ACTA ORTHOPAEDICA et TRAUMATOLOGICA TURCICA
www.aott.org.tr

Research Article

Psychological correlates of pain catastrophizing and disability in patients with Achilles tendinopathy: The roles of resilience and psychological inflexibility

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ARTICLE INFO

Article history:
Submitted June 15, 2025
Received in revised form
July 07, 2025
Last revision received form
October 28, 2025
Accepted November 28, 2025
Publication Date
February 13, 2026

Keywords:
Achilles tendinopathy
Distress
Mediator
Pain catastrophizing
Pain disability
Psychological inflexibility
Resilience

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ABSTRACT

Objective: This study aimed to clarify the contribution of psychological factors to pain adjustment in patients with Achilles tendinopathy. It specifically investigated the associations of psychological inflexibility, distress, and resilience with pain catastrophizing, and their indirect associations between pain intensity and pain disability.

Methods: A total of 120 participants (65% female; mean age = 49.17 years, SD = 12.06) completed validated measures of visual analog scales for pain level, psychological distress, psychological inflexibility, resilience, pain disability index, and pain catastrophizing. Hierarchical regressions identified correlates of pain catastrophizing. Bootstrapped mediation analyses (5000 samples) tested indirect effects of psychological variables on the pain intensity–disability relationship.

Results: Pain catastrophizing was most strongly associated with psychological inflexibility ($\beta = 0.413$, $P < .001$) and distress ($\beta = 0.284$, $P < .001$); resilience also showed a significant inverse association ($\beta = -0.181$, $P = .021$). Pain intensity had a weaker yet significant association with catastrophizing in both final steps. Mediation models revealed an indirect-only pattern of association between pain intensity and disability through both pain catastrophizing and psychological inflexibility, as the direct effects were not statistically significant ($c' = 0.044$, 95% CI [−0.092, 0.180]; 0.143, 95% CI [−0.014, 0.301], respectively). Resilience partially mediated this relationship ($c' = 0.207$, 95% CI [0.044, 0.370]), while distress was not a significant mediator.

Conclusion: Psychological processes, particularly catastrophizing and inflexibility, are strongly associated with the extent to which pain is linked to disability. These findings support the integration of psychological assessment into routine musculoskeletal rehabilitation in orthopedic practice. Addressing emotional processes and promoting psychological flexibility may improve treatment outcomes and prevent long-term disability.

Level of Evidence: Level III, cross-sectional study.

Introduction

Achilles tendinopathy (AT) is a common overuse injury causing pain, stiffness, and functional limitations, often reducing quality of life in active adults and athletes.[1,2] The management of AT might be challenging because symptoms can remain even after rehabilitation. Beyond tendon pathology, psychological factors increasingly appear to influence pain perception, disability, and recovery in AT.[1,3]

Pain is shaped not only by sensory input but also by cognitive, emotional, and behavioral processes. In chronic pain, markers such as pain duration or intensity rarely explain differences in disability, highlighting the need to consider psychosocial factors.[4] Consequently, attention has increasingly shifted toward psychological constructs to better explain patient outcomes and guide management strategies in foot and ankle pain.[5]

Pain catastrophizing is a key psychological factor in chronic pain, reflecting an exaggerated negative mindset toward actual or anticipated pain.[6] In acute AT, higher catastrophizing has been shown to be associated with greater symptom severity and functional impairment, explaining nearly half of dysfunction variance in runners.[7]This cognitive style is a critical target in pain management and may also contribute importantly to chronic AT. Psychological inflexibility, or experiential avoidance, involves attempts to suppress or escape distressing internal experiences.[8] In this study, psychological inflexibility is operationalized primarily as experiential avoidance, measured by the Acceptance and Action Questionnaire–II (AAQ-II), rather than as a broad psychological trait. High inflexibility is linked to greater disability, emotional distress, and poorer outcomes, and it mediates the association between pain, pain anxiety, and functional limitation.[9,10] Through overlapping mechanisms with catastrophizing, psychological inflexibility can undermine adaptive coping and reinforce functional impairment. In the same vein, psychological resilience, defined as the ability to maintain or regain emotional stability under stress, was inversely related to pain and disability. Higher resilience is associated with lower pain symptomatology, reduced pain disability, and better emotional adaptation in chronic pain populations.[11] Hence, resilience provides an important counterbalance and may

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Cite this article as: *Akça E, Kart H, Demir U, Akpınar F. Psychological correlates of pain catastrophizing and disability in patients with Achilles tendinopathy: the roles of resilience and psychological inflexibility. Acta Orthop Traumatol Turc. 2026, 60 (1), 0477, doi: 10.5152/j.aott.2026.25477.*

DOI: 10.5152/j.aott.2026.25477

moderate the negative impact of psychological symptoms on pain outcomes. Psychological distress, operationalized in this study as the combined burden of anxiety and depression, is another crucial construct. Individuals experiencing greater anxiety and depression tend to report higher levels of disability in AT.[12] Psychological distress is thus both an outcome and a potential mediator in pain-related processes.

The present study focuses on patients with AT to clarify the interplay between these psychological variables and pain-related outcomes. By applying a biopsychosocial framework and incorporating well-validated psychological instruments, the study aims to deepen the understanding of psychological correlates of chronic pain adjustment and to highlight candidate intervention targets that may enhance the success of orthopedic treatment in individuals with AT. Based on current evidence, it is specifically hypothesized that (1) resilience and psychological inflexibility would each explain unique variance in pain catastrophizing beyond sociodemographic, pain, and distress variables and (2) resilience, psychological inflexibility, distress, and pain catastrophizing mediate the relationship between pain intensity and pain-related disability.

Material and methods

Procedure

This study was approved by the Göztepe Süleyman Yalçın City Hospital Non-Invasive Clinical Research Ethics Committee (Approval No: 2025/0009 Date: 29 May 2025). The inclusion criteria were as follows: (1) individuals aged between 18 and 65 years, (2) a confirmed diagnosis of AT established by an orthopedic specialist, and (3) ongoing ankle pain for at least 6 weeks prior to assessment. The exclusion criteria were (1) a history of surgical intervention on the Achilles tendon, (2) the presence of other orthopedic conditions around the ankle (ankle osteoarthritis, fractures, ligament injuries, or bursitis) that could contribute to pain, and (3) a current diagnosis of a major psychiatric disorder or active suicidal ideation, as determined by a psychiatric evaluation. The AT diagnosis was confirmed by an orthopedic specialist based on patient history, physical examination, and X-ray evaluation. Eligible patients were informed about the study at the end of their routine clinical visit and invited to participate. Data were collected via face-to-face, semi-structured interviews conducted by a psychiatrist. The assessment took approximately 30 minutes. All participants provided informed consent and were assured of confidentiality. This investigation was designed as a cross-sectional study (Level III).

Measures

Pain Intensity: As recommended by Jensen et al,[13] pain intensity was assessed using 4 different 0-10 rating visual analog scales evaluating current, worst, mildest, and average pain experienced over the past week. A composite pain intensity score was computed by averaging these 4 values. This method has demonstrated high reliability and validity in chronic pain populations.[13] In the sample, this composite score demonstrated good internal consistency, with a Cronbach's α of 0.821.

Pain Duration: Participants reported the duration of their chronic pain in months, reflecting the time elapsed since the onset of persistent symptoms, regardless of diagnosis date or clinical course.

Pain Catastrophizing: The Pain Catastrophizing Scale (PCS) is a 13-item self-report measure that assesses exaggerated negative responses to actual or anticipated pain.[14] Participants rate statements on a 5-point Likert scale (0: Not at all to 4: All the time). Total scores (range: 0-52) reflect 3 subscales: rumination, magnification, and helplessness. Higher scores indicate greater pain catastrophizing.

Pain Disability: The Pain Disability Index (PDI) was used to assess the degree to which chronic pain interferes with daily functioning across various life domains, such as work, social activities, and self-care.[15] The scale includes 7 items rated on a 0-10 scale, with higher scores indicating greater disability.

Resilience: Resilience was measured using the Brief Resilience Scale, a 6-item instrument that assesses the ability to recover from adversity and stress.[16] Responses are rated on a 5-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"). Total scores range from 6 to 30, with higher scores indicating greater psychological resilience.

Psychological Inflexibility: The AAQ-II was used to assess psychological inflexibility.[17] In line with the scale developers, psychological inflexibility is a broader process construct within Acceptance and Commitment Therapy (ACT) (e.g., experiential avoidance, cognitive fusion, present-moment disengagement, values/committed action). *Experiential avoidance* is one example of this construct.[17] The AAQ-II is widely regarded as a proxy measure reflecting avoidance, fusion, and other ACT-related processes. In this study, AAQ-II primarily indexes experiential avoidance; thus, the use of "psychological inflexibility" is operational and refers to experiential avoidance as measured by AAQ-II, not the full construct. Notably, AAQ/AAQ-II developers have often discussed these terms interchangeably, consistent with this operationalization.[17] The 7 items are rated on a 7-point Likert scale (1="never true," 7="always true"), with higher scores reflecting greater avoidance of unpleasant internal experiences and reduced emotional openness.

Distress: General psychological distress was operationalized using the total score from the Hospital Anxiety and Depression Scale.[18]The HADS comprises 14 items, 7 for anxiety and 7 for depression, each rated on a 4-point scale. The total score provides an overall index of emotional distress, commonly used in both medical and community settings.

Required sample size

A priori power analysis was conducted to determine the required sample size for the planned analyses. For the hierarchical regression model explaining variance in pain catastrophizing with 9 independent variables in the final step, a medium-to-large effect size (f^2=0.15-0.25) was anticipated, requiring a minimum sample of 72-114 participants for adequate power (α=0.05, 1–β=0.80). For simple mediation models with medium path coefficients (a and b ≈ 0.30-0.60), a sample size of 59-124 is recommended to achieve 80%

HIGHLIGHTS

- Psychological variables explained significant variance in pain catastrophizing among patients with Achilles tendinopathy.
- Distress and psychological inflexibility emerged as the strongest correlates of pain catastrophizing.
- Resilience was a modest, negative correlate of pain catastrophizing.
- Psychological inflexibility, pain catastrophizing, and resilience mediated the relationship between pain intensity and perceived disability.
- Results support integrating brief psychological screening for resilience and psychological inflexibility and interventions into routine orthopedic care.

power using percentile bootstrap CIs.[19] The final sample size was determined to be 120 participants.

Participants

A total of 120 participants (78 females, 65.0%) with a mean age of 49.17 years (SD=12.06) were included in the study. Most were married (83.3%), while 15.8% were single and one was divorced. Educational levels ranged from primary (13.3%) to postgraduate (2.5%), with the largest group being high school graduates (34.2%). Just over half (51.7%) were not employed, and income levels were distributed across lower (31.7%), lower-to-middle (10.0%), middle-to-high (31.7%), and high (26.7%) brackets. Regarding previous treatment, 50.8% had used medication (oral nonsteroidal anti-inflammatory drugs such as ibuprofen, naproxen, acetaminophen, and topical anti-inflammatory gels), while smaller proportions reported injection therapy (10.8%), Extracorporeal Shockwave Therapy (9.2%), or other treatments (0.8%); 28.3% had no prior treatment.

Statistical analysis

All statistical analyses were conducted using IBM SPSS Statistics version 25 (IBM SPSS Corp.; Armonk, NY, USA) and R software (v4.4.2). Descriptive statistics were calculated for demographic and clinical variables. The assumption of normality was evaluated using visual inspection of histograms and Q-Q plots, as well as skewness and kurtosis values. All continuous variables demonstrated acceptable levels of normality for parametric analysis. Pearson correlation coefficients were used to examine associations among continuous variables. To explore correlates of pain catastrophizing, hierarchical multiple regression analyses were conducted. Model assumptions were checked prior to inference: (a) multicollinearity via variance inflation factors (VIF) and tolerance (criteria: VIF < 5, tolerance > 0.20), (b) linearity and homoscedasticity by visual inspection of standardized residuals versus fitted values and partial regression (component-plus-residual) plots, (c) normality of residuals using Q–Q plots and histograms, (d) independence of errors using the Durbin–Watson statistic. The change in adjusted R^2 and significance of incremental variance explained at each step were evaluated. In addition, mediation analyses were conducted using the PROCESS macro (5000 bootstrap samples; Hayes, 2022).[20] Four separate models were tested. Direct and indirect effects with 95% bootstrap CIs were reported. Sensitivity analyses examining pain duration employed mean-centering of variables, with interaction terms formed from the centered independent variables. The significance level was set at $P < .05$ for all analyses.

Results

Descriptive outcomes

The sample was predominantly composed of individuals experiencing chronic pain, with an average pain duration of 14.96 months (SD=13.44; range=1.5-96 months), indicating the chronic nature of pain in this group. Among the pain measures, the highest average score was observed for worst pain (mean=7.23, SD=2.19), while mild pain had the lowest mean (mean=2.52, SD=1.84). The composite pain intensity score averaged 4.79 (SD=1.77). In terms of psychological measures, mean pain catastrophizing was 18.74 (SD=12.22) and mean pain disability was 25.08 (SD=12.17). Psychological inflexibility averaged 20.79 (SD=9.80), whereas resilience averaged 20.52 (SD=5.03). Symptoms on the HADS were modest overall: anxiety M=5.43 (SD=4.32), depression M=5.30 (SD=4.02), and distress (HADS total) M=10.73 (SD=7.97). Descriptive statistics for all pain-related and psychological variables are presented in Table 1.

Table 1. The descriptive statistics of the study variables

Variable	Minimum	Maximum	Mean	SD
Age	18	62	49.17	12.06
Pain duration (months)	1.5	96	14.96	13.44
Current pain intensity	0	10	4.57	2.38
Average pain intensity	0	10	4.87	2.33
Worst pain intensity	0	10	7.23	2.19
Mildest pain intensity	0	10	2.52	1.84
Composite pain intensity	0.25	10.0	4.79	1.77
Pain catastrophizing	0	49	18.74	12.22
Pain disability	2	63	25.08	12.17
Psychological Inflexibility	7	46	20.79	9.80
Resilience	9	30	20.52	5.03
Anxiety	0	21	5.43	4.32
Depression	0	18	5.30	4.02
Distress (HADS total)	0.0	39.0	10.73	7.97

Correlational findings

Significant associations were observed between pain-related variables and psychological factors. Higher pain intensity (composite) was modestly correlated with increased psychological inflexibility (r=0.272, 95% CI [0.097, 0.430], P=.003), and lower resilience (r=−0.185, 95% CI [−0.353, −0.006], P=.043). Pain disability also showed moderate negative correlations with resilience (r=−0.435, 95% CI [−0.570, −0.277], $P < .001$), and positive correlations with psychological inflexibility (r=0.544, 95% CI [0.404, 0.659], $P < .001$), anxiety (r=0.428, 95% CI [0.269, 0.564], $P < .001$), depression (r=0.452, 95% CI [0.297, 0.584], $P < .001$), and total distress (r=0.460, 95% CI [0.306, 0.590], $P < .001$).

Pain catastrophizing was positively associated with both pain and psychological indicators. It correlated moderately with pain intensity (r=0.339, 95% CI [0.171, 0.489], $P < .001$) and strongly with pain disability (r=0.711, 95% CI [0.610, 0.790], $P < .001$). In psychological domains, it showed robust positive correlations with distress (r=0.615, 95% CI [0.489, 0.715], $P < .001$), psychological inflexibility (r=0.696, 95% CI [0.591, 0.778], $P < .001$), anxiety (r=0.628, 95% CI [0.506, 0.726], $P < .001$), and depression (r=0.544, 95% CI [0.404, 0.659], $P < .001$), and a moderate negative correlation with resilience (r=−0.510, 95% CI [−0.632, −0.364], $P < .001$).

Pain duration showed no significant associations with psychological constructs and was largely unrelated to other pain-related variables, and showed only a weak correlation with pain intensity (composite) (r=0.181, 95% CI [0.002, 0.349], P=0.048).

Finally, age showed small-to-moderate correlations with depression (r=0.244, 95% CI [0.068, 0.406], P=.007), pain disability (r=0.230, 95% CI [0.053, 0.393], P=.012), and a modest but significant association with pain catastrophizing (r=0.190, 95% CI [0.011, 0.357], P=.038), along with resilience (r=−0.185, 95% CI [−0.352, −0.006], P=.044). All other bivariate correlations are presented in Table 2 and CIs were given in Supplementary Table 10.

Multiple linear regression analysis

A hierarchical regression analysis was conducted in 5 steps to explore factors explaining variance in pain catastrophizing. Sociodemographic variables (marital status, education, and employment) were entered as the first block in hierarchical regression to control for their potential relevance to pain-related and psychological outcomes, which is well-established in chronic pain and psychosomatic research. Residual normality was examined using the

Table 2. Bivariate correlation matrix of clinical and psychological variable (n = 120)

	Age	Pain Duration	PI (Current)	PI (Average)	PI (Worse)	PI (Mild)	PI (Composite)	PC	PDI	PINFX	Resilience	Anxiety	Depression
Pain duration	0.09												
PI (Current)	−0.05	0.26**											
PI (Average)	0.01	0.14	0.60**										
PI (Worse)	0.10	0.08	0.49**	0.61**									
PI (Mild)	−0.03	0.09	0.54**	0.66**	0.31**								
PI (Composite)	0.01	0.18*	0.82**	0.89**	0.76**	0.75**							
PC	0.19*	0.17	0.22*	0.30**	0.33**	0.25**	0.34**						
PDI	0.23*	0.16	0.15	0.28**	0.30**	0.18	0.28**	0.71**					
PINFX	0.14	0.01	0.25**	0.21*	0.20*	0.21*	0.27**	0.70**	0.54**				
Resilience	−0.18*	−0.03	−0.19*	−0.14	−0.18	−0.08	−0.18*	−0.51**	−0.43**	−0.72**			
Anxiety	0.05	−0.11	0.12	0.22*	0.26**	0.07	0.21*	0.63**	0.43**	0.63**	−0.53**		
Depression	0.24**	0.03	0.03	0.13	0.16	−0.10	0.08	0.54**	0.45**	0.51**	−0.49**	0.83**	
Distress	0.15	−0.05	0.08	0.19*	0.22*	−0.02	0.15	0.61**	0.46**	0.60**	−0.54**	0.96**	0.95**

Significance levels: *$P < .05$, **$P < .01$.
PC, pain catastrophizing; PDI, Pain Disability Index; PI, pain intensity; PINFX, psychological Inflexibility.

Shapiro–Wilk tests. For the Model *4a*, the Shapiro–Wilk test indicated no significant deviation from normality, $W(120) = 0.979$, $P = .055$. For Model *4b*, residuals were also normally distributed, $W(120) = 0.988$, $P = .367$. Visual inspection of the histograms and Q–Q plots confirmed that the standardized residuals were approximately normally distributed, with no substantial skewness or kurtosis.

In Step 1, sociodemographic variables (age, gender, marital status, years of education, and employment status) explained 22.9% of the variance (Adjusted $R^2 = 0.229$, $P < .001$). Lower education ($\beta = -0.385$, $P < .001$) and unemployment ($\beta = -0.213$, $P = .026$) were significant variables. Step 2 introduced pain-related variables (pain duration and composite pain intensity), yielding an additional 7.3% explained variance ($\Delta R^2 = 0.073$, $P = .003$; Adjusted $R^2 = .293$). Composite pain intensity was a significant explanatory variable ($\beta = 0.282$, $P = .001$). In Step 3, psychological distress was added. This led to a substantial improvement in model fit ($\Delta R^2 = 0.203$, $P < .001$), with the adjusted R^2 rising to 0.504. Distress ($\beta = .491$, $p < .001$) showed the strongest association with pain catastrophizing. In the final hierarchical step, resilience and psychological inflexibility were entered in separate alternative steps to minimize potential multicollinearity and to clarify the unique contribution and clinical relevance of each construct. In Step 4a, resilience was added, contributing an incremental 2.2% to the explained variance ($\Delta R^2 = 0.022$, $P = .021$). The adjusted R^2 reached 0.523. Both distress ($\beta = 0.405$, $P < .001$) and lower resilience ($\beta = -0.181$, $P = .021$) were significant. Pain intensity remained significantly associated with catastrophizing ($\beta = 0.202$, $P = .004$). Finally, in Step 4b, psychological inflexibility was included instead of resilience. This model yielded a greater improvement ($\Delta R^2 = 0.098$, $P < .001$; Adjusted $R^2 = .606$). Psychological inflexibility ($\beta = 0.413$, $P < .001$) and distress ($\beta = 0.284$, $P < .001$) were the strongest correlates, with pain intensity ($\beta = 0.150$, $P = .018$) also remaining significant. The remaining data are available in Table 3. The unstandardized coefficients, 95% CIs, and collinearity diagnostics for all independent variables are presented in Supplementary Table 11 (Supplementary Material).

Mediation analysis

To investigate potential mediators linking pain intensity to perceived disability, 4 simple mediation models were tested, each including pain intensity (composite) as the independent variable and PDI as the dependent variable. The mediators examined were resilience, psychological inflexibility, distress, and pain catastrophizing. All bootstrap CIs (95% CI) were computed using the percentile bootstrap method with 5000 resamples. The standardized total effect of pain intensity on pain disability was statistically significant, $\beta = 0.280$, SE = 0.088, 95% CI [0.105, 0.455], $P = .002$.

In model A, resilience demonstrated concurrent direct and indirect associations between pain intensity and disability. Pain intensity was associated with lower resilience ($\beta = -0.186$, $P = .043$), which in turn related to higher disability ($\beta = -0.397$, $P < .001$). The standardized indirect effect was significant (ab = 0.074, 95% CI [0.006, 0.143]), while the standardized direct effect remained significant ($c' = 0.207$, 95% CI [0.044, 0.370]). In model B, pain intensity related to higher inflexibility ($\beta = 0.272$, $P = .003$), which was strongly associated with disability ($\beta = 0.505$, $P < .001$). The standardized indirect effect was substantial (ab = 0.137, 95% CI [0.036, 0.249]), whereas the standardized direct effect was not significant ($c' = 0.143$, 95% CI [−0.014, 0.301]), consistent with a statistically compatible indirect-only association. In model C, the indirect effect (ab = 0.066, 95% CI [−0.001, 0.146]) was non-significant, and the direct effect remained robust ($c' = 0.215$, 95% CI [0.055, 0.374]), suggesting that distress does not show a significant

Table 3. Summary of hierarchical regression models explaining pain catastrophizing

Independent Variables	Step 1	Step 2	Step 3	Step 4a (Resilience)	Step 4b (Psychological Inflexibility)
Age	0.059	0.100	0.071	0.049	0.058
Gender	0.01	0.072	0.058	0.071	0.074
Marital status	−0.095	−0.135	−0.121	−0.110	−0.113
Education	−0.385***	−0.348***	−0.194*	−0.171*	−0.138*
Work status	−0.213*	−0.198*	−0.151*	−0.161*	−0.101
Pain duration		0.013	0.095	0.099	0.073
Pain intensity		0.282**	0.218**	0.202**	0.150*
Distress			0.491***	0.405***	0.284***
Resilience				−0.181*	
Psychological Inflexibility					0.413***
Adjusted R^2	0.229***	0.293***	0.504***	0.523***	0.606***
F Change	8.080	6.122	48.594	5.468	29.673
Sig. F Change	<0.001	0.003	<0.001	0.021	<0.001

Coefficients are standardized.
Model 1: Sociodemographic variables.
Model 2: Adds clinical pain variables.
Model 3: Adds distress.
Models 4a and 4b: Add resilience and experiential avoidance respectively.
Significance levels: $^*P < .05$, $^{**}P < .01$, $^{***}P < .001$.

indirect association between pain intensity and disability. Finally in model D, pain intensity was associated with higher catastrophizing ($\beta = 0.340$, $P < .001$), which in turn showed a strong link with disability ($\beta = 0.696$, $P < .001$). The standardized indirect effect was large and significant (ab = 0.236, 95% CI [0.109, 0.343]), while the standardized direct effect was not significant (c′ = 0.044, 95% CI [−0.092, 0.180]), indicating an indirect-only pattern. Unstandardized and standardized values for all effects are reported in Table 4, and models were depicted in Figure 1.

Sensitivity to chronicity

Pain duration was introduced as a moderator in all mediation models; the X × W and M × W terms were not significant in any specification, indicating no moderated mediation by duration (Supplementary Table 3-8). Using the 3-month boundary commonly adopted in the AT literature, subgroup comparisons were then conducted (<3 vs. ≥3 months and finer blocks anchored on 3 months): none of the psychological measures differed significantly across duration groups (Supplementary Table 1 and 2). Taken together, these sensitivity/subgroup analyses provide no evidence that associations varied by chronicity. Full analysis details are provided in the Supplementary Materials.

Discussion

This study examined the interplay between relevant psychological processes and pain-related outcomes in patients with AT. The role and importance of these psychological constructs in pain adjustment were demonstrated through a hierarchical approach combined with mediation analyses.

Unexpectedly, traditional markers such as pain intensity and symptom duration showed minimal correlation with functional disability in AT. Pain intensity (composite) was only weakly associated with catastrophizing and disability, consistent with prior reports that intensity alone poorly accounts for function or emotional burden in non-cancer pain and certain psychological factors in patients with AT.[21,22] Pain duration also showed negligible associations, aligning with meta-analytic evidence that neither duration nor intensity moderates the link between pain acceptance and disability.[23] These findings indicate that patients' cognitive and emotional responses to pain influence disability more than symptom persistence or severity, highlighting the value of including psychosocial assessment in orthopedic care.[4]

The regression models explain variance in pain perception in AT attributable to psychological processes. Psychological distress accounted for the largest share of explained variance in pain catastrophizing at entry, but its contribution diminished once resilience and psychological inflexibility were included. Importantly, the data showed that both resilience and psychological inflexibility added incremental explained variance in pain catastrophizing after accounting for distress. In practice, this means that two patients with similar tendon pathology and pain intensity may have very different functional outcomes depending on their psychological profiles. For orthopedic clinicians, these results have clear implications. Screening for pain catastrophizing, avoidance, and low resilience can effectively identify patients at greater risk for pain disability. Multidisciplinary approaches that combine standard rehabilitation with targeted psychological strategies, such as resilience training or methods that

Table 4. Standardized and unstandardized direct, indirect, and total effects of pain intensity on PDI through mediators with bootstrapped intervals

Mediators of Models	Direct Effect (*c'*)	SE of *c'*	95% CI of *c'*	Indirect Effect (*ab*)	SE of *ab*	95% CI of *ab*	Total Effect (c)	SE of c	95% CI of c
Standardized values									
A. Resilience	0.207	0.083	[0.044, 0.370]	0.074	0.036	[0.006, 0.143]	0.280	0.088	[0.105, 0.455]
B. Psychological Inflexibility	0.143	0.080	[−0.014, 0.301]	0.137	0.055	[0.036, 0.249]			
C. Distress	0.215	0.081	[0.055, 0.374]	0.066	0.037	[−0.001, 0.146]			
D. Pain Catastrophizing	0.044	0.069	[−0.092, 0.180]	0.236	0.061	[0.109, 0.343]			
Unstandardized values									
A. Resilience	1.421	0.567	[0.2983, 2.543]	0.505	0.249	[0.032, 1.024]	1.926	0.607	[0.724, 3.128]
B. Psychological Inflexibility	0.985	0.546	[−0.097, 2.067]	0.941	0.389	[0.241, 1.756]			
C. Distress	1.474	0.554	[0.376, 2.571]	0.452	0.265	[−0.007, 1.020]			
D. Pain Catastrophizing	0.302	0.474	[−0.636, 1.240]	1.624	0.425	[0.771, 2.429]			

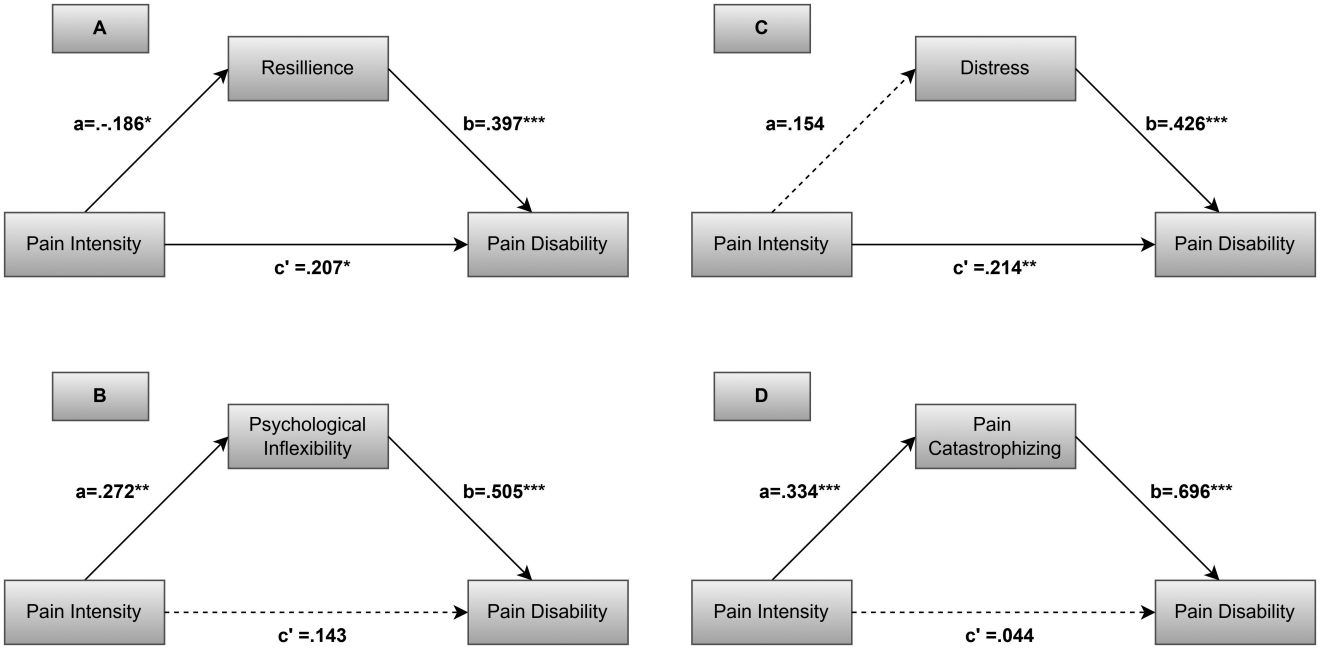


Figure 1. Conceptual mediation models illustrating the standardized path coefficient of pain intensity on pain disability through psychological variables. (A) Resilience showed a significant indirect association linking pain intensity to pain disability, while the direct association between pain intensity and disability also remained statistically significant. (B) Psychological inflexibility demonstrated a significant indirect association between pain intensity and pain disability, whereas the direct association was no longer statistically significant when psychological inflexibility was included in the model. (C) Distress was positively associated with pain disability; however, the indirect pathway linking pain intensity to disability through distress was not statistically significant. (D) Pain catastrophizing showed an indirect-only association between pain intensity and disability, underscoring its salient association within the cognitive–affective context of pain. Dashed arrows represent non-significant paths. *$P < .05$, **$P < .01$, ***$P < .001$.

reduce psychological inflexibility, may improve adherence, accelerate recovery, and prevent chronic disability in AT patients. The ACT protocols have demonstrated efficacy in this regard, showing reductions in both experiential avoidance and pain catastrophizing, which in turn improve disability and emotional functioning.[24,25] Similarly, a recent review suggested that psychological interventions enhance pain management by reducing catastrophizing, boosting resilience, and improving outcomes, warranting integration into multidisciplinary care in patients with physical pain.[26]

Pain duration showed minimal association with psychological factors, and sensitivity analyses for interaction and subgroup pattern corroborated the lack of association across chronicity strata. One potential explanation is a psychological adaptation or habituation process; over time, individuals may develop coping mechanisms that diminish the direct impact of chronicity on catastrophizing and disability. Alternatively, this finding may underscore the dominance of psychological factors over purely temporal ones as contributors to the pain experience.

The mediation results suggest that the association between pain and perceived disability in AT involves psychological responses that may be related to functional limitation and recovery. Pain catastrophizing accounted for the largest indirect association linking pain intensity with disability. This aligns with prior research showing that catastrophizing magnifies pain perception and contributes to functional decline even when objective tendon pathology is limited.[6,27] Clinically, patients who interpret pain as threatening often reduce activity due to fear, which can delay tendon recovery and rehabilitation progress. Identifying and addressing catastrophic thinking during routine orthopedic care may therefore help maintain mobility and prevent prolonged disability in AT. Psychological inflexibility also mediated the pain–disability relationship. This corroborates recent evidence showing that avoidance strategies contribute to functional limitation in chronic pain and are associated with substantial effect sizes in clinical populations.[9,10] Thus, this finding of the study suggests that rehabilitation programs that combine progressive loading with education about safe activity and flexible coping strategies may counteract this effect and improve adherence to orthopedic treatments. Interestingly, resilience demonstrated a modest but significant indirect effect. Participants with higher pain intensity were more likely to report diminished resilience, which in turn was related to greater disability. This supports previous work indicating that resilience acts as a protective factor, fostering adaptive coping strategies and emotional regulation in the face of persistent pain.[28] Although its association was weaker than that of catastrophizing or inflexibility, fostering resilience through patient education, goal-setting, and social support could complement orthopedic practice and enhance recovery.

This study has several limitations. First, the cross-sectional design prevents causal interpretations. While mediation models provide insight into potential mechanisms, they estimate indirect associations rather than causal ordering. Longitudinal designs are needed to confirm temporal sequencing and directionality. Second, all measures were self-reported, which may introduce common method bias and inflate associations. Incorporating clinician-rated or objective indicators (e.g., actigraphy for physical activity) would improve measurement precision. Third, the sample was drawn from a single urban clinical setting, which may limit generalizability. Fourth, while sociodemographic variables such as age and gender were collected and considered for pain catastrophizing, they were not systematically examined as moderators for other psychological outcomes. Fifth, AT subtypes were not recorded as separate clinical categories (e.g., insertional vs. midportion), which precluded any analysis of potential subtype-related differences. Future studies should explore sociocultural moderators, as pain expression and coping strategies can differ across populations. Additionally, while

the study focused on core psychological factors, other constructs such as self-efficacy, pain acceptance, or fear-avoidance beliefs were not included and may offer further explanatory power.

In conclusion, this study highlights that psychological inflexibility demonstrated the largest effect size as a correlate of pain catastrophizing, while pain catastrophizing itself was the strongest mediator linking pain intensity to functional disability. This pattern suggests that rigid avoidance and catastrophic interpretations in response to AT pain are associated with greater functional limitations. For orthopedic practice, the priority screening targets should therefore include pain catastrophizing (PCS) and psychological inflexibility (AAQ-II). Identifying these risk factors early allows clinicians to integrate brief education on safe activity, flexible coping strategies, and timely referrals for supportive interventions alongside standard rehabilitation. By addressing these psychological processes, orthopedic care can enhance adherence, protect mobility, and reduce the progression to chronic disability.

Data Availability Statement: The data that support the findings of this study are available on request from the corresponding author.

Ethics Committee Approval: Ethical committee approval was received from Göztepe Süleyman Yalçın City Hospital Non-Invasive Clinical Research Ethics Committee (Approval No: 2025/0009 Date: 29 May 2025).

Informed Consent: Informed consent was obtained from the patients who agreed to take part in the study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – E.A., H.K., U.D., F.A.; Design – E.A., H.K., U.D., F.A.; Supervision – E.A., H.K., U.D., F.A.; Resources – E.A., H.K., U.D., F.A.; Materials – E.A., H.K., U.D., F.A.; Data Collection and/or Processing – E.A., H.K., U.D., F.A.; Analysis and/or Interpretation – E.A., H.K., U.D., F.A.; Literature Search – E.A., H.K., U.D., F.A.; Writing Manuscript – E.A., H.K., U.D., F.A.; Critical Review – E.A., H.K., U.D., F.A.

Declaration of Interests: The authors have no conflict of interest to declare.

Funding: The authors declared that this study has received no financial support.

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Pain Duration Subgroup AnalysisMultiple-testing adjustment

We controlled family-wise Type I error across the six outcomes per table using Holm's step-down procedure and additionally reported Benjamini–Hochberg FDR (BH). Both methods are applied to the ordered *p*-values and include a monotonicity step to ensure logical consistency (i.e., larger raw *p* cannot yield a smaller adjusted *p* than a smaller raw *p*). Concretely:

- Holm (FWER): for ordered, $p_{(i)}$ adjusted values are $\tilde{p}_{(i)} = \max_{j \le i} \left\{ \min\left(1, (m - j + 1)\, p_{(j)}\right) \right\}$ (cumulative max enforces monotonicity).
- BH/FDR: provisional $q_{(i)}^{*} = (m / i)\, p_{(i)}$ are transformed via a backward cumulative min, $q_{(i)} = \min_{j \ge i} q_{(j)}^{*}$, again producing a monotone sequence.

Two-group comparison by pain duration: <3 months vs ≥3 months (Mann–Whitney U)

Group medians suggested higher disability in the <3 m group (PDI median=34.0) than the ≥3 m group (median=22.0). The Mann–Whitney test was significant before correction (U=245.0, Z=−2.537, *p*=.011, small–medium effect *r*=.232). After multiple-comparison adjustment across the six outcomes, significance did not survive: Holm-adjusted *p*=.066; Benjamini–Hochberg FDR *q*=.066. All other outcomes were nonsignificant both before and after correction (e.g., Pain intensity, Pain catastrophizing, Psychological Inflexibility, Resilience, Distress; all adjusted *p/q* ≥ .174).

Two-group comparison by pain duration: <6 months vs ≥6 months (Mann–Whitney U)

Group medians were similar across duration bands for most outcomes (e.g., Pain intensity: 4.63 vs 4.75 Pain catastrophizing: 17.50 vs 16.50). Raw *p*-values were nonsignificant for all tests (e.g., PDI: U=855.5, Z=−1.018, *p*=.309; Distress: U=732.0, Z=−1.890, *p*=.059). After adjustment (m=6), Holm-adjusted *p* values were ≥ .354 and FDR *q* values were ≥ .354; thus, no between-group differences reached statistical significance. Effect sizes were uniformly small (e.g., $r \le .173$).

Four-group comparison by pain duration: <3 m, 3–<6 m, 6–<12 m, ≥12 m (Kruskal–Wallis)

Omnibus tests indicated raw significance for PI (Composite) (H(3)=9.633, *p*=.022) and PDI (H(3)=7.951, *p*=.047), with medians suggesting higher current intensity and disability at the shortest duration (<3 m: PI (Composite)=5.25; PDI=34.0). However, after correcting across the six outcomes, neither remained significant (Holm: .132 and .235; FDR: .132 and .141). The remaining outcomes (Pain catastrophizing, Psychological Inflexibility, Resilience, Distress) were nonsignificant (raw $p \ge .201$; adjusted $p/q \ge .385$). Epsilon-squared effect sizes were small (e.g., $\varepsilon^2 \approx .057$ for PI (Composite); $\varepsilon^2 \approx .043$ for PDI).

Moderation of the Pain Intensity–Disability Association by Pain Duration (SPSS PROCESS MODEL 1, Supplementary Figure 1)

The moderation analysis indicated that pain intensity was significantly associated pain disability, whereas pain duration and the interaction term did not reach significance. The overall model accounted for 18.8% of the variance in PDI, R^2=.19, F(3,116)=6.07, p < .001.

Moderated Mediation with Resillience: Pain Duration as Moderator (SPSS PROCESS MODEL 58, Supplementary Figure 2)

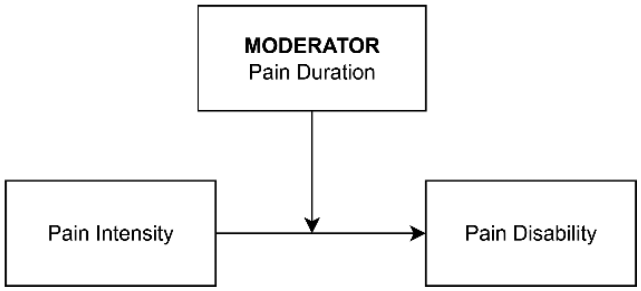
The moderated mediation model (Model 58) indicated that higher pain intensity was associated with lower resilience (b=–0.58, p=.028). In turn, resilience was negatively associated with disability (b=–0.91, p=.003). The interaction of pain intensity with pain duration on resilience, and the interaction of resilience with pain duration on disability, were not significant. The indirect effect of pain intensity on disability via resilience was significant at the mean level of pain duration (indirect effect=0.53, 95% CI [0.04, 1.07]), but not at lower or higher levels of pain duration.

Moderated Mediation with Experiential Avoidance: Pain Duration as Moderator (SPSS PROCESS MODEL 58, Supplementary Figure 2)

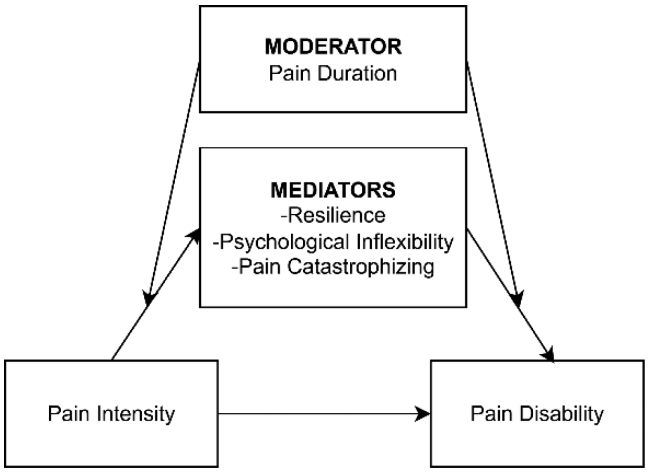
The moderated mediation analysis (Model 58) indicated that mild pain was significantly associated with psychological inflexibility (b=1.11, p=.043), which was in turn associated with higher pain disability (b=0.66, p < .001). The interaction terms were not significant, indicating that pain duration did not moderate either pathway.

Moderated Mediation with Pain Catastrophizing: Pain Duration as Moderator (SPSS PROCESS MODEL 58, see Supplementary Figure 2)

The moderated mediation analysis (Model 58) indicated that worst pain was significantly associated with pain catastrophizing (b=1.96, p < .001), which was in turn associated with higher pain disability (b=0.69, p < .001). The interaction terms (X×W and M×W) were not significant, indicating that pain duration did not moderate either pathway.



Supplementary Figure 1. Conceptual moderation model (PROCESS MODEL1). Pain duration (moderator) was tested as a moderator of the association between pain intensity (X) and pain disability (Y).



Supplementary Figure 2. Conceptual moderated mediation model (PROCESS Model 58). Pain intensity (X) is linked to pain disability (Y) indirectly via three mediators while pain duration (W) was examined as a moderator of the a (X→M) and b (M→Y) paths. All variables are continuous and were mean-centered for interaction testing.

Supplementary Table 1. Pain-related psychological outcomes across pain duration subgroups (<3 vs ≥3 months)

Outcome	<3 m (n= 9) (Median)	≥3 m (n=111) (Median)	U	Z	p* (raw)	Effect size (r)	p_adj (Holm)	q (FDR/BH)
Pain intensity	5.25	4.75	426.0	−0.733	.463	0.067	.880	.463
Pain catastrophizing	21.00	16.00	414.5	−0.847	.397	0.077	.880	.463
Pain Disability	34.00	22.00	245.0	−2.537	.011	0.166	.066	.066
Experiential avoidance	23.00	20.00	393.0	−1.062	.288	0.097	.880	.432
Resilience	17.00	20.00	310.5	−1.893	.058	0.173	.290	.174
Distress	12.00	8.00	376.5	−1.228	.220	0.112	.880	.432

*Mann-Whitney U.

Supplementary Table 2. Pain-related psychological outcomes across pain duration subgroups (<3m vs 3-6m vs 6-12m vs ≥12)

Outcome	<3 m (n=9) (Median)	3–6 m (n=11) Median	6–12 m (n=27) Median	≥12 m (n=73) Median	H (df=3)	p* (raw)	Effect size (ε^2)	p_adj (Holm)	q (FDR/BH)
Pain intensity	5.25	4.00	4.00	5.00	9.633	.022	0.057	.132	.132
Pain catastrophizing	21.00	12.00	11.00	17.00	3.495	.321	0.004	.235	.141
Pain Disability	34.00	16.00	20.00	23.00	7.951	.047	0.043	.804	.385
Psychological Inflexibility	23.00	13.00	16.00	21.00	2.363	.501	0.000	.804	.385
Resilience	17.00	24.00	19.00	20.00	4.634	.201	0.014	.804	.385
Distress	12.00	13.00	7.00	8.00	4.022	.259	0.009	.804	.501

*Kruskal-Wallis.

Supplementary Table 3. Pain Disability as a Function of Pain Intensity, Pain Duration, and Their Interaction

Term	b	SE (HC3)	*t*	*p*	95% CI [LL – UL]
Constant	25.55	1.19	21.43	<.001	[23.19, 27.92]
PI	2.22	0.70	3.19	.002	[0.84, 3.60]
PD	0.17	0.17	1.02	.312	[−0.16, 0.50]
PI × PD	−0.11	0.07	−1.53	.129	[−0.25,0.03]

PI: Pain Intensitiy (Composite Score), PD: Pain Duration.
Dependent Variable: Pain Disability.
Model summary: $R = .43$, $R^2 = .19$, $F(3,116) = 6.07$, $p < .001$, $MSE = 123.48$.
·R^2 for interaction term: .096, $F(1,116) = 2.33$, $p = .129$.

Supplementary Table 4. Step1: Resilience as a Function of Pain Intensity, Pain Duration, and Their Interaction

Term	b	SE	t	p	95% CI [LL – UL]
Constant	−0.06	0.47	−0.12	.902	[−0.98, 0.87]
PI	−0.58	0.26	−2.23	.028	[−1.10, −0.07]
PD	−0.00	0.04	−0.14	.891	[−0.07,0.06]
PI × PD	0.01	0.01	1.05	.296	[−0.01, 0.04]

PI: Pain Intensitiy (Composite Score), PD: Pain Duration
Dependent Variable: Resillience
Model summary: R = .043, F(3,116) = 1.95, p = .125 ·R2 for interaction: .008, p = .296

Supplementary Table 5. Step 2: Pain Disability as a Function of Pain Intensity, Pain Duration, Resillience and the Interaction of Resillience by Pain Duration

Predictor	b	SE	t	p	95% CI [LL – UL]
Constant	25.12	1.08	23.16	<.001	[22.97, 2.26]
PI	1.24	1.03	1.21	.230	[−0.80,3.29]
Resilience	−0.91	0.29	−3.09	.003	[−1.50,−0.33]
PD	0.11	0.22	0.51	.608	[−0.32, 0.54]
Resilience × PD	0.02	0.04	0.43	.669	[−0.07, 0.11]

PI: Pain Intensitiy (Composite Score), PD: Pain Duration
Dependent Variable: Pain Disability
Model summary: R^2 = .251, F(4,115) = 7.82, p < .001 ·R^2 for interaction: .006, p = .669

Supplementary Table 6. Step1: Experiential Avoidance as a Function of Pain Intensity, Pain Duration, and Their Interaction

Term	b	SE	t	p	95% CI [LL – UL]
Constant	0.1279	0.9285	0.1377	.8907	[−1.7111, 1.9668]
PI	1.1112	0.5425	2.0484	.0428	[0.0368, 2.1856]
PD	−0.0162	0.1030	−0.1577	.8750	[−0.2201, 0.1877]
PI × PD	−0.0589	0.0529	−1.1129	.2680	[−0.1637, 0.0459]

PI: Pain Intensitiy (Composite Score), PD: Pain Duration
Dependent Variable: Experiential Avoidance
Model summary: R2 = .0634 , F(3,116) = 1.6980, p = .1713 ·R2 for interaction = .0197, p = .2680

Supplementary Table 7. Step 2: Pain Disability as a Function of Pain Intensity, Pain Duration Psychological Inflexibility and the Interaction of Experiential Avoidance by Pain Duration

Term	b	SE	t	p	95% CI [LL – UL]
Constant	25.0890	0.9933	25.2577	.0000	[23.1215, 27.0566]
PI	0.3301	0.6608	0.4996	.6183	[−0.9788, 1.6391]
PINFX	0.6602	0.1314	5.0235	.0000	[0.3999, 0.9205]
PD	0.1322	0.1573	0.8403	.4025	[−0.1795, 0.4439]
PD X PINFX	−0.0033	0.0143	−0.2330	.8162	[−0.0316, 0.0249]

PI: Pain Intensity (Composite Score), PD: Pain Duration, PINFX: Psychological Inflexibility
Dependent Variable: Pain Disability
Model summary: R^2 = .3244, F(4,115) = 8.0207, p < 0.001 ·R^2 for interaction = .0017, p = .8162

Supplementary Table 8. Step1: Pain Catastrophizing as a Function of Pain Intensity, Pain Duration, and Their Interaction

Term	b	SE	t	p	95% CI [LL – UL]
Constant	0.1593	1.0664	0.1494	.8815	[−1.9527, 2.2714]
PI	1.9627	0.4767	4.1171	.0001	[1.0185, 2.9069]
PD	0.1622	0.1241	1.3073	.1937	[−0.0835, 0.4079]
PI X PD	−0.0678	0.0432	−1.5685	.1195	[−0.1534, 0.0178]

PI: Pain Intensity (Composite Score), PD: Pain Duration
Dependent Variable: Pain Catastrophizing
Model summary: R^2 = .1762, F3,116) = 8.1372, p = .0001 ·R^2 for interaction: = .0468, p = .1195

Supplementary Table 9. Step 2: Pain Disability as a Function of Pain Intensity, Pain Duration, Pain Catastrophizing and the Interaction of Pain Catastrophizing by Pain Duration

Term	b	SE	t	p	95% CI [LL – UL]
Constant	25.1570	0.7792	32.2852	.0000	[23.6135, 26.7004]
PI	0.3449	0.5830	0.5915	.5553	[−0.8099, 1.4997]
PC	0.6873	0.0909	7.5640	.0000	[0.5073, 0.8673]
PD	0.0443	0.1013	0.4375	.6626	[−0.1563, 0.2449]
PI X PC	−0.0026	0.0117	−0.2228	.8241	[−0.0259, 0.0207]

PI: Pain Intensity (Composite Score), PD: Pain Duration, PC: Pain Catastrophizing
Dependent Variable: Pain Disability
Model summary: R^2 = .5141, F(4,115) = 28.1872, p = .0000 ·R^2 for interaction = .0016, p = .8241.

Supplmentary Table 10. Correlation coefficients of study continuous variables and their 95% confidence interval

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1.Age	**1.000**												
2.Pain Duration	0.094 [-0.087, 0.269]	**1.000**											
3.PI (Current)	-0.055 [-0.232, 0.126]	0.257 [0.081, 0.417]	**1.000**										
4.PI (Average)	0.011 [-0.169, 0.190]	0.142 [-0.039, 0.313]	0.596 [0.466, 0.700]	**1.000**									
5.PI (Worse)	0.101 [-0.080, 0.275]	0.080 [-0.100, 0.256]	0.495 [0.346, 0.619]	0.613 [0.488, 0.714]	**1.000**								
6.PI (Mild)	-0.026 [-0.204, 0.154]	0.089 [-0.092, 0.264]	0.539 [0.398, 0.655]	0.661 [0.546, 0.751]	0.309 [0.137, 0.462]	**1.000**							
7.PI (Composite)	0.010 [-0.170, 0.189]	0.181 [0.002, 0.349]	0.825 [0.758, 0.875]	0.890 [0.846, 0.922]	0.758 [0.669, 0.825]	0.753 [0.664, 0.822]	**1.000**						
8.Pain Catastrophizing	0.190 [0.011, 0.357]	0.173 [-0.007, 0.341]	0.224 [0.047, 0.388]	0.297 [0.125, 0.452]	0.328 [0.158, 0.479]	0.250 [0.074, 0.410]	0.339 [0.171, 0.489]	**1.000**					
9.Pain Disability	0.230 [0.053, 0.393]	0.164 [-0.016, 0.333]	0.151 [-0.029, 0.322]	0.276 [0.102, 0.434]	0.299 [0.127, 0.454]	0.179 [-0.001, 0.347]	0.280 [0.107, 0.438]	0.711 [0.610, 0.790]	**1.000**				
10.Psychological Inflexibility	0.140 [-0.040, 0.312]	0.013 [-0.166, 0.192]	0.254 [0.078, 0.414]	0.209 [0.031, 0.375]	0.204 [0.026, 0.370]	0.209 [0.031, 0.374]	0.272 [0.097, 0.430]	0.696 [0.591, 0.778]	0.544 [0.404, 0.659]	**1.000**			
11.Resilience	-0.185 [-0.352, -0.006]	-0.026 [-0.204, 0.154]	-0.193 [-0.360, -0.015]	-0.139 [-0.310, 0.042]	-0.176 [-0.345, 0.003]	-0.078 [-0.254, 0.103]	-0.185 [-0.353, -0.006]	-0.510 [-0.632, -0.364]	-0.435 [-0.570, -0.277]	-0.718 [-0.795, -0.619]	**1.000**		
12.Anxiety	0.046 [-0.134, 0.224]	-0.113 [-0.286, 0.068]	0.125 [-0.055, 0.298]	0.218 [0.041, 0.383]	0.263 [0.088, 0.422]	0.067 [-0.114, 0.243]	0.213 [0.035, 0.378]	0.628 [0.506, 0.726]	0.428 [0.269, 0.564]	0.626 [0.503, 0.724]	-0.529 [-0.647, -0.387]	**1.000**	
13.Depression	0.244 [0.068, 0.406]	0.028 [-0.152, 0.206]	0.027 [-0.153, 0.205]	0.135 [-0.045, 0.307]	0.165 [-0.015, 0.334]	-0.103 [-0.277, 0.078]	0.078 [-0.103, 0.253]	0.544 [0.404, 0.659]	0.452 [0.297, 0.584]	0.510 [0.364, 0.631]	-0.495 [-0.620, -0.347]	0.826 [0.760, 0.876]	**1.000**
14.Distress	0.148 [-0.032, 0.319]	-0.047 [-0.225, 0.133]	0.081 [-0.099, 0.257]	0.186 [0.007, 0.354]	0.225 [0.048, 0.389]	-0.016 [-0.194, 0.164]	0.154 [-0.026, 0.325]	0.615 [0.489, 0.715]	0.460 [0.306, 0.590]	0.596 [0.467, 0.701]	-0.537 [-0.653, -0.396]	0.959 [0.941, 0.971]	0.952 [0.932, 0.967]

PI: Pain Intensity

Supplementary Table 11. Unstandardized Regression Coefficients, 95% Confidence Intervals, and Collinearity Diagnostics for the Hieararchical Models

Step	Independent Variable	B	SE	t	p	95% CI Lower	95% CI Upper	Tolerance	VIF	Durbin–Watson
1	(Constant)	35.268	6.108	5.774	< 0.001	23.168	47.368	—	—	1.908
	Age	0.060	0.103	0.581	0.563	−0.144	0.264	0.626	1.596	
	Gender	0.252	2.190	0.115	0.908	−4.086	4.590	0.879	1.137	
	Marital Status	−3.111	3.139	−0.991	0.324	−9.329	3.106	0.701	1.426	
	Work Status	−5.180	2.302	−2.250	0.026	−9.741	−0.620	0.725	1.379	
	Education	−1.379	0.317	−4.346	< 0.001	−2.008	−0.751	0.824	1.214	
2	(Constant)	22.724	7.007	3.243	0.002	8.842	36.607	—	—	1.995
	Age	0.101	0.099	1.018	0.311	−0.096	0.298	0.617	1.621	
	Gender	1.849	2.175	0.850	0.397	−2.462	6.159	0.818	1.223	
	Marital Status	−4.419	3.030	−1.458	0.148	−10.423	1.585	0.690	1.449	
	Work Status	−4.830	2.209	−2.187	0.031	−9.207	−0.454	0.723	1.384	
	Education	−1.247	0.314	−3.976	< 0.001	−1.868	−0.626	0.774	1.292	
	Pain Intensity	1.941	0.561	3.459	0.001	0.829	3.053	0.897	1.115	
	Pain Duration	0.012	0.075	0.156	0.877	−0.137	0.160	0.877	1.141	
3	(Constant)	10.445	6.128	1.704	0.091	−1.699	22.588	—	—	1.933
	Age	0.072	0.083	0.862	0.391	−0.093	0.237	0.615	1.625	
	Gender	1.484	1.823	0.814	0.418	−2.129	5.096	0.817	1.224	
	Marital Status	−3.953	2.539	−1.557	0.122	−8.985	1.079	0.690	1.450	
	Working Status	−3.686	1.858	−1.984	0.050	−7.367	−0.005	0.717	1.395	
	Education	−0.693	0.274	−2.527	0.013	−1.237	−0.150	0.709	1.410	
	Pain Intensity	1.506	0.474	3.176	0.002	0.566	2.446	0.882	1.134	
	Pain Duration	0.087	0.064	1.360	0.176	−0.040	0.213	0.852	1.174	
	Distress	0.752	0.108	6.971	< 0.001	0.538	0.966	0.842	1.188	
4a	(Constant)	21.301	7.593	2.805	0.006	6.253	36.349	—	—	1.894
	Age	0.049	0.082	0.597	0.552	−0.114	0.212	0.607	1.648	
	Gender	1.803	1.793	1.006	0.317	−1.750	5.356	0.812	1.231	
	Marital Status	−3.590	2.495	−1.439	0.153	−8.533	1.354	0.687	1.455	
	Working Status	−3.926	1.824	−2.152	0.034	−7.541	−0.311	0.715	1.399	
	Education	−0.611	0.271	−2.250	0.026	−1.148	−0.073	0.697	1.435	
	Pain Intensity	1.392	0.468	2.977	0.004	0.465	2.319	0.872	1.147	
	Pain Duration	0.090	0.062	1.445	0.151	−0.033	0.214	0.851	1.175	
	Distress	0.621	0.120	5.187	< 0.001	0.384	0.858	0.657	1.522	
	Resilience	−0.439	0.188	−2.338	0.021	−0.811	−0.067	0.670	1.491	
4b	(Constant)	2.331	5.663	0.412	0.681	−8.891	13.553	—	—	1.979
	Age	0.078	0.074	1.046	0.298	−0.070	0.225	0.615	1.625	
	Gender	1.282	1.626	0.788	0.432	−1.940	4.504	0.817	1.225	
	Marital Status	−4.043	2.264	−1.786	0.077	−8.530	0.443	0.690	1.450	
	Working Status	−2.465	1.671	−1.475	0.143	−5.776	0.847	0.704	1.420	
	Education	−0.493	0.247	−1.995	0.049	−0.984	−0.003	0.694	1.442	
	Pain Intensity	1.033	0.432	2.394	0.018	0.178	1.889	0.846	1.182	
	Pain Duration	0.102	0.057	1.800	0.075	−0.010	0.215	0.850	1.177	
	Distress	0.436	0.112	3.877	< 0.001	0.213	0.659	0.617	1.621	
	Psychological Inflexibility	0.515	0.095	5.447	< 0.001	0.328	0.702	0.577	1.733	