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The concept of pain inventory for children: The reliability and validity study of the Turkish version

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ABSTRACT

Background and purpose: Pain experiences in childhood are very likely to be reflected in adulthood. The early evaluation of the concept of pain in children may eventually lead to.
better patient outcomes in the future. Therefore, we aimed to culturally and developmentally adapt the Concept of Pain Inventory for Children (COPI) for Turkish children.
Methods: This descriptive, correlational study was conducted with 239 post-operative children aged 8–12 years between June and December 2021. The research adhered to COSMIN guidelines. The data were collected using a descriptive information form and the COPI. Factor analysis, Cronbach's alpha, and item–total score analysis were used for the data analysis.
Results: The resulting unidimensional scale consists of 12 items in Turkish. The scale explained 65% of the total variance. The exploratory factor analysis showed that the factor loadings of items ranged from 0.64 to 0.91. The confirmatory factor analysis showed that the factor loadings of items ranged from 0.66 to 0.92. Goodness of fit indexes were found to be as follows: Normed Fit Index >0.90; Incremental Fit Index >0.90; Comparative Fit Index >0.90; and the Root Mean Square Error of Approximation <0.08. The total Cronbach's alpha coefficient of the scale was 0.78 (reliable).
Conclusions: The 12-item Turkish translation of the COPI was deemed valid and reliable in 8–12-year-old children in a post-operative setting.
Practice implications: Evaluation of children's pain concepts during childhood may contribute to the identification of conceptual gaps for pain science education.

Introduction

The concept of pain as a universal factor is difficult to define (Reuter et al., 2019). As in nursing practice, it is a phenomenon frequently encountered by all health care providers (Palermo et al., 2012; Reuter et al., 2019). The clarity of the concept of pain is essential for pain management to promote the quality of life (Koechlin et al., 2020). The concept of pain focuses on the understanding of *"what pain really is, what function it serves, and what biological processes support it."* The concept of pain, in other words, can be defined as the way a person perceives pain (Moseley & Butler, 2015). To explain the pain and its associated concepts, first, the bio-psychosocial components of pain, which are determinants, should be defined (Fisher et al., 2018; Harrison et al., 2019; Moseley & Butler, 2015). These components are listed by Wijma et al. (2016) as the type of pain, motivation, somatic, cognitive, emotional, behavioral, and social factors. Emotional states such as fear, stress, and depression experienced by the individual in previous pain experiences increase the severity of pain. When individuals exaggerate their pain, the pain-related neurological activity in their brain increases, and as a result, they reflect more pain (Fisher et al., 2018). From a behavioral

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point of view, the behavior of avoiding movement was found to be associated with the individual's pain level (Moseley & Vlaeyen, 2015). Social and environmental conditions that create imbalances in the person's self and trigger stress also have negative effects on pain (Robins et al., 2016). As we adopt a biopsychosocial stance on the persistence of chronic pain, fear is argued to influence patient motivations, decisions, and well-being. For some individuals, breaking a vicious cycle of fear and avoidance will necessitate a comprehensive and thorough pain neuroscience education (den Hollander et al., 2016).

To evaluate the concept of pain, many components should be considered together (Pate et al., 2020). Determining biopsychosocial influences on pain can provide an understanding of the concept of pain (Fisher et al., 2018; Harrison et al., 2019; Moseley & Butler, 2015). These ideas are in a complex concept network relationship with each other, and conceptual change due to Pain Science Education occurs as a result of a slow process in line with the knowledge and beliefs gained and/or changed (Vosniadou, 2012). Pain experienced in childhood is very likely to be reflected in adulthood (Hassett et al., 2013; Pate et al., 2018). A person's concept of pain, which develops throughout childhood, is affected by a range of variables such as literacy, culture, and experiences of pain (Robins et al., 2016). In a study conducted by Boerner et al. (2016) with children who underwent a cold pressor test, one group was given threatening information while the other group was given non-threatening information. It was reported that those who received threatening information expected more pain, perceived pain as more threatening, and exaggerated pain more than the other group (Boerner et al., 2016). Obtaining personal data on the components of the concept of pain will help to plan pain science education (when? for how long?, etc.) and to guide the care plan (Robins et al., 2016; Wijma et al., 2016).

Pain science education is an integral part of pediatric pain management (Robins et al., 2016). For pain management to be more efficient and for pain science education to be evaluated, the concept of pain in individuals should be assessed (Pate et al., 2020). In the literature, some scales evaluate the level or the severity of pain in childhood and adulthood (Bieri et al., 1990; Merkel et al., 1997; Tarbell et al., 1992). For example, the Facial Pain Scale was developed by Bieri et al. (1990) and consists of a total of six facial expressions indicating the absence of pain and increasing the severity of pain. The Pain Rating Scale for Preschool Children was developed by Tarbell et al. (1992) and focuses on vocal pain, bodily pain, and facial expressions. The FLACC Pain Rating Scale was developed by Merkel et al. (1997) and includes a behavioral assessment of pain by considering the child's facial expression, leg movement, activity, crying, and appeasement status. For adults, the revised Neurophysiology of Pain Questionnaire (rNPQ), which focuses more on evaluating information, is used. It was developed to conceptualize the biological mechanisms effective in the formation of pain (Catley et al., 2013). The Concept of Pain Inventory for Children (COPI) was developed to assess a child's concept of pain (Pate et al., 2020). Considering that pain in childhood/adolescence can likely be re-experienced in adulthood, the early evaluation of the concept of pain becomes even more important.

The COPI, developed by Pate et al., was initially tested in Australia (Pate et al., 2020). To the best of our knowledge, there is no Turkish scale created to evaluate the concept of pain in Turkish children. A culturally and developmentally appropriate, valid, and reliable tool can contribute to health professionals' assessment of Turkish children's concept of pain. Therefore, we aimed to culturally and developmentally adapt the Concept of Pain Inventory for Children (COPI) for Turkish children.

Method

Study design

This methodological, descriptive, correlational study examined the validity and reliability of the COPI for children (Fig. 1). We evaluated the COPI measurement properties according to COnsensus-based Standards for the selection of health Measurement INstruments (COSMIN) guidelines.

Sample population and sampling

The research was carried out with post-operative children aged 8–12 between June and December 2021 in the pediatric clinics of a university and a state hospital in the northeastern region of Turkey. The inclusion criteria were a) being a Turkish-speaking child aged 8–12 years, b) being post-operative, c) being formal testing and confirmation of the child's literature by researchers, and d) being a volunteer and having parents' consent. The exclusion criteria were a) having a reading and writing difficulty, and b) having a cognitive impairment.

It is suggested in validity and reliability studies that the number of individuals to be sampled should be 5–20 times more than the number of items on the scale (DeVellis, 2016; Karagöz, 2019). Another suggestion is to evaluate the sample size as insufficient up to 100, low up to 200, good 200–500, very good 500–1000, and excellent over 1000 (Karagöz, 2019).

In this research, there are 412 children in total between June and December 2021 with post-operative children aged 8–12. Accordingly, 269 children between the ages of 8 and 12 who met the inclusion criteria of the study, agreed to participate in the study, and filled out the forms were included in the study. A preliminary study was conducted with 30 children who agreed to participate in the study. Those included in the preliminary study were excluded from the study. To check test-retest reliability, 40 children were retested four weeks after the main study. The data were collected by the researchers (EB and BA) in the patient's room by face-to-face survey method on the first post-operative day. Parents were also present in the patient's room during data collection.

Data collection tools

The descriptive information form

The form consisting of 14 closed-ended questions was prepared by the researchers in line with the literature (Fisher et al., 2018; Harrison et al., 2019; Pate et al., 2020). It includes questions about the socio-demographic characteristics of the child and parents, the surgical site, and the pain level of the child.

The concept of pain inventory (COPI)

The COPI was developed in 2020 to assess the concept of pain in English-speaking children aged 8–12 years (Pate et al., 2020). The 14-item scale is unidimensional with no sub-dimensions. Scale items are scored on a 5-point Likert scale (0 = Strongly disagree, 1 = Disagree, 2 = Not sure/Undecided, 3 = Agree, 4 = Strongly agree). The total score to be obtained from the scale varies between 0 and 56. There is no reverse-scored item on the scale. High scores indicate that the child's definition of the concept of pain is more compatible with contemporary pain science (Pate et al., 2020). The COPI demonstrated acceptable internal consistency (Cronbach's alpha = 0.775) and moderate test-retest reliability (intraclass correlation coefficient (3,1) = 0.55; 95% CI, 0.37–0.68) in children (Pate et al., 2020). Based on these results, it has been concluded that the scale is a valid and reliable measurement tool that can be used to evaluate children's pain.

Translation

The written consent of the scale developers was obtained at the beginning of the study. There are two points to be noted in adapting scales. The first is to ensure the equality of structure, concept, and language, and the other is to evaluate the psychometric properties of the measurement tools. Concept and language equality is achieved by the double translation method (Wild et al., 2005). For language validity, the scale was translated from English to Turkish by two independent language

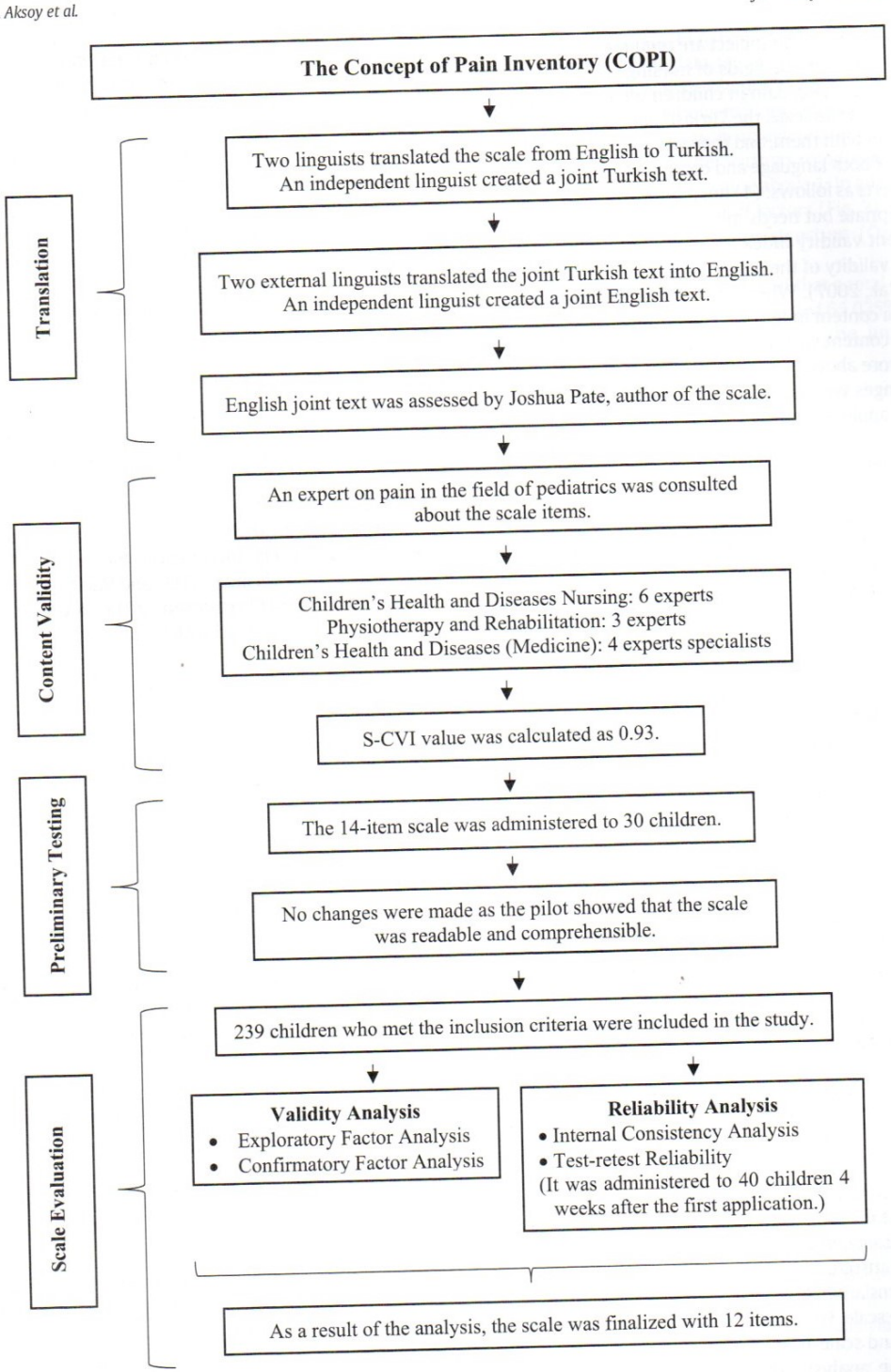

Fig. 1. Research process.

experts who master both languages and had not seen the scale before. Then, an independent expert evaluated whether the translation of the scale was equivalent to the original statements of the scale. Then the Turkish text was revised by a Turkish linguist.

The Turkish text, which was finalized in line with the recommendations of the experts, was translated back from Turkish to English by independent native English speakers and bilingual experts. It was ensured that the experts involved in the reverse translation did not have any knowledge of the original scale. A joint text in English was prepared by an external language expert different from the experts who did back translation. The comparison of the English joint text with the original scale and the evaluation of meaning was made by the researcher Joshua W. Pate, an original author of the English version of the scale.

Evaluation by experts

Content validity is performed to evaluate whether a scale measures the concept to be measured. For the content validity, consultation with

min. 3 and max. 20 experts on the subject are required (Esin, 2018). For content validity, experts from the fields of nursing (6), physiotherapy (4), and medicine (3) studying pain in children were consulted. A file containing the original of the scale, the Turkish joint text, and a preface to the scale was shared with them, and they were asked to evaluate the scale items in terms of both language and content. The scale items were evaluated by the experts as follows: (1) not appropriate; (2) needs to be corrected; (3) appropriate but needs minor modification; (4) very appropriate. The content validity index for the scale was calculated. To confirm the content validity of the scale, the score must be above 0.80 (Esin, 2018; Polit et al., 2007). When analyzed at the item level, each item of the scale has a content index of at least 0.85, and when analyzed at the scale level, the content validity index was found to be 0.93. A content validity index score above 90% indicates a perfect fit (Polit & Beck, 2018). Thus, no changes were made in the Turkish form, and the researchers decided to apply the scale to the main sampling.

Preliminary test (evaluation by children)

To evaluate the understandability of the scale, a preliminary study was conducted on 30 children who met the inclusion criteria and were then excluded from the sample. Ratings of readability and understandability of this scale were evaluated by the researchers through face-to-face interviews with children. Thirty children (12 female and 18 male individuals) reviewed the scale. Child ages ranged from 8 to 12 years ($M = 9.6$, $SD = 1.5$) and pain locations included head ($n = 4$), ear ($n = 1$), throat ($n = 8$), hand-arm ($n = 2$), stomach ($n = 3$) and leg-knee-foot ($n = 4$). The preliminary application showed that the readability and comprehensibility of the scale were sufficient. Children reported if items made sense and often volunteered suggestions of ways to simplify the wording of items (eg. 7 children suggested replacing the phrase "learning about pain" with "knowing about pain" and "warming" with "stimuli").

Ethical considerations

Ethical approval from Scientific Research and Publication Ethics Committee (Number: 2021/03 Date:14.04.2021) and written institutional permissions (Numbers: 23618724–772.02-02-3112 and E-44710342-044-4406 Dates: 26.08.2021 and 09.06.2021) were received to carry out the research. Prior to the application, the children in the sample group and their parents were informed about the purpose of the study. Then, verbal consent was obtained from children fulfilling the inclusion criteria, and verbal and written consent was obtained from their parents.

Statistical analysis

The data were analyzed with IBM SPSS 26.0 software, LISREL program, and AMOS 23.0 statistical programs. The data were first checked in terms of missing data and extreme values in the SPSS 26 package program. For descriptive statistics, numbers, percentages, and mean values were calculated. The translation-re-translation method was used for the language validity of the scale. For content validity, "Item-based content validity index (I-CVI) and scale-based content validity index (S-CVI)" were calculated. In the analysis, the 95% confidence interval was accepted as the statistical significance level of $p < 0.05$.

Validity

Content validity is the consensus reached by experts to evaluate the scale and how well each item that makes up the scale measures a theoretical construct (DeVellis, 2016; Polit & Beck, 2018). Explanatory factor analysis (EFA) and confirmatory factor analysis (CFA) were performed for the validity of The COPI for Children. Before factor analysis, the suitability of the data for factor analysis was evaluated using the Kaiser-Meyer-Olkin (KMO) coefficient and the Bartlett's test of sphericity. To make a factor analysis of the data in the literature, the KMO value should be at least 0.60, and Bartlett Sphericity test value should be statistically significant (Hayran, 2011; Jonhson & Christensen, 2014; Terwee et al., 2007).

The Principal Axis Factoring method was used for EFA. The Promax, an oblique rotation technique (Tabachnick & Fidell, 2013) was used because it was assumed that the components were related based on the theoretical structure of the scale. EFA was performed to determine the relationship between the item and the factor (Esin, 2018; Zamanzadeh et al., 2015). The number of factors, under which the scale items were patterned, was determined by the K1 eigenvalue method (DeVellis, 2016). In the literature, it is reported that while determining the factor under which the items will be placed, the minimum factor load should be 0.30 and above, and the items below this ratio should be removed from the scale (DeVellis, 2016; Jonhson & Christensen, 2014; Seçer, 2018). In the literature, it is recommended to evaluate the suitability of the factor structure EFA with CFA (DeVellis, 2016; Jonhson & Christensen, 2014; Marsh et al., 2019). CFA was used to determine whether items explained the original scale structure.

The goodness of fit of the model was evaluated Chi-square (χ^2), degrees of freedom (df), χ^2/df, Root Mean Square Error of Approximation (RMSEA), Standardized Root Mean Square Residual (sRMR), Comparative Fit Index (CFI), Incremental Fit Index (IFI), Normed Fit Index (NFI), Tucker–Lewis Index (TLI) and Relative Fit Index (RFI) (DeVellis, 2016; Jonhson & Christensen, 2014; Karagöz, 2019; Kline, 2015; Marsh et al., 2019; Tabachnick & Fidell, 2013).

Reliability

Internal consistency of the scale was determined using Cronbach's alpha coefficient (split-half method, Cronbach's α value, Spearman-Brown, Guttman split-half, and the correlation coefficient between the two halves). Cronbach's alpha coefficient shows whether the items forming the scale adequately represent the subject to be measured and whether the items are related to the subject to be measured and compatible with each other. Cronbach's alpha coefficient between 0.60 and 0.80 is reliable, and between 0.80 and 1.00 the scale is highly reliable (Kartal & Bardakçı, 2018; Nunnally & Bernstein, 2010; Özdamar, 2016; Rattray & Jones, 2007; Seçer, 2018). The Pearson correlation analysis was used for the item-total score analysis of the scale. The additivity, response bias, and time-based sensitivity of the scale were evaluated with Tukey's test of additivity, Ḥotelling's T^2 test, and Test-retest analysis, the Intraclass Correlation Coefficient (ICC), respectively. Two groups were compared using the student's *t*-test (Kartal & Bardakçı, 2018; Nunnally & Bernstein, 2010; Özdamar, 2016; Rattray & Jones, 2007; Seçer, 2018; Tabachnick & Fidell, 2013).

Results

Demographic data

The sample consists of 239 children. Their mean age was 10.02 ± 1.53, and 50.4% were male. The mothers of 31.8% had an associate and bachelor's degree, and the fathers of 36.4% were high school graduates. 71.5% had been applied a painful intervention before, and 87.4% had not had an operation before. 81.6% of the parents and 38.5% of the children were informed about pain and surgery before the operation. 85.4% received general anesthesia, 92.9% had postoperative pain, and 87.9% used analgesics after the operation. 28.5% reported the location of the postoperative pain as the abdominal region, and 33.9% reported severe postoperative pain (Table 1).

Validity analysis

Content validity

Item evaluation by experts. The draft scale was evaluated by 13 experts. The Davis technique was used in the evaluation of the "Item-based

Table 1
Sociodemographic characteristics (n = 239).

Characteristics		Participants	
		Frequency	Percentage
Gender	Female	118	49.4
	Male	121	50.4
Maternal Education Level	Primary school	29	12.1
	Secondary school	41	17.2
	High school	73	30.5
	Associate Degree + Bachelor's Degree	76	31.8
	Post graduate Degree	20	8.4
Paternal Education Level	Primary school	17	7.1
	Secondary school	37	15.5
	High school	87	36.4
	Associate Degree + Bachelor's Degree	77	32.2
	Post graduate Degree	21	8.8
Previous exposure to a painful surgical procedure	Yes	171	71.5
	No	68	28.5
Having a surgery previously	Yes	30	12.6
	No	209	87.4
Being informed about pre-operative pain and surgery (parents)	Yes	195	81.6
	No	44	18.4
Being informed about pre-operative pain and surgery (child)	Yes	92	38.5
	No	147	61.5
Type of anesthesia	Local	35	14.6
	General	204	85.4
Post-operative pain presence	Yes	222	92.9
	No	17	7.1
Postoperative use of analgesics	Yes	210	87.9
	No	14	5.9
Location of pain	Head	19	7.9
	Eye	3	1.3
	Ear	16	6.7
	Nose	7	2.9
	Throat	53	22.2
	Neck	5	2.1
	Hand-Arm	9	3.8
	Chest	20	8.4
	Stomach	68	28.5
	Hip	1	0.4
	Genital	10	4.2
	Leg-Knee-Foot	13	5.4
	No	15	6.3
Degree of pain	Very mild	2	0.8
	Mild	13	5.4
	Slightly severe pain	58	24.3
	Severe pain	70	29.3
	Very severe pain	81	33.9

content validity index (I-CVI) and scale-based content validity index (S-CVI)" (Alpar, 2018; Polit et al., 2007; Polit & Beck, 2018). 13 experts evaluated the COPI items. The I-CVI was found to be between 0.85 and 1.00 and S-CVI of 0.93, which was an acceptable score (DeVellis, 2016; Johnson & Christensen, 2014).

Construct validity

Exploratory factor analysis

In the scale adaptation process, EFA, which shows how the factor structure can be patterned for the Turkish sample, should be done. The Principal Axis Factoring method was used for EFA. As a result of the EFA, the KMO index value was found to be 0.924, and Bartlett's value was $p < 0.05$. The results prove that the sample is sufficient for EFA, and the data are suitable for factor analysis. This value indicates the suitability of the data set for EFA, in other words, its factorability (Özdamar, 2016; Seçer, 2018; Tabachnick & Fidell, 2013).

After performing the EFA, two items with a factor load below 0.30 were excluded from the data set. Then, exploratory factor analysis was performed again. How many factors the data set was patterned under was determined by the K1 eigenvalue method (DeVellis, 2016). According to this method, factors with an eigenvalue above 1 should be taken into account. The analysis after varimax rotation revealed that there was only one factor with an eigenvalue above 1. In addition, a scree plot was used to determine the number of factors (Fig. 2). The scree plot shows that the scale has a single factor structure (Özdamar, 2016; Seçer, 2018; Tabachnick & Fidell, 2013).

As a result of EFA, it was concluded that a total of 12 items were patterned under a single factor and explained 65.025% of the total variance. The factor loading was 0.64–0.91 for the unidimensional model (Table 2).

Confirmatory factor analysis

For the unidimensional models, on the basis of the CFA results showed the following fit indices: Chi-square (χ^2) = 102.52, degrees of freedom (df) = 44, χ^2 / df = 2.33, Root Mean Square Error of Approximation (RMSEA) = 0.08, Comparative Fit Index (CFI) = 0.94, Standardized Root Mean Square Residual (sRMR) = 0.04, Incremental Fit Index (IFI) = 0.96, Normed Fit Index (NFI) = 0.92, Tucker–Lewis Index (TLI) =0.94, and Relative Fit Index (RFI) = 0.94 (Table 3). The item-structure parameters obtained by analyzing the single-factor measurement model as a result of the first level CFA are shown in Fig. 3. The standardized factor loads ranged from 0.66 to 0.92 (Fig. 3). In addition, factor loadings were determined to be statistically significant according to the t value test.

Reliability analysis

Internal consistency analysis

The additivity of the unidimensional scale was measured by Tukey's test of additivity, and the non-additivity value was determined as F = 25.556 and $p \leq 0.001$. Hotelling's T^2 test was used to test whether the scale had response bias, and Hotelling's T^2 was found to be 336,482, $p \leq 0.001$. This finding showed that the responses (item averages) of the participants to the scale items were not equal, and there was no response bias in the scale (Çapık et al., 2018; Nunnally & Bernstein, 2010; Seçer, 2018).

The Cronbach α coefficient for the entire scale is 0.78. As a result of the split-half analysis of the scale, the Cronbach's α value of the first half was 0.76 and that of the second half was 0.71. The Spearman-Brown coefficient was 0.70, the Guttman split-half coefficient was 0.82, and the correlation coefficient between the two halves was 0.73 (Table 4).

The item-total correlation coefficients for the scale items ranged from 0.31 to 0.54 and were found to be within the acceptable range. The mean scores for the latent structures were moderate, and the standard deviation values met the requirement of being between −1.5 and + 1.5, which is expected for the normal distribution (Table 5).

Test-retest reliability

For the test-retest reliability analysis, the COPI was applied to a group of 40 people 4 weeks after it was administered to the children. The test-retest reliability coefficient of the scale was evaluated with Pearson Product-Moment Correlation. The results of the analysis revealed a statistically significant positive correlation between the test-retest scores of the scale ($r = 0.82$, $p < 0.05$). However, there was no statistically significant difference between the mean scores of the two measurements performed at four-week intervals ($p > 0.05$), which shows that the test-retest reliability of the COPI is ensured. The Intraclass Correlation Coefficient (ICC) value of the scale was found to be 0.93.

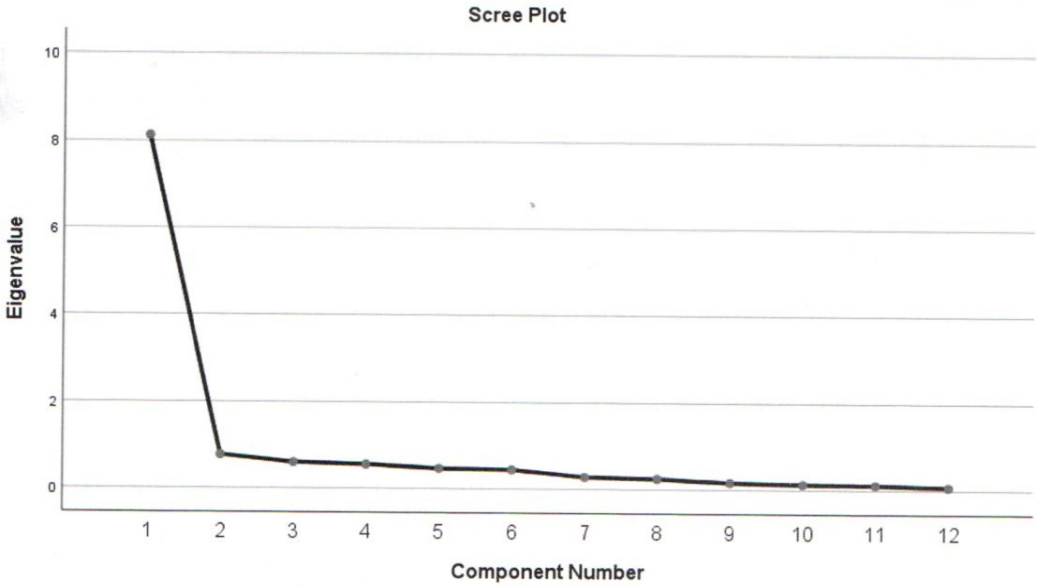

Fig. 2. Scree plot.

Scoring the scale

Each item on the scale is scored between 0 and 4. The range of scores to be obtained from the Turkish version of the scale is 0–48. There are no reverse-scored items on the scale. Higher scores indicate knowledge and beliefs about the pain that is more closely aligned with contemporary pain science education.

Discussion

Pain experience has a great impact on children/adolescents' activities of daily living and quality of life (Hassett et al., 2013; Pate et al., 2019). Pain experienced in childhood is an indicator of pain in adulthood (Hassett et al., 2013; Pate et al., 2018), so it is considered a serious health problem (Hassett et al., 2013; Pate et al., 2019), which causes children/adolescents to be absent from school, stay away from social activities, experience pain anxiety, and may eventually impair their social and emotional functionality (Calvo-Muñoz et al., 2018; Nelson et al., 2018). Therefore, it is important to measure how the pain experienced in childhood is conceptualized. The COPI is the first scale to evaluate the concept of pain when seeking care for pain. It is an appropriate, valid, and reliable tool for evaluating the concept of pain when seeking pain care in children aged 8–12 in Turkish society. The COPI evaluates knowledge and beliefs about pain aligned with contemporary pain science education. It can contribute to the evaluation of the views of health professionals in the field of pediatrics about the concept of pain in children.

Table 2
Exploratory factor analysis: Factor loadings of COPI items (n = 239).

Items	Factor 1
Item 2: Being sad can cause you to feel more pain.	0.910
Item 3: Distraction can make you feel less pain .	0.837
Item 4: Doing something you enjoy can make you feel less pain.	0.897
Item 5: Pain is a warning that the body needs to be protected.	0.807
Item 6: Feeling pain for a long time can make the brain more sensitive to stimuli.	0.736
Item 8: Knowing about pain can help you feel less pain.	0.850
Item 9: You may be injured and feel no pain.	0.831
Item 10: The brain can make pain better or worse.	0.865
Item 11: You may feel very little pain even if an injury is big.	0.671
Item 12: You may feel pain even after an injury heals.	0.859
Item 13: Pain usually feels better if you move your body a little more every day.	0.717
Item 14: The brain processes many details before you feel pain.	0.640
Eigenvalues	7.803
Explained variance	%65.025

It was determined in this study that I-CVI and S-CVI values were found to be above 0.80, which demonstrated a high level of consensus among experts and that the scale adequately represents the subject and has sufficient content validity (DeVellis, 2016; Jonhson & Christensen, 2014). In this study, the KMO index value was found to be 0.924, and Bartlett's sphericity test value was $p < 0.05$. These results show that the data is a suitable and sufficient sample for factor analysis. The absence of these values in the original study makes it impossible to make a comparison (Pate et al., 2020). In the study, the number of factors under which EFA was patterned was determined based on the K1 eigenvalue method. According to the eigenvalue method, factors with an eigenvalue of 1 and above were taken into account (Özdamar, 2016; Seçer, 2018; Tabachnick & Fidell, 2013). In this study, the COPI had a single factor structure for Turkish children, and the total variance was 65.025%. In the literature, it is stated that if the explained variance is above 60%, it means that the scale has strong validity (Jonhson & Christensen, 2014; Karagöz, 2019). Therefore, this value shows that the COPI has a very strong factor structure for the Turkish sample and supports construct validity. An evaluation could not be made because the total variance of the COPI was not given in the study of Pate et al. (2020).

In the original study, factor loads varied between 0.32 and 0.58 (Pate et al., 2020). In this study, two items with a factor load below 0.30 were excluded from the data set. As a result of EFA, factor loads of the unidimensional scale were found to be between 0.640 and 0.910, which suggested that the COPI, adapted into Turkish, preserves its original structure and has a strong factor structure for the Turkish sample (DeVellis, 2016; Jonhson & Christensen, 2014; Seçer, 2018).

The CFA showed that the COPI factor loadings were between 0.66 and 0.92 (DeVellis, 2016; Jonhson & Christensen, 2014; Marsh et al., 2019). In this study, it was determined that χ^2 / df = 2.33, RMSEA = 0.08, sRMR = 0.08 and fit indices were above 0.90. RMSEA value between 0.08 and 1 is an indicator of acceptable fit (Schermelleh-Engel et al., 2003). According to the literature, CFA fit indices above 0.90

Table 3
Goodness of fit indices.

Models/Data-model fit indices	χ^2	sd	χ^2/sd	RMSEA	NFI	sRMR	CFI	IFI	TLI	RFI
One-factor model	102.52	44	2.33	0.081	0.92	0.049	0.94	0.96	0.94	0.94

Notes: X2, Chi-square; df, Degrees of Freedom; RMSEA, Root Mean Standard Error Approximation; NFI, Normed Fit Index; SRMR, Standardized Root Mean Square Residual; CFI, Comparative Fit Index; IFI, Incremental Fit Index; TLI (NNFI), Normed Fit Index: Trucker-Lewis Index; RFI, Relative Fit Index.

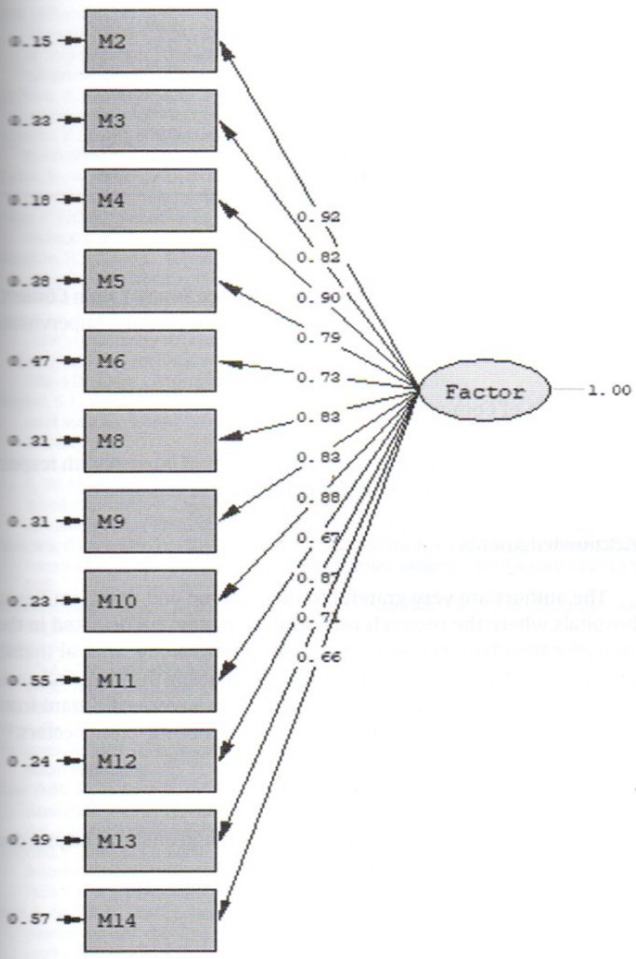

Fig. 3. Confirmatory factor analysis.
*M = Item number.

(CFI, IFI, NFI, TLI and RFI), χ^2 / df ratio < 5, and sRMR values <0.08 confirm the factor structure (DeVellis, 2016; Jonhson & Christensen, 2014; Karagöz, 2019; Kline, 2015; Marsh et al., 2019; Tabachnick & Fidell, 2013). The CFA results in this study show that the model fit of the scale is quite good and confirms the one-factor structure. Based on the results of EFA and CFA, it is a valid tool that supports the construct validity of the COPI.

The Tukey's test of additivity results in this study showed that the scores obtained from the COPI have the feature of the non-additivity ($F = 25.556$; $p \leq 0.001$) (Özdamar, 2016). In the study, Hotelling's T^2 test was used to determine whether the children's responses to the scale items were equal, suggesting that the scale did not have response bias and that the children's responses to the items were different (Hotelling T^2: 336.482, $p \leq 0.001$). These findings indicate that the COPI adapted into Turkish is reliable (Çapık et al., 2018; Seçer, 2018).

Pate et al. (2020) stated in their study that the total Cronbach's α value of the scale was 0.775. In this study, the Cronbach α coefficient was found to be 0.78. According to this value, it was seen that the scale was like its original structure and had strong internal consistency. In this study, Cronbach's α value, Guttman split-half coefficient, and Spearman-Brown values were found to be >0.70 using the split-half method; that is, there was a strong and significant correlation between the two halves. These values showed that the scale had a good level of reliability, that the items adequately represented the desired topic, that the items were related to the topic and that the items were compatible with each other (Kartal & Bardakçı, 2018; Nunnally & Bernstein, 2010; Özdamar, 2016; Rattray & Jones,2007; Seçer, 2018). Although the internal validity of the scale was high, these values could not be compared with the original study because the split-half method was not used in the original study (Pate et al., 2020).

Item total score correlation analysis shows the relationship between the scale total score and all the items that make up the scale. In this study, the items' total score correlation values were found to be >0.30. Pate et al. (2020) found the item-total score correlation values to be >0.31, which is consistent with the findings of this study. In addition, these findings are an indication that the scale has a high level of internal consistency and that the items on the scale exemplify the desired behaviors (DeVellis, 2016; Jonhson & Christensen, 2014; Karagöz, 2019; Kartal & Bardakçı, 2018; Nunnally & Bernstein, 2010; Özdamar, 2016; Rattray & Jones, 2007; Seçer, 2018; Tabachnick & Fidell, 2013).

Test-retest reliability analysis, a different dimension of scale reliability, is an indicator of the invariance and consistency of a scale over time (Marsh et al., 2019; Nunnally & Bernstein, 2010; Rattray & Jones, 2007). It was determined in this study that there was a positive, strong, and significant relationship ($r = 0.82$, $p < 0.05$) between the scores obtained from two measurements of the scale at four-week intervals ($r = 0.82$, $p < 0.05$). Pate et al. (2020) argued in their study that the COPI has moderate test-retest reliability. This value shows the internal consistency and time invariance feature of the COPI adapted to Turkish (Marsh et al., 2019; Nunnally & Bernstein, 2010; Rattray & Jones, 2007).

Practice implications

Our study results revealed that The COPI scale is a valid and reliable measurement tool for evaluating the concept of pain in children aged 8–12. Considering the validity and reliability of COPI, the use of COPI by experts who evaluate pain can be considered as a basic measure (e.g., pain science education tailored to COPI responses) or even an

Table 4
Results of the reliability analyses of the scale (n = 239).

	Cronbach's α	First half of Cronbach's α	Second half of Cronbach's α	Spearman–Brown	Guttman split-half	Correlation between two halves	Mean	SD
Scale Total	0.778	0.763	0.719	0.702	0.822	0.730	35.35	12.36

Abbreviations: SD, standard deviation.

Table 5
Correlations.

	Items	Mean ± SD	Item total score correlation (r)* (n = 239)	Test-Retest correlation of items (r)* (n = 40)
Factor	Item 2: Being sad can cause you to feel more pain.	3.14 ± 0.83	0.51	0.75
	Item 3: Distraction can make you feel less pain .	3.40 ± 0.89	0.48	0.80
	Item 4: Doing something you enjoy can make you feel less pain.	3.41 ± 0.85	0.48	0.77
	Item 5: Pain is a warning that the body needs to be protected.	3.34 ± 0.86	0.35	0.88
	Item 6: Feeling pain for a long time can make the brain more sensitive to stimuli.	2.92 ± 1.04	0.39	0.89
	Item 8: Knowing about pain can help you feel less pain.	2.97 ± 0.99	0.31	0.84
	Item 9: You may be injured and feel no pain.	1.99 ± 1.27	0.33	0.79
	Item 10: The brain can make pain better or worse.	2.85 ± 1.03	0.54	0.78
	Item 11: You may feel very little pain even if an injury is big.	2.22 ± 1.37	0.48	0.88
	Item 12: You may feel pain even after an injury heals.	2.71 ± 1.16	0.37	0.90
	Item 13: Pain usually feels better if you move your body a little more every day.	3.02 ± 1.15	0.38	0.80
	Item 14: The brain processes many details before you feel pain.	2.53 ± 1.86	0.41	0.85

Abbreviations: SD, standard deviation.
* $p < 0.001$.

outcome measure in directing the treatment process of children. It can be preferred for clinical and research studies as it is easy and practical and can be applied in a short time. It is thought that the evaluation of children's pain concepts is the first step to be taken in the planning of pain management and nursing educational and interventional practices in children. Therefore, health care professionals, especially nurses, can evaluate children's pain concepts using this scale and identify children's conceptual gaps.

Limitations/strengths

The use of the COSMIN checklist to evaluate the measurement characteristics of COPI, which determined that the methodology was "adequate" to "very good" for the evaluated features, strengthened this study (COSMIN, 2021; Mokkink et al., 2010). To reduce the possible effects of the virus during the COVID-19 epidemic, regulations and limitations have been made in surgical procedures around the world and in Turkey (Retzlaff, 2020; Zhou et al., 2020). It is emphasized that only emergency and semi-emergency surgeries should be performed in pediatric surgery, as in adult surgery (Özer Özlü & Vural, 2020). Elective surgeries are reasonably postponed based on the recommendations (Zheng et al., 2020; Zhou et al., 2020). Therefore, the main identified limitation of the study may be that the research data were collected only from emergency and semi-emergency surgeries. Another limitation of the study is that 12% of the children included in the study had difficulty understanding some words on the scale. For this reason, these difficult words were explained by the researchers using synonym expressions. Also, the generalizability of the findings is determined by the Turkish population. Therefore, due to the psychometric characteristics of other communities are not known, there are cultural differences, and the COPI should adapt to other populations.

Conclusion

The COPI was found to be a valid and reliable measurement tool for Turkish sampling of children aged 8–12 in this study. In further studies, the COPI can also be used for targeted pain science education and to evaluate the effectiveness of education in different cultures. It is recommended to carry out experimental studies with this scale to evaluate the effects of pain science education and the concept of pain in non-post-operative children.

CRediT authorship contribution statement

Vildan Apaydin Cirik: Conceptualization, Methodology, Supervision, Visualization, Writing – original draft, Writing – review & editing. **Elif Bulut:** Investigation, Writing – review & editing. **Bahar Aksoy:** Investigation, Writing – review & editing. **Hatice Sonay Yalçin Cömert:** Investigation, Writing – review & editing. **Joshua W. Pate:** Supervision, Writing – review & editing.

Declaration of Competing Interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.pedn.2022.05.019.

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