








# Association between sex differences on foot health related to the quality of life in a sample of sedentary people

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## SUMMARY

*Sedentary (sitting) time may produce many anatomical and physiological consequences which are supposedly associated with a decreased quality of life (QoL) related to foot health. Accordingly, this study aimed to analyze the QoL impact on the overall health and the foot health among male and female sedentary people. A total of 312 participants with an age mean of  $39.81 \pm 15.40$  years completed all phases of the study. In addition, self-reported data were registered. The participants' sedentary lifestyle was determined using the European Prospective Investigation into Cancer and Nutrition (EPIC) physical activity questionnaire.*

*Furthermore, the scores obtained from the Portuguese version of the Foot Health Status Questionnaire were registered. Sedentary people in the equivalent metabolic energy had  $301.09 \pm 72.22$  (min/week). In the first section, values were higher for foot pain and foot function and lower for general foot health and footwear. In the second section, values were higher for general health and vigor and lower for physical activity and social capacity. The differences between the sex groups of the study were statistically significant for footwear ( $P = 0.008$ ), physical activity ( $P = 0.002$ ), social capacity ( $P = 0.001$ ) and vigor ( $P = 0.001$ ) showing a worst QoL related to foot health in favor of male subjects in comparison with females. The rest of the domains did not show any statistically significant difference ( $P \geq .01$ ). The sedentary population evidenced a negative impact on the QoL related to foot health. This problem may be associated with this lifestyle, especially for males.*

**KEYWORDS:** Foot. Foot Deformities. Foot Injuries. Quality of life. Sedentary lifestyle.

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## INTRODUCTION

Sedentary (sitting) time may be characterized by a lifestyle with reduced walking or activity, which consequently leads to a sitting, reclining or lying posture and decreased energy expenditure ( $\leq 1.5$  metabolic equivalent of task)<sup>1</sup>. This condition can have many anatomical and physiological consequences related to impaired health outcomes, leading to the development of anxiety<sup>2</sup>, certain types of cancer<sup>3,4</sup> cardiovascular diseases<sup>4,5</sup> cholesterol<sup>6</sup>, depression<sup>7</sup>, diabetes<sup>8</sup>, high blood pressure<sup>9</sup>, metabolic syndrome<sup>10</sup>, musculoskeletal pain<sup>11</sup>, overweight<sup>12</sup>, obesity<sup>13</sup>, osteoporosis<sup>14</sup>, and other mortality causes<sup>15</sup>.

Furthermore, the prevalence and severity of sedentary lifestyles in females and males worldwide are high, estimated between 60-85%, with considerable harmful impacts that involve significant public health burdens and an enormous cost for individuals, society, and health care systems<sup>16,17</sup>. However, no prior research has been conducted on the negative health effects on the quality of life (QoL) related to foot health.

Also, there is a high prevalence rate of foot pathologies comprised between 71% and 93%<sup>18</sup> (i.e., cavus foot, flat foot, hallux rigidus, hallux valgus, hyperkeratosis, lesser toe deformities, metatarsalgia, Morton's neuroma, nails disorders, plantar fasciitis and tailor's bunions)<sup>18-2</sup>, which could be associated to a sedentary lifestyle and a potential factor in predicting loss of overall health.

Based on the foregoing and on the need for assessment, evaluation, and examination of the foot health of sedentary people may be very important. Indeed, disorders and alterations of the foot, painful or postural conditions, gait disturbance, the risk of falls and other basic diseases may be considered key factors when planning assistance and preventive health activities to improve QoL, wellbeing, and autonomy for the sedentary population.

Consequently, the goal of this research was to analyze the impact of the QoL related to foot health among male and female sedentary people. We hypothesized that sedentary people might present a negative impact on the QoL related to foot health.

## MATERIALS AND METHODS

### Design and Sample

This research consisted of a cross-sectional observational study carried out in a private podiatric medical and surgical center that provides treatment for

foot problems in the city of Porto (Portugal) during the period between October 2016 and October 2017. Participants were selected using a non-randomized consecutive sampling method, and their mean age was  $39.81 \pm 15.40$  years. A sample of 312 volunteers was recruited. The exclusion criteria included injury and a history of foot surgery, psychiatric or neurological disorders, diabetes, rheumatoid arthritis, chronic joint pathology, immunocompromised or lack of partial independence in daily activities, refusal to sign a consent form, the inability to follow the instructions necessary to carry out the present study, as well as patients of other nationalities (non-Portuguese) who did not master Portuguese.

### Procedure

Initially, participants were enrolled and interviewed about overall health, sociodemographic characteristics (age and sex) and presence of relevant factors such as arthritis, diabetes, obesity, vascular disease, osteoarticular disorders or participation in sports.

A single trainer researcher conducted a standardized clinical exam. Then, we measured the subject's demographic data, such as height and weight as well as determined the body mass index (BMI), from the height (m), and weight ( $\text{kg}^2$ ), applying Quetelet's equation ( $\text{BMI} = \text{weight} / \text{height}^2$ ).<sup>21</sup>

Next, the voluntary completed the Portuguese version of the European Prospective Investigation into Cancer and Nutrition (EPIC) Physical Activity Questionnaire<sup>22</sup>. This tool presented a higher construct of the degree, content and validity (Spearman correlation coefficient, *rs*) for male (*rs* = 0.47 - 0.89) and female (*rs* = 0.49 - 0.81). Also, this tool showed a high retest reliability (*rs* = 0.32 - 0.81 in male and *rs* = 0.28-0.72 in female)<sup>23</sup>. This self-administered instrument determines the duration of physical activity intensities average (day, week and month) in the three different tasks (professional, domestic and free time) and for five types of activities. The first task assesses rest (sleeping or sitting/lying awake). The second task assesses transport to or from work (walking, motorized vehicle, or other). The third task assesses professional activity (very light, light, moderate and heavy). The fourth task assesses household activities (very light, light and moderate). The final task assesses very light activities (watching TV, playing cards, reading) and exercise (light, moderate and heavy).

Also, each participant was measured using the energy cost of expenditure in the daily activities ap-

plying standard scores of the metabolic energy equivalent multiplied by the time spent in every task (min/day) for seven days (min/week)<sup>24,25</sup>.

Subsequently, participants completed the Portuguese version of the Foot Health and Quality of Life (PFHQL) tool that contains two sections<sup>26</sup>. The first section presents thirteen points related to foot pain (four questions), foot function (four questions), footwear (three questions) and general foot health (two questions), differing from other tools that only measure recorded foot pain, function of the foot and disability<sup>27,28</sup>.

Also, PFHQL presented appropriate psychometric properties, a higher construct of the degree, content, and validity (Cronbach  $\alpha$  = 0.89 – 0.95). In addition, a high retest reliability (intraclass correlation coefficient, ICC = 0.74 – 0.92) was shown<sup>29,30</sup>. The second section of the tool was adapted from the Medical Outcomes Study 36-Item Short-Form Health<sup>29</sup>, and presented items related to overall health (general health, physical activity, social capacity, and vigor), which demonstrated to be a valid measurement questionnaire<sup>31</sup>. The FHSQ software (Version 1.03) showed points from zero (poor health status) to one hundred (better health status).

### Sample size calculation

The sample size was calculated using the Clinical Epidemiology and Biostatistics Research Group software, Universidade da Coruña (<http://www.fis-terra.com/mbe/investiga/9muestras/9muestras2.asp>)<sup>32</sup>. The calculation was based on the population living in Portugal with a total of 6.979.785 adults on October 05, 2017 (<https://www.pordata.pt/DB/Municipios/Ambiente+de+Consulta/Tabela>). Considering a 2-tailed test, an  $\alpha$  level of 0.05, a desired power analysis of 95 % with a  $\beta$  level of 20%, a precision of 50% ( $P=0.5$ ) and assuming a loss of participants of 15%, at least 203 participants needed to be studied. Finally, a sample of 312 participants was included in the study.

### Ethical considerations

This study was approved by the local Bioethics Committee of the Hospital-Escola da Fundação Fernando Pessoa in Porto, Portugal (registry number: 30/2017). All voluntary participants gave written informed consent before beginning the investigation protocol. Additionally, the research followed international principles for medical research in human experimentation set forth by the World Medical Association in the Declaration of Helsinki.

### Statistical analysis

The descriptive analysis related to the variables, which appear in this research, was carried out. The qualitative variable (sex) was described as an absolute value. The quantitative variables were described as mean  $\pm$  standard deviation (SD), median  $\pm$  interquartile range (IR) as well as maximum and minimum values (range) for the male, female and total sedentary sample.

A Kolmogorov-Smirnov test was used to examine the normality of the distribution for all variables, and data were considered normally distributed if  $P > 0.01$ . The Kruskal Wallis test for independent samples was performed to analyze sociodemographic and PFHQL differences between men and women in the sedentary sample. In all the analyses,  $P < .01$  (with a 99% confidence interval) was considered statistically significant.

The IBM SPSS Statistics 19.0 package for windows was used to analyze the results. FHSQ (Version 1.03) was used to obtain the QoL scores related to foot health.

## RESULTS

The results for Kolmogorov Smirnov showed a normal distribution ( $P < 0.05$ ) for sociodemographic data and PFHQL scores. Therefore, the non-parametric Kruskal Wallis test was performed.

A total sample of 312 subjects, between 18 and 87 years old with a mean  $\pm$  SD of  $39.81 \pm 15.40$  years, concluded the investigation pathway. Most participants were of average weight (BMI,  $24.75 \pm 3.942$  kg/m<sup>2</sup>) and their metabolic equivalent of tasks showed a sedentary activity (MET,  $301.09 \pm 72.22$  min/week). Descriptive socio-demographic characteristics of the people, stratified by sex, are presented in Table 1.

The findings of the comparison between QoL related to the foot values of sex groups are shown in Table 2. The first specific section for the feet analyzed four domains: 1) pain, 2) function, 3) overall foot health and 4) footwear. The values were higher for foot pain and foot function and lower for general foot health and footwear. The second general section assessed four health domains: 1) overall health, 2) physical function, 3) social capacity, and 4) vitality. The values were higher for general health and vigor and lower for physical activity and social capacity.

The differences between the groups of the study were statistically significant for footwear ( $P = 0.008$ ), physical activity ( $P = 0.002$ ), social capacity ( $P = 0.001$ ), and vigor ( $P = 0.001$ ) showing a worst QoL

**TABLE 1:** SOCIO-DEMOGRAPHIC AND CLINICAL CHARACTERISTICS OF THE SAMPLE POPULATION

	Total Group Mean $\pm$ SD Range Median $\pm$ IR N = 312	Male Mean $\pm$ SD Range Median $\pm$ IR N= 219	Female Mean $\pm$ SD Range Median $\pm$ IR N= 93	P-Value Male vs. Female*
Age, years	39.81 $\pm$ 15.40 (18-87) 39 $\pm$ 24.25	38.15 $\pm$ 14.72 (18-87) 37 $\pm$ 23	43.72 $\pm$ 16.31 (18-86) 41 $\pm$ 24	0.005
Weight (kg)	68.57 $\pm$ 13.11 (40-115) 67.00 $\pm$ 19.00	63.88 $\pm$ 10.83 (42-98) 62 $\pm$ 14	79.62 $\pm$ 11.31 (56-115) 80 $\pm$ 12.50	0.001
Height (m)	1.66 $\pm$ 0.85 (1.45-1.92) 1.65 $\pm$ 0.11	1.62 $\pm$ 0.06 (1.45-1.80) 1.63 $\pm$ 0.10	1.74 $\pm$ 0.07 (1.50-1.92) 1.75 $\pm$ 0.10	0.001
BMI (kg/m <sup>2</sup> )	24.75 $\pm$ 3.942 (16.78-39.82) 24.21 $\pm$ 4.92	24.15 $\pm$ 4.17 (16.78- 39.82) 23.42 $\pm$ 4.97	26.17 $\pm$ 2.877 (20.61 – 36.43) 25.82 $\pm$ 3.59	0.001
METS (min/day)	43.82 $\pm$ 10.60 (24.00-80.24) 40.14 $\pm$ 15.80	43.20 $\pm$ 9.04 (27.99- 80.24) 40.42 $\pm$ 10.50	43.20 $\pm$ 9.04 (24.00- 69.83) 40.42 $\pm$ 10.50	0.583
METS (min/week)	306.76 $\pm$ 74.21 (168.00 – 561.73) 281.00 $\pm$ 110.66	302.44 $\pm$ 63.34 (168.00 – 488.83) 282.98 $\pm$ 73.55	302.44 $\pm$ 63.34 (168.00 – 488.83) 282.98 $\pm$ 73.55	0.582

Abbreviations: BMI, body mass index; METS, metabolic energy equivalent; IR, interquartile range; SD, standard deviation. In all the analyses,  $P < .01$  (with a 99% confidence interval) was considered statistically significant. \* Kruskal Wallis test for independent samples was performed.

**TABLE 2:** COMPARISONS OF FHSQ SCORES TOTAL GROUP AND SEX GROUP

	Total Group Mean $\pm$ SD Range Median $\pm$ IR N = 312	Male Mean $\pm$ SD Range Median $\pm$ IR N= 219	Female Mean $\pm$ SD Range Median $\pm$ IR N= 93	P-Value Male vs. Female*
Foot Pain	78.84 $\pm$ 22.80 (0-100) 84.37 $\pm$ 18.12	77.31 $\pm$ 22.82 (0-100) 84.37 $\pm$ 18.75)	82.46 $\pm$ 22.47 (0-100) 90 $\pm$ 21.87	0.013
Foot Function	85.92 $\pm$ 20.55 (0-100) 93.75 $\pm$ 18.75	84.73 $\pm$ 21.28 (0-100) 93.75 $\pm$ 18.75	88.71 $\pm$ 18.53 (6.25-100) 100 $\pm$ 18.75	0.104
Footwear	57.16 $\pm$ 28.67 (0-100) 58.33 $\pm$ 41.66)	54.30 $\pm$ 28.74 (0-100) 58.33 $\pm$ 45.83	63.89 $\pm$ 27.51 (0-100) 66.66 $\pm$ 33.33	0.008
General Foot Health	63.68 $\pm$ 23.89 (12.50-100) 60.00 $\pm$ 42.50	62.09 $\pm$ 23.92 (12.50-100) 60 $\pm$ 42.5	67.42 $\pm$ 23.51 (12.50-100) 72.5 $\pm$ 42.5	0.057
General Health	68.46 $\pm$ 22.98 (0-100) 70.00 $\pm$ 40.00	67.26 $\pm$ 23.12 (0-100) 70 $\pm$ 30	71.29 $\pm$ 22.52 (10-100) 80 $\pm$ 30	0.147
Physical Activity	83.51 $\pm$ 20.87 (0-100) 91.66 $\pm$ 22.22	81.61 $\pm$ 21.15 (11.11-100) 88.88 $\pm$ 27.77	87.99 $\pm$ 19.58 (0-100) 94.44 $\pm$ 11.11	0.002
Social Capacity	78.33 $\pm$ 21.13 (12.50-100) 81.25 $\pm$ 37.50	75.34 $\pm$ 21.58 (12.50-100) 75 $\pm$ 37.50	85.35 $\pm$ 18.30† (12.50-100) 87.5 $\pm$ 25	0.001
Vigor	51.66 $\pm$ 19.34 (0-100) 50.00 $\pm$ 31.25	49.32 $\pm$ 18.83 (0-100) 50 $\pm$ 25	57.19 $\pm$ 19.50 (12.50-93.75) 56.25 $\pm$ 31.25	0.001

Abbreviations: FHSQ, Foot Health Status Questionnaire; IR, interquartile range; SD, standard deviation. In all the analyses,  $P < .01$  (with a 99% confidence interval) was considered statistically significant. \*Kruskal Wallis test for independent samples was performed.

related to foot health in male subjects. The rest of the domains did not show any statistically significant difference ( $P \geq .01$ ).

## DISCUSSION

This study aimed to analyze the QoL impact on the overall and foot health among male and female sedentary people. Foot health may be very important for the overall health, independence, and QoL in the sedentary population.

Regarding a prior case-control study, a sample of 140 active and sedentary participants with mean age of 40 years in Iran were randomly selected and showed that active people presented better QoL than sedentary people<sup>33</sup>. Nevertheless, the QoL associated with foot health was not analyzed in this context in any investigation.

This is the first study to reveal that sedentary individuals present poor QoL values on the dimensions related to the foot. The outcomes of this research highlighted the need for medical and podiatric care in sedentary people. Sedentary people should be advised about the changes that a sedentary lifestyle will bring to their feet. Therefore, podiatric care would help to improve the lifestyle and overall health in this population.

These findings are consistent with a randomized controlled clinical intervention conducted by Campbell et al.<sup>34</sup>, which indicated that leg, ankle, and foot are habitually sites of the most pathologies in sedentary individuals.

Furthermore, this investigation revealed a significant increase in PFHSQ scores for foot pain, foot function, general health, vigor and lower scores for general foot health, footwear physical activity, and social capacity in the levels of QoL related with foot health in sedentary people. This is consistent with research that has demonstrated that lifestyle affects the risk of illnesses, symptoms, poorer response to treatment, and a significant increase in the use of medical services<sup>11,35,36</sup>

However, this study presented several limitations that should be acknowledged. Firstly, a new classification related to different lifestyles may help identify if there are other mechanisms involved. Secondly, sub-categories of metabolic energy equivalent would be beneficial to improve the strength of the study. Finally, expanding data collection to other countries would be beneficial to strengthen this study. This highlights the need for further studies

that should focus on foot health, lifestyle and QoL of the population.

## CONCLUSIONS

The sedentary population evidenced a negative impact on the QoL related to foot health. This problem may be associated with this lifestyle, especially in the males.

## DECLARATIONS

### Ethics approval and consent to participate

This study was approved by the local Bioethics Committee of the Hospital-Escola da Fundação Fernando Pessoa in Porto, Portugal (registry number: 30/2017). All voluntary participants gave written informed consent before beginning the investigation protocol.

### Consent for publication

The authors declare that they consent for publication.

### Availability of data and material

The data set supporting the conclusions of this article is available in the [daniellopez@udc.es](mailto:daniellopez@udc.es) in the Research, Health and Podiatry Unit. Department of Health Sciences. Faculty of Nursing and Podiatry. Universidade da Coruña, Spain.

### Competing interests

The authors report no conflicts of interest in this work.

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The authors did not receive any funding for the design, methods, subject recruitment, data collections, analysis and preparation of the paper or have any personal relationships with other people or organizations that could inappropriately influence (bias) their work.

### Authors' contributions

All authors: concept, design, analyses, interpretation of data, drafting of the manuscript and revising it critically for important intellectual content.

### Authors' information (optional)

None

## RESUMO

O tempo sedentário (sentado) pode produzir muitas consequências anatômicas e fisiológicas que supostamente estão associadas a uma redução de qualidade de vida (QoL) relacionada à saúde do pé. Por conseguinte, o objetivo deste estudo foi analisar o impacto da QV sobre a saúde geral e a saúde do pé entre pessoas sedentárias masculinas e femininas. Uma amostra de 312 participantes com idade média de 39,81 ± 15,40 anos completou todas as fases do processo de estudo. Além disso, os dados autorrelatados foram registrados. O comportamento sedentário dos informantes foi determinado usando o questionário de prospecção prospectiva de câncer e nutrição (Epic). Além disso, os resultados obtidos com a versão em português do Questionário de Status de Saúde do Pé (PFHSQ) foram registrados. As pessoas sedentárias no equivalente de energia metabólica apresentaram 301,09 ± 72,22 (min/semana). Na primeira seção, os valores foram maiores para a dor no pé e função do pé e diminuíram a saúde e o calçado do pé geral. Na segunda seção, os valores foram maiores para saúde geral e vigor e menores para atividade física e capacidade social. As diferenças entre os grupos sexuais do estudo foram estatisticamente significativas para o calçado ( $P = 0,008$ ), atividade física ( $P = 0,002$ ), capacidade social ( $P = 0,001$ ) e vigor ( $P = 0,001$ ), mostrando uma pior QV relacionada à saúde do pé a favor dos sujeitos do sexo masculino em relação aos participantes sedentários femininos. O restante dos domínios não apresentou diferença estatisticamente significativa ( $P \geq 0,01$ ). A população sedentária evidenciou um impacto negativo na QoL relacionada à saúde dos pés. Esse problema pode estar associado a este comportamento, especialmente no sexo masculino.

**PALAVRAS-CHAVE:** Pé. Deformidades do pé. Traumatismos do pé. Qualidade de vida. Estilo de vida sedentário.

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