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LITERATURE REVIEW

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Psychosocial variables and presence, severity and prognosis of plantar heel pain: A systematic review of cross-sectional and prognostic associations

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Abstract

Objective: Plantar heel pain (PHP) is often disabling, and persistent symptoms are common. Psychosocial variables are known to affect pain and disability but the association of these factors with PHP has yet to be established. The purpose of the present systematic review was to determine if psychosocial variables are associated with the presence, severity and prognosis of PHP.

Methods: A systematic review of the literature and qualitative synthesis was carried out. Electronic searches of MEDLINE, CINAHL, SPORTDiscus, PsycINFO and EMBASE were undertaken from the inception of the respective databases up to November 2017. Any study design incorporating measurements of psychosocial variables with participants with plantar heel pain were included. The quality of included articles was appraised using the Newcastle Ottawa Scale.

Results: Five articles from four studies were included in the review, with a total of 422 participants. Moderate-level evidence suggested a clinically unimportant association with the incidence of PHP and depression, anxiety and stress, and limited evidence suggested a clinically unimportant association with job dissatisfaction. Moderate-level evidence suggested that there may also be an association between depression, anxiety, stress and catastrophization and PHP pain, and between depression, anxiety, stress, catastrophization and kinesiophobia and PHP function. We also found moderate-level evidence that a psychological disorder may be associated with a poorer outcome to shockwave therapy.

Conclusion: In light of this review, the association of psychosocial variables and plantar heel pain cannot be ruled out. Given recommendations to adopt an individualized and stratified approach to other musculoskeletal conditions, clinicians should remain vigilant to their presence.

KEYWORDS

plantar heel pain, presence: severity, prognosis, psychosocial variables, systematic review

1 | INTRODUCTION

Plantar heel pain (PHP) is an umbrella term for pain on the plantar aspect of the heel (Riel et al., 2017). The terminology associated with PHP is varied, including plantar fasciitis, plantar fasciopathy and chronic plantar heel pain, which reflects the limited understanding of the pathoaetiology of this disorder, with suggested inflammatory, degenerative, vascular and neural components (McMillan, Landorf, Barrett, Menz, & Bird, 2009; Rodrigues et al., 2015). Adult foot complaints are common; an Australian survey reported a 17.5% prevalence of foot pain in the general population, with approximately 20% of these respondents reporting heel pain (Hill, Gill, Menz, & Taylor, 2008). PHP is also one of the most commonly reported running injuries, accounting for up to 17.5% of such injuries (Lopes, Hespanhol, Yeung, & Pena Costa, 2012). A UK survey of general practice found that foot and ankle conditions accounted for 8% of musculoskeletal consultations, with 7.5% of these being diagnosed as PHP (Menz, Jordan, Roddy, & Croft, 2010). A US study reported approximately one million outpatient healthcare visits per year for the diagnosis and management of PHP (Riddle & Schappert, 2004). The disease is often disabling, and while there is evidence of improvement following a range of treatments, persistent or recurrent symptoms are common (Landorf, 2015). A 5–15-year follow-up cohort study reported the risk of persistent symptoms at 10 years at 46.5%, with asymptomatic participants suffering symptoms for a mean duration of 725 days (Hansen, Krogh, Ellingsen, Bolvig, & Fredberg, 2018).

The first-line management of PHP routinely has a biomedical focus, with multiple healthcare providers involved in the provision of care. Treatments include stretching, strengthening, nonsteroidal anti-inflammatory drugs, orthotics, activity modification, advice, weight loss, night splints, electrotherapy, corticosteroid injections, extracorporeal shock wave therapy (ESWT) and platelet-rich plasma injections (Landorf, 2015; Martin et al., 2014). Such a variety of treatments highlights the limited current understanding of the condition, and also the paucity of high-quality randomized controlled trials.

Psychosocial variables, such as depression, anxiety and stress, have been shown to affect pain and disability (Jensen et al., 2012; Mallows, Debenham, Walker, & Littlewood, 2016; Vargas-Prada & Coggon, 2015). Pain catastrophization is the tendency to magnify and ruminate on pain, and kinesiophobia is a fear of movement. Both catastrophization and kinesiophobia are associated with pain severity and function in knee osteoarthritis (Helminen, Sinikallio, Valjakka, Väisänen-Rouvali, & Arokoski, 2016). In the foot and ankle, a significant association has been demonstrated between anxiety, depression, neuroticism and patients presenting with chronic foot and ankle pain (Awale, Dufour, Katz, Menz, & Hannan, 2016; Shivarathre, Howard, Krishna, Cowan, & Platt, 2014). However, data from these studies refer to generalized foot and/or ankle pain and do not allow for a subset of PHP data to be analysed. A systematic review evaluating the association between psychological variables and tendinopathy reported that psychological variables may be associated with and negatively influence outcome in tendinopathy, and, as such, recommended that clinicians should give due consideration to assessing and managing these variables in a multi-dimensional management plan (Mallows et al., 2016). However, a survey of physiotherapy practice in the UK found that the management approaches most routinely used for PHP were advice, education and general stretching exercises, with no reported evidence of psychosocial considerations (Grieve & Palmer, 2016).

To our knowledge, there is currently no systematic literature review of the evidence examining the cross-sectional and prognostic associations between psychosocial variables and PHP. Establishing any association between PHP, in terms of presence, severity and prognosis, and psychosocial variables may facilitate an individualized and stratified approach to PHP management. Hence, the aim of the present systematic review was to investigate the association between the presence, severity and prognosis of PHP and psychosocial variables.

2 | METHODS

The protocol of the present systematic review was registered (CRD42016046987) and it was performed using the predetermined protocol in accordance with the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA) statement (Moher et al., 2015).

2.1 | Data sources and search strategy

An electronic search of MEDLINE, CINAHL, SPORTDiscus, EMBASE and PsycINFO was undertaken from the inception of the respective databases up to November 2017. The search terms that were used are displayed in Table 1. The terms were kept intentionally broad as it was expected that there would be a limited number of studies in this area. Similar search terms and outcomes have been used previously (Mallows et al., 2016). In addition to the electronic search, citation searching and a hand search of the reference lists of the papers identified were carried out, and recognized experts in the field of PHP were contacted in an attempt to locate any further studies, published or unpublished, which were not identified in the electronic search. The search was conducted by two reviewers (C.D. and A.M.).

2.2 | Inclusion criteria

Studies recruiting adult participants with a clinical diagnosis of PHP were included. PHP was defined as heel pain on weight bearing and/or palpation of the plantar heel. Studies of symptomatic participants who did not have a specific diagnosis of PHP were excluded.

2.3 | Outcomes

Outcomes included the presence of PHP, and of pain and function, measured using patient-reported outcomes (PROS), including visual analogue scale (VAS) (Hawker, Mian, Kendzerska, & French, 2011) and the Foot Health Status Questionnaire (Bennett, Patterson, Wearing, & Baglioni, 1998). Other outcomes included the presence

TABLE 1 Key search terms used in the study selection process

	Search terms
1	Plantar heel pain OR Plantar fasci* OR heel pain syndrome
2	Depression OR anxiety OR stress OR psychosocial OR psycholog*
3	1 & 2 combined

of psychosocial variables, including depression, anxiety, stress, catastrophization and kinesiophobia, as measured by PROS, including the 21-item depression, anxiety and stress scale (short version) (Lovibond & Lovibond, 1995), pain catastrophizing scale (Sullivan, Bishop, & Pivik, 1995), Tampa Scale of Kinesiophobia (Kori, Miller, & Todd, 1991) and health questionnaires.

2.4 | Study design

Any study design which measured psychosocial variables in people with PHP were included, except for narrative reviews, editorials and other opinion-based publications, which were excluded.

2.5 | Language

No language restrictions were imposed.

2.6 | Risk of bias assessment

The Newcastle–Ottawa Scale (NOS; http://www.ohri.ca/programs) was used to assess the quality of the included studies. It was designed to evaluate bias based on participant selection, study group comparability, attainment of exposure in case–control studies and outcome of interest in cohort studies. It is a valid and reliable tool for assessing the quality of non-randomized studies, supported by the Cochrane Collaboration for quality appraisal of non-randomized trials (Zeng et al., 2015). The NOS uses a nine-star rating system with a maximum of four points available for selection, two for comparability and three for assessment of the outcome or exposure. The tool was deemed acceptable for the appraisal of cross-sectional studies as the effectiveness of an intervention was not being measured. Quality appraisal of the included articles was undertaken by two authors (C.D. and A.M.), and a third author (C.W.) was consulted in the event of any discrepancy.

2.7 | Data extraction

All data were extracted initially by a single author (C.D.) and verified by a second author (A.M.). Data included study characteristics, participant characteristics, source, sample size, intervention details if applicable, comparison group if applicable, and results. Quantitative data relating to psychosocial outcome measures, pain and function scores were also extracted. Statistical analyses were extracted including odds ratios (ORs), R2, and *p*-value.

2.8 | Data synthesis

Due to the heterogeneity of the psychosocial measures used in the studies, a qualitative approach to data synthesis was adopted, informed by the NOS score using levels of evidence (van Tulder, Furlan, Bombardier, & Bouter, 2003). Qualitative categorization of 'good' or 'poor' studies has not been established within the NOS guidance. A scoring system was therefore used to rate the evidence and inform the qualitative synthesis. The number of stars awarded to a study was divided by the number of items, to determine the score. Pre-determined methodological cut-off points were defined as: 0.00–0.44 low quality; 0.45–0.70 moderate quality; and 0.71–1.00 high quality. This calculation has been used previously to determine quality scores (Mallows et al., 2016). Levels of evidence have been adapted and adopted in previous research to grade the strength of observational and cross-sectional studies (Mallows et al., 2016). Levels are described as no evidence, conflicting, limited, moderate, and strong, based on the quality and number of studies (Table 2).

TABLE 2 Levels of evidence

Strong – consistent findings among multiple high-quality studies
Moderate – consistent findings among multiple low-quality studies or one high-quality study
Limited – one low-quality study
Conflicting – inconsistent findings among multiple studies
No evidence – no studies

ORs were deemed clinically relevant at ≤ 0.5 or ≥ 2.0, and the *p*-values of these were included to evaluate strength and significance, and were deemed significant when $p \leq 0.05$ (Littlewood, May, & Walters, 2013; McLean, May, Klaber-Moffett, Sharp, & Gardiner, 2010). R^2 was extracted to explain the variance in the dependent variable and was interpreted as follows: ≤ 0 = poor; 0.01–0.20 = slight; 0.21–0.40 = fair; 0.41–0.60 = moderate; 0.61–0.80 = substantial; 0.81–1.0 = almost perfect (Landis & Koch, 1977).

3 | RESULTS

3.1 | Study selection

The results of the literature search and study identification process are shown in Figure 1. The initial search identified 426 studies, with no additional studies identified through hand searching or citation searching. Following the removal of duplicates, 226 studies were screened by title and abstract for relevance. Five articles from four studies were included in the review (Chuckpaiwong, Berkson, & Theodore, 2009; Cotchett, Lennecke, Medica, Whittaker, & Bonanno, 2015,2016, 2017; Werner, Gell, Hartigan, Wiggerman, & Keyserling, 2010).

3.2 | NOS assessment

The quality appraisal of the included articles is shown in Table 3. Four articles were awarded seven stars and deemed to be of high quality (Chuckpaiwong et al., 2009; Cotchett et al., 2015, 2016, 2017), and the remaining article was awarded six stars and deemed to be of moderate quality (Werner et al., 2010).

3.3 | Study characteristics

The characteristics of the included articles are summarized in Table 4. Five articles from four studies were included, with a total of 422 participants (Chuckpaiwong et al., 2009; Cotchett et al., 2015, 2016, 2017; Werner et al., 2010). There was one cohort (Chuckpaiwong et al., 2009), and four cross-sectional observational articles (Cotchett et al., 2015, 2016, 2017; Werner et al., 2010).

The psychosocial variables measured included depression, anxiety and stress in two articles (Cotchett et al., 2015, 2016); catastrophization and kinesiophobia in one article (Cotchett et al.,

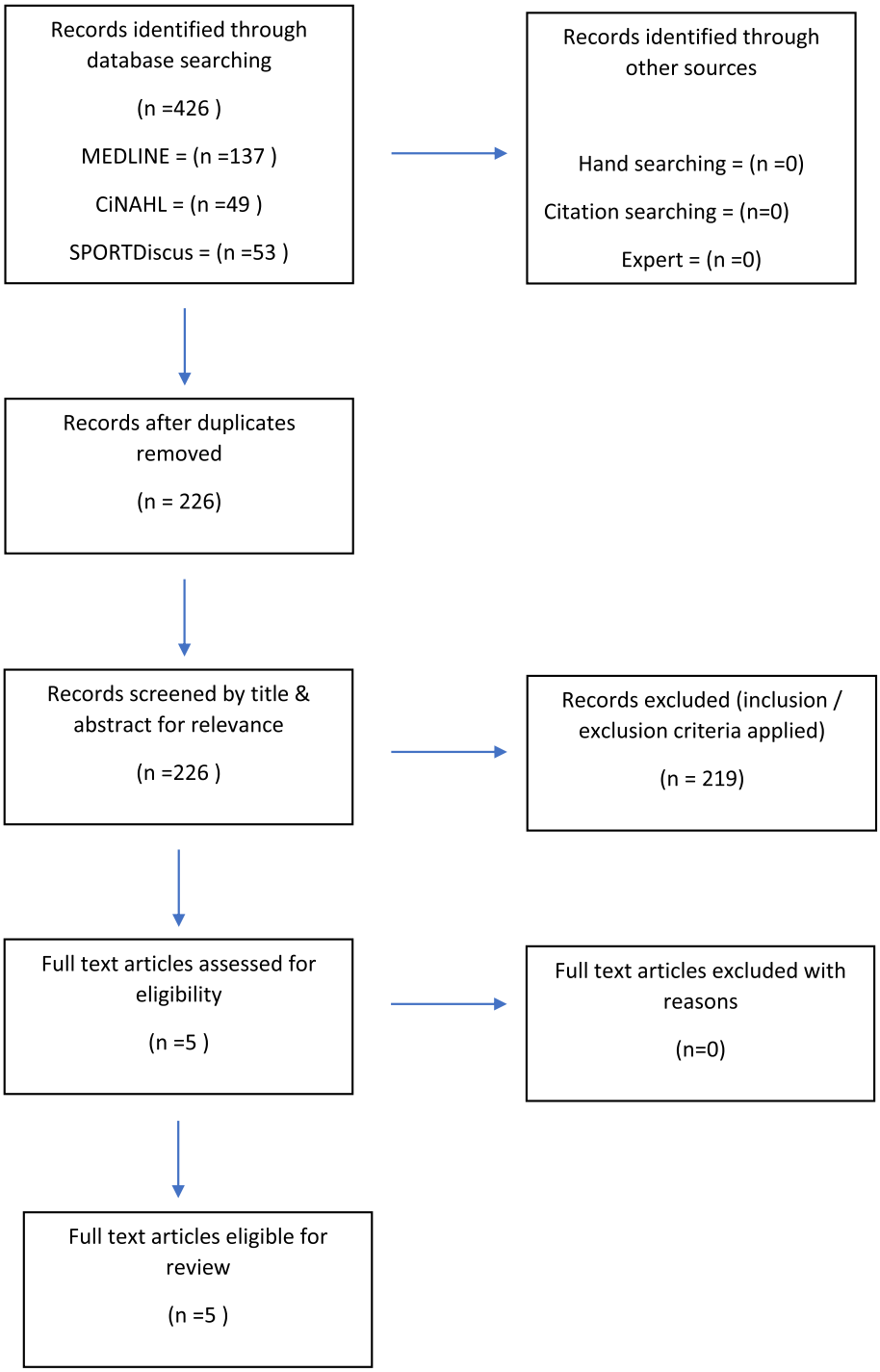

FIGURE 1 Study flow diagram

2017); psychological disorder in one article (Chuckpaiwong et al., 2009); and supervisor support, job dissatisfaction, co-worker support, job insecurity, education level, decision authority in one article (Werner et al., 2010).

TABLE 3 Risk of bias assessment

Author/ Year	Selection	Comparability	Exposure/outcome	Total No. stars	Quality of study
Chuckpaiwong et al. (2009)	***	**	**	7	High
Cotchett et al. (2017)	***	**	**	7	High
Cotchett et al. (2016)	***	**	**	7	High
Cotchett et al. (2015)	****	*	**	7	High
Werner et al. (2010)	**	**	**	6	Moderate

TABLE 4 Study characteristics

Study characteristics	Participants characteristics	Intervention	Psychosocial variable	Outcome measures	Incidence	Pain	Function	Prognosis
Chuckpaiwong et al. (2009) Cohort study Aimed to evaluate the clinical effectiveness of ESWT for the treatment of chronic PHP and to assess factors that influence the outcome of this treatment Bangkok, Thailand	225 participants (246 feet) who underwent consecutive ESWT treatment Male feet *n* = 74; female feet *n* = 172 The mean age of the participants was 48.8 years. Painful heel symptoms for 6 months or longer; and failure to respond to at least 5 conservative modalities	Single ESWT treatment session	Documented psychological disorder	Health questionnaire[a]	n/a	n/a	n/a	Clinically important association with psychological disorder and poorer outcome to ESWT (OR 0.161; $p < 0.05$)
Cotchett et al. (2017) Cross sectional, observational study Aimed to evaluate whether catastrophization and kinesiophobia, were associated with foot pain and foot function in people with PHP Victoria, Australia.	36 participants with PHP, aged ≥18 years Male *n* = 16; female *n* = 20 Mean age 47.3 years Clinical diagnosis of PHP for 1 month or longer, first-step pain during the previous week rated at least 20 mm on a 100 mm VAS	n/a	Catastrophization and kinesiophobia	Pain		Catastrophising Scale, Tampa Scale of Kinesiophobia, the Foot Health Status Questionnaire and a VAS	n/a	
Catastrophization explained a fair proportion of variability in first-step pain ($R^2 = 0.29$; $p = 0.008$)	Kinesiophobia explained a fair proportion of variability in foot function ($R^2 = 0.26$; $p = 0.006$). Catastrophization explained a moderate proportion of the variability in foot function ($R^2 = 0.43$; $p = 0.000$).	n/a						
Cotchett et al. (2016) Cross-sectional, observational study Aimed to evaluate the association between depression, anxiety, and stress with PHP Part of a randomized controlled trial that evaluated the effectiveness of trigger point dry needling for PHP Victoria, Australia	45 participants with PHP were matched by gender and age with 45 participants without PHP Male *n* = 23; female *n* = 22 Mean age 53 years Clinical diagnosis of PHP for 1 month or longer, first-step pain during the previous week rated at least 20 mm on a 100 mm VAS	n/a	Depression, anxiety and stress	21-item Depression, Anxiety and Stress Scale (short version) (DASS-21)	Clinically unimportant association with PHP and depression (OR = 1.322; $p = 0.001$) Clinically unimportant association with PHP and anxiety (OR = 1.257; $p = 0.010$) Clinically unimportant association with PHP and stress (OR = 1.147; $p = 0.003$)	n/a	n/a	n/a

(Continues)

TABLE 4 (Continued)

Study characteristics	Participants characteristics	Intervention	Psychosocial variable	Outcome measures	Incidence	Pain	Function	Prognosis
Cotchett et al. (2015) Cross-sectional, observational study Aimed to evaluate whether symptoms of depression, anxiety and stress are associated with foot pain and foot function in people with PHP Part of a randomized controlled trial that evaluated the effectiveness of trigger point dry needling for PHP Victoria, Australia	84 participants with PHP, aged 18 years or older Participants had a mean age of 56.1 years Male *n* = 43; female *n* = 41 Clinical diagnosis of PHP for symptoms 1 month or longer; first-step pain during the previous week rated at least 20 mm on a 100-mm VAS	n/a	Depression, anxiety and stress	Depression, Anxiety and Stress Scale (short version) (DASS-21) Pain and function items of FHSQ[b]	n/a	Stress explained a small proportion of variability in foot pain in females (R^2 = 0.13; p = 0.024) but was not significant in males (p = 0.190). Depression explained a small proportion of variability in foot pain in females (R^2 = 0.16; p = 0.013) but was not significant in males (p = 0.829)	Stress explained a fair proportion of variability in foot function in females (R^2 = 0.25; p = 0.001) but was not significant in males (p = 0.929) Depression explained a fair proportion of variability in foot function in females (R^2 = 0.25; p = 0.001) but was not significant in males (p = 0.326)	n/a
Werner et al. (2010) A cross-sectional observational study Aimed to determine the relative contributions of work activity, floor surface characteristics, weight, body mass index, age, foot biomechanics and other demographic and medical history factors to the prevalence of PHP Michigan, USA	407 participants PHP *n* = 32 Male *n* = 20; female *n* = 12 PHP defined as moderate or severe foot pain lasting more than 1 week or occurring at least 3 times in the previous year and experienced tenderness to palpation at the insertion of the plantar fascia on the calcaneus New PHP was defined as a worker with pain in the foot related to palpation of the plantar fascia at the calcaneus who did not report a history of plantar fasciitis in their medical history	n/a	Supervisor support, job dissatisfaction, co-worker support, job insecurity, education level, decision authority	Questionnaire	Clinically unimportant association with new PHP and job	dissatisfaction (OR = 1.3; p = 0.02),	n/a	n/a
n/a								

ESWT, extracorporeal shock wave therapy; FHSQ, Foot Health Status Questionnaire; n/a, not available; OR, odds ratio; PHP, plantar heel pain; VAS, visual analogue scale.

[a]No further information was identified on this outcome measure.

[b]FSHQ, where 0 is worst foot health and 100 is best.

3.4 | Psychosocial variables and the presence of PHP

3.4.1 | Depression

There was moderate-level evidence, from one high-quality article, of a clinically unimportant association between PHP and depression (OR = 1.322; p = 0.001) (Cotchett et al., 2016).

3.4.2 | Anxiety

There was moderate-level evidence, from one high-quality article, of a clinically unimportant association between PHP and anxiety (OR = 1.257; p = 0.010) (Cotchett et al., 2016).

3.4.3 | Stress

There was moderate-level evidence, from one high-quality article, of a clinically unimportant association between PHP and stress (OR = 1.147; p = 0.003) (Cotchett et al., 2016).

3.4.4 | Job dissatisfaction

There was low-level evidence, from one moderate-quality article, of a clinically unimportant association between new PHP and job dissatisfaction among assembly plant workers (OR = 1.3; p = 0.02) (Werner et al., 2010).

3.5 | Psychosocial variables and the severity of PHP

3.5.1 | Pain

Stress

There was moderate evidence, from one high-quality article, that stress explained a small proportion of the variability in foot pain in female patients (R^2 = 0.13; p = 0.024), but this was not significant in male patients (p = 0.190) (Cotchett et al., 2015).

Depression

There was moderate evidence, from one high-quality article, that depression explained a small proportion of the variability in foot pain in female patients (R^2 = 0.16; p = 0.013) but this was not significant in male patients (p = 0.829) (Cotchett et al., 2015).

Catastrophization

There was moderate evidence, from one high-quality article, that catastrophization explained a fair proportion of the variability in first-step pain (R^2 = 0.29; p = 0.008) (Cotchett et al., 2017).

3.5.2 | Function

Stress

There was moderate evidence, from one high-quality article, that stress explained a fair proportion of the variability in foot function in female patients (R^2 = 0.29; p = 0.001), but was not significant in male patients (p = 0.929) (Cotchett et al., 2015).

Depression

There was moderate evidence, from one high-quality article, that depression explained a fair proportion of the variability in foot function in female patients (R^2 = 0.25; p = 0.001), but this was not significant in male patients (p = 0.326) (Cotchett et al., 2015).

Kinesiophobia

There was moderate evidence, from one high-quality article, that kinesiophobia explained a fair proportion of the variability in foot function (R^2 = 0.26; p = 0.006) (Cotchett et al., 2017).

Catastrophization

There was moderate evidence, from one high-quality article, that catastrophization explained a moderate proportion of the variability in foot function (R^2 = 0.43; p < 0.001) (Cotchett et al., 2017).

3.6 | Psychosocial variables and prognosis in PHP

3.6.1 | Psychological disorder

There was moderate evidence, from one high-quality article, of a clinically important association between PHP and psychological disorder, and a poorer outcome for ESWT than in those without a documented psychological disorder (OR = 0.161; p < 0.05) (Chuckpaiwong et al., 2009).

4 | DISCUSSION

Previous systematic reviews of PHP have focused on risk factors (Irving, Cook, & Menz, 2006; van Leeuwen, Rogers, Winzenberg, & van Middelkoop, 2015) and, to date, no previous systematic review has evaluated the association with psychosocial variables. Overall, the present systematic review found significant heterogeneity between articles in terms of specific psychosocial variables and associated outcome measures. This heterogeneity precluded a meta-analysis of the data being carried out. The association between psychosocial variables and the incidence of PHP appears to be of a clinically unimportant size. This is based on moderate evidence from one high-quality article describing a clinically unimportant association with PHP and depression, anxiety and stress (Cotchett et al., 2016) and limited evidence from one moderate-quality article which found a clinically unimportant association between new PHP and job dissatisfaction among assembly plant workers (Werner et al., 2010). Sub-analysis between pain, PHP and psychosocial variables revealed moderate evidence from one high-quality article that stress and depression explained a small proportion of the variability in foot pain in female patients but this was not significant in male patients (Cotchett et al., 2015). There was also moderate evidence from one high-quality article that catastrophization explained a fair proportion of variability in first-step pain (Cotchett et al., 2017). Additional sub-analysis between function, pain and psychosocial variables has shown moderate evidence from one high-quality article that stress and depression both explained a fair proportion of the variability in foot function in female patients, but this was not significant in male patients (Cotchett et al., 2015). There was also moderate evidence from one high-quality article that kinesiophobia explained a fair proportion, and that catastrophization explained a moderate proportion, of the variability in foot function (Cotchett et al., 2017).

Examination of the association between psychosocial variables and the prognosis of PHP indicated that there is moderate evidence, from one high-quality article, of a clinically important association with psychological disorder and a poorer outcome to ESWT than in those without a documented psychological disorder (Chuckpaiwong et al., 2009). This is in keeping with previous research showing an association of psychological variables and personality traits with foot pain; depression, anxiety and somatization with low back pain; and anxiety, depression, kinesiophobia and distress with tendinopathy (Awale et al., 2016; Bener et al., 2013; Mallows et al., 2016; Shivarathre et al., 2014).

Although the present systematic review included all available studies, the results and conclusions that could be derived were somewhat limited by the individual sample sizes and the number of included studies. For example, when the data were stratified by gender, stress and depression explained slight and fair variability, respectively, in the severity of foot pain and function in female patients, but not male patients (Cotchett et al., 2015). This gender difference was not significant in similar research looking at the association between catastrophization and kinesiophobia and PHP (Cotchett et al., 2017) or in the other studies examined in the present review. Larger prospective studies are warranted to determine whether there is a true gender effect. Furthermore, further, well-designed prospective studies are warranted to determine with confidence the significance of associations between PHP and psychosocial variables, and how such information might inform treatment pathways for people reporting PHP. Although all of the articles reported statistically significant findings, the clinical importance of the results varied, with the largest effect size being the association between psychosocial variables and PHP function (Cotchett et al., 2015, 2017.

In addition to methodological variations, the uncertainty of findings may also be explained by the inconsistency in the diagnostic criteria for PHP (Cutts, Obi, Pasapula, & Chan, 2012). Three articles defined PHP as having symptoms for ≥1 month, first-step pain during the previous week rated as ≥20 mm on a 100 mm VAS (Cotchett et al., 2015, 2016, 2017). One of these defined PHP as moderate or severe foot pain lasting more than 1 week or occurring at least three times in the previous year, with tenderness to palpation at the plantar fascia insertion, (Werner et al., 2010), which is in keeping with other research (van Leeuwen et al., 2015). The remaining article defined chronic PHP as being painful heel symptoms lasting longer than 6 months (Chuckpaiwong et al., 2009). The lack of robust criteria for clinical diagnosis limited comparison between the studies and made it difficult to determine if PHP sub-groups exist and whether one such sub-group is influenced to a greater extent by psychosocial variables. Research aimed at identifying sub-classifications of PHP, similar to those seen in low back pain (Nijs et al., 2015), could help to bring clarity to a nebulous condition.

The presence of confounding variables has the potential to affect the studied variables, so the results may not have reflected a true relationship. The articles included in the review made varying attempts to control for confounding variables, most consistently age, gender and body mass index, through multivariate analysis. The variance in controlled variables between studies is understandable, due to the complexity and uncertainty regarding the pathoaetiology of PHP. However, this variance means that confounding anatomical, biomechanical and environmental confounders cannot be excluded from influencing the relationship and affecting the generalizability of the results. Further research into these areas will help to bring clarity to the significance of individual confounders, and may help to standardize the variables controlled for in future studies.

Whether psychosocial variables may have an impact on presence, severity and prognosis, or whether having PHP may influence psychosocial variables remains unclear. The nature and design of the studies evaluated n the current review did not allow for causation to be inferred, and it would be prudent at this stage to have a suspicion that there is likely to be a two-way interaction between psychosocial variables and PHP. The present review highlights the need for further prospective investigations, which should include psychosocial factors alongside biomechanical, anatomical and environmental factors. This would help to determine and rate with confidence the influence of these factors in PHP, and how they may or may not interact with each other.

5 | CONCLUSION

Overall, the present review found significant heterogeneity between studies in terms of psychosocial variables and outcome measures. This limits the pooling of data and the conclusions which can be drawn from them. Moderate-level evidence suggests a clinically unimportant association between the presence of PHP and depression, anxiety and stress, and limited evidence suggests a clinically unimportant association with job dissatisfaction. Moderate-level evidence also suggests that there may be an association between depression, anxiety, stress and catastrophization and PHP pain, and an association between depression, anxiety, stress, catastrophization and kinesiophobia and PHP function. There is moderate-level evidence that a psychological disorder may be associated with a poorer outcome to ESWT than in those without a documented psychological disorder.

In light of the results from the present review, an association between psychosocial variables and PHP cannot be ruled out. Given the recommendations to adopt an individualized and stratified approach to other musculoskeletal conditions, clinicians should remain vigilant to the presence of these variables. There is a need for further, well-designed prospective studies to determine confidently the significance of these associations and how such information might, or might not, inform treatment pathways for people reporting PHP.

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AUTHOR CONTRIBUTIONS

All authors listed made substantial contributions to the conception, design, acquisition, analysis and interpretation of data. All authors revised the manuscript critically for important intellectual content and approved the final version. Each author participated sufficiently in the work to take public responsibility for appropriate portions of

the content, and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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REFERENCES

Awale, A., Dufour, A. B., Katz, P., Menz, H. B., & Hannan, M. T. (2016). Link between foot pain severity and prevalence of depressive symptoms. *Arthritis Care and Research*, *68*(6), 871–876. https://doi.org/10.1002/acr.22779

Bener, A., Verjee, M., Dafeeah, E. E., Falah, O., Al-Juhaishi, T., Schlogl, J., … Khan, S. (2013). Psychological factors: Anxiety, depression, and somatization symptoms in low back pain patients. *Journal of Pain Research*, *6*, 95–101. https://doi.org/10.2147/JPR.S40740

Bennett, P., Patterson, C., Wearing, S., & Baglioni, T. (1998). Development and validation of a questionnaire designed to measure foot-health status. *Journal of the American Podiatric Medical Association*, *88*(9), 419–428. https://doi.org/10.7547/87507315-88-9-419

Chuckpaiwong, B., Berkson, E. M., & Theodore, G. H. (2009). Extracorporeal shock wave for chronic proximal plantar fasciitis: 225 patients with results and outcome predictors. *Journal of Foot and Ankle Surgery*, *48*(2), 148–155. https://doi.org/10.1053/j.jfas.2008.11.001

Cotchett, M., Lennecke, A., Medica, V. G., Whittaker, G. A., & Bonanno, D. R. (2017). The association between pain catastrophising and kinesiophobia with pain and function in people with plantar heel pain. *The Foot*, *32*, 8–14. https://doi.org/10.1016/j.foot.2017.03.003

Cotchett, M., Munteanu, S. E., & Landorf, K. B. (2016). Depression, anxiety, and stress in people with and without plantar heel pain. *Foot & Ankle International*, *37*(8), 816–821. https://doi.org/10.1177/1071100716646630

Cotchett, M. P., Whittaker, G., & Erbas, B. (2015). Psychological variables associated with foot function and foot pain in patients with plantar heel pain. *Clinical Rheumatology*, *34*(5), 957–964. https://doi.org/10.1007/s10067-014-2565-7

Cutts, S., Obi, N., Pasapula, C., & Chan, W. (2012). Plantar fasciitis. *Annals of the Royal College of Surgeons of England*, *94*(8), 539–542. https://doi.org/10.1308/003588412X13171221592456

Grieve, R., & Palmer, S. (2016). Physiotherapy for plantar fasciitis: A UK-wide survey of current practice. *Physiotherapy (United Kingdom)*, *103*(2), 193–200. https://doi.org/10.1016/j.physio.2016.02.002

Hansen, L., Krogh, T. P., Ellingsen, T., Bolvig, L., & Fredberg, U. (2018). Long-term prognosis of plantar fasciitis: A 5- to 15-year follow-up study of 174 patients with ultrasound examination. *Orthopaedic Journal of Sports Medicine*, *6*(3). 232596711875798. DOI: https://doi.org/10.1177/2325967118757983

Hawker, G. A., Mian, S., Kendzerska, T., & French, M. (2011). Measures of adult pain: Visual Analog Scale for Pain (VAS Pain), Numeric Rating Scale for Pain (NRS Pain), McGill Pain Questionnaire (MPQ), Short-Form McGill Pain Questionnaire (SF-MPQ), Chronic Pain Grade Scale (CPGS), Short Form-36 Bodily Pain Scale (SF-36 BPS), and Measure of Intermittent and Constant Osteoarthritis Pain (ICOAP). *Arthritis Care and Research*, *63*(Suppl. 11), 240–252. https://doi.org/10.1002/acr.20543

Helminen, E. E., Sinikallio, S. H., Valjakka, A. L., Väisänen-Rouvali, R. H., & Arokoski, J. P. A. (2016). Determinants of pain and functioning in knee osteoarthritis: A one-year prospective study. *Clinical Rehabilitation*, *30*(9), 890–900. https://doi.org/10.1177/0269215515619660

Hill, C. L., Gill, T. K., Menz, H. B., & Taylor, A. W. (2008). Prevalence and correlates of foot pain in a population-based study: The North West Adelaide health study. *Journal of Foot and Ankle Research*, *1*(1), 1–7. https://doi.org/10.1186/1757-1146-1-2

Irving, D. B., Cook, J. L., & Menz, H. B. (2006). Factors associated with chronic plantar heel pain: a systematic review. *Journal of Science and Medicine in Sport*, *9*(1–2), 11–22. https://doi.org/10.1016/j.jsams.2006.02.004

Jensen, M. P., Moore, M. R., Bockow, T. B., Ehde, D. M., Engel, J. M., & Otr, L. (2012). Psychosocial factors and adjustment to chronic pain in persons with physical disabilities. *A systematic review*, *92*(1), 146–160. https://doi.org/10.1016/j.apmr.2010.09.021.Psychosocial

Miller, R. P., Kori, S. H., Todd, D. D. (1991). The Tampa Scale: a measure of kinisophobia. *Clin J Pain*, *7*: 51–52. (Data unpublished). https://doi.org/10.1097/00002508-199103000-00053

Landis, J. R., & Koch, G. G. (1977). The measurement of observer agreement for categorical data. *Biometrics*, *33*(1), 159–174. https://doi.org/10.2307/2529310

Landorf, K. B. (2015). Musculoskeletal disorders: Plantar heel pain and fasciitis. *Clinical Evidence*, *11:1111*(2015), 1–43.

Littlewood, C., May, S., & Walters, S. (2013). Epidemiology of rotator cuff tendinopathy: A systematic review. *Shoulder & Elbow*. ??. DOI: https://doi.org/10.1111/sae.12028

Lopes, A. D., Hespanhol, L. C., Yeung, S. S., & Pena Costa, L. O. (2012). What are the main running related musculoskeletal injuries. *Sports Medicine*, *42*(10), 892–905. https://doi.org/10.2165/11631170-000000000-00000

Lovibond, P., & Lovibond, S. (1995). *Manual for the Depression and Anxiety Scales* (2nd ed.). Sydney, NSW: Psychology Foundation.

Mallows, A., Debenham, J., Walker, T., & Littlewood, C. (2016). Association of psychological variables and outcome in tendinopathy: A systematic review. *British Journal of Sports Medicine*, *43*(2), 255–266. https://doi.org/10.1136/bjsports-2016-096154

Martin, R. L., Davenport, T. E., Reischl, S. F., McPoil, T. G., Matheson, J. W., Wukich, D. K., … Godges, J. J. (2014). Heel pain – Plantar fasciitis: Revision 2014. *Journal of Orthopaedic & Sports Physical Therapy*, *44*(11), A1–A33. https://doi.org/10.2519/jospt.2014.0303

McLean, S. M., May, S., Klaber-Moffett, J., Sharp, D. M., & Gardiner, E. (2010). Risk factors for the onset of non-specific neck pain: A systematic review. *Journal of Epidemiology and Community Health*, *64*(7), 565–572. https://doi.org/10.1136/jech.2009.090720

McMillan, A. M., Landorf, K. B., Barrett, J. T., Menz, H. B., & Bird, A. R. (2009). Diagnostic imaging for chronic plantar heel pain: A systematic review and meta-analysis. *Journal of Foot and Ankle Research*, *2*(1), 1–11. https://doi.org/10.1186/1757-1146-2-32

Menz, H. B., Jordan, K. P., Roddy, E., & Croft, P. R. (2010). Characteristics of primary care consultations for musculoskeletal foot and ankle problems in the UK. *Rheumatology*, *49*(7), 1391–1398. https://doi.org/10.1093/rheumatology/keq092

Moher, D., Shamseer, L., Clarke, M., Ghersi, D., Liberati, A., Petticrew, M., … Stewart, L. A. (2015). Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) 2015 statement. *Systematic Reviews*, *4*(1), 1. https://doi.org/10.1186/2046-4053-4-1

Nijs, J., Apeldoorn, A., Hallegraeff, H., Clark, J., Smeets, R., Malfliet, A., … Ickmans, K. (2015). Low back pain: Guidelines for the clinical classification of predominant neuropathic, nociceptive, or central sensitization pain. *Pain Physician*, *18*(3), E333–E346.

Riddle, D. L., & Schappert, S. M. (2004). Volume of ambulatory care visits and patterns of care for patients diagnosed with plantar fasciitis: A national study of medical doctors. *Foot & Ankle International*, *25*(5), 303–310. https://doi.org/10.1177/107110070402500505

Riel, H., Cotchett, M., Delahunt, E., Rathleff, M. S., Vicenzino, B., Weir, A., & Landorf, K. B. (2017). Is 'plantar heel pain' a more appropriate term than 'plantar fasciitis'? Time to move on. *British Journal of Sports Medicine*, *51*(22), 1576–1577. https://doi.org/10.1136/bjsports-2017-097519

Rodrigues, R. N., Lopes, A. A., Torres, J. M., Mundim, M. F., Silva, L. L. G., & Silva, B. R. (2015). Compressive neuropathy of the first branch of the lateral plantar nerve: A study by magnetic resonance imaging. *Radiologia Brasileira*, *48*(6), 368–372. https://doi.org/10.1590/0100-3984.2013.0028

Shivarathre, D. G., Howard, N., Krishna, S., Cowan, C., & Platt, S. R. (2014). Psychological factors and personality traits associated with patients in chronic foot and ankle pain. *Foot & Ankle International*, *35*(11), 1103–1107. https://doi.org/10.1177/1071100714550648

Sullivan, M., Bishop, S., & Pivik, J. (1995). The pain catastrophizing scale: Development and validation. *Psychological Assessment*, *7*(4), 524–532. https://doi.org/10.1037/1040-3590.7.4.524

van Leeuwen, K. D. B., Rogers, J., Winzenberg, T., & van Middelkoop, M. (2015). Higher body mass index is associated with plantar fasciopathy/'plantar fasciitis': Systematic review and meta-analysis of various clinical and imaging risk factors. *British Journal of Sports Medicine*, *50*(16), 972–981. https://doi.org/10.1136/bjsports-2015-094695

van Tulder, M., Furlan, A., Bombardier, C., & Bouter, L. (2003). Updated method guidelines for systematic reviews in the Cochrane Collaboration Back Review Group. *Spine*, *28*(12), 1290–1299. https://doi.org/10.1097/BRS.0b013e3181b1c99f

Vargas-Prada, S., & Coggon, D. (2015). Psychological and psychosocial determinants of musculoskeletal pain and associated disability. *Best Practice and Research: Clinical Rheumatology*, *29*(3), 374–390. https://doi.org/10.1016/j.berh.2015.03.003

Werner, R. A., Gell, N., Hartigan, A., Wiggerman, N., & Keyserling, W. M. (2010). Risk factors for plantar fasciitis among assembly plant workers. *PM and R*, *2*(2), 110–116. https://doi.org/10.1016/j.pmrj.2009.11.012

Zeng, X., Zhang, Y., Kwong, J. S. W., Zhang, C., Li, S., Sun, F., & Du, L. (2015). The methodological quality assessment tools for preclinical and clinical studies, systematic review and meta-analysis, and clinical practice guideline: A systematic review. *Journal of Evidence-Based Medicine*, *8*(1), 2–10. https://doi.org/10.1111/jebm.12141

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