



Original Article

## The reliability and validity of the Korean version of the Upper Limb Functional Index

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**Abstract.** [Purpose] The purpose of this study was to establish the reliability and validity of Upper Limb Functional Index (ULFI), which has been translated into Korean, in treating patients with upper limb complaints. [Subjects and Methods] Forty-nine subjects with upper limb disorder, 20 males and 29 females, participated in this study. Reliability was determined by using the intra class correlation coefficient and Cronbach's alpha for internal consistency. Validity was examined by correlating ULFI scores with Disability of Arm, Shoulder and Hand (DASH). [Results] Test-retest reliability was 0.90. The criterion-related validity was established by a comparison with the Korean version of DASH. [Conclusion] The Korean version of ULFI was shown to be a reliable and valid instrument for assessing upper limb complaints.

**Key words:** Upper Limb Functional Index (ULFI), Reliability, Validity

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### INTRODUCTION

The patient-reported outcome measures play an important role for clinicians to understand a condition or disease of patients<sup>1</sup>. Additionally, it is easier and more practical to implement than the objective clinical measures<sup>2-4</sup>; moreover, it does not require a large number of patients in confirming the effect of treatment<sup>5</sup>. The region-specific tools are suitable for describing a change in the clinical status and for measuring the interventional effects on the spine, upper, and lower extremities as single kinetic chains, and compared with the joint or condition-specific measures<sup>6,7</sup>, these tools are more sensitive and more descriptive with respect to the functional status<sup>2,8,9</sup>.

There are four region-specific tools used for the upper limb: The Disabilities of the Arm, Shoulder, and Hand (DASH)<sup>10</sup>, the Upper Extremity Functional Scale<sup>5</sup>, the Upper Extremity Functional Index<sup>11</sup>, and the Neck and Upper Limb Index<sup>2</sup>.

DASH, which is the most frequently used tool in both clinical and research settings, has many redundant items and displays an unnecessarily high internal consistency<sup>2,13-15</sup>. Conversely, UEFS is reported to be less reliable<sup>16,17</sup>.

The Upper Limb Functional Index (ULFI) is designed to be a self-reported questionnaire as a means to evaluate the limitation of activity and participation due to upper limb musculoskeletal disorders. This index consists of 25 items that are easy to comprehend and calculate. Moreover, it takes a short amount of time to complete; thus, it is attractive in clinical settings<sup>13</sup>. It has been translated into multiple languages, including Italian<sup>18</sup>, Spanish<sup>19</sup>, Canadian French<sup>20</sup>, and Turkish<sup>21</sup>; this suggests

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**Table 1.** Demographic characteristics of study participants (N=49)

	Mean ± SD
Gender (female)	29 (59%)
Age (years)	44.3 ± 24.1
Dominance (right)	33 (67%)
Pain duration (months)	16.3 ± 9.3
Diagnosis	
Adhesive capsulitis	27
Impingement syndrome	4
Rotator cuff syndrome	4
Lateral epicondylitis	7
Wrist or hand fracture	2
Carpal tunnel syndrome	2
Hand osteoarthritis	3

**Table 2.** Test-retest reliability for ULFI

	Internal consistency ( $\alpha$ )	ICC (95% CI)
ULFI	0.94	0.90

**Table 3.** Pearson's correlation coefficients for the ULFI for a correlation with DASH

	DASH
ULFI	0.72

All correlations are significant at the 0.05 level.

DASH: disabilities of the arm, shoulder and hand

a high level of validity and reliability. However, the validity and reliability of the Korean version of ULFI have not been examined to date. In this regard, this study intends to examine the validity and reliability of the Korean version of the ULFI.

## SUBJECTS AND METHODS

A total of 49 outpatients with upper limb disorders receiving physical therapy at C Orthopedic Clinic in Gyeonggi-do were recruited for this study. The subject inclusion criterion was symptoms duration of  $\geq 12$  months. The exclusion criteria were as follows: The inability to read Korean or respond to the questionnaire, recent surgery infectious disease, neurological disease, cancer or other systemic diseases that may affect the upper limb. After the subjects were informed about the study, they agreed to participate and signed consent forms. The study was approved by the Institutional Review Board of Gachon University.

ULFI is a self reporting questionnaire designed to evaluate the activity limitations and participation restrictions resulting from upper limb musculoskeletal complaints. The questionnaire consisted of 25 "yes", "partly", or "no" questions. The ULFI score was calculated by summing the response items, then multiplying by four and subtracting from 100. The scores ranged from 0% (maximum limitation) to 100% (no disability).

The forward- and back-translations of the ULFI presented no major language problems for an expert committee including professors and language experts.

To evaluate the reliability, the test-retest method was used. The questionnaire was to be completed once, and again in 3 days. The 3-day test-retest reliability was analyzed according to the intra class correlation coefficient (2,1) as well as the internal consistency with Cronbach's  $\alpha$ . The criterion-related validity was evaluated by correlating the Korean DASH.

## RESULTS

The general characteristics of 49 subjects are shown in Table 1.

ICC was used for test-retest reliability, and the ULFI ICC (2,1) was 0.90 (90% confidence interval [CI] =0.85–0.95) showing a high level of reliability (Table 2).

The ULFI values showed significant correlations with the Korean version of all categories of DASH. The criterion-related validity calculating Pearson's correlation coefficient was  $r=0.72$  ( $p<0.05$ ) for DASH (Table 3).

## DISCUSSION

In this study, the Korean version of ULFI, which was utilized among patients with the upper limb damage was found to have a high level of reliability after measuring the test-retest reliability. In the Turkish version<sup>20</sup>, one study found a moderate level of reliability among subacute patients after testing the reliability two times with three-day interval. The Canadian French version<sup>19</sup> showed a very high level of reliability as a result of measuring the reliability of test-retest with three-day interval among patients with permanent upper limb damage. The present study also measured the reliability of test-retest with three-day interval among chronic patients who had suffered more than 12 months, and the result showed a high reliability. According to Terwee et al.<sup>21</sup>, Cronbach's  $\alpha$  coefficient above 0.95 indicates item redundancy. In this study, Cronbach's  $\alpha$  coefficient was 0.91, and the internal consistency was found to be as high as that of the Spanish, Canadian French, and

Turkish versions; meanwhile, item redundancy was not found.

The validity of the Canadian French version<sup>19)</sup> with respect to ULFI was proved to be high after examining the correlation with DASH among patients with subacute and chronic upper limb damage. To examine the validity of Spanish version<sup>18)</sup> of ULFI, the correlation with the Euroqol Health Questionnaire 5 Dimensions was measured; the result demonstrated a fair degree of validity. It was because an assessment tool for measuring the quality of life was used, unlike the previous studies that assessed the correlation with the region-specific criterion standard, which measures the functional disorder in the upper limb kinetic chain. This study assessed correlation with the DASH to examine the validity of ULFI as the Canadian French and the Turkish versions were assessed. Owing to the similarity between the two assessment tools, a high level of correlation was demonstrated.

Responsiveness is critical for clinicians to determine whether a certain intervention is effective; when there is a ceiling effect or a floor effect, the responsiveness is limited. Gabel et al.<sup>12)</sup> found that ULFI did not show any ceiling effect or floor effect, which means that the items are composed within an optimal range to identify any changes. This study also assessed the ceiling effect or floor effect based on the maximum and minimum scores of ULFI, and the finding was similar to that of previous studies. There were no missing responses from the participants, a comparable finding to both the English and Spanish versions. This means it was easy to understand and to complete the ULFI used in this study.

This study translated the existing ULFI into the Korean language and confirmed its a high level of reliability and validity. However, due to the small sample size and lack of responsiveness assessment, it may not be suitable for generalization. In the near future, it is essential to measure the reliability among a broader range of patients with upper limb disorder and to examine the correlation with more diverse assessment tools related to functional limitations in the upper limb.

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