# Hindi version of the lower extremity functional scale: a study of translation, validation and cross-cultural adaptation

## Versão hindi da escala funcional de extremidade inferior: um estudo de tradução, validação e adaptação transcultural

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**ABSTRACT | BACKGROUND:** Lower Extremity Function Scale (LEFS) serves as a patient-reported outcome measure, used to evaluate the functional status of lower extremity in different musculoskeletal conditions. It was originally developed in English language (E-LEFS) and numerous translations in different languages are available to measure its usability among different cultures. **OBJECTIVES:** To translate the English version of the Lower Extremity Function Scale (E-LEFS) into Hindi language and to evaluate its content validity, cross-cultural adaptation along with the concurrent validity and reliability. **METHOD:** Process of forward and backward translation was carried out by two bilingual translators and a physiotherapist after obtaining developer's approval, for which the Beaton guidelines were used. For the content validation, Delphi method of was employed in which 12 field experts of more than 5 years of experience participated. Cultural adaptation procedures were then carried out with 12 patients, who reported in out-patient department of the hospital through convenience sampling who were asked about whether the H-LEFS was well understood by the patients. Their responses were recorded as positive and negative responses. This process was followed by concurrent validation which was conducted by comparing the scores with the SF-36 scale, involving 30 patients with activity limitation in their daily life. Lastly, 50 patients were recruited for intra-rater reliability testing. **RESULT:** The scale was successfully translated and verified by the bilingual language experts. Content validity came out to be significant with each item scoring more than 0.92. Nearly all items, excluding item no. 8, 16, 17, 18, and 19 received universal agreement with a content validity ratio of 1. The average scale-level validity stood at 0.98, indicating excellent level of validity and the scale was found to be well adapted by the native people as out of 12 patients, 10 patients provided 100% positive response. Concurrent validation using Pearson's correlation coefficient came out excellent with the values of 0.993 for E-LEFS and 0.890 for SF-36. Cronbach's alpha and ICC values were calculated as 1.00 for Intra-rater reliability. **CONCLUSION:** LEFS was well translated into Hindi language with an excellent content and concurrent validity and is found to be highly reliable. Hence, it is recommended for the usage of native Hindi speaking population.

**KEYWORDS:** Lower Extremity. Musculoskeletal Conditions. Patient Reported Outcome Measures. Scale Validation. Language.

**RESUMO | INTRODUÇÃO:** A Escala de Função dos Membros Inferiores (LEFS, na sigla em inglês) serve como uma medida de resultados relatados pelo paciente, usada para avaliar o estado funcional dos membros inferiores em diferentes condições músculo-esqueléticas. Foi originalmente desenvolvido em língua inglesa (E-LEFS) e inúmeras traduções em diferentes idiomas estão disponíveis para medir a sua usabilidade entre diferentes culturas. **OBJETIVOS:** Traduzir a versão em inglês da Lower Extremity Function Scale (E-LEFS) para a língua hindi e avaliar sua validade de conteúdo, adaptação transcultural, juntamente com validade concorrente e confiabilidade. **MÉTODO:** O processo de tradução direta e reversa foi realizado por dois tradutores bilíngues e um fisioterapeuta após obtenção da aprovação do desenvolvedor, para a qual foram utilizadas as diretrizes de Beaton. Para a validação de conteúdo foi empregado o método Delphi, do qual participaram 12 especialistas da área com mais de 5 anos de experiência. Foram então realizados procedimentos de adaptação cultural com 12 pacientes, que compareceram ao ambulatório do hospital por meio de amostragem de conveniência e foram questionados se o H-LEFS era bem compreendido pelos pacientes. Suas respostas foram registradas como respostas positivas e negativas. Esse processo foi seguido de validação concorrente realizada por meio da comparação dos escores com a escala SF-36, envolvendo 30 pacientes com limitação de atividades de vida diária. Por fim, 50 pacientes foram recrutados para testes de confiabilidade intra-avaliador. **RESULTADO:** A escala foi traduzida e verificada com sucesso pelos especialistas em idiomas bilíngues. A validade de conteúdo revelou-se significativa, com cada item pontuando mais de 0,92. Quase todos os itens, excluindo os ítens no. 8, 16, 17, 18 e 19 receberam concordância universal com um índice de validade de conteúdo de 1. A validade média do nível da escala foi de 0,98, indicando excelente nível de validade e a escala foi considerada bem adaptada pelos nativos pois de 12 pacientes, 10 pacientes forneceram 100% de resposta positiva. A validação concorrente utilizando o coeficiente de correlação de Pearson obteve excelente resultado com valores de 0,993 para E-LEFS e 0,890 para SF-36. Os valores de alfa de Cronbach e ICC foram calculados como 1,00 para confiabilidade intra-avaliador. **CONCLUSÃO:** O LEFS foi bem traduzido para a língua hindi, com excelente conteúdo e validade concorrente e é considerado altamente confiável. Portanto, é recomendado para uso pela população nativa de língua hindi.

**PALAVRAS-CHAVE:** Extremidade inferior. Condições musculoesqueléticas. Medidas de resultados relatados pelo paciente. Validação de escala. Idioma.

# 1. Introduction

Lower Extremity Function Scale (LEFS) is the outcome measure used by patients to evaluate the functional status of the lower extremity and ability to do their daily tasks thereby assessing the quality of life (QOL) of an individual. This scale is originally designed by Jill M. Binkley in the year 1999 in English language (E-LEFS). It has a significant adequacy in determining the one's lower extremity functional status in all the musculoskeletal and neurological conditions affecting it (and affecting all day-to-day activities). This is a twenty-item ordinal scale where each item has a score ranging from 0 (representing the maximum difficulty) to 4 (representing no difficulty) summing up makes it an 80-score scale at the highest value. The score represents the current level of difficulty that the patient experiences when performing the activity itemized in the questionnaire.[1-5]

The test-retest reliability of the original E-LEFS was found to be 0.94 (95% lower limit confidence interval (CI) = 0.89). Construct validity of the E-LEFS has been determined by comparing its results with a 36-item Short Form Health Survey (SF-36), a different tool for evaluating patients' quality of life, particularly in relation to musculoskeletal conditions. The results showed that the E-LEFS and the SF-36's physical function subscale and physical component score were equivalent at r = 5.80 and r = 5.64, respectively.[1]

The validity of an item or scale is defined as how closely an outcome measure resembles what it is intended to assess. It also conveys the actual picture and result in assurance. The validity of the scale is an essential step that is taken when translation occurs as to preserve the authenticity of the new version in comparison to the existing one so that the population can use it without the fear of false interpretation.[6]

This scale is available in various languages like Persian[2], Finnish[3], German[4], Brazilian Portuguese[5,9], Greek[7], Arabic[8], Turkey[10], Dutch[11], Malaysian[12], Spanish[13], Italian[14], Gujarati[15] and Chinese[16] and about to be done in Philippine[17] as well. But a valid version of this scale in Hindi is important for the local population of India as Hindi is the most spoken language of the country (spoken by 43.63% of population i.e., 52.83 crore speakers according to 2011 Census)[18] and a patient-reported outcome measure is beneficial if it is well understood by the patient which implies a reduction in the risk of misinterpretation.

On that account, a Hindi version of LEFS (H-LEFS) is required to be developed and as a result, the clinicians will be able to create better goal-oriented healthcare programs among Hindi speaking population. The objectives of this study were to translate the E-LEFS into the H-LEFS, to determine the content and concurrent validity of H-LEFS, and to estimate its adaptability and reliability among native patients. Hence it was hypothesized that the scale might exhibit excellent content and concurrent validity and might be culturally adaptable as well as reliable.

# 2. Method

The study completely conforms to the World Medical Association's Helsinki Declaration, as well as the Council for International Organizations of Medical Sciences' International Ethical Guidelines for Health-Related Research Involving Humans (revised 2017). This study was done according to the guidelines set by Beaton et al.[19]

## 2.1 Ethical consideration

This study was commenced after getting the ethical clearance and receiving the no.-IEC-2663 from the Institutional Ethical Committee of a tertiary care teaching hospital situated in the north region of the country and was registered with CTRI, with reference no.: CTRI/ 2024/02/062686. The process of scale translation and validation has begun after receiving the confirmation letter of permission from the developer via electronic mail.

## 2.2 Procedure

### 2.2.1 Translation

This procedure includes 5 stages (Figure 1).

### 2.2.1.1 Stage 1: Permission from the developer

Before going ahead with the study, a letter for permission was sent to the corresponding authors and developer of the original LEFS requesting them to grant the approval for the translation of the scale.

### 2.2.1.2 Stage 2: Preparation of the scale draft

A panel of 2 individuals, one physiotherapist and one native person, were chosen for the formation of a rough draft by converting the English version of the LEFS into the Hindi language. The draft was reviewed by localities/ people who are well versed in both English and Hindi languages, which was well understood by them. Hence a rough draft of H-LEFS was achieved.

### 2.2.1.3 Stage 3: Forward translation

A formulated rough draft was sent to two independent language experts for verification and modifications in the required language. The experts were Master of Arts (MA) degree holders in Hindi language with more than 10 years of experience and had enough knowledge of both languages. They were requested to check and verify the translation of the original LEFS and ensure that the language and meaning of the questions remained unchanged. Their suggestions were noted and well-appreciated and all the rectifications/ corrections advised by them were settled.

### 2.2.1.4 Stage 4: Compilation

After receiving both the rectified drafts from the experts, they were compared with each other. Common items in both scales were compiled in one new draft. The corrections which were different from each other were analyzed and the one which fit best was recorded. By concluding all these steps and harmonizing all the suggestions given by the experts, the pre-final draft of H-LEFS was obtained.

### 2.2.1.5 Stage 5: Backward translation

The formulated pre-final draft was forwarded to the two blinded independent English language specialists, who were Master of Arts (MA) degree holders. They reviewed the pre-final draft to ensure that the translation done accurately captured the original meaning, and that the actual scale did not get altered in its meaning. After they translated the pre-final H-LEFS draft into English, the translation was compared with the original scale to verify that the items were not altered from their original language. After completing this procedure, a verified H-LEFS was obtained.

Hence, the final draft of H-LEFS was obtained which was further sent for the content validation process.

**Figure 1.** Process of translation of scale
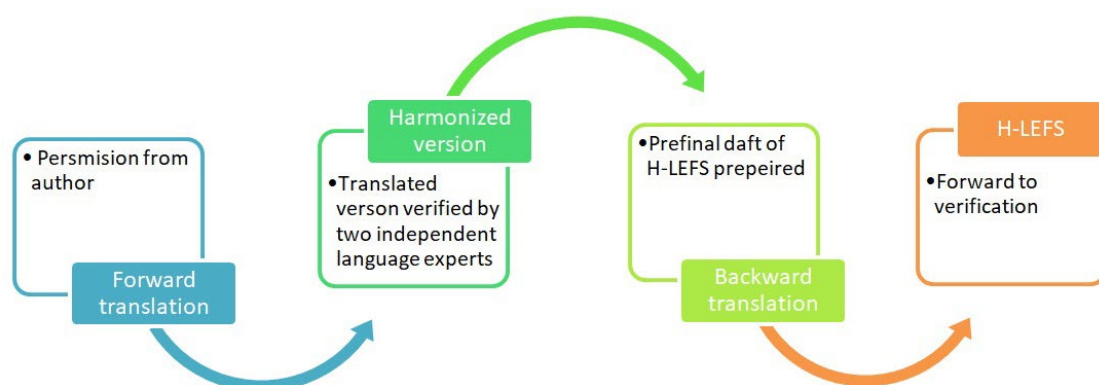


Source: the authors (2024).

### 2.2.2 Content Validation

The content of the final version of the scale has been validated through the Delphi method.[20] For the content validation of H-LEFS, 12 experts with a minimum of 5 years of experience in the field were invited, who were also kept blinded with the aim of the study. A Google form (https://forms.gle/eCSCsCwZdq7ce5DW9) was prepared containing each item of the scale and responses were recorded with the options of whether the translated item was 'valid' or 'invalid' and sent to all the experts. If the experts found any item 'invalid', they were also requested to suggest any changes required in the respective item. If each item of the scale was found to receive 80% valid responses, then it would be concluded as 'Validated', then only the other steps would be followed.

The content validity was performed in five parts as explained below.

#### 2.2.2.1 Individual-level Content Validity Index (I-CVI)

It is calculated by dividing the no. of evaluators who validated the item from the total no. of evaluators.[21] Each item of the scale has its own validity and is thus calculated separately.

#### 2.2.2.2 Content validity ratio (CVR)

It is characterized by the proportion that each item on the scale implies, representing the validity of each item within the scale in comparison to others. It is calculated using the formula: CVR= (Ne – N/2) ÷ N/2[20], where N is the total no. of experts and Ne is the no. of evaluators that agreed with the item. Each item is calculated separately for this ratio.

#### 2.2.2.3 Scale-level content validity index (S-CVI)

It is calculated in two ways; one is summing up the average value and the second one counts for the universal agreement.

#### 2.2.2.4 Averaging value (S-CVI/Ave)

It is defined as the average aggregation of all the I-CVIs. It is calculated by summing up all obtained I-CVI of all the items and dividing it by the total number of items the scale contains.[21]

#### 2.2.2.5 Universal Agreement Calculation (S-CVI/UA)

It is defined as the proportion of items on an instrument that achieves a significance rating by the experts i.e., all the experts that are in favor of the items. Even if one expert is against the item, that item is said to be not agreed universally. It is calculated by using the formula: sum of all UA scores/ total no. of items in the questionnaire.[22]

### 2.2.3 Cross-Cultural Adaptation

In this process, pilot testing assessed the adaptability of the H-LEFS scale among native people with lower limb musculoskeletal conditions, who visited the OPD setups of tertiary hospitals. 12 patients, aged 18-65 years, were recruited using convenience sampling, excluding those patients who had cognitive or psychological impairments, upper limb and spine issues, or those who were bedridden. Patients signed consent forms before beginning the procedure and completed an assessment form to diagnose their lower limb problems. They then filled out the translated version of the scale based on their current condition and the experiences they had while performing the listed activities. Afterwards, they were given a form for their responses as positive or negative responses, which included item numbers and space for feedback on their understanding of each item, including any suggested modification (Supplementary file).

### 2.2.4 Concurrent Validity

With reference to Beaton's guidelines[19], this procedure was conducted with the recruitment of 30

patients suffering from lower limb musculoskeletal disorders affecting hip/knee/ankle/foot from the same setup. The inclusion and exclusion were the same as followed for cross-cultural adaptation. This validity was calculated using the SF-36 and the original version of LEFS (E-LEFS). SF-36 is described as a health survey which is multipurpose in nature and contains 36 questions that inculcate the summary of the mental as well as physical health status of an individual. It is useful for the comparison of general and specific conditions related to any disease. These 36 questions are divided into 8 sub-scales and two summary measures.

As soon as the recruitment procedure was completed, all the demographic details and other assessments were documented. Patients were given an assessment form including an information sheet, consent form, and the three self-reported questionnaires. They were asked to fill all of these according to their understanding and percentage of association with their daily activities. The choices that each person had opted for were compared and assessed for how closely the answers on the various scales that they had chosen correlated with one another. It was calculated using the Pearson correlation coefficient.

### 2.2.5 Intra-rater Reliability

For this step of the study, 50 patients were recruited according to convenience. Independent evaluator, Evaluator A asked the patients to fill the translated Hindi version of the scale independently at two different time spans i.e., at the gap of 6-8 hours between both the readings (reading A1 and A2). The individuals were blinded by the fact that two recordings were obtained from them which were compared with each other.

## 2.3 Data Analysis

The gathered results were analyzed with the help of SPSS 26 i.e., Statistical Package of Social Sciences software, version 26. The analysis included content validation and concurrent validation along with cross-cultural adaptation and intra-rater reliability of the translated scale i.e., H-LEFS.

The normality of the data was tested using the Shapiro-Wilk test. Content validity was depicted by using I-CVI and S-CVI/Average methods. Concurrent validity was analyzed by applying the Spearman Rank Correlation test (depending on the normality of data) with SF-36 and original LEFS. Internal consistency of the scale was determined by using Cronbach's alpha and Intra-rater reliability was estimated through the Intra-Class Correlation Coefficient value depicted by using Shrout and Fleiss classification opting for the Two-way mixed methods with single measure form (ICC3,1).

## 3. Result

The evaluators who were invited to validate the content gave their responses within a week. The obtained responses were noted (Table 1). It was observed that all the items (except for items 8, 16, 17, 18 and 19) had a 100% positive (valid) response from the evaluators, although items 8, 16, 17, 18 and 19 received 92% validation for each of them. Thus, the H-LEFS was fortunate enough to gain validation for more than 80% positive responses. Hence, they were considered valid items for the scale. Therefore, no second round was considered (Figure 2).
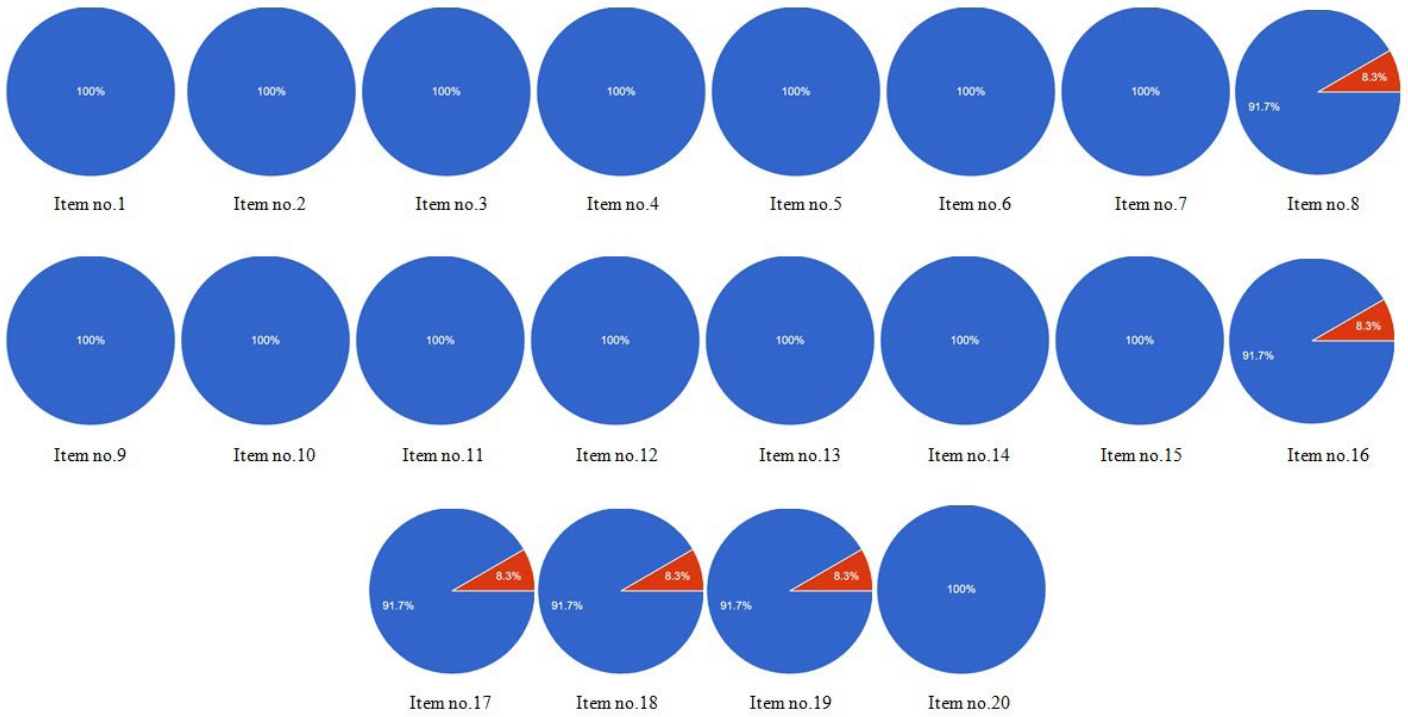
Source: the authors (2024).

All the items exhibited excellent Individual-level Content Validity Index (I-CVI) i.e., 1 except for 5 items which scored 0.92. For the Content Validity Ratio (CVR), the ratio came out to be perfect for 15 items out of 20. The value obtained for Averaging value (S-CVI/Ave) was 19.6/ 20=0.98; and for Universal Agreement Calculation (S-CVI/UA) was: 15/ 20= 0.75. These values indicate good to excellent S-CVI (Table 1).

**Table 1.** Content validity with Universal Agreement

| Item no. | E-1 | E-2 | E-3 | E-4 | E-5 | E-6 | E-7 | E-8 | E-9 | E-10 | E-11 | E-12 | I-CVI | Universal Agreement | Content validity ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Item 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 12/12=1 | 1 | 1 |
| Item 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 12/12=1 | 1 | 1 |
| Item 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 12/12=1 | 1 | 1 |
| Item 4 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 12/12=1 | 1 | 1 |
| Item 5 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 12/12=1 | 1 | 1 |
| Item 6 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 12/12=1 | 1 | 1 |
| Item 7 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 12/12=1 | 1 | 1 |
| Item 8 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 11/12=0.92 | 0 | 0.833 |
| Item 9 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 12/12=1 | 1 | 1 |
| Item 10 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 12/12=1 | 1 | 1 |
| Item 11 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 12/12=1 | 1 | 1 |
| Item 12 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 12/12=1 | 1 | 1 |
| Item 13 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 12/12=1 | 1 | 1 |
| Item 14 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 12/12=1 | 1 | 1 |
| Item 15 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 12/12=1 | 1 | 1 |
| Item 16 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 11/12=0.92 | 0 | 0.833 |
| Item 17 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 11/12=0.92 | 0 | 0.833 |
| Item 18 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 11/12=0.92 | 0 | 0.833 |
| Item 19 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 11/12=0.92 | 0 | 0.833 |
| Item 20 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 12/12=1 | 1 | 1 |

1= Valid and 0= not valid E – Evaluator, I-CVI = Individual level Content Validity Index
Source: the authors (2024).

Demographic characteristics of all patients (n=92) who participated throughout the study (cross-cultural adaptation (n=12), concurrent validity (n=30) and reliability testing (n=50) were explained in Table 2 in which the patients were found to be of extreme age groups having a mean age of 42.50 ± 13.06 years. Hence, younger as well as older patients participated in the study, although the results obtained throughout the study were consistent for all patients.

**Table 2.** Demographic details of patients participated in cross-cultural adaptation (n=12), concurrent validity (n=30) and reliability testing (n=50). Total patients, n=92

| S. No. | Variables | Mean± SD | Standard Error of Mean |
|---|---|---|---|
| 1 | Age (years) | 42.50 ± 13.06 | 1.78 |
| 2 | Gender | 1.63 ± 0.490 | 0.071 |
| 3 | Height (cm) | 164.83 ± 9.66 | 1.20 |
| 4 | Weight (kg) | 68.43 ± 10.98 | 1.59 |
| 5 | True Limb- length (cm) | 78.33 ± 5.63 | 0.72 |
| 6 | Apparent Limb- length (cm) | 84.63 ± 5.71 | 0.77 |
| 7 | BMI (kg/m$^2$) | 25.19 ± 3.50 | 0.55 |

*p value > 0.05, normally distributed
Source: the authors (2024).

For Cross-cultural Adaptation, it was observed that all the patients well understood the translated items and no item was left unfilled/ unanswered and no modifications were suggested by the patients. Therefore the scale showed a high level of cross-cultural adaptation among local people. 18 questions out of 20 scored 100% with all the positive responses and questions no. 8 and 18 scored 91.6% with 11 positive responses and 1 negative response (Table 3).

**Table 3.** Responses of the patients for cross-cultural adaptation (n=12)

| Item No. | Items | Total Patients = 12 | | Percentage |
|---|---|---|---|---|
| | | Positive Response | Negative Response | |
| 1 | कोई सामान्य काम, गृहकार्य या तिद्यालय की गतितितियां | 12 | 0 | 100% |
| 2 | कोई शौक , मनोरंजन या खेल की गतितितियां | 12 | 0 | 100% |
| 3 | स्नान के तलए जाना या बाहर तनकलना | 12 | 0 | 100% |
| 4 | कमरों के बीच में टहलना | 12 | 0 | 100% |
| 5 | अपने जूतों और मोजे पहनना | 12 | 0 | 100% |
| 6 | उकड़ू बैठना | 12 | 0 | 100% |
| 7 | भारी िस्तु जैसे तकरयाने के सामान का थैला जमीन से उठाना | 12 | 0 | 100% |
| 8 | अपने घर के आसपास की हल्की गतितितियां | 11 | 1 | 91.6% |
| 9 | अपने घर के आसपास भारी काम करना | 12 | 0 | 100% |
| 10 | कार के अन्दर जाना या बाहर तनकलना | 12 | 0 | 100% |
| 11 | दो बलॉक िक चलना | 12 | 0 | 100% |
| 12 | एक मील िक चलना | 12 | 0 | 100% |
| 13 | 10 सीतियां ऊपर चढ़िना या नीचे उिरना (लगभग 1 सीढ़ी) | 12 | 0 | 100% |
| 14 | 1 घंटे िक खड़े रहना | 12 | 0 | 100% |
| 15 | 1 घंटे िक बैठना | 12 | 0 | 100% |
| 16 | समाल जमान पर दौड़ना | 12 | 0 | 100% |
| 17 | असमाल जमीन पर दौड़ना | 12 | 0 | 100% |
| 18 | िेजी से दौड़िे समय िीिर मोड़ मुड़ना | 11 | 1 | 91.6% |
| 19 | उछलना | 12 | 0 | 100% |
| 20 | तबस्तर पर करिट बदलना | 12 | 0 | 100% |

To establish the Concurrent Validation, 30 patients of mean age 42.5±13.1 years, suffering from lower limb musculoskeletal disorder affecting hip/knee/ankle/foot were recruited. The correlation of H-LEFS with E-LEFS and SF-36 was excellent with Spearman Correlation coefficient (ρ) values of 0.993 and 0.890 respectively; with a-value of 0.001 (highly significant), depicting the scores were coincides with the already validated scales, E-LEFS and SF-36 (Table 4).

**Table 4.** Correlation of H-LEFS with E-LEFS and SF-36 (n=30) for concurrent validity

| S. No | Scales | Mean ± SD | Correlation coefficient | p-value |
|---|---|---|---|---|
| 1 | H-LEFS | 41.67 ± 12.63 | 1.000 | 0.001** |
| 2 | E-LEFS | 40.84 ± 14.45 | 0.993 | 0.001** |
| 3 | SF-36 | 42.39 ± 16.44 | 0.890 | 0.001** |

**p value < 0.05
Abbreviations:  H-LEFS= Hindi- Lower Extremity Functional Scale
E-LEFS= English- Lower Extremity Functional Scale
SF-36= Short-Form Survey questionnaire – 36
Source: the authors (2024).

Table 5 exhibited the Intra-rater Reliability testing demonstrating that the value of Cronbach's Alpha (α) and ICC value was found to be 1.00 depicting excellent reliability (Table 5).

**Table 5.** Internal consistency and reliability analysis of H-LEFS (n=50)

| Reliability | Cronbach's Alpha | Mean ± SD | | ICC (95% CI) |
|---|---|---|---|---|
| | | Trial 1 | Trial 2 | |
| Intra- rater reliability | 1.00 | 44.28 ± 13.95 | 44.24 ± 13.87 | 1.00 (0.99- 1.00) |

Source: the authors (2024).

# 4. Discussion

The efficiency of the lower extremities is essential for performing daily activities, particularly those involving locomotion, such as walking, climbing stairs, and balancing.[22,23] Problems in the lower extremities, affecting joints like the hip, knee, ankle, and foot, can significantly compromise functional mobility and the quality of life (QOL) due to their central role in movement and support.[1,17,24] These issues are not only physically debilitating but also medically expensive, impacting an individual's overall well-being and leading to a compromise in functional mobility.[17] The Lower Extremity Functional Scale (LEFS) is a widely used outcome measure that effectively assesses functional status and aids in planning a perfect treatment protocol.[6,7] LEFS has demonstrated a greater capacity to detect changes in lower-extremity function than the SF-36 physical function component, making it a preferred choice for documenting lower-extremity function.[5] The translation and cultural adaptation of the LEFS into Hindi aimed to make this tool accessible to a broader population, especially considering India's linguistic diversity, and adds to the body of literature supporting LEFS's cross-cultural applicability.

Translation: The decision to translate LEFS into Hindi was driven by the widespread use of Hindi in India and the need for a tool accessible to non-English speakers, as many individuals in India are not proficient in English and may struggle to understand English-based assessments.[18] Previous studies, such as the Gujarati translation, have highlighted the importance of addressing language barriers to improve accessibility for native speakers.[15] The translation process adhered to Beaton's guidelines[19] involving six translators from both medical and non-medical backgrounds, a practice consistent with successful adaptations in other languages, such as Brazilian Portuguese[9] and Chinese[16], where the involvement of diverse translators ensured cultural nuances were appropriately addressed. Unlike these adaptations, which required modifications to suit cultural contexts, no changes were made to the items in the Hindi translation, preserving the "true reflection of the original scale." Similar to the German and Dutch versions, minimal item alterations were necessary, highlighting the universal applicability of the scale while ensuring comprehension among native speakers.[4,11] Studies such as the Chinese translation altered items like "item no. 12" from a "1-mile walk" to a "1.6-kilometer walk" to match cultural understanding, which was not necessary for the Hindi version, further emphasizing its fidelity to the original scale.[16]

Content Validation: Content validation is a critical step in ensuring the accuracy and relevance of the translated scale.[22] The Delphi method[20] was used, involving a panel of 12 experts with over five years of experience in the field. These experts were external to the tertiary institute to ensure impartiality and prevent bias, contrasting with other studies that included members from their own research or ethical committees. The validation process yielded high aggregate scores of over 80% for all items, confirming the content validity of the scale. Unlike some studies that involved smaller panels of 3-5 experts[4,5,13,14], the inclusion of a larger and more diverse panel enhanced the robustness of the validation process. This study is notable for being the first to document the values of the individual item's "content validity index" along with its ratio and the "numeric value of the averaging value of the scale's validity" and "universal agreement aggregation," providing comprehensive evidence of the scale's validity. These results reinforce the scale's credibility and ensure its applicability in assessing functional mobility within the Hindi-speaking population.

Cross-Cultural Adaptation: Cross-Cultural Adaptation was conducted with 12 patients who had various lower-limb musculoskeletal conditions to evaluate the comprehensibility of the Hindi LEFS. Patients were instructed to indicate their understanding of each item with a "YES" or "NO." Only "items 8 and 18" were marked as "NO" by one participant, indicating a strong level of understanding overall. This result aligns with findings from the Italian and Persian studies, where minimal modifications were needed to address cultural differences and enhance comprehension.[2,14] The absence of significant cultural gaps or "missing responses" in the Hindi LEFS supports its effectiveness and relevance for the Indian population, comparable to other translations like the Finnish and Turkish versions, where language-specific adaptations were also successful.[3,10] In the Brazilian-Portuguese study, some patients noted similar items as being redundant, which was not the case in the Hindi version.[9] These findings underscore the importance of pilot testing in identifying potential barriers to comprehension and ensuring that the translated scale accurately reflects the cultural and linguistic context of the target population.

Concurrent Validity: To assess the concurrent validity of the Hindi LEFS, 30 patients who complained of activity limitation due to their respective musculoskeletal problems affecting their lower limb/s, completed the English LEFS, SF-36, and H-LEFS simultaneously. The correlation coefficients obtained were 0.933 with E-LEFS and 0.860 with SF-36, indicating a strong relationship between the scales and the translated version. These results exceed those reported in other studies, such as the Brazilian and Chinese translations, which showed lower correlation ranges, such as 0.82 and 0.67 – 0.89, respectively.[5,16] The high correlation values demonstrate the Hindi LEFS's capability to accurately measure lower-extremity function, maintaining consistency with the original English scale. Notably, this study is one of the few to report correlation values with E-LEFS, a component that is often overlooked in previous research, thereby enhancing the robustness of the validity assessment. The strong validity results of the Hindi LEFS affirm its utility as a reliable tool for assessing functional status in Hindi-speaking populations, providing healthcare professionals with a culturally adapted instrument that maintains the psychometric properties of the original scale.

Reliability testing: The reliability of the Hindi LEFS was assessed with 50 patients with musculoskeletal conditions affecting their lower limb/s. The study obtained Cronbach's alpha and ICC values of 1.00 indicating excellent reliability, surpassing those reported in previous studies such as the Taiwan Chinese[25] and German translations, which demonstrated slightly lower values, like the German scale's ICC value of 0.98 and Cronbach's alpha of 0.95.[4] The high reliability coefficients confirm that the Hindi LEFS consistently measures lower-extremity function across different evaluators and time points, providing confidence in its application in clinical settings.[26] This study is unique in reporting all three types of reliability, highlighting its comprehensive approach and the robustness of the Hindi LEFS. By ensuring high reliability, the study supports the scale's use in both clinical practice and research settings in India, facilitating accurate assessment and monitoring of patients with lower-extremity conditions.

Limitations and Future Recommendations: The study observed some limitations such as sample size estimation was not performed as it was taken in reference to the standard size used for the evaluation of psychometric properties. Then, the validation of the H-LEFS was determined using the Google form which might have impacted the results. Also, other validation processes were not considered which also provided a gap in the saturation of the instrument validation. Single-center study location might also affect the generalizability of the results. In view of the above limitations, other validation measures like construct validity, external & internal validity, predictive validity and other psychometric properties can be evaluated. Multi-center study can be planned for better generalizability of the results. Lastly, there were few participants at the extremes of age, especially the younger ones, which could alter the results of the research.

Hence, this translated scale can be implemented on the Hindi-speaking population of this country as it will be easy for the patients to determine and evaluate their progress from the condition.

## 5. Conclusion

The translation of the scale was conducted well, and the scale came out to be exceedingly valid with a high Averaging value of 0.98 and a good Universal Agreement Calculation of 0.75. The scale demonstrated remarkable adaptability among natives as well, along with excellent concurrent validity with both E-LEFS as well as SF-36 scales. The scale was found to be highly reliable also. Therefore, it can serve as a valuable instrument for assessing clinical conditions in individuals who speak Hindi as their native language.

### Authors contributions

The authors declared that they have made substancial contributions to the work in terms of the conception or design of the research; the acquisition, analysis or interpretation of data for the work; and the writing or critical review for relevant intellectual content. All authors approved the final version to be published and agreed to take public responsability for all aspects of the study.

### Conflicts of interest

No financial, legal, or political conflicts involving third parties (government, private companies, and foundations, etc.) were declared for any aspect of the submitted work (including but not limited to grants and funding, advisory board participation, study design, manuscript preparation, statistical analysis, etc.).

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# References

1. Binkley JM, Stratford PW, Lott SA, Riddle DL, North American Orthopaedic Rehabilitation Research Network. The Lower Extremity Functional Scale (LEFS): scale development, measurement properties, and clinical application. J. Phys. Ther. 1999;79(4):371-83. https://doi.org/10.1093/ptj/79.4.371

2. Negahban H, Hessam M, Tabatabaei S, Salehi R, Sohani SM, Mehravar M. Reliability and validity of the Persian lower extremity functional scale (LEFS) in a heterogeneous sample of outpatients with lower limb musculoskeletal disorders. Disabil. Rehabil. 2014;36(1):10-5. https://doi.org/10.3109/09638288.2013.775361

3. Repo JP, Tukiainen EJ, Roine RP, Ilves O, Järvenpää S, HäkkinenA. Reliability and validity of the Finnish version of the Lower Extremity Functional Scale (LEFS). Disabil. Rehabil. 2017;39(12):1228-34. https://doi.org/10.1080/09638288.2016.1193230

4. Naal FD, Impellizzeri FM, Torka S, Wellauer V, Leunig M, von Eisenhart-Rothe R. The German Lower Extremity Functional Scale (LEFS) is reliable, valid and responsive in patients undergoing hip or knee replacement. Qual. Life Res. 2015;24(2):405-10. https://doi.org/10.1007/s11136-014-0777-6

5. Pereira LM, Dias JM, Mazuquin BF, Castanhas LG, Menacho MO, Cardoso JR. Translation, cross-cultural adaptation and analysis of the psychometric properties of the lower extremity functional scale (LEFS): LEFS-BRAZIL. Braz. J. Phys. Ther. 2013;(17):272-80. https://doi.org/10.1590/S1413-35552012005000091

6. Bolarinwa OA. Principles and methods of validity and reliability testing of questionnaires used in social and health science researches. Niger. Postgrad. Med. J. 2015;22(4):195-201. PMID: 26776330

7. Stasi S, Papathanasiou G, Anagnostou M, Galanos A, Chronopoulos E, Baltopoulos PI, et al. Lower Extremity Functional Scale (LEFS): Cross-cultural adaption into Greek and reliability properties of the instrument. J. HEALTH Sci. 2012;6(4):750-56. Available from: https://www.researchgate.net/publication/231406735_Lower_Extremity_Functional_Scale_LEFS_Cross-Cultural_Adaption_into_Greek_and_Reliability_Properties_of_the_Instrument

8. Alnahdi AH, Alrashid GI, Alkhaldi HA, Aldali AZ. Cross-cultural adaptation, validity and reliability of the Arabic version of the Lower Extremity Functional Scale. Disabil. Rehabil. 2016;38(9):897-904. https://doi.org/10.3109/09638288.2015.1066452

9. Metsavaht L, Leporace G, Riberto M, Sposito MM, Del Castillo LN, Oliveira LP, et al. Translation and cross-cultural adaptation of the lower extremity functional scale into a Brazilian Portuguese version and validation on patients with knee injuries. J Orthop Sports PhysTher. 2012;42(11):932-9. https://www.jospt.org/doi/10.2519/jospt.2012.4101

10. Citaker S, Kafa N, HazarKanik Z, Ugurlu M, Kafa B, Tuna Z. Translation, cross-cultural adaptation and validation of the Turkish version of the Lower Extremity Functional Scale on patients with knee injuries. ArchOrthop Trauma Surg. 2016;136(6):389-95. https://doi.org/10.1007/s00402-015-2384-6

11. Hoogeboom TJ, de Bie RA, den Broeder AA, van den Ende CH. The Dutch Lower Extremity Functional Scale was highly reliable, valid and responsive in individuals with hip/knee osteoarthritis: a validation study. BMC Musculoskelet. Disord. 2012;13:3-10. https://doi.org/10.1186/1471-2474-13-117

12. Yunus MA, Musa R, Nazri MY. Construct and criterion validity of the Malaysia version of lower extremity functional scale (LEFS). ASMAR 2017;10:8-11. https://doi.org/10.1016/j.asmart.2017.09.002

13. Cruz-Diaz D, Lomas-Vega R, Osuna-Pérez MC, Hita-Contreras F, Fernández ÁD, Martínez-Amat A. The Spanish lower extremity functional scale: a reliable, valid and responsive questionnaire to assess musculoskeletal disorders in the lower extremity. Disabil. Rehabil. 2014;36(23):2005-2011. https://doi.org/10.3109/09638288.2014.890673

14. Cacchio A, De Blasis E, Necozione S, Rosa F, Riddle DL, di Orio F, et al. The Italian version of the lower extremity functional scale was reliable, valid, and responsive. J. Clin. Epidemiol. 2010;63(5):550-7. https://doi.org/10.1016/j.jclinepi.2009.08.001

15. Brahmbhatt BG, Sheth MS. Translation, Cross-Cultural Adaptation and Reliability of the Lower Extremity Functional Scale into a Gujarati Version and Validation. JCDR. 2018;12(8):9-12. https://doi.org/10.7860/JCDR/2018/35965.11876

16. Zhang C, Liu Y, Yuan S, Yang T, Gao Y, Zhu C, et al. Cross-Cultural Adaptation and Validation of the Simplified Chinese Version of the Lower Extremity Functional Scale. Biomed Res. Int. 2020;(9):2-7. https://doi.org/10.1155/2020/1421429

17. Sosa KE, Chavez FT, Bagsic LJ, Dato MS, Cruz LM, Manongsong WM, et al. Translation, Cross-Cultural Adaptation of the Lower Extremity Functional Scale into Filipino, and Analysis of its Psychometric Properties: A Study Protocol [Internet]. PJAHS. 2022;(5):9:57-63. Available from: https://www.researchgate.net/publication/358618945_Translation_Cross-Cultural_Adaptation_of_the_Lower_Extremity_Functional_Scale_into_Filipino_and_Analysis_of_its_Psychometric_Properties_A_Study_Protocol

18. The Hindu. What percentage of people prefer to speak Hindi across States? [Internet]. The Hindu; 2019. Available from: https://www.thehindu.com/data/what-percentage-of-people-prefer-to-speak-hindi-across-states/article27451589.ece

19. Gance-Cleveland B, Leiferman J, Yates S, Williams AT, Amura CR, Roberts M, et al. Spanish translation of StartSmartTM using the Beaton process to ensure tech equity. Journal of Health Care for the Poor and Underserved. 2021;32(2):85-105. https://muse.jhu.edu/article/789659

20. Grime MM, Wright G. Delphi method. Wiley statsref: Statistics reference online. 2016;1:1-6. https://doi.org/10.1002/9781118445112.stat07879

21. Sürücü L, Maslakçı A. Validity And Reliability In Quantitative Research. BMIJ. 2020;8(3):2694-2726. https://doi.org/10.15295/bmij.v8i3.1540

22. Almanasreh E, Moles R, Chen TF. Evaluation of methods used for estimating content validity. Res. Social Adm. Pharm. 2019;15(2):214-21. https://doi.org/10.1016/j.sapharm.2018.03.066

23. Vowell MP, Roller CL. Function and Movement of the Lower Extremity. In: Vowel MP, Roller CL. Kinesiology for the Occupational Therapy Assistant. Routledge; 2024. p. 123-147.

24. Lucas JW, Connor EM, Bose J. Back, Lower Limb, and Upper Limb Pain Among U.S. Adults, 2019. NCHS data brief. 2021;(415):1–8. PMID: 34473621

25. Hou WH, Yeh TS, Liang HW. Reliability and validity of the Taiwan Chinese version of the Lower Extremity Functional Scale. Journal of the Formosan Medical Association. 2014;113(5):313-20. https://doi.org/10.1016/j.jfma.2012.07.032

26. Modarres M, Groth K. Reliability and Risk Analysis. Boca Raton: CRC Press; 2023. https://doi.org/10.1201/9781003307495