	Activity Limitation/ Left Foot	p	Activity Limitation/ Right Foot	p
Gender												
Woman	9 (0-66)	0.222	8.5 (0-66)	0.345	9 (0-86)	<0.001	9 (0-88)	<0.001	0 (0-35)	<0.001	0 (0-35)	0.002
Man	3 (0-49)		3.5 (0-49)		2.5 (0-52)		3 (0-46)		0 (0-29)		0 (0-28)	
Do you have a chronic disease?												
No	6.5 (0-66)		7 (0-66)		7 (0-68)		7 (0-64)		0 (0-35)		0 (0-35)	
Yes	20 (0-25)	0.629	21 (0-21)	0.682	18 (0-86)	0.055	12.5 (0-88)	0.133	5 (0-29)	0.010	3.5 (0-29)	0.081
Do you smoke?												
No	5 (0-66)	0.139	6 (0-66)	0.160	8 (0-86)	0.702	8 (0-88)	0.446	0 (0-35)	0.192	0 (0-35)	0.137
Yes	13 (0-49)		13.5 (0-49)		6 (0-52)		6 (0-52)		0.5 (0-29)		1 (0-28)	
Do you live in a town or village in a province?												
No	8 (0-66)		8 (0-66)		6.5 (0-86)		7 (0-88)		0 (0-35)		0 (0-35)	
Yes	5.5 (0-49)	0.555	7 (0-49)	0.489	9 (0-52)	0.413	9 (0-52)	0.405	0 (0-21)	0.902	0 (0-25)	0.887
Is your hometown rural and hilly?												
No	5.5 (0-66)		5 (0-66)		6 (0-86)		5 (0-88)		0 (0-33)		0 (0-31)	
Yes	8 (0-47)	0.718	8 (0-48)	0.618	10 (0-68)	0.015	10 (0-64)	0.004	0 (0-35)	0.435	0 (0-35)	0.177
Does your big toe protrude outwards?												
No	7 (0-66)		7.5 (0-66)		7 (0-68)		7 (0-64)		0 (0-35)		0 (0-35)	
Yes	6.5 (0-20)	0.533	7 (0-21)	0.658	11 (0-86)	0.191	9 (0-88)	0.570	1 (0-29)	0.375	0 (0-29)	0.865
Do you wear high-heeled shoes a lot?												
No	8 (0-66)		8 (0-66)		8 (0-86)		8 (0-88)		0 (0-35)		0 (0-35)	
Yes	5 (0-19)	0.343	6.5 (0-21)	0.381	4.5 (0-32)	0.356	5 (0-31)	0.390	0 (0-15)	0.159	0 (0-12)	0.392
Which type of shoes do you wear the most?												
Sport	6 (0-66)		6.5 (0-66)		7 (0-68)		7 (0-64)		0 (0-35)		0 (0-35)	
Flat Base	20 (0-47)	0.336	24 (0-48)	0.314	11 (0-86)	0.100	13 (0-88)	0.104	0 (0-29)	0.902	0 (0-29)	0.916

Variables are given as median (minimum-maximum) considering the normality of the distribution.* : Mann Whitney U test

In Table 3, the relationships between foot pain, disability and activity limitation variables were evaluated with Spearman's rho correlation coefficient. According to the results statistically significant positive correlations were found between the variables of pain (left and right foot), disability (left and right foot) and activity limitation (left and right foot) ($p<0.001$). For example, the correlation

coefficient between pain in the left and right foot was 0.978, indicating a strong positive correlation. A high level of correlation was also found between disability variables, with a correlation coefficient of 0.956 between left foot disability and right foot disability ($p<0.001$). Among the variables related to activity limitation, a correlation of 0.912 was found between limitation in the left and right foot and this relationship was significant ($p<0.001$). The correlations between foot size and other variables were weak and significant correlations were found only between left and right foot disability and foot size ($r=-0.160$, $p=0.018$ and $r=-0.150$, $p=0.027$, respectively). These results suggest that there is a strong relationship between pain, disability and activity limitation in foot health assessments.

Table 3. Correlation analysis between foot pain, disability and activity limitation variables.

Variables		Pain/Left Foot	Pain/Left Foot	Disability/ Left Foot	Disability/Right Foot	Activity Limitation/ Left Foot	Activity Limitation/Right Foot	Your foot size
Pain/Left Foot	r	1.000						
	p	-						
Pain/Left Foot	r	0.978**	1.000					
	p	<0.001	-					
Disability/Left Foot	r	0.850**	0.832**	1.000				
	p	<0.001	<0.001	-				
Disability/Right Foot	r	0.846**	0.844**	0.956**	1.000			
	p	<0.001	<0.001	<0.001	-			
Activity Limitation/Left Foot	r	0.761**	0.730**	0.756**	0.711**	1.000		
	p	<0.001	<0.001	<0.001	<0.001	-		
Activity Limitation/Right Foot	r	0.764**	0.749**	0.703**	0.724**	0.912**	1.000	
	p	<0.001	<0.001	<0.001	<0.001	<0.001	-	
Your foot size	r	-0.089	-0.084	-0.160*	-0.150*	-0.096	-0.078	**1.000**
	p	**0.428**	**0.458**	**0.018**	**0.027**	**0.159**	**0.252**	**-**

r : Spearman's rho correlation coefficient; *p<0.05; **p<0.001

In Table 4, shows the distribution of university students responses to the 23 questions asked to assess the relationship between foot length and foot pain and function. The 23 questions focused on measuring the severity of the participants foot pain, its impact on activities of daily living, and the difficulties they experienced in certain situations, and were asked separately for the right and left foot.

Table 4. Distribution of answers to the questions.

Questions	Categories	Number (Percent (%))
1. How severe is your right foot pain when it is at its worst?	0	**55 (25.23)**
	1	**23 (10.55)**
	2	**24 (11.01)**
	3	**35 (16.06)**
	4	**21 (9.63)**
	5	**33 (15.14)**
	6	**12 (5.50)**
	7	**8 (3.67)**
	8	**4 (1.83)**
	10	**3 (1.38)**
1. How severe is your left foot pain when it is at its worst?	0	**56 (25.69)**
	1	**25 (11.47)**
	2	**23 (10.55)**
	3	**34 (15.60)**
	4	**19 (8.72)**
	5	**36 (16.51)**
	6	**9 (4.13)**
	7	**4 (1.83)**
	8	**7 (3.21)**
	9	**2 (0.92)**
	10	**3 (1.38)**
2. Right How severe is your foot pain in the morning?	0	**135 (61.93)**
	1	**29 (13.30)**
	2	**19 (8.72)**
	3	**13 (5.96)**
	4	**3 (1.38)**
	5	**9 (4.13)**
	6	**2 (0.92)**
	7	**5 (2.29)**
	9	**2 (0.92)**
	10	**1 (0.46)**
2. Left How severe is your foot pain in the morning?	0	**135 (61.93)**
	1	**36 (16.51)**
	2	**20 (9.17)**
	3	**11 (5.05)**
	4	**5 (2.29)**
	5	**7 (3.21)**
	7	**2 (0.92)**
	8	**2 (0.92)**

3. How severe is your pain when walking right barefoot?	0	**115 (52.75)**
	1	**30 (13.76)**
	2	**27 (12.39)**
	3	**16 (7.34)**
	4	**8 (3.67)**
	5	**6 (2.75)**
	6	**7 (3.21)**
	7	**3 (1.38)**
	8	**2 (0.92)**
	9	**2 (0.92)**
	10	**2 (0.92)**
3. How severe is your pain when walking barefoot on the left?	0	**115 (52.75)**
	1	**31 (14.22)**
	2	**25 (11.47)**
	3	**16 (7.34)**
	4	**13 (5.96)**
	5	**9 (4.13)**
	6	**6 (2.75)**
	7	**1 (0.46)**
	8	**1 (0.46)**
	10	**1 (0.46)**
4. How severe is your pain when standing right barefoot?	0	**95 (43.58)**
	1	**36 (16.51)**
	2	**26 (11.93)**
	3	**19 (8.72)**
	4	**13 (5.96)**
	5	**8 (3.67)**
	6	**6 (2.75)**
	7	**6 (2.75)**
	8	**6 (2.75)**
	10	**3 (1.38)**
4. How severe is your pain when standing barefoot on the left?	0	**92 (42.20)**
	1	**39 (17.89)**
	2	**27 (12.39)**
	3	**18 (8.26)**
	4	**16 (7.34)**
	5	**8 (3.67)**
	6	**6 (2.75)**
	7	**6 (2.75)**
	8	**5 (2.29)**
	10	**1 (0.46)**
5. How severe is your pain when walking with the right shoe?	0	**104 (47.71)**
	1	**34 (15.60)**
	2	**22 (10.09)**
	3	**21 (9.63)**
	4	**9 (4.13)**
	5	**11 (5.05)**

	6	**8 (3.67)**
	7	**4 (1.83)**
	8	**1 (0.46)**
	9	**3 (1.38)**
	10	**1 (0.46)**
5. How severe is your pain when walking with the left shoe?	0	**103 (47.25)**
	1	**32 (14.68)**
	2	**30 (13.76)**
	3	**15 (6.88)**
	4	**8 (3.67)**
	5	**14 (6.42)**
	6	**7 (3.21)**
	7	**6 (2.75)**
	8	**1 (0.46)**
	9	**2 (0.92)**
6. How severe is your pain when standing with the right shoe?	0	**102 (46.79)**
	1	**29 (13.30)**
	2	**24 (11.01)**
	3	**22 (10.09)**
	4	**7 (3.21)**
	5	**13 (5.96)**
	6	**9 (4.13)**
	7	**6 (2.75)**
	8	**1 (0.46)**
	9	**2 (0.92)**
	10	**3 (1.38)**
6. How severe is your pain when standing with the left shoe?	0	**102 (46.79)**
	1	**32 (14.68)**
	2	**25 (11.47)**
	3	**20 (9.17)**
	4	**7 (3.21)**
	5	**12 (5.50)**
	6	**9 (4.13)**
	7	**4 (1.83)**
	8	**4 (1.83)**
	9	**1 (0.46)**
	10	**2 (0.92)**
7. How severe is your foot pain when walking with right insoles? (Leave blank if you do not use insoles)	0	**50 (60.24)**
	1	**13 (15.66)**
	2	**6 (7.23)**
	3	**6 (7.23)**
	5	**4 (4.82)**
	6	**1 (1.20)**
	7	**3 (3.61)**
7. How severe is your foot pain when walking with left insoles? (Leave blank if	0	**50 (59.52)**
	1	**16 (19.05)**
	2	**4 (4.76)**
	3	**5 (5.95)**

you do not use insoles)	5	**4 (4.76)**
	6	**2 (2.38)**
	7	**3 (3.57)**
8. How severe is your foot pain when standing with right insoles? (Leave blank if you do not use insoles)	0	**53 (63.10)**
	1	**10 (11.90)**
	2	**4 (4.76)**
	3	**7 (8.33)**
	4	**5 (5.95)**
	5	**2 (2.38)**
	6	**1 (1.19)**
	7	**2 (2.38)**
8. How severe is your foot pain when standing with left insoles? (Leave blank if you do not use insoles)	0	**49 (59.76)**
	1	**14 (17.07)**
	2	**5 (6.10)**
	3	**4 (4.88)**
	4	**5 (6.10)**
	5	**1 (1.22)**
	6	**1 (1.22)**
	7	**2 (2.44)**
	8	**1 (1.22)**
9. Right How severe is your pain in the evening?	0	**105 (48.17)**
	1	**27 (12.39)**
	2	**22 (10.09)**
	3	**23 (10.55)**
	4	**14 (6.42)**
	5	**13 (5.96)**
	6	**5 (2.29)**
	7	**2 (0.92)**
	8	**3 (1.38)**
	9	**2 (0.92)**
	10	**2 (0.92)**
9. Left How severe is your pain in the evening?	0	**110 (50.46)**
	1	**27 (12.39)**
	2	**19 (8.72)**
	3	**23 (10.55)**
	4	**14 (6.42)**
	5	**7 (3.21)**
	6	**7 (3.21)**
	7	**5 (2.29)**
	8	**4 (1.83)**
	9	**1 (0.46)**
	10	**1 (0.46)**
10. Right How much difficulty do you have walking around the house?	0	**145 (66.51)**
	1	**38 (17.43)**
	2	**10 (4.59)**
	3	**6 (2.75)**
	4	**6 (2.75)**
	5	**4 (1.83)**

	6	**5 (2.29)**
	7	**2 (0.92)**
	8	**1 (0.46)**
	10	**1 (0.46)**
10. Left How much difficulty do you have walking around the house?	0	**146 (66.97)**
	1	**39 (17.89)**
	2	**9 (4.13)**
	3	**12 (5.50)**
	4	**2 (0.92)**
	5	**4 (1.83)**
	6	**3 (1.38)**
	8	**2 (0.92)**
	9	**1 (0.46)**
11. Right How much difficulty do you have walking on uneven surfaces outside?	0	**93 (42.66)**
	1	**35 (16.06)**
	2	**22 (10.09)**
	3	**31 (14.22)**
	4	**12 (5.50)**
	5	**8 (3.67)**
	6	**7 (3.21)**
	7	**4 (1.83)**
	8	**1 (0.46)**
	9	**2 (0.92)**
	10	**3 (1.38)**
11. Left How much difficulty do you have walking on uneven surfaces outside?	0	**84 (38.53)**
	1	**41 (18.81)**
	2	**24 (11.01)**
	3	**28 (12.84)**
	4	**13 (5.96)**
	5	**10 (4.59)**
	6	**9 (4.13)**
	7	**3 (1.38)**
	8	**1 (0.46)**
	9	**1 (0.46)**
	10	**4 (1.83)**
12. How much difficulty do you have walking the right 300 meters?	0	**92 (42.20)**
	1	**33 (15.14)**
	2	**25 (11.47)**
	3	**22 (10.09)**
	4	**18 (8.26)**
	5	**7 (3.21)**
	6	**7 (3.21)**
	7	**5 (2.29)**
	8	**5 (2.29)**
	9	**1 (0.46)**

	10	**3 (1.38)**
12. How much difficulty do you have when you walk 300 meters left?	0	**92 (42.20)**
	1	**34 (15.60)**
	2	**25 (11.47)**
	3	**24 (11.01)**
	4	**13 (5.96)**
	5	**11 (5.05)**
	6	**7 (3.21)**
	7	**3 (1.38)**
	8	**7 (3.21)**
	10	**2 (0.92)**
13. Right How much difficulty do you have climbing stairs?	0	**102 (46.79)**
	1	**29 (13.30)**
	2	**27 (12.39)**
	3	**16 (7.34)**
	4	**18 (8.26)**
	5	**9 (4.13)**
	6	**7 (3.21)**
	7	**3 (1.38)**
	8	**3 (1.38)**
	9	**2 (0.92)**
	10	**2 (0.92)**
13. Left How much difficulty do you have climbing stairs?	0	**100 (45.87)**
	1	**31 (14.22)**
	2	**25 (11.47)**
	3	**19 (8.72)**
	4	**12 (5.50)**
	5	**13 (5.96)**
	6	**9 (4.13)**
	7	**2 (0.92)**
	8	**4 (1.83)**
	10	**3 (1.38)**
14. Right How much difficulty do you have going down stairs?	0	**124 (56.88)**
	1	**40 (18.35)**
	2	**17 (7.80)**
	3	**17 (7.80)**
	4	**6 (2.75)**
	5	**5 (2.29)**
	6	**4 (1.83)**
	7	**2 (0.92)**
	8	**2 (0.92)**
	10	**1 (0.46)**
14. Left How much difficulty do you have going down stairs?	0	**125 (57.34)**
	1	**39 (17.89)**
	2	**19 (8.72)**
	3	**15 (6.88)**
	4	**6 (2.75)**
	5	**4 (1.83)**

	6	**4 (1.83)**
	7	**3 (1.38)**
	8	**1 (0.46)**
	10	**2 (0.92)**
15. How much difficulty do you have standing on the tips of your right toes?	0	**80 (36.70)**
	1	**30 (13.76)**
	2	**34 (15.60)**
	3	**18 (8.26)**
	4	**12 (5.50)**
	5	**17 (7.80)**
	6	**8 (3.67)**
	7	**5 (2.29)**
	8	**3 (1.38)**
	9	**6 (2.75)**
	10	**5 (2.29)**
15. How much difficulty do you have standing on the tips of your left toes?	0	**78 (35.78)**
	1	**32 (14.68)**
	2	**31 (14.22)**
	3	**20 (9.17)**
	4	**16 (7.34)**
	5	**10 (4.59)**
	6	**11 (5.05)**
	7	**5 (2.29)**
	8	**4 (1.83)**
	9	**8 (3.67)**
	10	**3 (1.38)**
16. How much difficulty do you have getting up from the right chair?	0	**142 (65.14)**
	1	**29 (13.30)**
	2	**24 (11.01)**
	3	**8 (3.67)**
	4	**5 (2.29)**
	5	**5 (2.29)**
	7	**2 (0.92)**
	8	**1 (0.46)**
	9	**1 (0.46)**
	10	**1 (0.46)**
16. How much difficulty do you have getting up from the left chair?	0	**142 (65.14)**
	1	**31 (14.22)**
	2	**17 (7.80)**
	3	**14 (6.42)**
	4	**4 (1.83)**
	5	**4 (1.83)**
	6	**2 (0.92)**
	8	**2 (0.92)**
	9	**1 (0.46)**
	10	**1 (0.46)**
	0	**145 (66.51)**
	1	**31 (14.22)**

17. How much difficulty do you have getting off the right sidewalk?	2	**14 (6.42)**
	3	**7 (3.21)**
	4	**11 (5.05)**
	5	**6 (2.75)**
	6	**1 (0.46)**
	8	**2 (0.92)**
	10	**1 (0.46)**
17. How much difficulty do you have getting off the left sidewalk?	0	**142 (65.14)**
	1	**31 (14.22)**
	2	**13 (5.96)**
	3	**15 (6.88)**
	4	**4 (1.83)**
	5	**8 (3.67)**
	6	**1 (0.46)**
	7	**2 (0.92)**
	8	**1 (0.46)**
	10	**1 (0.46)**
18. Right How much difficulty do you have walking fast?	0	**103 (47.25)**
	1	**36 (16.51)**
	2	**26 (11.93)**
	3	**16 (7.34)**
	4	**13 (5.96)**
	5	**11 (5.05)**
	6	**3 (1.38)**
	7	**6 (2.75)**
	9	**2 (0.92)**
	10	**2 (0.92)**
18. Left How much difficulty do you have walking fast?	0	**103 (47.25)**
	1	**41 (18.81)**
	2	**19 (8.72)**
	3	**17 (7.80)**
	4	**14 (6.42)**
	5	**7 (3.21)**
	6	**8 (3.67)**
	7	**5 (2.29)**
	8	**1 (0.46)**
	9	**1 (0.46)**
	10	**2 (0.92)**
19. How much of the time do you have to stay at home all day long because of your Right Foot problems?	0	**151 (69.27)**
	1	**31 (14.22)**
	2	**13 (5.96)**
	3	**7 (3.21)**
	4	**4 (1.83)**
	5	**4 (1.83)**
	6	**2 (0.92)**
	7	**4 (1.83)**
	8	**2 (0.92)**
	0	**153 (70.18)**

19. How much of the time do you have to stay at home all day because of your left foot problems?	1	**31 (14.22)**
	2	**8 (3.67)**
	3	**13 (5.96)**
	4	**2 (0.92)**
	5	**7 (3.21)**
	7	**2 (0.92)**
	8	**2 (0.92)**
20. How much of the time do you have to take bed rest because of your right foot problems?	0	**139 (63.76)**
	1	**39 (17.89)**
	2	**12 (5.50)**
	3	**14 (6.42)**
	4	**4 (1.83)**
	5	**3 (1.38)**
	6	**4 (1.83)**
	8	**3 (1.38)**
20. How much of your time do you have to take bed rest because of your left foot problems?	0	**139 (63.76)**
	1	**40 (18.35)**
	2	**11 (5.05)**
	3	**10 (4.59)**
	4	**8 (3.67)**
	5	**4 (1.83)**
	6	**3 (1.38)**
	7	**2 (0.92)**
	8	**1 (0.46)**
21. Are your activities of daily living limited because of your right foot problems?	0	**145 (66.51)**
	1	**31 (14.22)**
	2	**14 (6.42)**
	3	**11 (5.05)**
	4	**2 (0.92)**
	5	**7 (3.21)**
	6	**2 (0.92)**
	7	**1 (0.46)**
	8	**2 (0.92)**
	9	**2 (0.92)**
	10	**1 (0.46)**
21. Are your activities of daily living restricted because of your left foot problems?	0	**148 (67.89)**
	1	**29 (13.30)**
	2	**10 (4.59)**
	3	**6 (2.75)**
	4	**6 (2.75)**
	5	**8 (3.67)**
	6	**3 (1.38)**
	7	**1 (0.46)**
	8	**4 (1.83)**
	9	**2 (0.92)**
	10	**1 (0.46)**
	0	**189 (86.70)**
	1	**12 (5.50)**

22. Right How much of your time do you use a walking aid (cane, walker, crutch) indoors?	2	**3 (1.38)**
	3	**3 (1.38)**
	4	**1 (0.46)**
	5	**8 (3.67)**
	6	**1 (0.46)**
	7	**1 (0.46)**
22. Left How much of your time do you use a walking aid (cane, walker, crutch) indoors?	0	**187 (85.78)**
	1	**14 (6.42)**
	2	**4 (1.83)**
	3	**4 (1.83)**
	4	**3 (1.38)**
	5	**4 (1.83)**
	6	**1 (0.46)**
	8	**1 (0.46)**
23. Right How much of your time do you use a walking aid (cane, walker, crutch) outdoors?	0	**190 (87.16)**
	1	**9 (4.13)**
	2	**6 (2.75)**
	3	**3 (1.38)**
	4	**4 (1.83)**
	5	**3 (1.38)**
	7	**2 (0.92)**
	10	**1 (0.46)**
23. Left How much of your time do you use a walking aid (cane, walker, crutch) outdoors?	0	**191 (87.61)**
	1	**10 (4.59)**
	2	**4 (1.83)**
	3	**1 (0.46)**
	4	**3 (1.38)**
	5	**3 (1.38)**
	6	**1 (0.46)**
	7	**2 (0.92)**
	9	**2 (0.92)**
	10	**1 (0.46)**

DISCUSSION

This study examined the effects of participants' demographic and health characteristics on foot pain, disability and activity limitation. The findings reveal the effects of gender, chronic disease status and lifestyle factors on foot health. It is important to evaluate how these findings overlap or differ from existing studies in the literature in order to grasp the general meaning of the results obtained.

In our study, it was determined that women showed higher values than men in terms of foot distress, insufficiency and activity limitation. Significant differences were observed between genders especially in left and right foot disability values ($p<0.001$). This finding is consistent with the literature supporting differences in pain perception between genders. Kaplan stated that women have higher pain sensitivity than men and the prevalence of chronic pain is more common in women (Kaplan, T. 2017). . Women's habits of wearing high heels may also contribute to increased foot pain (Güven et al., 2017). In addition, differences in women's connective tissue and muscle structure may also affect these pain levels (Aksoy, 2020).

In the study, it was observed that chronic diseases were at the level of inability to stand and incapacity, higher than those without chronic diseases. Although there were no significant differences in some of the findings presented, a significant difference was found especially in left foot activity limitation among individuals with chronic diseases ($p=0.010$). These results suggest that chronicity has a negavite should be adverse impact on foot health as well as on general health. Participants with chronic diseases had higher levels of disability and activity limitation than those without chronic diseases. The negavite should be adverse effects of chronic diseases on overall health and quality of life have been widely documented in the literature (Eales, et al., 2000). These diseases often limit mobility and make activities of daily living difficult. For example, chronic conditions such as diabetes mellitus can negatively affect foot health (Lewis, 2006).

In our study, psychological disorders did not have a significant effect on foot pain and disability, although there are different findings in the literature. Psychological disorders are known to affect pain perception and general health status (Fancourt, 2018). However, a significant relationship may not have been found in this study due to the low rate of psychological disorders. Smoking did not have a significant effect on foot pain and disability in our study. However, while

smoking has been shown to have negavite should be adverse effects on general health, some studies have found that smoking has no significant effect directly on foot pain or disability (Haverstock, 1998). Other studies evaluating the effects of lifestyle factors have obtained similar results (Thomas, et al., 2019). Whether participants were born and raised in rugged or mobile terrain has a limited effect on foot health. Although the degree of disability was higher in individuals who grew up in rural and hilly terrain, the difference was not significant ($p=0.015$). This finding suggests that walking and physical activity may be more likely in rural areas.

Hallux valgus status did not have a significant effect on participants' foot pain and disability levels. However, it has been reported in the literature that hallux valgus negavite should be adverse affects foot health and may lead to limitation of movement (Hutton, et al.,1981, Nix, S., et al.,2012, Hagedorn, et al.,2013). In this study, a significant relationship may not have been found due to the low prevalence of hallux valgus.

In our study, it was observed that a large majority preferred sneakers, which resulted in no pain in the feet and a lower risk for disability. However, it was found that pain and disability levels were higher in individuals who were given flat sole shoes. This finding emphasizes that footwear choice has a direct impact on foot health. It is noteworthy that the shoe preferences of the participants, especially those who wore sneakers, had lower levels of pain and disability. In the literature, it has been reported that proper footwear selection has a significant impact on foot health and that incorrect footwear choice can lead to foot pain (McRitchie et al., 2018, Rome et al., 2011). Living in the city or village did not have a significant effect on foot pain and disability. The mean age of the participants was 19.97±3.31 years and no significant relationship was found between age and foot pain. The mean height and weight of the participants were 166.81±8.23 cm and 60.88±12.64 kg, respectively, and no significant relationship was found between these variables and foot pain. A negavite should be adverse correlation was found between foot size and disability, and it was observed that individuals with larger foot size experienced less disability. This finding offers new areas of research on how foot structure may play a role in disability. There was no significant difference between left and right foot pain levels in the study.

CONCLUSION

This study evaluated the effects of gender, chronic disease status and lifestyle factors on foot health. Findings revealed that women and individuals with chronic diseases experienced higher levels of disability and activity limitation. Factors such as smoking and place of residence had no significant effect on these health problems. These results provide important information for planning preventive and therapeutic interventions for foot health. Future research should confirm these findings with larger sample groups and examine long-term effects.

This study has several limitations that should be considered when interpreting the results. First, the sample consisted only of university students aged 17–25, limiting the generalizability of the findings to other age groups or populations with different socio-demographic characteristics. The study also had an unequal gender distribution, with a predominance of female participants, which may have influenced the gender-related analyses.

Second, although the Foot Function Index is a widely used and validated tool, it relies on self-reported data, which may be subject to response bias or inaccuracies in participants' recollection of symptoms and experiences. Additionally, the study did not include objective measures such as gait analysis or imaging to complement the self-reported data.

Third, the cross-sectional design precludes the establishment of causal relationships. While associations between variables such as gender, chronic diseases, and foot pain were observed, the temporal or causal direction of these relationships cannot be determined.

Finally, the study focused primarily on biomechanical and demographic factors, without extensively exploring psychological, environmental, or cultural influences that might contribute to foot pain and function. Future research could address these factors with a more diverse and balanced sample, longitudinal designs, and the inclusion of additional objective assessments.

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Author Contributions:

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