



Original Article

The reliability and validity of the Korean version of the lower limb functional index

TAE-SUNG IN, PT^{1)a}, JIN-HWA JUNG, OT^{2)a}, KYOUNG-SIM JUNG, PT^{2)*},
HWI-YOUNG CHO, PhD, PT^{3)*}

¹⁾ Department of Physical Therapy, Gimcheon University, Gimcheon, Republic of Korea

²⁾ Department of Occupational Therapy, Semyung University: 65 Semyung-ro, Jecheon-si, Chungbuk 390-711, Republic of Korea

³⁾ Department of Physical Therapy, Gachon University: 191 Hambangmoe-ro, Yeonsu-gu, Incheon 406-799, Republic of Korea

Abstract. [Purpose] The purpose of this study was to establish the reliability and validity of the Korean-translated version of the Lower Limb Functional Index (LLFI) in the assessment of patients with lower-limb disorders. [Subjects and Methods] Fifty-six subjects with lower-limb disorders, 24 men and 32 women, participated in this study. Reliability was determined by using the intra-class correlation coefficient and Cronbach's α for internal consistency. Validity was examined by correlating the LLFI scores with the Lower Extremity Functional Scale (LEFS) and Short Form 36 (SF-36) scores. [Results] The test-retest reliability was 0.95. The criterion-related validity was established through a comparison with the Korean versions of the LEFS and SF-36. [Conclusion] The Korean version of the LLFI was shown to be a reliable and valid instrument for assessing lower-limb complaints.

Key words: Lower Limb Functional Index (LLFI), Reliability, Validity

(This article was submitted Sep. 11, 2017, and was accepted Oct. 4, 2017)

INTRODUCTION

Function refers to the ability to perform activities required for daily life¹⁾. Patient-reported outcome measures can confirm the effect of an intervention and provide guidance for decision making on further treatment²⁾.

As joint- or disease-specific outcome measures focus on a specific joint or disease, such measures are difficult to use for assessing health outcomes in patients with functional impairment and pain associated with multiple joints³⁻⁷⁾.

Alternatively, region-specific measures are suitable for patients who complain of dysfunction of various joints within a single kinetic chain, such as the upper and lower spine⁸⁾.

Measurements that can evaluate the function of the lower limb as a single regional kinetic chain include the Lower Extremity Functional Scale (LEFS)⁹⁾ and the Foot and Ankle Ability Measure (FAAM)¹⁰⁾. However, the FAAM focuses on the lower leg below the knee joint; moreover, the most commonly used LEFS is characterized by excessive internal consistency, which indicates item redundancy, as well as a lack of sensitivity and long-term responsiveness¹¹⁾.

The Lower Limb Functional Index (LLFI), developed based on the World Health Organization's International Classification of Functioning, encompasses body structures, body function, activities, participation, and environmental factors. The LLFI questionnaire is easy and fast to complete and offers suitable readability with almost no missing responses¹²⁾.

The LLFI has been translated into different languages, including Spanish¹²⁾ and Turkish¹³⁾, and its high reliability and

^aThese two principal co-authors contributed equally to this work.

*These two corresponding authors contributed equally to this work.

*Corresponding authors. Kyoung-Sim Jung (E-mail: jkspt@hanmail.net); Hwi-young Cho (E-mail: hwiyoung@gachon.ac.kr)

©2018 The Society of Physical Therapy Science. Published by IPEC Inc.



This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial No Derivatives (by-nc-nd) License. (CC-BY-NC-ND 4.0: <https://creativecommons.org/licenses/by-nc-nd/4.0/>)

Table 1. Demographic characteristics of the study participants

	Mean \pm SD
Gender (Male:Female)	56 (24:32)
Age (years)	55.2 \pm 21.8
Pain duration (months)	24.2 \pm 16.3
Subregion	
Hip	
Osteoarthritis	2
Total joint replacement	3
Knee	
Osteoarthritis	32
Meniscal injury	5
Ligament injury	4
Ankle & Foot	10

Table 2. Test-retest reliability of the Lower Limb Functional Index (LLFI)

	ICC (95% CI)	Internal consistency (α)
LLFI	0.95	0.87

ICC: intra-class correlation.

Table 3. Pearson's correlation coefficients of LLFI for a correlation with LEFS and SF-36

	LEFS	SF-36
LLFI	0.86	0.78

All correlations are significant at the 0.05 level.

LLFI: Lower Limb Functional Index; LEFS: Lower Extremity Functional Scale; SF-36: Short Form 36.

validity have been verified. However, the reliability and validity of the Korean version of the LLFI (K-LLFI) for patients with lower-limb disorders has not been determined. This study therefore aimed to identify the reliability and validity of the K-LLFI.

SUBJECTS AND METHODS

A total of 56 outpatients with lower-limb disorders receiving physical therapy at C Orthopedic Clinic in Gyeonggi province were recruited for this study. The subject inclusion criterion was a referral by a medical practitioner for musculoskeletal lower-limb symptoms classified as chronic (≥ 12 months). The exclusion criteria included difficulty in comprehending written Korean language, cognitive disorder, and neurological or cardiopulmonary comorbidities. After being informed about the study, the subjects agreed to participate and signed consent forms. The study was approved by the Institutional Review Board of Gachon University (1044396-201706-HR-098-01).

The LLFI is a 25-item region-specific patient-reported outcome measure. It has response options of “yes” (1 point), “partly” (0.5 point), or “no” (0 point) questions. The score is calculated by summing the response items, then multiplying the sum by 4. The total score is subtracted from 100 to provide a score of 0% to 100% (0%=maximum function).

Forward translations from English to Korean were performed by two native Korean-speaking translators. Then, back-translation to English was done by two native English-speaking translators. The translated questionnaire was understood without any difficulty by the participants¹⁴.

To evaluate for reliability, the test–retest method was used. The questionnaire was completed during the initial visits. For test–retest reliability, all patients completed the questionnaires after 7 days. The 7-day test–retest reliability was analyzed according to the intra-class correlation (ICC) coefficient (2,1) and the internal consistency with Cronbach's α . The criterion-related validity was evaluated by correlating the Korean LEFS and Short Form 36 (SF-36).

RESULTS

The general characteristics of the 56 subjects are shown in Table 1.

The ICC was used for assessing test-retest reliability, and the ICC (2,1) of the K-LLFI was 0.95 (90% confidence interval, 0.89–0.97), showing a very high level of reliability (Table 2).

The K-LLFI values showed significant correlations with the Korean versions of the LEFS and SF-36. The correlation between the K-LLFI and the LEFS and SF-36 was high ($r=0.86$, $r=0.78$, respectively, $p<0.05$) (Table 3).

DISCUSSION

In this study, the test–retest reliability of the K-LLFI was assessed in patients with a lower-limb injury, and a high reliability was obtained. For the English and Turkish versions, reliability was assessed at an interval of 2 and 3 days, respectively, in patients with acute conditions^{2, 12}. It was assessed at an interval of 7 days for the Spanish version in patients with chronic conditions¹¹. The resulting reliability of the three versions was high. In this study, the test–retest reliability was assessed at an interval of 7 days in patients with a chronic condition that had lasted for >12 months, and the reliability was high ($r=0.95$). The Spanish and Turkish versions demonstrated good internal consistency without item redundancy¹⁴. The results of this study showed a Cronbach's α coefficient of 0.87, which was consistent with those of the Spanish and Turkish versions.

For the original English version, the validity of the LLFI was examined by assessing its correlation with the LEFS, another region-specific measure, and good validity was identified². The Spanish version demonstrated a moderate correlation with

the Western Ontario and McMaster Universities Osteoarthritis Index when a validity test was performed¹¹). Although the LEFS is the most ideal measure for a Turkish version, it was not available. When correlation with the SF-36 was instead assessed for the Turkish version, the validity was fair¹²). In this study, to measure the validity of the LLFI, correlations with the LEFS and SF-36 were assessed, and a high validity was observed with the LEFS and a fair validity was observed with the SF-36, which are similar to the results of the Turkish version.

An error value indicates the sensitivity in detecting changes with time. When a difference in the actual score exceeds the error value, changes can be detected, meaning that a lower error value indicates a higher sensitivity¹⁵). In the English versions, the LLFI showed a lower error value than the LEFS²). The study on the Turkish version stated the need for further investigations to determine a clinically important difference in relation to the error value¹²).

Both the English and Turkish versions showed almost no missing responses compared with the LEFS. Furthermore, the Turkish version had fewer half-mark users than the English version, and suggested a format modification to include the three boxes consisting of “yes”, “half”, and “no” answers in order to promote the use of this option¹²). In this study, there were neither missing responses nor items reported as difficult to understand. Therefore, the readability of the version was suitable.

This study confirmed the high reliability and validity of the K-LLFI. However, the results cannot be generalized because of the small sample size and because responsiveness in detecting changes with time was not evaluated. Therefore, further studies are necessary to assess the reliability of the version with a broader range of patients with lower-limb injuries.

ACKNOWLEDGEMENT

This work was supported by a Gimcheon University research grant.

REFERENCES

- 1) Wang TJ: Concept analysis of functional status. *Int J Nurs Stud*, 2004, 41: 457–462. [[Medline](#)] [[CrossRef](#)]
- 2) Gabel CP, Melloh M, Burkett B, et al.: Lower limb functional index: development and clinimetric properties. *Phys Ther*, 2012, 92: 98–110. [[Medline](#)] [[CrossRef](#)]
- 3) Wright JG, Young NL: The patient-specific index: asking patients what they want. *J Bone Joint Surg Am*, 1997, 79: 974–983. [[Medline](#)] [[CrossRef](#)]
- 4) Meenan RF, Gertman PM, Mason JH: Measuring health status in arthritis. The arthritis impact measurement scales. *Arthritis Rheum*, 1980, 23: 146–152. [[Medline](#)] [[CrossRef](#)]
- 5) Bellamy N, Buchanan WW, Goldsmith CH, et al.: Validation study of WOMAC: a health status instrument for measuring clinically important patient relevant outcomes to antirheumatic drug therapy in patients with osteoarthritis of the hip or knee. *J Rheumatol*, 1988, 15: 1833–1840. [[Medline](#)]
- 6) Battle-Gualda E, Esteve-Vives J, Piera MC, et al.: Traducción y adaptación al español del cuestionario WOMAC específico para artrosis de rodilla y cadera. *Rev Esp Reumatol*, 1999, 26: 38–45.
- 7) Escobar A, Quintana JM, Bilbao A, et al.: Validation of the Spanish version of the WOMAC questionnaire for patients with hip or knee osteoarthritis. *Western Ontario and McMaster Universities Osteoarthritis Index. Clin Rheumatol*, 2002, 21: 466–471. [[Medline](#)] [[CrossRef](#)]
- 8) Gabel CP, Melloh M, Burkett B, et al.: The Spine Functional Index: development and clinimetric validation of a new whole-spine functional outcome measure. *Spine J*, 2013, S1529-9430(13)01598-2. [[Medline](#)]
- 9) Binkley JM, Stratford PW, Lott SA, et al. North American Orthopaedic Rehabilitation Research Network: The Lower Extremity Functional Scale (LEFS): scale development, measurement properties, and clinical application. *Phys Ther*, 1999, 79: 371–383. [[Medline](#)]
- 10) Martin RL, Irrgang JJ, Burdett RG, et al.: Evidence of validity for the Foot and Ankle Ability Measure (FAAM). *Foot Ankle Int*, 2005, 26: 968–983. [[Medline](#)] [[CrossRef](#)]
- 11) Cuesta-Vargas AI, Gabel CP, Bennett P: Cross cultural adaptation and validation of a Spanish version of the Lower Limb Functional Index. *Health Qual Life Outcomes*, 2014, 12: 75. [[Medline](#)] [[CrossRef](#)]
- 12) Duruturk N, Tonga E, Gabel CP, et al.: Cross-cultural adaptation, reliability and validity of the Turkish version of the Lower Limb Functional Index. *Disabil Rehabil*, 2015, 26: 1–6. [[Medline](#)]
- 13) Beaton DE, Bombardier C, Guillemin F, et al.: Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine*, 2000, 25: 3186–3191. [[Medline](#)] [[CrossRef](#)]
- 14) Terwee CB, Bot SD, de Boer MR, et al.: Quality criteria were proposed for measurement properties of health status questionnaires. *J Clin Epidemiol*, 2007, 60: 34–42. [[Medline](#)] [[CrossRef](#)]
- 15) de Vet HC, Terwee CB, Ostelo RW, et al.: Minimal changes in health status questionnaires: distinction between minimally detectable change and minimally important change. *Health Qual Life Outcomes*, 2006, 4: 54. [[Medline](#)] [[CrossRef](#)]