

Cross-sectional study of podiatric health in Spain

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Abstract

Introduction

Podiatric health is crucial to people's overall well-being and independence but is often underestimated. Foot injuries are common, affecting mobility and increasing the risk of falls. This study aimed to evaluate podiatric health using the Foot Health Status Questionnaire (FHSQ) in the constructs of pain, function, general health and footwear.

Material and Methods.

Observational, analytical, cross-sectional and prospective study with 2,424 people over 18 years of age in Spain. The FHSQ questionnaire, which measures foot pain, foot function, footwear and general foot health, was applied.

Results

Of the participants, 1,998 were women and 426 men, with a mean age of 37.86 years. Significant differences were found between sex, with men reporting better results in "footwear". Geographic and age differences were also significant, with older adults reporting worse podiatric health.

Discussion

Podiatric health significantly affects quality of life. Differences by sex, age, and region indicate the need for personalized approaches to podiatric care. Promoting podiatric health should be a priority to improve overall well-being.

Conclusion

Foot health is fundamental. It is crucial to recognize its importance and improve podiatric education and services, focusing on the needs of different demographic groups.

1. Introduction

Foot health plays a crucial role in an individual's overall well-being, contributing to their independence, autonomy, and quality of life [1]. However, its importance is often underestimated, despite the growing incidence of foot injuries, which ranges from 61% to 79%, becoming a significant public health issue [1–4]. Chronic foot conditions can lead to a loss of ability to perform daily activities, affecting gait, balance, and increasing the risk of falls.

Podiatry, by addressing the treatment of various pathologies[4] that affect the foot, contributes to the promotion of health and well-being [5]. Both community and preventive podiatry highlight their impact on quality of life and public health [6]. The literature emphasizes the need for solid education in foot health to understand how socioeconomic determinants, lifestyles, and other factors influence foot health and, consequently, overall health [7].

To assess the impact of foot health on quality of life, various tools have been developed, such as the Foot Function Index [8], the American Academy of Orthopaedic Surgeons Foot and Ankle Module [9], the Patient Health Questionnaire [10], the Manchester Foot Pain and Disability Index [11], the Foot Health Status Questionnaire (FHSQ) [12, 13], and the Cumberland Ankle Instability Tool [14]. The FHSQ is considered a gold standard questionnaire to comprehensively evaluate foot health status, including pain, functional capacity, footwear, and general foot health [13, 15–18].

The main objective of this study is to assess the impact of foot health on the quality of life of the Spanish population by applying the FHSQ questionnaire. We aim to understand the foot health of the Spanish population concerning the variables Pain, Function, General Health, and Footwear.

2. Materials and methods

2.1. Study Design

An observational, analytical, cross-sectional, prospective population study was conducted, encompassing the Spanish population. The research received ethical approval from the Comité de Ética de la Investigación de la Universidad Católica de Valencia San Vicente Mártir (CEI). The project (UCV/2023-2024/055) was evaluated in the committee meeting held on November 19, 2023, and received a favorable ethical report issued on April 1, 2024. The study was carried out in accordance with the STROBE guidelines [19] (see Supplementary Materials A1) and followed the principles of the World Medical Association Declaration of Helsinki. All participants provided written informed consent [19,20] when completing the survey.

2.2. Participants

The study population will consist of all individuals over the age of 18 residing in Spain, regardless of sex, race, socioeconomic level, or health condition. The inclusion criteria are: a) individuals over 18 years of age, b) residents of Spain, c) ability to read, d) understand, and e) complete the questionnaire in Spanish. The exclusion criteria are: a) minors, b) individuals with diagnosed cognitive difficulties preventing them from understanding and responding to the questionnaire, and c) those with difficulty comprehending the Spanish language.

2.3. Sample Size

To determine the representative sample size, a 95% confidence level ($Z = 1.96$) and a 5% margin of error ($E = 0.05$) were used. Assuming a conservative proportion of 0.5 and maximizing the necessary sample size, a sample of approximately 385 individuals will be required to conduct the survey with a 95% confidence level and a 5% margin of error.

2.4. Intervention

All participants were asked to complete the Spanish version of the FHSQ self-report [10,16], a validated questionnaire that focuses on foot health-related quality of life. This questionnaire consists of three sections and provides two composite scores ranging from 0 to 100, where higher scores (closer to 100) indicate better quality of life in relation to foot health and general health, while lower scores (closer to 0) reflect worse quality of life in these aspects. Each question offers several response options on a Likert-type ordinal scale, and only one item is selected as the most appropriate response. The questionnaire does not provide a global score but specific indices for each domain, and to calculate these scores, the responses are entered into a computer program (FHSQ, version 1.03).

For this research, only Section 1 is used to address our objectives, which evaluates foot pain, foot function, footwear, and general foot health, with a specific number of questions: 4 on pain, 4 on function, 3 on footwear, and 2 on general foot health. Pain and function evaluations are based on physical phenomena, while the footwear evaluation considers practical aspects such as availability and comfort, and the perception of general foot health is based on patients' self-assessment. This section has shown high validity (Cronbach's $\alpha = 0.89\text{--}0.95$) and test-retest reliability (intraclass correlation coefficient = $0.74\text{--}0.92$) [16].

2.5. Questionnaire Administration

Data collection will be carried out by autonomous communities, starting with the Valencian Community. Local authorities, such as mayors and municipal staff, will be contacted to facilitate the dissemination of the survey both in person and online. Additionally, influencers and opinion leaders on social media will be contacted to promote participation in the survey. Promotional videos will also be created and disseminated through social media platforms such as Facebook, Instagram, and TikTok. The online version of the questionnaire will be available at: <https://forms.office.com/e/7Se0xCXg60>.

- **Sex:** This variable was classified as male and female.
- **Age:** The "age" variable was classified into three categories: Young adult, which includes individuals aged 18 to 35; Middle-aged adult, which includes individuals aged 36 to 55; and Older adult, which includes individuals aged 56 and older. This classification facilitates the segmentation of the adult population into different stages of life.

· **Province:** The "province" variable was established as a geographic category and classified into five regions: North, South, East, West, and Central. This categorization allows the grouping of provinces according to their geographic location within a given area. Spain is divided into 50 provinces, and each of them can be classified into one of the geographic categories: North, South, East, West, and Central (see Supplementary Material A2).

2.6. Statistical Analysis

All variables were coded according to the guidelines set by the FHSQ questionnaire authors for the constructs Foot Pain (questions 1,2,3,4), Foot Function (questions 5,6,7,8), General Foot Health (questions 9,13), and Shoes (questions 10,11,12).

All variables were expressed as mean and standard deviation (SD). The assumption of normality was assessed using the Kolmogorov-Smirnov test ($p > 0.05$). T-tests for independent samples were applied with the grouping variable sex, and ANOVA was conducted for the variables Geographic Category and Age.

Cohen's effect size (ES) was expressed as the standardized mean difference. The ES was considered trivial (<0.20), small ($0.20-0.59$), moderate ($0.60-1.19$), large ($1.20-1.99$), and very large (>2.00) (24). For effect size using ω^2 , it was classified as small: $\omega^2 \approx 0.01$; moderate: $\omega^2 \approx 0.06$; large: $\omega^2 \approx 0.14$ [21].

All analyses were conducted using statistical analysis software (JASP, Netherlands). The statistical significance level was set at $p < 0.05$, meaning that an association will be considered statistically significant when the p-value is less than 0.05.

3. RESULTS

The final analytical sample consisted of 2.516 respondents, with 81 excluded for not meeting the age criteria and 10 for incorrectly specifying their age, with values over 100 years. This left a total of 2.424 participants, of which 1.998 were women and 426 were men. The mean age was 37.86 ± 9.83 (Fig. 1).

Four variables related to foot health and footwear were examined: Foot Pain, Foot Function, General Foot Health, and Shoes (see Table 1).

Table 1
Comparison of Foot Health-Related Variables by sex.

Variable	Total (Mean $\pm$ SD) (n = 2.424)	Female (Mean $\pm$ SD) (n = 1.998)	Male (Mean $\pm$ SD) (n = 426)	P value	D de Cohen
Foot pain	78.52 $\pm$ 17.99	77.85 $\pm$ 18.08	81.63 $\pm$ 17.27	< 0.001	-0.20
Foot function	85.61 $\pm$ 19.87	85.10 $\pm$ 20.24	87.98 $\pm$ 17.86	0.006	-0.15
General foot health	73.07 $\pm$ 14.37	72.49 $\pm$ 14.22	75.78 $\pm$ 14.77	< 0.001	-0.23
Shoe	47.80 $\pm$ 28.99	44.52 $\pm$ 28.27	63.17 $\pm$ 27.37	< 0.001	-0.66

Although there are statistically significant differences between sex groups in all measures, the effect sizes are small for most of them, except for the "Shoe" measure, where a moderate effect size is observed. This implies that the largest difference between sex is found in the scores related to footwear, with higher scores for the male group compared to the female group (Fig. 2).

If we analyze these data by dividing them into the geographic categories of North, South, East, West, or Center, we can examine whether the same differences exist based on where we live (see Table 2).

Table 2
Comparison of Foot Health-Related Variables by Geographic Region

Variables (FHSQ)	center	North	South	East	West	P value	ω^2
Foot function	83.74 $\pm$ 22.54	84.44 $\pm$ 20.87	85.38 $\pm$ 19.73	87.19 $\pm$ 18.05	81.62 $\pm$ 23.28	0.002	0.005
Foot Health	72.12 $\pm$ 13.98	72.14 $\pm$ 14.37	73.18 $\pm$ 14.23	74.11 $\pm$ 14.73	70.58 $\pm$ 13.01	0.02	0.003
Shoe	44.79 $\pm$ 29.16	46.99 $\pm$ 29.14	44.92 $\pm$ 27.91	50.13 $\pm$ 28.87	47.76 $\pm$ 30.42	0.006	0.004
Foot pain	76.51 $\pm$ 20.26	77.43 $\pm$ 18.74	78.63 $\pm$ 16.91	79.32 $\pm$ 17.45	79.46 $\pm$ 15.78	0.10	0.001

The analysis of variance (ANOVA) performed for the variables Foot Pain, Foot Function, General Foot Health, and Shoe in relation to Geographic Category shows that there are significant differences between geographic regions for Foot Function ($F(4, 2259) = 4.09$, $p = 0.002$, $\omega^2 = 0.005$), General Foot Health ($F(4, 2259) = 3.05$, $p = 0.02$, $\omega^2 = 0.003$), and Shoe ($F(4, 2259) = 3.61$, $p = 0.006$, $\omega^2 = 0.004$), while Foot Pain does not show significant differences ($F(4, 2259) = 1.97$, $p = 0.10$, $\omega^2 = 0.001$). Although the differences in Foot Function, General Foot Health, and Shoe are statistically significant ($p < 0.05$), the effect sizes are small, indicating that geographic differences explain only a small proportion of the total variance in these

variables. This suggests that, despite the significant differences, the magnitude of the differences between regions is relatively small, which could be useful for further studies exploring other factors that contribute to variation in these foot health measures.

Table 3
Comparison of Foot Health-Related Variables by Age Group

Foot pain	Young adult (mean $\pm$ SD)	Young adult Middle (Mean $\pm$ SD)	Adult Older adult (Mean $\pm$ SD)	P value	ω^2
	80.34 $\pm$ 15.91	77.82 $\pm$ 18.44	69.86 $\pm$ 26.23	< .001	0.010
Foot function	87.29 $\pm$ 17.05	85.13 $\pm$ 20.69	75.77 $\pm$ 29.13	< .001	0.010
Foot Health	74.38 $\pm$ 14.56	72.40 $\pm$ 14.23	69.03 $\pm$ 13.19	< .001	0.007
Shoe	51.38 $\pm$ 28.35	45.45 $\pm$ 29.08	43.08 $\pm$ 30.35	< .001	0.010

The analysis of variance (ANOVA) conducted for the variables Foot Pain, Foot Function, General Foot Health, and Shoe in relation to Age shows that there are significant differences between age groups for Foot Pain ($F(2, 2421) = 18.69$, $p < .001$, $\omega^2 = 0.010$), Foot Function ($F(2, 2421) = 17.21$, $p < .001$, $\omega^2 = 0.010$), Foot Health ($F(2, 2421) = 9.81$, $p < .001$, $\omega^2 = 0.007$), and Shoe ($F(2, 2421) = 13.52$, $p < .001$, $\omega^2 = 0.010$). Although the differences in Foot Pain, Foot Function, General Foot Health, and Shoe are statistically significant ($p < 0.05$), the effect sizes are small, indicating that geographic differences explain only a small proportion of the total variance in these variables. This suggests that, despite the significant differences, the magnitude of the differences between regions is relatively small, which could be helpful for additional studies exploring other factors that contribute to the variation in these foot health measures.

4. Discussion

The results of this study reveal significant differences in the variables studied according to sex, geographic region, and age group. Regarding sex differences, it was observed that men reported better results in all variables analyzed [22], especially in the variable related to footwear, where the effect size was moderate (Cohen's $d = -0.66$). This difference may be related to various biological and social factors, such as differences in foot structure and social roles, which may influence exposure to specific risk factors and access to adequate podiatric care [23].

This could be due to women's greater tendency to use unsuitable footwear [24], which negatively affects their podiatric health. Studies have shown that many women report difficulties in finding comfortable and adequate footwear [25, 26], which is associated with higher levels of pain and foot problems [27].

Additionally, previous research has indicated that women have a higher prevalence of foot pain compared to men [27], linked to wearing inappropriate footwear, such as high heels and narrow shoes that do not provide the necessary support. Studies found a prevalence of 24% foot pain [28], and between 22% and 34%, which increases with age [29].

Geographically, although significant differences were found in foot function, general foot health, and footwear [29, 30], these differences were small. This suggests that while there are regional variations [28, 31], other factors may more significantly influence podiatric health. It is possible that differences in access to healthcare services and podiatric health education between regions play an important role [32].

Regarding age groups (Table 3), it was found that older adults showed worse outcomes in all variables [28, 30], indicating that aging has a notable impact on foot health [33–35]. This finding underscores the need for specific approaches for the elderly population, including adequate prevention and treatment programs for this demographic group. The relationship between age and the frequency and duration of foot pain is clear, with prevalence increasing exponentially.

The tools used to measure foot health-related quality of life, such as the FHSQ [4, 10], have proven useful in capturing the multiple dimensions of podiatric health, including pain, function, footwear, and general foot health. However, it is important to consider the continuous validation and cultural adaptation of these instruments to ensure their applicability in different population and geographic contexts.

The results of this study confirm the need for comprehensive podiatric care that considers differences in sex, age, and region. Foot health promotion should be a priority on the public health agenda to improve the quality of life of the entire population, especially in vulnerable groups such as older adults and women. The implementation of educational and preventive programs, as well as improving access to quality podiatric services, is recommended.

The data obtained also suggest that promoting podiatric health and educating people on proper footwear use can be effective strategies to improve quality of life, especially for women and older adults. The implementation of community podiatric health programs and raising awareness about the importance of foot care could help reduce the observed differences and improve overall well-being [5].

4.1 Limitations of the Study

This study presents several potential biases that could influence its results. A possible selection bias arises from including only individuals over 18 years old residing in Spain who understand and can complete the questionnaire in Spanish, thus excluding minors, individuals with cognitive difficulties, and non-Spanish speakers. The study sample has a significantly higher proportion of women (1.998) compared to men (426), which may skew the results, particularly if there are significant sex differences in podiatric health.

Although geographic differences were considered, the small differences found suggest a possible underrepresentation or overrepresentation of certain regions, which may not adequately reflect the regional diversity in podiatric health in Spain. Additionally, the classification of the "age" variable into only three broad categories (young adult, middle-aged adult, older adult) may oversimplify variations within each age group.

Further studies are needed to more accurately and comprehensively assess these findings and ensure that the results are representative of the population's diversity.

5. Conclusion

The results of this study underscore the importance of podiatric health in the overall quality of life of the Spanish population. Statistically significant differences were observed across sex, geographic regions, and age groups, with women and older adults showing poorer foot health outcomes. Footwear emerged as a key variable, particularly affecting women, likely due to inappropriate footwear choices. Despite regional variations in foot health, the effect sizes were small, suggesting that factors such as access to care and education may play a more critical role in determining podiatric health. Given the significant impact of foot health on mobility and independence, especially among older adults, there is a pressing need for targeted interventions, including education on proper footwear and access to podiatric services. Addressing these issues in public health initiatives could lead to substantial improvements in quality of life, particularly for vulnerable groups such as women and the elderly. Future research should focus on further exploring the underlying factors contributing to these disparities and developing tailored strategies for prevention and care.

Declarations

Ethics Statement

The study received ethical approval from the Comité de Ética de la Investigación de la Universidad Católica de Valencia San Vicente Mártir (CEI). The project was evaluated in the committee meeting held on November 19, 2023, and was granted a favorable report issued on April 1, 2024 (reference UCV/2023-2024/055). All participants voluntarily provided written informed consent.

Consent for publication

The patients gave their oral and written informed consent for the publication of their anonymous and clustered data and anonymous photographs.

Availability of data and material

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Competing interests

The authors declare that they have no competing interests

Author contributions

VPN: Data curation, Writing-original draft, Writing, review and editing. ECL: Formal analysis, Validation, Writing-original draft, Writing, review and editing. GGN: Formal analysis, Supervision and Validation. NFE: Writing, review and editing. MTGM: Data curation, Formal analysis, Supervision, review and editing JFT: Conceptualization, Software, Formal analysis, Supervision, Validation, Writing-original draft, Writing, review and editing.

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Appendices

Supplementary Material A1. STROBE guidelines

Supplementary material A2: Regions of Spain where the study was conducted.

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Figures

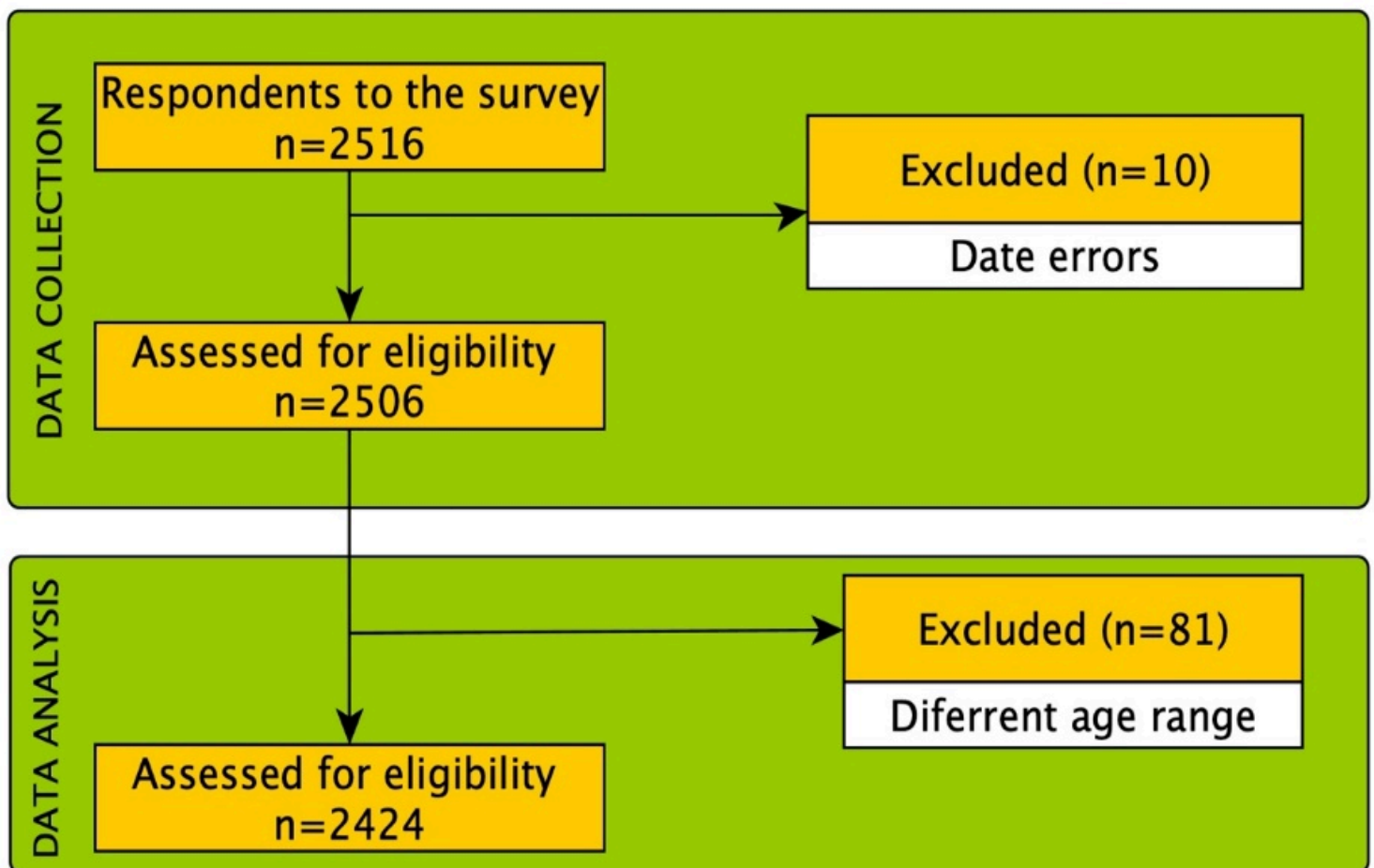


Figure 1

Flowchart of the selection and analysis process of the respondents included in this study.

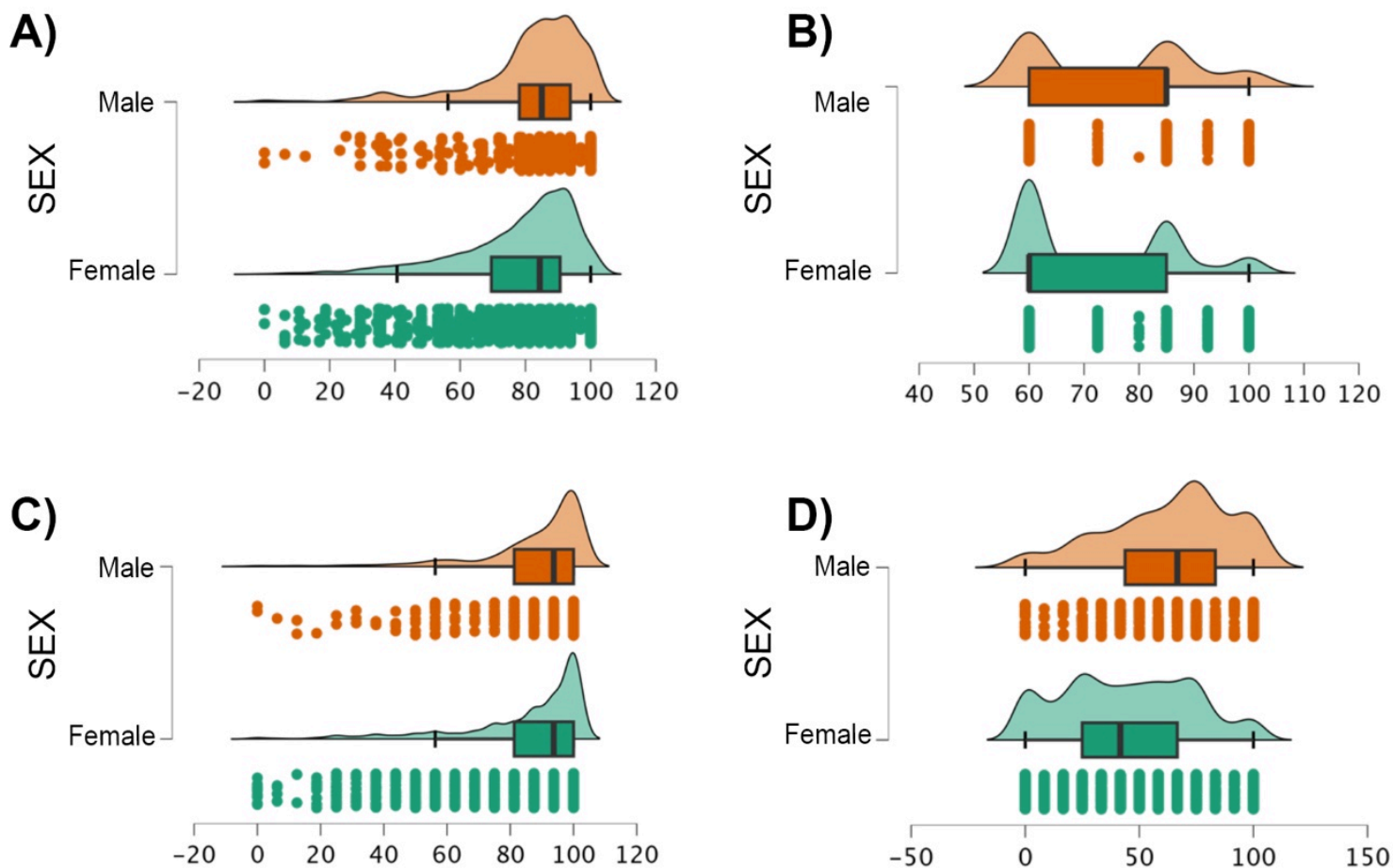


Figure 2

Distribution of Scores between Men and Women; A) Foot pain B) General foot health C) Foot function D) Shoe Footwear

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [Supplementarymaterial21.docx](#)
- [Supplementarymaterial11.docx](#)