Acta Biomed 2024; Vol. 95, N. 5: e2024177 DOI: 10.23750/abm.v95i5.16236

Original article

Cross-cultural adaptation and validation of the Kazakh version of American Orthopaedic Foot and Ankle Society Score (AOFAS) questionnaire

Meruyert Makhmetova[1], Kazybek Baktybergen[2], Yerik Raimagambetov[3], Bagdat Balbossynov[4], Dina Saginova[5]

[1]Research School, Astana Medical University, Astana, Kazakhstan; [2]School of Medicine, Nazarbayev University, Astana, Kazakhstan; [3]Department of Orthopaedics No. 5, National Scientific Centre of Traumatology and Orthopaedics named after Academician Batpenov N.D., Astana, Kazakhstan; [4]Department of the Arthroscopy and Sports Trauma, National Scientific Centre of Traumatology and Orthopaedics named after Academician Batpenov N.D., Astana, Kazakhstan; [5]Centre for Science and Education, National Scientific Centre of Traumatology and Orthopaedics named after Academician Batpenov N.D., Astana, Kazakhstan

Abstract. *Background and aim:* The AOFAS-AHS questionnaire is used to evaluate the function of the ankle joint. However, its use in the Republic of Kazakhstan is difficult due to the unavailability of the questionnaire in the Kazakh language. This study aimed to translate and culturally adapt the American Orthopaedic Foot and Ankle Society Ankle-Hindfoot Scale (AOFAS-AHS) into Kazakh (AOFAS-KLV) and evaluate its reliability and validity. *Methods:* 66 Kazakh-speaking patients with ankle and hindfoot pathologies participated. Statistical analyses included descriptive methods for patient characteristics and questionnaire scores, alongside psychometric analyses to assess reliability (internal consistency and test-retest reliability) and construct validity using guidelines from the Consensus-based Standards for the Selection of Health Measurement Instruments (COSMIN). *Results:* The AOFAS-KLV demonstrated adequate reliability with a Cronbach's α of 0.724 for the total score. Test-retest reliability was confirmed with intraclass correlation coefficients (ICC) ranging from 0.853 to 0.958. Content validity showed minimal ceiling and floor effects. Construct validity was acceptable, with Spearman's rank correlations supporting predefined hypotheses. The Bland-Altman analysis indicated no systematic bias. *Conclusions*: The culturally adapted AOFAS-KLV is a valid and reliable instrument for assessing foot and ankle pathologies in Kazakh patients, contributing to standardized clinical evaluations and long-term patient monitoring in Kazakhstan. Further research should focus on responsiveness and longitudinal validity. (www.actabiomedica.it)

Key words: AOFAS, Kazakh translation, ankle, cultural adaptation, reliability, validity

Introduction

Ankle injuries are among the most common sports injuries, often leading to functional disability, chronic pain, and exclusion from professional activities (1). Unfortunately, one of the unfavorable outcomes of these injuries is cartilage damage, which can quickly lead to ankle osteoarthritis (2). In addition, ankle injuries can lead to osteochondral lesions that mainly affect working-age men. Clinical symptoms of ankle injuries include localized pain and swelling in the medial or lateral ankle regions, which worsen with weight bearing and exercise. Some patients may also report instances of ankle locking or impingement. Post-traumatic osteoarthritis accounts for about 12% of all osteoarthritis (OA) cases and develops earlier

than primary OA (3). Two-thirds of post-traumatic osteoarthritis cases are more commonly due to rotational trauma to the ankle (4). The remaining cases arise from chronic ligamentous instability, malpositioning, inflammatory arthritis, neuropathy, systemic disease, or idiopathic causes. In ankle surgery, several tests are employed to measure clinical outcomes and assess the success of interventions. These methods involve objective measures such as laboratory tests and vital signs. Clinicians also use standardized follow-up examinations, known as "clinician-based outcomes" to monitor progress (5). Patient-reported outcome measures (PROMs) provide a subjective approach for patients to directly report information regarding their function, quality of life, pain, and symptoms without the need for interpretation by a physician (6). Some questionnaires are solely PROMs, while others combine a patient-reported portion with a physician-reported portion.

However, most of these questionnaires are presented in English and within its cultural context, which causes difficulties in applying them in other countries. This problem is critical because the results of the questionnaires depend on subjective responses from patients. Misinterpretation or misunderstanding by patients can lead to errors in assessment and render the use of these scales ineffective. Thus, there is a need for careful translation and cultural adaptation of questionnaires without loss of meaning (7). The American Orthopaedic Foot and Ankle Society Ankle-Hindfoot Scale (AOFAS-AHS) rating system is one of the most widely used tools by clinicians for reporting foot and ankle diseases. This clinical evaluation system, created by Kitaoka et al., merges the patient's self-reported pain and functional assessments with the surgeon's objective evaluations during a physical examination, which includes analysis of sagittal motion, hindfoot motion, stability, and ankle joint alignment (8). The original language version of the AOFAS-AHS has demonstrated reliability (8-10). The study populations included assessments of non-traumatic conditions, such as general ankle and hindfoot complaints, as well as ankle joint osteoarthritis. The initial version of the AOFAS-AHS is written in English, limiting its use in non-English-speaking countries. The AOFAS-AHS has previously been translated and culturally adapted into other languages such as Dutch, Arabic, Iranian, Turkish, Danish, Italian, Persian and German and has been shown to be a valid and reliable scoring system (11-20). However, there is no translation and cultural adaptation of the AOFAS-AHS into Kazakh (AOFAS-KLV). Therefore, the purpose of this study was to translate and culturally adapt the AOFAS-AHS into Kazakh and to assess its reliability and validity.

Methods

Participants

This single-center observational study was conducted between June 2023 and February 2024. Approval of the local ethics committee dated 09.11.2022 No. 4/2 was obtained. All participants were informed about research study before providing written informed consent. Inclusion criteria were: (1) age 18 or older; (2) ankle and hindfoot pathologies which included osteoarthritis, plantar fasciitis, chronic ankle impingement syndrome, calcaneal spur, cartilage lesions, diabetic foot; (3) the ability to read, write, or comprehend Kazakh fluently. Exclusion criteria were: (1) peripheral neuropathy and nerve injury; (2) infection; (3) acute fractures in the lower extremities; (4) radiating pain because of the chronic spine disorders; (4) multitrauma. A total of 66 Kazakh-speaking patients were included in the study (Figure 1).

The study included 46 patients (69.7%) with isolated ankle osteoarthritis, 8 patients (12.1%) with both ankle and subtalar osteoarthritis, 5 patients (7.6%) with ankle osteoarthritis and chronic ankle instability, and 7 patients (10.6%) with ankle impingement syndrome (Table 1). The diagnoses were confirmed by orthopedic specialists based on symptoms, physical examination, and instrumental examination findings. All patients were interviewed using the AOFAS-KLV questionnaire translated into Kazakh language.

AOFAS-AHS questionnaire

The AOFAS-AHS questionnaire consists of nine questions, four of which assess pain and function, while the remaining five evaluate range of motion,

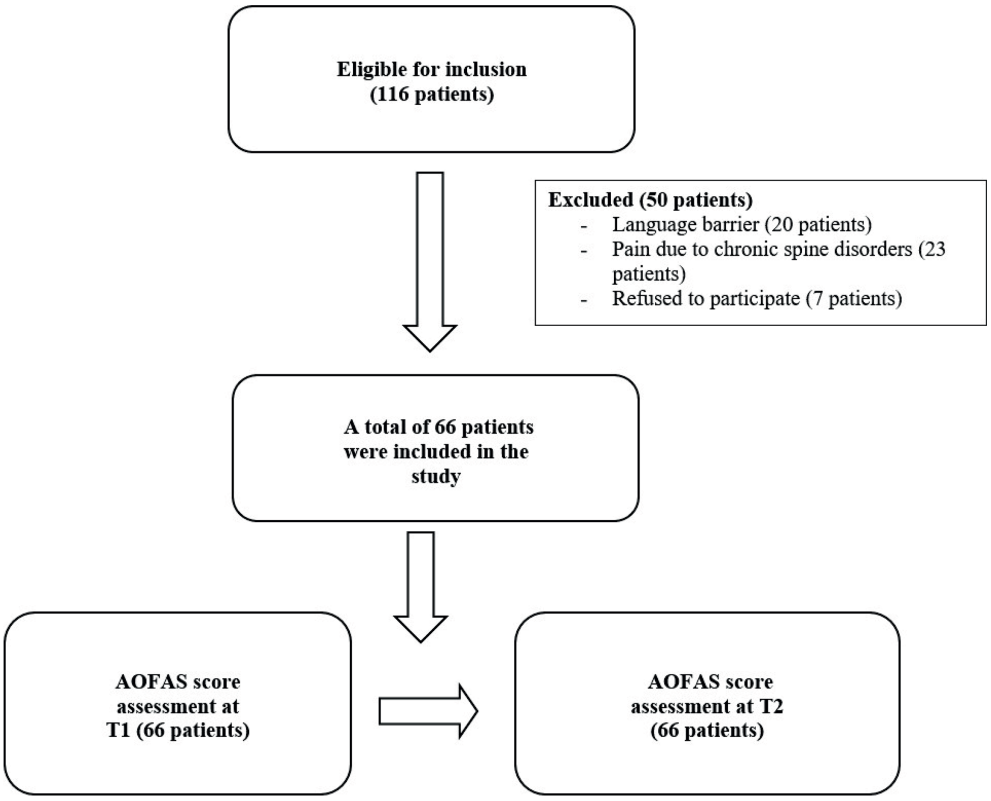

Figure 1. Flowchart.

Table 1. Demographic data for the study patients. Data of the study are presented as median (Interquartile range) or as n (%).

Age	
Median (IQR)	54 (44;61)
Sex	
Male (n (%))	36 (54)
Female (n (%))	30 (46)
BMI	
Median (IQR)	26.45 (23.4;28.8)
Affected side	
Right (n (%))	41 (62)
Left (n (%))	25 (38)
Diagnosis	
Isolated ankle osteoarthritis n (%)	46 (69.7)
Ankle osteoarthritis and chronic ankle instability n (%)	5 (7.6)
Ankle impingement syndrome n (%)	7 (10.6)
Both ankle and subtalar osteoarthritis n (%)	8 (12.1)

instability, deformity, and bearing capacity. To calculate the total score, the scores for each response, which are not evenly distributed among the different questions, must be summed. The scores range from zero to 100, with the maximum score reflecting the best joint function.

EQ-5D-5L

The EuroQol Group introduced the EQ-5D-5L in 2009 to enhance the instrument's sensitivity and minimize ceiling effects compared to the EQ-5D-3L. The EQ-5D-5L includes two components: the EQ-5D descriptive system and the EQ visual analogue scale (EQ VAS). The descriptive system covers five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Each dimension is rated on five levels: no problems, slight problems, moderate problems, severe problems, and extreme problems. Patients select their health status by ticking

the box next to the most fitting statement in each of the five dimensions. This choice results in a 1-digit number representing the level chosen for that dimension. These digits across the five dimensions combine into a 5-digit number that characterizes the patient's overall health state.

This questionnaire was employed to evaluate construct validity through hypothesis testing. The Kazakh-language version, translated by the developers following a standardized protocol, ensures equivalence with the original version. For our study, we utilized the Kazakh-language version of the EQ-5D-5L questionnaire, obtained from the official EuroQol website (21).

Translation and cross-cultural adaptation

The study followed the recommended five stages of cross-cultural adaptation, which include translation, synthesis, back-translation, peer review, and pre-testing (22). Translation: First, two native Kazakh speakers, including one orthopedist and one non-medical expert, translated the original version of the questionnaire into Kazakh. A synthesis of these translations was then made, and both translators agreed on the translated version. Synthesis, Back-Translation, and Review by an Expert Committee: The translated AOFAS-KLV questionnaires were aligned to produce a single questionnaire. A native English speaker, who was also fluent in Kazakh, then translated this version back into English. This back-translated version was compared with the original at an expert committee meeting to eliminate possible contradictions and ambiguities. Pre-Testing: Finally, the translated version of AOFAS-KLV was pre-tested on a group of 10 patients from the cultural adaptation focus group. Feedback was received from all patients on whether they understood the questions and could provide answers. In question 2, the phrase "means of additional support" was not clear to all patients, so examples such as crutches, canes, and walkers were added for clarification. In question 3, the unit of measurement "street block" was changed to 100 meters. In question 9, "alignment" was changed to "foot position" and "deformity." After all adjustments, the final version of the AOFAS-KLV scale in the Kazakh language was accepted (Table S1).

Statistical analysis

Statistical Package Social Sciences (SPSS V. 29.0) was used for statistical analysis of the study. Descriptive method of statistical analysis was performed for patient characteristics and questionnaire scores. Measurement properties of AOFAS scale were identified based on the Consensus-based Standards for the Selection of Health Measurement Instruments (COSMIN) guidelines (23). The already validated EQ-5D-5L (sub)scales in Kazakhstan were used to compare with AOFAS (sub)scales. A summary of the statistical analysis and measurement properties is shown in Table 2.

Psychometric analysis

Content validity evaluates scale's capability for measuring the concept of the interest in the proper way. This can be analyzed by using ceiling and flooring effects, which can be identified if more than 15% of the study population gains the highest possible score (60 points) or lowest possible score (0 point). The ceiling and flooring effects were investigated at two different time points, which are T1 (Day 0) and T2 (Day 7). Cronbach' α used to identify internal consistency, that reveals the extent to which items of the scale measure the same construct. The value of Cronbach' α greater than 0.7 is assumed acceptable. Construct validity demonstrates the degree to which the scores of a scale correspond to the hypotheses which depend on the assumption that the scale provides an accurate measurement of the target construct. AOFAS total score, its (sub) scales, and EQ-5D-5L subscales used to identify correlation between them. Spearman's rank coefficients (r) were used for statistical analysis, with the strength of correlation classified as high ($r > 0.60$), moderate ($0.3 < r < 0.6$), or low ($r < 0.3$). Construct validity was accepted as adequate if at least 75% of the results corresponded to the predefined hypotheses. Reliability reflects the degree to which a scale measures the construct of interest consistently and it can be identified by using the intra-class correlation coefficient (ICC). The ICC is categorized in terms of agreement, where ICC < 0.2 indicated as poor, fair (ICC = 0.2-0.4), moderate (ICC = 0.4-0.6), significant (ICC = 0.6-0.8), and complete agreement (ICC > 0.8). The ICC for the

Table 2. Measurement characteristics and its definitions.

Measurement property	Definition/calculation	Result	Data used
Floor and ceiling effects	Percentage of patients with lowest or highest possible score	> 15%	T1, T2
Reliability			
Internal consistency	Cronbach's α value	0.70-0.95 for unidimensional scales	T1
Construct validity	Spearman's rank correlation (r) of scores between scales.		T1
	Strength of correlation: high (r>0.6), moderate (0.3<r< 0.6) or low (r<0.3)		
Test-retest reliability			
ICC (agreement)	ICC (agreement) with 95% CI	>0.70 at n≥50	T1, T2
Absolute agreement			
SEM (agreement) and SDC	SDC (individual)=1.96<x√2xSEM		T1, T2
	SDC (group)=SDCindividual/√n		
RCI	RCI=SDC (group)/maximum score×100%		T1, T2
Bland-Altman analysis	95% limits of agreement=(meanchange T2–T1)±1.96xSDchange	Measurement bias is indicated by the presence of zero outside of interval	T1, T2

Abbreviations: ICC, intraclass correlation coefficient; RCI, Reliable Change Index; SEM, Standard Error of measurement; SDC, smallest detectable change.

AOFAS (sub)scales was evaluated at T1 and T2 with sample size of at least 50 patients. The calculations of the Standard error of measurement (SEM agreement) and the Smallest detectable change (SDC) are shown in Table 2. The degree of the absolute agreement was determined by a Bland and Altman analysis.

Results

According to Table 1, a total of 66 patients participated in the study, with a median age of 54 years (IQR 44-61). From a total of 66 patients, 36 (54%) were males, while 30 (46%) were females. The median BMI was 26.45 (IQR 23.4–28.8). 41 (62%) patients had the right side affected.

Figure 2 shows the distribution of the AOFAS total score at T1 and T2. The median at T1 is 49.5, with an interquartile range (IQR) of 39 to 57. Meanwhile, the median at T2 is 49, with an IQR of 39 to 59. Both T1 and T2 exhibit relatively similar median scores, with a total range going from 12 to 82. According to Table 3, there is a slight change in the AOFAS total scores from T1 to T2, with an insignificant increase in the mean score from 46.8 ± 16.1 to 47.3 ± 16.4. The mean of the pain subscale increased from 17.8 ± 8.14 at T1 to 19.39 ± 9.26 at T2, and this could be due to effective pain management between the two time points.

Floor and ceiling effects

The total AOFAS, pain subscale, and function subscale had no ceiling effects at both T1 and T2. However, the alignment subscale of AOFAS had a ceiling effect of 19.7% and 15.2% at T1 and T2, respectively (Figure 3A).

At both time points, there were no floor effects in the total AOFAS score or function subscale. While the AOFAS pain subscale had a floor effect of 15.2% at both T1 and T2, The AOFAS alignment showed a floor effect of 16.7% only at T2 (Figure 3B).

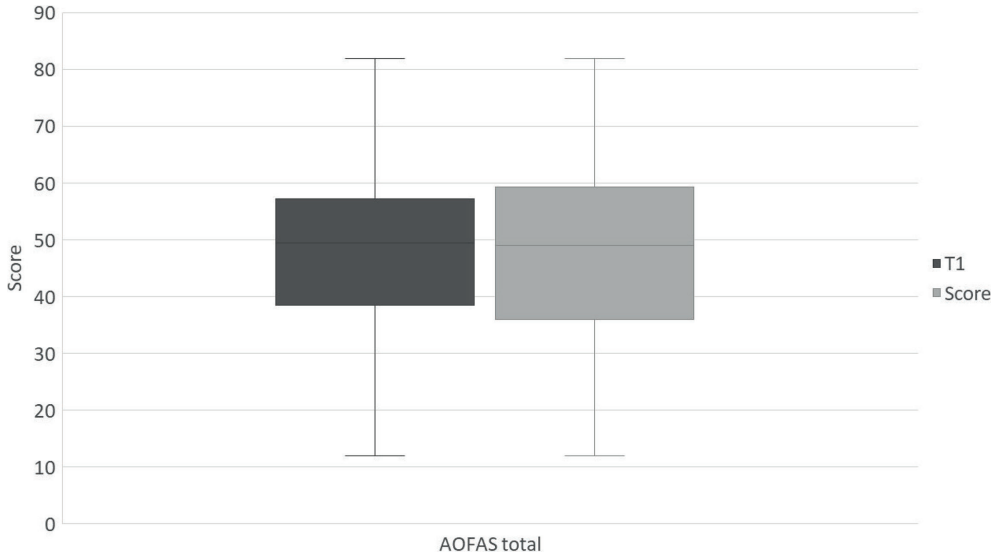

Figure 2. Box plot of AOFAS total score at T1 and T2.

Table 3. Summary of statistics of AOFAS score assessments at T1 and T2.

(Sub)scale	Mean± SD	Median	Range	Minimum and Maximum scores
AOFAS score assessment (T1)				
Total	46.8 ± 16.1	49.5	12-82	0-100
Pain	17.8 ± 8.14	20	0-30	0-40
Function	23.5 ± 8.28	24.5	4-42	0-50
Alignment	5.45 ± 2.73	5	0-10	0-10
AOFAS score assessment (T2)				
Total	47.3 ± 16.4	49	12-82	0-100
Pain	19.39 ± 9.26	20	0-30	0-40
Function	22.98 ± 8.53	24	7-42	0-50
Alignment	4.94 ± 2.84	5	0-10	0-10

Abbreviation: SD, Standard deviation.

Reliability

Internal consistency

The total AOFAS score exhibited a Cronbach's α of 0.724, which suggests adequate internal consistency (Table 4). In addition, the AOFAS Function Subscale also showed adequate internal consistency with a Cronbach's α of 0.746. The AOFAS Pain and Alignment subscales consist of only one item, due to which Cronbach's α was not applicable to these subscales. The EQ-5D-5L represented adequate internal consistency (α = 0.850).

Construct validity

Table 5 shows hypothesized correlations between subscales of AOFAS and EQ-5D-5L. Spearman's rank correlations for construct validity are provided in Table 6. Construct validity was adequate for both the AOFAS total scale and pain subscale; the predictions were carried out correctly for 88.9% of predefined

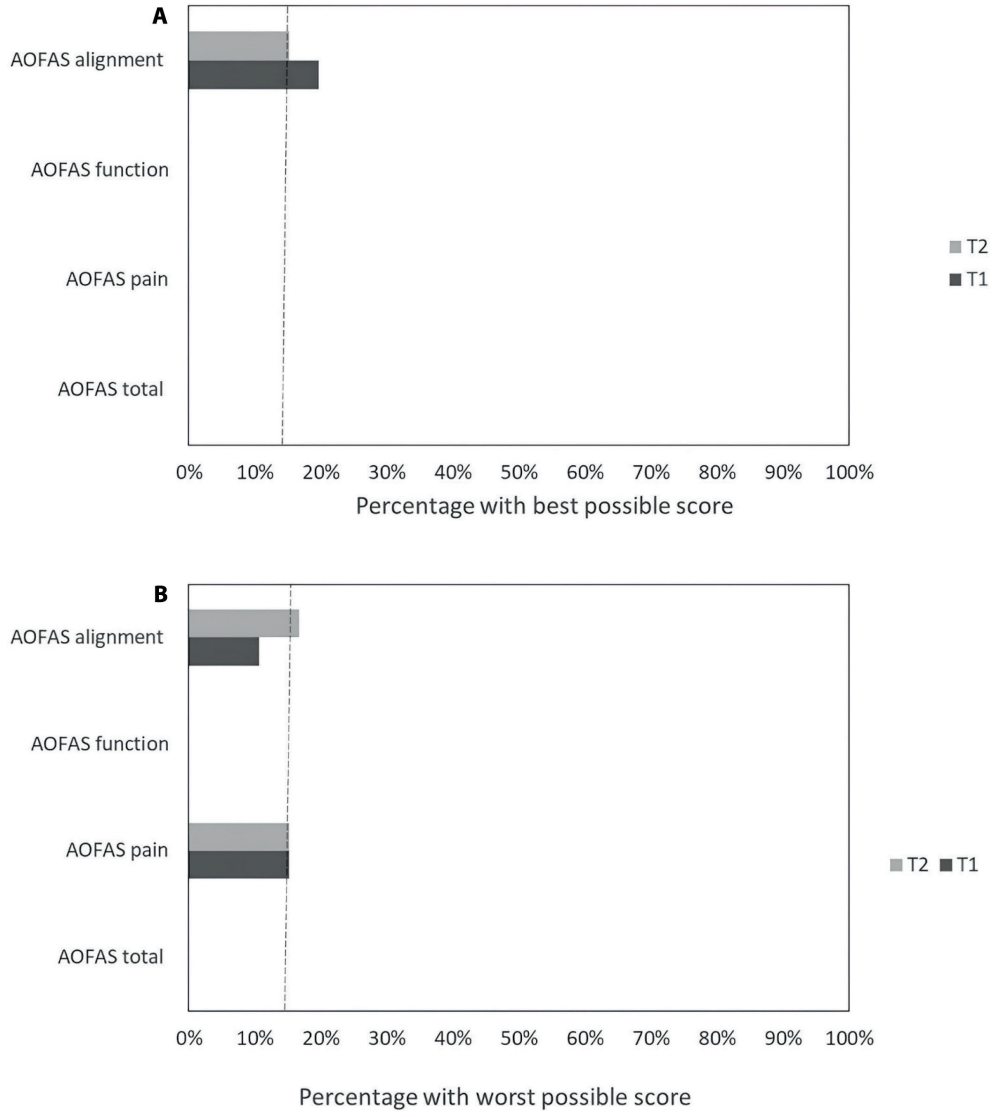

Figure 3. Ceiling effects (A) and Floor effects (B) of the (sub)scales of the AOFAS used in patients at T1 and T2. The dotted line shows the acceptable 15% of patients with the maximum score. AOFAS, American Orthopaedic Foot and Ankle Society.

hypotheses in both subscales. The predefined hypotheses of the function and alignment subscales were predicted accurately for 7 out of 9 correlations (77.8%).

Reproducibility

Test-retest reliability

The intraclass correlation coefficient (ICC), which indicates the reliability of the study, is demonstrated in Table 7. The ICC for all subscales of AOFAS indicated adequate (>0.70) test-retest reliability, which ranged from 0.853 to 0.958.

Agreement and the smallest detectable change

According to Table 7, the Smallest Detectable Change (SDC) and the Reliable Change Index (RCI) suggest the agreement level. The total scale of AOFAS had an SDC of 2.86 with 2.86% RCI, while the alignment subscale of AOFAS showed an SDC of 1.3 with 13.0% RCI, respectively. In Figure 4, the Bland and

Table 4. Internal consistency of instruments used in patients. Data for T=1 was used. * Not Applicable, as this subscale consists of one item only.

(Sub)scale	n	NO of items	Cronbach's α
AOFAS			
Total	66	9	0.724
Pain	66	1	NA*
Function	66	7	0.746
Alighment	66	1	NA*
EQ-5D-5L			
Total	66	5	0.85

Abbreviations: AOFAS, American Orthopaedic Foot and Ankle Society. EQ-5D-5L, EuroQol 5-Dimension 5-level.

Table 5. Hypothesized correlations between (sub)scales of AOFAS and EQ-5D-5L for construct validity in patients.

		AOFAS			
(Sub)scale		**Pain**	**Function**	**Alignment**	**Total**
AOFAS	Pain	N/A	moderate	moderate	high
	Function	high	N/A	moderate	high
	Alignment	moderate	low	N/A	moderate
	Total	high	high	moderate	N/A
EQ-5D-5L	Mobility	high	high	moderate	high
	Self care	high	high	moderate	moderate
	Usual activities	moderate	high	high	high
	Pain/discomfort	high	high	moderate	high
	Anxiety/depression	high	high	moderate	high

Abbreviations: AOFAS, American Orthopaedic Foot and Ankle Society. EQ-5D-5L, EuroQol 5-Dimension 5-level.

Table 6. Construct validity of the instruments in patients. Data for T=1 was used. The number of patients was 66 in each (sub)scale. r>0.6 indicates high correlation, 0.3<r>0.6 moderate correlation and r<0.3 low correlation.

		AOFAS			
(Sub)scale		**Pain**	**Function**	**Alignment**	**Total**
AOFAS	Pain	1	0.63	0.36	0.75
	Function	0.63	1	0.5	0.97
	Alignment	0.36	0.5	1	0.63
	Total	0.75	0.97	0.63	1
EQ-5D-5L	Mobility	-0.63	-0.78	-0.51	-0.82
	Self care	-0.67	-0.41	-0.41	-0.52
	Usual activities	-0.48	-0.81	-0.46	-0.8
	Pain/discomfort	-0.81	-0.83	-0.47	-0.85
	Anxiety/depression	-0.67	-0.76	-0.42	-0.78

Abbreviations: AOFAS, American Orthopaedic Foot and Ankle Society. EQ-5D-5L, EuroQol 5-Dimension 5-level.

Table 7. Intraclass correlation coefficient (ICC) and Bland-Altman analysis of (sub)scales of AOFAS in patients. Change scores of (sub)scales of AOFAS were calculated from T=1 to T=2. The number of patients was 66.

Sub(scale)	n	ICC(2,1) (CI 95%)	SEM	SDC (patient)	Max score	RCI (%)	Mean difference (SD)	95% limits of agreement
AOFAS								
Total	66	0.94 (0.89-0.96)	4.1	2.8	100	2.8%	-0.44 (7.97)	-16.06 to 15.18
Pain	66	0.85 (0.76-0.91)	3.3	2.5	40	6.4%	-1.51 (6.13)	-13.54 to 10.51
Function	66	0.95 (0.93-0.97)	1.7	1.8	50	3.7%	0.55 (3.37)	-6.06 to 7.16
Alignment	66	0.91 (0.84-0.95)	0.8	1.3	10	13%	0.53 (1.55)	-2.51 to 3.57

Abbreviations: ICC, intraclass correlation coefficient; RCI, Reliable Change Index; SEM, Standard Error of measurement; SDC, smallest detectable change.

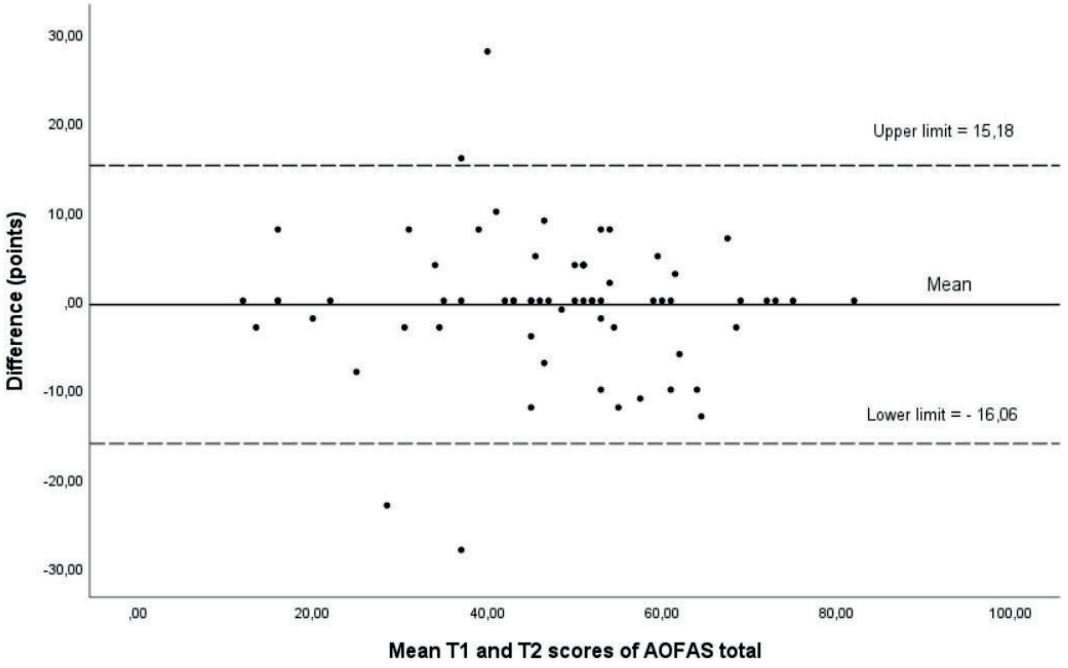

Figure 4. Bland-Altman plot of the AOFAS total score. Change scores of AOFAS total were calculated from T=1 to T=2. Each dot represents a single patient. The black line represents the mean difference. The upper and lower dashed lines are the 95% limits of agreement.

Altman analysis indicated that the 95% limit of agreement for the mean change for the AOFAS total score contains zero, which excludes bias in measurements.

Discussion

This study translated and culturally adapted the AOFAS-KLV into the Kazakh language. The AOFAS-KLV was evaluated in terms of psychometric properties using 66 Kazakh-speaking patients. It is shown that AOFAS-KLV has an acceptable level of reliability and reproducibility, while low flooring and ceiling effects are noticeable. Ceiling and floor effects were analyzed during hospitalization (T1) and 7 days after hospitalization (T2). The ceiling effect was present only in the AOFAS-KLV alignment subscale in both T1 and T2. The observed ceiling effect in the

alignment subscale can be due to the clinical characteristics of our patients. In this study, patients had chronic pathologies of the ankle and hindfoot rather than acute conditions like fractures. Therefore, it can result in a minimal level of alignment issues in a significant proportion of patients. The AOFAS-KLV pain subscales showed flooring effects at both T1 and T2, while the alignment subscale showed only at T2. A limited range of response options for questions regarding pain and alignment can result in most patients clustering at the lower end of the AOFAS scale. This can be confirmed by other studies in Dutch and Danish versions (12, 17). The internal consistency of the AOFAS-KLV total and function subscales was adequate. The Cronbach's α of the AOFAS-KLV total subscale was 0.724, which is slightly above the acceptable level of 0.7. In previous studies, Cronbach's α of the AOFAS-KLV total revealed various results. For example, Cronbach's α in arthroplasty and ankle osteoarthritis was 0.84 and 0.68, respectively (24, 25). Analysis of the predictions by using Spearman's rank correlations showed adequate construct validity for all subscales of the AOFAS-KLV separately, including the total scale. Similar results were obtained in another study with ankle and hindfoot-related pathology presented by Fomichev at al., where correlations between subscales of AOFAS and EQ-5D-5L were analyzed (26). However, most studies use the SF-36 scale for correlation with the AOFAS to identify construct validity (18). Although SF-36 is widely used around the world, it is not translated into Kazakh. On the other hand, EQ-5D-5L is a well-translated and culturally adapted scale that has already been applied in Kazakhstan. Adequate reliability of test-retest for the subscales of AOFAS-KLV is confirmed by the ICC values ranging from 0.85 to 0.95. Likewise, ICC values of hindfoot fractures in the Dutch population and ankle-related fractures in the Danish population versions of the AOFAS Ankle-Hindfoot Scale ranged from 0.79 to 0.97 (13, 17). According to the Bland and Altman analysis, there was no systematic bias between test and retest for the total AOFAS-KLV. The measurement error is quite small, with an SDC of 2.8. In comparison, the Turkish population with foot and ankle disorders had an SDC of 13.3 for the total AOFAS subscale (16).

Conclusion

The AOFAS Ankle-Hindfoot Scale that was culturally adapted and translated to Kazakh language demonstrated adequate reliability and validity. Overall, it can be employed to assess foot and ankle pathologies of Kazakh patients. However, AOFAS-KLV should be further evaluated in terms of responsiveness and longitudinal validity.

Ethic Approval: Approval of the local ethical commission of National Scientific Centre of Traumatology and Orthopaedics named after Academician Batpenov N.D. dated 09.11.2022 No. 4/2 was obtained.

Conflict of Interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

Authors Contribution: M. M.: Data curation, Investigation, Writing – original draft, Writing – review & editing; K. B.: Data curation, Formal Analysis, Writing – original draft, Writing – review & editing; Y. R.: Conceptualization, Methodology, Supervision; B. B.: Conceptualization, Methodology, Supervision; D. S.: Conceptualization, Formal Analysis, Methodology, Project administration.

Declaration on the Use of AI: None.

Funding: This research is funded by the Science Committee of the Ministry of Science and Higher Education of the Republic of Kazakhstan (Grant No. AP19679620).

References

1. Walls RJ, Ross KA, Fraser EJ, et al. Football injuries of the ankle: A review of injury mechanisms, diagnosis and management. World J Orthop. 2016 Jan 18;7(1):8-19. doi: 10.5312/wjo.v7.i1.8.
2. Dahmen J, Lambers KTA, Reilingh ML, van Bergen CJA, Stufkens SAS, Kerkhoffs GMMJ. No superior treatment for primary osteochondral defects of the talus. Knee Surg Sports Traumatol Arthrosc. 2018 Jul;26(7):2142-2157. doi: 10.1007/s00167-017-4616-5.
3. Brown TD, Johnston RC, Saltzman CL, Marsh JL, Buckwalter JA. Posttraumatic osteoarthritis: a first estimate

of incidence, prevalence, and burden of disease. J Orthop Trauma. 2006 Nov-Dec;20(10):739-44. doi: 10.1097/01.bot.0000246468.80635.ef.
4. Barg A, Pagenstert GI, Hügle T, et al. Ankle osteoarthritis: etiology, diagnostics, and classification. Foot Ankle Clin. 2013 Sep;18(3):411-26. doi: 10.1016/j.fcl.2013.06.001.
5. Richter M, Agren PH, Besse JL, et al. EFAS Score - Multilingual development and validation of a patient-reported outcome measure (PROM) by the score committee of the European Foot and Ankle Society (EFAS). Foot Ankle Surg. 2018 Jun;24(3):185-204. doi: 10.1016/j.fas.2018.05.004.
6. Dawson J, Boller I, Doll H, et al. The MOXFQ patient-reported questionnaire: assessment of data quality, reliability and validity in relation to foot and ankle surgery. Foot (Edinb). 2011 Jun;21(2):92-102. doi: 10.1016/j.foot.2011.02.002.
7. Guillemin F, Bombardier C, Beaton D. Cross-cultural adaptation of health-related quality of life measures: literature review and proposed guidelines. J Clin Epidemiol. 1993 Dec;46(12):1417-32. doi: 10.1016/0895-4356(93)90142-n.
8. Kitaoka HB, Alexander IJ, Adelaar RS, Nunley JA, Myerson MS, Sanders M. Clinical rating systems for the ankle-hindfoot, midfoot, hallux, and lesser toes. Foot Ankle Int. 1994 Jul;15(7):349-53. doi: 10.1177/107110079401500701.
9. Madeley NJ, Wing KJ, Topliss C, Penner MJ, Glazebrook MA, Younger AS. Responsiveness and validity of the SF-36, Ankle Osteoarthritis Scale, AOFAS Ankle Hindfoot Score, and Foot Function Index in end stage ankle arthritis. Foot Ankle Int. 2012 Jan;33(1):57-63. doi: 10.3113/FAI.2012.0057.
10. Westphal T, Piatek S, Halm JP, Schubert S, Winckler S. Outcome of surgically treated intraarticular calcaneus fractures--SF-36 compared with AOFAS and MFS. Acta Orthop Scand. 2004 Dec;75(6):750-5. doi: 10.1080/00016470410004148.
11. Van Lieshout EM, De Boer AS, Meuffels DE, et al. American Orthopaedic Foot and Ankle Society (AOFAS) Ankle-Hindfoot Score: a study protocol for the translation and validation of the Dutch language version. BMJ Open. 2017 Feb 27;7(2):e012884. doi: 10.1136/bmjopen-2016-012884.
12. de Boer AS, Tjioe RJC, Van der Sijde F, et al. The American Orthopaedic Foot and Ankle Society Ankle-Hindfoot Scale; translation and validation of the Dutch language version for ankle fractures. BMJ Open. 2017 Aug 3;7(8):e017040. doi: 10.1136/bmjopen-2017-017040.
13. De Boer AS, Meuffels DE, Van der Vlies CH, et al. Validation of the American Orthopaedic Foot and Ankle Society Ankle-Hindfoot Scale Dutch language version in patients with hindfoot fractures. BMJ Open. 2017 Nov 14;7(11):e018314. doi: 10.1136/bmjopen-2017-018314.
14. Alhadhoud M, Alsiri N, Alsaffar M, Glazebrook M. Cross-cultural adaptation and validation of an Arabic version of the American Orthopedics Foot and Ankle Score (AOFAS). Foot Ankle Surg. 2020 Dec;26(8):876-882. doi: 10.1016/j.fas.2019.11.001.
15. Vosoughi AR, Roustaei N, Mahdaviazad H. American Orthopaedic Foot and Ankle Society ankle-hindfoot scale: A cross-cultural adaptation and validation study from Iran. Foot Ankle Surg. 2018 Jun;24(3):219-223. doi: 10.1016/j.fas.2017.02.007.
16. Analay Akbaba Y, Celik D, Ogut RT. Translation, Cross-Cultural Adaptation, Reliability, and Validity of Turkish Version of the American Orthopaedic Foot and Ankle Society Ankle-Hindfoot Scale. J Foot Ankle Surg. 2016 Nov-Dec;55(6):1139-1142. doi: 10.1053/j.jfas.2016.06.001.
17. Erichsen J, Froberg L, Viberg B, Damborg F, Jensen C. Danish Language Version of the American Orthopedic Foot and Ankle Society Ankle-Hindfoot Scale (AOFAS-AHS) in Patients with Ankle-Related Fractures. J Foot Ankle Surg. 2020 Jul-Aug;59(4):657-663. doi: 10.1053/j.jfas.2019.08.027.
18. Leigheb M, Janicka P, Andorno S, Marcuzzi A, Magnani C, Grassi F. Italian translation, cultural adaptation and validation of the "American Orthopaedic Foot and Ankle Society's (AOFAS) ankle-hindfoot scale". Acta Biomed. 2016 May 6;87(1):38-45. PMID: 27163894.
19. Sayyed-Hosseinian SH, Hassankhani GG, Bagheri F, Alavi N, Shojaie B, Mousavian A. Validation of the Persian Version of the American Orthopedic Foot and Ankle Society Score (AOFAS) Questionnaire. Arch Bone Jt Surg. 2018 May;6(3):233-239. PMID: 29911141; PMCID: PMC5990714.
20. Kostuj T, Krummenauer F, Schaper K, et al. Analysis of agreement between the German translation of the American Foot and Ankle Society's Ankle and Hindfoot Scale (AOFAS-AHS) and the Foot Function Index in its validated German translation by Naal et al. (FFI-D). Arch Orthop Trauma Surg. 2014 Sep;134(9):1205-10. doi: 10.1007/s00402-014-2046-0.
21. EuroQol. http://www.euroqol.org (date last accessed 21 March 2024).
22. Beaton DE, Bombardier C, Guillemin F, Ferraz MB. Guidelines for the process of cross-cultural adaptation of self-report measures. Spine (Phila Pa 1976). 2000 Dec 15;25(24):3186-91. doi: 10.1097/00007632-200012150-00014.
23. Mokkink LB, Terwee CB, Patrick DL, et al. The COSMIN checklist for assessing the methodological quality of studies on measurement properties of health status measurement instruments: an international Delphi study. Qual Life Res. 2010 May;19(4):539-49. doi: 10.1007/s11136-010-9606-8.
24. Pinsker E, Inrig T, Daniels TR, Warmington K, Beaton DE. Reliability and validity of 6 measures of pain, function, and disability for ankle arthroplasty and arthrodesis. Foot Ankle Int. 2015 Jun;36(6):617-25. doi: 10.1177/1071100714566624.
25. Paget LDA, Sierevelt IN, Tol JL, Kerkhoffs GMMJ, Reurink G. The completely patient-reported version of the

American Orthopaedic Foot and Ankle Society (AOFAS) score: A valid and reliable measurement for ankle osteoarthritis. J ISAKOS. 2023 Oct;8(5):345-351. doi: 10.1016/j.jisako.2023.07.003.
26. Fomichev VA, Sorokin EP, Konovalchuk NS, Pashkova EA, Sereda AP. Cross-Cultural Adaptation and Validation of the Russian-Language Version of the American Orthopaedic Foot and Ankle Society Ankle-Hindfoot Scale (AOFAS-AHS). Traumatology and Orthopedics of Russia 2023;29(4):78-86. doi: 10.17816/2311-2905-16494. (In Russian).

Correspondence:
Received: 23 July 2024
Accepted: 11 September 2024
Meruyert Makhmetova, MD
Research School, Astana Medical University, Astana, Kazakhstan
Beibitshilik str., 49a, 010000 Astana, Republic of Kazakhstan,
E-mail: meruertmakhmetova@gmail.com, makhmetova-m@nscto.kz
ORCID: 0009-0004-3044-7724

ANNEX

Table S1. AOFAS-KLV scale translated into Kazakh language and adapted in English language.

PARAMETERS	Points
Pain (40 points)	
None	40
Mild, occasional	30
Moderate, daily	20
Severe, almost always present	0
Function (50 points)	
Activity limitations, support requirements (crutches, canes, walkers)	
No limitations, no support	10
No limitation of daily activities, limitations of recreational activities, no support	7
Limited daily and recreational activities, cane	4
Severe limitation of daily and recreational activities, use of walker, crutches, wheelchair	0
Maximum walking distance, meters	
600 or more	5
400 to 600	4
100 to 400	2
Less than 100	0
Walking surfaces	
No difficulty on any surface	5
Some difficulty on uneven terrain, stairs, inclines, ladders	3
Severe difficulty on uneven terrain, stairs, inclines, ladders	0
Gait abnormality	
None, slight	8
Obvious	4
Marked	0
Sagittal motion (flexion plus extension)	
Normal or mild restriction (30° or more)	8
Moderate restriction (15° - 29°)	4
Severe restriction (less than 15°)	0
Hindfoot motion (inversion plus eversion)	
Normal or mild restriction (75% - 100% normal)	6
Moderate restriction (25% - 74% normal)	3
Marked restriction (less than 25% of normal)	0
Ankle-hindfoot stability (anteroposterior, varus-valgus)	
Stable	8
Definitely unstable	0
Foot position (10 points)	
Correct position, without deformity	10
Malposition of the ankle-hindfoot , without deformity , no symptoms	5
Malposition of the ankle-hindfoot with deformity, symptoms	0