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Impact of fibromyalgia and related factors on foot function and quality of life: Cross-sectional study☆

Sara López-Muñoz [a], Miguel Ángel Gracia-Vesga [b], Alba Gracia-Sánchez [c,1], Sara Zúnica-Garcia [c,2], Gabriel Gijón-Nogueron [d,e,*,3], Esther Chicharro-Luna [a,4]

[a] Department of Behavioural Sciences and Health, Nursing Area, Faculty of Medicine, Miguel Hernández University, Alicante, Spain
[b] Occupational Therapy, Faculty of Medicine, Miguel Hernández University, Alicante, Spain
[c] Department of Behavioural and Health Sciences, Nursing Area, Faculty of Medicine, Miguel Hernández University, Spain
[d] Department of Nursing and Podiatry, Faculty of Health Sciences, University of Málaga, Spain
[e] IBIMA Plataforma Bionand

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ABSTRACT

Background: The aim of study is to examine the factors that may influence pain, disability and the limitation of activity due to the presence of fibromyalgia in the foot.
Methods: 323 patients diagnosed with fibromyalgia were recruited. Each participant completed the Foot Function Index questionnaire (FFI) and the Revised Fibromyalgia Impact Questionnaire (FIQR). A multivariate analysis was performed to determine the factors associated with high scores in each of these questionnaires.
Results: In both questionnaires, the subscales presenting the highest scores were foot pain (FFI score: 71.18 ± 20.40) and symptom intensity (FIQR score: 36.23 ± 8.04). According to the multivariate analysis, foot function is influenced by age ($p = < 0.001$), BMI ($p = 0.001$), lack of physical activity ($p = < 0.001$), the presence of rheumatoid arthritis ($p = 0.012$), retirement due to disability ($p = < 0.001$) and being unemployed ($p < 0.001$).
Conclusion: Fibromyalgia affects foot function, provoking significant pain. Related factors include age, BMI, lack of physical activity, the presence of rheumatoid arthritis, and employment status.

1. Introduction

Fibromyalgia syndrome is characterised by chronic diffuse generalised musculoskeletal pain, with a duration of at least three months [1–4]. It is the second most frequent pathology among rheumatic diseases [5]. Its origin is unknown [3,6], although it is known to provoke central sensitivity characterised by neurocircuit dysfunction [1]. Patients usually describe experiencing painful regions, in the axial skeleton [7]. The condition is also associated with fatigue, sleep disorder, functional limitations [1–3], joint and muscle stiffness, insomnia, mood disorders, cognitive dysfunction, anxiety, depression, emotional distress, heightened sensitivity and inability to perform the basic activities of daily life [8].

Comorbidities associated with fibromyalgia include painful neuropathies [9], anxiety [10], depression [11], circulatory system disease, diabetes, irritable bowel syndrome [12], migraine, rheumatoid arthritis [13], lupus erythematosus [14], sleep apnoea [15], spondyloarthritis [16,17], connective tissue disorder [18] and generalised chronic pain.

The prevalence of fibromyalgia varies according to the criteria applied, the population samples analysed and the interpretation made of the results [3,19]. but is estimated to range from 0.2% to 6.6% among the general population [2]. Among European populations, values of 2.3%– 6% have been reported [20] and worldwide, 2.40% [21]. The disease mainly affects women [19], especially those aged between 35 and 60 years.

The widespread chronic pain associated with fibromyalgia provokes negative reactions in patients, disturbing their emotional well-being

☆ Levels of Evidence IV

* Corresponding author at: Department of Nursing and Podiatry, Faculty of Health Sciences, University of Málaga, Spain
E-mail address: gagijon@uma.es (G. Gijón-Nogueron).
[1] ORCID: 0000-0001-9643-4548
[2] ORCID: 0000-0001-6657-7636
[3] ORCID: 0000-0003-4558-3548
[4] ORCID: 0000-0003-4766-5723

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and heightening the risk of depression and anxiety [4,8,22]; these two outcomes have a reported prevalence of 70% and 60%, respectively [4]. Moreover, sleep disorders often intensify the appearance of symptoms, while moderate to high levels of physical activity can alleviate insomnia [23]. In many cases, however, fibromyalgia significantly reduces the patient's quality of life [24,25].

Foot function is a key factor in determining an individual's quality of life. Greater rigidity in the feet, and hence decreased mobility, can provoke a significant deterioration in the hallux valgus and apophysis of the calcaneus, the internal longitudinal arch and the fifth toe. Tarsal tunnel syndrome is frequently observed and in some cases this is considered one of the eighteen critical pain areas for the diagnosis of fibromyalgia [26].

Fibromyalgia syndrome also has major economic repercussions [27]. In Spain, for example, it provokes an annual expenditure of 12.993 billion euros [28]; in the Netherlands, the annual cost per patient is 7813 euros [22,29]; in Canada, between 3840 and 7973 dollars [20,30]; in Germany, between 2234 and 2641 euros [20]; in France, between 862 and 924 euros [20] and in the USA, between 10,697 and 20,463 dollars [20].

The socioeconomic impact of fibromyalgia arises not only from the increased consumption of health resources, but also from the greater need for social resources and specialised support to manage the disease [29,31]. Patients with fibromyalgia frequently require primary care, specialist attention, physiotherapy, psychology and rehabilitation [22], in certain instances, surgical interventions may be necessary, including procedures like knee arthroplasty [32]. Moreover, the condition makes the patient more liable to complications from these procedures [33]. Eight percent of the costs incurred correspond to pharmacological treatment, since 74% of patients are prescribed non-steroidal anti-inflammatory drugs [22]. In addition, non-health resources are needed, such as apparatus, adaptations to the living space, domestic care, support groups, help from third parties for household tasks and (for those in employment) sick leave [29].

In view of the above considerations, the main aim of this study is to determine the impact of fibromyalgia and to identify the factors that most influence foot function (pain, disability and the limitation of activity).

2. Method

2.1. Study design

This observational study was designed following The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines [34]. Participants were recruited from December 2022 to February 2023.

2.2. Ethics statement

The study was approved by the Ethics Committee of the University (Code: TFG.GPO.ECL.SLM.221123). All participants were informed of the aims of the study. The data were collected anonymously, and the ethical principles set out in the Declaration of Helsinki [35] were followed in all respects.

2.3. Statistical analysis

All statistical analyses were conducted using SPSS v.24.0 software (SPSS Inc., Chicago, IL, USA). Quantitative variables are reported by means and standard deviations. Categorical variables are reported by frequencies, cross-tabulations and descriptive analysis.

The Kolmogorov-Smirnov test was used to measure the normality of the distribution, assuming $p > 0.01$. The Mann-Whitney U test was applied to assess differences. A bivariate correlation test was applied to determine the relationship between the FFI and FIQR scores. Linear regression was performed to determine the factors influencing the final FFI score.

2.4. Participants

The study sample consisted of 323 patients diagnosed with fibromyalgia by a rheumatologist. The study was carried out from December 2022 to February 2023.

The sampling approach was consecutive and by convenience, applying the following inclusion criteria: all participants should a) be at least 18 years of age; b) be diagnosed with fibromyalgia; c) have signed the informed consent form. The exclusion criteria were a history of lower limb surgery or any musculoskeletal injuries in the last six months.

2.5. Procedure

Sociodemographic variables (age, gender, educational level, marital status, employment situation), anthropometric variables (weight, height, BMI) and clinical variables (family history of fibromyalgia, duration of symptoms and diagnosis, type of treatment). Subsequently, the patient self-completed the Foot Function Index (FFI) questionnaire and the Fibromyalgia Impact Questionnaire (FIQR).

The FFI provides a quantitative measure of foot health [36]. The Spanish-language version was validated in 2013 [37]. It is divided into three domains: pain (9 items), disability (9 items) and activity limitation (5 items), with 23 questions in all. Each item is scored from 0 to 9. The final FFI score is obtained by summing the scores obtained for the items, dividing this by the maximum possible score (207 points) and multiplying by 100 to express the result as a percentage.

The FIQR is the only questionnaire adapted and validated for use in Spanish that quantifies the impact of fibromyalgia and quality of life [38]. In a 2003 revision, the Likert scale and the visual analogue scale were removed, and symptom severity was scored from 0 to 10, with 10 being the worst possible symptom. In addition, the symptoms associated with fibromyalgia were expanded to include sensitivity to touch, memory disorders, postural balance, hyperalgesia and sensitivity to environmental factors. Finally, the questions were reformulated, making them applicable to both genders [39]. Like the FFI, the FIQR is divided into three blocks: fibromyalgia-related difficulty in performing activities in the last week (9 items); overall influence of fibromyalgia in the last seven days (2 items); and intensity of symptoms (10 items). Each item is scored from 0 to 10. The score for the first block is obtained as the sum of the scores for the nine items, divided by three; for the second block, the sum of the two items; and for the third block, the sum of the scores for the ten items, divided by two. The overall score is the sum of these three blocks.

3. Results

The study sample consisted of 323 patients diagnosed with fibromyalgia (306 women, 17 men), with a mean age of 52.50 ± 9.15 years and a mean BMI of 26.94 ± 5.88.

Of these participants, only 26.9% were in employment, and 19.8% were on sick leave. 82.7% were receiving medication for the condition and only half of the sample regularly performed some type of physical activity. 41.8% used stress control techniques to minimise pain and functional limitation (Table 1).

In both questionnaires, the subscales producing the highest scores were those for foot pain (FFI score: 71.18 ± 20.40) and symptom intensity (FIQR score: 36.23 ± 8.04), followed by foot

Table 1
Descriptive analysis of the sociodemographic and disease-related variables considered.

Variable	Total group n = 323 Mean ± SD
Age (years)	52.50 ± 9.15 (22–78)
weight (kg)	71.04 ± 15.34 (38–125)
BMI (kg/cm²)	26.94 ± 5.88 (15.79–66.94)
Duration of condition since diagnosis (years)	9.27 ± 7.68 (0.10–32)
Duration of condition since the onset of symptoms (years)	15.8 ± 10.90 (0.2–56)
Family history of fibromyalgia (yes/no) %	22.9/77.1
Sex (male/female) %	94.7/5.3
Marital status (single/married/separated/widowed) %	11.8/65.3/18.9/4
Education (basic/primary/secondary/university level) %	1.5/32.2/41.5/24.8
Employment status (in education/ employed/ retired/ on sick leave/ homemaker/ unemployed) %	0.6/26.9/7.4/15.8/19.8/9.3/20.1
Currently using plantar orthosis (yes/no) %	44.9/55.1
Currently receiving medication (yes/no) %	82.7/17.3
Regular physical activity (yes/no) %	49.2/50.8
Regular application of stress-control techniques (yes/no) %	41.8/58.2

Abbreviations: BMI - Body mass index.

disability (FFI score: 62.45 ± 23.5) and difficulty in performing activities (FIQR score: 17.97 ± 7.09) *(*Table 2*)*.

In the results obtained with the FIQR, the symptoms producing the highest mean scores (on a scale of 0–10) were sleep quality (7.92 ± 2.51), sensitivity to noise, light and cold (7.68 ± 2.18), pain (7.60 ± 1.90) and soreness to touch (7.54 ± 2.19). The activities of daily living subject to the greatest limitation were climbing stairs (7.16 ± 2.80), lifting and carrying a full shopping bag (7.08 ± 3.07) and sweeping, mopping or vacuuming (6.57 ± 2.98).

With the FFI, the highest mean scores for foot pain (on a scale of 0–10) were recorded for pain at the end of the day (7.80 ± 2.32) and pain when walking with shoes (7.51 ± 2.31). The item producing the lowest score was foot pain in the morning (5.91 ± 2.84). The greatest difficulty encountered was standing on tiptoe (7.53 ± 2.70), followed by walking quickly (7.35 ± 2.63) and climbing stairs (6.86 ± 2.59).

There was a strong correlation between the final FFI and FIQR scores (r = 0.612) and moderate ones for pain vs. symptom intensity, for disability vs. difficulty in performing activities and for activity limitation vs. overall impact of the condition *(*Table 2*)*.

Bivariate analysis revealed significant relationships between the final FFI score and the concomitant existence of rheumatoid arthritis (p = < 0.001), having a job (p = < 0.001), and being on sick leave or retired due to the disease (p = 0.001). Significant relationships were also observed between the final FIQR score and being in employment (p = < 0.001), being on sick leave or retired for health reasons (p = < 0.001) and being unemployed (p = 0.002) *(*Table 3*)*.

Multivariate analysis (R^2 0.23) highlighted a significant relationship between the FFI score and age (p < 0.001), BMI (p = 0.001), lack of physical activity (p < 0.001), the presence of rheumatoid arthritis (p = 0.012), being retired for health reasons (p < 0.001) and being unemployed (p < 0.001). The factors that most influenced foot function (with the highest standardised ß coefficient) were being retired or on sick leave, being unemployed and not performing regular physical activity *(*Table 4*)*.

4. Discussion

Although the prevalence of fibromyalgia reported in podiatry clinics is 13.9%, few studies have been undertaken to investigate the impact of foot pathologies in patients with this condition [40], despite the fact that foot function may be affected by the pain and fatigue experienced. In our study, participants reported low levels of foot function, often associated with severe pain, a finding that is in line with previous research in this area [40,41]. However, the cause of these symptoms is unknown, and previous studies have not detected greater joint stiffness, hyperkeratosis or lesions than in the unaffected population [42]. Nevertheless, 44.9% of the patients in our study used a plantar orthosis to alleviate symptoms. The fatigue experienced during walking might be associated with overuse of the hip flexor muscles instead of the ankle plantar flexors [43].

Fibromyalgia is not the only disease associated with pain, foot disability and activity limitation. Foot function may also be affected by other rheumatic pathologies. Thus, lupus erythematosus can provoke vascular disease, neuropathy and skin or nail disorders [44,45] while rheumatoid arthritis has been associated with pronated feet, metatarsalgia and hallux valgus [46,47], all of which can impair foot function [48,49]. In our study, the patients who also had rheumatoid arthritis scored poorly in both questionnaires, from which we conclude that the simultaneous presence of both pathologies is a high risk factor for impaired foot function. Although we did not find a significant relation between the use of plantar orthoses and improved foot function, the use of custom-prescribed orthoses could alleviate symptoms, at least in the short term [50].

In accordance with Ciaffi [40], we found that inadequate foot function was associated with a greater impact on the quality of life of persons with fibromyalgia, and that the FFI and FIQR scores were strongly correlated. Being retired, on sick leave or unemployed, due to fibromyalgia-related reasons, are significantly related to poor foot function. Therefore, good foot care and management could reduce the amount of sick leave required. This chronic pathology is

Table 2
Correlation between the FFI (pain, disability and activity limitation) and FIQR scores.

Foot Function Index (FFI)	Total Group n = 323 Mean ± SD	FIQR	Total Group n = 323 Mean ± SD	Pearson's correlation
Pain	71.18 ± 20.40 (0–100)	Symptom intensity	36.23 ± 8.04 (9.5–50)	r = 0.505 p = < 0.001
Disability	62.45 ± 23.55 (0–100)	Difficulty in performing activities	17.97 ± 7.09 (1.7–30)	r = 0.507 p = < 0.001
Activity limitation	26.56 ± 25.22 (0–100)	Overall influence	12.64 ± 5.44 (0–20)	r = 0.469 p = < 0.001
Total FFI score	53.40 ± 20.39 (3.33–100)	Total FIQR score	66.85 ± 17.95 (20.7–97.5)	r = 0.612 p = < 0.001

Pearson's correlation. In all analyses, p‘0.05 (with a 95% confidence interval) was considered statistically significant. Correlation is perfect with r = 1; moderate with 0.4 < r < 0.6, high with 0.6 < r < 0.8 and very high with 0.8 < r < 1.

Table 3
Factors related to worse foot function and worse FIQR score.

Variable	n	Total Group n = 323 Mean ± SD Final FFI score		Total Group n = 323 Mean ± SD Final FIQR score	
Family history of fibromyalgia	Yes (74)	50.92 ± 22.42	0.280	66.23 ± 18.88	0.828
	No (249)	54.14 ± 19.74		67.03 ± 17.70	
Comorbidity:			0.808		
Diabetes	Yes (18)	53.55 ± 18.32		64.54 ± 20.47	0.782
	No (305)	53.39 ± 20.54		66.98 ± 17.82	
Rheumatoid arthritis	Yes (46)	61.96 ± 19.53	**< .001**	69.45 ± 18.42	0.195
	No (277)	51.98 ± 20.22		66.41 ± 17.87	
Lupus erythematosus	Yes (6)	60.62 ± 33.02	0.656	66.88 ± 17.70	0.872
	No (317)	53.26 ± 20.14		65 ± 30.75	
Employment status			**< .001**		
In employment	Yes (87)	43.24 ± 20.12		58.64 ± 18.09	**< .001**
	No (236)	57.15 ± 19.22		69.87 ± 16.96	
Sick leave or health-related retirement	Yes	60.09 ± 18.20	**< .001**	72.67 ± 16.06	**< .001**
	No	49.70 ± 20.64		63.63 ± 18.17	
Unemployed	Yes	56.98 ± 18.77	0.107	72.83 ± 16.39	**0.002**
	No	52.50 ± 20.72		65.34 ± 18.04	
Currently using plantar orthosis	Yes (145)	55.56 ± 19.26	0.172	66.40 ± 17.46	0.492
	No (178)	51.64 ± 21.16		67.21 ± 19.26	
Currently receiving medication	Yes (56)	54.68 ± 20.66	**0.010**	68.20 ± 17.68	**0.003**
	No (267)	47.30 ± 18.02		60.38 ± 18	
Regular physical activity	Yes (159)	48.79 ± 19.37	**< .001**	62.73 ± 18.76	**< .001**
	No (164)	57.87 ± 20.42		70.84 ± 16.21	
Regular application of stress-control techniques	Yes (135)	52.75 ± 19.60	0.585	64.92 ± 17.47	0.075
	No (188)	53.87 ± 20.98		68.23 ± 18.21	

The Mann-Whitney U test for independent samples was applied. In all analyses, p‹0.05 (with a 95% confidence interval) was considered statistically significant.

Table 4
Multivariate analysis of the factors that influence foot function (FFI).

Model	Non-standardised coefficients		Standardised coefficients	t	Sig.	95% confidence interval for B	
	Beta	Standard error	Beta			Lower bound	Upper bound
(Constant)	13.503	7.264		1.859	0.064	-0.789	27.796
Age	0.387	0.115	0.174	3.363	< 0.001	0.160	0.613
BMI	0.571	00.174	0.165	3.275	0.001	0.228	0.914
Unemployed	12.098	2.739	0.238	4.417	< 0.001	6.709	17.487
Retired or on sick leave	13.876	2.262	0.326	6.134	< 0.001	9.425	18.328
Rheumatoid arthritis	7.438	2.944	0.128	2.526	0.012	1.645	13.231
Physical activity	-8.581	2.024	-0.211	-4.239	< 0.001	-12.564	-4.599

Multiple linear regression. In all analyses, p‹0.05 (with a 95% confidence interval) was considered statistically significant.

associated with considerable socioeconomic costs (30), requiring medication for pain relief, continual visits to medical specialists, support therapies and physiotherapeutic treatments, among other measures.

It is important to control lifestyle habits such as those impacting on sleep quality [51], which is closely related to pain and fatigue. Most of the participants in our study reported poor sleep quality, a factor that might be related to the high pain scores recorded for both the FIQR and the FFI. Regular physical exercise and good nutrition are key factors in alleviating the impact of fibromyalgia. Among our participants, a greater BMI was associated with a higher FFI score, which is in line with D'Onghia [52], who reported that obesity was related to pain intensity, stiffness, fatigue, functional disorders, physical disability, poor sleep quality, cognitive dysfunction and an impaired quality of life. To prevent these consequences, low-intensity exercise, combining resistance training and coordination, can improve psychological variables, reduce perceived pain, enhance the quality of life and improve physical condition [53]. In our study, poor foot function was associated with low levels of physical activity, probably due to the patients' inability to perform it.

A better understanding of foot function and related factors would enable us to design and implement individualised treatment plans to reduce the impact of fibromyalgia and improving patients' quality of life.

5. Limitation

The present study is subject to certain limitations, chief among which is the relatively small sample size considered. Although 323 patients were included, this number may be considered inadequate, given that the disease affects 2.4% of the population.

Another important limitation is the fact that the disease provokes acute episodes of pain, but our study data do not reflect whether the patient was experiencing such a flare-up when the questionnaires were completed. This situation would have generated a short-term increase in the intensity and number of associated symptoms, which could have biased the scores obtained with each questionnaire.

When comparing patients with rheumatoid arthritis who experience foot problems alongside fibromyalgia, it can indeed present challenges in conducting a comprehensive analysis. Furthermore, it is important to consider the specific types of foot problems encountered by these patients, such as flat foot or cavus foot, as these conditions could potentially introduce bias into the study. By not accounting for the specific foot problems, the results may not accurately reflect the true impact of the comorbidity. Therefore, it is crucial to address and document the specific foot conditions experienced by the patients to ensure a more accurate assessment of the relationship between rheumatoid arthritis, fibromyalgia, and associated foot problems.

6. Conclusion

Fibromyalgia affects foot function, provoking pain and disability and significantly impairing the activities of daily living. The main factors associated with reduced foot function are age, BMI, insufficient physical activity, the presence of rheumatoid arthritis and employment status. A greater awareness of the importance of these factors could help physicians and patients establish preventive measures to improve foot health and alleviate the impact of fibromyalgia.

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