



Original article

<https://doi.org/10.18019/1028-4427-2026-32-2-205-213>

Translation, cross-cultural adaptation and validation of the Russian language version of the Karlsson – Peterson ankle function score system (KAFFS)

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Abstract

Introduction In 1991, J. Karlsson and L. Peterson proposed a system for assessing the functional state of the ankle joint. This questionnaire assesses pain, activity, instability and disturbances in daily activities using nine assessment parameters. The Karlsson – Peterson questionnaire has been used actively in foreign studies and literature sources, but despite its widespread use, its original version is in English, and until now there was no official adapted version in Russian.

The **aim** of the study was to translate, cross-culturally adapt and psychometrically validate the Russian version of the Karlsson – Peterson questionnaire for clinical use in patients with chronic lateral instability of the ankle joint.

Materials and methods The study included 60 patients at the preoperative examination stage in a state of clinical stability. The Karlsson – Peterson questionnaire was translated and adapted according to the ISPOR methodology. All patients filled in the Karlsson – Peterson and AOFAS-AHS questionnaires. A total of 39 patients were re-administered after 7–14 days. The following measures were assessed: internal consistency (Cronbach's α), test-retest reliability (ICC), standard measurement error (SEM), minimally significant difference (MDC), extreme effects, and construct validity.

Results The Russian version of the Karlsson – Peterson questionnaire showed high internal consistency ($\alpha = 0.826$) and good reproducibility (ICC = 0.720). SEM was 2.89, MDC was 7.95 points. There were no ceiling or floor effects. Significant correlations were found between the final scores of the Karlsson – Peterson questionnaire and AOFAS-AHS.

Discussion The study demonstrated the reliability, validity, and sensitivity of the Russian version of the Karlsson – Peterson questionnaire. The questionnaire is an informative and clinically interpretable tool for assessing the condition of the ankle joint in patients with chronic ankle instability.

Conclusion The Russian version of the Karlsson – Peterson questionnaire demonstrated high psychometric properties and can be recommended for use in clinical and research practice, as well as for assessing the functional state of patients with chronic lateral instability of the ankle joint to assess the dynamics of changes in the treatment process.

Keywords: Karlsson and Peterson scoring system for ankle function, validation, ankle joint, chronic instability

For citation: Kubrina TN, Sorokin EP, Pashkova EA, Konovalchuk NS, Demianova KA, Faustova YuP, Preobrazhensky PM. Translation, cross-cultural adaptation and validation of the Russian language version of the Karlsson – Peterson ankle function score system (KAFFS). *Genij Ortopedii*. 2026;32(2):205–213. doi: 10.18019/1028-4427-2026-32-2-205-213.

INTRODUCTION

Chronic lateral ankle instability is a significant clinical problem in medicine, as it affects a physically active part of the population [1]. This condition is characterized by repetitive supination injuries to the ankle joint and a feeling of instability; it frequently leads to impairment in quality of life and the ability to participate in sports or daily activities [1–4]. This pathology is widespread, as cases of acute injuries to the ligamentous apparatus of the ankle joint account for up to 21 % of all lower extremity injuries [5]. After an acute injury, all patients initially undergo conservative treatment (immobilization, walking not bearing weight on the injured limb, and subsequent rehabilitation). From 10 to 30 % of such patients report a subjective feeling of loss of control over the ankle joint after conservative treatment which has a high risk of developing undesirable consequences and requires surgical treatment [6–8].

High incidence of post-traumatic ankle instability has necessitated the development of a questionnaire to assess ankle function for the diagnosis of this condition and for evaluation of surgical treatment outcomes. Functional assessment of the ankle is an important element in the diagnosis and treatment monitoring of patients with chronic lateral ankle instability [9, 10]. Patient-reported outcome measures (PROMs) are now being used to more accurately convey patient perceptions and functional characteristics [11].

Currently, various questionnaires validated for the Russian-speaking population have been used in ankle surgery practice: FAAM (Foot and Ankle Ability Measure), FADI (Foot and Ankle Disability Index), SEFAS (Self-reported Foot and Ankle Score), MOxFAQ (Manchester-Oxford Foot Questionnaire), and others [12–14]. These questionnaires have proven themselves to be reliable tools for assessing ankle condition, but they do not focus on patient's subjective perceptions. The authors searched for a questionnaire suitable for assessing ankle function in patients with chronic ankle instability. Among the many scales used in clinical practice, the Karlsson – Peterson Ankle Function Score (KAFS) stands out for its specificity and focus on patient's subjective sensations [15, 16]. The KAFS scale, popular in orthopedic practice, was proposed by J. Karlsson and L. Peterson in 1995 in Sweden [17]. The assessment is based on nine parameters; pain, swelling, subjective instability, limitations in sports are among them. The main objective of the KAFS is to evaluate the functional state of the ankle joint after injuries or surgeries from the patient's point of view. The questionnaire has been actively used in foreign studies, but at present, a Russian-language version of the KAFS questionnaire validated according to all standards is not presented in the literature. Therefore, cultural and linguistic adaptation is required for the use of this scale in clinical practice.

The **aim** of the study was to translate, cross-culturally adapt and psychometrically validate the Russian version of the Karlsson – Peterson questionnaire for clinical use in patients with chronic lateral instability of the ankle joint.

MATERIALS AND METHODS

Karlsson – Peterson Questionnaire (KAFS)

The KAFS questionnaire was first published by J. Karlsson and L. Peterson in 1991 in a scientific article [15], but a more complete description of the questionnaire and its application for assessing treatment outcomes appeared in 1995 [17]. Thus, 1995 is considered a key year for the popularization and beginning of the active use of this questionnaire in orthopedic practice and scientific research. Important features of this questionnaire include its convenience and speed of completion, as well as high sensitivity to such concepts as pain, subjective instability in the ankle joint, and impairment of daily activities. The questionnaire is completed by the patient independently without the participation of a physician, which demonstrates its focus on the patient's perceptions.

The KAFS consists of three main sections that assess different aspects of the ankle function:

- 1) Symptoms Score. This section is subjective and assesses the patient's sensations, such as pain, swelling, instability, and stiffness. The maximum score is 30;
- 2) Function Score. This section assesses the patient's ability to perform daily activities, such as climbing stairs, running, housework, and the need for an orthotic support. The maximum score is 30.
- 3) Sports Activity Score. This section evaluates athletic activity, such as the patient's activity level, distance, and frequency of training. The maximum score is 40.

The maximum possible score on the KAFS questionnaire is 100 points which indicates an ideal, asymptomatic ankle function and a full return to sports and daily activities without limitations. A score of < 70 points is a poor result and indicates significant, persistent problems.

The advantages of the KAFS questionnaire include its ease of completion, coverage of key aspects, and focus on patient perception.

AOFAS-AHS questionnaire

AOFAS-AHS (American Orthopaedic Foot and Ankle Society ankle-hindfoot scale) is one of the most well-known tools in orthopedic practice. This questionnaire is designed for a comprehensive assessment of ankle, subtalar, and hindfoot function. The AOFAS-AHS combines the patient's subjective assessment of their symptoms with objective data assessed by the physician.

AOFAS-AHS scale has three domains resulting in maximum total of 100 points.

- 1) Pain. This is the most significant section, assessing the intensity and limitations caused by pain. The maximum score is 40;
- 2) Function. This section includes several parameters: activity and limitations, requirement for additional means of support, walking distance, and gait. The maximum score is 50;
- 3) Deformation. This parameter is designed to assess the patient's assessment of the presence of deformity. The maximum score is 10.

A maximum score of 100 points on this questionnaire indicates an ideal outcome (pain-free, full function, perfect alignment). Patients who score < 50 points have a poor outcome.

The Russian version of the questionnaire has been validated and adapted for the Russian-speaking population within the framework of the international standardized protocol EuroQol (European Quality of life) [18], therefore we used this questionnaire to check the construct validity.

Translation and adaptation

Translation and cross-cultural adaptation of the KAFS questionnaire were carried out according to the ISPOR (International Society for Pharmacoeconomics and Outcomes Research) methodology [18, 19]. The KAFS questionnaire, consisting of nine questions, was translated into Russian by a trauma orthopedic surgeon with an advanced level of English and a professional translator. Two parallel versions of the translation were obtained. A working group was created that compared the two translations, discussed discrepancies and created a single synthesized version. Two other independent translators, born in an English-speaking country, translated the synthesized version of the questionnaire back into English. A committee was created, which included methodologists, orthopedic specialists, linguists, and translators (who participated in the translation process). The committee members discussed and resolved all discrepancies,

ensuring the conceptual, semantic and cultural equivalence of the questionnaire. Thus, the final version of the questionnaire was created and approved. To test the functionality of the approved version, pilot testing and cognitive interviews were conducted.

A printed version of the questionnaire was administered to 20 patients with chronic ankle instability. During the cognitive interview, patients were asked questions such as, "How did you understand this question?", "Were any words or phrases unclear to you?", and others.

During this testing and interview, no difficulties in answering or understanding the questions were encountered by the patients, which may indicate high distinguishability and cognitive accessibility of the scale. To assess test-retest reliability, 39 patients re-completed the printed version of the questionnaire 7–14 days after the initial completion in a state of clinical stability. To further assess construct validity, all patients were asked to complete the AOFAS-AHS questionnaire [18].

Karlsson – Peterson questionnaire used for the Russian version

Parameter	Variants of answers	Points
Pain	None	20
	During exercise	15
	Walking on uneven surface	10
	Walking on even surface	5
	Constant	0
Swelling	None	10
	After exercise	5
	Constant	0
Instability	None	25
	1-2 / year (during exercise)	20
	1-2 / month (during exercise)	15
	Walking on uneven ground	10
	Walking on uneven ground	5
	Constant (severe) using ankle support	0
Stiffness	None	5
	Moderate (morning, after exercise)	2
	Marked (constant, severe)	0
Stair climbing	No problems	10
	Impaired (instability)	5
	Impossible	0
Running	No problems	10
	Impaired	5
	Impossible	0
Work activities	Same as pre-injury	15
	Same work, less sports, normal leisure activities	10
	Lighter work, no sports, normal leisure activities	5
	Severe impaired work capacity, decreased leisure activities	0
Support	None	5
	Ankle support during exercise	2
	Ankle support during daily activities	0

Study design

The validation procedure was conducted on a specific patient sample over time in accordance with international guidelines. This study was designed as a prospective, cohort, observational study. All patients and their data were collected at a single institution, making it a single-center study.

Patients' sample

The study group included 60 patients with chronic lateral instability of the ankle joint: 30 women and 30 men aged 18 to 65 years (average age, 36.3 years), hospitalized at the Vreden National Medical Research Center of Traumatology and Orthopedics from January 2023 to April 2024 for surgical treatment: anatomical plastic surgery of the lateral ligamentous complex of the ankle joint according to Brostrom – Gould.

Inclusion criteria: patients of 18 years of age and older who gave their informed consent

Criteria of non-inclusion: written refusal of the patient to participate in the study, previous surgical interventions on the lateral ligamentous complex, a history of fractures at the level of the ankle joint, osteochondral defect of the talus

Exclusion criteria: refusal to provide the necessary information about health status and medical history, unwillingness to continue participation in the study at any stage of the study

Description of eligibility criteria: The patient sample was formed based on the presence of a primary inversion injury of the ankle joint, a subjective feeling of instability, as well as on the basis of instrumental studies and functional tests performed confirming damage to the lateral ligamentous complex of the ankle joint.

Statistical analysis

The obtained data were introduced into tables using Microsoft Excel, allowing for editing and processing. Jamovi (version 2.3.28) and PAST (version 4.03) were used for statistical processing.

Psychometric assessment

The evaluation of the psychometric properties of the Russian-language version of the KAFS questionnaire was carried out on the basis of the international principles of COSMIN (Consensus-based Standards for the Selection of Health Status Measurement Instruments) [21].

Cronbach's α coefficient is a statistical indicator that helps assess the internal consistency between all questionnaire items and the questionnaire as a whole. It does not prove unidimensionality or evaluate other types of reliability, but rather indicates how well all items measure the same characteristic. This coefficient is calculated automatically using software packages and does not require manual calculation. The Cronbach's α coefficient in the range of 0.7 to 0.9 is considered high and indicates excellent consistency across all items in assessing the overall construct [22].

Construct validity was assessed by correlation analysis with the AOFAS-AHS questionnaire using the Spearman criterion. Construct validity shows how well a set of indicators reflects a concept. Test-retest reliability was calculated using the Intraclass Correlation Coefficient (ICC) [22]. The Standard error of the measurement (SEM) was calculated using the formula: $SEM = SD \times \sqrt{1 - ICC}$. The minimal detectable change (MDC) was determined with the formula: $MDC = 1.96 \times SEM \times \sqrt{2}$. Ceiling and floor effects were defined as the proportion of patients who

scored the maximum or minimum value for the final score. Values lower than 15% are considered low for ceiling and floor effects.

Hypothesis planning

Construct validity is the extent to which a questionnaire measures the theoretical construct it was designed to measure. One of the most powerful ways to assess construct validity is to examine relationships with other variables. Our study utilized a comparison method with AOFAS-AHS questionnaire scores based on pre-formulated hypotheses about the strength of the expected correlations [20]. Spearman's correlation coefficient is used to test these hypotheses, as the data are more stable to deviations from a normal distribution [23].

RESULTS

Cross-cultural adaptation meant ensuring that the translated questionnaire was not only linguistically accurate but also conceptually and semantically equivalent to the original, as well as simple and understandable to patients. We needed to ensure data comparability and guarantee that the instrument was reliable and valid for use in the new culture.

All 60 patients included in the study completed the entire study. The average KAFS score was 36.3 (minimum 26; maximum 72) out of a possible 100. All patients were interviewed in person by a trauma/orthopedic specialist. They were provided with information on how to correctly complete the questionnaire, resulting in a 100% completion rate. None of the patients included in the study reported any difficulties in completing the printed version of the questionnaire. The average time to complete the questionnaire was 3.1 minutes.

The distribution of scores for the Russian-language version of the KAFS questionnaire revealed no significant ceiling or floor effects (0 points and 100 points), critical indicators of the quality of a measuring instrument, demonstrating the questionnaire's good discriminatory ability, high sensitivity, and suitability for measuring ankle function in patients with varying degrees of pathology severity.

Internal consistency

The Russian-language version of the KAFS questionnaire demonstrated high internal consistency, confirming that this ankle function assessment tool is comprehensive and consistent in measuring the required property. The Cronbach's α coefficient was 0.826. This calculation was based on the initial completion of the printed version of the questionnaire and included 60 patients at the preoperative stage in a state of complete clinical rest.

Reliability

The test-retest analysis helped us assess the stability of measurement results over time. The Russian-language version of the KAFS questionnaire demonstrated good test-retest reliability in 39 patients who repeated the printed version of the KAFS questionnaire within 7-14 days of the initial survey in their clinical condition unchanged prior to surgery. The intraclass correlation coefficient (ICC) for the total score was 0.720, indicating good reproducibility and stability of questionnaire results obtained by the repeated completion.

To assess measurement accuracy, the standard error of measurement (SEM) was calculated and found to be 2.89 points. The minimally significant difference (MDC) of 7.95 points confirms the high accuracy and reliability of this questionnaire.

Construct validity

To assess construct validity, we developed five pre-defined hypotheses regarding correlation strength. The indicators were assessed using Spearman's rank correlation coefficients. All five hypotheses (100%) were confirmed (Table 1), demonstrating high construct validity for the Russian-language version of the KAFS [21].

Table 1

Hypothesis testing to determine the construct validity of the translated version of the questionnaire

Compared scales/domains	Hypothesis	Expected ρ
KAFS and AOFAS-AHS: activity	Direct correlation	≥ 0.5
KAFS and AOFAS-AHS: instability	Direct correlation	≥ 0.5
KAFS and AOFAS-AHS: pain/discomfort	Direct correlation	≥ 0.5
KAFS and AOFAS-AHS: use of additional support means	Direct correlation	≥ 0.4
KAFS and AOFAS-AHS: selfservice	Direct correlation	≥ 0.4

DISCUSSION

Chronic ankle instability is currently a pressing issue due to its prevalence among physically active and working individuals. Currently, there is no scale that is specific for this condition and useful during diagnosis and postoperative follow-up. Physicians use a variety of scales that do not fully reflect the patient's subjective sensations and are not specific for assessing the subjective sensations of patients with chronic lateral ankle instability. The international literature shows that authors actively use the KAFS scale for diagnosing chronic ankle instability and postoperative follow-up, considering it the most specific for this condition [24–28]. This study, in accordance with international criteria, translated, cross-culturally adapted, and validated the Russian-language version of the KAFS on a sample of patients with chronic lateral ankle instability. The obtained results prove the high psychometric characteristics of this scale.

CONCLUSION

The KAFS questionnaire demonstrated high sensitivity and specificity in assessing ankle joint function. Unlike the AOFAS-AHS questionnaire, which combines objective and subjective parameters, the KAFS questionnaire focuses on patient perceptions, making it particularly valuable for assessing quality of life and the patient's perception of ankle stability.

The KAFS questionnaire is a valid and reliable tool for assessing ankle function in patients with chronic lateral ankle instability. The application of the KAFS in clinical practice allows for a more accurate assessment of the effectiveness of treatment and the level of joint function recovery in patients with chronic lateral ankle instability, considering patient's subjective perceptions.

Conflict of interests The authors declare that there is no conflict of interests..

Source of funding The study was not sponsored.

Ethical approval Ethical approval of the study protocol was not conducted.

Informed consent All patients signed an informed consent form to participate in the study.

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The article was submitted 10.10.2025; approved after reviewing 02.12.2025; accepted for publication 09.02.2026.

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