# The reliability and validity of the Turkish version of the brief pain inventory-short form in patients with cancer pain

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*ABSTRACT*

**Objectives:** The aim of this study was to evaluate the reliability and validity of the Turkish version of the Brief Pain Inventory (BPI-TR) in patients with cancer pain.

**Patients and methods:** The study included 130 patients (70 females, 60 males; mean age: 56.1±13.3 years; range, 18 to 87 years) diagnosed with any type and stage of cancer between April 2017 and March 2018. Brief Pain Inventory, Pain Disability Index, EORTC QLQ C30 and Pain Management Index were used to collect data. The reliability of the scale was tested with "internal consistency" and its validity with "construct validity". Cronbach's alpha values of >0.70 were accepted as the threshold for internal consistency. Construct validity was tested in the context of structural validity with factor analysis and also tested in terms of convergent construct validity by investigating its correlation with the Pain Disability Index (PDI) and the European Organization for Research and Treatment of Cancer Quality of Life Questionnaire Core 30 (EORTC QLQ-C30).

**Results:** The internal consistency of pain severity and pain-related interference was found as 0.91 and 0.95, respectively. The alpha coefficient was found to be between 0.795 and 0.873 for the pain severity index and between 0.729 and 0.861 for the pain-related interference index. There was a clear link between the BPI-TR pain severity index and the ninth question in the EORTC QLQ-C30 (rho=0.66, p<0.05). The association between the BPI-TR interference index and the 19th question in the EORTC QLQ-C30 was also strong (rho=0.77, p<0.05). The correlation between the BPI-TR interference index and the PDI was found to be moderate (rho=0.50, p<0.05).

**Conclusion:** The BPI-TR was found to be a reliable and legitimate tool to evaluate cancer pain in the Turkish population.

*Keywords:* Cancer pain, disability evaluation, pain management, pain measurement.

Pain is a severe condition that is commonly seen in cancer patients[1] with moderate to severe pain being estimated to be 38% prevalent. The prevalence of cancer pain in advanced metastatic and end-stage disease is 64%.[2] The World Health Organization (WHO) reported in 2012 that there were 14.1 million new cancer cases, 8.2 million cancer deaths, and 32.6 million cancer patients diagnosed in the previous five years worldwide.[3] In 2014, the cancer incidence rate in Türkiye was 210.2 per 100,000 people annually, with 163,417 new cancer cases diagnosed yearly.[4] Uncontrolled pain in cancer patients can affect daily activities, life quality, and mental function, as well as cause the treatment to be interrupted or stopped. Inadequate pain assessment is a major problem in the effective management of cancer pain.[5,6] Standardized

and validated scales are highly useful in measuring cancer pain. Cancer pain assessment should include pain intensity as well as pain impact on physical activity, sleep, emotional status, recreational and social activities. In 1994, Cleeland et al.[7] developed the Brief Pain Inventory (BPI) to facilitate communication between patients and health practitioners. The BPI Short Form (BPI-SF) evaluates the severity of pain and its functional impact. The BPI-SF is a simple, rapid, and time-efficient scale. The original English version was translated into numerous languages and approved for use in a variety of conditions including nociceptive, neuropathic, and postoperative pain.[7-19] The Turkish version of the Brief Pain Inventory (BPI-TR) has been validated for "musculoskeletal pain".[20]

One of the challenges in providing adequate relief for cancer pain originating from the head, neck, thorax, abdomen, and musculoskeletal system is the lack of validated scales that can accurately evaluate chronic pain. If cancer-related pain is to be treated, data on the prevalence, severity, and impact of pain on quality of life (QoL) and treatment efficacy must be obtained and monitored using validated questionnaires. The aim of this study was to evaluate the reliability and validity of the BPI-TR in Turkish patients suffering from cancer pain.

## PATIENTS AND METHODS

### Subjects

The observational study was conducted in both outpatients and inpatients who were diagnosed with any type and stage of cancer and were consulted to us for pain management by oncology, hematology, radiation oncology, and surgical clinics between April 2017 and March 2018. Two hundred twenty-eight patients visited our clinic. A total of 45 patients with a history of surgery, radiation therapy, or chemotherapy within the previous month, severe psychiatric disorder, cognitive impairment, substance abuse, insufficient Turkish knowledge, pregnancy, or lactating women were all excluded. Twenty-eight patients refused to participate in the study, two preferred invasive pain treatment, and 19 were unable to complete the questionnaires. Sample size was calculated a 10: 1 respondent-to-item ratio which proposed by Nunnaly.[21] The BPI-TR has 10 items, and 110 (11×10) participants should be included. Accordingly, 130 patients (70 females, 60 males; mean age: 56.1±13.3 years; range, 18 to 87 years) were deemed sufficient and included in this study.

### Evaluation criteria

The BPI-SF is a two-factor tool that assesses "pain severity and pain interference". The pain severity factor consists of four items that require patients to measure the severity of their current pain on a scale of 0 to 10 in order to capture the worst, average, and least pain intensity they feel in the previous 24 h. The number "0" indicates "no pain" while "10" indicates "the worst pain imaginable". The pain interference factor involves nine items that require patients to assess "the impact of pain on mood, sleep, working, walking, relationships with others and enjoyment of life". It has a type 0-10 scale with values ranging from 0 (does not interfere) to 10 (interferes completely).

"The Pain Management Index" (PMI) evaluates the relationship between the analgesics prescribed and the severity of pain indicated by the patient. The PMI is a conservative estimate of the treatment adequacy since it excludes the need for dose and patient compliance. In our study, we first determined the most potent analgesic level, and then we found the most severe pain score in the BPI-TR. We used the threshold values of pain severity identified by Serlin et al.[22] The PMI score ranged from (-3) to (+3) and was calculated by subtracting the pain level from the analgesic level. Negative PMI scores were thought to indicate insufficient analgesic drug recommendation, whereas positive PMI scores were thought to indicate appropriate pain treatment. The Pain Disability Index (PDI) is a brief scale that measures seven areas of daily living quality and any disabilities. It evaluates leisure activities, housework, social activities, occupational life, sexual activities, and personal care. It was designed to assess several types of pain and has been used in musculoskeletal pain and cancer pain.[23-25] Participants are asked to assess themselves from 0 (no disability) to 10 (worst disability) for each question. Uğurlu et al.[26] conducted a Turkish validity and reliability study of the PDI in patients with the chronic inflammatory rheumatic disease.

The European Organization for Research and Treatment of Cancer Quality of Life Questionnaire Core 30 (EORTC QLQ-C30) is a scale that primarily evaluates the impact of cancer and the QoL of cancer patients. The EORTC QLQ-C30 quality of life questionnaire includes functional scales, global QoL scale, and symptom scales. The EORTC QLQ-C30 has two sections focused on cancer pain. The ninth question of the EORTC QLQ-C30 evaluates pain intensity, while the 19th question evaluates the effect of pain on regular activities. In 2016,

Cankurtaran et al.[27] validated the Turkish version of the EORTC QLQ-C30 questionnaire for cancer patients.

The cancer type and stage, duration of diagnosis, treatment history, and pain characteristics of the patients were all noted. The patients were scored with the Eastern Cooperative Oncology Group (ECOG) performance score in terms of mobilization status. Patients were then classified according to their status of performance as good (ECOG score 0, 1) or poor (ECOG score 2, 3, 4).

Participants were asked to complete the BPI-TR, PMI, PDI, and EORTC QLQ-C30 tools.

### Statistical analyses

Descriptive analysis was used for demographic data, cancer, and cancer pain characteristics, pain severity, and pain-related interference dimensions of the BPI-TR. The statistical significance level was set at $p<0.05$. Psychometric evaluation was performed for reliability (internal consistency) and construct validity of the BPI-TR. The BPI-TR's factors were determined by the varimax rotation method using principal component analysis (PCA). An Eigenvalue greater than one was accepted as a threshold for factors' extraction. The variance percentage was stated by each factor, and the factor loads for each item were calculated. Cronbach's alpha values were calculated for both the pain severity and pain-related interference dimensions of the BPI-TR to assess reliability. Cronbach's alpha >0.70 was accepted as a threshold for internal consistency.[28]

The PCA was performed with varimax rotation (Kaiser normalization), and Spearman's correlation coefficient was used to assess construct-convergent validity. The Spearman correlations were utilized between the BPI-TR severity dimension and the ninth question of the EORTC QLQ-C30 3rd edition and between the BPI-TR pain-related interference dimension and the 19th question of the EORTC QLQ-C30. Between the BPI-TR interference dimension and the PDI, the Spearman correlation was calculated, and the BPI-TR dimensions were compared to the EORTC QLQ-C30 global health status/QoL and emotional status subgroups. The relationship of the BPI-TR dimensions with PMI and ECOG performance scale was performed with Spearman's correlation analysis.

### RESULTS

Demographic characteristics and clinical variables of the patients were given in Table 1. The five most common cancers were gastrointestinal cancers (17.9%), breast cancer (16.4%), lung cancer (13.4%), gynecological cancers (11%), and hematologic cancers (11.2%). Metastasis was found in 72.4% (n=97) of the patients. Analgesics prescriptions were classified according to the WHO analgesic ladder, and it was found that 32.9% (n=44) of the patients were at the third step, 56.7% (n=76) were at the second step and the rest were at the first step. According to the ECOG performance scale, 47.8% (n=64) patients were in good condition. The suitability of the treatment was evaluated by the PMI and 18.6% of the patients had a negative PMI. The duration of cancer diagnosis ranged from 1 to 150 months, with a mean duration of 29.3±31.2 months. The duration of cancer pain ranged from 1 to 49 months, with a

| TABLE 1 Demographic characteristics and clinical variables of the patients (n=130) | | | | |
|---|---|---|---|---|
| | n | % | Mean±SD | Min-Max |
| Age (year) | | | 56.1±13.3 | 18-87 |
| Disease duration (month) | | | 29.3±31.2 | 1-150 |
| Cancer pain duration (month) | | | 8±7.6 | 1-49 |
| Cancer type | | | | |
| Gastrointestinal | 24 | 17.9 | | |
| Breast | 22 | 16.4 | | |
| Lung | 18 | 13.4 | | |
| Gynecologic | 15 | 11.2 | | |
| Hematologic | 15 | 11.2 | | |
| Others | 40 | 29.9 | | |
| Cancer stage | | | | |
| 1 | 6 | 4.5 | | |
| 2 | 16 | 11.9 | | |
| 3 | 15 | 11.2 | | |
| 4 | 97 | 72.4 | | |
| Pain type | | | | |
| Visceral | 11 | 8.2 | | |
| Pure neuropathic | 6 | 4.5 | | |
| Pure pleuritic | 1 | 0.7 | | |
| Somatic | 35 | 26.1 | | |
| Nociceptive+neuropathic | 68 | 50.8 | | |
| Somatic+visceral | 13 | 9.7 | | |
| WHO analgesic ladder | | | | |
| 1 | 14 | 10.4 | | |
| 2 | 76 | 56.7 | | |
| 3 | 44 | 32.9 | | |
| ECOG | | | | |
| 0 | 17 | 12.7 | | |
| 1 | 47 | 35.1 | | |
| 2 | 21 | 15.7 | | |
| 3 | 39 | 29.1 | | |
| 4 | 10 | 7.4 | | |

SD: Standard deviation; WHO: World Health Organization; ECOG: Eastern Cooperative Oncology Group performance score.

**TABLE 2**
Descriptive statistics for each item of BPI-TR (n=130)

| Items | Mean±SD | CI* | Median | Range | % Floor | % Ceiling |
|---|---|---|---|---|---|---|
| Worst pain | 5.9±2.6 | 5.4-6.3 | 6 | 0-10 | 2.2 | 8.2 |
| Average pain | 2.3±2 | 1.9-2.7 | 2 | 0-10 | 18.7 | 1.5 |
| Least pain | 4.2±2.3 | 3.8-4.6 | 4 | 0-10 | 4.5 | 1.5 |
| Pain right now | 3.3±2.9 | 2.7-3.8 | 3 | 0-10 | 20.1 | 4.5 |
| Activity | 5.3±3.2 | 4.8-6 | 6 | 0-10 | 8.2 | 10.4 |
| Emotional activity | 4.7±3.4 | 4-5.2 | 5 | 0-10 | 16.4 | 11.2 |
| Walking | 4.5±3.6 | 3.8-5 | 5 | 0-10 | 22.4 | 11.2 |
| Work | 5.3±3.6 | 4.7-5.9 | 5 | 0-10 | 11.2 | 19.4 |
| Relationships | 4.2±3.5 | 3.6-4.8 | 6 | 0-10 | 26.1 | 8.2 |
| Sleeping | 4.6±3.3 | 4.1-5.2 | 5 | 0-10 | 15.7 | 9 |
| Enjoyment of life | 4.8±3.4 | 4.2-5.4 | 5 | 0-10 | 11.9 | 11.9 |
| Sum of severity scores | 15.7±8.9 | 14.2-17.3 | 15 | 0-40 | 2.2 | 1.5 |
| Sum of interference scores | 33.4±21.1 | 30-37.1 | 35 | 0-70 | 3.7 | 0.7 |

BPI-TR: Turkish version of the Brief Pain Inventory; SD: Standard deviation: CI: Confidence interval.

mean duration of 8±7.6 months. The patients had a history of chemotherapy, radiotherapy and cancer surgery in 84% (n=113), 52.2% (n=70), and 58.2% (n=78), respectively (Table 1). Table 2 shows the descriptive statistics for each item on the BPI-TR and the sum of the pain severity and pain-related interference dimensions of the BPI-TR.

### Item reliability-internal consistency

Internal consistency was found to be 0.91 and 0.95 for pain severity and pain-related interference dimensions of the BPI-TR, respectively. When an item was deleted, the alpha coefficients changed from 0.89 to 0.90 for the pain severity dimension 0.94 for all the pain-related interference dimension of the BPI-TR. Cronbach's alpha coefficients are shown in Table 3.

**TABLE 3**
Internal consistency of the BPI-TR

| Pain severity items (α=0.91) | | Pain interference items (α=0.95) | |
|---|---|---|---|
| Worst | 0.90 | Activity | 0.94 |
| Average | 0.90 | Mood | 0.94 |
| Least pain | 0.90 | Walking | 0.94 |
| Right now | 0.89 | Work | 0.94 |
| | | Relationships | 0.94 |
| | | Sleeping | 0.94 |
| | | Enjoyment of life | 0.94 |

### Construct validity-factor analysis

The 2-factor eigenvalues of the pain severity and pain-related interference indexes were 7.7 and 1.2, respectively. The total variance was found to be 78.4%. The alpha coefficient was found to be between 0.795 and 0.873 for the pain severity index and between 0.729 and 0.861 for the pain-related interference index. Factor loadings of 11 items of the BPI-TR are shown in Table 4.

**TABLE 4**
Factor loadings of the factor analysis of the BPI-TR items rotated factor matrix

| Items | Factor analysis | |
|---|---|---|
| | Factor 1: Pain interference | Factor 2: Pain severity |
| Worst pain | 0.375 | 0.873 |
| Average pain | | 0.849 |
| Least pain | 0.367 | 0.821 |
| Pain right now | | 0.795 |
| General activity | 0.742 | 0.428 |
| Mood | 0.811 | |
| Walking | 0.837 | 0.359 |
| Work | 0.858 | |
| Relation with others | 0.861 | |
| Sleeping | 0.729 | 0.482 |
| Enjoyment of life | 0.749 | 0.428 |

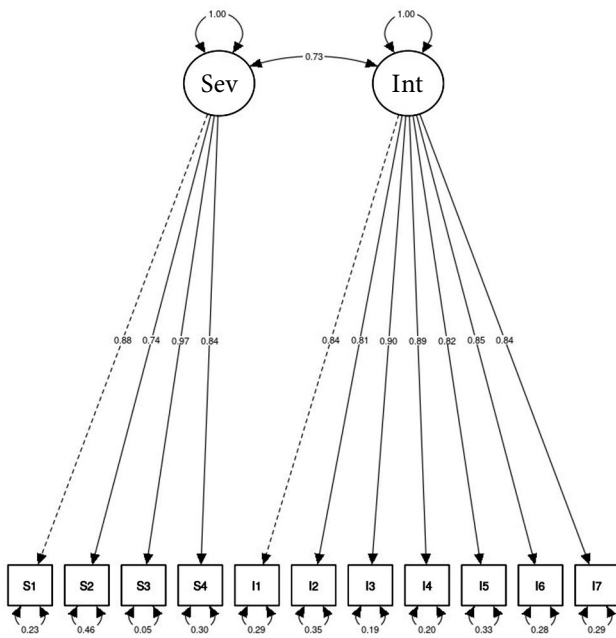BPI-TR: Turkish version of the Brief Pain Inventory.

**Figure 1.** The path diagram of the confirmatory analysis.
Sev: Pain severity; Int: Pain interference.

**Confirmatory factor analysis**

The compliance of the BPI-TR with the 2-factor structure was tested by confirmatory factor analysis. The chi-square statistics ratio to the degree of "freedom ($\chi^2/df$)", the comparative fit index (CFI), the Tucker-Lewis index (TLI), and the root mean the square error of approximation (RMSEA) were calculated. The standardized root mean square residual (SRMR) indices were used to calculate the difference between the observed correlation and the model implied correlation matrix. As a result of the analysis, it was observed that the model fit indices gave satisfactory results. The path diagram of the confirmatory analysis is shown in Figure 1.

$\chi^2/df = 3.83$, CFI = 0.91. TLI = 0.89, RMSEA = 0.15 (0.13-0.17) and SRMR = 0.052.

**Convergent construct validity**

A strong correlation was found between BPI-TR "pain severity index" and the ninth question of "EORTC QLQ-C30" (S-9: Did you have pain?) (rho=0.66, p<0.05). Furthermore, there was a strong correlation between the BPI-TR pain-related interference index and the 19th question of the EORTC QLQ-C30 (Q-19: "Did pain interfere with your daily activities?") (rho=0.77, p<0.05). The correlation between the BPI-TR interference index and the PDI was calculated to be moderate (rho=0.50, p<0.05) (Table 5). In addition, both the pain-related interference and the pain severity dimensions of the BPI-TR were found to be positively correlated with ECOG performance status and negatively correlated with the PMI, global health status/QoL, and emotional status domains of the QLQ-C30 (Table 5).

## DISCUSSION

Insufficient pain evaluation is an important problem in cancer pain management. The SF of BPI was developed to assess pain prevalence and pain characteristics, and it has been translated into several languages. It is a common and widely used questionnaire in various pain conditions.

The internal consistency of the BPI-TR demonstrated that it was a reliable scale. When an item from the scale was deleted, the alpha coefficients once again showed good internal consistency. This suggested that each of the items would make a similar contribution to the underlying construction to be measured.

| **TABLE 5** Spearman correlation coefficient (rho) analysis of BPI with other functional parameters | | |
|---|---|---|
| | Correlation coefficients (r) | |
| Tools | BPI-pain severity | BPI-pain interference |
| QLQ C30 pain intensity | 0.66* | 0.77* |
| QLQ C30 pain interference | 0.66* | 0.77* |
| Pain disability index | 0.54* | 0.50* |
| QLQ C30 Quality of life | -0.49* | -0.68* |
| QLQ C30 Emotional function | -0.62* | -0.67* |
| BPI-TR: Turkish version of the Brief Pain Inventory; QLQ C30: Quality of Life Questionnaire; * p=0.01. | | |

In other versions of the BPI-SF factor analysis, there were two interpretable factors that were consistently produced as pain severity and pain-related interference dimensions. In our study, the BPI-TR had a two-factor model, which is consistent with the literature.[14,16,17,29,30] A few research stated a three-factor structure of pain severity, activity, and mood interference.[9,31] The differences between factor models might be attributed to conceptual changes in words during the translation process (cross-cultural adaptation).

In convergent construct validity, pain-related interference and pain severity dimensions of the BPI-TR were compared with pain items (questions 9 and 19) of the EORTC QLQ-C30 and this comparison demonstrated a strong correlation. Also, validation studies from Norway and Poland had shown to correlate BPI-SF with the pain items of QLQ-C30 in cancer patients with pain.[9,29]

The WHO recommends using PMI to assess the sufficiency of pain treatment in cancer patients. In the meta-analysis of 20 studies published between 2007 and 2013, the rate of insufficient cancer pain management varied between 4% and 68%. Furthermore, inadequate relief in pain management has been associated with flawed choices in choosing the correct analgesia.[32] In our study, we questioned pain severity and effects with the BPI-TR and only 18.6% of the cancer patients had a negative PMI, which is less than the literature. Also, the negative correlation of the BPI-TR with PMI was shown. We evaluated the pain and its effects with the BPI-TR. The BPI-TR, which evaluates pain and pain-related effects in a brief but comprehensive manner, allows physicians and patients to better focus on pain characteristics and management. This is the major reason to use the scale in cancer patients since cancer patients can be impatient and vulnerable in filling out long questionnaires in outpatient clinics.

In our study, it has been shown that there was a positive correlation between both dimensions of the BPI-TR and global health status/QoL, and the emotional status subgroup of QLQ C30. Subsequently, the BPI-TR could be considered an appropriate and sufficient tool for measuring the impact of pain on QoL in cancer patients. Moreover, a previous study from Germany showed that both the pain severity and pain-related interference dimensions in the BPI-SF had a good correlation with the Short Form 36 (SF-36) in patients with cancer-related pain.[16] Several other

studies demonstrated that severe pain in cancer patients was strongly related to depression[15,33-35] and low QoL.[29,33,36,37]

The BPI-SF is superior to the EORTC QLQ-C30 in the measurement of pain on a more distinct scale and in the assessment of pain severity as present and as normal, worst, and least pain for the preceding day. In addition, the BPI-SF complements the EORTC QLQ-C30 in the evaluation of pain in many areas of the function.[9]

The ECOG performance status, which was developed specifically for cancer patients and can be scored with a short clinical observation, was correlated with both components of the BPI-TR. The correlation between the clinician's objective scoring and the patient's subjective pain severity and effects of pain supports the use of BPI-TR in clinical practice for cancer pain. Studies in the literature with similar performance scale correlation results for the BPI-SF to our study have strengthened the validation of the inventory.[16,29]

The study's strengths were that several outcome measures were used to validate the BPI-TR in cancer patients, and there was no missing data since the patients filled out the questionnaires under supervision.

The limitation of our study was the cross-sectional design. A prospective study design of the BPI-TR can provide more insight into the usefulness of cancer pain management dynamically and its suitability in follow-up periods.

In conclusion, the BPI-TR is a useful and valid scale for measuring pain in cancer patients in the Turkish population. We believe that the BPI-TR will assist clinicians and researchers in evaluating cancer pain, planning appropriate treatment, and determining efficacy as it accurately evaluates pain severity and pain-related situations.

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