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ORIGINAL RESEARCH

Reliability and validity of the Turkish version of the Lower Extremity Functional Scale in patients with different lower limb musculoskeletal dysfunctions

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Abstract

Background/Aims Lower extremity functional scales in Turkish are limited in number and generalisability. The aims of this study were to translate the Lower Extremity Functional Scale into Turkish, and to investigate its reliability and validity in patients with different musculoskeletal conditions in their lower extremities.

Methods The Turkish Lower Extremity Functional Scale, Visual Analogue Scale and Timed Up and Go test were administered in 256 outpatients with a re-test after 24–48 hours. Internal consistency, test–retest reliability, construct validity, factor structure and floor-ceiling effects were investigated.

Findings The Scale has good reliability and validity. The Spearman correlation coefficient was 0.91 and intraclass correlation coefficient was 0.923. The standard error of measurement value was 4.015 and internal consistency coefficient was 0.92. Item-total correlation values were 0.46–0.74. It had a 3-factor structure, explaining 58.51% of the total variance and the eigenvalues were 1.04–8.26. It had no floor and ceiling effects, and was negatively correlated with the Visual Analogue Scale and Timed Up and Go test (P=0.000).

Conclusions The Turkish Lower Extremity Functional Scale is a reliable and valid tool to be used in participants with lower extremity musculoskeletal dysfunctions. Evaluation of its responsiveness and minimal clinically important difference in future studies would have a great value.

Key words: ■ Assessment ■ Cross-cultural adaptation ■ Musculoskeletal ■ Orthopaedics ■ Outcomes research ■ Pain

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INTRODUCTION

Disorders of the soft tissues, muscles, bones and joints of the lower extremities are common musculoskeletal problems, which reduce quality of life by limiting daily living, working and leisure time activities (Hou et al, 2014; Duruturk et al, 2015; Alnahdi et al, 2016). Physical tests, clinical examinations, imaging and laboratory findings are not always sufficient to adequately reflect the impact of the disease on patients, and do not always correlate well with the self-reported functional ability and health (Hou et al, 2014; Citaker et al, 2016).

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Therefore, for a comprehensive assessment of the impact of the injury or disease on the patients, functional evaluations and self-reported measures are also used (Hou et al, 2014; Citaker et al, 2016).

Functional mobility

Functional ability assessments help to determine the level of disability, set the goals of therapeutic interventions and guide the decision making process in order to enable the most effective treatment planning (Stasi et al, 2012).

Self-reported measures have many advantages, such as being feasible, cost-effective, and clinically relevant to patient-centered care (Pua et al, 2009; Hou et al, 2014). Self-reporting measures alsoprovide a more practical and cost-effective solution than physical performance measures to obtain standardised data from large numbers of individuals (Pua et al, 2009).

Since improvement of functional mobility is an important goal of orthopaedic rehabilitation, evaluation of this outcome by a single measure at all phases of rehabilitation is of importance to both patients and clinicians (Yeung et al, 2009). The Lower Extremity Functional Scale (Binkley et al, 1999) is a widely used self-reported measure to assess the functional status of patients with any musculoskeletal conditions in the lower extremities (Binkley et al, 1999; Yeung et al, 2009). This scale, which was developed by Binkley et al (1999) includes 20 items rated on 5 possible numeric response categories from 0 (extreme difficulty/unable to perform the activity) to 4 (no difficulty) (Binkley et al, 1999). The overall score is the sum of scores on all items, and ranges from 0 to 80, with higher score indicating better functional ability (Binkley et al, 1999; Pua et al, 2009; Yeung et al, 2009; Stasi et al, 2012; Hou et al, 2014; Alnahdi et al, 2016; Citaker et al, 2016).

Lower Extremity Functional Scale

The Lower Extremity Functional Scale is shown to be a clinically useful, simple, valid, reliable and responsive tool, with excellent psychometric properties (Binkley et al, 1999; Yeung et al, 2009; Metsavaht et al, 2012; Hou et al, 2014; Alnahdi et al, 2016; Mehta et al, 2016). Because of these properties, this Scale has been translated and culturally adapted into many languages, including Taiwan-Chinese, Arabic, Greek, Brazilian-Portuguese, Dutch, Italian, Persian, Spanish, French-Canadian, and German (Cacchio et al, 2010; René et al, 2011; Hoogeboom et al, 2012; Metsavaht et al, 2012; Stasi et al, 2012; Pereira et al, 2013; Cruz-Diaz et al, 2014; Hou et al, 2014; Negahban et al, 2014; Naal et al, 2015; Alnahdi et al, 2016).

At the start date of this study in 2014, there were no published scales in Turkish that could be used to assess the functional status of patients with any musculoskeletal conditions in the lower extremities. In 2015, Duruturk et al published a study about reliability and validity of the Turkish version of the Lower Limb Functional Index, which was composed of more items than the Lower Extremity Functional Scale (25 items) (Duruturk et al, 2015). In 2016, Citaker et al reported cross-cultural adaptation and validation results of a Turkish version of the Lower Extremity Functional Scale (Citaker et al, 2016). They have stated that, inclusion of only patients with knee disorders was a limitation for the study, in regard to generalisability of their findings to patients with other complaints of the lower limb (Citaker et al, 2016).

AIMS

Since the subject-related existing studies were limited in number and generalisability, this study was performed in order to translate and culturally adapt the Lower Extremity Functional Scale into Turkish, and to investigate relative (test–retest) and absolute

reliability, internal consistency; construct validity; factorial structure and floor-ceiling effects of this version in a heterogeneous sample of outpatients with lower limb musculoskeletal disorders.

METHODS

Ethical approval

Ethical and administrative approvals were obtained from the Scientific Research Ethical Board of the Muğla Sıtkı Koçman University (approval date: 17 October 2014) and General Secretary of the Association of Public Hospitals in Isparta Province (approval date: 27 October 2014, and document number: 80795514/770), respectively. Also, permission for translating the scale into Turkish was obtained from the developers (Binkley et al, 1999). The study conforms to the Declaration of Helsinki. All participants signed an informed consent form.

Translation process

Guidelines by Guillemin et al (1993) and Beaton et al (2000) were followed for translation and cross-cultural adaptation process of the Lower Extremity Functional Scale into Turkish. The original version of the Lower Extremity Functional Scale (©1996 JM Binkley) was translated into Turkish by two bilingual translators, independently. The results of these two written translations were analysed and synthesised by the translators, the first author, and two other academicians, by addressing and resolving each issue by consensus. For example, 'walking a mile' was translated as 'walking 1.5 km', by taking the metric system used in Turkey into consideration. Also, 'walking 2 blocks' was translated as 'walking along two streets', since the term 'block' is not used in Turkish. This common draft was then back-translated into English by two people, independently. One of them was an English native-speaker, who also speaks Turkish very well. Both were experts in English language and literature, have no medical background, they were blinded to the original version, and were not aware of the intent and concepts underlying the material.

Final version

A committee was then constituted in order to produce a final version of the Turkish Lower Extremity Functional Scale. All the members of the committee were bilingual; five were experts in physiotherapy, and one in English language. The equivalence of this version with the original version was reviewed by the committee. After some minor corrections, a consensus was reached, and a pilot study was performed on 23 patients (13 women and 10 men) and with a musculoskeletal dysfunction in a lower limb. The aim of this stage was to determine the comprehensibility of the measure in Turkish. Each item was read in a standard manner by the physiotherapist and the patients were asked to score the comprehensibility of that item on a 4-point Likert scale (1=not comprehensible, 4=completely comprehensible). The percentage of items scored as 3 or 4 was 96%. Therefore, its comprehensibility was considered to be adequate to study the reliability and validity of the Turkish Lower Extremity Functional Scale.

Participants

Participants of this study were recruited from the orthopaedics or physical therapy and rehabilitation clinics of a University Hospital, three private hospitals and a state hospital in Isparta Province, and were asked to participate in the study if they met the inclusion criteria. Participants were included in the study if they:

- Were older than 18 years of age (no upper age limit was applied)
- Had a musculoskeletal condition (bone, joint, muscle and/or other soft tissue pain and/or functional limitation due to signs of limited motion in the affected hip, knee or ankle) (Stasi et al, 2012) in one lower limb
- Attended the orthopaedics or physical therapy and rehabilitation clinics of the related hospitals as an outpatient
- Signed the informed consent form.

Participants were excluded from the study if they:

- Were not able to read, understand and write Turkish
- Not able to perform the Timed Up and Go Test without using a physical aid
- Had a cognitive disorder
- Had vision and/or hearing problems
- Had a musculoskeletal symptom resulting from neurological aetiology
- Had neurological or cardiopulmonary comorbidities
- Had a rheumatic disease leading to secondary osteoarthritis
- Had a metabolic disease of the musculoskeletal system
- Had undergone any prior osteotomy or joint replacement surgery.

Sample size was calculated by using the $(p'.q'.Z^2_{\alpha/2})/d^2$ formula for an unknown number of the population (n). The expected prevalence of 20% of lower limb pain and musculoskeletal conditions and a 95% confidence interval ($Z_{\alpha/2}$=1.96) was taken into consideration (Karagöz, 2014; Southerst et al, 2015). Since the calculated number was 246, initially, 265 evaluation forms were distributed. Three individuals with hearing problems; one patient below 18 years old; and two illiterate patients were excluded as they did not meet the inclusion criteria. Additionally, three patients did not turn up on the reassessment day. Therefore, the study was completed by participation of 256 voluntary patients, who fulfilled the inclusion criteria and attended all assessment protocols.

Measures

Physical (age, gender, height, weight, body mass index) and sociodemographic characteristics (educational status, occupation and marital status) of the participants were recorded. Dominant lower limb (right/left); site of the musculoskeletal dysfunction (hip/thigh/knee/leg/ankle/foot); history of lower limb surgery (yes/no); medical diagnosis (osteoarthritis, strain, ligament injury, meniscal injury, patellofemoral pain, etc); and the time since application to the clinic (week) were questioned.

Participants were then asked to fill in the Turkish Lower Extremity Functional Scale form (*Appendix).* In order to assess the construct validity of the scale, two different measures (the Visual Analogue Scale and the Timed Up and Go Test) were also administered. The Visual Analogue Scale score (0–10 cm) was used to define the current intensity of pain. The Timed Up and Go Test was the second preferred measure for correlation analysis, as it is a simple, quick and widely used clinical performance-based measure of lower extremity function, mobility and fall risk (Herman et al, 2011). For this test, participants were asked to stand up from a standard chair with seat height of 45 cm, walk a distance of 3 metres at a comfortable pace, turn, walk back and sit down. In the Timed Up and Go Test, shorter times indicate better performance (Herman et al, 2011). During the test, the participants did not hold on to anything to stand up, and no physical assistance was given. The same physiotherapist administered all the tests and recorded the time to complete the task for Timed Up and Go Test.

In order to perform test–retest analysis; these assessments were repeated after 24–48 hours, with no therapy in between. The reason of providing no therapy between the assessments was to minimise the risk of clinical situation change and

the reason of selecting a short interval between test and retest procedures was to reduce the patients' waiting time without receiving any treatment (Cacchio et al, 2010; Metsavaht et al, 2012; Cruz-Diaz et al, 2014; Negahban et al, 2014; Citaker et al, 2016).

It was hypothesised that the Visual Analogue Scale and Timed Up and Go Test scores would moderately to strongly correlate with the Turkish Lower Extremity Functional Scale score.

Statistical analysis

The data were analysed at the 0.05 alpha level; IBM SPSS Statistics for MacOSX, version 22.0 (IBM Corp, 2013, Armonk, NY, USA) was used for the statistical analysis. Quantitative variables were described as mean ± standard deviation, and qualitative variables as number and percentage. The Kolmogorov–Simirnov test (Kolmogorov, 1993; Smirnov, 1948) was used to assess the suitability to normal distribution. Reliability was assessed through relative (test–retest) reliability, absolute reliability and internal consistency. Test–retest reliability of the scale was evaluated through Spearman correlation analysis, intraclass correlation coefficient (ICC; two-way random effects model with absolute agreement) and 95% confidence interval (CI). Spearman correlation coefficients were classified as high (above 0.60), moderate (between 0.60 and 0.30) or low (below 0.30) (Bland and Altman, 1999). The ICC scoring range is 0 and 1; with 1 indicating perfect reliability. ICC was interpreted as 'little, if any', 'moderate correlation', 'high correlation' and 'very high correlation', if the value was 0.00–0.025, 0.26–0.69, 0.70–0.89 and 0.90–1, respectively (Cruz-Diaz et al, 2014).

The standard error of measurement (SEM) was used to determine the absolute reliability, using the formula SEM=SD, where SD means standard deviation of the baseline scores (Metsavaht et al, 2012; Negahban et al, 2014; Naal et al, 2015). Internal consistency was assessed by Cronbach's alpha coefficient, corrected item-total correlation, and Cronbach's alpha if the item was deleted. Cronbach's alpha coefficient was considered as 'high' if above 0.80, 'moderate' if between 0.70 and 0.80, and 'low' if below 0.70 (Andresen, 2000). The Kaiser–Meyer–Olkin Measure of Sampling Adequacy was used to determine the sufficiency of the sample and multivariate normality (Kaiser, 1970). Suitability of the sample for factor analysis was assessed by Bartlett's test of sphericity (Bartlett, 1937).

Factor analysis was performed by using a principal component analysis with varimax rotation. The number of factors was determined by using the factor scree plot (>1.0). The number of individuals with the lowest (0) or highest (80) scores was calculated in order to determine the floor and ceiling effects. Floor and ceiling effects were considered present if more than 15% of the participants achieved the highest or lowest score (Pereira et al, 2013; Cruz-Diaz et al, 2014; Citaker et al, 2016).

FINDINGS

Sample characteristics

A total of 256 patients (147 women, 109 men) with a mean age of 52.71 ± 15.67 years were included in the study. The dominant side of the majority of participants (86.7%) was the right side. The mean year of education was 8.13 ± 4.40; 56.3% of the participants had only elementary school graduation and only 13% had a university degree. Approximately half (48.4%) of the participants were housewives, and most of the participants (77.7%) were married (*Table 1*).

Information about the site of the musculoskeletal dysfunction (hip/thigh/knee/leg/ankle/foot); history of lower limb surgery (yes/no); and medical diagnosis

Table 1. Physical and sociodemographic characteristics of the participants

***n*=256**		**X ± SD**
Age (year)		52.71 ± 15.67
Height (cm)		165.23 ± 9.55
Weight (kg)		78.5 ± 12.78
Body mass index (kg/m^2)		28.87 ± 4.84
Education		***n* (%)**
	Primary school degree	148 (57.8)
	Secondary school degree	27 (10.6)
	Bachelor's degree	50 (19.5)
	Master's or doctorate degree	31 (12.1)
Occupation		
	Housewife	124 (48.4)
	Blue collar worker (manual worker, farmer, etc)	28 (10.9)
	White collar worker (clerk, secretary, etc)	35 (13.7)
	Student	16 (6.3)
	Self-employed	16 (6.3)
	Retired	37 (14.5)
Marital status		
	Single	50 (19.5)
	Married	199 (77.7)
	Divorced/widow/widower	7 (2.7)

(osteoarthritis, strain, ligament injury, meniscal injury, patellofemoral pain, etc) are presented in *Table 2*. The mean time since their first visit to the orthopaedics or physical therapy and rehabilitation clinics was 1.97 ± 1.33 week (minimum=1, maximum=11 weeks).

Reliability

According to Spearman correlation analysis, total scores of the test and retest were significantly correlated (r=0.91, P=0.000). Test–retest Spearman's correlation coefficients of each item ranged from 0.64 (item 8) to 0.80 (item 19) (P=0.000) (*Table 3*). Calculated ICC (95% CI) was 0.923 (0.902–0.940) and P<0.000. The standard error of measurement was calculated as 4.015. The Cronbach alpha coefficient of the Turkish Lower Extremity Functional Scale was good (alpha=0.92) and item-total correlations were 0.46–0.74 (Andresen, 2000; Stasi et al, 2012). The alpha value did not change with removal of the item with the lowest correlation value (item 15) (*Table 3*).

Floor and ceiling effect

Mean total scores of the Turkish Lower Extremity Functional Scale were 38.32 ± 14.47 (minimum–maximum=10–80) and 39.29 ± 14.54 (minimum–maximum=11–80) for the test and retest assessments, respectively. Only one participant had the highest score (80) and none had the lowest score (0). Since the rate of the participants that obtained the lowest or highest scores was less than 15%, it was concluded that the

Table 2. Medical characteristics of the participants

***n*=256**		
Site of the lesion		***n* (%)**
	Hip	11 (4.3)
	Thigh	8 (3.1)
	Knee	211 (82.4)
	Leg	7 (2.7)
	Ankle	16 (6.3)
	Foot	3 (1.2)
History of lower limb surgery		
	Yes	75 (29.3)
	No	181 (70.7)
Medical diagnosis		
	Osteoarthritis	130 (50.8)
	Strain	21 (8.2)
	Ligament injury	29 (11.3)
	Meniscal injury	51 (19.9)
	Patellofemoral pain	3 (1.2)
	Fracture	22 (8.6)

Turkish Lower Extremity Functional Scale had no floor and ceiling effects, and had good content validity (Hoogeboom et al, 2012; Metsavaht et al, 2012; Citaker et al, 2016).

Factor analysis

Sampling adequacy and suitability of the scale for factor analysis was determined by the Kaiser–Meyer–Olkin Measure of Sampling Adequacy test and the Bartlett test of sphericity. According to the findings, thte Kaiser–Meyer–Olkin Measure of Sampling Adequacy coefficient was 0.92 and the Bartlett sphericity test result was statistically significant (x^2=2786.86, P=0.000), indicating that the data was suitable for factor analysis.

Factor analysis was performed by using a principal component analysis with varimax rotation. The number of factors was determined by using a scree plot, which shows the eigenvalues on the *y*-axis and the number of factors on the *x*-axis. Factors with eigenvalues ≥1 were considered significant, and therefore, it was concluded that the Turkish Lower Extremity Functional Scale had a 3-factor structure, with eigenvalues ranging 1.04–8.26 (*Figure 1*).

This factor structure could explain 58.51% of the total variance (factor 1=41.28%, factor 2=12.06%, factor 3=5.17%). According to the principal component analysis with varimax rotation, the factor loads of items ranged between 0.45 (item 15) and 0.90 (item 17) (*Table 4*).

Construct validity

Correlation analysis have shown that the Turkish Lower Extremity Functional Scale score had negative and moderate to high correlations with Visual Analogue Scale and Timed Up and Go Test scores both for the first and second assessments (test–retest) (P=0.000) (*Table 5*).

Table 3. Internal consistency and test–retest reliability of the Turkish Lower Extremity Functional Scale

	Internal consistency		Test–retest reliability	
Item	**Item-total correlation**	**Cronbach α if item deleted**	***r***	***P***
1	0.62	0.92	0.71	0.000
2	0.49	0.92	0.66	0.000
3	0.57	0.92	0.71	0.000
4	0.59	0.92	0.65	0.000
5	0.56	0.92	0.75	0.000
6	0.58	0.92	0.78	0.000
7	0.61	0.92	0.68	0.000
8	0.59	0.92	0.64	0.000
9	0.68	0.92	0.65	0.000
10	0.68	0.92	0.73	0.000
11	0.69	0.92	0.77	0.000
12	0.74	0.92	0.78	0.000
13	0.58	0.92	0.70	0.000
14	0.64	0.92	0.76	0.000
15	0.46	0.92	0.69	0.000
16	0.60	0.92	0.77	0.000
17	0.55	0.92	0.78	0.000
18	0.51	0.92	0.71	0.000
19	0.55	0.92	0.80	0.000
20	0.53	0.92	0.74	0.000
Total				

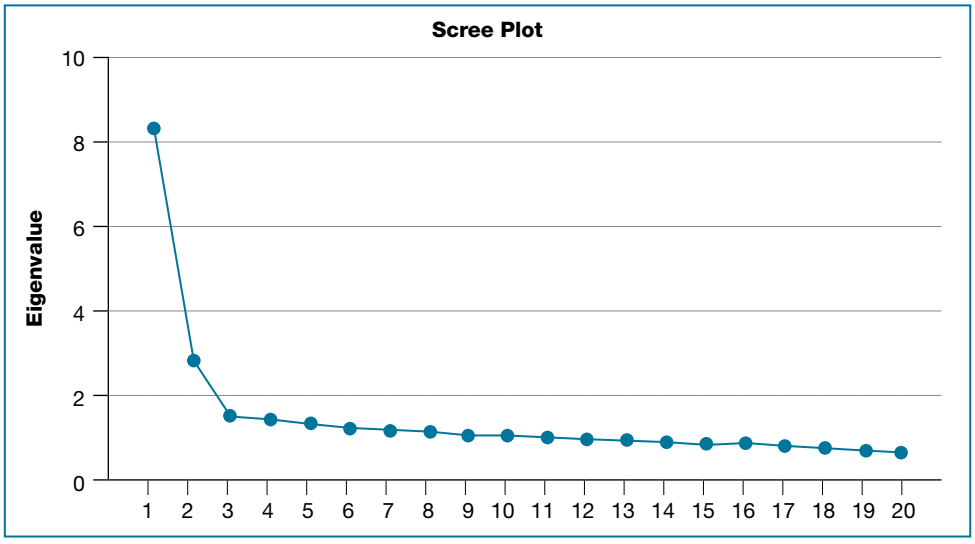

Figure 1. Scree plot showing the factors with eigenvalues ≥1

Table 4. Turkish Lower Extremity Functional Scale factor loads

Factor	Item		Factor loads
Factor 1			
	3	Getting into or out of the bath	0.49
	6	Squatting	0.65
	7	Lifting an object, like a bag of groceries from the floor	0.72
	10	Getting into or out of a car	0.67
	11	Walking 2 blocks	0.57
	12	Walking a mile	0.55
	13	Going up or down 10 stairs (about 1 flight of stairs)	0.71
	14	Standing for 1 hour	0.50
Factor 2			
	16	Running on even ground	0.84
	17	Running on uneven ground	0.90
	18	Making sharp turns while running fast	0.90
	19	Hopping	0.78
Factor 3			
	1	Any of your usual work, housework, or school activities	0.68
	2	Your usual hobbies, recreational or sporting activities	0.75
	4	Walking between rooms	0.49
	5	Putting on your shoes or socks	0.53
	8	Performing light activities around your home	0.63
	9	Performing heavy activities around your home	0.49
	15	Sitting for 1 hour	0.45
	20	Rolling over in bed	0.65

Table 5. Correlations of Turkish Lower Extremity Functional Scale total scores with Visual Analogue Scale and Timed Up and Go scores

	r	*P*
Turkish LEFS total score (1)-VAS (1)	–0.38	0.000
Turkish LEFS total score (2)-VAS (2)	–0.41	0.000
Turkish LEFS total score (1)-TUG (1)	–0.63	0.000
Turkish LEFS total score (2)-TUG (2)	–0.65	0.000

LEFS: Lower Extremity Functional Scale; VAS: Visual Analogue Scale; TUG: Timed Up and Go Test; (1): test; (2): re-test

DISCUSSION

In this study, the Lower Extremity Functional Scale was translated and cross-culturally adapted to Turkish following standard guidelines (Guillemin et al, 1993; Beaton et al, 2000), and its psychometric properties were evaluated in order to be used

in a heterogeneous sample of Turkish-speaking participants with lower extremity musculoskeletal dysfunctions.

There were some minor problems encountered in translation process of the scale, especially related with the distance measure units used in the original version. Since the metric system is used in Turkey, 'walking a mile' was translated as 'walking 1.5 km', and since the term 'block' is not used in Turkish, 'walking two blocks' was translated as 'walking along two streets'. Back translation corresponded well to the original version and the comprehensibility of the Turkish version was high (0.96) according to the findings of the pilot study. Modifications related with the distance measure units can be seen in some other version studies of the scale as well. One mile, which is an imperial unit of measurement, was rounded off to 1 km in the Italian, Spanish, and Brazilian-Portuguese versions; over 1 km in the German version; 1.6 km in the Taiwan-Chinese version; 1.5 km in the Dutch, Arabic and Brazilian versions, 1500 m in the Greek version and in a previous Turkish version (Cacchio et al, 2010; Hoogeboom et al, 2012; Metsavaht et al, 2012; Stasi et al, 2012; Pereira et al, 2013; Cruz-Diaz et al, 2014; Hou et al, 2014; Naal et al, 2015; Alnahdi et al, 2016; Citaker et al, 2016). '

Two blocks' was translated as 250 m in Arabic, Spanish and Dutch, 500–1000 m in German; and 500 m in a previous Turkish version (Hoogeboom et al, 2012; Cruz-Diaz et al, 2014; Naal et al, 2015; Alnahdi et al, 2016; Citaker et al, 2016). In the Greek version of the scale, the related term was described in Greek, instead of giving a numeric value (Stasi et al, 2012). In this Turkish version of the scale, we also preferred to use the term 'sokak' which can be translated as 'street' in English, and may be synonymous with 'block', being a non-numeric distance term used in Turkish, just as in its original version.

Consistency and reliability

Internal consistency of the Turkish Lower Extremity Functional Scale was quietly high (Cronbach alpha=0.92), and all the items had item-total correlations above 0.40 (0.46–0.74), indicating that all items are homogenous and correlated well with each other (Negahban et al, 2014; Alnahdi et al, 2016). These findings are similar to the related findings of some other language versions of the scale (Stasi et al, 2012; Hou et al, 2014; Negahban et al, 2014; Alnahdi et al, 2016; Citaker et al, 2016).

Relative reliability of the Turkish Lower Extremity Functional Scale was investigated through Spearman and ICC tests, and both of them showed very high correlations (0.91 and 0.923, respectively) between the test and retest conditions. The calculated ICC value of the scale was similar to the value found in the French version (0.92), and higher than the values of the original (0.86), Italian (0.91) and Dutch (0.86) versions (Binkley et al, 1999; Cacchio et al, 2010; René et al, 2011; Hoogeboom et al, 2012). Also, as an indicator of the absolute reliability, the standard error of measurement of the scale was calculated as 4.015, and this value is lower than the standard error of measurements of the German (6.3), Taiwan-Chinese (4.1) and Dutch (4.4) versions (Hoogeboom et al, 2012; Hou et al, 2014; Naal et al, 2015).

Factorial structure

The Turkish Lower Extremity Functional Scale has a 3-factor structure and this factorial structure is different from the factorial structure of the previously published Turkish, Taiwan-Chinese, Arabic, Spanish and German versions (Cruz-Diaz et al, 2014; Hou et al, 2014; Naal et al, 2015; Alnahdi et al, 2016; Citaker et al, 2016). It seems that high impact activities load on Factor 2, low impact activities load on Factor 3 and moderate impact activities load on Factor 1. The items of Factor 2 (items 16, 17, 18 and 19) is the same with the ones in the second factor of the previous Turkish version

(Citaker et al, 2016). The factor-structure of Turkish Lower Extremity Functional Scale could explain 58.51% of the total variance. This rate is close to the previously published Turkish version (59.3%), and within the range of some other language versions (54.3–84.95%) (Cruz-Diaz et al, 2014; Hou et al, 2014; Naal et al, 2015; Alnahdi et al, 2016; Citaker et al, 2016). The differences in factorial structure might be related to the sample properties included in different studies.

Consistent with the previously published studies, the Turkish Lower Extremity Functional Scale was found to have no floor or ceiling effects (Binkley et al, 1999; Cacchio et al, 2010; Hoogeboom et al, 2012; Metsavaht et al, 2012; Stasi et al, 2012; Negahban et al, 2014; Naal et al, 2015; Alnahdi et al, 2016; Citaker et al, 2016). Additionally, its negative and moderate correlation with Visual Analogue Scale scores, and negative and high correlation with Timed Up and Go Test scores, along with the findings of the factorial analysis, support the hypothesis that Turkish Lower Extremity Functional Scale has satisfactory construct validity. Correlation of Visual Analogue Scale and Lower Extremity Functional Scale scores has also been investigated in previously published Turkish, Arabic and Brazilian-Portuguese version studies, which all indicated moderate or high correlations between the parameters (Metsavaht et al, 2012; Alnahdi et al, 2016; Citaker et al, 2016). Stasi et al (2013) have stated that their study was the first validation study of the Lower Extremity Functional Scale scale where the Timed Up and Go Test was used as an additional objective validation criterion. Consistent with the related findings of this study; they have demonstrated a strong inverted association between the Lower Extremity Functional Scale score and the performance time of the Timed Up and Go Test.

Strengths of study

The strengths of this study are use of a prospective design and validated methods for a cross-cultural adaptation and validation process; set of a performance measure to determine the convergent validity; adequate sample size (for both test and retest procedures); and the characteristics of the participants. Congruently to the original, Spanish, Taiwan-Chinese, Greek, Persian, Brazilian-Portugese, Italian and Arabic versions, the present study was conducted on a heterogeneous sample (different medical diagnosis, lesion type, lesion site, presence/absence of surgical history) of participants with a musculoskeletal problem in the lower extremity (Binkley et al, 1999; Cacchio et al, 2010; Stasi et al, 2012; Pereira et al, 2013; Cruz-Diaz et al, 2014; Hou et al, 2014; Negahban et al, 2014; Alnahdi et al, 2016). Therefore, it can be suggested that the present study is superior to the previous work of Turkish Lower Extremity Functional Scale translation in regard to the generalisability of the findings. Additionally, when the fact that reliability and validity of this Turkish Lower Extremity Functional Scale was demonstrated on participants where over half of whom had only primary school education is taken into consideration, it may be said that this scale is suitable for evaluating participants with a low level of education.

Limitations

The lack of assessment of responsiveness, known group validity and predictive validity is a limitation for this study.

CONCLUSIONS

As a reliable and valid tool to assess functionality, the Turkish Lower Extremity Functional Scale can be applied to Turkish-speaking people with various different musculoskeletal disorders in the lower limbs. Evaluation of the responsiveness of

the scale and determination of the minimal clinically important difference in future studies would have a great value, in order to analyse its ability to measure clinically significant changes in health over time, and find out which scores reflect changes in a clinical intervention that are meaningful for the patient.

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Conflict of interest

The authors declare that there are no conflicts of interest.

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APPENDIX

Alt Ekstremite Fonksiyonel Ölçeği

Şu anda bacağınızda mevcut olan problem nedeniyle aşağıda listelenen aktivitelerde herhangi bir zorlanma yaşayıp yaşamadığınızı bilmek istiyoruz. Lütfen **her bir** aktivite için tek bir cevap veriniz.

Bugün aşağıdaki aktivitelerde hiç zorlanma yaşadınız mı veya yapsanız yaşar mısınız? (Her satırda bir rakamı daire içine alınız)

Aktiviteler	Aşırı zorlanma veya aktiviteyi yapamama	Epeyce zorlanma	Orta düzeyde zorlanma	Biraz zorlanma	Zorlanma yok
Günlük iş, ev işi veya okul aktivitelerinizin herhangi biri	0	1	2	3	4
Her zamanki hobileriniz, boş zaman veya spor aktiviteleriniz	0	1	2	3	4
Banyo küvetine girmek veya çıkmak	0	1	2	3	4
Odalar arasında yürümek	0	1	2	3	4
Ayakkabılarınızı veya çoraplarınızı giymek	0	1	2	3	4
Çömelmek	0	1	2	3	4
Yerden alışveriş poşeti gibi bir nesneyi kaldırmak	0	1	2	3	4
Evinizin içinde hafif işler yapmak	0	1	2	3	4
Evinizin içinde ağır işler yapmak	0	1	2	3	4
Arabaya binmek veya inmek	0	1	2	3	4
İki sokak yürümek	0	1	2	3	4
1.5 km yürümek	0	1	2	3	4
10 basamak (yaklaşık yarım kat) merdiven çıkmak veya inmek	0	1	2	3	4
1 saat ayakta durmak	0	1	2	3	4
1 saat oturmak	0	1	2	3	4
Düzgün zeminde koşmak	0	1	2	3	4
Engebeli zeminde koşmak	0	1	2	3	4
Hızlı koşarken keskin dönüşler yapmak	0	1	2	3	4
Zıplamak	0	1	2	3	4
Yatakta dönmek	0	1	2	3	4
Sütun toplamı:					

Puan: ……/80