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Original Article

Translation of AOFAS Hallux Metatarsophalangeal-Interphalangeal Scale into Portuguese

Bruno Rodrigues de Miranda[1], Paollo Fideles Loures[2], Rafaella Azevedo Degani[1], Jonathan Naim Mora Emboz[1], Leticia Zaccaria Oliveira[1], Álvaro Diego Pupa de Freitas[1], Gregory Bittar Pessoa[1], Fabio Correa Paiva Fonseca[1], Danilo Ryuko Candido Nishikawa[1], Rui dos Santos Barroco[1]

1. Centro Universitário, Faculdade de Medicina do ABC, Santo André, SP, Brazil.
2. Hospital do Servidor Público Municipal de São Paulo, São Paulo, SP, Brazil.

Abstract

Objective: Translate, culturally adapt, and evaluate the reproducibility of the American Orthopaedic Foot And Ankle Society (AOFAS) Hallux Metatarsophalangeal-Interphalangeal Scale questionnaire into Portuguese.

Methods: The AOFAS and the 36-Item Short Form (SF-36) questionnaires were applied to 50 patients with hallux pathologies. The methodology followed the criteria defined by Reichenheim & Moraes for translation and cultural adaptation of questionnaires.

Results: The Cronbach's alpha coefficient of the domains was 0.99, indicating excellent reliability. Scores for the first and second evaluations were 65.5 and 64.2, respectively, with high interobserver concordance (65.5 vs. 65.3). Cronbach's alpha consistency analysis and Spearman's correlation analysis were 1.0, an extremely high index.

Conclusion: According to the established criteria, the questionnaire's translation and cultural adaptation were conducted effectively, with very high interobserver concordance, and can be safely reproduced in Portuguese.

Level of evidence IV, case series.

Keywords: Hallux; AOFAS; Translation; Validation.

Introduction

Surgeries involving the foot and ankle are frequent in orthopedic practice; however, the evaluation of results in scientific studies may be questionable due to the different methods used by the researchers to evaluate them[1]. To solve this issue, a standardized instrument is necessary to compare the results of treatments with patients with the same condition[2].

It is known that the quality of life of patients with foot and ankle disorders is directly influenced by orthopedic treatments[3], therefore, the evaluation of these results with a reliable and quality methods allows comparisons between clinical trials.

As different factors influence foot injuries during recovery, monitoring the progress of each patient is essential. There is a wide variety of instruments, with items directed to the performance of daily activities, which helps the physician to understand how each individual responds to treatment. However, most of the questionnaires are available in English and are produced and applied according to the demographic and cultural characteristics of the region of origin[4-6]. Social, cultural, and linguistic differences may represent a barrier to interpreting these instruments[7].

Based on the original questionnaires, studies and validations of the established characteristics are subsequently performed[8,9].

The American Orthopaedic Foot And Ankle Society (AOFAS) questionnaire (Figure 1), produced by Kitaoka et al., is an instrument used to evaluate results in foot surgeries based on patient's complaints. It evaluates three domains: pain,

Study Performed at the Hospital do Servidor Público Municipal de São Paulo, São Paulo, SP, Brazil.

Correspondence: Rafaella Azevedo Degan. Rua Horácio Alves da Costa nº 174, apto 63, Jd. Nosso Lar, 04401-000 São Paulo, SP, Brazil. **Email:** rafaelladegani@gmail.com. **Conflicts of interest:** none. **Source of funding**: none. **Date received:** February 6, 2024. **Date accepted:** April 16, 2024. **Online:** April 30, 2024.

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function, and alignment, totaling 100 points, with 100 being the best clinical outcome and zero the worst[10]. Although it is a questionnaire used by most scientific studies for foot and ankle pathologies worldwide, it only has translation and cultural validation into Portuguese for the ankle and hindfoot.

The objective of this study is to translate, culturally adapt, and evaluate the reproducibility of the AOFAS Hallux Metatarsophalangeal-Interphalangeal Scale questionnaire into Portuguese, according to the protocols recommended for this type of study.

Methods

Questionnaire

The AOFAS Hallux Metatarsophalangeal-Interphalangeal Scale was used in this study, which consists of nine topics addressing three domains: pain (40 points), function (50 points), and alignment (10 points). The evaluation was performed by the examiners, using an interview and a physical examination, with a score of 100 points for the best clinical result and zero points for the worst. The result could be classified as excellent (100-90 points), good (75-89 points), fair (60-74 points), and poor (< 60 points).

Pain (40 points)	
None	40
Mild, occasional	30
Moderate, daily	20
Severe, almost always present	0
Function (45 points)	
Activity limitations	
No limitations	10
No limitations of daily activities such as employment	7
Limited daily and recreational activities	4
Severe limitation of daily and recreational activities	0
Footwear requirements	
Fashionable, conventional shoes, no insert required	5
Comfort footwear, shoe insert	3
Modified shoes or brace	0
MTP joint motion (dorsiflexion plus plantarflexion)	
Normal or mild restriction (75° or more)	10
Moderate restriction (30°–74°)	5
Severe restriction (less than 30°)	0
IP joint motion (plantarflexion)	
No restriction	5
Severe restriction (<10°)	0
MTP-IP stability (all direstions)	
Stable	5
Definitely unstable or able to disiocate	0
Callus related to hallux MTP-IP	
No callus or asymptomatic callus	5
Callus, symptomatic	0
Alignment (15 points)	
Good, hallux well aligned	15
Fair, some degree of hallux malalignment observed, no symptoms	8
Poor, obvious symptomatic malalignment	0
Total	100

AOFAS = American Orthopaedic Foot and Ankle Society.
Grading: Excellent = 90–100 points; Good = 75–89 points; Fair = 60–74 points; Poor = <60 points.

Figure 1. AOFAS questionnaire.

The translation was conducted by two independent translators and evaluated according to the criteria defined by the recommendations proposed by Reichenheim & Moraes.

First, the questionnaire to be translated was identified. Then, two independent Brazilian translators were hired, aware of the objectives of the study, aiming at a conceptual and not only literal translation of the instrument. After, two independent American translators were hired, but they were not informed about the objectives of the study to perform the back-translation to verify if the Brazilian version could be considered adequate to the standards used in the original version.

The final version was prepared by a committee composed of four foot and ankle specialists, two physiotherapists, and an independent translator to verify a patient's understanding of the questions and answers to validate the processes of translation, cultural adaptation, and application of the questionnaire among Brazilian patients (Table 1).

Table 1. Final questionnaire.

Final version
Pain (40 points)
None – 40 Mild, occasional – 30 Moderate, daily – 20 Severe, almost always present – 0
Function (45 points)
Activities limitation
No limitations – 10 No limitation of daily activities, such as those performed at work, limitation of recreational activities – 7 Limitation of daily and recreational activities – 4 Severe limitation of daily and recreational activities – 0
Footwear requirements
Fashionable, conventional footwear, no insole required – 5 Comfortable footwear, with insole – 3 Adapted footwear or brace – 0
MTP joint motion (dorsiflexion and plantarflexion)
Normal or mild restriction (75° or more) – 10 Moderate restriction (30º - 74º) – 5 Severe restriction (less than 30°) – 0
IP joint motion (plantarflexion)
No restricted – 5 Severe restriction (less than 10°) – 0 MTP-IP stability (all directions) Stable – 5 Definitely unstable or able to disiocate – 0 Callus related to hallux MTP-IP No callus or asymptomatic callus – 5 Callus, symptomatic – 0
Alignment (15 points)
Good, hallux well aligned – 15 Fair, some degree of hallux malalignment, asymptomatic – 8 Poor, obvious symptomatic malalignment – 0
Total: 100 points
Excellent: 90-100 points; Good: 75-89 points; Fair: 60-74 points; Poor: < 60 points.

The study's methodological design can be seen in Figure 2.

The 36-Item Short Form (SF-36) (Quality of Life) questionnaire was used to obtain a correlation and measurement, which addresses eight categories based on physical and emotional characteristics. This questionnaire consists of 36 items that evaluate functional capacity, physical aspects, pain, general health, vitality, social, emotional, and mental health. Other researchers have already translated and validated it into Portuguese[11].

Study population

After approval by the Institutional Review Board, 50 Brazilian patients were evaluated in the orthopedics and traumatology department of a tertiary hospital between 2019 and 2021. All patients signed the informed consent form.

Inclusion criteria were patients over 18 years old, with outpatient follow-up and clinical pathology diagnosis that affects the hallux with confirmation by imaging exam (Figure 3). The exclusion criteria were acute trauma, currently using immobilization cast or cognitive disorders that prevent the application of the questionnaire, or those who did not accept to sign the informed consent form.

Among the patients selected, there were no exclusions or follow-up loss in the reapplication of the questionnaires.

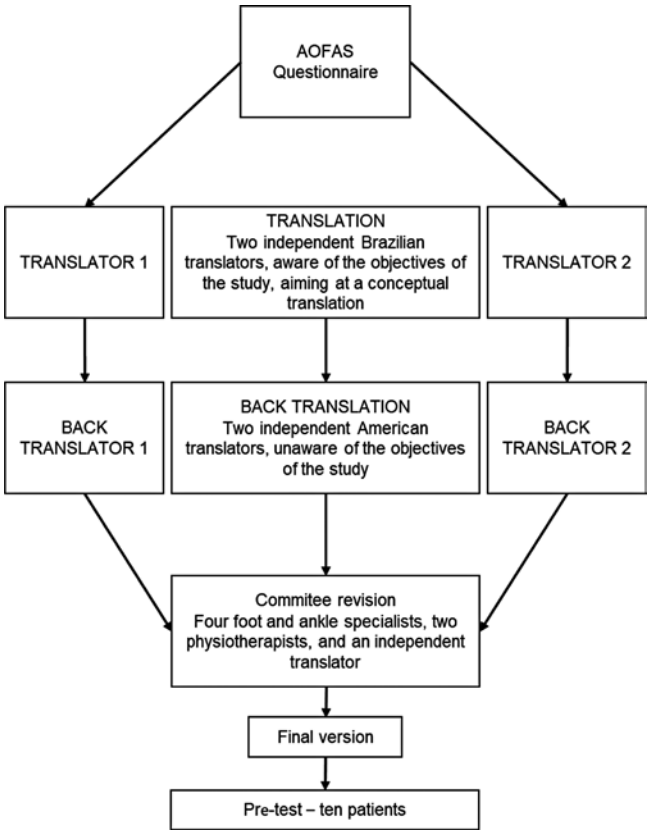

Figure 2. Methodological design.

Assessment of psychometric properties

Data were entered into Microsoft Excel software and submitted to statistical analysis through specific software to obtain reliable correlation parameters. The significance level was 5%. The statistical package used was SPSS 24.0 for Windows.

Initially, a descriptive analysis of all study variables was performed. The qualitative variables were presented in terms of their absolute and relative values, and the quantitative variables in terms of their central tendency and dispersion values. The Kolmogorov-Smirnov and Levene tests were used to evaluate the adherence to the normal curve and the homogeneity of the variances, respectively[12].

The Wilcoxon test was used to compare the first and second values of each AOFAS domain since most variables did not present the two principles satisfied above (Non-parametric test). To evaluate the correlation between the SF-36 and the AOFAS domains, in the first and second evaluations, the Spearman correlation coefficient was used (because most of the variables did not present the two principles described above—Non-parametric)[13-15].

The Kappa intraclass correlation coefficient (ICC) was used to evaluate the first and second AOFAS concordance for each domain, with its respective 95% confidence interval. Cronbach's alpha correlation coefficient was used to evaluate internal consistency[13-15].

Results

Fifty patients were interviewed. Table 2 shows the descriptive analysis of age, sex, and diagnosis variables. The results showed that most of the patients were women diagnosed with hallux valgus.

Table 3 shows the mean with standard deviation and the Kappa ICC with a 95% confidence interval and the significance level. An excellent intraclass concordance for all domains was observed.

Table 4 shows the comparison of the first and second AOFAS results for each domain. The results showed no significant

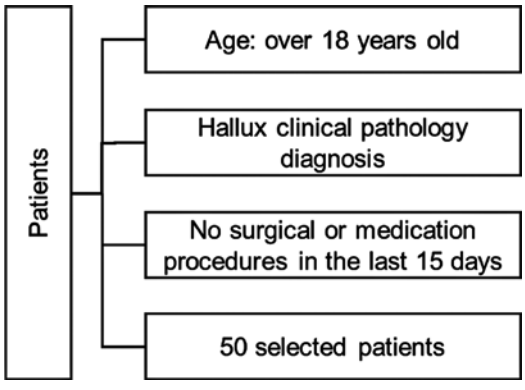

Figure 3. Patient's selection.

Table 2. Descriptive data analysis

Variables	Total (n = 50)
Age (years)	
Mean (SD)	57.20 (12.39)
Minimum - Maximum	28 – 86
Sex (Nº(%))	
Women	36 (72.0)
Men	14 (28.0)
Diagnostic (N(%))	
Rigid hallux	6 (12.0)
Hallux valgus	44 (88.0)

SD: standard deviation

Table 3. Intraclass correlation analysis of AOFAS questionnaire domains

	Pre	Post	ICC (95%CI)	p-value
	Mean (SD)			
Pain	25.0 (10.5)	24.6 (10.3)	0.98 (0.97; 0.99)	< 0.0001
Function	7.6 (2.9)	7.6 (2.9)	0.99 (0.98; 1.00)	< 0.0001
Shoes	6.6 (2.9)	6.6 (2.9)	1.00	< 0.0001
MTP motion	7.4 (3.4)	7.3 (3.4)	0.98 (0.96; 0.99)	< 0.0001
IP motion	3.7 (2.2)	3.9 (2.1)	0.89 (0.82; 0.94)	< 0.0001
Stability	4.6 (1.4)	4.4 (1.6)	0.78 (0.65; 0.87)	< 0.0001
Calus	3.2 (2.4)	3.1 (2.5)	0.96 (0.93; 0.98)	< 0.0001
Alignment	7.4 (4.7)	6.8 (4.6)	0.84 (0.73; 0.90)	< 0.0001
Total	65.5 (23.1)	64.2 (23.0)	0.98 (0.97; 0.99)	< 0.0001

SD: standard deviation; ICC: Intraclass correlation coefficient; 95%CI: 95% confidence interval; p-value: significance level; MTP: metatarsophalangeal; IP: interphalangeal.

difference between the first and second evaluations by the Wilcoxon test in each domain (p > 0.05).

Table 5 shows Spearman's correlation analysis of the first and second AOFAS for each domain. A directly proportional correlation was observed between the first and second evaluations in each AOFAS domain.

Discussion

Standardizing an evaluation instrument for hallux injuries is crucial due to the significance of these occurrences. The hallux plays a vital role in balance, support, and strength during walking, jumping, and other foot movements. Treatments with less-than-expected results can cause lasting and potentially limiting compromises in many activities[1,2].

Indeed, instruments that assess progress and outcomes over time are crucial for tailoring the best approach for each patient[3]. Measuring results based on the patient's reports is necessary in orthopedics, especially in foot-related injuries[3].

The AOFAS scoring system is widely used in evaluating outcomes following treatment for ankle and foot injuries. Given

Table 4. First and second comparison of AOFAS domains

	Pre	Post	Level of significance*
Pain			
Mean (95%CI)	25.0 (22.0; 28.0)	24.6 (21.7; 27.5)	
Standard deviation	10.5	10.3	0.15
Minimum - Maximum	0 – 40	0 – 40	
Function			
Mean (95%CI)	7.6 (6.8; 8.5)	7.6 (6.7; 8.4)	0.32
Standard deviation	2.9	2.9	
Minimum - Maximum	0 – 10	0 – 10	
Shoes			
Mean (95%CI)	6.6 (5.8; 7.4)	6.6 (5.8; 7.4)	1.00
Standard deviation	5	2.9	
Minimum - Maximum	0 – 10	0 – 10	
MTP motion			
Mean (95%CI)	7.4 (6.4; 8.4)	7.3 (6.3; 8.3)	0.32
Standard deviation	3.4	3.4	
Minimum - Maximum	0 – 10	0 – 10	
IP motion			
Mean (95%CI)	3.7 (3.1; 4.3)	3.9 (3.3; 4.5)	0.16
Standard deviation	2.2	2.1	
Minimum - Maximum	0 – 5	0 – 5	
Stability			
Mean (95%CI)	4.6 (4.2; 5.0)	4.4 (3.9; 4.9)	0.15
Standard deviation	1.4	1.6	
Minimum - Maximum	0 – 5	0 – 5	
Calus			
Mean (95%CI)	3.2 (2.5; 3.9)	3.1 (2.4; 3.8)	0.32
Standard deviation	2.4	2.5	
Minimum - Maximum	0 – 5	0 – 5	
Alignment			
Mean (95%CI)	7.4 (6.0; 8.7)	6.8 (5.4; 8.1)	0.19
Standard deviation	4.7	4.6	
Minimum - Maximum	0 – 15	0 – 15	
Total			
Mean (95%CI)	65.5 (58.9; 72.1)	64.2 (57.7; 70.8)	0.04
Standard deviation	23.1	23.0	
Minimum - Maximum	0 – 93	0 – 93	

MTP: metatarsophalangeal; IP: interphalangeal; 95%CI: 95% confidence interval.
* Wilcoxon test.

that patient input is integral to this assessment, ensuring clear and accurate translation is essential to maintain the integrity and reliability of the results. However, this instrument is not yet available in many languages, and researchers must obtain an adequate linguistic and cultural adaptation[15]. Although widely used to evaluate foot pathologies in Brazil, the AOFAS instrument for hallux pathologies has not yet been translated and culturally adapted into Portuguese.

Table 5. First and second Spearman's correlation coefficient of AOFAS domains

	Pain	Function	Shoes	MTPampli	Ipampli	Stability	Calus	Alignment	Total
Pain	0.97**	0.78**	0.60**	0.61**	0.35*	0.37**	0.59**	0.47**	0.92**
Function	0.75**	0.98**	0.43**	0.54**	0.37**	0.40**	0.48**	0.50**	0.80**
Shoes	0.60**	0.46**	1.00**	0.45**	0.37**	0.37**	0.55**	0.28	0.68**
MTP motion	0.56**	0.52**	0.40**	0.97**	0.61**	0.20	0.30*	0.07	0.65**
IP motion	0.45**	0.42**	0.33*	0.62**	0.89**	0.38**	0.41**	0.43**	0.58**
Stability	0.39**	0.37**	0.38**	0.39**	0.48**	0.80**	0.49**	0.38**	0.47**
Calus	0.65**	0.55**	0.57**	0.29*	0.38**	0.38**	0.96**	0.41**	0.70**
Alignment	0.46**	0.48**	0.32*	0.05	0.26	0.44**	0.40**	0.84**	0.51**
Total	0.91**	0.81**	0.66**	0.66**	0.54**	0.42**	0.68**	0.51**	0.98**

MTP: metatarsophalangeal; IP: interphalangeal; *: $p < 0.05$; **: p 0.01.

Commonly, a literal translation might be sufficient for many purposes; however, in the healthcare context, a cross-cultural adaptation is crucial to ensure the intended methodology is accurately maintained. This process allows a complete understanding of the instruments without deviations from the language adopted for research[12].

Translating the AOFAS instrument is essential to ensure uniformity in assessment among researchers from different languages and facilitate result comparisons across diverse populations, given its widely recognized effectiveness. However, clarity, reliability, and ease of interpretation are essential standards to uphold during translation. A positive point regarding the AOFAS instrument is that it is short, and the questions are objective, which can be important when seeking translation and cultural adaptation to other languages[16].

It is important to remember that the AOFAS questionnaire has subdivisions to evaluate hindfoot and ankle, midfoot, hallux, and smaller toes, each with specific sub-items for the foot segment under study[11]. The AOFAS Ankle-Hindfoot Scale is the only part already translated and culturally adapted into Portuguese [4]. According to De Boer et al., the Ankle-Hindfoot subdivision is responsive and valid in its original language; however, studies suggested that its translation and validation in other languages still need to be deepened[17].

To evaluate the Ankle-Hindfoot AOFAS, De Boer et al. conducted a study with 118 patients (three follow-up losses), in which they analyzed the reliability, construct validity, reproducibility, and internal consistency. Although the internal consistency was considered inadequate, the subscales were adequate. The validity of the constructs was 82.4% within the study hypotheses, but their longitudinal validity was not seen as appropriate. Their results indicate that the instrument has good results when translated; however, more specific criteria need to be adopted to evaluate results in long-term longitudinal studies[17].

Our study translated the AOFAS Hallux Metatarsophalangeal-Interphalangeal Scale to understand whether the translation can cause negative impacts that can be interpreted inadequately and obtain results different from the reality of each individual evaluated.

This study had a predominantly female population (72%), a mean age of 57.2 years, and 88% with hallux valgus. The epidemiological data follows the literature recognizing hallux valgus as one of the most common diseases affecting the foot, with high prevalence in several epidemiological studies. The prevalence of this disease is known to be higher in women, around 2.3 times higher than in men[18]. The prevalence of hallux valgus is increasing with age, confirmed by studies demonstrating a prevalence of up to 74% in older populations[19].

The intraclass evaluation showed an extremely close concordance and a high reliability coefficient. The interobserver concordance was extremely close, not being total in only two items, "function" (7.6 vs. 7.5) and " metatarsophalangeal motion" (7.4 vs. 7.3). High concordance among the examiners indicates that the questionnaire was well-designed, clear and easy to understand in all phases of the study, both among the researchers and participants. The high result can be further explained due to the quantitative and, therefore, objective assessment, as shown in the study by Rodrigues et al.[2]. The validation and cultural adaptation protocol follows a well-defined flowchart to ensure the quality and applicability of the translation process. These sequential steps ensure that different researchers find similar results when interviewing the same participant, which was achieved in our study.

It is important to verify that when applying the questionnaire for the second time, the same researcher finds results comparable to the first application for the same patient in the same evaluation conditions. In our study, the results among the domains were significantly similar in the first and second evaluations by the Wilcoxon test. All intraclass evaluations had a high concordance, with slightly lower stability and alignment values than the other hallux AOFAS items.

The data in our study reinforce that having a reliable, valid, and reproducible measurement instrument is crucial for orthopedists across different locations to evaluate and compare results qualitatively. To this end, patient-reported outcome scores, such as the AOFAS score, have increased. As an example of using this scoring system, a 2018 Persian-language study evaluated 53 patients with ankle and hindfoot conditions. In this study, Cronbach's alpha coefficient was 0.696, which is considered an acceptable value and a reliable

objective subscales test (Kappa). The test-retest reliability measured by the ICC was 0.853 ($p < 0.001$), and the Pearson correlation coefficient between AOFAS and SF-36 was 0.415 ($p = 0.008$). The data showed that the AOFAS Persian translation demonstrated acceptable validity and reliability without cultural adaptation[19]. These data corroborate the success of the questionnaire translation process in the studied population, just like our study, in which the translation proved valid, acceptable, and reproducible.

Conclusions

The data collected affirm that the translation and cultural adaptation of the AOFAS Hallux Metatarsophalangeal-Interphalangeal Scale questionnaire for hallux pathologies were conducted effectively. According to the established criteria, the results showed that the instrument is valid with a very high interobserver concordance and can be safely reproduced in Portuguese.

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References

1. Venkatesan S, Schotanus MG, Hendrickx RP. Dutch Translation of the Manchester-Oxford Foot Questionnaire: Reassessment of Reliability and Validity. J Foot Ankle Surg. 2016;55(6):1199-1201.
2. Rodrigues RC, Masiero D, Mizusaki JM, Imoto AM, Peccin MS, Cohen M, et al. Translation, cultural adaption and validation of the "American Orthopaedic Foot and Ankle Society (AOFAS) Ankle-Hindfoot Scale." Acta Ortop Bras. 2008;16(2):107-11.
3. Katsambas A, Abeck D, Haneke E, van de Kerkhof P, Burzykowski T, Molenberghs G, et al. The effects of foot disease on quality of life: results of the Achilles Project. J Eur Acad Dermatol Venereol. 2005;19(2):191-5.
4. Moore F, Vickrey B, Fortin K, Lee L. Two Multiple Sclerosis Quality-of-Life Measures: Comparison in a National Sample. Can J Neurol Sci. 2015;42(1):55-63.
5. Laucis NC, Hays RD, Bhattacharyya T. Scoring the SF-36 in Orthopaedics: A Brief Guide. J Bone Joint Surg Am. 2015; 97(19):1628-34.
6. Morris C, Doll H, Wainwright A, Davies N, Theologis T, Fitzpatrick R. The Oxford Ankle Foot Questionnaire for Children: review of development and potential applications. Prosthet Orthot Int. 2010;34(3):238-44.
7. Leigheb M, Vaiuso D, Rava E, Pogliacomi F, Samaila EM, Grassi FA, et al. Translation, cross-cultural adaptation, reliability, and validation of the Italian version of the American Orthopaedic Foot and Ankle Society - MetaTarsoPhalangeal-InterPhalangeal Scale (AOFAS-MTP-IP) for the hallux. Acta Biomed. 2019;90(12-S):118-26.
8. 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;46(12):1417-32.
9. Wilburn J, McKenna SP, Twiss J, Rouse M, Korkosz M, Jancovic R, et al. Further international adaptation and validation of the Rheumatoid Arthritis Quality of Life (RAQoL) questionnaire. Rheumatol Int. 2015;35(4):669-75.
10. 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;15(7):349-53.
11. Ciconelli RM, Ferraz MB, Santos W, Meinão I, Quaresma MR. Brazilian-Portuguese version of the SF-36. A reliable and valid quality of life outcome measure. Rev Bras Reumatol. 1999; 39(4):143-50.
12. Callegariu-Jacques, SM. Bioestatística: Princípios e Aplicações. Porto Alegre: Ed. ARTMED; 2003.
13. Siegel S. Estatística não paramétrica. São Paulo: Ed. McGraw-Hill do Brasil; 1981.
14. Kleinbaum DG, Kupper LL, Muller KE, Nizam A. Applied regression analysis and other multivariable methods. Belmont, Duxbury Press; 1998.
15. Van Lieshout EM, De Boer AS, Meuffels DE, Den Hoed PT, Van der Vlies CH, Tuinebreijer WE, 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;7(2):e012884.
16. 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;6(3):233-9.
17. De Boer AS, Meuffels DE, Van der Vlies CH, Den Hoed PT, Tuinebreijer WE, Verhofstad MHJ, 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;7(11):e018314.
18. Nix S, Smith M, Vicenzino B. Prevalence of hallux valgus in the general population: a systematic review and meta-analysis. J Foot Ankle Res. 2010;3:21.
19. Menz HB, Lord SR. Foot pain impairs balance and functional ability in community-dwelling older people. J Am Podiatr Med Assoc. 2001;91(5):222-9.