UDK BROJEVI:
616.727.2-009.7(497.11)DOI: <https://doi.org/10.5937/ZZ1903005N>**VALIDACIJA SRPSKE VERZIJE UPITNIKA O BOLU I
OGRANIČENOJ POKRETLJIVOSTI RAMENA (SPADI)****VALIDATION OF SERBIAN SHOULDER PAIN AND DISABILITY
INDEX (SPADI)**Aleksandra Nikolić¹, Sonja Čejović², Milan Bjekić³, Sandra Šipetić Grujičić¹**SAŽETAK**

Uvod/Cilj: Indeks bola i ograničene pokretljivosti ramena (SPADI) se preporučuje i često koristi za merenje trenutnog bola i nesposobnosti u ambulantnom okruženju. Međutim, validnost i pouzdanost srpskog SPADI upitnika nisu do sada proučavani. Cilj ove studije je bio da se proceni pouzdanost i validnost SPADI upitnika na srpskom jeziku.

Metode: Istraživanje je sprovedeno kao panel studija na Institutu za ortopedsko hirurške bolesti „Banjica“ (IOHB) u Beogradu. Obuhvaćeno je 33 pacijenata sa sindromom bolnog ramena, koji su bili upućeni na pregled kod lekara na IOHB tokom 2016. i 2017. godine. Srpska verzija SPADI upitnika prevedena je u skladu sa međunarodnim smernicama. Unutrašnja validnost je procenjena određivanjem Cronbach-ovog alfa koeficijenta. Interklasni koeficijent korelacije (ICC) je primenjen za procenu test-retest pouzdanosti. Faktorska analiza je korišćena za ispitivanje konačne strukture upitnika.

Rezultati: SPADI upitnik ima odličan nivo unutrašnje konzistentnosti (Cronbach alfa = 0,946). Pouzdanost posle ponovnog testiranja SPADI upitnika bila je veoma visoka (ICC = 0,997). Pomoću eksploratorne faktorske analize izdvojen je jedan faktor koji objašnjava 50,1% varijanse.

Zaključak: Srpska verzija SPADI upitnika ima visok nivo unutrašnje konzistentnosti i pouzdanosti. Međutim, naši rezultati ukazuju da, iako konceptualno upitnik ima dva domena, naši ispitanici ne prave razliku između bola i ograničenosti pokreta, te se preporučuje samo upotreba ukupnog skora SPADI upitnika.

Ključne reči: *bolno rame, nesposobnost, SPADI, validnost, pouzdanost*

SUMMARY

Introduction/Aim: The Shoulder Pain and Disability Index (SPADI) is recommended and frequently used instrument for measuring current shoulder pain and disability in an outpatient setting. However, the validity and reliability of the Serbian SPADI are unknown. Aim of this study was to evaluate the reliability and validity of the Serbian version of SPADI.

Methods: The research was conducted as a panel study at the Institute for Orthopedic Surgery “Banjica” (IOSB) on 33 patients with shoulder pain syndrome who were referred to a physician at IOSB during 2016 and 2017. Cross-cultural adaptation was performed according to the international guidelines. Internal validity was assessed by determining the Cronbach’s alpha coefficient. Intraclass correlation coefficient (ICC) was used for test-retest reliability. Factor analysis was used to examine the structure of the questionnaire.

Results: The SPADI questionnaire in our sample had an adequate level of internal consistency (Cronbach alpha = 0.946). The test-retest reliability of the SPADI questionnaire was very high (ICC = 0.997). Using exploratory factor analysis, one factor solution explained 50,1% of the variance.

Conclusion: The Serbian version of SPADI questionnaire has a high level of internal consistency and the test-retest reliability but our results suggest that pain and disability, although distinguishable conceptually, may not be distinguished by patients. Since there was no support for separation into two dimensions we recommend the use of total SPADI score only as a measure of the impact impaired shoulder.

Keywords: *shoulder pain, disability, SPADI, validity, reliability*

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Introduction

Shoulder pain is a common and disabling medical problem. The pain and disability associated with shoulder pain can have a large impact on individuals leading to an inability to work or to carry out household and leisure-time activities. It is the third most common cause of musculoskeletal consultation in primary care, after back and knee (1). Prevalence figures differed from 6.9 to 26% for point prevalence, 18.6-31%, for 1-month prevalence, 4.7-46.7% for 1-year prevalence and 6.7-66.7% for lifetime prevalence (2). There are differences in case definitions, diagnostic procedures, and response rates that may be responsible for these large ranges.

The etiology of shoulder pain is diverse, and may be due to problems with the neck, glenohumeral joint, acromioclavicular joint, rotator cuff, or other soft tissues around the shoulder (3). Rotator cuff problems are the most common source of shoulder pain (3-5), accounting for more than two-thirds of cases (4). Recovery from shoulder pain can be slow. In a prospective study 25% of people with shoulder pain reported previous episodes, while many patients (41%) reported persistent symptoms one year after the initial presentation of their complaints to the general practitioner (6). According to Swedish study physiotherapy treatments accounted for 60% and the costs for sick leave contributed to 84% of the total costs of painful shoulder (7). Shoulder pain is widespread medical problem and presents a considerable burden on the affected person and the society.

Pain is the most common reason for consulting a practitioner, regardless of the disorder that caused shoulder pain (3). Treatment of shoulder pain is commonly aimed at pain reduction and improvement of functional disabilities (8). That's why outcome measurements should include an instrument (e.g. questionnaire) for the evaluation of functional disabilities (9). There are several self-administered shoulder pain and disability questionnaires. The Shoulder Pain and Disability Index (SPADI) was originally developed in English (10). It has been translated and validated in several languages and showed excellent reliability and responsiveness (11-13).

Serbian Shoulder Pain and Disability Index has not been validated and tested for reliability. Aim of this study was to evaluate the reliability and validity of the Serbian Shoulder Pain and Disability Index for patients with shoulder pain.

Methods

The research was conducted at the Institute for Orthopedic Surgery "Banjica" (IOSB) in Belgrade. The research was designed as a panel study. Thirty-three patients with shoulder pain syndrome who were referred to a physician at the Institute for Orthopedic Surgery Banjica in Belgrade during 2016 and 2017 were included in the study. The criteria for inclusion of the respondents in the study were: age 18-75 years, persons suffering from some shoulder pain entity for shorter or longer period, acute and chronic form of pain. Exclusion criteria were: patients with diabetes, malignant and autoimmune diseases, mental disorders and those who were not motivated to take part in the study.

This research was approved by the Ethics Committee of IOSB.

Final orthopedic diagnosis was made by clinical examination (medical history and physical examination, which also includes some specific tests), shoulder X-ray and ultrasound examination of the diseased region. In some cases, additional magnetic resonance imaging (MRI) and laboratory analyzes were performed.

Specific SPADI questionnaire was used to assess pain and disability (10). For the purpose of this paper, a Serbian version of the SPADI questionnaire was created (Appendix 1). Translation, cultural adaptation and validation of this specific questionnaire according to a standardized procedure were performed (14).

The original SPADI questionnaire was firstly translated from English into Serbian by two independent translators. By comparing their two translations and synthesizing them into one by a group of experts in Serbian, English, and specific medical issues, the consensus was made for the first Serbian version of the questionnaire. According to the algorithm, the first Serbian version of the questionnaire was then back translated by the other two independent translators who had not previously seen the original version of the questionnaire. The two translations obtained were compared to the original English version by a group of experts who formed the second Serbian version. Any inconsistencies were resolved. Terms and expressions that are common in everyday Serbian language were used. For better understanding, some expressions were adapted for the local population.

In order to test psychometric characteristics of Serbian version of SPADI question-

naire 33 respondents completed questionnaire two times within three days. In the meantime patients were not given any form of therapy that could affect their symptoms.

Shoulder Pain and Disability index – SPADI was developed to provide a self-administered instrument that would reflect the disability and pain associated with the clinical syndrome of painful shoulder (10). It consists of 13 items divided into two domains. The first domain is related to pain in the shoulder area, and the second one is about mobility or degree of activity limitation. The pain-related part consists of five questions in which the respondent subjectively rates their pain during the week from 0 to 10. The second part of the test consists of eight questions referring to subjective ability to perform individual daily activities, and are also rated 0 to 10. It takes 5-10 minutes for the SPADI questionnaire to be completed. A pain rating of «0» corresponds to «the absence of every possible pain» and «10» is «the strongest possible pain imaginable.» In the second part of the test, «0» corresponds to «no difficulties» in performing daily activities, and «10» is a measure of «absolutely difficult and necessary assistance» in performing them. The subscale scores were calculated by adding the item scores for that subscale and dividing this number by the maximum score possible for the items that were deemed applicable by the subject. This number was then multiplied by 100. Therefore, scores could theoretically range from 0 to 100 with higher scores indicating greater impairment. The total SPADI score was calculated by averaging the pain and disability subscale scores. Thus, the total SPADI score could also range from 0 to 100.

SPSS 21.0 (SPSS Inc., Chicago, IL, USA) was used for statistical data analysis. Internal consistency was assessed by determining the Cronbach's alpha coefficient. Satisfactory validity was present if the Cronbach's alpha coefficient is higher than 0.7 (15). Intraclass correlation coefficient (ICC) was used for test-retest reliability. By convention, reliability is satisfactory if $ICC > 0.7$ (16). Factor analysis was used to examine the internal structure of the questionnaire (17). Factor extraction was performed by principal component analysis with Varimax rotation. The Kaiser-Meyer-Olkin Measure and Bartlett's Test of Sphericity (18) were computed to determine whether the data were suitable for factor analysis. A varimax rotation method was used to obtain independent factors and an item was considered to be loaded on a factor if the matrix coefficient was 0.50 or larger. The dif-

ference was marked as significant if $p < 0.05$.

Results

Total of 33 respondents (28 men and 15 women) of average age 53.4 ± 11.1 were included in the validation of the questionnaire. The majority of subjects were diagnosed with rotator cuff syndrome (9), calcifying tendinitis of the shoulder (9), and adhesive capsulitis of the shoulder (6) (Table 1).

Table 1. Characteristics of patients included in the study

Characteristics	Number (%)
Sex	
Male	18 (54.5)
Female	15 (45.5)
Age ($\bar{x} \pm SD$)	53.4 ± 11.1
Diagnosis	
1. Tendinitis m.biceps brachii caput longum GH	1 (3.0)
2. Syndroma armillae rotatoriae	9 (27.3)
3. Tendinitis humeroscapularis calcificata	9 (27.3)
4. Capsulitis humeroscapularis adhesive	6 (18.2)
5. Luxatio articuli humeroscapularis	2 (6.1)
6. Contusio regionis deltoideae et brachii	1 (3.0)
7. Periarthritis humeroscapularis	1 (3.0)
8. Laesio traumatica tendinis musculi rotatoris articuli humeri	1 (3.0)
9. Arthrosis glenohumeralis incipiens	1 (3.0)
10. Bursitis regionis humeroscapularis	1 (3.0)
11. Arthralgia art. glenohumeralis	1 (3.0)

$\bar{x}$ - mean, SD-standard deviation

Internal consistency was assessed by determining the Cronbach's alpha coefficient. The SPADI questionnaire had high level of internal consistency (Cronbach alpha = 0.946). The "pain" domain (Cronbach alpha = 0.888) and the "disability" domain (Cronbach alpha = 0.917) had both an adequate level of internal consistency. The test-retest reliability of the SPADI was examined to determine whether the scores derived were relatively stable over period of time which was short enough that little real clinical change could be expected. ICCs and their 95% confidence intervals were calculated as level of agreement between the initial and three days follow-up scores. The test-retest reliability of the SPADI questionnaire was excellent ($ICC = 0.997$, $p < 0.001$).

Exploratory factor analysis was used to examine the structure of the questionnaire. Factor extraction was performed by principal component analysis with Varimax rotation. Calculated Kaiser-Meyer-Olkin Measure of Sampling Adequacy 0.851 and highly significant ($p < 0.001$) Bartlett's Sphericity Test indicated that factor analysis was appropriate. According to factor analysis, two factors had eigenvalues greater than one (initial eigenvalues 8.17 and 1.36) (Figure 1).

Figure 1. Factor analysis for Serbian version of SPADI, Scree plot

These two factors together explain 73.3% of the total variance (first factor explains 50,1% of the variance, while the other explains 23,2% of the variance). Since a one factor solution explains 50,1% of the variance, and scree plot indicates that there is one factor that extracts predominately, the resulting structure corresponds to the structure of the one-domain questionnaire. Rotated factor matrix did not separate clearly between the pain and disability items, with a significant cross-loading for pain and disability subscale questions 4, 5, 7, 8, 12 i 13. In order to examine all possibilities correctly, and to evaluate according to common rule of extracting all eigenvalues above 1.0, we examined the possibility of extracting two factors on our data. In the rotated matrix, the first 8 items and the items 11 and 13 had the highest correlation with the first extracted component, while the items 9, 10, 12 with the second (Table 2). According to our results, ten items correspond to the 'disability' domain, while three items correspond to the 'pain' domain.

Table 2. Factor analysis for Serbian version of SPADI, Rotated Component Matrix

	Component	
	1	2
Q1	0.705	0.001
Q2	0.814	0.289
Q3	0.885	0.261
Q4	0.776	0.327
Q5	0.633	0.416
Q6	0.828	0.265
Q7	0.824	0.326
Q8	0.802	0.418
Q9	0.180	0.909
Q10	0.205	0.929
Q11	0.870	0.236
Q12	0.458	0.568
Q13	0.723	0.406

Extraction method: Principal component analysis, Rotation Method: Varimax with Kaiser Normalization

Discussion

The painful shoulder or shoulder pain syndrome comprises a large number of pathological entities of the shoulder joint itself and associated anatomical structures, primarily the muscles of the rotator cuff. This condition is very common. The syndrome is characterized by the onset of pain and limited mobility in the shoulder joint, resulting in limited working capacity and impaired quality of life. The cumulative incidence of shoulder complaints in general practice was estimated to be 11.2/1000 patients/year (8) with a lifetime prevalence up to 66.7% (2).

The Shoulder Pain and Disability Index (SPADI) is a specific questionnaire used for shoulder disease. This study shows that the Serbian SPADI consists of one factor and can be considered as a valid and reliable questionnaire. Internal consistency and test-retest reliability were high. The SPADI questionnaire had Cronbach alpha of 0.946. The Cronbach's

alpha found in other studies ranged between 0.90 and 0.95 (10,19-23) and ICC values ranged between 0.88 and 0.96 (11,22-27), which was consistent with our results. These findings indicated excellent internal consistency and high reproducibility of the questionnaire.

Using exploratory factor analysis, one factor that explained 50,1% of the total variance was extracted. Principal component analysis with varimax rotation did not separate clearly between the pain and disability items, with a mixture of pain and disability subscale questions distributing into each factor. There was significant cross-loading for questions 4, 5, 7, 8, 12 i 13. Even though eigenvalues suggest that there could be two-factors, 4 questions have significant cross-loading between factors. With one factor structure only 3 questions shift. The factor analysis we conducted in this population demonstrated that the SPADI had a predominantly one-dimensional structure in this study setting which is not in accordance with the initial conceptualization by Roach et al (10). Even though authors suggest two domain questionnaire there were a number of items in their original validation study that did not follow that pattern (10). Principal components factor analysis without rotation produced one factor but the results of the varimax rotation provided limited support for maintaining two separate subscales. A number of the disability items loaded strongly onto both factors (10). A study by Hill et al (19) reported a two factor structure as originally described. Other validity studies could not confirm the same pattern or have found the SPADI is unidimensional (20-22,25). It appears likely that shoulder pain and shoulder disability are highly associated. In a study by Roddey et al (22) they concluded that people do not distinguish between pain and disability and a possible explanation for that could be the wording of the SPADI items. The disability scale items ask respondents to indicate the amount of difficulty they have with specified functions. Authors suggest it is possible that when people report their difficulty in performing an activity, they consider pain to be part of what makes the activity difficult. In a study by Faucher et al. they have proposed that pain and disability items in questionnaires may correlate because pain and disability items address similar tasks (28).

Since the Serbian version of SPADI questionnaire has an excellent level of internal consistency and test-retest reliability, but as well as number of other studies didn't confirm

the structure of two-domain questionnaire, we could say that according to our results the SPADI scale measures the impact of impaired shoulder as a one construct.

The main limitation of this study is the size of the obtained sample. Because of small number of participants, it cannot be definitely claimed that original two factor structure of questionnaire wouldn't be approved if the sample was bigger. Further research is needed to examine the longitudinal data on other psychometric properties including sensitivity to change and error scores as a representation of a minimal clinically important difference. The great reliability observed in our study may be attributable to the shorter interval between tests (3 days) which could induce an artificial inflation of correlation coefficients due to recall bias.

Conclusion

The Serbian version of SPADI questionnaire has an excellent level of internal consistency. The test-retest reliability of the SPADI questionnaire is very high (ICC = 0.997) but precision for documenting the status of individual patients. Our results suggest that pain and disability, although distinguishable conceptually, may not be distinguished by patients. Since there were no support for separation into two dimensions, we recommend the use of total SPADI score only as a measure of the impact of impaired shoulder.

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Appendix 1

Skala bola i ograničenosti pokreta ramena

Molimo Vas da označite **broj** koji najbliže odgovara Vašem iskustvu tokom protekle nedelje u vezi problema koji imate sa ramenom.

Skala bola

Koliko je jak Vaš bol...

Zakružite **broj** koji najbolje opisuje koliki Vam je **bol**, pri čemu je **0 = nema bola**, a **10 = najjači mogući bol**

...kada je najjači?	0	1	2	3	4	5	6	7	8	9	10
...kada ležite na strani koja Vas boli?	0	1	2	3	4	5	6	7	8	9	10
...kada pokušavate da dohvatite nešto sa visoke police?	0	1	2	3	4	5	6	7	8	9	10
...kada pokušavate da dodirnete zadnju stranu svog vrata?	0	1	2	3	4	5	6	7	8	9	10
...kada nešto gurate rukom koja je zahvaćena bolom?	0	1	2	3	4	5	6	7	8	9	10

Skala ograničenosti pokreta ramena

Koliko Vam je teško...

Zakružite **broj** koji najbolje opisuje koliki Vam je **teško**, pri čemu je **0 = nema poteškoća**, a **10 = toliko teško da je neophodna pomoć**

...kada perete kosu?	0	1	2	3	4	5	6	7	8	9	10
...kada perete leđa?	0	1	2	3	4	5	6	7	8	9	10
...kada oblačite potkošulju ili džemper koji se navlači preko glave?	0	1	2	3	4	5	6	7	8	9	10
...kada oblačite košulju koja se zakopčava spreda?	0	1	2	3	4	5	6	7	8	9	10
...kada oblačite pantalone?	0	1	2	3	4	5	6	7	8	9	10
...kada stavljate neki predmet na visoku policu?	0	1	2	3	4	5	6	7	8	9	10
...kada nosite težak predmet od 4,5 kg?	0	1	2	3	4	5	6	7	8	9	10
...kada nešto vadite iz zadnjeg džepa?	0	1	2	3	4	5	6	7	8	9	10

Shoulder pain and disability index

Please place a mark on the line that best represents your experience during the last week attributable to your shoulder problem.

Pain scale

How severe is your pain?

Circle the number that best describes your pain where: **0** = no pain and **10** = the worst pain imaginable.

At its worst?	0	1	2	3	4	5	6	7	8	9	10
When lying on the involved side?	0	1	2	3	4	5	6	7	8	9	10
Reaching for something on a high shelf?	0	1	2	3	4	5	6	7	8	9	10
Touching the back of your neck?	0	1	2	3	4	5	6	7	8	9	10
Pushing with the involved arm?	0	1	2	3	4	5	6	7	8	9	10

Disability scale**How much difficulty do you have?**

Circle the number that best describes your experience where: **0** = no difficulty and **10** = so difficult it requires help

Washing your hair?	0	1	2	3	4	5	6	7	8	9	10
Washing your back?	0	1	2	3	4	5	6	7	8	9	10
Putting on an undershirt or jumper?	0	1	2	3	4	5	6	7	8	9	10
Putting on a shirt that buttons down the front?	0	1	2	3	4	5	6	7	8	9	10
Putting on your pants?	0	1	2	3	4	5	6	7	8	9	10
Placing an object on a high shelf?	0	1	2	3	4	5	6	7	8	9	10
Carrying a heavy object of 10 pounds (4.5 kilograms)	0	1	2	3	4	5	6	7	8	9	10
Removing something from your back pocket?	0	1	2	3	4	5	6	7	8	9	10

Source: Roach KE, Budiman-Mak E, Songsiridej N, Lertratanakul Y. Development of a shoulder pain and disability index. *Arthritis Care Res* 1991;4(4):143-9.

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