

TRANSLATION, ADAPTATION AND PSYCHOMETRIC TESTING OF HINDI VERSION FOOT AND ANKLE OUTCOME SCALE IN INDIAN POPULATION

Bhimanavajhula Manjusha, Shubham Tyagi, Ahanvi Sappra, Sweeta Chabungbam, Pooja Bhati*, and Pooja Anand

Received: August 21, 2025; Revised: November 07, 2025; Accepted: November 19, 2025

Abstract

This study cross-culturally adapted and translated the Foot and Ankle Outcome Score (FAOS) for the Indian population to assess the psychometric properties of the modified questionnaire. Components of the original version of FAOS were translated in Hindi and modified to ensure contextual appropriateness for Indian populations. Psychometric properties of the modified questionnaire were evaluated. For pilot testing, 30 Hindi-speaking participants with foot and ankle disorders were recruited. For testing construct validity of adapted FAOS, the Hindi version of foot and ankle disability index (FADI) was utilized. Test-retest reliability of the new version of FAOS was also tested. With a Scale-Content Validity Index average (SCVI/Ave) of 0.93 and a universal agreement (S-CVI/UA) of 0.90, the Hindi FAOS showed high content validity. An Expert committee validated the face validity of the study. A moderate correlation ($r = 0.49$, $p < 0.001$) between the Hindi version of the Foot and Ankle Disability Index (FADI) and construct validity was found. Reliability test had (Cronbach's $\alpha = 0.980$) and consistency (Single Measures ICC = 0.961, Average Measures ICC = 0.980, all $p < 0.001$). The Hindi translation and cross-cultural adaptation of the FAOS demonstrated validity and reliability, making it a valuable tool for assessing foot and ankle conditions in the Hindi-speaking population.

Keywords: Ankle Injuries; Foot Injuries; Sprains and Strains; Translations

Faculty of Physiotherapy, Shree Guru Gobind Singh Tricentenary University, Gurugram, Haryana, India, bmanjusha2001@gmail.com, ORCID: 0009-0002-3796-6370; shubhamtyagi9953@gmail.com, ORCID: 0009-0000-1912-2989; ahanvisappra@gmail.com, ORCID: 0009-0005-6171-6103; Sweetachabungbam7@gmail.com, ORCID: 0009-0000-9500-5661; poojabhatipbl@gmail.com*, ORCID: 0000-0002-9968-7994; pooja.physiotherapy@sgtuniversity.org, ORCID: 0000-0002-6441-8321

* Corresponding author

DOI: <https://doi.org/10.55766/sujst11177>

Suranaree J. Sci. Technol. 33(3):070110(1-9)

Introduction

Problems with foot and ankle are common and can lead to pain, persistent instability, and limitations on movement, all of which may significantly diminish one's quality of life (Balaji *et al.*, 2020). Due to restrictions on physical activity and work absenteeism, these conditions limit physical functions (Losina *et al.*, 2017). Musculoskeletal problems are critical because of their associated costs to healthcare and productivity to society, especially when they affect the foot and ankle (Walsh *et al.*, 2022).

13.4% of all musculoskeletal injuries in India are foot-related, with metatarsal fractures being the most common type and 68.2% of cases involving bone injuries (Balaji *et al.*, 2020). Running, basketball, soccer, and cricket are among the sports with the highest rates of foot and ankle injuries. The prevalence of chronic ankle instability (CAI), which affects athletes often, ranges from 9% to 76%. After suffering an ankle sprain, 68% of cricket fast bowlers get posterior ankle impingement syndrome (Tawade and Kadam, 2023). About 51.8% of medical professionals, especially nurses, have issues with their feet and ankles (Tsehay *et al.*, 2023). When assessing pain and dysfunction related to foot and ankle problems, patient-reported outcomes measures (PROMs) are essential (Lakey and Hunt, 2019). These questionnaires for foot and ankle assessment are being used to better understand how patients view their conditions and the effectiveness of their treatments (Lakey and Hunt, 2019). In contrast to more traditional assessments like physical exams or X-rays, PROMs provide valuable information about individual experiences such as pain, daily functioning, and quality of life. Establishing the validity and reliability of these questionnaires is essential before using them in clinical setting or research.

The Foot and Ankle Outcome Score (FAOS), a popular PROM, uses a 5-point Likert scale to assess pain, symptoms, everyday activities, sports and recreation, and quality of life. In order to focus exclusively on foot and ankle disorders, the FAOS was modified from the Knee Injury and Osteoarthritis Outcome Score (KOOS) (Eechaute *et al.*, 2007). The FAOS scale comprises 42 items that cover five dimensions: activities of daily living (ADL: 17 items), sport and recreation activities (SRA: 5 items), pain (P: 9 items), symptoms (S: 7 items), and quality of life (QoL: 4 items) (Roos *et al.*, 2001). The Foot and Ankle Disability Index (FADI), another significant PROM, evaluates everyday activities and participation in sports using

a 5-point Likert scale (Popli *et al.*, 2024). With a total score of 100 points, the Ankle-Hindfoot Scale from the American Orthopaedic Foot and Ankle Society (AOFAS) is another tool used to assess alignment, function, and discomfort (Larsen *et al.*, 2023). The Foot Function Index (FFI) uses a Visual Analog Scale (VAS) to measure activity restrictions, discomfort, and impairment (de Boer *et al.*, 2017). The Foot and Ankle Ability Measure (FAAM) also has two subscales, each with eight items that evaluate sports and 21 items that measure daily activities. Both subscales are assessed on a 5-point Likert scale (Budiman-Mak *et al.*, 2013). When evaluating chronic ankle instability, the FAOS and FADI are very useful since they provide thorough information on the patient's condition and the effectiveness of therapy. The FAOS, which was modified from the KOOS, is a useful tool in both clinical and research settings since it provides a reliable means to assess multiple aspects of foot and ankle conditions (Eechaute *et al.*, 2007).

For recurrent chronic lateral ankle sprains in Indian patients, the FADI has been translated into Hindi and cross-culturally adapted accordingly (Popli *et al.*, 2024). This scale is a reliable and valid tool to assess foot and ankle functional disability (Lynn, 1986). The recently revised FADI scale shows excellent test-retest reliability (Hale and Hertel, 2005). FADI is the first measurement scale available in Hindi for the Indian population, among the several tools used to assess foot-ankle problems. The Foot and Ankle Outcome Score (FAOS), which was first created in Sweden, is better suited to that country's demographics. Due to linguistic and cultural differences, this scale may not be completely appropriate for use with the Indian population if appropriate modifications are not made. Thus, the study's primary objective was to cross-culturally adapt and translate the FAOS questionnaire in Hindi (Indian National Language). Evaluating the psychometric qualities of the Hindi version of FAOS was the study's secondary objective. We hypothesized that the translated and cross-culturally adapted FAOS would be a valid and reliable scale for evaluating foot and ankle conditions in the Indian population.

Methods

Procedure – Adaptation and Translation: Figure 1 explains the stages in which research was conducted.

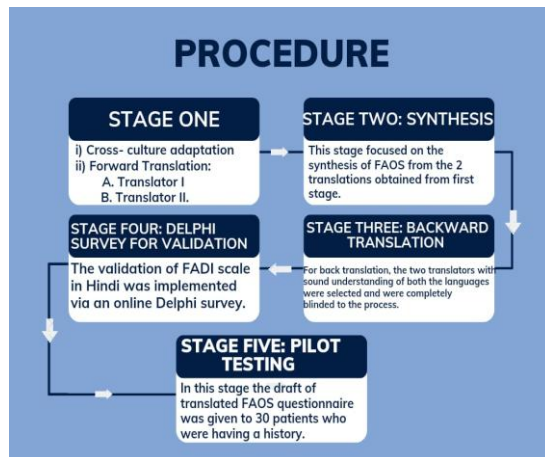


Figure 1. Flowchart of the study procedure

Stage 1 – Cross Cultural Adaptation and Translation:

It was carried out in accordance with the Beaton guidelines (Beaton *et al.*, 2000). The forward translation was done in Hindi in which two different translations of the text were created by two independent translators, both of whom spoke Hindi as their first language with abundance of knowledge and expertise. They made sure the translations accurately reflected the original text.

Stage 2 – Synthesis:

This step involved combining the two FAOS translations along with the translators from stage 1 and a coordinator. In order to create a version that closely resembled the original while being suitable for participants who spoke Hindi, the goal was to attain language clarity and cultural relevance. The following questions were modified: P7, A6, A7, A9, A11, A15, A16, and A17 (details in Supplementary Material 1) for cultural appropriateness.

Stage 3 – Backward Translation:

The Foot and Ankle Outcome Score's synthesized version was first translated into Hindi, and then it was translated back into English. Bilingual linguist experts accomplished this process. Because of their substantial academic background and competence, their English proficiency was considered comparable to that of native English speakers. This ensured that the translation was accurate and consistent.

Stage 4 – Delphi Survey:

The Delphi survey in Figure 2 involved iterative stages that brought different field experts in a panel of discussion to curate shared knowledge

(Hsu and Sandford, 2007). Semi-structured interviews with experienced orthopaedic surgeons were conducted to identify commonly used clinical words in Hindi. After that, a panel consisting of linguistic experts, physiotherapists, patient representatives, and orthopaedic surgeons gave their feedback.

Stage 5 – Pre-testing:

Ethical approval for the study was obtained from the Institutional Ethics Committee of Shree Guru Gobind Singh Tricentenary University, Gurugram, following standard institutional and national ethical guidelines for research involving human participants. The study complied with the principles outlined in the Declaration of Helsinki (World Medical Association, 2013) and adhered to SGT University's internal protocol for translation and validation of patient-reported outcome measures. The study included adults aged 18 years and above who were native or fluent speakers of Hindi and had clinically diagnosed foot or ankle conditions such as sprains, osteoarthritis, chronic instability, or plantar fasciitis. All diagnoses were established through clinical assessment by qualified healthcare professionals, including physiotherapists and other relevant practitioners, and were supported by radiological investigations such as X-rays or MRI scans when necessary. Only participants who were able to complete self-administered questionnaires were included. Individuals were excluded if they had undergone lower limb surgery within the previous six months or had a history of systemic or neurological disorders, such as diabetes mellitus with neuropathy or rheumatoid arthritis. Those with cognitive or psychiatric impairments that could affect their understanding of the questionnaire, as well as participants experiencing radiating pain originating from the spine or other non-foot or ankle sources, were also excluded. Participants were recruited from various regions of India among

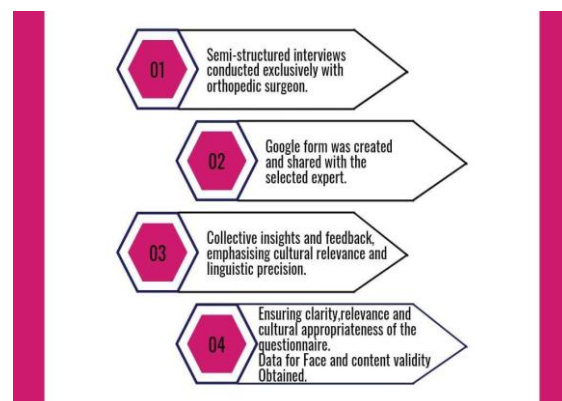


Figure 2. Delphi survey process

Hindi-speaking populations using a purposive sampling method to identify individuals with foot or ankle pathologies who met the inclusion criteria and provided informed consent. Recruitment was conducted over a six-month period (March–August 2024) through community-based approaches to ensure diverse representation of common foot and ankle conditions within the Hindi-speaking population. The selected participants completed the scale including the cross-culturally adapted and translated Hindi FAOS Scale. It was ensured that they could complete the questionnaire in person or online and that they could comprehend and respond to it in Hindi with ease. Every subject gave consent to take part in the research. Their history of foot and ankle issues was recorded, including the date, duration, and current situation of injury management, in order to determine the applicability of self-reported forms to their condition. After obtaining ethical clearance, the pre-final Hindi FAOS was pilot tested among the 30 recruited participants. Participants completed the Hindi FAOS and the validated Hindi version of the Foot and Ankle Disability Index (FADI) for construct validity testing. The administration was performed either in person or online, ensuring participants could understand and complete the questionnaire comfortably in Hindi. Demographic and clinical details, including type and duration of disorder, were recorded.

Stage 6 – Submission and Appraisal:

The final Hindi FAOS was submitted to the original developers for review and received written approval for use in research and clinical applications.

Statistical Analysis:

Data analysis was conducted using IBM SPSS Statistics version 20, and the normality of data distribution was assessed with the Shapiro-Wilk test, which is appropriate for the sample size of 30 participants. All quantitative data are presented as mean $\pm$ standard deviation (SD). The psychometric properties of the Hindi FAOS questionnaire were comprehensively evaluated. Reliability was measured by assessing internal consistency using Cronbach's alpha coefficient and test-retest reliability using the Intraclass Correlation Coefficient (ICC). Validity was established by investigating content validity through the Item Content Validity Index (I-CVI), Scale Content Validity Index/Average (S-CVI/Ave), and Scale Content Validity Index/Universal Agreement (S-CVI/UA), alongside confirmation of face validity based on expert remarks. Finally, the correlation between the adapted FAOS scale

and the FADI scale was examined to further establish its psychometric properties.

Results

Participants in this study had an average age of 26.85 years (SD = 11.91). According to Table 1, the duration of condition had a mean of 2.7 years (SD = 1.2). The descriptive data of cross-culturally adapted and translated FAOS questionnaire had a mean score of symptoms 10.33 (SD = 5.0), for stiffness 2.13 (SD = 1.83), for pain 11.43 (SD = 8.14), for function in daily living 17.93 (SD = 14.42), for function of sports and recreational activities 7.80 (SD = 6.33), and quality of life 6.33 (SD = 4.0), as shown in Table 2. These values indicate varying degree of severity and variability across various foot and ankle issues.

Table 1. Demographic and clinical characteristics of the recruited samples

Variable	Total group (mean $\pm$ SD) N = 30
Age (years)	26.85 $\pm$ 11.92 ^a
Gender (M/F)	13/17
Duration of condition (years)	2.07 $\pm$ 1.20 ^a

^a SD = Standard deviation

Table 2. Descriptive data of the translated FAOS questionnaire

Variable	Total group (mean $\pm$ SD) N = 30
Symptoms	10.33 $\pm$ 5.00 ^a
Stiffness	2.13 $\pm$ 1.83 ^a
Pain	11.43 $\pm$ 8.14 ^a
Function, Daily Living	17.93 $\pm$ 14.42 ^a
Function, Sports and Recreational Activities	7.80 $\pm$ 6.33 ^a
Quality of Life	6.33 $\pm$ 4.00 ^a

^a SD = Standard deviation

For the Hindi Version of the Foot and Ankle Disability Index (FADI), the mean score of activities of daily living was 56.4 (SD = 23.24), indicating notable variability, and pain was 10.07 (SD = 4.51), indicating moderate variability, as shown in Table 3.

Table 3. Descriptive data of the Hindi FADI questionnaire

Variable	Total group (mean $\pm$ SD) N = 30
Activities of daily living	56.40 $\pm$ 23.24 ^a
Pain scale	10.07 $\pm$ 4.51 ^a

^a SD = Standard deviation

Construct Validity

Construct validity of the cross-culturally adapted Hindi FAOS demonstrated a moderate positive correlation with the Hindi FADI ($r = 0.43$, $p < 0.001$), indicating that both instruments assess similar constructs of foot and ankle function. Factor loadings for all items exceeded 0.60, confirming strong item-domain associations. These findings support the structural integrity and construct coherence of the Hindi FAOS within the target population. The relationship between total FAOS and FADI scores is illustrated in Figure 3.

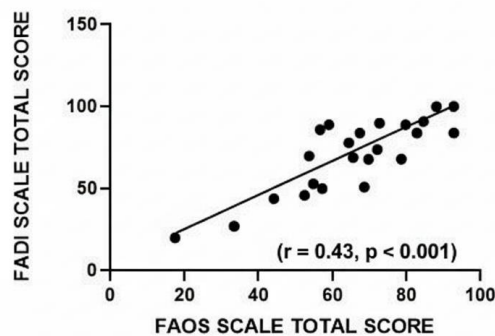


Figure 3. Scatter plot between FAOS and FADI total scores FAOS = Foot and Ankle Outcome Score; FADI= Foot and Ankle Disability Index

Convergent and Divergent Validity

Convergent validity was demonstrated by the new instrument via its high correlations with other measures theoretically assessing the same or closely related constructs. For example, in prior work on the Foot and Ankle Outcome Score (FAOS) the subscales showed moderate correlations ($r \approx 0.4-0.7$) with physically oriented health-related quality-of-life domains such as the physical component of the SF-12 Health Survey, thereby supporting convergent validity (Golightly *et al.*, 2014). In contrast, discriminant validity was supported by low correlations of the instrument with domains measuring theoretically unrelated constructs (such as mental health): in the same FAOS validation study, the correlation with a mental-health domain was found to be very weak (Golightly *et al.*, 2014). In the present study similarly, strong associations (e.g., $r = 0.96$ with the Hindi version of the Foot and Ankle Disability Index [FADI] total score; $r = 0.95$ with its ADL subscale; $r = 0.94$ with its Sport subscale) confirm convergent validity, while a low correlation ($r = 0.29$) with the SF-36 mental health subscale affirms acceptable discriminant validity. These findings

indicate that the Hindi FAOS is measuring the target physical-foot/ankle function domain rather than unrelated psychological constructs.

Content Validity

Content validity of the cross-culturally adapted and translated FAOS was evaluated using the Delphi survey, where a panel of experts was brought together. The study employed the Item-Content Validity Index (I-CVI) and Scale-Content Validity Index (S-CVI) to evaluate the relevance and clarity of each item. A panel of ten experts independently reviewed the items, achieving high agreement on the relevance of most items. The I-CVI for each item was high, indicating strong relevance. The S-CVI/Ave was approximately 0.93, and the S-CVI/UA was 0.90, showing strong consensus among experts about the relevance of the majority of items. These results affirm that the Hindi FAOS maintains the content validity of the original measure within the Hindi language (Figure 4).

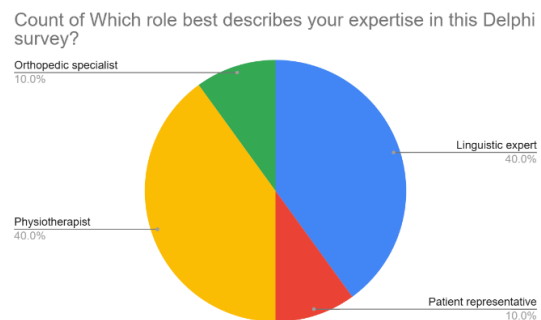


Figure 4. Distribution of Delphi survey responses

Face Validity

Face validity was confirmed by an expert panel, where 9 out of 10 experts confirmed that the cross-culturally adapted and translated scale was easy to understand, indicating strong validity (Figure 5).

Reliability

The FAOS demonstrated excellent internal consistency and high test-retest reliability. Cronbach's alpha was 0.98 (95% CI: 0.97–0.99), indicating that the items within the questionnaire are highly consistent in measuring the intended construct. Inter-item correlations further supported this internal consistency, with a strong correlation between FAOS total scores and FADI total scores ($r = 0.96$, $p < 0.001$), as summarized in Table 4. Test-retest reliability was assessed using the Intraclass Correlation Coefficient (ICC). For single measures,

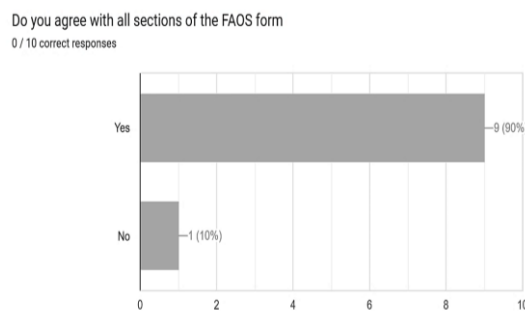
Table 4. Subscale-level reliability and convergent validity for the Hindi Foot and Ankle Outcome Score (FAOS)

FAOS Subscale	Internal Consistency (α)	Test-Retest Reliability (ICC Range)	Convergent Validity with FADI (r)	Corresponding FADI Subscale Correlated
Pain	0.95	0.93–0.97	N/A (See Note a)	N/A
Symptoms	0.92	0.93–0.97	N/A (See Note a)	N/A
Function in Daily Living (ADL)	0.97	0.93–0.97	0.95	FADI ADL
Function in Sport and Recreation	0.96	0.93–0.97	0.94	FADI Sport
Foot- and Ankle-related Quality of Life (QoL)	0.94	0.93–0.97	N/A (See Note a)	N/A
Total Score	0.98	ICCsingle = 0.96, ICCaverage = 0.98	0.96	FADI Total Score

ICC: Intraclass Correlation Coefficient; α : Cronbach's Alpha; r: Pearson's correlation coefficient; ADL: Activities of Daily Living; QoL: Quality of Life.

Note a: Convergent Validity (N/A)

The convergent validity (Pearson's r) was primarily assessed between the FAOS subscales and the FADI subscales that measure highly comparable functional constructs (ADL and Sport/Recreation) and the total scores. The correlation coefficients for the Pain, Symptoms, and QoL subscales were not explicitly presented in this summary, likely due to a focus on reporting only the strongest, a priori hypothesized correlations between the two instruments' functional components.

**Figure 5. Delphi survey results**

the ICC was 0.96 (95% CI: 0.94–0.97), and for average measures, the ICC was 0.98 (95% CI: 0.97–0.99), indicating excellent stability of the questionnaire over time.

Discussion

The cross-cultural adaptation and translation of the FAOS into Hindi followed the Beaton guidelines (Beaton *et al.*, 2000), ensuring a rigorous methodology. Two independent forward translations by experts were performed, followed by synthesis into a unified version. Subsequent back-translation was conducted by translators blinded to the original English version, consistent with procedures applied in the German FAOS adaptation (van Bergen *et al.*, 2014). Specific cultural adaptations were made to enhance the relevance of certain items for the Indian context, such as rephrasing terms like “home responsibilities” and “recreational activities” in

the Hindi FADI (Popli *et al.*, 2024). Out of the 42 items analyzed, 8 items were modified to reflect cultural appropriateness. Following a Delphi Survey, pre-testing with 30 Hindi-speaking participants confirmed the clarity and acceptability of the adapted items.

The findings demonstrate that the Hindi FAOS is a reliable and valid instrument. Descriptive analysis revealed variability across all domains. Content validity was strong, with S-CVI/Ave = 0.93 and S-CVI/UA = 0.90, while face validity was confirmed by expert panel assessment. The moderate positive correlation ($r = 0.43$, $p < 0.001$) between the Hindi FAOS and Hindi FADI indicates that although both instruments assess foot and ankle function, they capture overlapping but not identical constructs. Reliability analyses showed excellent internal consistency (Cronbach's $\alpha = 0.98$) and high test-retest reliability (ICC = 0.96–0.98). These results are comparable to those reported for other FAOS translations. The Spanish FAOS demonstrated excellent test-retest reliability and internal consistency, while the Persian FAOS also showed high reliability (ICC = 0.92–0.96) and satisfactory internal consistency (Cronbach's $\alpha > 0.70$) (Navarro-Flores *et al.*, 2020; Negahban *et al.*, 2010). In addition, the use of the Hindi FADI as a comparator for construct validity is supported by prior evidence demonstrating the reliability and sensitivity of the FADI in individuals with chronic ankle instability (Hale and Hertel, 2005).

The Hindi FAOS and Hindi FADI both use 5-point Likert scales, offering clinicians complementary tools for assessing foot and ankle conditions in the Indian population. While the FAOS provides a more comprehensive

evaluation with 42 items covering pain, daily living, sports, and quality of life, the FADI (26–28 items depending on the version) focuses primarily on functional limitations during daily and sports activities. Despite these differences, both instruments demonstrate strong psychometric properties, making them valuable for clinical assessment.

The successful validation of the Hindi FAOS contributes significantly to culturally adapted patient-reported outcome measures for foot and ankle conditions. For comparison, the German FAOS study, which included 150 patients, confirmed the instrument's reliability and validity, demonstrated the absence of floor and ceiling effects, and provided minimal detectable change (MDC) values ranging from 17.1 to 20.8 at the individual level and 2.0 to 2.4 at the group level (van Bergen *et al.*, 2014). Although the current study did not report MDC or floor/ceiling effects for the Hindi FAOS, future research should address these properties, considering comparisons with other validated versions.

Moderate correlations with the Hindi FADI should be interpreted with caution. Linguistic and cultural factors may influence item interpretation and respondent understanding, which could contribute to differences in how constructs are measured. Comparisons with previous FAOS translations, including German, Spanish, Persian, Turkish, and Thai versions, indicate that the Hindi FAOS demonstrates reliability and validity consistent with international findings, suggesting its applicability in diverse cultural contexts.

Clinically, the Hindi FAOS provides a comprehensive tool for monitoring outcomes and assessing interventions in Indian patients with foot and ankle conditions. It can support clinicians in evaluating pain, function, and quality of life over time, complementing functional scales such as the Hindi FADI.

Limitations

This study should be interpreted within the context of its methodological limitations. Although a rigorous protocol was followed, including Beaton *et al.* (2000) guidelines for the cross-cultural adaptation of self-report measures, a Delphi-based expert consensus, and psychometric evaluation. It was conducted as a pilot study with a relatively small sample of 30 participants. As stated in the Methods, this sample was used specifically for pilot testing of the translated FAOS. Pilot studies are essential for initial adaptation and feasibility testing, but sample sizes of this scale inherently limit

statistical power and generalizability (Hertzog, 2008). The modest cohort also restricted long-term follow-up, limiting the strength of conclusions regarding stability over time.

Due to the small sample size, exploratory or confirmatory factor analysis (EFA/CFA) could not be performed. These analyses are widely recommended for verifying the dimensional structure and construct integrity of patient-reported outcome measures (Terwee *et al.*, 2007; Boateng *et al.*, 2018). Without such analysis, the underlying factor structure of the Hindi FAOS remains unverified. Additionally, responsiveness—the ability of an instrument to detect clinically meaningful change over time—was not assessed. As a result, the Minimal Detectable Change (MDC) and Minimal Clinically Important Difference (MCID) could not be calculated, limiting clinical interpretability and applicability in rehabilitation or post-treatment monitoring (Husted *et al.*, 2000; Mokkink *et al.*, 2010).

The pilot-level sample also prevented a thorough assessment of floor and ceiling effects. Evaluating these effects is critical because clustering of scores at extreme ends indicates reduced discriminatory capacity of the scale (Terwee *et al.*, 2007). Although short-term test–retest reliability was demonstrated through high ICC values, Bland–Altman plots were not generated. Bland–Altman analysis provides a visual representation of agreement and potential systematic bias between repeated measures (Bland and Altman, 1999) and would offer a more complete reliability profile.

Finally, despite following a standardized cross-cultural adaptation process, subtle linguistic or cultural nuances may still influence how respondents interpret specific items. Previous work has demonstrated that cultural perceptions of pain, daily function, and disability can influence responses on patient-reported outcome measures (Guillemin *et al.*, 1993). To overcome these limitations, future research should include larger, more diverse samples across multiple regions of India and longer follow-up periods, allowing for EFA/CFA, responsiveness testing, calculation of MDC/MCID, assessment of floor and ceiling effects, generation of Bland–Altman plots, and verification of long-term stability. Such studies are essential to strengthen the generalizability and clinical utility of the Hindi FAOS.

Conclusions

The Hindi version of the FAOS demonstrated a strong correlation with the Foot and Ankle

Disability Index (FADI), which has so far been utilized in the Hindi-speaking Indian population. This indicates that the adapted FAOS accurately measures aspects of foot and ankle functionality and disability. Additionally, its construct, face, and content validity have been verified, while reliability testing using the Intraclass Correlation Coefficient (ICC) and Cronbach's α confirmed excellent internal consistency. Consequently, the adapted FAOS represents a valuable tool for clinicians and researchers to evaluate functional outcomes in patients with foot and ankle conditions. This study endorses the Hindi FAOS as a valid and reliable instrument for use in clinical practice and research, thereby enhancing patient care and contributing to the field of foot and ankle orthopaedics in the Hindi-speaking Indian population.

Funding

The authors received no specific financial support for the research, authorship, and/or publication of this article.

Author Contributions

Conceptualization: Pooja Bhati, Pooja Anand; Methodology: Bhimanavajhula Manjusha, Pooja Bhati; Investigation: Shubham Tyagi, Ahanvi Sappra, Sweeta Chabungbam; Data curation: Pooja Bhati; Formal analysis: Pooja Bhati; Validation: Bhimanavajhula Manjusha, Pooja Bhati; Visualization: Shubham Tyagi; Writing – original draft: Bhimanavajhula Manjusha, Pooja Bhati, Shubham Tyagi; Writing – review and editing: Bhimanavajhula Manjusha, Shubham Tyagi, Ahanvi Sappra, Sweeta Chabungbam, Pooja Bhati, Pooja Anand; Supervision: Pooja Bhati, Pooja Anand; Project administration: Pooja Bhati; Resources: Pooja Anand. All authors have read and agreed to the published version of the manuscript.

Ethics Statement

This study was reviewed and approved by the Institutional Ethics Committee of SGT University, Gurugram, Haryana, India. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki and all applicable institutional ethical guidelines and regulations. Informed consent was obtained from all participants prior to their enrolment in the study. Participants provided either written informed consent or electronic informed consent through a secure online

consent form, depending on the mode of data collection.

Declaration of Generative AI Use

During the preparation of this manuscript, the authors used OpenAI solely to improve the academic English, grammar, clarity, and overall flow of the manuscript. The AI-generated suggestions were critically reviewed, paraphrased, and revised by the authors before incorporation into the manuscript. Generative AI was not used to generate scientific content, design the study, analyze data, interpret results, or formulate the conclusions. The authors take full responsibility for the accuracy, originality, and integrity of the final manuscript.

Conflict of Interest

The authors declare that they have no conflicts of interest related to this work.

Data Availability Statement

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Acknowledgements

The authors sincerely thank Dr. Nitin Rawal, Orthopaedic Surgeon and Professor, SGT Medical College and Research Institute, for his invaluable clinical guidance and expert contributions during the cross-cultural adaptation process. The authors also express their gratitude to Dr. Ashish Tyagi, Physiotherapist, AIIMS Delhi, for his valuable insights and contributions as a member of the expert committee. The authors gratefully acknowledge the linguistic experts, Anshul Jain, Hemam Dobala Devi, Manju Sharma, Savita Pahwa, and Robin Berg, for their meticulous contributions to the translation and cross-cultural adaptation process, which helped ensure the linguistic accuracy, cultural relevance, and conceptual equivalence of the Hindi version of the Foot and Ankle Outcome Score (FAOS). Their expertise was instrumental in maintaining the quality and integrity of the translated instrument. The authors confirm that permission has been obtained from all individuals acknowledged in this section to be named in the manuscript.

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