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Investigating Latent Structure, Reliability, and Gender Differences for the Arabic Format of the Pain Catastrophizing Scale

Ahmed K. Alshaya[1]

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Abstract: Pain catastrophizing (PC) has been shown theoretically, clinically, and empirically to be a fundamental psychological construct to understanding and clinically managing the experience of pain. This significance has necessitated the development of psychometric measures of PC. Hence, the Pain Catastrophizing Scale (PCS) has been developed and subsequently translated/adapted to various languages and societies. An Arabic version of the PCS (PCS-A) has been adapted and tested in a Saudi sample. However, data regarding the underlying structure of the PCS-A has yet to be available. This study was set up to uncover the latent structure of the PCS-A, look at the reliability of the extracted structure, and test gender differences in it in a sample of 272 Saudi university students; 53.3% were women, with a mean age of 20.78 (± 1.67). A series of confirmatory factor analyses suggested a hierarchical latent structure for the PCS-A, comprising a second-order factor (α = 0.85) and three first-order factors corresponding to the original structure, as follows: rumination (4 items; α = 0.69), helplessness (6 items; α = 0.78), and magnification (3 items; α = 0.64). No gender differences were found on the PCS-A scores. Findings were discussed in light of previous literature on PCS and the cultural characteristics of Saudi society.

Keywords: Pain, Psychology of Pain, Pain Catastrophizing, Psychometric Tests, Latent Structure.

التحقق من البنية الكامنة والثبات والفروق بين الجنسين للنسخة العربية من مقياس كارثية الألم

د. أحمد كساب الشايع[1]

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المستخلص: أظهرت الأطروحات النظرية والشواهد التجريبية والعيادية جوهرية مفهوم كارثية الألم في فهم خبرة الألم الجسدي الذاتية، والتعامل معها عيادياً. وهذا جعل من الضروري بناء مقاييس سيكومترية جيدة لهذا المفهوم. وبناءً عليه، وُضع مقياس كارثية الألم، والذي نُقل وكُيّف لاحقاً إلى العديد من اللغات والمجتمعات. وقد أُعدت نسخة عربية من هذا المقياس، واُختبرت لدى عينة سعودية، إلا أنه لا تتوفر بيانات حول البنية الكامنة لهذه النسخة العربية. أُجريت هذه الدراسة للكشف عن البنية الكامنة للنسخة العربية من مقياس كارثية الألم، والتحقق من ثبات مكونات هذه البنية، وتفحّص الفروق بين الجنسين على هذه المكونات. جرى تناول هذه الأهداف باستخدام بيانات عينة عرضية من طلبة جامعيين حجمها 272، 53.3 ٪ منها إناث، بمتوسط عمري قدره 20.78 (± 1.67). كشفت التحليلات العاملية التوكيدية عن بنية كامنة ذات طبيعة هرمية، تتمثل في عامل واحد من الدرجة الثانية (الفا = 0.85)، وثلاثة عوامل من الدرجة الأولى، مماثلة لعوامل البنية الأصلية للمقياس، وهي الاجترار (4 بنود، الفا = 0.69)، والعجز (6 بنود، الفا = 0.78)، والتضخيم (3 بنود، الفا = 0.64)؛ كما لم يظهر وجود فروق جوهرية بين الجنسين على مختلف درجات المقياس. نُوقشت النتائج على ضوء الأدبيات السابقة حول المقياس والخصائص الثقافية للمجتمع السعودي.

الكلمات المفتاحية: الألم، علم نفس الألم، كارثية الألم، الاختبارات السيكومترية، البنية العاملية الكامنة.

(1) قسم علم النفس - جامعة الملك سعود

(1) Department of Psychology - King Saud University

Introduction

Pain Catastrophizing (PC), defined generally as "an exaggerated negative mental set brought to bear during actual or anticipated pain experience" (Sullivan et al., 2001 ,p. 53 ; Sullivan & Tripp, 2024), is a key multidimensional psychological construct relating to the subjective experience of pain. Studies have shown that PC encompasses several cognitive and emotional processes. For example, magnifying the degree of threat and perceived seriousness of pain, helplessness and pessimism regarding the person's own capability to handle the pain, depression, distress, sustained attention toward painful somatic sensations, and greater possibility of recalling past experiences of pain (Le et al., 2024; Neblett, 2017; Petrini & Arendt-Nielsen, 2020; Sullivan & Tripp, 2024).

Existing experimental and observational evidence highlighted the role PC can play in addressing pain experienced in various diseases. Including rheumatic musculoskeletal disorders/pain (Alcon et al., 2023; Wilk et al., 2024), neck pain (Park et al., 2016), migraine (Alvarez-Astorga et al., 2021), orthodontic conditions (Costa et al., 2020), knee Arthroplasty (Sullivan et al., 2009), chronic musculoskeletal conditions (Alcon et al., 2023), fibromyalgia (Gracely et al., 2004), and cancer (Anagnostopoulos et al., 2023; Wilson et al., 2022). Furthermore, high levels of PC have been linked with pain-related disability (Sullivan et al., 2002; Ugurlu et al., 2017), poor response to pharmacological treatment of neuropathic pain (Mankovsky et al., 2012), experiencing pain with greater intensity (Sullivan et al., 1995; Sullivan et al., 2006), frequent use of pain medications (Roman-Juan et al., 2023; Valdes et al., 2015), pain chronicity/persistence (Burns et al., 2015), and worse quality of life (Montag et al., 2023).

Given the relevance of PC in both research and clinical spheres, Sullivan and his colleagues have constructed the Pain Catastrophizing Scale (PCS; Sullivan et al., 1995) to provide a comprehensive assessment tool that taps into various PC ingredients for clinical and non-clinical populations. In Sullivan et al.'s study, an initial 13-item set derived from previous work on pain catastrophizing was subjected to principal components analysis (PCA), which yielded three correlated factors. Namely, rumination (4 items; Cronbach's alpha [α] = 0.87), assessing worry, ruminative thinking, and failure to stop thoughts related to pain; magnification (3 items; α = 0.60), describing exaggeration of distress associated with pain and negative expectations; and helplessness (6 items; α = 0.79), reflecting perceived helplessness and incapability to deal efficiently with pain. In addition, using the cold pressor procedure, an experimental task known

to elicit non-harming pain, the researchers demonstrated that individuals scoring high on the PCS exhibit greater negative thinking about pain, distress, and pain intensity. Additional analyses also showed that PCS is correlated with several pain-related constructs, such as emotional distress, negative ideas related to pain, depression, anxiety, fear of pain, and negative affect (Sullivan et al., 1995). Later research has extended Sullivan and colleagues' (1995) work by further examining the PCS psychometrics.

Concerning the latent structure of the measure, which is probably the most fundamental requirement for a psychometric test; the findings are not fully consistent. Sullivan et al.'s (1995) three-factor model has been replicated in various reports using either Exploratory Factor Analysis (EFA) or Confirmatory Factor Analysis (CFA), or both (Bansal et al., 2016; Chibnall & Tait, 2005; Cook et al., 2021; Fernandes et al., 2012; Ibrahim et al., 2021; Kemani et al., 2019; Meyer et al., 2008; Osman et al., 1997; Sehn et al., 2012). Other studies suggested Sullivan et al.'s three original factors can better be conceptualized within a second-order hierarchical model, in which the three factors served as first-order factors, and an underlying second-order factor representing overall PC that accounts for correlations among the first-order factors (D'Eon et al., 2004; Osman et al., 2000; Ugurlu et al., 2017; Yap et al., 2008).

Furthermore, other studies reported two-factor models instead. Osman et al. (1997) proposed a two-factor solution in which original helplessness and magnification subscales items loaded onto one factor and rumination items on the other, which was cross-validated using a different dataset in the same paper by CFA. This structure was later replicated in Chibnall and Tait (2005) and Akbari et al. (2021). Huijer et al. (2017) reported a different two-factor model, where helplessness items formed their own factor, the first factor, and both rumination and magnification indicators clustered together on the second factor.

These contradicting factorial results may raise questions about the stability of the underlying foundation of the PCS. However, it should be maintained that such discrepancy is generally not uncommon in factor analytic outcomes, which can result from various sources. In the case of the PCS, factorial discrepancy is likely attributable to differences in three aspects across the studies: the thresholds of goodness of fit indices employed, sample characteristics, and the analytic method (EFA or CFA). Nevertheless, carefully examining these findings would reveal meaningful and helpful patterns. The original three-factor solution is the most frequently extracted structure, either as a correlated three-factor model or as a second-order hierarchical model. The two-factor solution proposed by

Osman and colleagues (1997) and extracted in two succeeding analyses is also worth considering.

Regarding the reliability of the PCS, internal consistency in particular, estimates across the various latent structures ranged broadly from appropriate to excellent, with Cronbach's alpha values exceeding 0.80 in most studies, especially for the total score (Akbari et al., 2021; Huijer et al., 2017; Ikemoto et al., 2020; Kemani et al., 2019; Osman et al., 2000; Yap et al., 2008).

Performance on the PCS has been found influenced by gender. In keeping with the well-established link between pain and gender (Le et al., 2024; Pieretti et al., 2016; Unruh, 1996), women have consistently been noted to score significantly higher than men do on the PCS (D'Eon et al., 2004; Huijer et al., 2017; Ibrahim et al., 2021; Osman et al., 2000; Osman et al., 1997). This finding aligns with that of the PCS development study (Sullivan et al., 1995). However, a few exceptions with no gender differences have also been published (Sehn et al., 2012; Yap et al., 2008). No conclusive explanation can be given for the tendency of women to catastrophize more than men (see Sullivan et al. (2001) for a brief discussion), as it could have stemmed from diverse potential reasons, including engaging in catastrophic thinking in general, using more emotion-focused coping strategies, and being more expressive of their pain-related cognitions and emotions than men (Le et al., 2024; Sullivan et al., 1995).

The psychometric characteristics of the PCS, coupled with the significance of the attributes being measured, have led to its translation into several languages and subsequent validations in these populations. For instance, Nigeria (Hausa language; Ibrahim et al., 2021), China (Yap et al., 2008), Brazil (Sehn et al., 2012), South Africa (Morris et al., 2012), Kenya (Swahili language; Kibet et al., 2024), Norway (Fernandes et al., 2012), India (Bansal et al., 2016), Canada (Canadian French; French et al., 2005), Turkish (Ugurlu et al., 2017), Sweden (Kemani et al., 2019), and Germany (Meyer et al., 2008). Arabic-speaking adaptations of the PCS have also been developed in Lebanon (Huijer et al., 2017) and Saudi Arabia (Terkawi et al., 2017). These studies have generated good support for the psychometric appropriateness of PCS. More importantly, they have emphasized the need to re-examine the measure's factorial structure and psychometrics when adapted to new cultures.

Regarding the Saudi adaptation, which is the subject of this article, Terkawi et al. (2017) produced an Arabic translation of the PCS (PCS-A) and tested it in 113 chronic pain patients from two Riyadh-based hospitals. They reported alpha levels of 0.94, 0.81, 0.82, and 0.89 for the total score, rumination, magnification, and

helplessness subscales, respectively. Test-retest reliability with a time interval of "at least 72" hours has also been estimated for the total score (0.84), rumination (0.83), magnification (0.81), and helplessness (0.80) subscales. The PCS-A score was weakly associated with self-reported pain severity on the numerical rating scale, did not correlate with that of the brief pain inventory, and differed significantly between patients diagnosed with neuropathic pain and those who were not. Unexpectedly, no gender differences were reported on the PCS-A.

Despite the significance of Terkawi et al.'s (2017) work, further psychometric investigations of the PCS-A are warranted. It is well-known that determining the underlying structure is crucial when adapting psychometric measures to a new language/culture to test for conceptual equivalency and clarify the meaning of test scores (AERA, APA, & NCME, 2014; International Test Commission, 2017). This analysis is particularly required when the measure of interest is considered multidimensional, like the PCS. In another requirement, the structure revealed should then be evaluated in terms of reliability of its components (i.e., factors) (Tabachnick & Fidell, 2007). Moreover, considering that Terkawi et al.'s negative outcome regarding gender differences on the scale contradicts the vast majority of empirical results stated above, and the theoretical assumptions that Saudi society tends to be masculine (as opposed to feminine), according to the cultural dimensions put forward by Hofstede and colleagues (Hofstede et al., 2010) and endorsed by Saudi-based psychological research (e.g., Al-Shanbari & Alruwaita, 2007; Alruwaita, 2009; Alruwaita, 2007); this observation merits re-testing to ensure its replicability.

Specifically, this study has three objectives. First, uncovering the latent structure of PCS-A, if any, hypothesizing that an empirically-supported latent structure does exist for the PCS-A, testing the goodness of fit of three models derived from previous literature, (a) the correlated three-factor model extracted by the development study of the measure (Sullivan et al. 1995), (b) the second-order hierarchical model of Osman et al. (2000), and (c) the two-factor model proposed by Osman et al. (1997). Second, estimating the internal consistency reliability of components of the extracted structure, hypothesizing that reliability estimates would be equal to or greater than 0.70. Third, re-examining the gender differences, hypothesizing that women would exhibit significantly higher levels of PC than men would.

Method

Design: This is a psychometric observational study employing correlational and cross-sectional designs.

Sample: A convenience sample of 272 Saudi students from the Colleges of Education and Arts of King Saud University in Riyadh, Saudi Arabia.

One-hundred forty-five (53.3 %) were female. Age ranged from 18 to 27, with a mean of 20.78 and a standard deviation of 1.67. Most participants come from psychology (49.6%) and media (45.6%) subjects, whereas the rest come from social work (1.5%), history (1.1%), English (0.7%), Arabic (0.7%), Islamic studies (0.4%), and pre-school education (0.4%) subjects. The sample size was deemed appropriate for the analyses planned (see the data analyses section for details on sample size calculation and related power analyses).

Tool:

The Pain Catastrophizing Scale-Arabic Version (PCS-A; Sullivan et al., 1995; Terkawi et al., 2017)

A 13-item Arabic-speaking self-report measure of pain catastrophizing through three subscales assessing rumination (4 items) (e.g., *I can't stop thinking about how much it hurts*), magnification (3 items) (e.g., *I worry that something serious may happen*), and helplessness (6 items) (e.g., *It's awful and I feel that it overwhelms me*). Respondents are instructed to rate the degree to which they experienced a set of thoughts and feelings when in pain on a 5-point Likert scale: not at all (0), to a slight degree (1), to a moderate degree (2), to a great degree (3), all the time (4). Scores are obtained by summing items within each subscale and total score, in which a higher score indicates a greater level of the attribute measured. Further details, including psychometric properties, are presented previously in the introduction section. A list of PCS-A items is presented in Terkawi et al. (2017).

Data analyses: In line with relevant literature (e.g., Field, 2005; Kline, 2011; Tabachnick & Fidell, 2007), data was screened before carrying out the main analyses relating to the study's three objectives. The screening included exploring the normality of distributions, in which a score is regarded as distributing normally when its corresponding skewness is found to range between -2 and +2, and kurtosis from -7 to +7, visual inspection of the distributions is also utilized in assessing normality; detecting and omitting random/inattentive responses (i.e., responding to at least 30% of items using the exact option in a row); identifying and tackling outliers, defined as cases with z score equal to or greater than 3.29 ($p < 0.001$), or highlighted as outliers by the Box-Plot diagrams in SPSS; missing values; out-of-range scores;

The G*Power 3.1.9.6 software (Faul et al., 2009; Faul et al., 2007) was employed to determine the sample size required for gender differences testing (i.e., between-groups design), thus ensuring sufficient statistical power to detect effects if they do exist. Explicitly, an a priori power analysis was carried out, involving effect sizes gathered from previous comparable studies, a desired power of .80, and an alpha of .05. The

sample size needed for CFAs was determined based on the frequently used rule-of-thumb of the subjects-to-variables ratio of 10:1 (Field, 2005). Suitability of the data for factor analyses was also examined using Kaiser-Meyer-Olkin (KMO) and Bartlett's tests, in which the former should exceed 0.80 and the latter should be statistically significant to suggest data adequacy (Field, 2005; Tabachnick & Fidell, 2007).

The first objective of uncovering the latent structure of the PCS-A was realized by testing the goodness-of-fit of three models: the three-correlated factors model of the original development study (Sullivan et al., 1995), a two-factor model (Osman et al., 1997), and a hierarchical three-factor model (Osman et al., 2000). The model's parameters were estimated using the Maximum likelihood method. Consistent with the widely used recommendations (Barrett, 2007; Bentler & Bonett, 1980; Hu & Bentler, 1999; Mueller, 1996), the following indices were utilized to assess the model's goodness-of-fit: (a) chi-square ratio, χ^2/df, (i.e., chi-square divided by its degrees of freedom) lower than or equal to 3; (b) the Root Mean Square Error of Approximation (RMSEA) lower than or equal to 0.07; (c) the Comparative Fit Index (CFI) higher than or equal to 0.90; and (d) Tucker-Lewis index (TLI) higher than or equal to 0.90. Also, if initial testing suggested an inadequate fit, modification indices (MIs) were inspected to reformulate and retest models by allowing pairs of error terms (i.e., residuals) with the highest MIs figures to covary. Factor loadings (standardized estimates) should be higher than or equal to 0.32 to be deemed significant.

Once a CFA-based latent structure model was established to meet the above criteria, descriptive statistics of its facets were calculated, including means, medians, standard deviations, ranges, skewness, and kurtosis. Relatedly, items' discrimination and internal validity were tested by calculating corrected item-total correlations (CITCs), with a threshold of 0.30 indicating a sufficient level (Anastasi & Urbina, 1997; Groth-Marnat & Wright, 2016).

Regarding the second objective, Cronbach's α was computed to assess the internal consistency reliability of components of the structure revealed in the previous analysis. As a rule of thumb, alpha value should be greater than 0.70 to be considered acceptable, with some authorities suggesting that a cut-off score of 0.60 can also be used for research purposes (Anastasi & Urbina, 1997; Field, 2005; Gregory, 1996). Finally, for the third objective, gender differences were tested using t-tests in scores found to be normally distributed or Mann-Whitney's U test if otherwise revealed. All analyses were carried out using SPSS/23 and Amos 23.0.0.

Study procedure and data collection: The study was advertised to potential participants

during lectures. Interested individuals were then provided with a participant information sheet detailing the study's scope, aims, and procedures, what they would be asked to do if taken part, data management and analysis aspects, and their right to withdraw at any time without having to explain. Participants signed informed consent forms prior to completing the questionnaire. A paper-and-pencil format of the measure was administered to willing participants in groups ranging in size from 11 to 32.

Results

Preliminary analyses: All items were found to be distributed normally. No outliers or out-of-range scores were found. Amongst the entire sample, 18 participants had missing values, 17 had only one missing value, and the other had two. Missed values were replaced using the series mean procedure. The proportions of men and women were found equally distributed within the sample, χ^2 (1, n = 272) = 1.191, p = 0.275. Table 1 displays the means, standard deviations, medians, and indices of distribution normality for all items. KMO value was 0.88 and Bartlett's test's chi-square was statistically significant (χ^2 (78) = 1091.56, p < .001), supporting the suitability of the data for factor analysis.

Table 1

Descriptive Statistics of the Arabic Version of Pain Catastrophizing Scale (PCS-A)

Item no.	Items wording	M	SD	Med.	Skew.	Kurt.
1)	I worry all the time about whether the pain will end (H).	1.63	1.06	1	.30	-.69
2)	I feel I can't go on (H).	1.24	1.03	1	.60	-.22
3)	It's terrible and I think it's never going to get any better (H).	.71	.92	0	1.40	1.85
4)	It's awful and I feel that it overwhelms me (H).	1.22	1.06	1	.71	-.14
5)	I feel I can't stand it anymore (H).	1.05	1.06	1	.82	-.09
6)	I become a afraid that the pain will get worse (M).	1.65	1.22	2	.24	-.90
7)	I keep thinking of other painful events (M).	1	1.13	1	.98	.12
8)	I anxiously want the pain to go away (R).	2.69	1.30	3	-.67	-.75
9)	I can't seem to keep it out of my mind (R).	1.23	1.09	1	.79	.05
10)	I keep thinking about how much it hurts (R).	1.16	1.09	1	.91	.26
11)	I keep thinking about how badly I want the pain to stop (R).	1.57	1.18	1	.40	-.70
12)	There's nothing I can do to reduce the intensity of the pain (H).	1	1.06	1	.87	.07

13)	I wonder whether something serious may happen (M).	1.28	1.25	1	.70	-.56

Note. M = Mean; SD = Standard Deviation; Med. = Median; Skew. = Skewness; Kurt. = Kurtosis; H = Helplessness subscale; M = Magnification subscale; R = Rumination subscale

Latent structure analyses: As stated before, three models were tested using CFAs, for which Table 2 shows the fit indices. Initial testing of Model 1 (three correlated factors) revealed that it did not fit the data well as the TLI was slightly lower than 0.90. However, this model fitted adequately once specific residuals were permitted to correlate as suggested by the MIs (Model 2). Similarly, the two-factor model (Model 3) was not of an adequate fit at first, with levels of TLI, CFI, and RMSEA not meeting the prespecified thresholds for a good fit. However, after correlating residuals highlighted by MIs, this structure demonstrated a suitable fit to the data (Model 4). The hierarchical model, Model 5, was of a marginal model fit due to the TLI being lower than the required threshold of 0.90, akin to the results of testing Model 1 above. This model fitted well with once correlating residuals of four couples of items (Model 6).

Models 2, 4, and 6 all met the thresholds for acceptable goodness-of-fit; however, Models 2 and 6 had better-fit indices at face value than Model 4. Furthermore, although Models 2 and 6 had identical model fit indices, the latter (i.e., the hierarchical model) appeared preferable for two

Table 2

Confirmatory Factor Analyses of the PCS-A: Fit Indices for the Models Tested

Model	χ^2	*df*	χ^2/df	CFI	TLI	RMSEA (90% CI)
1) Sullivan et al.'s (1995) original three correlated factors model	150.49*	62	2.43	0.91	0.89	.07 (.06, .09)
2) Sullivan et al.'s (1995) original three correlated factors model with residuals correlated	114.89*	58	1.98	0.95	0.93	.06 (.04, .08)
3) Osman et al.'s (1997) two-factor model	191.44*	64	2.99	.88	.85	.09 (.07, .10)
4) Osman et al.'s (1997) two-factor model with residuals correlated	132.75*	59	2.25	.93	.91	.07 (.05, .08)
5) Osman et al.'s (2000) hierarchical model	150.49*	62	2.43	0.91	0.89	.07 (.06, .09)
6) Osman et al.'s (2000) hierarchical model with residuals correlated	114.89*	58	1.98	0.95	0.93	.06 (.04, .08)

Note. df = degree of freedom; X^2/df = chi-squared test statistic divided by its df; CFI = Comparative Fit Index; TLI = Tucker Lewis Index; RMSEA= The Root Mean Square Error of Approximation; CI = Confidence Interval.

[a] Residuals correlated are those of items 1/5, 2/12, 9/11, and 10/8.

[b] Residuals correlated are those of items 1/13, 2/12, 5/7, 7/13, and 10/8.

[c] Residuals correlated are those of items 1/5, 2/12, 9/11, and 10/8.

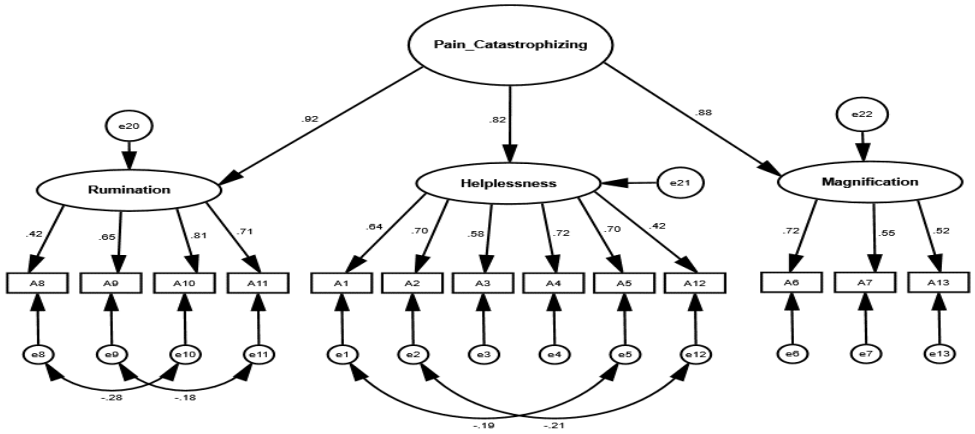
* / $p < 0.001$

reasons. First, the intercorrelations between the three factors in Model 2 (0.75 between helplessness and rumination, 0.72 between helplessness and magnification, and 0.80 between rumination and magnification) may denote the presence of a higher-order factor that would explain these correlations. Second, adopting a hierarchical structure would secure empirical justification for how the scale is used and scored by summing the responses to the 13 items for the total score and summing responses to specific items for each one of the three subscales and for using the total score as an over-reaching indicator of pain catastrophizing in research and clinical grounds. For these reasons, the hierarchical model is the structure of choice in this study, on which the remaining analyses are based.

As seen in Figure 1, the second-order factor is associated with the first-order factors: rumination (0.92), helplessness (0.82), and magnification (0.88). Items had standardized estimates (i.e., loadings) on their respective first-order factors (i.e., subscales) ranging from 0.42 to 0.81. Descriptive indicators of components of the hierarchical structure are displayed in Table 3.

Figure 1

Hierarchical Model for the PCS-A



Internal consistency reliability analysis:

Table 3 shows that Cronbach's α of the PCS-A total score was good, reaching a level well beyond 0.80, while ranging from acceptable to satisfactory for three subscales. Only one item, item 8, was indicated to be associated with an increase in alpha for the total score from 0.854 to 0.858 if deleted but was kept due to the promised increase being negligible. The same item, 8, was also found to increase alpha of the rumination subscale from 0.693 to 0.738 if deleted, and again, no action was taken for the same reason above. For the helplessness, alpha was anticipated to rise to 0.798 instead of its current level (0.778) when item 12, out of this subscale's six items, was removed. Finally, if omitted, no

item was highlighted to enhance the magnification subscale's alpha.

Gender differences analysis:

At an item level, no gender differences were found on 11 out of the 13 items. The two items on which the two genders demonstrated statistically significant differences were item 10 of the rumination subscale (*I keep thinking about how much it hurts*) and item 12 from the helplessness subscale (*There's nothing I can do to reduce the intensity of the pain*). For item 10, men have been observed to have a higher mean level (M = 1.30, SD = 1.15) than women (M = 1.03, SD = 1.15), t(255.53) = 2.04, p < .05, 95% CI 0.01, 0.53. Men also scored higher (M = 1.17, SD = 1.07) relative to women (M = 0.86, SD = 1.03) on item 12, t(270) = 2.44, p < .05, 95% CI 0.06, 0.56. A marginal difference (i.e., very close but still above the statistical significance limit of 0.05) was also found on item 8 (p = 0.06), on which men reported "greater" overall performance. Likewise, the two genders did not differ statistically significantly on the total score and three subscales, although men displayed means that are, at face value, "higher" than women on all of these scores.

Table 3

Descriptive Statistics for the PCS-A Scores

	PCS-A (13 Items)	Rumination (4 Items)	Helplessness (6 Items)	Magnification (3 Items)
Mean (SE)	17.42 (0.53)	6.65 (0.21)	6.84 (0.26)	3.93 (0.17)
Median	17	7	6	4
SD	8.75	3.39	4.26	2.75
Possible range	0-52	0-16	0-24	0-12
Min.- Max.	1 - 46	0 - 16	0 - 21	0 - 12
Skewness	.49	0.19	0.68	0.55
Kurtosis	-0.06	-0.40	0.19	-0.13
α	0.85	0.69	0.78	0.64

Note. SE = Standard Error of Mean; SD = Standard Deviation; α =Cronbach's Alpha; PCS-A = Total Score of the Arabic Version of the Pain Catastrophizing Scale.

Discussion

This study was carried out to offer an additional psychometric evaluation for a previously available Arabic version of the pain catastrophizing scale (PCS-A), an important measure of pain catastrophizing for both research and clinical purposes worldwide. Explicitly, exploring the latent structure, internal consistency reliability, and retesting gender differences in a Saudi sample. Findings suggested

a hierarchical latent model as the optimal solution to reflect the underlying structure of the PCS-A, consisting of a second-order factor and the original three factors as first-order factors. The three original subscales of the measure were replicated as three first-order factors within this framework, and an appropriately reliable second-order factor represented the total score (i.e., overall PC). Estimates of the internal consistency reliability were generally suitable, especially for the total score. In line with Terkawi et al. (2017), PCS-A scores did not vary significantly between men and women. Findings generally support the psychometric appropriateness of the measure, and a handful of points deserve discussion.

Besides the hierarchical model mentioned above, another model associated with identical fitting indices has also been extracted: the original three correlated factors model extracted by the PCS development study (Sullivan et al., 1995). Both structures have been consistent with and provided support for previous findings. The hierarchical model aligns with previous literature that uncovered the same hierarchy (D'Eon et al., 2004; Osman et al., 2000; Ugurlu et al., 2017; Yap et al., 2008). Likewise, the empirical support gained in this study for the original three-factor model is consistent with the vast majority of factorial analyses of PCS (Bansal et al., 2016; Chibnall & Tait, 2005; Cook et al., 2021; Fernandes et al., 2012; Ibrahim et al., 2021; Kemani et al., 2019; Meyer et al., 2008; Osman et al., 1997; Sehn et al., 2012; Sullivan et al., 1995). The decision to adopt the hierarchical model was justified on statistical and practical grounds. Statistically, representing components hierarchically would better reflect the magnitude of intercorrelations between them. Such a model would also be practical as it demonstrates the possibility of using the scores on PCS-A either as a total score or separate scores of the three subscales.

The factorial findings above add to the ongoing endeavors to theoretically conceptualize PC assessed using the PCS (e.g., Sullivan et al., 2001; Sullivan & Tripp, 2024). A few statements can be put forward in this regard. First, in light of evidence accumulating over prior studies and this study, it would be plausible to conclude that PC is a multidimensional phenomenon comprising three independent while interconnected elements: rumination, helplessness, and magnification. This conclusion is vital, as delineating scientific concepts is necessary for establishing valid and "useful" theorization around them.

Second, this composite nature of PC is unlikely to be culture-specific, i.e., pertaining to a particular culture or general cultural background, but rather manifesting relatively equally across a wide range of culturally varied societies. The three-factor structure, whether in the form of correlated factors or hierarchical organization, has been found in this study with a sample drawn from a primarily collectivist society, Saudi Arabia, as well as in samples from different parts of the

globe, including, for instance, North America (Canada; Sullivan et al., 1995), South America (Brazil; Sehn et al., 2012), East Asia (South Korea and China; Cho et al., 2013; Yap et al., 2008), Europe (Germany and Norway; Fernandes et al., 2012; Meyer et al., 2008), and Africa (Nigeria; Ibrahim et al., 2021). Nevertheless, whereas the three constituents of PC appear to "exist" across cultures, the magnitude of this existence, reflected by the scores on the various language versions of PCS, may vary (Hayashi et al., 2022). Nonetheless, none of these analyses included a direct comparison between two or more cultural groups to robustly conclude the cross-cultural equivalency of the PCS. Prospective studies are encouraged to test the latter issue directly by employing the measurement invariance approach.

Third, as to whether the underlying foundations of PCS apply to both symptomatic and asymptomatic populations alike, the jury is still out. That is, since a significant amount of existing evidence supporting this structure was gathered using clinical samples, patients with pain in particular, it would be premature to attempt to synthesize a valid conclusion in this respect. The present study, offering support for a three-factor structure in a non-clinical sample, can be an encouraging step toward further exploring structural variations in PCS between clinical and non-clinical populations. Two investigations might be needed to address this issue: testing the measurement invariance of the PCS across patients and non-patients and testing the dimensionality of PC measured by the PCS using taxometric analysis (e.g., Longley et al., 2010).

The previous result of absence of gender differences on the PCS-A reported by Terkawi et al. (2017) replicated well in this study. The performance of men and women on PCS-A items, subscales, and total scores did not differ statistically significantly. Whereas this replication strengthen the observation, it should be noted that it is in disagreement with most literature that frequently found women to score higher than men (e.g., D'Eon et al., 2004; Huijer et al., 2017; Osman et al., 2000; Sullivan et al., 2001), while aligning with the small number of studies that have found no gender differences, like Yap et al. (2008) in Hong Kong, China, Sehn et al. (2012) in Brazil, and Park et al. (2016) in South Korea.

The lack of gender differences shown in this study is unlikely to be due to sampling issues, since power analysis indicated sufficiency of sample size for this analysis, nor to imbalance in men/women representation in the sample, as a proportion of men/women was not found significant in an analysis reported earlier. Moreover, given that the other Saudi study reported a similar result, Terkawi et al. (2017), using a clinical sample of older age, this finding may also not be attributable to the current sample being non-clinical or younger, at face value, than samples of previous studies.

No solid explanation can be given currently to explain the above observation. However, future research is strongly encouraged to reinvestigate this result in larger samples, and if found to replicate robustly, two hypotheses may be considered for testing in Saudi samples. First, the absence of gender differences on PCS-A may be the product of over-reporting tendency in responding to items, particularly among men, which overshadows actual performance.

The second hypothesis is that both genders equally share Islamic-based cognitions and behaviors related to the subjective experience of pain, which may have contributed to balancing their performance on the scale through mediating or moderating effects. These may include but are not limited to, positive cognitive appraisals of pain as a way of "purifying the soul", practicing patience and not explicitly complaining about one's fate (i.e., pain), believing that the pain experience is for a reason that one may or may not realize but should accept. If they do exist, such cognitions and behaviors may constitute a cultural specificity related to how Saudis perceive and react to pain along the lines of previous studies on health-related appraisals (e.g., Alruwaita, 2002).

Finally, several potential limitations should be kept in mind when reviewing this work. Firstly, the sample of this study comprises undergraduate students with a possibly restricted age range. The experiences of pain they had actually been through may be limited in number and intensity, rendering their perceptions of coping with pain by catastrophizing possibly less representative of real situations. Second, although this study brought helpful insights into the PCS-A performance, crucial information still needs to be studied. Neither this study nor that of Terkawi et al. (2017) gathered evidence concerning the convergent and divergent validity of the PCS-A. As a result, the meaning of the score on the PCS-A may not be sufficiently clarified, which is a concern that research and clinical usage of the scale should pay attention to.

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