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Original Research Article

Clinical, Psychological, and Neurophysiological Outcomes Associated with Pain and Function in Individuals with Unilateral Plantar Heel Pain

Francisco Alburquerque-Sendín, PT, PhD*,† Marta Ríos-León, PT, PhD‡ Juan A. Valera-Calero, PT, PhD§ Gustavo Plaza-Manzano, PT, PhD¶,| César Fernández-de-las-Peñas, PT, PhD, Dr Scient,||, Ricardo Ortega-Santiago, PT, PhD||,** and Daiana Priscila Rodrigues-de-Souza, PT, PhD***

*Department of Nursing, Pharmacology and Physical Therapy, Universidad de Córdoba, Córdoba, Spain; †Maimonides Biomedical Research Institute of Cordoba (IMIBIC), Córdoba, Spain; ‡Hospital Nacional de Parapléjicos, SESCAM, Toledo, Spain; §Department of Physiotherapy, Faculty of Health, Universidad Camilo José Cela, Villanueva, de la Cañada, Madrid, Spain; ¶Instituto de Investigación Sanitaria del Hospital Clínico San Carlos, Madrid, Spain; |Department of Radiology, Rehabilitation and Physiotherapy, Universidad Complutense de Madrid, Madrid, Spain; ||Department of Physical Therapy, Occupational Therapy, Rehabilitation and Physical Medicine, Universidad Rey Juan Carlos, Alcorcón, Madrid, Spain; and **Cátedra de Investigación y Docencia en Fisioterapia: Terapia Manual y Punción Seca, Universidad Rey Juan Carlos, Alcorcón, Madrid, Spain

Correspondence to: César Fernández de las Peñas, PT, PhD, DrScient, Facultad de Ciencias de la Salud, Universidad Rey Juan Carlos, Avenida de Atenas s/n, 28922 Alcorcón, Madrid, Spain. Tel: +34 91 488 88 84; Fax: + 34 91 488 89 57; E-mail: cesar.fernandez@urjc.es.

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Abstract

Objective. To assess the potential relationship of demographic (age, gender, body mass index, height, weight), clinical (affected side, duration of symptoms, health-related quality of life), psychological (depressive levels), or neurophysiological (pressure pain sensitivity and number of trigger points) variables with foot function and pain intensity in patients with unilateral plantar heel pain (PHP). **Methods**. Fifty-four patients with PHP (48% females) were recruited. Data on demographics, months with pain, time in standing position, depression, pressure pain thresholds (PPTs), number of trigger points, health-related quality of life, function, and pain intensity were collected. A multivariable correlation analysis was performed to determine the associations among the variables, and a regression analysis was conducted to explain the variance in function and pain intensity. **Results**. Pain intensity was negatively correlated with symptom duration and calcaneus bone PPT and positively associated with gender, time in standing position, and number of trigger points. Function was negatively correlated with PPTs on the calcaneus bone, the flexor digitorum brevis muscle, and the abductor hallucis muscle and with quality of life and was positively correlated with age, gender, and depressive levels. Stepwise regression analyses revealed that 60.8% of pain intensity was explained by female gender, calcaneus PPTs, time in a standing position, and function. Furthermore, gender, quality of life, age, depressive levels, and calcaneus bone PPTs explained 52.4% of function variance. **Conclusions**. This study found that demographic, clinical, psychological, and neurophysiological variables can mutually interact to affect function and pain intensity in patients with unilateral PHP. These findings could guide clinicians in the identification, prevention, and treatment of PHP risk factors.

Key Words: Plantar Heel Pain; Pain; Depression; Function; Foot; Pressure Pain

Introduction

Plantar heel pain (PHP) is a musculoskeletal condition characterized by throbbing medial plantar heel pain, especially during the first step in the morning or after long rest periods [1]. Although pain symptoms decrease after further walking, several actions, such as prolonged weight bearing and plantar fascia overload or stretching, increase symptoms [2]. Its prevalence ranges from 4% to 9.6% and can be highly disabling (loss of work) in almost 8% of the patient population [3]. The annual economic burden of PHP, in both direct and indirect costs, is estimated at US$284 million in the United States of America [4]. In fact, around two million patients consult a health care professional every year for this condition [5]. Despite the impact and prevalence of PHP, its pathogenesis/etiology is not completely understood, and this lack of understanding makes it difficult to determine effective treatment and preventive programs [6]. In fact, up to 20% of patients with PHP continue with symptoms longer than 1 year [7].

Previous studies have attempted to identify intrinsic and extrinsic physical factors associated with the presence of PHP. Foot-level findings (e.g., pronated foot type, limited ankle joint, or first metatarsophalangeal dorsiflexion) [7], presence of active trigger points (TrPs) [8], reduced muscle strength and endurance [7], increased body mass index (BMI) [9], and occupations requiring long periods of standing [3] have been found to be directly associated with the presence of PHP. Others have investigated the role of psychological factors in PHP. Cotchett et al. found that stress and depression were significant predictors of foot pain and function in females with PHP [10]. Similar results were recently observed by Harutaichun et al., who found that anxiety was associated with pain intensity in a military sample suffering from PHP [11]. Previous studies have investigated only physical or only psychological factors. Emerging evidence also supports the presence of altered central nociceptive pain processing in people with PHP [12, 13]; however, the relevance of this factor to pain and function has not been previously investigated in the population with PHP.

Identification of the variables associated with pain and function in patients with PHP could help clinicians to identify, prevent, and more effectively treat risk factors. No previous study has investigated the role of demographic, clinical, psychological, and neurophysiological factors and the relative importance of each associated variable to explaining the variance of pain intensity and function in PHP. Therefore, the objective of the present study was to investigate the relationship of demographic (age, gender, BMI, height, weight), clinical (affected side, duration of symptoms, health-related quality of life), psychological (depressive levels), or neurophysiological (pressure pain sensitivity and number of TrPs) variables with pain intensity and function in people with PHP.

Methods

Participants

Consecutive individuals presenting to a tertiary physical therapy clinic in Madrid, Spain, with a report of PHP from January 2020 to June 2021 were screened for potential eligibility. Inclusion criteria included 1) age 18 years or older; 2) unilateral heel pain symptoms lasting longer than 3 months; and 3) a clinical diagnosis of PHP as described by the clinical practice guidelines from the Orthopaedic Section of the American Physical Therapy Association (APTA), i.e., insidious onset of sharp pain on the plantar heel surface on weight bearing after a period of non–weight bearing, pain increasing in the morning with the first step after waking up, and tenderness with palpation of the proximal insertion of the plantar fascia [14]. Exclusion criteria were 1) previous surgery within the lower extremity; 2) presence of any positive neurological sign consistent with nerve root compression; 3) any underlying medical condition causing heel pain, e.g., rheumatoid arthritis, diabetes mellitus, peripheral neuropathy; or 4) receipt of any type of treatment for the foot within the previous 6 weeks. The study was approved by the local Ethics Committee (URJC 051220160022020). All participants signed a written informed consent form before their inclusion.

Main Outcomes: Pain and Function

Participants rated, on an 11-point numerical point rating scale (NPRS; 0= no pain; 10= maximum pain), their pain intensity at their first step in the morning, their mean pain intensity during the day, and their worst level of pain experienced during the preceding week [15]. The mean of all values was used to calculate a pain intensity score for the main analysis.

Function was assessed with the Foot Function Index (FFI) [16], the most commonly used foot-specific self-measure [17]. The FFI has shown to be valid, reliable, and sensitive to change in people with PHP [18]. The FFI consists of 23 self-reported items divided into three subscales: pain (nine items), disability (nine items), and activity limitation (five items). Each item is scored from 0 (no pain or difficulty) to 10 (worst pain or pain so difficult that it requires help). Each subscale scores from 0% to 100%, where higher scores indicate lower levels of function and worse foot health–related quality of life [18]. In the present study, the FFI total score, i.e., the mean of the three subscale scores, was used in the main analysis.

Demographic and Clinical Data

The demographic data collected included age, gender, and height and weight (BMI; kg/m^2). Clinical data included the affected side, number of years with pain, number of hours per day in a standing position, and health-related quality of life.

Health-related quality of life was assessed with the paper-based five-level version of EuroQol-5D (EQ-5D-5L) [19, 20]. All responses were converted to an overall utility score (0–1) by applying crosswalk index values for Spain [21]. Quality-adjusted life-years were estimated for each participant. Quality-adjusted life-years combine length and quality of life into a single index number between 0 and 1, where 0 corresponds to a health state judged to be equivalent to death and 1 corresponds to optimal health [21].

Neurophysiological Variables: Pressure Pain Thresholds and TrPs

Participants were asked to avoid any analgesic or muscle relaxant for 24 hours before the examination. The minimal amount of pressure at which a sensation of pressure changes to pain (i.e., the pressure pain threshold [PPT]) was assessed with an electronic algometer (Somedic, Farsta, Sweden). Pressure was applied at a rate of approximately 30 kPa/s on each point. Participants were instructed to press the "stop button" of the algometer as soon as the pressure resulted in the first sensation of pain. The mean of three trials on each point was calculated and used for the main analysis. A 30-second resting period was allowed between trials for avoiding possible temporal summation [22].

PPTs were bilaterally assessed over different musculoskeletal structures, including the main symptomatic area (the calcaneus bone [origin of the plantar fascia]) and two adjacent areas (the flexor digitorum brevis and abductor hallucis muscles), one segmental-related area (the tibialis anterior muscle), and one distant pain-free unrelated area (the second metacarpal space). Xiong et al. found intra-rater reliability ranging from 0.74 to 0.97 for PPT scores in these areas [23].

The internal gastrocnemius muscles, flexor hallucis brevis, adductor hallucis, and quadratus plantae were explored for the presence of TrPs as previously described [8]. The order of evaluation was randomized between subjects, with a 2-minute rest period between muscles. TrPs were diagnosed when there was a sensitive spot in a taut band of a skeletal muscle that elicited referred pain in response to manual compression [24]. A TrP was considered active when the elicited referred pain reproduced, partially or totally, the symptom of the patient, whereas a TrP was considered latent when the elicited referred pain did not reproduce any symptom experienced by the patient [24]. The total number of TrPs was included in the analysis.

Psychological Variable: Depressive Levels

The severity of depression was evaluated with the Beck Depression Inventory (BDI-II), a 21-item self-report questionnaire assessing affective, cognitive, and somatic symptoms of depression [25].

Sample Size Determination

The sample size was estimated for the dependent outcomes of pain intensity and function (FFI score). An adequate sample size for prediction models was based on a range of 10–15 subjects per potential predictor variable, with no more than five predictors within the model [26]. Accordingly, for three potential predictor variables, a minimum of 45 participants would be required. In an alternative sample size calculation according to the multiple linear regression model (GPower 3.1 software), with an estimated mean effect size of 0.25, an alpha level 0.05, power of 0.9, and two predictors, the required sample size would be 54 subjects.

Statistical Analysis

Descriptive statistics (means and standard deviations) were used to describe participant features from the total sample and by gender. The Kolmogorov-Smirnov test revealed that all quantitative data exhibited a normal distribution. Independent Student *t* tests were conducted to evaluate gender differences for all outcomes.

A multiple linear regression analysis was used to determine which predictor variables could be associated with the main (dependent) variables: pain intensity (NPRS, 0–10) and function (FFI total score). The following variables were considered as potential predictors and included within the models: age, sex, height, weight, months with symptoms, time in a standing position, BDI (depressive levels), health-related quality of life (EQoL-5D), PPTs, and number of TrPs.

First, correlations between the predictor and the dependent variables were assessed through the use of Pearson correlation coefficients. The Pearson correlation coefficients were used to identify multicollinearity and shared variance between the variables (defined as $r > 0.8$). All statistically significant variables associated with pain intensity (NPRS) or function (FFI score) were included in a stepwise multiple linear regression model (hierarchical regression analysis) to assess the independent variables that contributed significantly to the variance of each of the dependent variables. The significance criterion of the critical *F* value for entry into the regression equation was set at $P < 0.05$. Changes in adjusted R^2 were reported after each step of the regression model to determine the association of the additional variables.

Results

Sixty individuals with symptoms compatible with PHP were screened for eligible criteria. Six individuals (10%) were excluded because of bilateral symptoms (n = 3) and previous steroid injection (n = 3). Finally, 54 patients (48% women, mean age: 41 ± 13.5 years) were included. Table 1 shows data of the total sample and by gender. Females had lower height and weight, higher pain intensity, worse function, lower PPTs, and a greater number of TrPs than did males.

Table 1. Baseline outcomes (mean ± standard deviation) of the sample (total and by gender)

	Total (n = 54)	Males (n = 28)	Females (n = 26)
Age, years	41.0 ± 13.5	42.7 ± 13.1	39.1 ± 14.2
Height, cm	172.4 ± 10.5	177.9 ± 8.3	166.6 ± 9.6**
Weight, kg	78.6 ± 16.4	87.0 ± 16.3	69.4 ± 10.8**
BMI, kg/m^2	28.1 ± 16.0	30.9 ± 21.7	25.1 ± 3.8
Affected side, n, left/right	28/26	15/13	13/13
Duration of pain, months	23.9 ± 28.1	30.2 ± 34.7	17.15 ± 16.6
Time in standing position, hours/day	3.05 ± 2.5	3.2 ± 2.65	2.9 ± 2.4
Mean Intensity of Foot Pain, NPRS, 0–10	5.8 ± 2.0	4.7 ± 1.8	6.95 ± 1.45**
FFI, 0–100			
Pain scale	43.5 ± 21.15	34.05 ± 17.6	53.8 ± 20.1**
Disability scale	32.15 ± 23.7	23.0 ± 19.5	42.0 ± 24.3**
Activity limitation scale	13.0 ± 12.0	10.4 ± 11.0	15.8 ± 12.6
Total score	40.7 ± 18.3	31.8 ± 16.1	50.25 ± 15.8**
Beck Depression Inventory, 0–21	10.4 ± 10.4	8.4 ± 9.9	12.45 ± 10.7
EuroQoL-5D, 0–1	0.7 ± 0.15	0.7 ± 0.15	0.65 ± 0.2
PPT, kPa			
Hand	210.8 ± 100.0	227.5 ± 120.6	193.2 ± 71.6
Tibialis anterior muscle	284.4 ± 144.2	325.6 ± 171.6	239.3 ± 92.2*
Calcaneus bone	366.8 ± 216.7	395.2 ± 212.8	334.4 ± 220.7
Flexor digitorum brevis muscle	321.7 ± 125.5	376.6 ± 124.5	263.8 ± 98.1**
Abductor hallucis muscle	271.6 ± 98.1	306.0 ± 103.9	230.45 ± 71.6**
Number of TrPs	7.3 ± 4.8	5.8 ± 5.3	9.0 ± 3.7*

*$P < 0.05$; **$P < 0.001$.

Bivariate Correlation Analysis

The intensity of foot pain was negatively correlated with months with pain ($r = –0.301$, $P = 0.02$) and PPT over the calcaneous bone ($r = –0.471$, $P < 0.001$) and was positively associated with gender ($r = 0.577$, $P < 0.001$), time in a standing position ($r = 0.402$, $P = 0.002$), and the number of TrPs ($r = 0.240$, $P = 0.035$).

Function was negatively correlated with PPTs over the calcaneus bone ($r = –0.358$, $P = 0.004$), the flexor digitorum brevis muscle ($r = –0.350$, $P = 0.005$), and the abductor hallucis muscle ($r = –0.347$, $P = 0.007$) and with EQ-5D-5L ($r = –0.425$, $P < 0.001$) and was positively associated with age ($r = 0.233$, $P = 0.04$), gender ($r = 0.507$, $P < 0.001$), and BDI-II ($r = 0.314$, $P = 0.02$).

In addition, significant correlations existed among the independent variables (r: $–0.233 < r < 0.682$; Table 2), but none were considered to be multicollinear (defined as $r > 0.8$); therefore, each variable was included in the regression analyses.

Multiple Regression Analysis

The hierarchical regression analyses for pain intensity and function are shown in Tables 3 and 4, respectively.

Stepwise regression analyses revealed that gender (contribution 32%), PPT over the calcaneous bone (contribution 18%), time in a standing position (contribution 7%), and function (contribution 2.8%) were significant predictors of pain intensity, and, when all combined, they explained 60.8% of the variance in foot pain (adjusted r^2: 0.608; $P < 0.001$, Table 3).

Similarly, regression analyses revealed that gender (contribution 24%), health-related quality of life (contribution 10%), age (contribution 8%), depression (contribution 6%), and PPT over the calcaneous bone (contribution 3%) were significant predictors of function, and, when combined, they explained 52.4% of the variance in foot function (adjusted r^2: 0.524; $P < 0.001$, Table 4).

Discussion

This study found that pain intensity and foot function in patients with PHP can be partially explained through the use of a regression analysis based on demographic, psychological, and neurophysiological variables, which supports the complexity of this pain condition. The present findings could guide clinicians in the identification, prevention, and treatment of these PHP risk factors.

Association of PHP Pain and Function with Demographic Variables

The main demographic feature associated with pain intensity and function was female gender. A second demographic feature associated just with function was older age. Although the peak prevalence of PHP occurs between 20 and 34 years of age, no clear association between PHP with age is generally reported [14]. Thus, even if the presence of PHP is most common in female runners [14], a previous systematic review did not find enough evidence to consider an association between gender and PHP [3]. This imbalance could be due to the differences in the risk profiles of men and women during sports practice [27]. Our results showed that females exhibited greater foot pain intensity and worse function.

Table 2. Pearson product–moment correlation matrix showing the association of the intensity of foot pain and function (FFI total score) with the independent variables

	Pain Intensity	FFI Total Score	Age	Gender	BMI	Months with Pain	Time in Standing Position	BDI	EuroQoL-5D	Hand PPT	Tibialis Anterior-Muscle PPT	Calcaneus PPT	Flexor Digitorum Brevis Muscle PPT	Abductor Hallucis Muscle PPT
Age	–0.200	0.233*												
Gender	0.577**	0.507**	–0.131											
BMI	–0.185	–0.107	0.209	–0.186										
Months with pain	–0.301*	–0.086	–0.007	–0.234*	–0.046									
Time in standing position	0.402**	0.107	0.260*	–0.056	–0.002	–0.037								
BDI-II	0.209	0.314*	–0.250*	0.196	0.070	0.281*	–0.291*							
EQ-5D-5L	–0.164	–0.425**	0.082	–0.166	–0.007	0.238*	–0.109	0.238*						
Hand PPT	0.080	–0.168	–0.296*	–0.171	0.000	0.111	–0.282*	0.604**	0.157					
Tibialis anterior PPT	0.043	–0.202	–0.352**	–0.299*	0.033	0.238*	–0.263*	0.452**	0.044	0.682**				
Calcaneus PPT	–0.471**	–0.358**	–0.287	–0.142	0.029	0.165	–0.214	0.400**	–0.024	0.709**	0.708**			
Flexor digitorum brevis muscle belly PPT	–0.071	–0.350**	–0.501**	–0.457**	0.078	0.198	–0.195	0.138	–0.101	0.428**	0.641**	0.585**		
Abductor hallucis muscle belly PPT	–0.120	–0.347**	–0.261*	–0.411**	0.148	0.143	–0.257*	0.213	0.040	0.392**	0.598**	0.618**	0.827**	
Number of TrPs	0.240*	0.082	–0.360**	0.330**	–0.175	0.315*	–0.342**	0.679**	0.172	–0.585**	–0.393**	–0.388**	0.125	0.169

*$P < 0.05$; **$P < 0.01$.

Table 3. Summary of the stepwise regression analyses to determine predictors of mean intensity of foot pain

	Predictor Outcome	*B*	SE *B*	95% CI	*B*	*t*	*P*
Mean intensity of foot pain	Step 1						
	Gender	2.283	0.449	1.383 to 3.183	0.577	5.089	<0.001
	Step 2						
	Gender	2.972	0.413	2.142 to 3.803	0.751	7.192	<0.001
	Calcaneus PPT	–0.442	0.133	–0.709 to –0.174	–0.489	–3.318	0.002
	Step 3						
	Gender	3.189	0.390	2.405 to 3.972	0.805	8.179	<0.001
	Calcaneus PPT	–0.461	0.124	–0.710 to –0.213	–0.511	–3.732	<0.001
	Time in standing position	0.232	0.077	0.078 to 0.387	0.290	3.026	0.004
	Step 4						
	Gender	2.719	0.428	1.858 to 3.579	0.678	6.355	<0.001
	Calcaneus PPT	–0.429	0.120	–0.669 to –0.189	–0.475	–3.588	0.001
	Time in standing position	0.210	0.074	0.060 to 0.359	0.261	2.818	0.007
	FFI total score	0.025	0.011	0.003 to 0.048	0.231	2.270	0.028

SE= standard error; CI= confidence interval.
R^2 adj.= 0.320 for step 1, R^2 adj.= 0.505 for step 2, R^2 adj.= 0.574 for step 3, and R^2 adj.= 0.608 for step 4.

Table 4. Summary of the stepwise regression analyses to determine predictors of ffi total score

	Predictor Outcome	*B*	SE *B*	95% CI	*B*	*t*	*P*
FFI total score	Step 1						
	Gender	18.430	4.348	9.704 to 27.155	0.507	4.238	<0.001
	Step 2						
	Gender	16.319	4.079	8.130 to 24.507	0.449	4.001	<0.001
	EQ-5D-5L	–34.804	12.737	–65.374 to –14.235	–0.350	–3.125	0.003
	Step 3						
	Gender	17.643	3.844	9.922 to 25.364	0.485	4.590	<0.001
	EQ-5D-5L	–41.935	11.940	–65.917 to –17.954	–0.369	–3.512	0.001
	Age	0.404	0.140	0.122 to 0.686	0.301	2.874	0.006
	Step 4						
	Gender	15.446	3.725	7.961 to 22.931	0.425	4.147	<0.001
	EQ-5D-5L	–51.435	11.835	–75.218 to –27.652	–0.453	–4.346	<0.001
	Age	0.498	0.137	0.222 to 0.774	0.371	3.625	0.001
	BDI-II	0.503	0.190	0.122 to 0.885	0.285	2.651	0.011
	Step 5						
	Gender	13.109	3.786	5.498 to 20.721	0.360	3.463	<0.001
	EQ-5D-5L	–55.574	11.645	–78.988 to –32.160	–0.489	–4.772	<0.001
	Age	0.437	0.136	0.163 to 0.711	0.325	3.202	0.002
	BDI-II	0.682	0.204	0.272 to 1.091	0.386	3.348	0.002
	Calcaneus PPT	–1.892	0.925	–3.752 to –0.033	–0.228	–2.046	0.046

SE= standard error; CI= confidence interval.
R^2 adj.= 0.242 for step 1, R^2 adj.= 0.352 for step 2, R^2 adj.= 0.433 for step 3, R^2 adj.= 0.494 for step 4, and R^2 adj.= 0.524 for step 5.

It should be noted that previous reviews and studies considered the potential association of sociodemographic variables with the presence (prevalence) of PHP, but not with clinical variables, e.g., pain intensity and function, such as in our study.

Similarly, a previous systematic review investigating the association of PHP with sociodemographic features reported that PHP was more frequently found in individuals with lower socioeconomic level, infrequent use of high-heeled footwear (females), low physical activity, and higher BMI [3]. Again, that review investigated the association of lifestyle factors and frequency of health care use with the presence of PHP but not with any clinical feature [3]. In line with this hypothesis, although the association between BMI and PHP seems to be strong in nonathletic populations, causality cannot be clearly confirmed [28]. In the present study, neither height or weight nor BMI explained pain intensity and foot function. This lack of correlation could be one reason explaining the low grade of evidence (E) of weight loss interventions as a treatment option for PHP [14].

Association of PHP Pain and Function with Grade of Depression

Although the present study is not the first study to use a hierarchical regression analysis to explain the variance in pain and function in patients with PHP [10], we significantly improved the accuracy of this previous model. The most accurate models provided by Cotchett et al. [10] explained 25% of the variation in foot function on the

basis of age, sex, BMI, and depression and 0.7% of the variation in foot pain scores on the basis of age, gender, and BMI.

However, applying specific models for female gender and depression contributed an additional 16% of the variance in foot pain. In addition, another model based on female gender, BMI, and stress accounted for 6.4% of the variance in foot pain. Anxiety was a not predictor of foot pain in women or men in the study by Cotchett et al. [10]. We observed that the severity of depression contributed 6% to the variance in function, but not to pain intensity, in agreement with Cotchett et al. [10]. The present results and previous results support the role of depressive levels in function in individuals with PHP. In fact, previous evidence has supported an association between depression and the severity of chronic pain [29]. Therefore, depression should be considered in preventive and treatment programs for individuals with PHP. Nevertheless, it should be considered that the depressive levels observed in our study and in the study by Cotchett et al. [10] were relatively small.

Association of PHP Pain and Function with Neurophysiological Outcomes

The association of pressure sensitivity with pain and function was assessed in the present study for the first time. We assessed PPTs in several locations, both locally and distally, but only PPT on the calcaneous bone was included in regression models. The presence of lower PPTs in a symptomatic area (e.g., the calcaneous bone) reflects the presence of peripheral sensitization, whereas the presence of lower PPTs in distant pain-free areas (e.g., the hand) is a sign of central sensitization [30]. Although current evidence supports the presence of widespread pressure pain hyperalgesia as a sign of central sensitization in PHP [12, 13], the present study showed an association of pain intensity and function with localized, but not widespread, PPTs. These results would agree with current theories explaining the relevance of localized sensitization, probably related to potential damage in the plantar fascia or surrounding tissues, in individuals with PHP [13]. In fact, linear associations of widespread pressure pain sensitivity with pain, pain-related disability, or function in musculoskeletal pain disorders are controversial [31]. This could be attributed to the fact that pain is a complex experience in which clinical and biological factors do not directly influence pain perception, representing valuable individual difference factors.

Limitations

Finally, some potential limitations of the present study should be recognized. First, we used a cross-sectional design; therefore, cause-and-effect relationships should not be inferred. Second, although we included multiple aspects, such as demographic, clinical, psychological, and neurophysiological variables, other variables, such as sleep disturbances, fear of movement, and anxiety, were not included. These other variables could give a broader vision of the biopsychosocial model approach in PHP. In addition, objective measures, such as the thickness of the plantar fascia observed via ultrasound, could also play a role in understanding pain intensity and function in the population with PHP [32]. Future longitudinal studies will help to determine the clinical implications of these identified factors.

Conclusions

This study found that pain intensity and foot function in patients with PHP can be partially explained (60.8% and 52.4%, respectively) by demographic, clinical, psychological, and neurophysiological variables. Female gender and PPT on the calcaneous bone were associated with pain intensity and function. Depressive levels were associated with function but not with pain intensity. These findings could guide clinicians in the identification, prevention, and treatment of these PHP risk factors. Future longitudinal studies will help to determine the clinical implications of these findings.

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