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PAIN CATASTROPHIZING AND NEUROPATHIC SYMPTOMS PREDICT POOR RECOVERY IN INDIVIDUALS WITH CHRONIC PLANTAR HEEL PAIN: A PROSPECTIVE COHORT STUDY

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Vol. 5 No. 2 (2026)

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Abstract

Background

Chronic plantar heel pain (CPHP) is one of the most common musculoskeletal foot disorders and is frequently associated with persistent pain, reduced physical function, and impaired quality of life. Although biomechanical factors have traditionally been emphasized in the management of CPHP, increasing evidence suggests that psychological and neuropathic mechanisms may contribute to prolonged symptom persistence and poor recovery outcomes.

Objective

To investigate whether pain catastrophizing beliefs and neuropathic symptoms predict poorer long-term recovery outcomes in individuals with chronic plantar heel pain over a 12-month follow-up period.

Methods

A prospective cohort study was conducted involving 220 participants with clinically diagnosed chronic plantar heel pain. Baseline assessments included demographic, physical, psychological, and behavioral variables. Pain catastrophizing was assessed using the Pain Catastrophizing Scale (PCS), neuropathic symptoms were evaluated using the painDETECT questionnaire, and depressive symptoms were measured using the Patient Health Questionnaire-9 (PHQ-9). Pain severity, foot function, and health-related quality of life were assessed using the Foot Health Status Questionnaire (FHSQ) and EQ-5D questionnaire at baseline and 12-month follow-up. Linear mixed-effects regression models were used to determine longitudinal predictors of recovery outcomes.

Vol. 5 No. 2 (2026)

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Results

A total of 208 participants completed the 12-month follow-up assessment. Higher baseline pain catastrophizing scores were significantly associated with persistent pain severity and poorer recovery trajectories over time (β = 0.41, 95% CI 0.24 to 0.58, $p < 0.001$). Greater neuropathic symptom involvement was also significantly associated with delayed pain reduction and persistent symptoms during follow-up (β = 0.37, 95% CI 0.19 to 0.54, $p < 0.001$). Increased sedentary behavior was associated with poorer functional and quality-of-life outcomes, whereas higher daily step counts demonstrated favorable associations with recovery. Traditional biomechanical variables including body mass index, ankle plantarflexor strength, and first metatarsophalangeal joint dorsiflexion mobility did not demonstrate significant predictive value for long-term recovery outcomes. Pain catastrophizing and neuropathic symptoms remained significant independent predictors after adjustment for demographic and clinical covariates.

Conclusion

Pain catastrophizing beliefs and neuropathic symptom involvement were significant predictors of poorer long-term recovery outcomes in individuals with chronic plantar heel pain. Psychological and neuropathic factors demonstrated stronger prognostic associations than traditional biomechanical measures. These findings highlight the importance of incorporating biopsychosocial assessment into rehabilitation strategies for chronic plantar heel pain.

INTRODUCTION

Chronic plantar heel pain (CPHP), commonly referred to as plantar fasciitis or plantar heel pain syndrome, is one of the most prevalent musculoskeletal disorders affecting the foot and ankle region and represents a major source of pain, disability, and healthcare utilization worldwide (1-3). Approximately 10% of the general population experience plantar heel pain during their lifetime, making it one of the most common causes of foot pain in adults (4, 5). The condition is typically characterized by pain localized around the plantar calcaneal region, particularly during the first steps

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Online ISSN 3007-2387

Print ISSN 3007-2379

Khalid et al - 2026

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after periods of rest or prolonged weight-bearing activities (6). Persistent symptoms frequently impair walking tolerance, occupational participation, recreational activity, and overall quality of life (5, 7). Traditionally, CPHP has been considered a localized mechanical disorder associated with repetitive plantar fascia loading, obesity, reduced ankle dorsiflexion, altered foot posture, calf muscle dysfunction, and repetitive overuse (3, 8-10). Consequently, conventional management strategies have primarily focused on tissue-based interventions including stretching, orthotic therapy, taping, strengthening exercises, and manual therapy (11). Despite widespread clinical use of these approaches, long-term recovery outcomes remain inconsistent, and many individuals continue to experience persistent pain and functional limitation despite conservative treatment (12).

Recent advances in pain science suggest that persistent plantar heel pain may involve mechanisms extending beyond peripheral tissue pathology alone (13). Central sensitization, characterized by amplification of neural signaling within the central nervous system, has emerged as an important contributor to chronic musculoskeletal pain conditions (14). Individuals with chronic pain frequently demonstrate altered pain modulation, heightened pain sensitivity, and maladaptive psychological responses that may contribute to prolonged symptom persistence and disability (13, 14).

Among psychological contributors, pain catastrophizing has received considerable attention as a significant prognostic factor in chronic pain disorders. Pain catastrophizing refers to an exaggerated negative cognitive and emotional response toward actual or anticipated pain experiences and is characterized by rumination, magnification, and helplessness (15). Elevated catastrophizing levels have consistently been associated with increased pain intensity, fear-avoidance behavior, disability, reduced physical performance, and poorer rehabilitation outcomes across several chronic musculoskeletal conditions (15, 16). Fear-avoidance models further suggest that individuals with elevated catastrophizing may progressively avoid movement and physical activity because of anticipated pain or reinjury, thereby contributing to deconditioning and persistent symptoms (16).

Pakistan Journal of Medical & Cardiological Review
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Neuropathic pain mechanisms are also increasingly recognized in individuals with chronic plantar heel pain. Traditionally considered a nociceptive disorder, CPHP may involve sensitization-related mechanisms in a subgroup of patients presenting with burning pain, tingling, hypersensitivity, electric shock-like sensations, and radiating discomfort (13, 17). Emerging evidence suggests that altered peripheral nerve sensitivity and central pain-processing dysfunction may contribute substantially to persistent symptom severity and delayed recovery outcomes (17).

Although previous literature has extensively investigated biomechanical contributors to plantar heel pain, prospective longitudinal evidence examining the prognostic influence of psychological and neuropathic factors remains limited. Furthermore, the relative contribution of these factors compared with traditional biomechanical variables is insufficiently understood. Identification of these mechanisms may improve prognostic evaluation and facilitate development of more targeted biopsychosocial rehabilitation strategies for individuals with chronic plantar heel pain.

Therefore, the present prospective cohort study aimed to investigate whether pain catastrophizing beliefs and neuropathic symptoms independently predict poorer long-term recovery outcomes in individuals with chronic plantar heel pain over a 12-month follow-up period.

Objective

The primary objective of this prospective cohort study was to investigate whether pain catastrophizing beliefs and neuropathic symptoms predict poorer long-term recovery outcomes in individuals with chronic plantar heel pain over a 12-month follow-up period.

The secondary objectives were:

1. To examine the longitudinal associations between pain catastrophizing, neuropathic symptom severity, and pain recovery trajectories.
2. To evaluate the relationship between psychological and neuropathic factors and functional recovery outcomes measured using the Foot Health Status Questionnaire (FHSQ).

Vol. 5 No. 2 (2026)

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Print ISSN 3007-2379

Khalid et al - 2026

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3. To determine the influence of pain catastrophizing and neuropathic symptoms on health-related quality of life assessed using the EQ-5D questionnaire.

4. To compare the prognostic contribution of psychological and neuropathic factors with traditional biomechanical and physical measures including body mass index, ankle plantarflexor strength, and first metatarsophalangeal joint dorsiflexion mobility.

5. To identify independent predictors of persistent pain and poorer recovery outcomes in individuals with chronic plantar heel pain.

Methodology

Study Design

A prospective cohort study with a 12-month longitudinal follow-up was conducted to investigate whether pain catastrophizing beliefs and neuropathic symptoms predict poorer long-term recovery outcomes in individuals with chronic plantar heel pain (CPHP). The study was designed and reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for cohort studies.

Vol. 5 No. 2 (2026)

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Khalid et al - 2026

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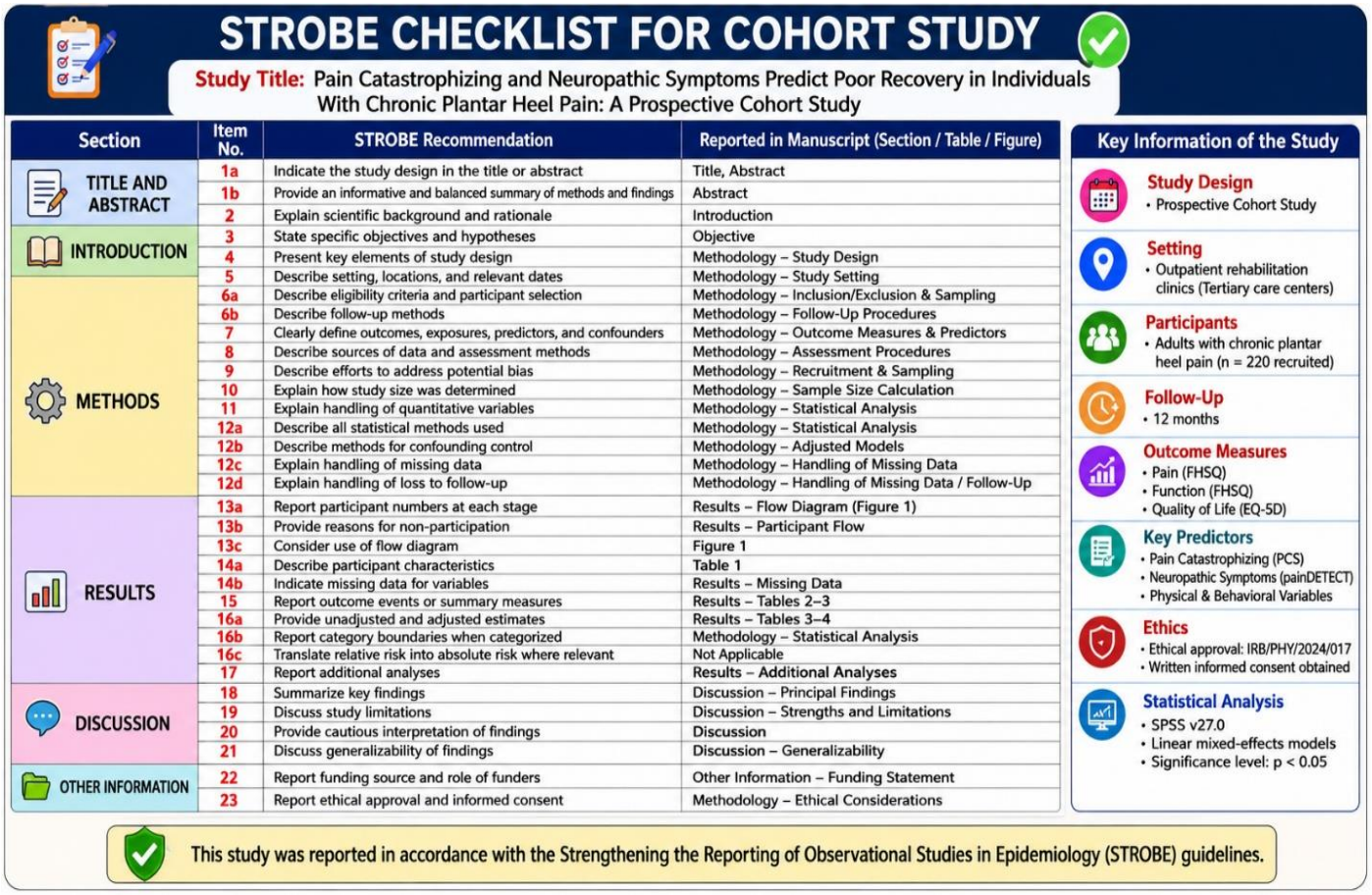

Figure 1. STROBE checklist summarizing reporting components of the prospective cohort study on pain catastrophizing, neuropathic symptoms, and recovery outcomes in chronic plantar heel pain.

Study Setting

The study was conducted in outpatient musculoskeletal rehabilitation and physiotherapy clinics affiliated with tertiary healthcare centers. Participant recruitment, baseline assessment, and follow-up procedures were completed between January 2024 and December 2024.

Vol. 5 No. 2 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

Khalid et al - 2026

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Recruitment and Sampling

Participants were recruited using a consecutive sampling technique. Individuals presenting to participating clinics with symptoms consistent with chronic plantar heel pain were screened for eligibility during the recruitment period. Eligible participants who fulfilled the study criteria and agreed to participate were enrolled consecutively to minimize selection bias and improve representativeness of the clinical population.

Participants

A total of 220 participants with clinically diagnosed chronic plantar heel pain were included in the study.

Inclusion Criteria

Participants were eligible for inclusion if they met the following criteria:

- Adults aged 18 years or older
- Clinical diagnosis of chronic plantar heel pain
- Symptom duration greater than 3 months
- Pain localized to the plantar calcaneal region
- Pain aggravated during the first steps after rest or prolonged weight-bearing activities
- Ability to understand study procedures and complete questionnaires independently
- Willingness to provide written informed consent

Exclusion Criteria

Participants were excluded if they had:

- Previous foot or ankle surgery
- Recent lower limb fracture or traumatic injury within the previous 6 months
- Systemic inflammatory or rheumatological disorders
- Neurological disorders affecting lower limb function or pain perception

Vol. 5 No. 2 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

Khalid et al - 2026

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- Confirmed peripheral neuropathy or lumbar radiculopathy
- Pregnancy
- Corticosteroid injection to the foot within the previous 3 months
- Cognitive impairment limiting questionnaire completion
- Other diagnosed causes of heel pain including stress fracture, infection, or tumor

Sample Size Calculation

Sample size estimation was performed using G*Power software version 3.1 based on multiple regression analysis with an anticipated medium effect size ($f^2 = 0.15$), statistical power of 80%, alpha level of 0.05, and inclusion of multiple predictor variables. The minimum required sample size was estimated to be 172 participants. To account for potential attrition during longitudinal follow-up, a total sample of 220 participants was recruited.

Baseline Assessment Procedures

At baseline, participants underwent multidimensional assessment including demographic, clinical, psychological, behavioral, and physical variables.

Demographic and Clinical Variables

Demographic and clinical information collected at baseline included participants' age, sex, symptom duration, body mass index (BMI), waist circumference, and physical activity behavior.

Physical Measures

Ankle Plantarflexor Strength

Ankle Plantarflexor muscle strength was assessed using standardized resistance testing procedures and recorded in Newton-meters per kilogram (Nm/kg).

Vol. 5 No. 2 (2026)

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https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

Khalid et al - 2026

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First Metatarsophalangeal Joint Dorsiflexion Mobility

First metatarsophalangeal joint dorsiflexion range of motion was assessed using standard goniometric measurement techniques.

Morning Stiffness

Participants reported the duration and severity of morning stiffness associated with plantar heel pain symptoms.

Psychological and Neuropathic Measures

Pain Catastrophizing

Pain catastrophizing beliefs were assessed using the Pain Catastrophizing Scale (PCS), a validated self-reported questionnaire evaluating rumination, magnification, and helplessness associated with pain experiences. Higher scores indicated greater levels of maladaptive pain-related cognitions.

Neuropathic Symptoms

Neuropathic pain-related symptoms were evaluated using the painDETECT questionnaire. The instrument was used to identify neuropathic-like symptom involvement including burning sensations, tingling, hypersensitivity, and radiating pain characteristics.

Depressive Symptoms

Depressive symptoms were assessed using the Patient Health Questionnaire-9 (PHQ-9).

Behavioral Measures

Daily Step Count

Average daily physical activity levels were assessed using daily step count measurements.

Vol. 5 No. 2 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

Khalid et al - 2026

DOI: http://doi.org/10.5281/zenodo.20771774

Sedentary Time

Sedentary behavior was recorded as the average duration of sedentary activity per day.

Outcome Measures

Primary outcomes included:

- Pain severity
- Foot function
- Health-related quality of life

Foot Health Status Questionnaire (FHSQ)

Pain severity and foot function outcomes were assessed using the Foot Health Status Questionnaire (FHSQ), a validated instrument commonly used in foot and ankle research.

EQ-5D Questionnaire

Health-related quality of life was assessed using the EQ-5D questionnaire. Outcome assessments were completed at baseline and at 12-month follow-up.

Follow-Up Procedures

Participants were followed prospectively for 12 months following baseline assessment. Follow-up assessments were conducted using the same outcome measures administered at baseline. Participant retention and data completeness were monitored throughout the study period. Reasons for loss to follow-up were documented where available.

Handling of Missing Data

Participants with incomplete baseline assessments were excluded from longitudinal analysis. For follow-up assessments, missing outcome data were handled using maximum likelihood estimation within linear mixed-effects regression models, allowing inclusion of participants with partially

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https://pakjmcr.com/index.php/1/about
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missing repeated-measures data while minimizing bias associated with complete-case analysis. Sensitivity analyses were additionally performed to examine the consistency of findings following participant attrition.

Statistical Analysis

All statistical analyses were performed using IBM SPSS Statistics version 27.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize demographic, clinical, psychological, behavioral, and physical characteristics of the study population. Continuous variables were reported as mean ± standard deviation, while categorical variables were expressed as frequencies and percentages.

Normality Testing

Normality of continuous variables was assessed using the Shapiro–Wilk test together with visual inspection of histograms, Q–Q plots, skewness values, and kurtosis statistics. Variables demonstrating substantial deviation from normality were examined for potential transformation before regression analysis.

Longitudinal Analysis

Linear mixed-effects regression models were used to investigate longitudinal associations between baseline predictor variables and recovery outcomes over the 12-month follow-up period. Interaction effects between predictor variables and time were included to assess changes in recovery trajectories over time. Potential confounding variables including age, sex, symptom duration, body mass index, and depressive symptoms were included in adjusted regression models. Statistical significance was established at $p < 0.05$.

Vol. 5 No. 2 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

Khalid et al - 2026

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Results

Participant Characteristics

A total of 220 participants with chronic plantar heel pain (CPHP) were enrolled in the prospective cohort study. Of these, 208 participants (94.5%) completed the 12-month follow-up assessment and were included in the final longitudinal analysis. Twelve participants were lost to follow-up because of relocation, withdrawal of consent, or incomplete outcome data.

Vol. 5 No. 2 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

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Khalid et al - 2026

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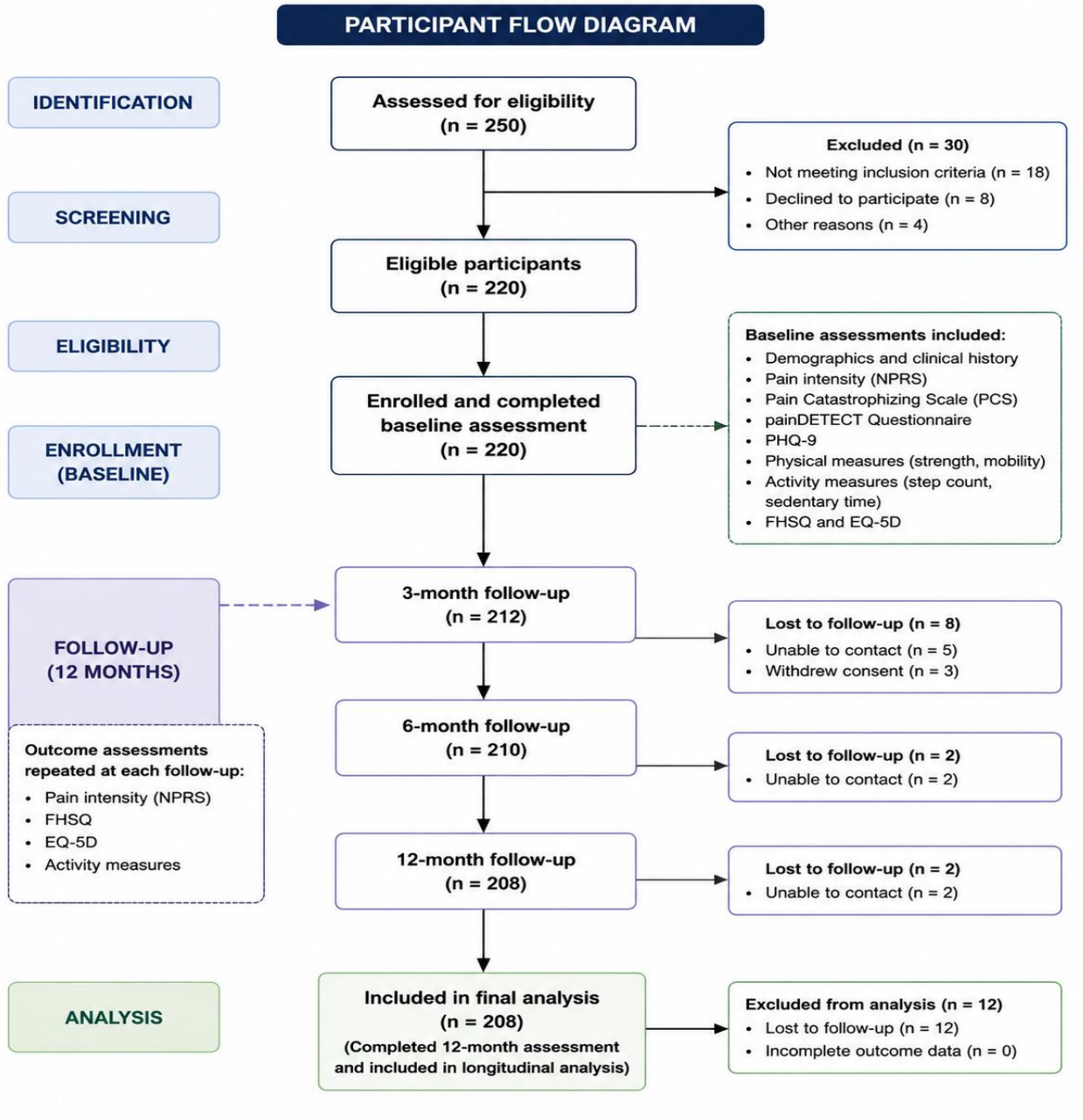

Figure 2. Participant flow diagram of study recruitment, follow-up, and final analysis.

Vol. 5 No. 2 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

Khalid et al - 2026

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The mean age of participants was 46.8 ± 11.2 years, and the majority were female (63.2%). The mean duration of symptoms at baseline was 11.4 ± 6.7 months. Baseline demographic, psychological, and physical characteristics are presented in Table 1.

Table 1. Baseline Characteristics of Participants (N = 220)

Variable	Mean ± SD / n (%)
Age (years)	46.8 ± 11.2
Female	139 (63.2%)
Male	81 (36.8%)
Symptom duration (months)	11.4 ± 6.7
BMI (kg/m²)	28.6 ± 4.3
Waist circumference (cm)	96.1 ± 10.8
PCS score	24.7 ± 9.5
PainDETECT score	15.2 ± 6.1
PHQ-9 score	8.1 ± 4.6
Ankle Plantarflexor strength (Nm/kg)	1.42 ± 0.37
First MTPJ dorsiflexion mobility (°)	61.5 ± 11.4
Daily step count	6218 ± 1835
Sedentary time (hours/day)	8.3 ± 2.1

Longitudinal Pain Outcomes

Linear mixed-effects regression analysis demonstrated significant associations between baseline psychological variables and longitudinal pain recovery trajectories over the 12-month follow-up period. Higher baseline pain catastrophizing scores were independently associated with persistent pain severity and poorer pain recovery over time. Participants with elevated PCS scores demonstrated

Vol. 5 No. 2 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

Khalid et al - 2026

DOI: http://doi.org/10.5281/zenodo.20771774

significantly less reduction in pain intensity during follow-up assessments (β = 0.41, 95% CI 0.24 to 0.58, $p < 0.001$).

Similarly, greater neuropathic symptom involvement measured using the painDETECT questionnaire was significantly associated with persistent pain outcomes throughout follow-up (β = 0.37, 95% CI 0.19 to 0.54, $p < 0.001$). The interaction between painDETECT score and time demonstrated a significant negative association with pain reduction over 12 months (β = −0.29, 95% CI −0.47 to −0.11, $p = 0.002$), indicating delayed recovery trajectories among participants with higher neuropathic symptom burden. Depressive symptoms measured using the PHQ-9 also demonstrated a moderate association with persistent pain outcomes (β = 0.21, 95% CI 0.05 to 0.37, $p = 0.011$).

Table 2. Longitudinal Predictors of Pain Recovery Over 12 Months

Predictor Variable	β Coefficient	95% CI	p-value
PCS score	0.41	0.24 to 0.58	<0.001
PainDETECT score	0.37	0.19 to 0.54	<0.001
PHQ-9 score	0.21	0.05 to 0.37	0.011
BMI	0.08	−0.05 to 0.20	0.231
Waist circumference	0.04	−0.08 to 0.16	0.498
Ankle Plantarflexor strength	−0.09	−0.25 to 0.07	0.267
First MTPJ dorsiflexion mobility	−0.06	−0.17 to 0.05	0.291
Daily step count	−0.24	−0.40 to −0.08	0.004
Sedentary time	0.33	0.15 to 0.51	<0.001

Pain catastrophizing and neuropathic symptom involvement emerged as the strongest independent predictors of persistent pain outcomes over the 12-month follow-up period.

Vol. 5 No. 2 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

Khalid et al - 2026

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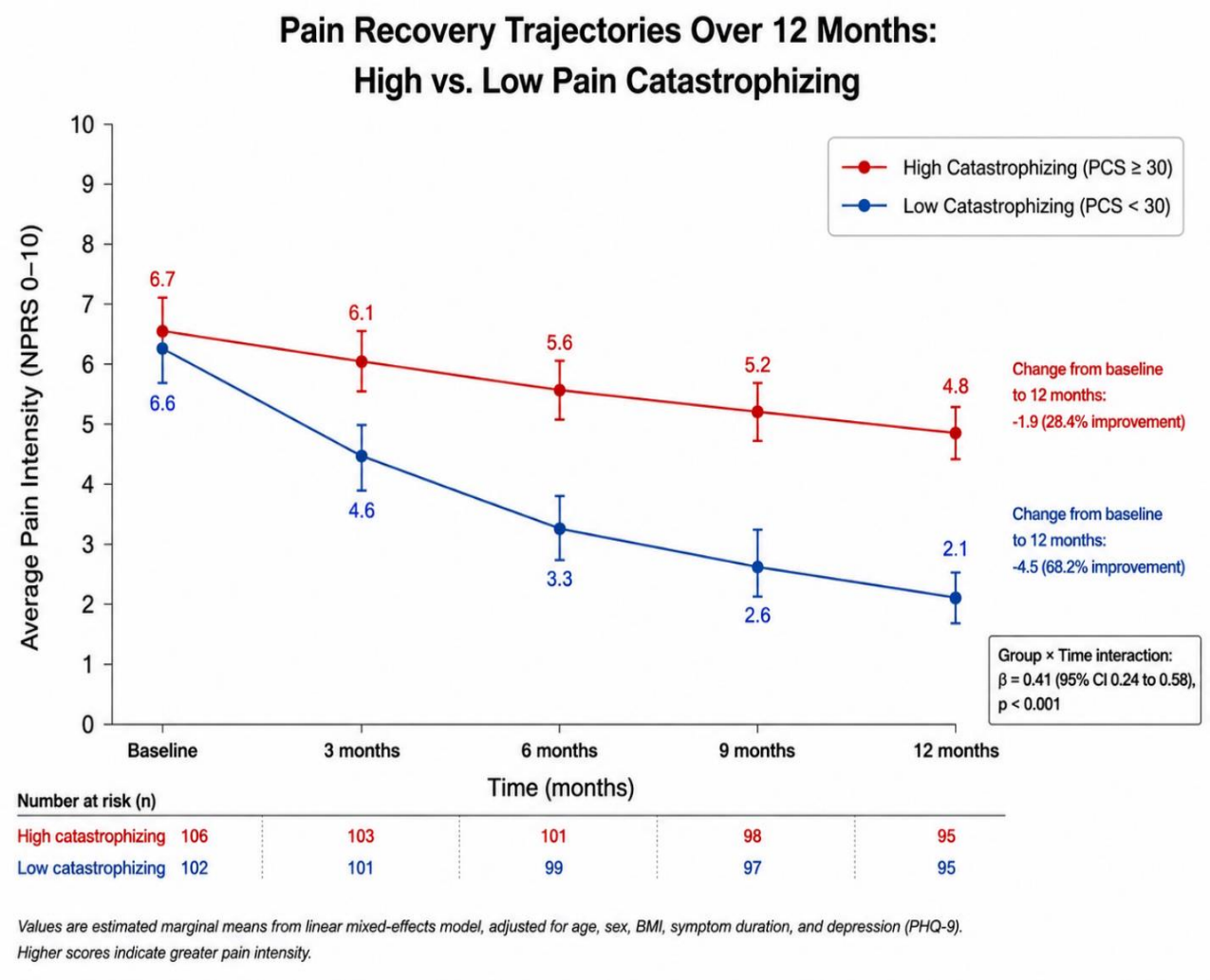

Figure 3. Pain recovery trajectories over 12 months according to pain catastrophizing status.

Vol. 5 No. 2 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

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Print ISSN 3007-2379

Khalid et al - 2026

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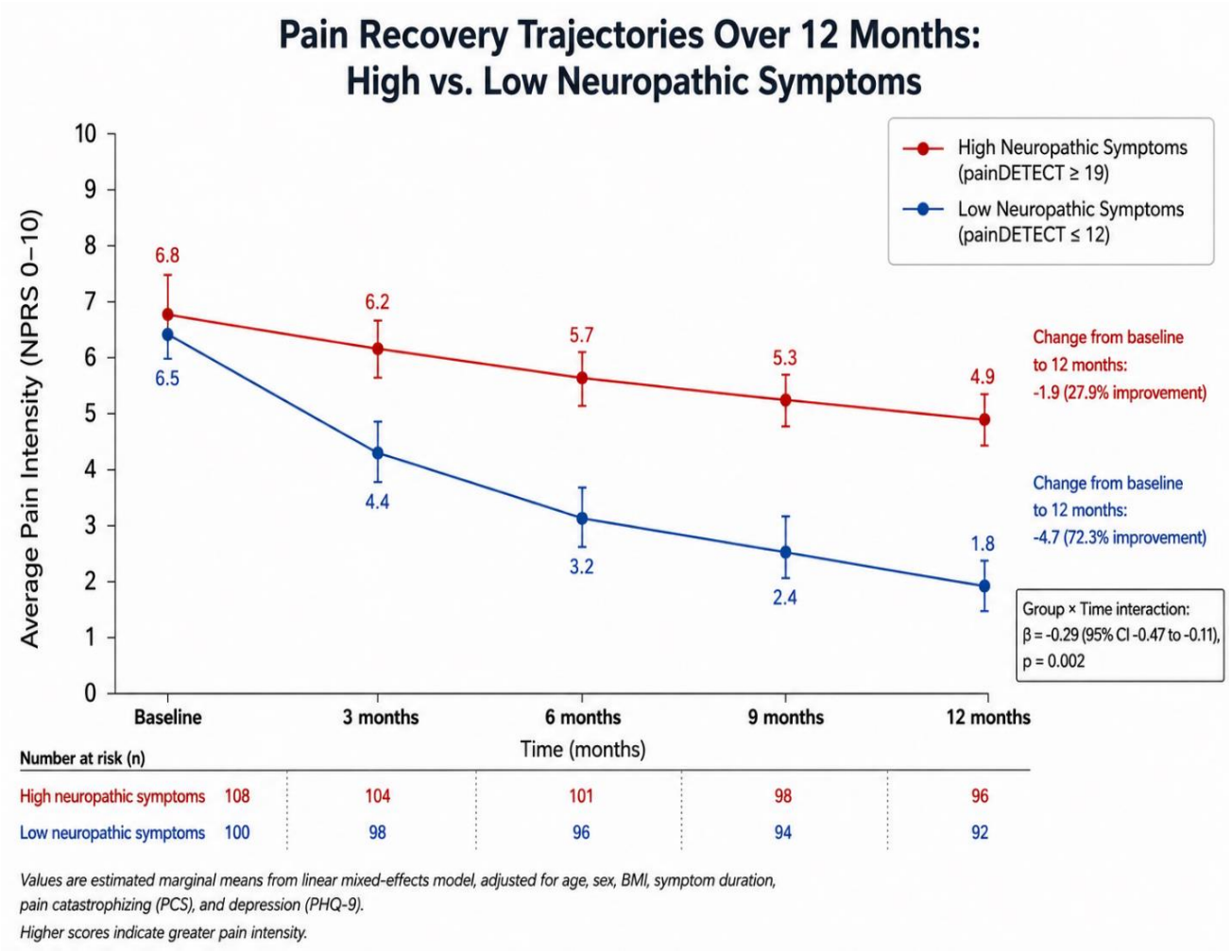

Figure 4. Pain recovery trajectories over 12 months according to neuropathic symptom severity.

Functional Outcomes

Functional recovery assessed using the Foot Health Status Questionnaire (FHSQ) demonstrated significant longitudinal associations with physical activity and sedentary behavior. Higher average daily step counts were associated with improved functional outcomes during follow-up ($\beta = 0.31$, 95% CI 0.14 to 0.47, $p < 0.001$). In contrast, increased sedentary behavior was significantly associated with poorer functional recovery ($\beta = -0.35$, 95% CI −0.52 to −0.18, $p < 0.001$). Higher

Vol. 5 No. 2 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

Khalid et al - 2026

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PCS scores were associated with lower FHSQ function scores over time (β = −0.28, 95% CI −0.45 to −0.11, p = 0.002). Greater neuropathic symptom severity also predicted poorer functional recovery (β = −0.26, 95% CI −0.42 to −0.10, p = 0.003). Traditional biomechanical variables including ankle Plantarflexor strength, BMI, waist circumference, and first metatarsophalangeal joint dorsiflexion mobility did not demonstrate significant longitudinal associations with functional recovery.

Table 3. Predictors of Functional Recovery (FHSQ Outcomes)

Predictor Variable	β Coefficient	95% CI	p-value
PCS score	−0.28	−0.45 to −0.11	0.002
PainDETECT score	−0.26	−0.42 to −0.10	0.003
Daily step count	0.31	0.14 to 0.47	<0.001
Sedentary time	−0.35	−0.52 to −0.18	<0.001
BMI	−0.07	−0.18 to 0.04	0.194
Plantarflexor strength	0.09	−0.06 to 0.24	0.228

Quality of Life Outcomes

Health-related quality of life assessed using the EQ-5D questionnaire demonstrated significant associations with psychological and behavioral variables. Participants with elevated PCS scores reported persistently poorer quality-of-life outcomes over time (β = −0.32, 95% CI −0.48 to −0.16, p < 0.001). Similarly, greater neuropathic symptom involvement was associated with reduced EQ-5D scores throughout follow-up (β = −0.29, 95% CI −0.44 to −0.13, p < 0.001). Higher sedentary time demonstrated significant negative associations with quality-of-life recovery (β = −0.27, 95% CI −0.43 to −0.10, p = 0.002), whereas greater daily step counts were associated with improved EQ-5D outcomes (β = 0.22, 95% CI 0.07 to 0.37, p = 0.005).

Vol. 5 No. 2 (2026)

Pakistan Journal of Medical & Cardiological Review

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Online ISSN 3007-2387

Print ISSN 3007-2379

Khalid et al - 2026

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Table 4. Predictors of Quality-of-Life Outcomes (EQ-5D)

Predictor Variable	β Coefficient	95% CI	p-value
PCS score	−0.32	−0.48 to −0.16	<0.001
PainDETECT score	−0.29	−0.44 to −0.13	<0.001
Daily step count	0.22	0.07 to 0.37	0.005
Sedentary time	−0.27	−0.43 to −0.10	0.002
PHQ-9 score	−0.19	−0.34 to −0.04	0.014

Multivariable Regression Analysis

Multivariable linear mixed-effects regression models were adjusted for age, sex, symptom duration, BMI, and depressive symptoms. After adjustment, pain catastrophizing and neuropathic symptom involvement remained independently associated with persistent pain severity, reduced functional recovery, and poorer quality-of-life outcomes. The final adjusted model explained 42% of the variance in longitudinal pain outcomes (R^2 = 0.42). Pain catastrophizing demonstrated the largest independent effect size among all predictors included in the model. Physical variables including BMI, waist circumference, ankle plantarflexor strength, and first metatarsophalangeal joint dorsiflexion mobility were not identified as significant predictors of long-term recovery outcomes.

Vol. 5 No. 2 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

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Khalid et al - 2026

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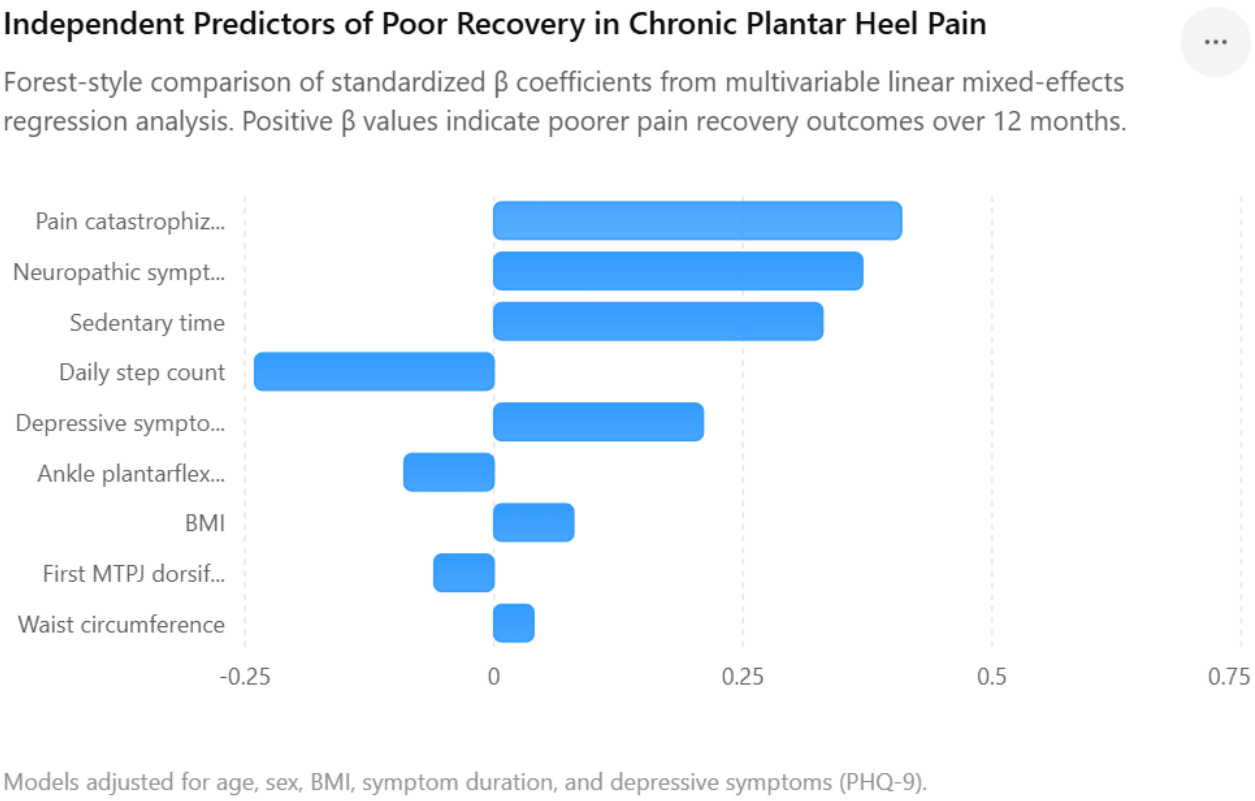

Figure 5. Forest plot demonstrates independent predictors of poor recovery over 12 months

Discussion

The present prospective cohort study investigated whether pain catastrophizing beliefs and neuropathic symptoms predict long-term recovery outcomes in individuals with chronic plantar heel pain. The findings demonstrated that elevated pain catastrophizing and neuropathic symptom involvement were associated with persistent pain severity, poorer functional recovery, and reduced health-related quality of life over the 12-month follow-up period. In contrast, traditional biomechanical and physical variables demonstrated comparatively limited prognostic value for long-term recovery outcomes. These findings support the growing understanding that chronic plantar

Vol. 5 No. 2 (2026)

Pakistan Journal of Medical & Cardiological Review

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Khalid et al - 2026

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heel pain is not solely a localized mechanical disorder but may also involve psychological and sensitization-related mechanisms contributing to symptom persistence and disability.

The present findings are consistent with previous evidence demonstrating that maladaptive pain-related cognitions contribute substantially to persistent pain and disability in chronic musculoskeletal disorders. Sullivan et al. described pain catastrophizing as a multidimensional construct characterized by rumination, magnification, and helplessness associated with pain experiences (5, 15). Elevated catastrophizing has previously been associated with increased pain intensity, fear-avoidance behavior, reduced physical performance, and poorer rehabilitation outcomes across several chronic pain conditions (3, 15, 16). The observed association between neuropathic symptom involvement and poor recovery outcomes further supports emerging evidence suggesting that sensitization-related mechanisms may contribute to chronic plantar heel pain (3, 13, 17). Neuropathic-like symptoms including burning pain, tingling, hypersensitivity, and radiating discomfort may reflect altered peripheral nerve sensitivity or central pain-processing dysfunction, potentially contributing to delayed recovery trajectories and persistent symptom severity. The limited predictive value of biomechanical variables observed in the present study also aligns with previous literature reporting inconsistent associations between structural impairments and long-term plantar heel pain outcomes (8, 9, 11). Although biomechanical factors may contribute to symptom development, they may not fully explain chronicity or recovery variation among individuals with persistent plantar heel pain (5).

The findings of this study have important implications for clinical rehabilitation practice. Assessment of individuals with chronic plantar heel pain should extend beyond traditional biomechanical examination and include screening for psychological distress, maladaptive pain beliefs, and neuropathic symptom involvement. Patients presenting with elevated pain catastrophizing and neuropathic symptom burden may require more comprehensive biopsychosocial rehabilitation approaches rather than isolated tissue-focused interventions alone. Integration of pain neuroscience education, psychologically informed physiotherapy, graded exposure, behavioral

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interventions, and activity modification strategies may improve long-term outcomes in individuals with persistent plantar heel pain. Early identification of high-risk individuals may also improve prognostic evaluation and facilitate individualized treatment planning

Strengths and Limitations

Several strengths should be acknowledged. The prospective longitudinal cohort design allowed evaluation of recovery trajectories over a 12-month period. The study additionally incorporated multidimensional assessment of psychological, neuropathic, behavioral, and physical variables within the same analytical framework, providing a broader understanding of factors influencing recovery outcomes in chronic plantar heel pain.

However, several limitations should also be considered. The observational design limits causal inference between predictor variables and recovery outcomes. Psychological and neuropathic measures were based on self-reported questionnaires, which may introduce response bias. Furthermore, unmeasured confounding factors including treatment adherence, occupational demands, psychosocial stressors, and lifestyle factors may have influenced recovery trajectories. Generalizability of findings may also be limited to individuals with chronic plantar heel pain receiving outpatient rehabilitation care

Future Research Directions

Future prospective and interventional studies are needed to further investigate the mechanistic relationship between pain catastrophizing, neuropathic symptoms, and chronic plantar heel pain persistence. Randomized controlled trials evaluating biopsychosocial rehabilitation approaches, pain neuroscience education, and psychologically informed physiotherapy interventions may provide further insight into optimizing long-term outcomes in this population. Additionally, future research should investigate whether early screening and targeted management of psychological and

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neuropathic factors can reduce chronicity and improve recovery trajectories in individuals with plantar heel pain.

Conclusion

Pain catastrophizing beliefs and neuropathic symptom involvement were significant predictors of poorer long-term recovery outcomes in individuals with chronic plantar heel pain. Participants presenting with elevated maladaptive pain cognitions and neuropathic symptom severity demonstrated persistent pain, poorer functional recovery, and reduced health-related quality of life over the 12-month follow-up period. In contrast, traditional biomechanical variables demonstrated limited prognostic value for long-term recovery trajectories. The findings support the growing evidence that chronic plantar heel pain involves both peripheral and central pain-related mechanisms and highlight the importance of incorporating biopsychosocial assessment into clinical rehabilitation practice. Early identification and targeted management of psychological and neuropathic factors may improve prognostic evaluation and facilitate more individualized rehabilitation strategies aimed at improving long-term recovery outcomes in individuals with chronic plantar heel pain.

References

1. Rogers J, Jones G, Wills K, Winzenberg T. Pain Catastrophizing Beliefs and Neuropathic Symptoms Are Associated With a Poorer Long-Term Recovery in Chronic Plantar Heel Pain: A Cohort Study. Physical Therapy. 2025;105(12):pzaf134.
2. Rogers J, Jones G, Cook JL, Wills K, Lahham A, Winzenberg TM. Chronic plantar heel pain is principally associated with waist girth (systemic) and pain (central) factors, not foot factors: a case-control study. journal of orthopaedic & sports physical therapy. 2021;51(9):449–58.

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Print ISSN 3007-2379
Khalid et al - 2026
DOI: http://doi.org/10.5281/zenodo.20771774

3. Ahmad S, Ezepue MH, Saeed MN, Qureshi MM, Onyeogulu CN, Wahid E, et al. Body Mass Index and its Association with Plantar Fascia and Calf Muscle Tightness in Salespersons of Swat: An Analytical Cross-Sectional Study. The Healer Journal of Physiotherapy and Rehabilitation Sciences. 2026;6(1):132–42.
4. Morrissey D, Cotchett M, Said J'Bari A, Prior T, Griffiths IB, Rathleff MS, et al. Management of plantar heel pain: a best practice guide informed by a systematic review, expert clinical reasoning and patient values. British journal of sports medicine. 2021;55(19):1106–18.
5. Rahim M, Rahim H, Maham A, Jutt J, Rehmat S, Shah SM, et al. Effects of Dry Needling on Heel Pain and Function in Patients with Plantar Fasciitis: A Randomized Controlled Trial: https://doi. org/10.5281/zenodo. 19942011. Pakistan Journal of Medical & Cardiological Review. 2026;5(2):1081–91.
6. Koc Jr TA, Bise CG, Neville C, Carreira D, Martin RL, McDonough CM. Heel pain–plantar fasciitis: revision 2023: clinical practice guidelines linked to the international classification of functioning, disability and health from the academy of orthopaedic physical therapy and American academy of sports physical therapy of the American physical therapy association. Journal of Orthopaedic & Sports Physical Therapy. 2023;53(12):CPG1–CPG39.
7. Drake C, Chapman L, Burnett C, Halstead J, Redmond A, Roddy E, et al. Plantar Heel Pain Management: A Survey of UK Registered Healthcare Professionals. Journal of foot and ankle research. 2025;18(4):e70087.
8. Karakılıç GD, Selcuk MMA, Öztürk EA. Frequency of central sensitization and nociplastic pain in patients with plantar fasciitis: Central sensitization and nociplastic pain in plantar fasciitis. International Orthopaedics. 2025;49(5):1091.
9. Nadimi J, Abdul W, Whelan R, Hutchison A-M. Does a Relationship Exist Between Plantar Heel Pain and Stress, Anxiety, and Depression: A Systematic Review of the Literature. Journal of the American Podiatric Medical Association. 2025;115(1).

Pakistan Journal of Medical & Cardiological Review
https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387
Print ISSN 3007-2379

Khalid et al - 2026
DOI: http://doi.org/10.5281/zenodo.20771774

10. Ríos-León M, Valera-Calero JA, Ortega-Santiago R, Varol U, Fernández-de-Las-Peñas C, Plaza-Manzano G. Analyzing the interaction between clinical, neurophysiological and psychological outcomes underlying chronic plantar heel pain: a network analysis study. International journal of environmental research and public health. 2022;19(16):10301.
11. Cotchett M, Frescos N, Whittaker GA, Bonanno DR. Psychological factors associated with foot and ankle pain: a mixed methods systematic review. Journal of foot and ankle research. 2022;15(1):10.
12. Kurien T, Scammell BE. Mechanisms of pain in knee osteoarthritis that influence outcomes after total knee arthroplasty surgery. Bone & Joint 360. 2021;10(4):5–11.
13. Seerden SF, Dankaerts W, Swinnen TW, Westhovens R, De Vlam K, Vanwanseele B. Differences in multi-segmental spine kinematics between patients with different stages of axial spondyloarthritis and healthy controls. Musculoskeletal Science and Practice. 2021;53:102368.
14. Alaiti RK. Movement-related pain as a learned response: an investigation of the possible mechanisms underlyng movement-related pain persistence and recovery in subjects with chronic musculoskeletal pain: Universidade de São Paulo; 2021.
15. Lentz TA, George SZ, Manickas-Hill O, Malay MR, O'Donnell J, Jayakumar P, et al. What general and pain-associated psychological distress phenotypes exist among patients with hip and knee osteoarthritis? Clinical Orthopaedics and Related Research®. 2020;478(12):2768–83.
16. Buckthorpe M, Gokeler A, Herrington L, Hughes M, Grassi A, Wadey R, et al. Optimising the early-stage rehabilitation process post-ACL reconstruction. Sports Medicine. 2024;54(1):49–72.
17. Tan VAK, Tan CC, Yeo NEM, Zhang M, Mehta KV, Tian RHH, et al. Consensus statements and guideline for the diagnosis and management of plantar fasciitis in Singapore. Ann Acad Med Singap. 2024;53(2):101–12.