The influence of heel height related on quality of life on the foot in a sample of women

Daniel López-López[1]
Javier Marañon-Medina[1]
Marta Elena Losa-Iglesias[2]
César Calvo-Lobo[3]
David Rodríguez-Sanz[4]
Patricia Palomo-López[5]
Ricardo Becerro de Bengoa Vallejo[6]

1. Research, Health and Podiatry Unit. Department of Health Sciences. Faculty of Nursing and Podiatry. Universidade da Coruña, Spain.
2. Faculty of Health Sciences. Universidad Rey Juan Carlos, Spain.
3. Nursing and Physical Therapy Department, Institute of Biomedicine (IBIOMED), Faculty of Health Sciences, University of León, Ponferrada, León, Spain
4. Physical Therapy & Health Sciences Research Group. European University of Madrid, Villaviciosa de Odón, Madrid, Spain.
5. University Center of Plasencia. Universidad de Extremadura, Spain.
6. School of Nursing, Physiotherapy and Podiatry. Universidad Complutense de Madrid, Spain.

SUMMARY

Many women have worn high-heel shoes (HHS) at some point in their lives and many wear them on a daily basis, with higher prevalence between 39% and 78% observed in institutional and clinical settings. The purpose of this study was to describe and compare the scores obtained with regard to foot health and health in general in a sample of women that use HHS as opposed to a sample of women without HHS with normalized reference values. A sample of 120 participants with a mean age of 41.94 ± 13.912 came to a health center where self-reported data were registered. The subjects with and without HHS were determined and the scores obtained were compared in the Foot Health Status Questionnaire (FHSQ). This questionnaire is made of 13 questions that assess 4 health domains of the feet, namely pain, function, general health and footwear. The women in the HHS group showed a worse quality of life related to health in general and to foot health specifically. Differences between the two groups were evaluated by means of a t-test for independent samples, showing statistical significance (P<0.01). Women with HHS present a negative impact on the quality of life related to foot health.

KEYWORDS: *Foot deformities. Foot diseases. Quality of life. Shoes.*

INTRODUCTION

Many women have worn high-heel shoes (HHS) at some point in their lives and many wear them daily basis,[1,2] with higher prevalence between 39% and 78 % observed in institutional and clinical settings[3,4] and representing a huge proportion of the female population.

The increasing popularity of HHS include present day fashion,[5] part of the professional attire,[6] social events,[3] personal expression,[7] source of authority,[8] sexual independence,[9] mark of flaunted femininity,[10] psychological empowerment and joy.[11]

However, there are consequent negative side effects, such as foot problems,[12] sprained ankles,[13] lower back pain,[14] leg disorders,[15] hip pain,[16] knee pain,[17] walking instability,[18] a high risk of falls[19] and venous disease symptoms.[20]

Also, walking in HHS causes many orthopedic conditions (e.g., blisters, bunions, hallux valgus, hyperkeratotic lesions, lesser toe deformities).[21,22]

This kind of disorders represent an important public health issue[22] and have an important economic impact[23] to the affected work and personal activity as it happens to women,[23] all of which can severely impact autonomy, welfare and loss of quality of life.[24]

Despite this, up until now, there are no studies – that have been able to analyze the quality of life related to foot health in women that wear HHS.

Based on this background and taking into account the existence of unmet care and follow-up care of feet, the purpose of this study was to describe and compare the scores obtained with regard to foot health and health in general in a sample of women that wear HHS as opposed to a sample of women without HHS with normalized reference values.

METHODS
Design and Sample

The overall study was completed in 18 months, from January 2014 to June 2015. The study was carried out among women who have been seen at the Clinic of Podiatric Medicine and Surgery, a facility that provides treatment of diseases and disorders of the foot at the University of A Coruña in the city of Ferrol (Spain).

It was a cross sectional study. Data was collected through a randomized sampling method, the criterion for inclusion being between 18 and 65 years old. All of the participants spent the same amount of time walking at the day, including after-work and weekend. The exclusion criterion was a recent history of ankle injury, including sprain, tendinitis, or any muscular pathology in the lower extremity, as well as those who refused to sign the consent form or were incapable of understanding the instructions necessary to carry out the present study. None of the participants had a neurologic condition affecting the lower limbs.[25-27]

Sample size

Having established a minimal difference score of at least 21 (as clinically relevant) among the groups under study in the FHSQ, and considering that the standard deviation on that scale for the people is around 29[28, 29] for a bilateral hypothesis, an alpha risk of 5% and a statistical power of 80%, and a beta error of 20%, at least 47 cases must be studied in each group (n=94).

Procedure

At enrolment, patients were interviewed about general health, demographic characteristics (age and gender) and frequency with which they wore HHS. A single trained examiner performed a standardized clinical exam on all participants measuring height and weight with the subjects barefoot and wearing light clothing. The body mass index (BMI) was calculated from the height (m) and weight (kg²), applying the Quetelet's equation $BMI = weight / height^2$.[30]

Then, a measuring tape was used to determine the height of the heel. It was measured vertically from the floor to the top of the heel at the back, including the top piece. The instrument classified the shoes in two groups: with HHS (>3 cm) and without HHS (< 3 cm). Studies have shown that the discomfort increases with the heel height and that a heel height >3 might have adverse effects on the body.[31, 32]

Lastly, participants' informants filled out the *Foot Health Status Questionnaire* (FHSQ). This self-administered questionnaire on health-related quality of life is intended specifically for the foot which is recognized as a valid test.[33, 34] Foot-specific and general health-related quality of life was assessed by using the Foot Health Status Questionnaire (version 1.03),[35] which comprises three main sections. Section 1 consists of 13 questions reflecting four foot health-related domains (Table 1): foot pain, foot function, footwear, and general foot health. This section has demonstrated a high degree of content, criterion, and construct validity (Cronbach α= 0.89–0.95) and high retest reliability (intraclass correlation coefficient = 0.74–0.92),[36] and it has been shown to be the most appropriate measure of health-related quality of life for women that use high heeled shoes population.[37]

Each domain has a specific number of questions. Four regarding pain, 4 on function, 3 on footwear and 2 on general foot health. The assessment of pain and function is based on physical phenomena; the evaluation of footwear uses practical aspects related to availability and the comfort of the shoes, while the perception of the foot's general health is based on the patients' self-assessment of the state of their feet. Each question allows several answers and these are placed on a Likert-type ordinal scale (words or phrases corresponding to a numeric scale). The descriptors for these scales vary for each domain and the person completing the questionnaire has to choose only one response, whichever is thought to be the most appropriate. The questionnaire does not provide a global score, but rather generates an index for each domain. In order to obtain these indices, the responses are analyzed by a computer program (The FHSQ, Version 1.03) which, after processing the data, gives a score ranging from 0 to 100. A 0 score represents

the worst state of health for the foot and 100 is the best possible condition. Furthermore, the software also provides graphical images of the outcomes.

Section 2 includes questions that reflect four general health-related domains: general health, physical activity, social capacity, and vigor. The domains and questions in this section are largely adapted from the Medical Outcomes Study 36-Item Short-Form Health Survey,[38] which has been validated for use in the Australian population.[39]

Section 3 collects socioeconomic status, comorbidity, service utilization and satisfaction information and their medical record. This study was conducted according to the Strengthening the Reporting of Observational Studies in Epidemiology guidelines (STROBE).[40]

ETHICAL CONSIDERATIONS

This research was approved by the Research Ethics Committee at the University of A Coruña (Spain). All participants gave informed written consent before being included, and the ethical standards in human experimentation contained in the WMA Declaration of Helsinki, the Council of Europe Convention on Human Rights and Biomedicine, the UNESCO Universal Declaration on the Human Genome and Human Rights and those of the relevant national bodies and institutions were observed at all times.

STATISTICAL ANALYSIS

Statistical analyses were performed using IBM SPSS Statistics 19.0, Chicago, IL, USA for Windows. Qualitative variables are shown as absolute values and percentages, whilst the quantitative variables described are the mean, median, standard deviation (SD) and maximum and minimum values.

The Kolmogorov-Smirnov test was used to test the normality of the data and were considered normally distributed if $p > 0.05$. The results of these tests indicated that the data were normally distributed and that parametric statistical tests were most appropriate. Independent Student t tests were performed to determine whether there were statistically significant differences in all variables between the two groups.

The Foot Health Status Questionnaire Version 1.03 was used to obtain quality of life scores related to foot health. In all of the analyses, P<0.01 (with a 99% confidence interval) was considered statistically significant. Data analysis was conducted with SPSS software, version 19.0 (SPSS Science, Chicago, Illinois).

RESULTS
Sample characteristics

A total of 120 women completed all stages of the research process. The mean age was 41.94 ± 13.91 years (range 18 to 65) for total population and in table 5 the clinical and sociodemographic characteristics of the participants are showed informants. As can be seen, is relevant that most informants are overweight (BMI = 25.45 ± 4.51 kg/m²). No statistically significant differences were found between the two groups for participant age, height, weight and BMI (P>0.01). The results for the variables measured are shown in Table 1.

In what regards the comparison of the scores obtained with the FHSQ, results appear on Table 2.

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

	Total Group Mean ± SD Range N= 120	Heel height shoes Mean ± SD Range N= 60	No Heel height shoes Mean ± SD Range N= 60	P Value
Age, years	41.94 ± 13.91 (18–65)	41.25 ± 11.99 (18–63)	42.63 ± 15.66 (20–65)	0.588
Weight (kg)	67.27 ± 12.67 (45–110)	66.05 ± 12.65 (45–110)	68.49 ± 12.67 (48–110)	0.294
Height (cm)	162.49 ± 6.45 (150–176)	163.38 ± 6.225 (150–176)	161.60 ± 6.61 (150–174)	0.130
BMI (kg/m2)	25.45 ± 4.51 (18.66 – 42.97)	24.71 ± 4.52 (18.66 – 41.91)	26.18± 4.42 (19.16 – 42.97)	0.074

Abbreviations: BMI, body mass index; SD, standard deviation. In all the analyses, P < .01 (with a 99% confidence interval) was considered statistically significant. P-values are from Independent student t-test.

These scores were lower for the group of women that use HHS, both in the first section of the questionnaire, which assesses the informants' quality of life related specifically to foot health, and in the second section, which assesses the informants' health in general related informants without HHS, with normalized reference values,

The differences between the two groups were statistically significant (p<0.05) for those dimensions in the questionnaire which assessed foot pain and general foot health.

DISCUSSION

The purpose of this study was to describe and compare the scores obtained with regard to foot health and health in general in a sample of women that use HHS as opposed to a sample of women without HHS with normalized reference values.

Women people are the predominate wearers of HHS, and the gender that have the highest rate of lower limb health problems, painful and disabling conditions.[41, 42] Although none has focused on the relationships HHS and quality of life related to foot health.

The study outlined in this protocol is, therefore, novel in that it targets a HHS used by those females that spent the same amount of time walking at the day, including after-work and weekend. In our study, participants with HHS present lower scores in quality of life related to health in general on all the dimensions related to foot health specifically: foot pain, foot function, footwear and general foot health and in general on all the dimensions related to general health, physical activity, social capacity and vigor than women without HHS with normalized reference values. Our results are in line with a systematic review of Barnish et al indicating that HHS and musculoskeletal injuries has been strongly associated with poor foot health.[43]

However, our findings need to be interpreted in the context of several methodological limitations that should be acknowledged. First this research excluded people who required custom shoes or custom inserts. Second, our footwear assessment tool was limited to one key feature: HHS and no other characteristics of shoe toe-box shape. Third, a larger and more diverse (individuals from various countries) sample size would be beneficial to improve the strength of the study. Fourth, expanding data collection to other countries may help to identify if there is a culture where this association does not exist and identify the mechanisms involved.

This highlights the need for further research on the presence and severity of HHS and how it influences on the foot in order to improve women's health, quality of life and autonomy. The longitudinal cohort studies may be useful to study the shoes heel effect along the time.

TABLE 2 - FHSQ MEAN SCORES FOR THE CASE AND CONTROL GROUPS.

	Total Group Mean (SD) Range N = 120	Heel height shoes Mean (SD) Range N = 60	No Heel height shoes Mean (SD) Range N = 60	P Value
Foot Pain	71.93 ± 21.39 (0-100)	65.86 ± 22.76 (0-100)	78.00 ± 18.17 (19-100)	0.001
Foot Function	76.56 ± 27.98 (0-100)	66.46 ± 32.19 (0-100)	86.67 ± 18.32 (0-100)	0.001
Footwear	51.46 ± 31.33 (0-100)	45.42 ± 31.12 (0-100)	57.50 ± 30.63 (0-100)	0.034
General Foot Health	56.50 ± 30.21 (0-100)	48.37 ± 28.67 (0-100)	64.63 ± 29.74 (0-100)	0.002
General Health	62.00 ± 27.58 (0-100)	50.00 ± 28.22 (0-100)	74.00 ± 21.08 (20-100)	0.001
Physical Activity	72.45 ± 32.50 (17-100)	60.93 ± 38.58 (0-100)	83.98 ± 19.27 (17-100)	0.001
Social Capacity	72.81 ± 33.39 (0-100)	58.96 ± 37.82 (0-100)	86.67 ± 20.69 (0-100)	0.001
Vigor	61.09 ± 26.38 (0-100)	51.87 ± 25.01 (0-100)	70.31 ± 24.61 (13-100)	0.001

Abbreviations: FHSQ = Foot Health Status Questionnaire Survey;. SD, standard deviation. In all the analyses, P < .01 (with a 99% confidence interval) was considered statistically significant. P-values are from Independent student t-test

CONCLUSION

This study provides evidence that women who wear HHS have a negative impact on the quality of life regarding foot health. These findings suggest that advising women to minimize their use of HHS may have long-term benefits on general health, and this could be investigated in future studies.

Declaration of Funding and Role of Funding
None.

Conflict of Interest

The authors did not receive any financial assistance and they do not have any personal relationships with any other people or organizations that could inappropriately influence (bias) their work.

Author contributions
All authors: concept, design, analysis, interpretation of data, drafting of manuscript or revising it critically for important intellectual content.

RESUMO

*Muitas mulheres usaram sapatos de salto alto (SSA) em algum momento de suas vidas e muitas usam diariamente, com maior prevalência entre 39% e 78%, observadas em contextos institucionais e clínicos. O objetivo deste estudo foi descrever e comparar os escores obtidos em relação à saúde dos pés e à saúde em geral em uma amostra de mulheres que utilizam SSA em oposição a uma amostra de mulheres sem SSA com valores de referência normalizados. Uma amostra de 120 participantes com idade média de 41,94 ± 13,912 chegou a um centro de saúde onde os dados autorrelatados foram registrados, os informantes com e sem SSA foram determinados e os escores obtidos foram comparados no Foot Health Status Questionnaire (FHSQ). Esse documento tem 13 questões que avaliam quatro domínios de saúde dos pés, nomeadamente dor, função, saúde geral e calçado. As mulheres do grupo SSA apresentaram pior qualidade de vida relacionada à saúde em geral e à saúde dos pés, especificamente. As diferenças entre os dois grupos foram avaliadas por meio de um teste **t** para amostras independentes, mostrando significância estatística (P <0,01). As mulheres com SSA apresentam um impacto negativo na qualidade de vida relacionada à saúde dos pés.*

PALAVRAS-CHAVE: *Deformidades do pé. Doenças do pé. Qualidade de vida. Sapatos.*

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