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Psychometric properties of the Persian version of the pain beliefs and perceptions inventory (PBPI) in individuals with chronic low back pain

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Abstract

Introduction: This study constitutes a methodological investigation aimed at scrutinizing the validity and reliability of the Persian version of the Pain Beliefs and Perceptions Inventory (PBPI) in individuals afflicted with chronic low back pain.

Methods: To gauge reliability, both the test-retest and internal consistency methods were deployed. Furthermore, the correlation coefficient was utilized to assess discriminant validity among 118 individuals suffering from chronic low back pain. The questionnaire's construct validity was ascertained by probing the correlation between the subscales of pain persistence in the future, pain stability in the present, self-blame, and the mysteriousness of pain, with the constructs of pain catastrophizing, disability, pain-related anxiety, coping strategies, quality of life, and pain intensity.

Results: Statistical analysis using the Shapiro-Wilk test revealed a non-normal data distribution. Consequently, the non-parametric Spearman's correlation coefficient was used to scrutinize construct and discriminant validity. The intraclass correlation coefficient (ICC) ranged from 0.58 to 0.78 for the subscales of pain persistence in the future, pain stability in the present, self-blame, and the mysteriousness of pain. Additionally, Cronbach's alpha coefficient ranged from 0.74 to 0.88. With the exception of the self-blame subscale, the other subscales exhibited significant positive correlations with constructs of pain catastrophizing, disability, anxiety, coping strategies, and pain intensity, as well as significant negative correlations with quality of life (correlation coefficient ranging between 0.19 and 0.49).

Conclusion: The outcomes about test-retest reliability, construct validity, and discriminant validity collectively suggest that the Persian version of the PBPI possesses robust psychometric properties.

Keywords: Pain Beliefs and Perceptions Inventory, Chronic Low Back Pain, Validity, Reliability

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Introduction

Chronic back pain is one of the most common musculoskeletal disorders with a prevalence of 10-20%. Evidence reveals the influential role of socio-demographic, psychological, and clinical characteristics in the chronicity of back pain (1). Examining psychological risk factors, in addition to the biomechanical approach, aids us in our understanding of the persistence and spread of back pain (2).

Back pain is not always associated with movement disorders and abnormalities. Sometimes, there is an association with negative effects on social relationships, life satisfaction, and psychological disorders such as depression and anxiety. The profile of psychosocial performance in people suffering from back pain is related to their type of pain perception, coping strategy and level of social support (3).

The biopsychosocial model of pain considers the type of pain perception and coping strategies as two factors that can explain the difference between individuals with chronic pain. A person's belief toward pain and the way they perceive it, along with their coping strategies can differ, depending on the situation and culture (4, 5). Research suggests that unfavorable attitudes about pain have an impact on how well chronic pain is treated. Unfavorable attitudes can also turn acute pain into chronic pain and have a detrimental effect on a patient's overall health, self-efficacy, and performance (5, 6). It is recommended that individuals with chronic pain use a variety of cognitive-behavioral techniques to address maladaptive beliefs (6). Different tools were designed to evaluate and determine the beliefs related to pain. The Pain Beliefs and Perceptions Inventory (PBPI) is one of them. Quick and easy identification of cognitive factors is one of the reasons for choosing this scale. This 16-item instrument was designed by Williams and Thorn in 1989. Each of its statements is rated, using a 4-point Likert scale including options of strongly agree, agree, disagree, strongly disagree (7). The PBPI evaluates emotions, behavior, and pain-related perceptions. Strong relationships have been found between this tool and personality traits, physiological processes, coping mechanisms, and feelings of anxiety, depression, and pain (8).

The original version of the questionnaire is composed of three factors namely, time (belief in the stability and continuity of pain), mysteriousness (belief in the mysteriousness and unknowingness of pain) and self-blame (self-guilt and blaming oneself for the pain). The study found that the internal consistency coefficients for the time and mysteriousness of pain subscales as well as self-blame were 0.65 and 0.80, respectively (7). According to a study by Turner et al. (2000) on patients with chronic pain, those who believe in persistence of their pain in the present and continuation of it in the future are more likely to experience physical disability and depression with more severity. The lack of repetition of the time factor, and the emergence of two factors of belief in pain permanence and pain constancy led to the design of a four-factor model (9). Asghari et al. (2005) investigated the psychometric properties of this questionnaire among 232 patients with cancer pain. In this study, the construct validity of the questionnaire was tested using the factor analysis method, and the fourth statement (pain confuses me) was removed from the factor analysis due to a very strong positive bias (10).

The first factor is belief in Pain Permanence with a score between 8 and -8. A positive score indicates a deeper belief in the continuation of pain in the future. The second factor is self-blame. Its score is between 6 and -6, with a positive score suggesting a deeper belief in self-blame. Pain Constancy is stated as the third factor. Its score ranges from 8 to -8. A positive score in this situation expresses a deeper belief in the stability of pain. The fourth and final factor is Mysteriousness, scoring between 8 and -8. A higher score shows a deeper belief in the unknowability of pain and a person's attitude towards pain as an ambiguous phenomenon. The internal consistency coefficients of these four factors varied between 0.70 and 0.77. Persian version of PBPI questionnaire has a significant correlation with disability, psychological structures and coping strategies (10).

The PBPI questionnaire has been translated into several languages with different target populations (6, 11-15). Although the Persian version of this questionnaire is available, due to the different nature of chronic cancer pain and chronic musculoskeletal pain, the psychometric characteristics of the Persian version have not been investigated among people with chronic

low back pain. Therefore, the aim of the present study is to investigate the validity and reliability of the Persian version of PBPI among this group of patients. Based on the COSMIN checklist, the following hypotheses were considered to express the correlation between the PBPI questionnaire and other scales (16).

1. There is a positive and significant correlation between the subscales of the PBPI questionnaire and the constructs of pain catastrophizing, Roland Morris disability questionnaire, coping mechanisms, pain-related anxiety symptoms and pain intensity of people dealing with chronic back pain.

2. There is a negative and significant correlation between the subscales of the PBPI questionnaire and the quality of life of people with chronic back pain.

Methods

This study of localization, validity and reliability of PBPI scales is a methodological one. 118 people suffering from chronic back pain who visited the physical therapy centers of Tehran in the summer and fall of 2017 and 2018 participated in this study (15). The criteria for entering the study include: suffering from back pain for more than three months, the ability to speak Farsi (Persian language), and being in the age range of 18 to 55 (17). People with cognitive disorders, known pathologies (such as discopathy, spinal canal stenosis, fractures in the spine and osteoporosis), and spondylolisthesis as well as those who were pregnant were excluded from the study (17). Eventually, 118 people were eligible to participate in the study and all of them signed the participation consent form. This study was approved by the Ethics Committee of The University of Social Welfare and Rehabilitation Sciences (No:IR.USWR.REC.1396.205).

Pain Beliefs Perception Inventory (PBPI)

The questionnaire was designed by Williams and colleagues in 1989 to assess people with chronic non-cancer pain. The original version of this questionnaire has 16 items and three subscales including mystery, time, and self-blame. Patients rate their pain beliefs on a four-point Likert scale from -2 (completely disagree) to +2 (completely agree). The scoring of 3, 9, 12 and 15th items are calculated in reverse (7). After the factorial structure of the PBPI was examined, four factors (mystery, permanence, constancy, and self-blame) were ultimately identified (9). Asghari et al. localized this questionnaire in Persian language in 2005, which resulted in 15 items with four similar subscales (10). The factor of belief in pain permanence in the future is obtained through summation of the scores achieved from statements Nos. 4, 8, 11 and 14. Summing up the scores of statements Nos. 6, 10 and 12 presents us with the factor of belief in self-blame. Moreover, the score from statements Nos. 5, 3, 9 and 15, states the factor of belief in the constancy of pain in the present time. The factor of belief in the mystery of pain is obtained from the sum of the scores related to statements Nos. 2, 1, 7 and 13.

Coping Strategies Questionnaire (CSQ-8)

The CSQ questionnaire was designed by Rosenstiel and Keefe (1983) in people with chronic back pain. This tool had 50 items, 7 diverse cognitive and behavioral strategies. The six mentioned cognitive strategies include diverting attention, catastrophizing, ignoring pain sensations, reinterpretation, coping self-statements, and praying. It is considered a behavioral coping strategy to increase the level of activity. Behavioral and cognitive coping strategy scales of each item have seven options (0 = never use, 3 = sometimes use, 6 = always use) (18). Each scale is scored between 0 and 36. The Persian version of this scale is available, which, similar to the original version, has Cronbach's alpha coefficient of above 0.70 for subscales (19).

Roland Morris Disability Questionnaire (RMDQ)

This questionnaire is used to measure the disability caused by chronic back pain. It contains 24 questions with yes and no answers. Its score is from 0 to 24, where 0 indicates no disability and 24 indicates severe disability. This scale is widely used in various researches and has favorable internal consistency and construct validity (20).

Visual Analog Scale (VAS)

Visual analog scale is used to measure pain intensity. This scale includes a straight horizontal line of 100 mm, with one end being "no pain" and the other being "the most severe pain possible". The patient marks the pain intensity on the 100 mm continuum of this straight line (21).

Pain Catastrophizing Scale (PCS)

The scale of pain catastrophizing was designed by Sullivan (1995) with the aim of evaluating the level of catastrophic thoughts and behaviors of a person (22). In this questionnaire, subjects are asked to reflect on past painful experiences. Then, rate the degree they experience the thirteen mentioned thoughts and feelings during these events on a 6-point scale. The scale ranges from 0, "not at all or at all" to 4, "always or always" (23).

Beck Depression Inventory-II (BDI-II)

This questionnaire was first designed by Beck. Today, its 21-item version is used which includes specific symptoms of depression. The samples are selected with one of these items that indicates the severity of depression symptoms (24). Each item has a score between 0 and 3. The total score is between 0 and 63. This questionnaire can be used in people over 13 years old and it was localized by Ghasemzadeh in 2005. Its Cronbach's alpha was reported as 0.87 (25).

Pain Anxiety Symptom Scale (PASS-20)

Pain Anxiety Symptom Scale is a self-report tool designed by McCracken in 1992. It is deployed to assess anxiety and fear reactions caused by pain in people who suffer from chronic pain. The total score is between 0 and 100. A higher score indicates pain-related anxiety (26). Shanbezadeh et al (2017) scrutinized the validity and reliability of this tool among the chronic back pain group. Intraclass correlation coefficients for all subscales were higher than 0.70%. Also, Cronbach's alpha was more than 0.70% for all the subscales (27).

Short Form-36 (SF-36)

The quality-of-life scale, a shortened 36-itemed form, was designed by Ware (1992) to evaluate the quality of life and general health (28). This questionnaire was translated into Farsi in 2005 and its psychometric properties were examined (29).

Statistical Analysis

Ceiling and floor effects determine the number and percentage of people who got the lowest and highest score in each of the subscales. If more than 15% of patients have a minimum or maximum score, the questionnaire cannot differentiate between patients at the extremes of the scale (30) .

To evaluate the reliability, this scale was given to 54 patients with chronic back pain in two stages, with a time interval of one week. The purpose of retest assessments was to differentiate between actual score variance and temporary error, which arises from time-related variations in individuals' emotional states, physiological conditions, or cognitive processes (31). In order to measure relative and absolute reliability, Intraclass correlation coefficient (ICC), Standard error of measurement (SEM) and Minimal detectable change (MDC) were calculated between the two stages of measurement (32). By using absolute reliability indices, it is possible to distinguish clinical changes in the sample's condition from changes that may be due to measurement error. To calculate ICC in SPSS version 17, Two-Way Random-Effects Model or (1 and 2) was used.

ICC equal to or higher than 0.7 was considered as the acceptable limit of the reliability level. SEM was obtained using ICC and standard deviation, and MDC was obtained using SEM, with its calculation formula stated as below (33):

$$SD\sqrt{1-ICC}$$

$$1.96 \times \sqrt{2} \times SEM$$

Internal consistency reliability was assessed with Cronbach’s Alpha on the 4 subscales of the PBPI, which is used to evaluate the strength of the relationship between individual's questions within the scale. Mean scores, an alpha coefficient of more than 0.80 was considered as sufficient and acceptable (32).

The Bland-Altman analysis was used to assess how well subscales agree between tests and retests. The mean difference and limits of agreement with a 95% confidence interval served as the method's outcome measures (17).

To evaluate the construct validity of the Persian version of the PBPI scale, the correlation between the score of their subscales and the scores of the Persian version of RDMQ, PCS, CSQ, CSQ, PASS-20, SF-36 and pain intensity was calculated in people with non-specific chronic back pain.

In order to calculate the Item-Total correlation, Dimensionality on an item level, after individually removing the score of each item from the subscale score related to it, Spearman's correlation coefficient was measured for each item with its corresponding subscale score. Acceptable correlation coefficients are 0.4 or lower, and each item's correlation with each of the other subscales should be less than that of the relevant subscale (34).

Results

The background information of people was collected through a self-report questionnaire designed by the researcher. The average age of the subjects was 36.36 with a standard deviation of 10.51 years. The average pain intensity during the test was 30.9 mm based on the linear scale. 29.2% of the subjects in this research were men and 70.8% were women. 19.1% of subjects had education up to diploma, 48.4% had bachelor's degree and 32.5% had master's and doctorate education. The results of the Shapiro-Wilk statistical test showed that the distribution of data in all subscales of the PBPI questionnaire was not normal. Therefore, in the present study, non-parametric statistical methods were used to check the correlation of data.

Table 1 shows the floor and ceiling effect for the subscales' scores of the Persian version of PBPI. As can be seen in the table, less than 15% of people had the minimum or maximum scores of the subscales, except the self-blame subscale.

The obtained results from ICC, SEM, MDC and Bland-Altman agreement along with the mean and standard deviation of each subscale are also mentioned in Table 1. Munro's classification was used to describe the degree of relative reliability (17).

Reliability between zero and 0.25 was considered very low, 0.26 and 0.49 low, 0.50 and 0.69 medium, 0.7 and 0.89 high, and finally, 0.9 and 1 very high. For the majority of the subscales, ICC values between 0.70 and 0.78 were found, which is above the acceptable limit. However, for the subscale of belief in the mystery of pain, an average score of 0.58 was reported. According to Table 1, Cronbach's alpha values in this study for the subscales' scores ranged from 0.74 to 0.88.

Table 1. Flooring and ceil effects, Test-retest reliability, limitation of agreement of Persian version of PBPI (n=118).

SUBSCALE	Permanence	Self-blame Pain	Constancy	Mysteriousness
mean	-6.23	0.26	-2.85	-1.25
SD	5.58	3.13	3.2	3.02
Cronbach's alpha	0.82	0.83	0.88	0.74
ICC	0.70(0.53-0.81)	0.72(0.56-0.83)	0.78(0.65-0.9087)	0.58(0.38-0.73)
SEM	3.05	1.65	1.5	1.95
MMDC	8.47	4.59	4.16	5.42
flooring effect %	0.80%	3.40%	1.70%	3.40%
ceiling effect%	2.50%	28%	4.20%	1.70%
mean difference (95% CI)	-0.301 (-1.47-0.87)	0.37 (-0.635-0.71)	-0.339 (-0.93-0.25)	0.43 (-0.34-1.21)
LOA	-8.67-8.07	-4.74-4.82	-4.58-3.9	-5.08-5.95

SD: standard deviation, ICC: intraclass correlation coefficient, SEM: Standard Error of Measurement, MDC: minimal detectable change, LOA: limitation of agreement.

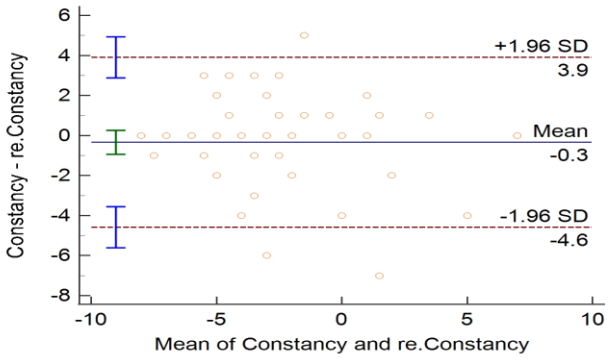

Figure 1. Bland-Altman Plot of constancy subscale of Persian version of PBPI in individual with non-specific Chronic Low Back pain.

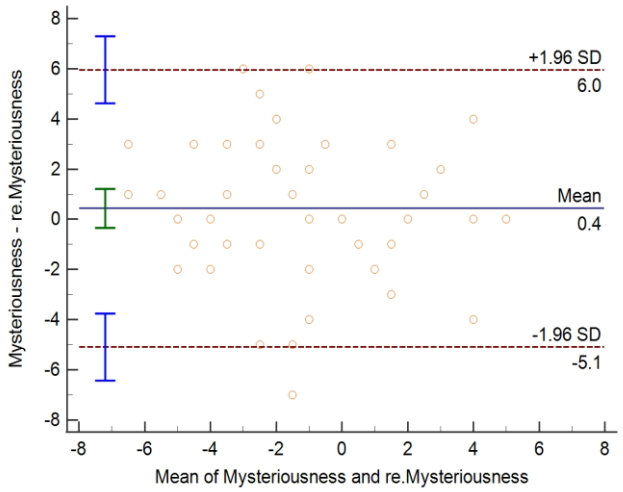

Figure 2. Bland-Altman Plot of Mysteriousness subscale of Persian version of PBPI in individual with non-specific Chronic Low Back pain.

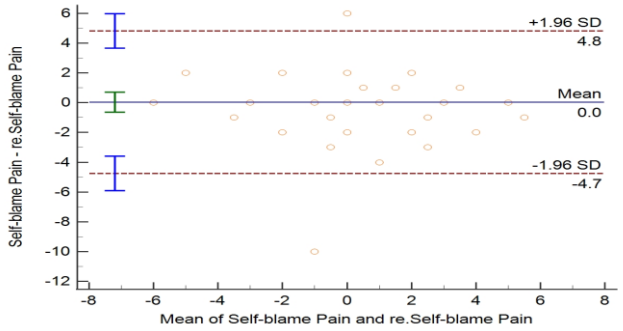

Figure 3. Bland-Altman Plot of self-blame subscale of Persian version of PBPI in individual with non-specific Chronic Low Back pain.

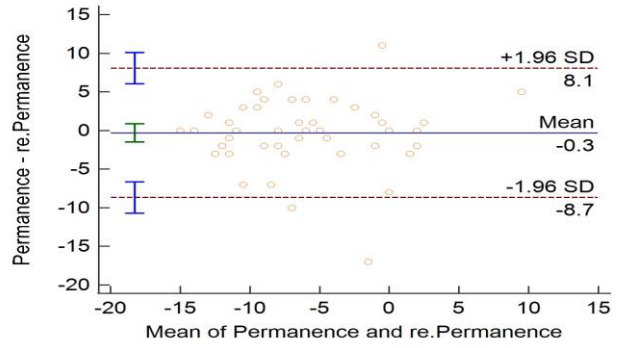

Figure 4. Bland-Altman Plot of Permanence subscale of Persian version of PBPI in individual with non-specific Chronic Low Back pain.

The correlation coefficients between the subscales' scores of the PBPI questionnaire with the scores of the RMDQ, CSQ, PCS, PASS-20, SF-36 and pain intensity are summarized in table 2.

Table 2. Correlation coefficients between PBPI questionnaire scores with RMDQ, CSQ, BDI-II, PCS, PASS-20, SF-36 questionnaire scores and pain intensity (n=118).

Scales/ subscales	Permanence	Self-blame Pain	Constancy	Mysteriousness
PCS	0.424**	0.139	.361** 0	0.332**
PASS.20	0.353**	0.110	00.266**	0.230*
BDI-II	0.416**	0.073	.367** 0	0.266**
SF36.PH.T	-0.511**	-0.021	-0.500**	-0.306**
SF36.MH.T	-0.323**	-0.069	-0.237*	-0.269**
SF36.T	-0.455**	-0.050	-0.401**	-0.315**
Diverting attention	-0.027	0.076	0.031	-0.102
Reinterpretation	0.025	.192*	0.054	-0.006
Catastrophizing	.500**	0.150	0.398**	0.300**
Ignoring pain	-0.198*	0.137	-0.118	-0.061
Praying-hope	0.110	0.075	0.154	-0.007
self-statement	-0.074	0.141	0.050	-0.167
Increasing activity levels	0.023	0.182	0.093	0.088
VAS.	0.212*	0.147	0.194	0.062
RMDQ	0.462**	0.172	0.482**	0.190*

** Correlation coefficients significant at P<0.000, *Correlation coefficients significant at P<0.05. PCS; Pain Catastrophizing Scale, VAS; Visual Analogue Scale, RMDQ; Roland Morris Disability Questionnaire; BDI-II; Back Inventory Index, SF-36; Short Form, MH; Mental Health, PH; Physical Health, PASS; Pain Anxiety Symptom Scale, Pain Intensity.

The results of Table 3 shows that the Spearman correlation between each item and its corresponding subscale was between 0.360 and 0.689, whereas the correlation with other subscales was between 0.089 and 0.589. This means that the correlation of each item with its own subscale was more than the correlation between the score of that item with other subscales. A significant value for the correlation between all items and subscales was reported to be less than 0.001.

Table 3. Item-total correlation of Persian version of PBPI (n=118).

Item	Permanence	Self-blame Pain	Constancy	Mysteriousness
I4	0.689**	0.259**	0.616**	0.399**
I8	0.399**	0.019	0.311**	0.143**
I11	0.454**	0.002	0.326**	0.377**
I14	0.461**	0.072	0.333*	0.243*
I6	0.12	0.684**	0.123	0.038
I10	0.057	0.658**	0.027	-0.009
I12	0.213*	0.36**	0.123	0.116
I3	0.608**	0.037	0.578**	0.207*
I5	0.654**	0.035	0.584**	0.256**
I9	0.701**	0.015	0.602**	0.248**
I15	0.667**	0.059	0.478**	0.357**
I1	0.037	0.197*	0.801**	0.551**
I2	0.061	0.333**	0.654**	0.636**
I7	0.081	0.289**	0.744**	0.512**
I13	-0.131	0.186	0.677**	0.486**

Discussion

In the current study, less than 15% of the participants met the minimum and maximum scores in the subscales, with the exception of self-blame, which had a floor impact of 0.28%. This can show the power of the Persian version of the PBPI scale in differentiating the various beliefs and pain perception in patients with back pain. Findings from the current study corroborated results from a research by Monticone et al. (2014) and Azevedo et al. (2017), where more than 15% of individuals had at least a minimal score on the self-blame subscale. (6, 15).

All subscales' ICC values fell between 0.7 and 0.78, with the exception of the mystery of pain subscale, which had a score of 0.58. This result validates the average of the mystery of pain subscale and the other three subscales' strong reliability. It also shows that in both tests, the order of people with respect to the entire test group has stayed appropriate. The results of another study including individuals with chronic pain fell within a same range (0.88-0.79) (15). The results of the other research, which included participants with chronic back pain, were similar (6). Cronbach's alpha coefficient of the subscales of mystery of pain was reported to be in the range of 0.74 to 0.88, which is in line with the results of other studies that had been done previously (6, 10, 15).

The minimum MDC for the subscales of belief in pain permanence, self-blame, pain constancy, and mysteriousness were 89.47,4.59, 4.16, and 5.42, respectively. With the aid of the MDC results, therapists and researchers are able to ascertain the true changes and validity of the subscales' scores (27). The agreement between the mean difference and the results indicates that each subscale fell within the predetermined limitations. Failure to calculate MDC and SEM and agreement in previous studies has limited the possibility of comparing their results.

The PBPI subscales' construct validity results suggested that, all subscales, except self-blame exhibited a positive and significant association with disability, pain-related anxiety symptoms, depression, and catastrophizing. Also, a significant negative relationship was observed between the quality of life and the subscales of pain permanence, pain constancy, and pain mystery. Among the coping strategies, only catastrophizing showed a positive and significant relationship with three subscales of the PBPI questionnaire, except self-blame. A positive and significant relationship was reported between pain intensity and the subscales of pain

among 122 people with chronic pain. A negative relationship was observed between the level of quality of life and the subscales of pain mystery, pain constancy, and pain permanence. Similar to the present study, they did not report a significant relationship between this questionnaire and the subscale of self-blame (15).

A notable positive correlation was observed between the permanence subscales and pain intensity, while no such association was identified for the remaining subscales. The permanence subscales of the PBPI concentrate on the daily life encounters of pain, suggesting a potentially more robust connection with the factual experience of pain intensity as assessed through the VAS. Contrary findings were reported by

Blanch et al., who evidenced a strong correlation between all PBPI subscales and pain intensity. Discrepancies in results may be attributed to variations in sample sizes; notably, the study by Blanch et al. predominantly involved participants afflicted with fibromyalgia (8).

According to the Cognitive-Behavioral Theory and the Biopsychosocial model, there is a significant correlation between disability, pain catastrophizing, and predictable coping strategies (8). This statement confirms the results of previous studies as well as the present one. The lack of correlation between self-blame and other scales was also found in previous studies. This could be due to the lack of a structure related to self-blame, which calls for more attention in future studies (1, 13, 35, 36). The construct validity results confirmed the hypotheses considered at the beginning of the present research.

The strong correlation between the items of the Persian version of PBPI with their corresponding subscale indicates the appropriate structure of this version. In addition, it shows that each subscale consists of appropriate items (6, 15).

Limitation

This study's limited number of participants may compromise its external validity and generalizability. Moreover, lack of implementation of content validity and exploratory factor analysis is another limitation that can be addressed in future studies.

Conclusion

The psychometric properties of the Persian version of the Pain Beliefs and Perceptions Inventory (PBPI) were examined among individuals suffering from chronic back pain, demonstrating commendable levels of validity and reliability. This instrument can be effectively employed by physical Therapists and researchers to assess patients' beliefs and perceptions regarding pain, contributing to enhanced treatment outcomes.

Competing interests

The authors declare that they have no competing interests.

Statement of the Institutional Review Board Approval

Informed consent form approved by the Ethics Committee at University of Social Welfare & Rehabilitation Sciences (No: IR.USWR.REC.1396.205).

Authors contributions

BA, **STM** and **AS** contributed to the concept and design of the study and collected the data. **SKGA** drafted the manuscript and prepared the final version, read and revised the manuscript critically for important intellectual content. Finally, all authors approved the final version of the manuscript for publication.

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