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Validity And Reliability of the Indonesian Version of the American Orthopaedic Foot And Ankle Society Ankle-Hindfoot Score as an Instrument for Assessing Ankle and Hindfoot Function

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ABSTRACT

W Background: Standardized outcome instruments are essential for evaluating pain, function, and clinical status in patients with ankle and hindfoot disorders. The American Orthopaedic Foot and Ankle Society (AOFAS) Ankle-Hindfoot Score is widely used internationally, but a formally validated Indonesian-language version is needed for use in Indonesian clinical practice and research. Objective: This study evaluated the validity and reliability of the Indonesian version of the AOFAS Ankle-Hindfoot Score in adults with ankle and hindfoot disorders. Methods: A methodological validation study was conducted in a multicenter clinical setting. Adults with traumatic, postoperative, or degenerative ankle and hindfoot disorders who could understand Indonesian and provide informed consent were included. The AOFAS score was assessed together with the Foot and Ankle Outcome Score (FAOS) and Short Form-36 (SF-36). Internal item validity was examined using Pearson correlation, internal consistency using Cronbach's alpha, and inter-rater reliability using Cohen's kappa. Convergent validity was assessed by correlation with FAOS and SF-36. Floor and ceiling effects were also examined. Results: Eighty-seven participants were included in the descriptive analysis. The mean age was 40.0 ± 16.1 years, 58.6% were male, and 44.8% had a university education. The mean AOFAS Ankle-Hindfoot Score was 59.03 ± 19.72. In the 81 participants included in item-level validation and inter-rater analyses, all nine AOFAS items were valid, with item correlations ranging from 0.623 to 0.856 and $p < 0.001$. Internal consistency was high (Cronbach's alpha = 0.851). Inter-rater reliability was excellent, with Cohen's kappa values ranging from 0.911 to 1.000 and a mean kappa of 0.975. Convergent correlations were strong with FAOS ($r = 0.850$) and SF-36 ($r = 0.911$), both $p < 0.001$. No floor or ceiling effect was observed for the total AOFAS score. Conclusion: The Indonesian AOFAS Ankle-Hindfoot Score demonstrated good internal validity, high internal consistency, excellent inter-rater agreement, and strong convergent validity in the study population. It can therefore be considered a useful instrument for assessing ankle and hindfoot function in Indonesian adults, although further studies should evaluate responsiveness and performance in specific non-traumatic populations.

INTRODUCTION

Outcome measurement is an important component of contemporary orthopaedic practice because treatment success cannot be determined solely from radiographic or anatomical findings. Functional status, pain, mobility, stability, and health-related quality of life are clinically meaningful outcomes that should be assessed systematically. Standardized scoring instruments allow clinicians and researchers to quantify these domains, monitor patients over time, and compare outcomes across populations, interventions, and healthcare settings.[1–4]

The ankle and hindfoot complex is particularly relevant to functional outcome assessment because it is exposed to substantial mechanical loading and is essential for gait, balance, and adaptation to uneven surfaces. The ankle joint is formed by the tibia, fibula, and talus, while the subtalar, talonavicular, and calcaneocuboid joints contribute to hindfoot motion and adaptability. Disorders affecting these structures, including fractures, instability, osteoarthritis,

deformity, and postoperative conditions, can produce pain, restricted movement, altered gait, and reduced participation in daily activities.[12–16]
The American Orthopaedic Foot and Ankle Society (AOFAS) Ankle-Hindfoot Score is one of the most widely used clinical scoring systems for ankle and hindfoot disorders. It combines pain, function, and alignment into a 100-point scale, with higher scores representing better clinical status. The instrument includes patient-reported components and clinician-assessed physical findings, making it practical for routine orthopaedic assessment.[5,6,19]
Despite its widespread use, the AOFAS score has been criticized because it is not a fully patient-reported outcome measure and includes clinician-dependent components that may introduce inter-observer variation. Its psychometric performance has also been questioned in comparison with contemporary PROMs such as FAOS.[5,6,19,23] These limitations make formal validation particularly important when the instrument is translated into another language or used in a different cultural context.
Cross-cultural adaptation is not equivalent to literal translation. Translation and validation should preserve conceptual equivalence while ensuring that wording is understandable and relevant to the target population. Previous studies of translated AOFAS instruments, including Dutch, Japanese, Persian, and other language versions, have demonstrated the importance of cultural adaptation and psychometric testing.[7,8,10,22]
In Indonesia, a formally validated Indonesian-language version of the AOFAS Ankle-Hindfoot Score has been needed to facilitate consistent clinical evaluation and research. An Indonesian instrument may improve patient comprehension and reduce language-related measurement error while enabling comparison with international studies. Therefore, this study aimed to evaluate the validity and reliability of the Indonesian version of the AOFAS Ankle-Hindfoot Score in adults with ankle and hindfoot disorders.

METHODS

Study design and setting

This was a methodological validation study with a cross-sectional assessment of the psychometric performance of the Indonesian AOFAS Ankle-Hindfoot Score. The study was conducted in a multicenter clinical setting involving Haji Adam Malik General Hospital Medan, Haji Hospital Medan, and Ibnu Sina Hospital Padang. The study period was reported in the source manuscript as November 2025 to January 2026 in the methods section, while the results section states that participant recruitment continued from November 2025 to April 2026. This discrepancy should be verified against the study log before journal submission.

Participants

The target population comprised adults with ankle or hindfoot disorders, including traumatic, postoperative, and degenerative conditions. Inclusion criteria were age ≥18 years; a diagnosis involving the ankle or hindfoot; independent ambulation before injury or disease onset; clinical condition permitting physical examination; ability to read and understand Indonesian; and provision of informed consent. Patients with cognitive or psychiatric disorders that could interfere with comprehension of the instruments, or severe medical conditions preventing questionnaire completion, were excluded.

Instruments

The principal instrument was the AOFAS Ankle-Hindfoot Score Indonesian version. The score ranges from 0 to 100 and evaluates pain, function, and alignment. The study also used the Indonesian versions of the Foot and Ankle Outcome Score (FAOS) and Short Form-36 (SF-36) as comparator instruments for convergent validity. FAOS assesses pain, other symptoms, activities of daily living, sport and recreation, and foot- and ankle-related quality of life. SF-36 evaluates general health-related quality of life across physical and mental health domains.

Variables and outcomes

The independent variable was the Indonesian AOFAS score, while FAOS and SF-36 were used as dependent/comparator measures for validity assessment. Age and educational level were considered potential confounding variables. The principal psychometric outcomes were item validity, internal consistency, inter-rater reliability, convergent validity, and floor and ceiling effects.

Statistical analysis

Data analysis was planned using IBM SPSS Statistics version 27. Descriptive statistics were used to summarize demographic and clinical characteristics. Categorical variables were presented as frequencies and percentages, whereas numerical variables were summarized using means and standard deviations. Item validity was examined using Pearson correlation, with statistical significance assessed at $p < 0.05$. Internal consistency was assessed using Cronbach's alpha. Inter-rater reliability between two orthopaedic examiners was evaluated using Cohen's kappa. Convergent validity was assessed by Pearson correlation between AOFAS and the comparator instruments, FAOS and SF-36. Floor and ceiling effects were examined as the proportions of participants concentrated at the extreme ends of the scoring range.

Ethical considerations

The study protocol was to be conducted after approval by the Health Research Ethics Committee of the Faculty of Medicine, Universitas Sumatera Utara. Participants were informed about the study objectives, benefits, and procedures and provided written informed consent. Patient identity and clinical information were to be kept confidential, and participants could withdraw at any time without affecting their medical care.

RESULTS

Participant characteristics

A total of 87 respondents met the reported inclusion and exclusion criteria and were included in the descriptive analysis. The mean age was 40.0 ± 16.1 years. Men comprised 51 participants (58.6%) and women 36 (41.4%). The largest educational group was university education (39 participants; 44.8%), followed by senior high school (28; 32.2%), junior high school (11; 12.6%), and elementary school (9; 10.3%). The mean total AOFAS Ankle-Hindfoot Score was 59.03 ± 19.72.

Table 1. Demographic characteristics and overall AOFAS score.

Characteristic	n (%) / Mean ± SD
Age, years	40.0 ± 16.1
Male	51 (58.6)
Female	36 (41.4)
Elementary school	9 (10.3)
Junior high school	11 (12.6)
Senior high school	28 (32.2)
University	39 (44.8)
AOFAS total score	59.03 ± 19.72
Total	87 (100)

AOFAS scores by sex and educational level

The mean AOFAS score was 57.5 ± 20.0 among men and 61.2 ± 19.4 among women. By educational level, the highest overall mean was observed among participants with elementary education (68.7 ± 9.34), followed by university education (62.2 ± 17.5), junior high school (56.8 ± 27.6), and senior high school (52.4 ± 20.1). Within sex-specific educational groups, mean scores varied, with the lowest mean among men occurring in the senior high school group (46.9 ± 18.71) and among women in the junior high school group (48.3 ± 35.81). These descriptive differences were not accompanied by inferential testing in the source data and therefore should not be interpreted as statistically significant group differences.

Table 2. Descriptive AOFAS scores by sex and educational level.

Group	n	Mean ± SD
Male	51	57.5 ± 20.0
Female	36	61.2 ± 19.4
Elementary school	9	68.7 ± 9.34
Junior high school	11	56.8 ± 27.6
Senior high school	28	52.4 ± 20.1
University	39	62.2 ± 17.5
Male—elementary	5	67.8 ± 8.73
Male—junior high	8	60.0 ± 26.02
Male—senior high	16	46.9 ± 18.71
Male—university	22	62.0 ± 18.10
Female—elementary	4	69.8 ± 11.32
Female—junior high	3	48.3 ± 35.81
Female—senior high	12	59.8 ± 20.36
Female—university	17	62.5 ± 17.34
Total	87	59.0 ± 19.7

Internal item validity

Item-level validity was assessed in 81 participants. All nine AOFAS items demonstrated statistically significant positive correlations. Pearson correlation coefficients ranged from 0.623 to 0.856, and all p values were <0.001. The strongest item correlations were observed for alignment (Q9, r=0.856), pain (Q1, r=0.849), and stability (Q8, r=0.848). The lowest correlation was observed for activity/function (Q2, r=0.623). All correlations exceeded the stated minimum criterion of r>0.30.

Table 3. Item-level validity of the Indonesian AOFAS Ankle-Hindfoot Score (n=81).

Item	Domain	Pearson r	p	Interpretation
Q1	Pain	0.849	<0.001	Valid
Q2	Activity/Function	0.623	<0.001	Valid
Q3	Maximum walking distance	0.817	<0.001	Valid
Q4	Walking surface	0.796	<0.001	Valid
Q5	Gait abnormality	0.675	<0.001	Valid
Q6	Sagittal motion	0.735	<0.001	Valid
Q7	Hindfoot motion	0.726	<0.001	Valid
Q8	Stability	0.848	<0.001	Valid
Q9	Alignment	0.856	<0.001	Valid

Internal consistency

The Indonesian AOFAS Ankle-Hindfoot Score demonstrated high internal consistency across its nine items, with a Cronbach's alpha of 0.851. According to the classification used in the source manuscript, this was considered excellent/highly reliable internal consistency.

Table 4. Internal consistency reliability.

Instrument	Items	Cronbach's alpha	Interpretation
Indonesian AOFAS Ankle-Hindfoot Score	9	0.851	High / excellent internal consistency

Inter-rater reliability

Inter-rater reliability was assessed between two orthopaedic examiners evaluating the same 81 participants. Cohen's kappa values ranged from 0.911 to 1.000, with $p<0.001$ for all items. The mean kappa was 0.975, indicating almost perfect agreement. Perfect agreement ($\kappa=1.000$) was observed for walking surface, hindfoot motion, and stability.

Table 5. Inter-rater reliability of the Indonesian AOFAS score.

Item	Cohen's κ	p	Agreement
Q1 Pain	0.911	<0.001	Almost perfect
Q2 Activity/Function	0.982	<0.001	Almost perfect
Q3 Walking distance	0.981	<0.001	Almost perfect
Q4 Walking surface	1.000	<0.001	Almost perfect
Q5 Gait	0.977	<0.001	Almost perfect
Q6 Sagittal motion	0.977	<0.001	Almost perfect
Q7 Hindfoot motion	1.000	<0.001	Almost perfect
Q8 Stability	1.000	<0.001	Almost perfect
Q9 Alignment	0.947	<0.001	Almost perfect
Mean	0.975	—	Almost perfect

Convergent validity

Convergent validity was examined by comparing the Indonesian AOFAS score with FAOS and SF-36. The AOFAS score showed a strong positive correlation with FAOS ($r=0.850$, $p<0.001$) and SF-36 ($r=0.911$, $p<0.001$). These findings support convergent validity, indicating that higher AOFAS scores were associated with better scores on the comparator measures.

Table 6. Convergent validity of the Indonesian AOFAS score.

Comparator instrument	Pearson r	p	Interpretation
FAOS total score	0.850	<0.001	Very strong positive correlation
SF-36 total score	0.911	<0.001	Very strong positive correlation

Floor and ceiling effects

The total AOFAS score had a mean of 59.0 ± 19.7 and showed no floor or ceiling effect (0% for each). FAOS also demonstrated no ceiling effect across its subscales; a small floor effect was observed only in the sport and recreation domain (2.2%). For SF-36, the largest floor effect was observed in emotional role limitations (14.9%), followed by physical role limitations (12.6%). These values remained below the 15% threshold described in the source manuscript. Ceiling effects in SF-36 were low, ranging from 0% to 4.5% across the reported domains.

Table 7. Distribution, floor effects, and ceiling effects of AOFAS, SF-36, and FAOS (n=87).

Instrument / subscale	Mean ± SD	Floor effect	Ceiling effect
AOFAS total	59.0 ± 19.7	0%	0%
SF-36 Physical functioning	57.2 ± 23.0	1.1%	1.1%
SF-36 Physical role limitation	48.7 ± 28.3	12.6%	3.4%
SF-36 Emotional role limitation	54.5 ± 25.9	14.9%	3.4%
SF-36 Energy	58.4 ± 11.9	0%	0%
SF-36 Emotional well-being	63.6 ± 12.2	0%	0%
SF-36 Social functioning	63.7 ± 13.7	0%	1.1%
SF-36 Pain	57.5 ± 22.3	0%	1.1%
SF-36 General health	66.0 ± 12.7	0%	1.1%
SF-36 Health change	51.4 ± 22.7	3.4%	4.5%
FAOS Pain	49.4 ± 26.7	0%	0%
FAOS Symptoms	46.8 ± 25.2	0%	0%
FAOS ADL	53.8 ± 24.8	0%	0%
FAOS Sport/Recreation	39.0 ± 23.5	2.2%	0%
FAOS Quality of Life	41.7 ± 24.0	0%	0%

DISCUSSION

This study evaluated the psychometric performance of the Indonesian AOFAS Ankle-Hindfoot Score in adults with ankle and hindfoot disorders. The main findings were that all nine AOFAS items demonstrated significant item-level validity, internal consistency was high, inter-rater agreement was almost perfect, and correlations with FAOS and SF-36 were strong. In addition, the total AOFAS score showed neither a floor nor a ceiling effect in the study population. Taken together, these findings support the usefulness of the Indonesian AOFAS score as a standardized measure of ankle and hindfoot function.

The demographic profile showed a predominance of men and a mean age within the productive-age range. The higher proportion of male participants may reflect the clinical composition of patients with ankle and hindfoot disorders in the participating centers, particularly traumatic presentations. The source manuscript describes trauma and fractures as prominent clinical conditions, although a complete diagnosis-by-category table was not provided in the reported results. Consequently, the present article does not quantify the diagnostic distribution beyond the information explicitly reported.

All nine AOFAS items had Pearson correlation coefficients above 0.60 and $p<0.001$. This indicates that each item contributed meaningfully to the overall construct measured by the instrument. Pain, stability, and alignment showed particularly strong correlations with the total score. The findings are consistent with previous cross-cultural validation work showing that the AOFAS can retain satisfactory psychometric properties after translation and cultural adaptation.[6–8,10,22] The present results also suggest that the Indonesian wording was sufficiently understandable for the study population, including participants with different educational backgrounds.

The internal consistency coefficient of 0.851 indicates that the nine items demonstrate strong coherence. This is relevant because an outcome instrument should produce reasonably consistent measurements when its items are intended to assess related aspects of a clinical construct. The finding is compatible with previous reports of acceptable reliability for translated AOFAS versions, although direct comparison should be made cautiously because different studies may use different populations, domains, scoring approaches, and analytical procedures.[6,7]

Inter-rater reliability was particularly strong. The mean kappa of 0.975, with individual values from 0.911 to 1.000, indicates almost perfect agreement between the two orthopaedic examiners. This is important for the AOFAS because several components require clinician assessment, including motion, stability, gait, and alignment. High agreement suggests that the Indonesian instructions and operational definitions were sufficiently clear to produce consistent scoring between examiners. It is possible that examiner calibration before assessment contributed to this

high agreement; however, the extent and procedure of calibration were not described in sufficient detail in the source manuscript and should be reported explicitly in a journal submission.

The strong correlation with FAOS (r=0.850) supports convergent validity because both instruments address clinically related aspects of foot and ankle symptoms and function. The correlation with SF-36 was also strong (r=0.911), indicating that ankle and hindfoot functional status was closely associated with general health-related quality of life in this sample. These findings are clinically plausible because pain and functional limitation of the ankle and hindfoot can affect mobility, daily activities, social participation, and perceived health. Nevertheless, because SF-36 is a generic health-related quality-of-life instrument rather than an ankle-specific measure, the correlation should be interpreted as evidence of related constructs rather than equivalence between the instruments.

The absence of floor and ceiling effects in the total AOFAS score is another favorable finding. A score distribution that does not cluster excessively at the lowest or highest possible value suggests that the instrument can discriminate across a range of functional states in the studied population. FAOS also showed minimal extreme-score effects, while some SF-36 domains approached but did not exceed the 15% threshold reported in the source manuscript. These findings support adequate score dispersion, although larger samples are required to determine whether the same pattern is maintained in patients with very mild or very severe disease.

The study has several limitations. First, the source manuscript contains inconsistencies in the reported study period, sample size used for different analyses, and several psychometric coefficients. The descriptive analysis is based on 87 participants, whereas item validity and inter-rater analyses are based on 81 participants. The results tables report Cronbach's alpha of 0.851 and convergent correlations of 0.850 with FAOS and 0.911 with SF-36, while parts of the discussion and conclusion report alpha=0.873 and correlations of 0.992 and 0.988. The table-derived values have been used in this article because they directly document the reported analyses, but these discrepancies must be reconciled against the original statistical output before submission.

Second, the cross-sectional design does not permit assessment of responsiveness, namely the ability of the instrument to detect clinically meaningful change over time. Responsiveness is especially important for outcome instruments intended to evaluate treatment results. Third, the sample may not represent the full spectrum of ankle and hindfoot pathology, particularly non-traumatic disorders. Future studies should therefore include larger and more heterogeneous populations, including degenerative disease, diabetic foot conditions, inflammatory arthritis, and congenital deformities. Fourth, the translation and cross-cultural adaptation procedure should be described in greater methodological detail, including forward translation, reconciliation, back-translation, expert review, pretesting, and cognitive debriefing where applicable, in accordance with established recommendations.[22]

CONCLUSION

The Indonesian version of the AOFAS Ankle-Hindfoot Score demonstrated significant item-level validity, high internal consistency, almost perfect inter-rater reliability, and strong convergent validity with FAOS and SF-36 in the study population. All nine items showed significant correlations, Cronbach's alpha was 0.851, mean Cohen's kappa was 0.975, and correlations with FAOS and SF-36 were 0.850 and 0.911, respectively. No floor or ceiling effect was observed for the total AOFAS score. These findings support the use of the Indonesian AOFAS Ankle-Hindfoot Score for clinical assessment and research involving Indonesian adults with ankle and hindfoot disorders. Further prospective and multicenter research is recommended to evaluate responsiveness, minimal clinically important change, test-retest reliability, and validity in specific non-traumatic populations.

RECOMMENDATIONS

Future studies should evaluate the proportion of patients achieving the minimum or maximum possible scores to further assess discrimination at the extremes of disease severity. Validation should also be extended to specific non-traumatic populations, including patients with diabetic foot ulcers, rheumatoid arthritis, and adult congenital foot deformities such as congenital talipes equinovarus. Additional studies should assess responsiveness and longitudinal measurement properties and should report the translation and cultural-adaptation procedure in accordance with internationally recognized guidelines.

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