

Shoulder Pain and Disability Index: a validation study in Turkish women

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ABSTRACT

Introduction: The Shoulder Pain and Disability Index (SPADI) is a valid and reliable questionnaire used in shoulder disorders. The purpose of this study was to test the convergent validity and the reliability of the SPADI.

Methods: A total of 101 female patients with shoulder pain were enrolled in the study. The SPADI and the Health Assessment Questionnaire (HAQ) were completed by all the participants. Pain was measured using the Visual Analogue Scale (VAS) during the active range of motion. Reliability was measured by internal consistency and test-retest reliability. Internal consistency was determined by calculating Cronbach's alpha value. Convergent validity was examined by correlating the SPADI questionnaire with the VAS and HAQ scales.

Results: Cronbach's alpha value for the SPADI was found to be 0.94. Test-retest reliability of the SPADI was found to be high (0.92). The correlation coefficient for convergent validity of the SPADI was 0.65 and 0.67 for the VAS and HAQ overall scores, respectively.

Conclusion: The results of the present study suggest that the SPADI is a valid and reliable instrument to assess shoulder pain in Turkish female patients.

Keywords: disability, functional status, reliability, shoulder pain, validity

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INTRODUCTION

Shoulder disorders are still one of the major health problems in clinical practice, and shoulder pain is the third most common type of musculoskeletal pain after spinal and knee pain.^(1,2) The annual prevalence of shoulder pain accompanied by disability in the general population is approximately 20%, with the rates increasing among the elderly, according to several epidemiological studies.⁽³⁻⁵⁾

The quantification of pain is necessary not only for the evaluation of novel therapies, but also for the evaluation of outcome measures of impairment and disability.⁽⁶⁾ There is increasing interest in questionnaires or functional measurements among investigators with regard to the ability of these tools to measure the impact of a disease on the performance of daily activities.⁽⁷⁾ Region-specific questionnaires usually focus on specific areas of the body and on domains related to what are being measured compared to the generic ones, which usually evaluate general health and wellness.⁽⁸⁾ In the past decades, the function of the shoulder has been assessed by conventional methods, such as muscle strength and range of motion. However, questionnaires specific to shoulder region are more often used in recent years to evaluate the level of disability and the efficacy of treatment.⁽⁹⁾ There are several valid and reliable shoulder disability questionnaires that have been developed in the English-speaking countries, which were then translated into other languages, such as the Disability of Arm, Shoulder and Hand Questionnaire (DASH),⁽¹⁰⁾ Shoulder Rating Questionnaire,⁽¹¹⁾ Shoulder Pain and Disability Index (SPADI),⁽¹²⁾ Western Ontario Rotator Cuff Index (WORC),⁽¹³⁾ Rotator Cuff Quality of Life Measure,⁽¹⁴⁾ Oxford Shoulder Scale,⁽¹⁵⁾ and the Dutch version of the Shoulder Disability Questionnaire.⁽¹⁶⁾ DASH has been most extensively studied and has received the best ratings for its clinometric properties.⁽⁹⁾ Nevertheless, this questionnaire was not specifically developed for the shoulder region.^(10,17)

SPADI was developed by Roach et al, and has been found to be the quickest (within five minutes) and easiest to complete, as well as being more responsive to change.^(12,18) SPADI has been used in various validation studies. Besides the original English version, the German and Slovene versions of this instrument have also been validated.^(19,20) SPADI has also been translated and cross-culturally adapted into the Turkish language.⁽²¹⁾ Generally, validity is established by correlating either the SPADI scores with generic questionnaires using Short Form 36 (SF-36) and Sickness Impact Profile (SIP), or another shoulder-specific instrument (e.g. DASH), and is defined as the convergent validity.^(19,21,22) However, the Health Assessment Questionnaire (HAQ) and the Visual

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Analogue Scale (VAS) have been used less frequently in validation studies of the SPADI. The original HAQ is one of the main instruments to assess the upper and lower extremity physical functions in musculoskeletal disorders. The HAQ was developed to evaluate the global physical function in patients with rheumatoid arthritis.⁽²³⁾ The VAS is also a common instrument used worldwide with tested validity and reliability.⁽²⁴⁾ The aim of this study was to investigate the relationship between the SPADI questionnaire and the VAS and HAQ scales in terms of the convergent validity, as well as to test the reliability of the SPADI by calculating its internal consistency and test-retest reliability.

METHODS

Data were initially obtained from 108 consecutive patients (age ≥ 18 years) with shoulder pain lasting for at least one week, who directly applied or were referred to the outpatient clinic of the Physical Medicine and Rehabilitation Department of Mersin University Hospital over a period of six months. However, at the end of the data collection period, there were only seven male patients compared to 101 female patients. Therefore, the data of the male patients were excluded from the statistical analyses, as it would not be statistically conceivable to include them in the analysis, especially when making gender comparisons. The study was performed in accordance with the principles of the Declaration of Helsinki and approved by the ethics committee of the hospital. Written, signed and informed consent was obtained from all the participants.

Patients were excluded from the study if they had other major diseases causing disability, impairments in the cervical spine, elbow and/or hand affecting the shoulder function, a history of inflammatory arthritis, polymyalgia rheumatica or gross structural or neurological abnormalities, previous fracture or surgery to the shoulder, upper limb, neck or thorax, shoulder instability and dislocation, referred pain from the neck and internal organs, a regional tumour and metastasis, and if they were pregnant or breastfeeding. None of the patients were immigrants, and patients who were cognitively impaired, illiterate, or did not have a sufficient mastery of the Turkish language to complete the questionnaires independently were also excluded from the study group.

Following the interview, all the patients completed a form that described their demographic and clinical characteristics. Careful medical history-taking and physical examination that were specific to the shoulder region were carried out by the same clinician. Routine biochemical tests, including glucose, transaminases,

Table 1. Demographic and clinical characteristics of the patients (n = 101).

Characteristic	Mean \pm SD (range)
Age (yrs)	53.10 \pm 8.52 (38–75)
Duration of pain (mths)	17.34 \pm 27.13 (1–120)
VAS score (range 0–10)	
VAS score at rest	3.83 \pm 2.25 (0–8)
VAS score during AROM	6.71 \pm 1.71 (3–10)
SPADI total score (range 0–130)	85.63 \pm 19.06 (32–124)
HAQ total score (range 0–3)	1.23 \pm 0.67 (0–3)

SD: standard deviation; VAS: visual analogue scale; AROM: active range of motion; SPADI: Shoulder Pain and Disability Index; HAQ: Health Assessment Questionnaire

urea, creatinine, erythrocyte sedimentation rate, C-reactive protein, urinalysis and appropriate plain radiographs, were performed in all the participants for differential diagnosis. Shoulder ultrasonography and magnetic resonance imaging were also conducted, where required. At the end of the physical examination, patients were asked to fill the questionnaires pertaining to pain and disability under the supervision of the investigators at the hospital. Strict instructions were given to patients to complete the questionnaires without external help after reading the instructions. The participants were either prescribed medication or referred to the physiotherapy unit of the hospital for rehabilitation after the final evaluation.

Pain was evaluated during the active range of motion (AROM) using VAS.⁽²⁴⁾ Patients were asked to rate their pain intensity on a 10-cm straight line. The VAS score was anchored at 'no pain' (0 cm) and 'most intense pain imaginable' (10 cm). The SPADI consists of two dimensions (pain and disability) with a total of 13 questions.⁽¹²⁾ The pain dimension consists of five questions pertaining to the severity of an individual's pain. Disability was assessed with eight questions designed to measure the degree of difficulty an individual has with various activities of daily living requiring the use of the upper extremities. To answer the questions, the patients placed a mark on a 10-cm VAS for each question. Verbal anchors for the pain dimension were 'no pain at all' and 'worst pain imaginable' and those for the disability dimension were 'no difficulty' and 'so difficult it requires help'. Scores from both dimensions were then averaged to derive a total percentage score. Higher scores reflected more pain and greater disability.

The HAQ is one of the main instruments to assess the physical functioning with aspects of general health in musculoskeletal disorders.⁽²³⁾ The HAQ scale contains

Table II. Categorical characteristics of the patients (n = 101).

Characteristic	No. (%)
Diagnosis by physician	
Adhesive capsulitis	59 (58.4)
Rotator cuff/biceps tendinitis	27 (26.7)
Rotator cuff tear	2 (1.9)
Myofascial, osteoarthritis, bursitis	13 (12.8)
Education*	
Elementary	53 (52.0)
Mid school	9 (8.8)
High school	20 (19.6)
University	18 (17.6)
Occupation*	
Housewife	73 (73.0)
Working	3 (3.0)
Retired	24 (24.0)
Smoking	
None	80 (79.2)
Smoker	17 (16.8)
Ex-smoker	4 (4.0)
Involvement side*	
Right	47 (47.0)
Left	50 (50.0)
Bilateral	3 (3.0)
Comorbidities	
Hypertension	23 (22.7)
Diabetes mellitus	15 (14.8)
Hyperthyroidism	13 (12.8)
Heart failure	3 (2.9)
Other	6 (5.9)
None	41 (40.6)

* Data is missing in one patient.

20 questions divided into eight domains: dressing and grooming, arising, eating, walking, hygiene, reach, grip and activities. The response categories vary from 'without any difficulty' (score 0) to 'unable to do' (score 3). The highest score in each domain determines the score for that domain in the questionnaire. The index was calculated by summing up the item score in each of the eight domains and dividing the sum by 8, yielding a score of 0–3. The original HAQ was validated and adapted to the Turkish population.⁽²⁵⁾

All statistical analyses were performed using the Statistical Package for the Social Sciences version 13.0 for windows (SPSS Inc, Chicago, IL, USA). A p-value < 0.05 was considered statistically significant. Descriptive statistics was reported as mean \pm standard deviation (SD) for the demographic and clinical characteristics of the study group. Reliability determines whether the questionnaire is able to measure in a consistent and reproducible way, and refers to the extent to which the measured variance in a score reflects the true score.^(8,26) In this study, the reliability of the SPADI was tested by internal consistency and test-retest reliability.

Internal consistency is the ability of a scale to

measure a single coherent concept.⁽²⁷⁾ It was assessed by calculating Cronbach's coefficient alpha value. A value of 0.7 was assessed as the lower limit and a value of 0.8 represented a good value. A value of 0.8–0.95 was regarded as excellent.⁽²⁸⁾ We also tested the internal consistency by correlating the individual item scores to the total score, defined as item-total correlation. The item-total correlation of SPADI was calculated by Spearman correlation coefficient. A correlation of at least 0.4 was assumed as the standard for supporting scale internal consistency.⁽²⁹⁾ The test-retest reliability, which is a measure of stability or reproducibility, shows the capability of a scale to give the same result when administered on separate occasions.⁽²⁷⁾ The test-retest reliability of the SPADI was measured by using intraclass correlation coefficient (ICC). In this study, 60 randomly selected patients completed the SPADI twice within a time interval of 5–7 days before the final evaluation of the patients. Values of ICC vary from 0 (no stability) to 1 (perfect stability).

In the absence of a true "gold standard" against which to assess the criterion validity of the SPADI,⁽²⁶⁾ we compared the SPADI questionnaire with external measures to reflect the impact of shoulder pain. Convergent validity is concerned with the extent to which a particular measure relates to other measures, with theoretically derived hypotheses for the constructs that are being measured.⁽²⁸⁾ To test the convergent validity, correlations between the SPADI questionnaire and the VAS scores, the total score of the HAQ scale were measured. The Spearman correlation coefficient was used to test the convergent validity of the SPADI scale. Correlation values ≥ 0.4 were considered satisfactory ($r \geq 0.81$ –1.0 was considered excellent, 0.61–0.80 very good, 0.41–0.60 good, 0.21–0.40 fair and 0.00–0.20 poor).

RESULTS

The main demographic and clinical characteristics of the patients and their categorical characteristics are presented in Table I and Table II, respectively. Acceptability of the SPADI was satisfactory, with a completion time of about five minutes. Item 13 (removing something from the back pocket) had the least respondents (22%) due to the fact that women usually do not carry something in their back pants pocket in Turkey.

The Cronbach's alpha value for SPADI total score was 0.94. The item-total correlations of the SPADI varied at 0.63–0.85, and all items in the SPADI were moderately to highly correlated with the total score (Table III). Both findings indicated good internal consistency of the questionnaire. The ICC for the SPADI was 0.92,

Table III. Correlations between each item on the shoulder pain and disability index (SPADI) questionnaire and the sum score of the SPADI (n = 101).

Question	ITC ^a	p-value
How severe is your pain:		
01 At its worst	0.65	< 0.001
02 When lying on the involved side	0.64	< 0.001
03 Reaching for something on a high shelf	0.82	< 0.001
04 Touching the back of your neck	0.83	< 0.001
05 Pushing with the involved side	0.83	< 0.001
How much difficulty do you have:		
06 Washing your hair	0.82	< 0.001
07 Washing your back	0.83	< 0.001
08 Putting on an undershirt or pullover sweater	0.85	< 0.001
09 Putting on a shirt which has buttons down the front	0.77	< 0.001
10 Putting on your pants	0.78	< 0.001
11 Placing an object on a high shelf	0.86	< 0.001
12 Carrying a heavy object of 5 kg	0.63	< 0.001
13* Removing something from the back pocket	0.77	< 0.001

^a Derived by Spearman's correlation coefficients.

*The total number of responses is less than 101 due to missing values.

ITC: item-total correlation

which showed high reproducibility of the questionnaire. The convergent validity of the SPADI was tested by Spearman's correlation coefficients. The correlation coefficient between the SPADI and HAQ total score was good ($r = 0.67$), and this correlation was statistically significant ($p < 0.001$). Similarly, the correlation between the SPADI and VAS score during the AROM was very good ($r = 0.65$), and statistically significant ($p < 0.001$).

DISCUSSION

Among the musculoskeletal disorders, shoulder pain is a common cause of morbidity and disability in the general population.^(30,31) As most of the population suffers from shoulder pain and the prevalence of shoulder pain varies between 2%–26% in various countries,^(3,4,5,32,33) the functional measurement specific to shoulder region is essential for the Turkish population so as to evaluate the functional status or disability. Only the SPADI and WORC index, which was developed for rotator cuff diseases, are currently available in a validated Turkish version.^(22,34) The purpose of the present study was to test the convergent validity of the SPADI scale by correlating the questionnaire with the VAS and HAQ scales. Our findings demonstrated that the convergent validity of the SPADI is good, and that the SPADI questionnaire is a reliable instrument, as indicated by its internal consistency, item-total correlation and test-retest reliability. However, the absence of male patients in the study group is a major limitation and impedes the generalisability of our findings. Therefore, the findings of

this study should only be applicable to female patients. The vast majority of the patients did not answer item 13 (“How much difficulty do you have removing something from your back pocket?”) of the SPADI questionnaire, as the question was more applicable to male patients, as men, and not women, usually carry something (e.g. wallet) in their back pocket in Turkey. This finding concurs with a previous report in which the authors stated that the SPADI could be more applicable to male than female patients, as this question was biased toward male patients.⁽²²⁾ Therefore, special caution is warranted when considering item 13 of the SPADI questionnaire.

High internal consistency coefficient (0.94) and the test-retest reliability (0.92) values for SPADI in the present study yielded strong correlations that were consistent with previous reports. High coefficient alpha values (0.86–0.95) and moderate test-retest reliability (0.65) were found in the initial validation of the original SPADI questionnaire.⁽¹²⁾ MacDermid et al revalidated the SPADI questionnaire, and found a high coefficient alpha value (> 0.95) of the total SPADI score without reporting a test-retest reliability analysis.⁽³⁵⁾ Internal consistency was good (0.83), both in the Turkish and Slovene (0.92) validation studies, as was the case in our study.^(20,21) Angst et al also found a high coefficient alpha value (0.94) for the total SPADI score in the German validation of the SPADI.⁽¹⁹⁾ In contrast to previous reports, we did not analyse the subscales of the SPADI, and our study revealed a coefficient only for the SPADI total score. This is because the factor analyses with and without varimax

rotation revealed that the scale appeared to measure one construct and hence, the division between the two dimensions may not be warranted since the scale may not reflect the two separate dimensions.⁽²²⁾ Nevertheless, the lack of coefficient values for the subscales is another limitation of our study, as the SPADI is generally accepted as a bi-dimensional scale involving pain and disability. Thus, one can conclude that only a single coefficient alpha, which theoretically measures one construct, may be an inappropriate way of analysis.

The convergent validity was tested by comparing the SPADI score with the VAS and the HAQ overall scores. The correlation coefficients between the SPADI and VAS during AROM, and the overall HAQ scores were good. Similar results were found when compared to the data with the original and translated versions of the SPADI.^(19,20,21,35) However, in a German validation study, the authors found very high correlations between the SPADI total score, DASH total score ($r = 0.88$) and the American Shoulder and Elbow Surgeons (ASES) questionnaire score ($r = 0.92$), as compared to the SF-36 total score ($r = 0.69$). The authors stated that these findings were expected due to the differences in the constructs between condition-specific questionnaires such as DASH, SPADI and ASES, and generic questionnaires such as SF-36.⁽¹⁹⁾ The correlations between the SPADI scale and SF-36 were tested by the investigators in different settings, resulting in poor to high correlations.^(21,36)

Poor correlations have also been found between the SPADI and SIP scores involving work and recreation issues, and the authors also stated that the SPADI did not appear to adequately measure occupational and recreational disabilities.⁽²²⁾ These clinical trials suggest that SIP measurement may not be as sensitive to the disability experienced by patients who have shoulder-related problems. However, Angst et al claimed that specific instruments could not be cross-validated using generic questionnaires like SF-36, as the SF-36 scores do not correlate as well with the specific instruments, thus confirming that the SF-36 measures additional aspects of the physical health and provides more comprehensive information than the condition-specific questionnaires.⁽³⁷⁾ On the other hand, Urwin et al reported that the HAQ scale could be a useful general screening tool for identifying those with musculoskeletal disorders, although it is not the most appropriate tool to assess disability related to shoulder pain.⁽³⁸⁾ Currently, there is only one validation study in the literature where the convergent validity was determined by comparing the SPADI with the HAQ scale, and the authors found that the SPADI correlated substantially with the HAQ overall score ($r = 0.61$),⁽³⁹⁾

and this was consistent with our result. However, despite the good correlation, there is a major limitation in that the extent of the relationship between the subscales of the SPADI and the HAQ questionnaires is still unclear, as subscale correlations of the questionnaires were not analysed in this study.

Instruments measuring functional status should also reflect their psychometric properties.⁽⁸⁾ Since the SPADI concentrates more on restricted functional activities, limited information is available involving the psychometric properties of the SPADI. Previous reports revealed that depression was the strongest determinant of nonspecific shoulder pain in women, and it has been suggested that common musculoskeletal complaints without clinical findings may indicate adverse psychological factors and personality traits rather than the presence of an underlying pathologic condition.⁽³³⁾ The association between psychological factors, such as depression, anxiety, distress, related emotions, personality traits and pain or disability, is still yet to be investigated.

In conclusion, although it is difficult to draw definite conclusions due to the major limitations of the study, our findings concerning the SPADI questionnaire seem to support the results of previous studies, where the SPADI has been established as a reliable and valid measurement, and the SPADI scale, as a useful region-specific instrument in Turkish women having shoulder disorders. However, further reliability and validity trials with more heterogenic groups and using different questionnaires related to psychological status are essential in order to reveal the psychometric properties of the SPADI questionnaire.

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