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Psychometric characteristics of the Turkish version of the pain flexibility scale for children with cancer

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ABSTRACT

Purpose: This study was conducted to evaluate the validity and reliability of the Pain Flexibility Scale for children with cancer in Turkey.
Design and method: This was a methodological–descriptive–correlational study conducted on 211 children with cancer. Data were collected using the information form and Pain Flexibility Scale for children with cancer. The data were evaluated using explanatory and confirmatory factor analysis, Cronbach's alpha, split-half, item-total score correlation, and test-retest analysis.
Results: The explained variance rate of the scale, in which factor analysis confirmed the two-dimensional structure, was 85.31%. The factor loads were greater than 0.30, and all fit indices were greater than 0.90. In addition, RMSEA was less than 0.080 and was significant. The total Cronbach's alpha value of the scale was 0.82, and the Cronbach's alpha values of its sub-dimensions were 0.82 and 0.79.
Conclusions: The Pain Flexibility Scale for children with cancer is a valid and reliable measurement tool for the Turkish sample.
Practice implications: Pain Flexibility Scale facilitates the development of psychological interventions based on acceptance, which can enable children with cancer to cope more successfully with pain.

Introduction

One of the most prevalent symptoms in pediatric oncology patients is pain, which exerts negative consequences on their quality of life (Linder & Hooke, 2019). Pain is experienced by children as a consequence of the illness, cancer treatment side effects, and/or medical processes (Kristjánsdóttir et al., 2012; Twycross et al., 2015). Pain triggers anxiety in children with cancer, which can increase the experience/ level/ intensity of the pain (Cioffi et al., 2016; Hedén et al., 2013). Psychological acceptance of pain has been reported, especially in children with chronic pain (Pielech et al., 2017; Vowles et al., 2014). One of the most important characteristics of flexibility is psychological acceptance (McCracken, 1998). Increasing psychological acceptance in individuals is an important component of providing flexibility (McCracken & Gutiérrez-Martínez, 2011). Acceptance and commitment therapy can be applied to individuals to increase their resilience (McCracken & Gutiérrez-Martínez, 2011). In particular, acceptance and commitment therapy aims to help individuals face obstacles rather than avoid unpleasant stimuli (McCracken, 1998; McCracken & Gutiérrez-Martínez, 2011). This is accomplished through enhancing psychological adaptability, which is characterized by "Having to deal with pain without responding, criticizing, or attempting to diminish it" (McCracken, 1998; McCracken & Gutiérrez-Martínez, 2011). This includes actively participating in meaningful life activities during pain, rather than putting life on hold and waiting for the pain to pass (Pielech et al., 2017). Therefore, acceptance-based interventions witness an increase in pain tolerance and a decrease in pain intensity and pain discomfort (Pielech et al., 2017; Vowles et al., 2014; Zeidan et al., 2011). In addition, the quality of life of children who actively participate in meaningful life activities during pain is high (Buhle & Wager, 2010; Cederberg et al., 2017).

An attentive, unresponsive attitude to unpleasant stimuli is established in acceptance-based therapies (Buhle & Wager, 2010). The goal is to simply observe the ongoing occurrences without making any mental judgments (Buhle & Wager, 2010). This posture weakens the experience of pain and helps the sufferer better select their actions rather than reacting rigidly to situations that occur both internally and externally (Cederberg et al., 2017). In a study, interventions that helped children display a non-reactive attitude to painful stimuli were applied; it was reported that pain discomfort in children decreased after the

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intervention (Cederberg et al., 2017). Although several instruments measuring the psychological acceptance of chronic pain have been reported in the literature (Reneman et al., 2014; Wicksell et al., 2010), there exist no instruments for children experiencing acute pain. Determining the acceptance of pain in pediatric oncology patients will shed light on intervention studies in this area. It will aid in the development of acceptance-based psychological therapies that can assist children with cancer who are experiencing pain in coping with their difficult circumstances (Cederberg et al., 2017). Valid and reliable tools that measure pain acceptance in children with cancer are important.

Purpose

This study was conducted to assess the validity and reliability of the Pain Flexibility Scale for Children with Cancer in a Turkish population. The scale was developed by Cederberg et al. in 2017.

Materials and methods

Design

This study was conducted methodologically to evaluate the validity and reliability of the scale of the Pain Flexibility Scale for children with cancer in Turkey.

Sample population and sampling

The study was conducted between November 2020 and May 2021 with children receiving pediatric hematology–oncology clinic treatment in a university hospital located in the western region of Turkey and accepting patients from neighboring cities.

Another recommended method for sample calculation in scale development studies is the three rules, namely the rules of 5 s, 10 s, and 100 s. A researcher should take at least five people per item to perform factor analysis. If there is no problem in reaching the sample, the number of people per item should be 10 (Brown, 2015; Finch, 2019). Because the Pain Flexibility Scale for children with cancer includes 20 items, the number of children per item was calculated as 10, and it was planned to include 200 children in the study.

Thus, the sample was drawn using a simple random selection procedure from children aged 7 to 18 years who were undergoing cancer treatment and had volunteered to take part in the study. The study comprised 221 youngsters who freely consented to take part in the study and filled all the necessary paperwork. A pre-application was created for 10 children who consented to participate. Children who were included in the pre-application were removed from the sample, leaving 211 children in the study.

The research data were collected using the Information Form and Pain Flexibility Scale for children with cancer.

Information form

The "Information Form" consisted of five questions on a child's age, gender, diagnosis, duration of diagnosis, and treatment received.

Pain flexibility scale for children with cancer

The Pain Flexibility Scale for children with cancer was developed by Cederberg et al. (2017). It consists of 20 items and two sub-dimensions (Cederberg et al., 2017). The scale was designed to measure pain acceptance in patients with chronic pain. The valued actions subscale measures participation in meaningful activities despite the presence of pain, whereas the pain resistance sub-scale evaluates the respondent's degree of avoidance or control over pain. The scale is based on the 7-point Likert system: 0 = "I totally disagree (Never true)," 6 = " I totally agree (Always true)." In the scale, certain items (1, 2, 3, 5, 6, 7, 8, 9, 11, 13, 14, 15, 16, 18, 20 items) are reverse coded. An increase in the scale score indicated a higher level of acceptance. Cronbach's alpha coefficient (α) of the scale varied from 0.87 to 0.91. The factor loads of the items varied from 0.44 to 0.89 (Cederberg et al., 2017).

Steps of research

The following four steps were followed for the validity and reliability of the scales.

Language validity stage

The most acceptable phrase, the target language's structure should be used when translating the scale adaption. Idioms and culturally unfamiliar things should be replaced. Jenny Thorsell Cederberg, a member of the study team, provided formal permission through e-mail for the scale to be adapted to Turkish and used for the study. Three linguists independently translated the scale into Turkish. The Turkish language of the scale was adjusted using the researchers' group effort after it was translated into Turkish. The Turkish language of the scales was confirmed by a Turkish language specialist. A separate linguist specialist reverse-translated the Turkish scale into English.

Expert opinion stage

To evaluate the content validity of the scales, it is recommended to have at least three expert opinions (Morgado et al., 2017). For the scales translated into Turkish, the opinions of five experts (a Child and Adolescent Psychiatrist, a clinical specialist psychologist, a child hematology–oncology specialist, two pediatric nursing faculty members working in this field) were obtained, and the agreement between the expert opinions was evaluated.

Pre-trial stage

The scale was administered to 10 children with cancer who had similar characteristics to the sample; these children were not included in the sample.

Validity and reliability calculation stage

To obtain the scale, the data obtained from the draft scale were created by two researchers in the research team who had documents on statistical methods.

Statistical analysis

The IBM SPSS Statistics 26.0 package and IBM SPSS Amos version 25.0 were used for data analysis (Corp, 2019, 2020). The descriptive statistics were calculated using percentages and mean scores. The error margin was set at 0.05 while analyzing the data. Statistical methods used in the research are shown in Fig. 1.

Ethics committee approval

To perform the research, permission was obtained from the owners of the scales used in the research via e-mail. In addition, institutional permission was obtained from the hospital where the research was to be conducted. Ethics Committee approval was obtained from the ethics committee of a university. In this study, written consent was obtained from the parents and verbal consent from the children.

Results

Among the children who participated in the study, 53.1% ($n = 112$) were 7 to 12 years old, 46.9% ($n = 99$) were in the 13 to 18 years of age

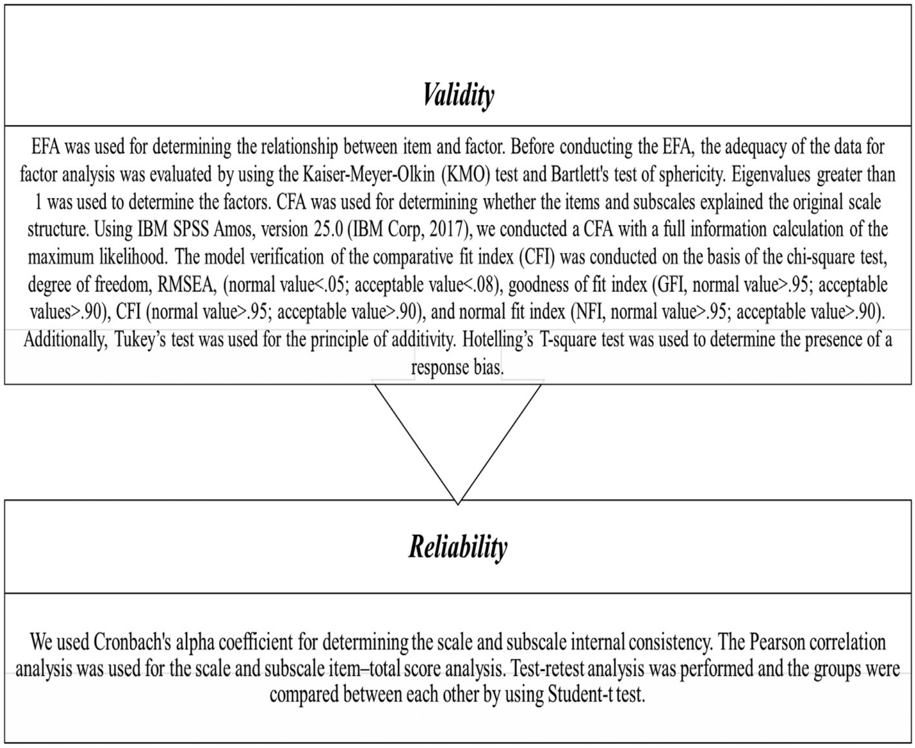

Fig. 1. Statistical Analysis.

range, 44.5% ($n = 94$) were girls, 55.5% ($n = 117$) were boys. In addition, 40.3% ($n = 85$) of the children had leukemia, 30.8% ($n = 65$) had nervous system tumors, 17.5% ($n = 37$) had solid tumors, and 11.4% ($n = 24$) had other types of cancer. We determined that 43.6% ($n = 91$) of them were diagnosed with cancer 4 to 6 months ago and 75.8% ($n = 160$) received chemotherapy. When the causes of pain in the children participating in the study were examined, it was found out that 25.1% ($n = 53$) had cancer-related pain, 46.9% ($n = 99$) had pain as a side effect of treatment, 23.7% ($n = 50$) had pain due to medical procedures, and 4.3% ($n = 9$) reported that they experienced pain for other reasons.

The agreement among experts ranged from 0.88 to 0.99 for each item (I-CVI), whereas it was 0.96 for the whole scale (S-CVI).

Explanatory factor analysis results of the scale are shown in Table 1. The Promax rotation method was used in factor analysis, as in the original form of the scale. Factor analysis results confirm that the scale consists of two sub-dimensions. According to Table 1, the total explained variance rate of the scale was 85.31%. The factor loadings of the scale varied from 0.66 to 0.96.

Confirmatory factor analysis results of the scale are shown in Table 2 and Fig. 2. The analysis results confirmed the two-dimensional scale structure. According to the confirmatory factor analysis results, factor loads ranged from 0.55 to 0.75.

The α of the whole scale was determined as 0.821, Valued Action Subscale α value was 0.820, and Pain Resistance subscale α value was 0.791. The results of the split-half analysis of the scale are shown in Table 3.

The response bias analysis showed that Hotelling's T square value was 667.352 and $F = 40.145$ ($p < 0.01$). This result showed that there was no response bias in the scale. In addition, the summability analysis showed $F = 0.682$ and $p = 0.840$, and the scale was determined to be additive.

The Pearson correlation analysis showed that the correlations of the items with the total score ranged from 0.46 to 0.67, and the correlations of the item-subscale scores ranged from 0.41 to 0.69 (Table 4).

Table 1
Results of Explanatory Factor Analysis (n:211).

Items	Sub Scale	
	Valued Action Sub Scale	Pain Resistance Sub Scale
1. It's impossible to do anything when I am in pain.		0.891
2. Pain is always bad.		0.964
3. I need to focus on getting rid of the pain.		0.746
4. There are many things I can do simultaneously while being in pain.	0.704	
5. Being in pain makes me worried.		0.866
6. The pain is always scary.		0.802
7. I need to control my worry over the pain.		0.693
8. Being in pain affects me very much.		0.753
9. I avoid movements or situations that might increase the pain.		0.790
10. I continue doing things even when I am in pain.	0.891	
11. I have to struggle to do things when I am in pain.		0.695
12. I can focus on other things even while I am in pain.	0.858	
13. The pain always feels like a threat to me.		0.686
14. The pain needs to pass before I can focus on anything else.	0.802	
15. I am afraid of pain.		0.888
16. When I am in pain, I can do nothing else.	0.681	
17. I feel that I can cope with the pain.	0.665	
18. I can't think about anything else when I am in pain.	0.710	
19. I continue to do things that are important to me even while I am in pain.	0.847	
20. Being in pain is too difficult for me.	0.799	
Explained Variance (%)	52.795	32.512
KMO coefficient	0.950	
Barlett test	7824.786 ($p < 0.001$)	

KMO: Kaiser-Meyer Olkin coefficient.

Table 2
Model fit indices of the scale.

	X^2	DF[a]	X^2/DF	RMSEA[b]	GFI[c]	CFI[d]	IFI[e]	RFI[f]	NFI[g]	TLI[h]
Two Factor Model	389.648	94	4.145	0.062	0.95	0.96	0.96	0.96	0.95	0.95

[a] Degree of Free.
[b] Root Mean Square Error of Approximation.
[c] Goodness of Fit Index.
[d] Comparative Fit Index.
[e] Incremental Fit Index.
[f] Relative Fit Index.
[g] Normed Fit Index; TLI (NNFI): Trucker-lewıs Index.

The Pearson Moments Multiplication Correlation or test–retest reliability coefficient was used to examine the scale's invariance after it was used twice at 4-week intervals. The test–retest scores of the measure showed a statistically significant positive correlation ($r = 0.93$, $p = 0.000$; Table 5). Student's t-test was used for dependent groups to examine if there was a difference in the mean scores at 4-week intervals from the scale (Table 5).

Discussion

The I-CVI and S-CVI values above 0.80 indicate an agreement between the expert opinions (Polit et al., 2007). In this study, the I-CVI

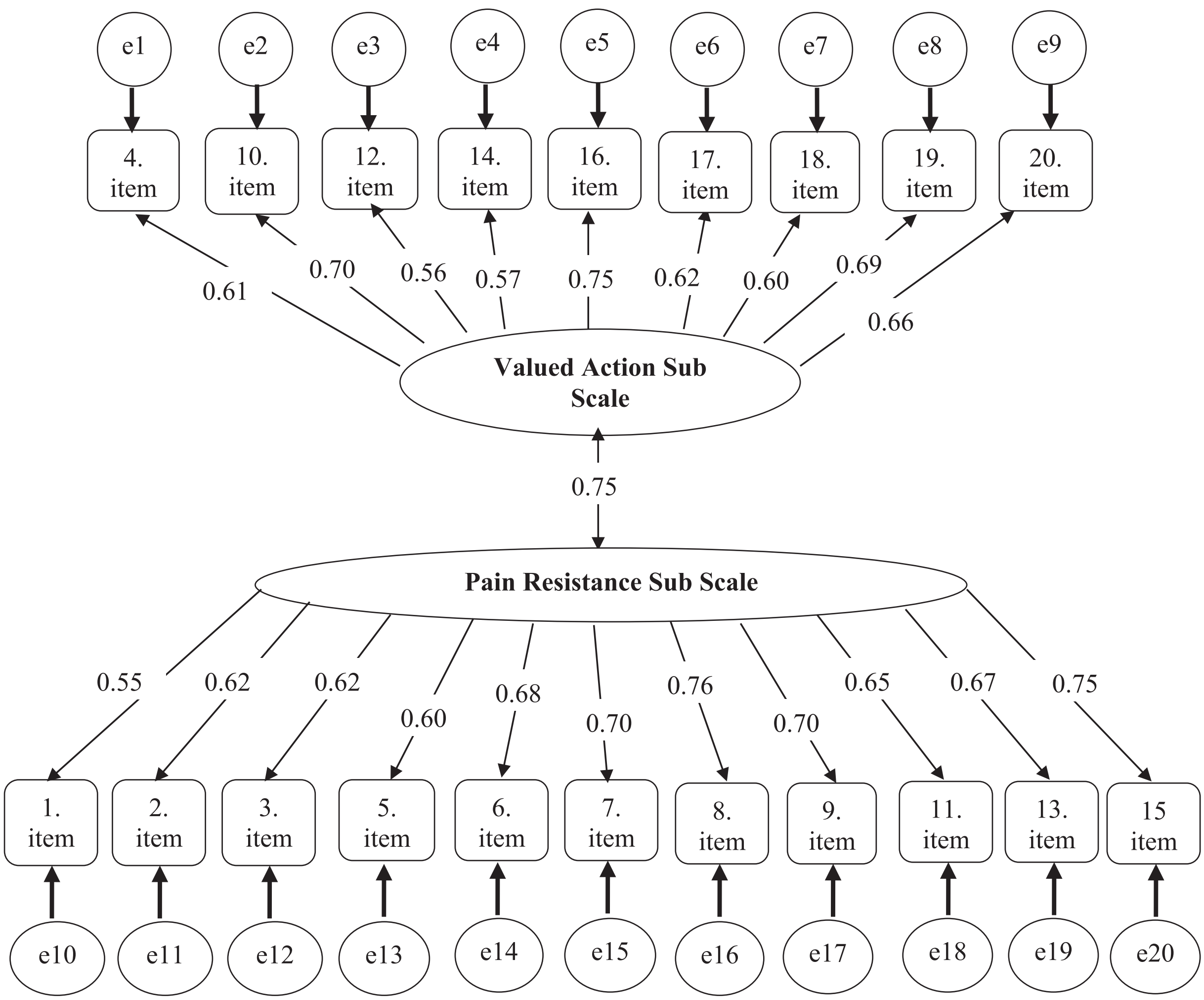

Fig. 2. Confirmatory Factor Analysis of Two Factor Model.

Table 3
Results of the reliability analyses of the scale and sub scale (n = 211).

Sub-dimensions	Cronbach α	First half of Cronbach α	Second half of Cronbach α	Spearman-Brown	Guttman split-half	Correlation between two halves	M ± SD (Min-Max)
Scale Total	0.821	0.81	0.82	0.86	0.86	0.79	65.53 ± 11.54 (0−120)
First Sub Scale	0.820						29.92 ± 3.11 (0–54)
Second Sub Scale	0.791						35.60 ± 9.13 (0–66)

Table 4
Correlations of the item total score and sub scale total score.

Items	X ± SD	Item-Total Score Correlation*	Item-Subscale Total Score Correlation*	Test-Re test Correlations of Items* ($n = 42$)
1	3.17 ± 1.87	0.92	0.92	0.92
2	3.27 ± 1.74	0.91	0.91	0.98
3	3.20 ± 1.79	0.91	0.92	0.99
4	3.23 ± 1.88	0.83	0.81	0.91
5	3.11 ± 1.93	0.93	0.94	0.98
6	3.25 ± 1.78	0.91	0.91	0.99
7	3.18 ± 1.79	0.93	0.93	0.92
8	3.29 ± 1.92	0.92	0.94	0.99
9	3.27 ± 1.92	0.93	0.93	0.96
10	3.18 ± 1,84	0.87	0.86	0.95
11	3.38 ± 1.79	0.94	0.94	0.99
12	3.40 ± 1.88	0.90	0.91	0.91
13	3.17 ± 1.87	0.90	0.90	0.98
14	3.22 ± 1.90	0.92	0.92	0.96
15	3.33 ± 1.72	0.94	0.92	0.94
16	3.47 ± 1,65	0.92	0.92	0.98
17	3.27 ± 1.89	0.89	0.87	0.99
18	3.27 ± 1.64	0.91	0.91	0.92
19	3.36 ± 2.12	0.86	0.86	0.95
20	3.39 ± 1.72	0.80	0.81	0.96

* $p < 0.001$.

and S-CVI values were above 0.80, indicating an agreement among the experts and that the scale measured the subjects adequately.

Important tests that evaluate the suitability and adequacy of the data for factor analysis are the Bartlett Sphericity test and Kaiser–Meyer–Olkin (KMO) analysis. The Bartlett Sphericity test result should be statistically significant, and the KMO value should be 0.60 and above for factor analysis (Boateng et al., 2018). The results of the analysis presented in Table 1 show that the database and the number of individuals participating in the study were sufficient to perform the factor analysis. The studies conducted by Cederberg et al. (2017) show that the sample size is less than that in the present study; however, the factor analysis results are similar to our study (Cederberg et al., 2017).

It is emphasized that the explained variance ratio, which is an important indicator of construct validity, should be above 40% in multidimensional scales. A higher explained variance rate of the scale results in a stronger construct validity (Boateng et al., 2018; Finch, 2019). The variance explained in this study was over 50%, indicating that the construct validity was strong. The explained variance rate of this study was found to be higher than the rate of the original scale (Cederberg et al., 2017).

Explanatory factor analysis is used to determine under which subdimension the items of the scale will be placed. Although it is recommended to have a minimum factor load of 0.30 and above, it is emphasized that items below 0.30 should be removed from the scale (Finch, 2019). The factor loads of the items in the two subdimensions in the original form of the scale ranged from 0.44 to 0.89 (Cederberg et al., 2017). The results of the present study were similar to the factor loadings in the original scale and revealed a strong factor structure.

The majority of the literature on scale validity and reliability suggests that the structure revealed by explanatory factor analysis should be examined with confirmatory factor analysis (Brown, 2015; Xia & Yang, 2019). In this study, two subdimensions were formed, similar to the original scale. The confirmatory factor analysis determined that the root mean square error of approximation (RMSEA) value was 0.062. In addition, the chi-square value divided by the degrees of freedom (X^2/df) was 4.145. In addition, the fit indices were compatible with the values suggested in the literature. In the current literature, model fit indices greater than 0.90 are accepted as an indication of a good fit. In addition, it is emphasized that the X^2/df value should be less than 5 and the RMSEA value should be less than 0.08 (Brown, 2015; Marsh et al., 2020). The CFA results in this study were found to be compatible with the criteria specified in the literature. Because the CFA results were not presented in the study in which the original scale was developed, a comparison could not be made (Cederberg et al., 2017).

The α coefficient, which should be close to 1 in scale studies, evaluates whether the items measure the same feature. In addition, it reveals whether the items are related to the subject to be measured or not. The literature recommends this value to be between 0.60 and 1.00 (Nunnally & Bernstein, 2010). In this study, the α values of the total and sub-dimensions of the scale were greater than 0.70. The items adequately measured the issue of pain flexibility in children and had high reliability. In the original study of the scale, α values were found to be greater than 0.80 (Cederberg et al., 2017). This result shows that the scale is similar to its original structure and has a strong internal consistency.

In the split-half analysis, one of the analyses showing the reliability level of the scale, the coefficients are expected to be more than 0.70 (Chakrabartty & Nath Chakrabartty, 2013; Nunnally & Bernstein, 2010). The coefficients in this study were more than 0.70, indicating a strong and significant relationship between the two halves. Because the results of split-half analysis were not presented in the original study, the results of the two studies could not be (Cederberg et al., 2017).

Response bias is an important factor affecting the reliability of the scale. No response bias should be expected in a scale study. If individuals who fill out the response bias scale answer the scale according to their own opinions, the reliability of the scale is negatively affected (Çapık et al., 2018; Nunnally & Bernstein, 2010). In this study, no response bias in the scale was detected as a result of Hotelling's *t*-test.

Table 5
Test-Retest Score Mean Obtained from the Scale and their Comparison (n = 42).

Scales	Scale Score Mean		Analysis Results			
	First Implementation X ± SD	Second Implementation X ± SD	r	p	t	p
Pain Flexibility Scale	65.53 ± 11.54	64.45 ± 10.28	0.93	<0.001	0.52	0.614

To prove whether the items in the scale measure the variable to be measured, it is recommended to perform an item-total score analysis. Thus, the relationship between the scores obtained from the scale items and the total score of the scale is explained (Jonhson & Christensen, 2014). The acceptable value is greater than 0.20. However, it is expected to be as close to 1 as possible and in a positive direction (Jonhson & Christensen, 2014). In this study, the values were greater than 0.20, and there was a positive relationship. Because Pearson's correlation analysis results were not presented in the original scale study, a comparison could not be made (Cederberg et al., 2017).

Even if the test–retest correlation coefficient is satisfactory, it is advised that the mean and standard deviations of the two measurement results be studied and that both measurement findings be identical (Noble et al., 2019). When the "*t*-test in dependent groups" was used to assess if there was a statistically significant difference between the mean scores in the application when completed with 4-week intervals, no statistically significant difference was observed between the mean scores ($p > 0.05$) (Table 5).

Although the overall scores of the individuals may not differ significantly, they might answer each item differently. Thus, the uniformity of the materials in both applications must be considered (Noble et al., 2019). In assessing the association between the first and second application scores of each item, the test–retest reliability coefficients of the scale items were statistically significant ($p = 0.000$). The scale items yielded identical results in both assessments, demonstrating that the expressions were clear and consistent.

Practice implications

tTo achieve psychological acceptance of pain, it is necessary to first determine pain flexibility. In Turkey, a scale to assess the acute pain acceptance in children with cancer is now available, allowing researchers to investigate acceptance as a therapy change mechanism in this setting. We believe that this scale is a critical step in the development of acceptance-based psychological therapy that can help people feel better.

Limitations

Despite several strengths, this study had certain limitations. The first limitation of this study was that children who had all cancer types and diagnosis times were included in the study. The second limitation was the use of random sampling method in sample selection, and this could have affected the generalizability of the study. This study was conducted with children aged 7 to 18 years, as in the original scale. Therefore, it cannot be used in children aged 0 to 6 years.

Conclusion

This study results support that the Pain Flexibility Scale for children is a valid and reliable measurement tool for evaluating acute pain in children with cancer for the Turkish sample. The Pain Flexibility Scale can be used to determine the psychological acceptance of acute pain. In addition, cross-cultural comparative studies can be planned using scales.

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Contributors' statement

All the authors contributed to the concept and design, acquisition and interpretation of data, drafting the article and gave final approval of the version to be published.

Conflicts of Interests

The authors have no funding or conflicts of interest to disclose. The authors have no conflicts of interest to disclose.

CRediT authorship contribution statement

Murat Bektas: Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. **Aslı Akdeniz Kudubes:** Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

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