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The Upper Extremity Functional Index (UEFI): Cross-cultural adaptation, reliability, and validity of the Turkish version

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Abstract.
BACKGROUND: Turkish version of the Upper Extremity Functional Index (UEFI) may help to assess shoulder function in patients with shoulder impingement syndrome (SAIS).
OBJECTIVE: To translate and cross-culturally adapted UEFI into Turkish and to assess its acceptability, reliability, validity in patients with SAIS.
METHODS: This study conducted with 93 SAIS participants. UEFI, the short version of the Disability of the Arm, Shoulder and Hand scale (Quick DASH), the Shoulder Pain and Disability Index, and the Short Form-36 Health Survey (SF-36) were administered. Acceptability was assessed in terms of refusal rate, rates of missing responses, and administration time. Test-retest reliability was assessed with intra class correlation coefficient (ICC), internal consistency was assessed with Cronbach's alpha coefficient. Validity was assessed by floor and ceiling effects, skew of distributions and Pearson's correlation coefficients.
RESULTS: Cronbach's alpha coefficients for the UEFI at Time 1 and Time 2 were as follows: $\alpha = 0.89$ and $\alpha = 0.89$. Average measure ICC was 0.80. The UEFI score demonstrated strong negative correlations with SPADI total score and Quick DASH score. There was not a significant correlation between the UEFI and mental health subscale score derived from SF-36.
CONCLUSIONS: The Turkish version of UEFI is acceptable, valid, and reliable.

Keywords: Shoulder, validation, reliability, questionnaire, outcome measure

1. Introduction

Subacromial Impingement Syndrome (SAIS) is the most prevalent diagnosis (44–65%) in a physically active population in patients who are complaining of shoulder pain [1,2] and it is a common shoulder disorder involving repetitive micro trauma to the soft tissues in the subacromial space, resulting in substantial pain and functional disability [3,4]. Subjective pain and functional disability have been evaluated with rating scales, scoring systems and questionnaires for years [5, 6]. Patient-reported outcome measures have become an important part of the assessments used in clinical studies. Currently, a variety of validated measures are available [5–7].

One of the outcome measures intended for upper extremity disorders is the upper extremity functional index (UEFI) which has been assessed regarding validity

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in upper extremity disorders [8]. Cross-cultural adaptation of validated outcome instruments has been advocated to facilitate their use in international multicenter clinical trials [9], which would also reduce the need for developing new instruments with the same purpose.

To our knowledge, Turkish version of UEFI is not available. We believe that the Turkish version of the UEFI may help to assess shoulder function practically in the clinic in patients with SAIS. The aim of this study was to adapt UEFI into Turkish and to assess its acceptability, reliability, validity in patients with SAIS.

2. Methods

2.1. Cross-cultural adaptation process

The translation, adaptation and validation process of the UEFI from English to Turkish was initiated after taking due consent from the author of the original version. Then approval was obtained from Review Board of University of Baskent (KA12/213).

Two forward translations were made from English into Turkish independently of each other. Both translators were bilingual with Turkish as their first language, and having physiotherapy background. A synthesis of the original questionnaire and both initial Turkish translations was performed, resulting in Version 1. In this phase, inappropriate wording choices were identified and resolved following discussion between the translators. Two translators who are blind to the original version of the UEFI then independently translated Version 1 back into English. Their first language was English and they had no medical background. An expert committee, which included two forward translators, an independent physiotherapists and a medical doctor, compared the backward translations with each other and with the original questionnaire. Differences in translation were debated with alternative wording suggested when it was necessary. Item c "Lifting a bag of groceries to waist level", item d "Lifting a bag of groceries above your head", item e "Grooming your hair" required discussion. "Groceries" wording was translated as "pazar". Item e was changed as "saçınızı yıkamak". This phase resulted in a pre-final version of the Turkish translation of the UEFI. Pre-final version of UEFI was pilot tested on 10 patients with SAIS. Patients completed the UEFI and were asked if they found any items difficult, upsetting, or confusing. Difficulties encountered by the patients were noted, and the translations were revised as needed. All items were considered to be easy to understand by all participants who filled out the index (Appendix) [10–12].

2.2. Sample size justification

The sample size was determined based on statistical power analysis procedures using PASS 2005 software (NCSS, Kaysville, UT, USA). With an assumption of the value of the correlation under the null hypothesis (R0) = 0, the value of correlation under the alternative hypothesis (R1) = 0.30, Ha: R0 <> R1, α = 5% and β = 20%, then, the estimated sample size was 84 participants. We increased the primary sample size by 10% to avoid the loss of potential non-respondents. Thus our minimum sample size for the validation study was 93 subjects.

2.3. Participants

The study was performed at Baskent University Physical Medicine and Rehabilitation Outpatient Clinic, Ankara, Turkey between February and June 2013. A total of 93 consecutive patients who were diagnosed with SAIS enrolled to this study. Inclusion criteria were; the participants who can read and write Turkish and whose native language was Turkish, ability to give written informed consent and more problem than shoulder zone in the same extremity. The exclusion criterions were inability to complete the questionnaire due to cognitive impairment and lack of bilateral upper extremity problem. Informed consent was obtained from all participants prior to participation in the study.

2.4. Instruments

2.4.1. The Upper Extremity Functional Index

It is a self-administered questionnaire which measures disability in people with upper extremity orthopedic conditions. The questionnaire lists 20 activities and the patient gives a score to each based on the difficulty they have completing that activity. The scores given to 20 questions are added to give highest possible score of "80". The lowest possible score is "0". A lower scores indicate that the person is reporting increased difficulty with the activities as a result of their upper limb condition [8].

2.4.2. The Quick Disability of the Arm, Shoulder, and Hand Scale

We used the Turkish and short version of the Disability of the Arm, Shoulder and Hand scale (Quick DASH) in our study. It consists of 11 items from the original 30-item DASH. Each item has five response options and the scores for all items are used to calculate a scale score ranging from "0" (no disability) to "100" (most severe disability) [13].

2.4.3. The Shoulder Pain and Disability Index

The Turkish version of the Shoulder Pain and Disability Index (SPADI) was used in the study [14]. It consists of two subscales, one for pain and the other for functional activities. The pain subscale consists of five questions regarding the severity of an individual's pain. Functional activities are assessed with eight questions designed to measure the degree of difficulty an individual has with various activities of daily living that require upper-extremity use. Each item is responded to by a visual analogue scale ranging from "no pain"/"no difficulty", to "worst pain imaginable"/"so difficult required help". Item scores for each section are averaged to produce separate subscale scores ranging from "0" to "100". The scores from both subscales are averaged to derive a total score from "0" (best) to "100" (worst). Higher scores indicate greater pain and disability [15].

2.4.4. The Medical Outcomes 36-Item Short Form Health Survey (SF-36)

Mental health was measured using the Turkish version of the Medical Outcomes 36-Item Short Form Health Survey (SF-36) [16]. The SF-36 includes eight multi-item scales containing two to 10 items each plus a single item to compare the current health with a person's health one year ago (health transition). The scales cover the dimensions of physical functioning (PF), role physical (RP), bodily pain (P), general health (GH), vitality (V), social functioning (SF), role emotional (RE), and mental health (MH). All items pertaining to each scale (excluding health transition) are summed and transformed to form a scale from "0" to "100". Psychometrically, the mental health subscale contains a mixture of mental symptoms and psychological well-being items. It captures the levels of psychological stress and anxiety during the last month. High scores in the mental health subscale indicate feeling happy, peaceful and calm and low scores reflect feeling nervous and depressed [17].

The data related to the socio-demographic and clinic characteristics of the participants were collected. All instruments filled at the beginning of study by a physiotherapist (Time 1). The patients completed the UEFI questionnaire twice. Second assessments were applied after 5 days (Time 2) by the same physiotherapist. No specific treatment for the shoulder was given between the 2 evaluations, and all these patients reported no change in functional status at the second visit.

2.5. Statistical analysis

In this study, we used the Statistical Package for the Social Sciences (SPSS for Windows 17.0) for statistical analyses. We checked the missing values for each questionnaire prior to further analysis.

Acceptability was assessed in terms of refusal rate, rates of missing responses, and administration, and scoring time.

Test-retest reliability was analyzed in a subgroup of 35 patients, selected at random by use of random numbers generated by computer. All the variables in this subgroup of patients can be considered to be normally distributed after a Kolmogorov-Smirnov test. Test-retest reliability was assessed with the intra class correlation coefficient (ICC), with 2-way random-effects model [18]. Internal consistency of the scale was assessed with the Cronbach's alpha coefficient at Time 1 and Time 2. An alpha value of 0.70 or higher was considered as acceptable for group comparisons [19,20]. ICC values were interpreted as: excellent reliability $\geqslant$ 0.80, moderate reliability = 0.60–0.79, and questionable reliability $<$ 0.60 [21].

Content validity was assessed at Time 1 by examining the floor and ceiling effects, and skew of the distribution. We hypothesized that the skewness statistics range from -1 to $+1$ [22], and floor and ceiling effects are less than 20% [23].

Convergent and divergent construct validity was assessed at Time 1 by examining the Pearson's correlation coefficients of the UEFI total score compared to the SPADI subscales and SPADI total scores, the Quick DASH, mental health subscale of SF-36. We hypothesized that UEFI score is highly correlated with the SPADI total score and Quick DASH score. Additionally, we hypothesized that UEFI score is inadequately or weakly correlated with theoretically unrelated subscale (mental health subscale) scores derived from SF-36. Pearson's correlation coefficients were interpreted as follows: very weak = 0.00 to 0.19; weak = 0.20 to 0.39; moderate = 0.40 to 0.59; strong = 0.60 to 0.79; very strong = 00.8 to 1.00. All analysis was two-tailed and the significance level was set at 0.05 [24].

3. Results

A total of 93 patients with SAIS participated in the study. Eighty-six of the patients (92.5%) were right-side dominant, and the affected shoulders of 62 (66.7%) patients were right side. The patients' demographic and clinical characteristics are presented in Table 1. As shown in Table 2, there were no significant correlations between the UEFI score and the patient's characteristics (age, marital status, education

Table 1
The participants' demographic and clinical characteristics

Variables	Statistics
Age (years), Mean (SD)	56.00 ± 13.81
BMI (kg/m^2), Mean (SD)	27.90 ± 6.43
Gender, n (%)	
Female	75 (80.6)
Male	18 (19.4)
Dominant side, n (%)	
Right	86 (92.5)
Left	7 (7.5)
Affected extremity, n (%)	
Right	62 (66.7)
Left	31 (33.3)
Marital status, n (%)	
Married	69 (74.2)
Single	20 (21.5)
Divorced	4 (4.3)
Education level, n (%)	
Illiterate	1 (1.1)
Elementary school	15 (16.1)
Junior high school	8 (8.6)
High school	20 (21.5)
College	49 (52.7)

SD: standard deviation, kg: kilogram, m: meter, n: number, %: percentage, BMI = body mass index.

Table 2
Correlation coefficients between the UEFI score and independent variables ($n = 93$)

Independent variables	Correlation coefficients	95% CI
Pearson		
Age	−0.10	−0.31–0.11
BMI	−0.15	−0.36–0.06
Spearman		
Gender	0.25	0.01–0.45
Marital status	−0.13	−0.34–0.08
Education level	0.05	−0.18–0.28
Dominant side	−0.14	−0.29–0.04
Affected extremity	−0.12	−0.32–0.08

BMI: body mass index, $p = 0.015$ for gender, all other p values > 0.05.

level, BMI, work status, dominant side and affected extremity), however a significant correlation was between the UEFI score and gender (rho = 0.25; $p = 0.015$; 95% CI of rho = 0.01–0.45).

3.1. Descriptive analyses of the data

Descriptive statistics for the UEFI, SPADI, Quick DASH, and SF-36 mental health scores obtained during the initial visit are summarized in Table 3.

3.2. Data quality and acceptability

All eligible subjects accepted to take part in the study. There were no missing data for items except the item of "driving" and the item of "Doing up buttons". There were 16 (17.2%) missing value on the item of "driving". There was one (1.1%) missing value on the item of "Doing up buttons". Prior to further data analysis, we imputed the missing data using the weighted hot-deck procedure [25]. Average time to complete the UEFI was 2.76 minutes. A combined patient completion and therapist scoring time was approximately 3 minutes.

Table 3
Descriptive data for the UEFI, Quick DASH and SPADI ($n = 93$)

Instruments	Mean (SD)	95% CI
UEFI	45.5 ± 13.45	42.7–48.2
Quick DASH	42.3 ± 15.82	39.1–45.6
SPADI		
Pain	61.3 ± 19.03	58.1–64.6
Disability	47.6 ± 19.92	43.5–51.7
Total	52.7 ± 18.16	48.9–56.4
SF-36		
Mental Health	59.0 ± 12.90	56.3–61.7

UEFI: Upper Extremity Functional Index; Quick DASH: Quick Disability of the Arm, Shoulder, and Hand Scale; SPADI: Shoulder Pain and Disability Index; Sf-36: Short Form-36 Health Survey.

Table 4
Convergent and divergent validity ($n = 93$)

	UEFI	
	Correlation coefficients (r)	95% CI
SPADI Subscales		
Pain	−0.46*	−0.60–0.28
Disability	−0.56*	−0.60–0.40
Total	−0.61*	−0.72–0.46
Quick DASH	−0.63*	−0.74–0.49
SF-36 subscale		
Mental Health	−0.05†	−0.3–0.2

*$p = 0.001$, †$p = 0.663$; UEFI: Upper Extremity Functional Index; SPADI: Shoulder Pain and Disability Index; Quick DASH: Quick Disability of the Arm, Shoulder, and Hand Scale; Sf-36: Short Form-36 Health Survey.

3.3. Reliability

Cronbach's alpha coefficients for the UEFI at the Time 1 and Time 2 were as follows: $\alpha = 0.89$ and $\alpha = 0.89$. Average measure ICC was 0.80 (95% CI; 0.60–0.90).

3.4. Content validity

Frequency distribution of scores on UEFI was quite symmetrical and skewness was 0.15. No patients recorded the minimum score of "0" on the UEFI, which would represent the worst functional status

(floor), and no corresponding maximum score of "80", which would represent the best functional status (ceiling). UEFI had no floor, and ceiling effects.

3.5. Construct validity

Table 4 shows Pearson's correlation coefficients between UEFI score and SPADI, Quick DASH, and SF-36 mental health scores. The UEFI score demonstrated strong negative correlations with the SPADI total score ($r = -0.61, p = 0.001$) and Quick DASH score ($r = -0.63, p = 0.001$). Whereas there was not a significant correlation between the UEFI score and theoretically unrelated subscale (mental health subscale) score derived from SF-36 (divergent validity) ($r = -0.05, p = 0.663$).

4. Discussion

The use of measurement tools in physical therapy has increased dramatically since early 1900s. Shoulder-specific scales were developed to measure the effect of patients' shoulder dysfunction on their quality of life. For clinicians, valid measurement tools provide important information to support effective clinical interpretation. The original version of UEFI has been shown to be a reliable, valid, responsive, and acceptable outcome measure [8]. However, to enable comparison between evaluations made in different countries, this questionnaire needs not only to be translated and linguistically validated, but also to be demonstrated its psychometric properties. Here, we present data on metric properties of the Turkish version of UEFI.

An important consideration in the choice of a scale is the practicability of using that scale to assess a patient's function and disability. The scale needs to be short enough that the patient can easily complete it and the clinicians easily review it. However, it must also contain enough items to adequately assess the patient's functional status [26]. The quicker completion and scoring time of the UEFI will reduce the time required by the clinician, and make it ideal for use in a rehabilitation clinic [27]. In this study, none of the respondents refused to participate to the study. The missing value rate was over fifteen percent on the item of "driving". We cannot interpret this finding as a refusal, because none of them had a driving licence. This issue should be taken into account at further developmental stages of the index. The time taken to fill out and score of UEFI was highly low. These results showed that the Turkish version of UEFI is an acceptable instrument to patients with SAIS.

In the study, we found that Cronbach's alpha values for UEFI exceed the suggested cutoff value of 0.70, revealing an acceptable level for group comparisons [28]. Measures of precision were not calculated for Cronbach's alpha, because of the lower bound of a reliability coefficient [29]. If we consider the point estimate of the ICC and the evaluation criteria proposed by Richman et al. [21], then we can interpret the reliability coefficient as being excellent. However, it should be noted that the estimate for the lower bound of the CI for ICC was 0.60, which denotes moderate reliability.

The results of present study showed that the Turkish version of UEFI has no floor and ceiling effects, as well as good frequency distribution of scores on index. This is consistent with an original previous study [8] and indicates that the Turkish version of UEFI has a good content validity. Correlation coefficients revealed that the Turkish version of UEFI, SPADI, and Quick DASH capture the similar construct. This finding confirms good convergent construct validity. On the other hand, correlation coefficient between the Turkish version of UEFI and the mental health subscale of the SF-36 indicates that two measures are distinct, and confirms good divergent construct validity. In this study, we found that there were no any significant correlations between UEFI score and patients' characteristics. This finding shows that patient' characteristics, a potential bias source, do not influence his/her classification which then determines the plan of treatment established by the physiotherapist.

All the patients in this study had SAIS, and thus, our results cannot be extrapolated to other groups of patients with different upper extremity disorders. The patient sample used in this study was limited to the outpatient physiotherapy and rehabilitation clinic in Ankara. Therefore, we suggest that the UEFI psychometric properties should be further tested in patients with different upper extremity disorders and settings.

5. Conclusion

The Turkish version of UEFI is acceptable, valid, and reliable for use in Turkish patients with SAIS. UEFI could be practical scale for assessing SAIS patient's function and disability.

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Appendix

Üst ekstremite fonksionel ideksi

Aşağıda sıralanan aktiviteleri yaparken, kolunuzdaki problem nedeniyle zorluk yaşayıp yaşamadığınızı öğrenmek istiyoruz. Lütfen her bir aktivite için aşağıdaki sorulara cevap veriniz.

Bugün, aşağıdaki aktiviteleri yaparken zorluk çektiniz mi/çeker misiniz? (Size uygun olan cevabın altındaki numarayı daire içine alınız)

	Aktiviteler	Aşırı Zorluk	Oldukça Zorluk	Orta Derecede Zorluk	Hafif Derecede Zorluk	Zorluk Yok
a	Günlük iş, ev işleri veya okul aktiviteleriniz	0	1	2	3	4
b	Hobileriniz, boş zaman değerlendirme veya spor aktiviteleriniz	0	1	2	3	4
c	Pazar torbasını bel seviyesine kaldırmak	0	1	2	3	4
d	Baş seviyesi üzerindeki bir rafa bir şey yerleştirmek veya oradan almak	0	1	2	3	4
e	Saçınızı yıkamak	0	1	2	3	4
f	Elinizden güç alarak kendinizi yukarı kaldırmak (örneðin küvet veya sandalyeden)	0	1	2	3	4
g	Yemek hazırlamak (örneğin, soymak, kesmek)	0	1	2	3	4
h	Araba kullanmak	0	1	2	3	4
I	Elektrik süpürgesi kullanmak, süpürmek veya tırmık kullanmak	0	1	2	3	4
j	Giyinmek	0	1	2	3	4
k	Düğme iliklemek	0	1	2	3	4
l	El araçları veya aletleri kullanmak	0	1	2	3	4
m	Kapı açmak	0	1	2	3	4
n	Temizlik yapmak	0	1	2	3	4
o	Ayakkabı bağlamak	0	1	2	3	4
p	Uyumak	0	1	2	3	4
q	Çamaşır yıkamak (örneğin, yıkamak, ütülemek, katlamak)	0	1	2	3	4
r	Kavanoz açmak	0	1	2	3	4
s	Top fırlatmak	0	1	2	3	4
t	Etkilenmiş kolunuz ile küçük bir çanta taşımak	0	1	2	3	4
	Sütun Toplamları					

SKOR: ……..\80.