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Psychometric Properties of the Persian version of the Pain Anxiety Symptom Scale (PASS-20) in Chronic Non-specific Neck Pain Patients

Abstract:

Objectives: Pain-related anxiety has been linked to avoidance behaviour, maintenance of pain and disability. A valid and reliable tool is required to evaluate pain-related anxiety among Persian speaking adults with chronic non-specific neck pain (CNSNP). This study aimed to evaluate psychometric properties of the Persian Pain Anxiety Symptom Scale-20 (PASS-20) according to the Consensus-Based Standards for the Selection of Health Measurement Instruments (COSMIN) checklist in Iranian adults with CNSNP.

Methods: 198 individuals with CNSNP completed the PASS-20. The factorial structure (confirmatory factor analysis (CFA), exploratory factor analysis (EFA)), test-retest reliability (intraclass correlation coefficient (ICC), standard error of measurement (SEM) and minimal detectable change (MDC)), internal consistency (Cronbach's alpha), and construct validity (convergent and known-group validity) were assessed. The correlation between PASS-20 with Pain Catastrophizing Scale (PCS), Tampa Scale for Kinesiophobia (TSK), Neck Disability Index (NDI), Beck Depression Inventory (BDI), visual analog scale (VAS) (Spearman's rank correlation) were examined. Known-group validity of PASS-20 was evaluated by comparing the difference between the PASS-20 scores of the known groups based on level of disability, pain intensity and gender using non-parametric tests.

Results: The CFA showed almost the best fit with the original version. The subscales and total score demonstrated good internal consistency (Cronbach's α: 0.70-0.92) and high test-retest reliability (ICC: 0.94-0.97). PASS-20 had significant moderate correlations with PCS, TSK, NDI, VAS and a significant low correlation with BDI. Regarding known-group validity, the total score of Persian PASS-20 was higher in CNSNP with higher levels of pain and disability and in the female gender.

Conclusions: The Persian PASS-20 has acceptable psychometric properties in adults with CNSNP. The results of the factor analysis supported the four-factor structure comparable to the original version.

Ethical committee number: 921672004

Keywords: Factor analysis, Reliability, Validity, Anxiety, Neck ache

1. Introduction

Neck pain is one of the most common musculoskeletal complaints, which almost affects two-thirds (70%) of the world population during their lifetime [1]. The prevalence of chronic non-specific neck pain (CNSNP) is 15.34 % in Iran [2]. Only 10% of people with neck pain are diagnosed with a specific pathology, and the rest are defined as CNSNP [3]. Neck pain affects the quality of life, working conditions and overall well-being of the patients [4]. The fear-anxiety-avoidance model of chronic pain describes the role of pain-related fear and anxiety on maintenance of pain [5, 6]. Patients with higher pain-related anxiety shift more attention towards pain-related stimuli [7]. They constantly check the body for pain sensation, leading to avoidance behaviours [8]. In the long term, individuals with pain-related anxiety would develop disability and depression [8]. The development of disability emphasizes the importance of evaluating pain-related anxiety in chronic pain disorders.

The Pain Anxiety Symptom Scale (PASS) is a commonly used instrument that evaluates four aspects of pain-related anxiety (cognitive anxiety, physiological anxiety, avoidance and fear of pain) in individuals with chronic pain disorders [5]. The psychometric properties of the short form of PASS consisting of 20 items (PASS-20) have been evaluated in several languages, including German [9], Chinese [10], Korean [11], Arabic [12], Turkish [13], Spanish [14], and Persian [15]. All versions have shown acceptable reliability and validity; however, the factor structure of Spanish, Chinese and Korean versions differed from the original version. The reliability and convergent validity of the Persian PASS-20 have been evaluated in chronic low back pain (LBP) patients [15]; however, the factor structure has not been examined. In addition, the associations between fear of pain with disability and pain were different between LBP and neck pain patients [16]. These associations have been evaluated with other questionnaires such as the Tampa Scale of kinesiophobia (TSK) and the Fear-Avoidance Belief Questionnaire (FABQ) [16]. It was shown that fear of pain and disability is greater in LBP patients [17, 18]. Therefore, the findings related to LBP individuals could not be generalized to neck pain patients. The diverse populations raise concerns if the construct validity (association between pain-related anxiety with pain and disability and other psychological constructs) and known-group validity of PASS-20 applies to CNSNP patients [19]. Since variations in population and setting can affect the measurement properties [20], assessing the psychometric properties of the Persian PASS-20 in CNSNP is necessary. This study aimed to examine: 1) reliability, 2) factorial structure, 3) construct validity (convergent and known-group validity) in Persian-speaking individuals with CNSNP. Psychometric assessments were performed according to the Consensus-Based Standards for the Selection of Health Measurement Instruments (COSMIN) guidelines [21].

2. Methods

2.1. Participants and procedure

A consecutive convenience sample of 198 native Persian speakers with CNSNP living in Iran participated in this study from September to December 2017. The sample size was based on COSMIN criteria, recommended at least greater than seven subjects per item and sample size > 100 for assessing psychometric properties. All participants were diagnosed with non-specific neck pain by their primary care doctor [22]. They were recruited from physiotherapy clinics of Social Welfare and Rehabilitation Science University in Tehran. The inclusion criteria were non-specific neck pain for at least three months, 18-50 years of age and Persian language fluency. The exclusion criteria were any reports of major psychiatric disorders, history of trauma, accidents, surgery in the neck region, and specific spinal pathology. For reliability assessment, 110 participants filled out the Persian PASS-20 two times, with an interval of 6 to 8 days between the test and retest sessions. They were asked to fill out the questionnaires at the same clinic to keep the environment similar for both sessions [21]. The study was approved by the Ethics Committee at the University of Social Welfare and Rehabilitation Science, and written informed consent was obtained from all participants. This study was reported in accordance with the COSMIN guidelines [21].

2.2. Pain Anxiety Symptom Scale-20 (PASS-20)

The short form of PASS-20 was developed by McCracken et al. in 2002 [23] to assess pain-related anxiety, with four subscales: Cognitive Anxiety, Physiological Anxiety, Escape/Avoidance and Fear of Pain. Each item is rated on a six-point Likert scale ranging from 0 (never) to 5 (always). Higher scores represent higher pain-related anxiety. Each subscale provides a score evaluating each aspect of pain-related anxiety. The previously validated Persian version of PASS-20 was used in this study [15]. The translation process had been conducted according to the standards for cross-cultural adaptation (forward and backward translation) of health-related questionnaires [24]. The translation was done by two Persian native professional translators, and backward translation was done by a bilingual person fluent in English and Farsi. The back-translated version was sent to the developer of the PASS-20 to confirm the similarity of the original and translated versions.

3. Analyses

3.1. Reliability

Intraclass correlation coefficient (ICC), two-way random-effects model with 95% confidence interval, was used for relative reliability. The standard error of measurement (SEM) and minimal detectable change (MDC) were used to measure the absolute reliability. SEM was calculated using the formulae (SEM= SD× $\sqrt{1-ICC}$) [25], and MDC was obtained by SEM × √2 ×1.96 [26, 27]. Cronbach's alpha coefficient was used to measure internal consistency [28].

3.2. Factor Structure

A comparative Confirmatory Factor Analysis (CFA) was performed to find the best latent factor model for PASS-20. In line with the recommendations, several fit indices were used to assess model fit [29]. A Principal Component Analysis (PCA) with an Oblique (Promax) rotation was used [30] for Exploratory Factor Analysis (EFA). The Scree test and the Eigenvalues above one were used to identify the number of factors. For each item, acceptable factor loading was defined as 0.4 or greater [31].

3.3. Construct Validity

The association between PASS-20 with Persian versions of Neck Disability Index (NDI) [32], Pain Catastrophizing Scale (PCS) [33], Tampa Scale for Kinesiophobia (TSK) [34], Beck Depression Inventory (BDI-II) [35], and 100-mm Visual Analogue Scale (VAS) [36] were evaluated for convergent validity. Correlation coefficients less than 0.30, 0.30–0.60, and greater than 0.60 were considered low, moderate, and strong, respectively [37]. Two hypotheses were proposed: 1) to obtain moderate to strong correlations between PCS, TSK with PASS-20, as these constructs assess psychological factors related to pain [10, 38], 2) and to report moderate correlations between NDI, VAS and BDI with PASS-20, which are conceptually distinct but associated with each other according to the fear-avoidance model of pain [9, 11]. Known-group validity could be evaluated by assessing the differences between the scores of PASS-20 in groups expected to vary [20]. Previous studies have shown higher PASS-20 scores in females [39] and in chronic pain patients with higher levels of disability and pain [9, 12]. Therefore, this study assessed the known-group validity by comparing the PASS-20 scores between genders, levels of disability and pain intensity in CNSNP patients. We hypothesized that female with CNSNP patients, and those with higher levels of pain intensity (mild ≤ 3.4, 3.5-6.4 moderate, and severe ≥ 6.5) [40] and higher perceived disability (0-8%: no disability, 10-28%: mild, 30-48%: moderate, 50-68%: severe, and 70-100% complete disability) [41] would show higher PASS-20 scores. The construct validity was rated as positive if at least 75% of the hypotheses were confirmed [20].

3.4. Statistical analyses

Statistical analyses for reliability, construct validity and EFA were performed using SPSS version 17. Lavaan (Version 0.6-5), an R Package for Structural Equation Modeling by Yves Rosseel was used for CFA Statistical analyses. The difference between the PASS-20 scores of the known groups was evaluated by Kruskal-Wallis and Mann Whitney U test due to the non-normal distribution of PASS-20 scores. Spearman rank correlations were used to evaluate convergent validity. Since statistical analysis is likely not to be biased when less than 10% of data are missing, we used mean value substitution to handle missing data [42, 43].

4. Results

The sociodemographic data are presented in Table 1. Participants were in the range of 20 to 50 years of age (mean age 33.78, standard deviation (SD) = 9.59), and the mean (SD) of pain duration was 51.96 (45.88) months.

Table 1. Descriptive statistics for sociodemographic data (n=198).

Characteristic		n (%)
Gender	Male	60 (30.5%)
	Female	138 (69.5%)
Marital status	Single	90 (45.5%)
	Married	108 (55.5%)
Educational level	Completed high school	6 (3%)
	Collage	48 (24%)
	Graduate school	76 (38.5%)
	Postgraduate	68 (34.5%)
Employment status	Employed	96 (48.5%)
	Unemployed	102 (51.5%)

4.1. Reliability

Table 2 shows the descriptive statistics for the total and subscales scores of Persian PASS-20. An acceptable range of ICC is equal to or greater than 0.70 [20, 44]. The ICC, SEM and MDC were 0.97, 2.99 and 8.25 for the total score of PASS-20, respectively. The Cronbach's alpha was 0.92 for the PASS-20 in CNSNP, all items included. Alpha values between 0.70 to 0.95 considered as acceptable [28].

Table 2. Descriptive statistics for the total and subscales scores of Persian PASS-20 (n=198) and reliability measures of the Persian PASS-20 (n=110).

item	Mean (SD)	Cronbach	ICC	95% CI		SEM	MDC
				Lower	Upper		
Total	42.65 (17.60)	0.92	0.97	0.98	0.97	2.99	8.25
Cognitive anxiety	13.94 (5.71)	0.89	0.96	0.97	0.94	1.12	3.09
Avoidance	11.12 (4.80)	0.70	0.95	0.97	0.93	1.01	2.78
Fear	10.51 (5.39)	0.82	0.94	0.96	0.92	1.25	3.45
Physiologic anxiety	7.07 (5.05)	0.82	0.95	0.97	0.93	1.14	3.14

4.2. Confirmatory Factor Analysis

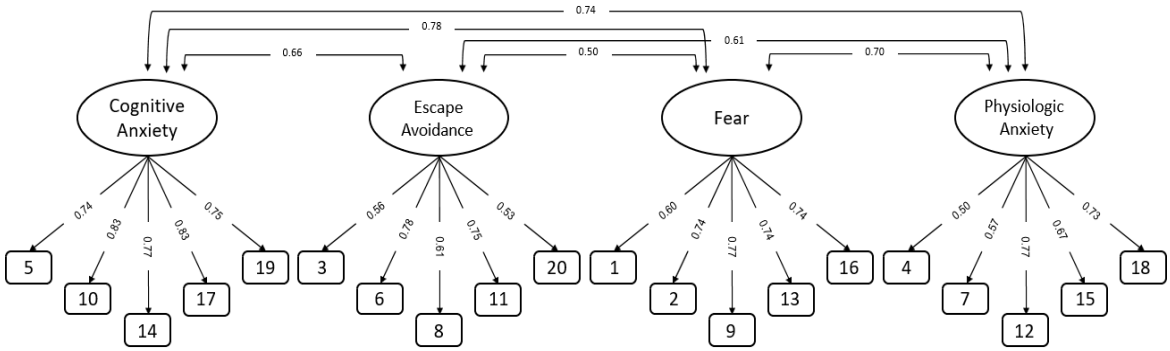
Table 3 summarizes the goodness-of-fit indices of all five alternative competing models. CFA was performed using models including the four-factor of the original version by McCracken et al. [23], the three and four-factor model of the Korean version [11], the four-factor of the German and Arabic versions [9, 12], and two-factor of Spanish version [14]. Model fit was assessed using the goodness-of-fit indices such as; X^2/ degree of freedom ratio $\leq$ 3.0, Root Mean Square Error of Approximation (RMSEA) $\leq$ 0.08, Goodness-of-fit Index (GFI) $\geq$ 0.90, Comparative Fit Index (CFI) $\geq$ 0.90, Tucker-Lewis Index (TLI)) $\geq$ 0.90 [45], the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) (Lower values indicate better fit). The Original four-factor model of McCracken et al. shows almost the best alternative indices compared to the rest of the models. The lowest X^2/ df (2.3), RMSEA (0.081), AIC (13082.0) and BIC (13233.7), and almost the highest CFI (0.88), TLI (0.87), and GFI (0.84) were observed.

Table 3. Goodness-of-fit indices of confirmatory factor analysis of the Persian PASS-20 (n=198).

	χ2	df	X2/df	p-value	CFI	TLI	GFI	RMSEA	SRMR	AIC	BIC	r
1-factor model	649.7	170	3.8	0.000	0.750	0.721	0.721	0.118	0.086	13341.6	13473.6	NA
2-factor model	647.6	169	3.8	0.000	0.751	0.720	0.722	0.119	0.086	13341.6	13476.8	F1:F2 = 0.99
3-factor model	487.1	167	2.9	0.000	0.833	0.810	0.797	0.097	0.074	13185.0	13326.8	F1:F2 = 0.70
												F1:F3 = 0.79
												F2:F3 = 0.76
4-factor model	378.1	164	2.3	0.000	0.888	0.871	0.841	0.081	0.062	13082.0	13233.7	F1:F2 = 0.65
												F1:F3 = 0.78
												F1:F4 = 0.74
												F2:F3 = 0.50
												F2:F4 = 0.61
												F3:F4 = 0.70

S-B X^2 (Satorra and Bentler scaled Chi-squared statistic); df (degree of freedom), RMSEA (Root Mean Square Error of Approximation, GFI (Goodness-of-fit Index), CFI (Comparative Fit Index), TLI (Tucker-Lewis Index), AIC (the Akaike Information Criterion), BIC (Bayesian Information Criterion), and SRMR (Standardized Mean Square Residual). Note: the four-factor models are based on McCracken et al. (23), Kreddig et al. (9), and Tashani et al. (12), the three and four-factor models based on Cho et al. (11), and two-factor model based on Lopez-Martinez et al. (14).

Figure 1. The graphical path diagram of the present study four-factor structure of PASS-20.



4.3. Exploratory Factor Analysis

The Kaiser-Meyer-Olkin (KMO > 0.6) and the Barlett test of sphericity were performed for each item to determine the sampling adequacy [30, 31]. The KMO was 0.9, and the Barlett's test of sphericity was significant (Barlett's $\chi 2 = 2023.11$, $p < 0.001$), showing that the data was appropriate for the PCA. Items that loaded 0.4 or greater on each factor were retained. The EFA results indicated a four-factor solution with eigenvalues greater than 1 (8.14, 1.77, 1.45 and 1.20). Table 4 presents the results of factor loadings, with each factor were labelled with the explained variances as follow: 1. Cognitive Anxiety (40.71%), 2. Fear of Pain (8.85%), 3. Physiological Anxiety (7.25%), and 4. Avoidance (5.95%). The four factors explained 62.72% of the total variance. Initial item communalities (h2) were moderate, ranging from 0.51 to 0.68. Half of the items of each latent variable showed a factor loading greater than 0.60, supporting the factor stability for the Persian PASS-20. All factors consisted of almost the same items as the original PASS-20 except two items, saliently loaded on two factors, item 19 (0.44 on factor 1 vs 0.48 on factor 2) and 12 (0.46 on factor 1 vs 0.54 on factor 3).

Table 4. Factor loadings of the Persian PASS-20 questionnaire after oblique (Promax) rotation (n=198).

		Factor Loading				
Item	Item Wording	Cognitive Anxiety	Fear	Physiologic Anxiety	Escape/ Avoidance	h2
17	I find it hard to concentrate when I hurt	.917				.76
10	During painful episodes, it is difficult for me to think of anything else besides the pain	.786				.71
5	I cannot think straight when I am in pain	.761				.68
14	When I hurt, I think about the pain constantly	.702				.70
19	I worry when I am in pain	.444	.486			.67
2	When I feel pain I am afraid that something terrible will happen		.895			.73
1	I think that if my pain gets too severe, it will never decrease		.885			.62
9	When I feel pain I think that I may be seriously ill		.713			.62
16	When pain comes on strong I think I might become paralyzed or more disabled		.649			.63
13	Pain sensations are terrifying		.422			.57
4	I begin trembling when engaged in activity that increases pain			.749		.51
7	Pain seems to cause my heart to pound or race			.703		.54
15	Pain makes me nauseous (feel sick)			.690		.58
12	When I sense pain I feel dizzy or faint	.460		.548		.63
18	I find it difficult to calm my body down after periods of pain			.419		.51
6	I will stop any activity as soon as I sense pain coming on				.828	.73
3	I go immediately to bed when I feel severe pain				.710	.54
11	I avoid important activities when I hurt				.644	.66
20	I try to avoid activities that cause pain				.578	.53
8	As soon as pain comes on I take medication to reduce it				.551	.53
	Percent of variation (%)	40.6	8.85	7.25	5.9	
	Cumulative variance (%)	40.67	49.52	56.77	62.72	

4.4. Construct Validity

87% of the results regarding construct validity corresponded with the prior hypotheses. Table 5 represents the Spearman correlation between PASS-20 and its subscales with the TSK, PCS, BDI, NDI and pain intensity. Total PASS-20 scores showed a moderate positive correlation with PCS, TSK, NDI and pain intensity and a weak correlation with BDI ($P< 0.05$). Scores of Cognitive and Fear of pain subscales showed the highest correlations with PCS and TSK ranging from 0.44 to 0.57. The Physiologic subscale showed the highest correlations with PCS, NDI, and TSK, ranging from 0.34 to 0.51. The Escape/Avoidance subscale showed the highest correlation with PCS (0.41).

Table 5. Spearman Rank Correlations of the Total score and Subscales of Persian PASS-20 with PCS, TSK, BDI, NDI and Pain Intensity (n=198).

Item	PASS	Cognitive	Avoidance	Fear	Physiologic
NDI	0.39**	0.27**	0.21**	0.37**	0.40**
PCS	0.64**	0.57**	0.41**	0.50**	0.51**
TSK	0.43**	0.44**	0.18**	0.47**	0.34**
BDI	0.15*	0.14*	0.10	0.14*	0.12
VAS	0.36**	0.30**	0.19**	0.47**	0.23**

** Correlation coefficients are significant at $P < 0.01$. * Correlation coefficients are significant at $P < 0.05$. BDI indicates Beck Depression Inventory; NDI, Neck Disability Index; PASS-20, Pain Anxiety Symptom scale; PCS, Pain Catastrophizing Scale; TSK, Tampa Scale of Kinesiophobia.

4.5. Known-group validity

Table 6 presents the median and interquartile range [IQR] between different groups for the PASS-20. The total score of the PASS-20 was significantly higher for females and for people with higher levels of pain and disability, confirming the presence of known-group validity.

Table 6. Known-group validity of the Persian PASS-20 (n=198).

Group		Number in group	Median [IQR]	P value
Gender	Male	60	40 [28.73-47.21]	0.022
	Female	138	46 [35.63-51.89]	
Pain	¥*Mild	96	39 [25.83-46.77]	P<0.001
	*Moderate	88	46 [36.78-59.46]	
	¥Severe	14	60 [42.76- 65.25]	
Disability	ь*No disability	7	5 [1.11- 23.43]	P<0.001
	^Mild	112	40 [31.02-47.99]	
	¥ *Moderate	64	46 [36.38-52.45]	
	ь ¥ ^Severe, complete	15	64 [60.04-73.21]	

ь ¥^* The symbols show the significant group differences. IQR: interquartile range. The significant level is 0.05.

5. Discussion

This study evaluated the reliability, validity and factor structure of the Persian PASS-20 in Iranian adults with CNSNP. The relative reliability and internal consistency were acceptable for the total score and all subscales of PASS-20, which were comparable with the findings of other versions (ranged 0.87 to 0.93) [11, 13]. The MDC values aid clinicians and researchers to separate true and reliable changes of pain-related anxiety over and above measurement errors. The changes in the scores should exceed the MDC values for the total score (8.2) to consider it a real change.

The CFA findings showed that the Persian version best fit with the four-factor model of the original PASS-20 [23] in Western clinical [46, 47] and nonclinical samples [48]. The data from the Persian PASS-20 fits well with the latent structure of the source version that was translated from, indicating a good agreement between the two constructs. In the original four-factor model, there are moderate to high between factors correlations, which suggests the presence of independent and distinct four factors but at the same time moderately correlated as they measure the same construct. The single, two, and

three-factor models produced poor fit models compared to the original model. Further, the EFA findings support the four-factor model of the original PASS-20 [23] in Western clinical [46, 47] and nonclinical samples [48]. These four factors were almost similar to the factor structure of the original English PASS-20. The order of the factors based on variance loading was Cognitive Anxiety, Fear of pain, Physiological Anxiety, and Escape-Avoidance. In addition, the items allocated to each factor are almost the same as the item distribution of the original version [23]. Only two of the items saliently loaded on two factors. Item 12 loaded on factor 3 (Physiological Anxiety), which was slightly higher than factor 1 (Cognitive Anxiety), and item 19 loaded on factor 2 (Fear of pain) slightly higher than factor 1 (Cognitive Anxiety) [30]. This is plausible that fear and anxiety are overlapping emotions related to defence systems triggered by threat stimulus that are difficult to differentiate [49]. Fear is present-oriented caused by real threat stimulus, and anxiety is future-oriented due to threat anticipation [49]. It is unclear whether this relevant distinction between fear and anxiety was made in developing the pain-related fear or anxiety instruments. Cho et al. suggested the Fear of pain and Cognitive Anxiety subscales of the PASS-20 are related to fearful thinking, and to some extent, both subscales assess the cognitive aspects of pain-related anxiety [11].

In line with the construct validity hypotheses, the results revealed a moderate positive correlation between Persian PASS-20 with PCS, TSK, NDI and pain intensity. This demonstrates that greater pain-related anxiety is correlated with catastrophizing thoughts, fear of pain and re-injury, higher disability and pain intensity. In this study, PASS-20, especially the Cognitive Anxiety and Fear subscales, showed the highest association with PCS. This was consistent with the Spanish and Persian versions in low back pain patients [14, 15]. Vancleef et al. (2009) reported that the Cognitive Anxiety and Fear subscale of PASS-20 and PCS are conceptually related to catastrophizing cognitions [38]. TSK demonstrated the highest association with the Fear subscale of PASS-20 than the other subscales, consistent with the German, Korean, Chinese and original versions of PASS-20 [9-11, 23]. This represents the conceptual proximity of fear of pain with fear of movement or re-injury [46]. Probably, people who are more fearful of re-injury or painful stimuli have a more anxious response to pain. The total score of PASS-20 showed a positive and moderate correlation with pain intensity. This correlation is higher for the Fear subscale, consistent with the original, Korean and Chinese versions of PASS-20 [10, 11, 23]. Commonly, pain intensity shows a relationship with emotional responses to pain, such as fear and anxiety [49, 50]. In addition, evaluating pain in fearful individuals reduces the pain threshold and intensifies pain perception [51].

Disability showed the highest correlation with the Physiological Anxiety subscale, consistent with Chinese, Korean and German versions of PASS-20 [9-11]. Patients with higher levels of pain-related anxiety believe that pain and biological symptoms are signs of damage to the body system. Studies have shown that high pain-related anxiety has been linked to maladaptive coping strategies that lead to disability [8, 52]. The total score of PASS-20 and Cognitive anxiety score of the present study were higher than in western countries [9, 14]; on the contrary, the Escape/avoidance subscale was lower. This could imply lower anxious avoidance responses to pain despite high cognitive anxiety in Persian speaking adults with CNSNP living in Iran. This behavior resembles an endurance response in Iranian neck pain patients. According to the avoidance-endurance model of pain, some chronic pain patients would show maladaptive endurance responses even in the presence of pain, accompanied by different positive and negative cognitive responses [52]. Endurance behavior predisposes individuals at risk of overuse or overload of physical structure and maintenance of pain. Two reasons could explain the inconsistent finding between the present study and western countries. First, this study has been conducted only on neck pain patients, while other PASS-20 versions had included various pain sites and primarily low back pain. Second, the cultural contexts, financial constraints and health system provider barriers would also affect the behavioral responses to pain in our population under study [53].

In contrast to the prior hypothesis, a weak but positive correlation was obtained between the total score of Persian PASS-20 with depression in CNSNP patients, which was inconsistent with the original, Korean, Chinese, Turkish and Persian versions. In most of these studies, various musculoskeletal pain or rheumatic diseases were included. It seems that pain location can affect the onset of depressive symptoms [51]. Furthermore, the biopsychosocial model for depression has shown that genetic, social and cognitive factors could contribute to the aetiology of depression. Therefore, the interaction of these factors would develop depression [54]. In applied psychology, the association between variables is highly complex, and it is unlikely in a correlational study that one factor alone can explain a substantial amount of the variance in another outcome with a high correlation [55, 56]. Therefore, interpretation of the associations found in psychological research should be made cautiously.

Regarding known-group validity, the total score of Persian PASS-20 was higher for females and groups with higher levels of pain and disability, as expected. Previously greater pain-related psychological issues have been reported in females [57]. In addition, according to the fear-anxiety avoidance model of pain, higher levels of pain-related anxiety would lead to higher pain and disability [57, 58].

6. Limitations

There were several limitations in the present study. First, recruitment by a convenience sampling method, which increases the potential risk of selection bias and limits the generalizability of the results. Second, the results were derived from cross-sectional correlational analyses that do not allow us to conclude causal relationships. It would be interesting for further research to find the possible causal relationships between each of the concepts examined in this study. Finally, this study just involved CNSNP patients that might restrict the generalizability of the findings to any other neck complications.

7. Conclusions

The Persian PASS-20 has acceptable psychometric properties in adults with CNSNP. The factor analyses supported the four-factor structure comparable to the original version. The Persian PASS-20 can be used to measure four aspects of pain-related anxiety in CNSNP patients. Considering the strength of correlations (low to moderate) observed between pain-related anxiety and disability, catastrophizing, fear of re-injury, depression and pain intensity, the associations should be interpreted cautiously.

8. List of Abbreviations:

BDI: Beck Depression Inventory, **LBP:** Low Back Pain, **CNSNP:** Chronic Non-Specific Neck Pain, **CFA:** Confirmatory factor Structure, **CFI:** Comparative Fit Index, **GFI:** Goodness-of-fit Index, **ICC:** Intraclass Correlation Coefficient, **IQR:** Interquartile Range, **MDC:** Minimal Detectable Change, **NDI:** Neck Disability Index, **PASS-20:** Pain Anxiety Symptom Scale, **PCS:** Pain Catastrophizing Scale, **RMSEA:** Root Mean Square Error of Approximation, **SRMR:** Standardized Mean Square Residual, **CFI:** Comparative Fit Index, **TLI:** Tucker-Lewis Index, **AIC:** Akaike Information Criterion, **BIC:** Bayesian Information Criterion, **SEM:** Standard Error of Measurement, **SD:** Standard Deviation, **TSK:** Tampa Scale for Kinesiophobia, **VAS:** Visual Analog Scale

9. Ethical declaration:

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Competing interests: Authors state no conflict of interest**.**

Informed Consent: Informed consent has been obtained from all individuals included in this study.

Ethics approval: The study was approved by the Ethics Committee at the University of Social Welfare and Rehabilitation Science.

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