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# Cross-cultural adaptation and measurement properties of the Portuguese version of the Ankle Instability Instrument

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### Abstract

**Introduction.** Chronic ankle instability is one of the most common clinical conditions in the general population, especially in adult athletes. The cross-cultural adaptation of self-reported questionnaires that identify and classify this condition contribute to criteria standardization in research but also in rehabilitation. **Aim of Study.** To validate the Ankle Instability Instrument to the Portuguese population and to investigate its psychometric properties. **Material and Methods.** Linguistic and semantic equivalence of the original version of the Ankle Instability Instrument to the Portuguese population was firstly performed. The Portuguese version of the Ankle Instability Instrument was then applied to 81 higher education adult students, with ( $n = 59$ ) and without history of ankle sprain ( $n = 22$ ). Participants were evaluated two times with an interval of one week to assess the psychometric properties of the Portuguese version of the Ankle Instability Instrument. **Results.** In the reliability of binary responses based on the test-retest, the tetrachoric correlation coefficient ranged from 0.99 to 1.00. In addition, the Kuder-Richardson coefficient was 0.79 suggesting good internal consistency. **Conclusions.** Test-retest showed an almost perfect match in all answers between the two moments, which seem to be related to sample characteristics. The internal consistency value was similar to the one obtained in the original version. The Portuguese version of the Ankle Instability Instrument is highly reliable and can be used in clinical practice.

**KEYWORDS:** chronic ankle instability, self-reported questionnaire, reliability, cross-cultural adaptation.

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### Introduction

It is generally accepted that self-reported questionnaires are valuable tools not only to identify the subjective impact of different clinical conditions, but also to help establishing the diagnostic in a variety of situations [27]. Further, their usefulness has been consistently shown, namely in clinical practice and health research because the information provided is highly reliable and inexpensive [27].

The Chronic Ankle Instability (CAI) is an example of a clinical condition whose diagnosis is not solely based on objective findings [16], but also in subjective feelings of instability and “giving-way” [7]. Actually, in addition to persistent residual pain and oedema, this dysfunction is associated to ankle instability symptoms

up to 75% of the cases [16], and can involve mechanical and/or functional deficits [7, 16]. Mechanical instability originates from structural capsule-ligamentous changes and may be defined as a movement of the ankle joint complex beyond its physiological limit [7, 16]. These mechanical changes lead to altered proprioceptive input and altered motor control programmes [8] which, in turn, seem to perpetuate ankle instability. Functional instability results from neuromuscular/proprioceptive deficits and consequent deficit of postural control, which compromise the dynamic stability of the joint complex, being characterized by the ankle “giving-way” sensation [7, 16]. The high prevalence of CAI after ankle sprain [26], one of the most common sport related injury (contact and non-contact) [12], highlight the need of developing and validating tools able to identify CAI [16]. In fact, ankle sprain has been estimated to occur in 2.15 cases per 1000 individuals per year in the general population [25], and in 4.2 cases in 1000 hours of exposure in athletes [12] leading to high health care costs [25].

Based on the impact of CAI on society and health systems [10], the need of developing valid and reliable self-reported tools to assess/classify CAI has been highlighted [9]. Furthermore, this need is amplified by a diversity of criteria used to identify subjects with CAI [14], which make difficult to produce scientific evidence that can be extended to the various populations and regions of the world [14]. To avoid this problem, the International Ankle Consortium currently recommends the use of three self-reported tools to identify this condition: the Ankle Instability Instrument (AII), the Cumberland Ankle Instability Tool (CAIT) and the Identification of Functional Ankle Instability (IdFAI) [14]. Despite this recommendation, according to our knowledge, and unlike CAIT and IdFAI [6, 15, 17, 19, 22, 28] the AII was not adapted to other languages and cultures, highlighting the need to adapt the AII, specially to European-Portuguese considering that none of the mentioned tools are adapted to this specific population. To provide a foundation for answering research questions about the reliability of this tool for identifying CAI, the test-retest and the internal consistency should also be assessed. We believe that this will not only benefit clinicians but will also allow researchers to compare this condition across populations, and most certainly help conducting comprehensive experimental and epidemiological studies.

### Aim of Study

The aim of this study was to culturally and linguistically adapt the AII to the European-Portuguese population and to investigate its psychometric properties.

## Material and Methods

### *Subjects*

The present cross-sectional observational and test-retest study included a convenient sample of 81 participants (18 males and 63 females). Physically active higher education students with or without history of ankle sprain were included in the present study. Participants presented in average an age of  $20,77 \pm 2,19$  years old and a body mass index of  $24,46 \pm 1,36 \text{ kg/m}^2$  (males) and  $21,60 \pm 2,08 \text{ kg/m}^2$  (females). All were physically active: 31 (38.2%) participated in competitive or recreational sports and 50 (61.7%) in jogging or gym activities. Forty-four percent of the participants maintained their physical activity three times a week, usually for a period of 60-90 minutes (55.6%). Most of them ( $n = 59$ ) presented history of ankle sprain. Participants were excluded when presenting musculoskeletal injuries other than ankle sprain, pathologies affecting postural control namely history of lower limb surgery, balance disorders, neuropathies, diabetes, as well as participants taking oral or local anaesthetics. To increase the accuracy of the participants answers, based on the prediction that participants with bilateral ankle sprain would be less able to identify a bilateral impairment, those presenting history of bilateral ankle sprain were also excluded. In fact, since the perception of instability is frequently asymmetrical, it is possible the participants identify instability in the most affected side and the inexistence of instability in the less affected side. The characterization of the sample was performed by a health professional. The AII was self-filled with reference to the injury limb in the group with ankle sprain history and to a randomly chosen limb in the uninjured participants [9].

### *Instrument*

The Ankle Instability Instrument was developed by Docherty et al. (2006) aiming to accurately identify and evaluate individuals with CAI. The AII was initially developed in a physically active young university sample. Further, it is a fast-track instrument since it only has nine closed binary response questions and 3 ordinal answers. It was suggested that any individual with CAI history has a “yes” answer to 5 or more questions of the 9 binary items [14]. It has also been shown that AII is highly reliable (Intraclass Correlation Coefficient, ICC = 0.95) in young adults with and without ankle injury history [9]. An exploratory factor analysis of the original version ( $n = 101$ ) showed that AII had three

factors (Severity of initial ankle sprain; History of ankle sprain and Instability during activities of daily life) and reduced the instrument from 21 to 12 questions [9]. However, in the present study no Factor Analysis was done for the following reasons: (i) our sample size is small comparative to the number of items; (ii) since nine items have binary responses, and there is also a possibility for three ordinal responses, a polychoric correlation matrix is need which is not available in SPSS, for example. Even if we had this matrix, and use specialized software as EQS or LISREL, for example, we would not be able to have a satisfactory solution because of convergence problems – small sample size, too few cases per response category, or no cases at all, and missing responses [5].

#### *Ethical aspects*

The study was approved by the Ethics Committee of the School of Health, Polytechnic Institute of Porto (1719/2014). All the participants signed a term of consent. The author of the original version of the questionnaire authorized the validation and use of the instrument.

#### *Conceptual equivalence and linguistic or semantic equivalence*

Translation to the Portuguese language of the English AII [9] was done according to the Guidelines for cross-cultural adaptation of self-report measures [2]. Two professional bilingual translators in Portuguese and English did the forward translation of the English AII into Portuguese. One translator was a physiotherapist and professional translator while the other was a university professor of Social Sciences and professional translator. The translation was done independently of each other [2]. A consensus meeting between the two translators was then held in which the independently developed versions were compared. Differences in versions were discussed and a single consensus version was developed [2]. Back-translation from Portuguese into English was done by two other professional bilingual translators who were blinded to the original English AII. The back-translation was also done independently. A consensus meeting between the two back-translators was held in which the independently developed versions were compared [2]. Finally, an expert committee, consisting of other bilingual physiotherapists and university professors, compared the individually back-translated and final back-translated versions of the Portuguese version of the AII to the English AII with the sole aim to preserve the semantic, idiomatic, experiential

and conceptual equivalence. Differences in versions were discussed and a single consensus version was developed and named “Instrumento de Avaliação da Instabilidade do Tornozelo”. This version was later used in a pilot test or “Comprehension Test”. Thus, a document titled “Comprehension Test” was distributed to 40 subjects of the target population but who presented at least one of the exclusion criteria mentioned. The purpose of this assessment was to verify the clarity and comprehensiveness of all items of the Portuguese version [2].

#### *Test-retest reliability and internal consistency*

Internal consistency measures the extent to which items, comprising a scale, measure the same construct [13]. To assess the internal consistency of the questionnaire items, Kuder Richardson (KR-20) [18] version of Cronbach's alfa was used only on the nine binary scale items. Although there is no universal cut-point on how sizeable KR-20 should be, there is some agreement on a possible standard threshold of 0.70 [1, 13]. To evaluate the test-retest reliability participants were asked to complete the Portuguese version of AII in two moments with a 1-week interval. The tetrachoric correlation (rho) was used on the binary items to assess reliability between test and retest [3].

All statistical procedures were performed using STATA 15 (Data Analysis and Statistical Software) with a 5% significance level.

## **Results**

#### *Instrument's validation*

At the meeting with the 1<sup>st</sup> panel of judges, a consensus was reached on its translation. After the application of the “comprehension test” no difficulties in understanding were mentioned. Finally, at the meeting with the 2<sup>nd</sup> panel of judges, it was concluded that the translated instrument had no underlying or ambiguous concepts. Therefore, no changes were made to the “comprehension test” or pre-final version. The content validity of the AII was therefore checked. The definitive version of the instrument, after translation and review by the two panels of judges, is set out in Appendix I.

Of all the participants, 35 (43%) were classified with CAI through the AII, while the remaining 46 (57%) were considered without CAI (Table 1). Table 1 shows information disaggregated by sex.

**Table 1.** Participants classified with CAI using the AII

	Male (n = 18)	Female (n = 63)	Total (n = 81)
With CAI	6	29	43% (35)
Without CAI	12	34	57% (46)

Note: CAI – Chronic Ankle Instability; AII – Ankle Instability Instrument

#### *Instrument application, test-retest reliability and internal consistency*

Reliability of the binary responses in test and retest showed that rho varied from 0.99 to 1.00, which demonstrates an almost perfect match between all the answers given at the two moments. Cohen's kappa produced similar values (0.90-1.00). Further, the KR-20 was 0.79 (95% CI = 0.71, 0.85) suggesting a good internal consistency, which reflects how homogenous a set of items are to reflect its construct/factor. Additionally, item difficulty was low (mean value = 0.46), item-rest correlation mean value was 0.47 indicating no apparent redundancy in item formulation, and item variances were relatively similar (Table 2).

**Table 2.** Kuder–Richardson coefficient (KR-20) of the nine binary response questions of the AII (Portuguese version)

Item	Obs	Item difficulty	Item variance	Item-rest correlation
1	81	0.7284	0.1978	0.4480
2	81	0.3333	0.2222	0.3666
3	81	0.4444	0.2469	0.2888
4	81	0.6173	0.2362	0.5889
5	81	0.1852	0.1509	0.4332
6	81	0.6296	0.2332	0.4911
7	81	0.6420	0.2298	0.5736
8	81	0.1605	0.1347	0.4205
9	81	0.3951	0.2390	0.6411
Test		0.4595		0.4724

KR-20 coefficient is 0.7910

Note: AII – Ankle Instability Instrument

#### **Discussion**

The recognition of the impact of CAI on society and health systems has been described by several authors [10]. The adaptation of self-reported tools created to identify CAI for different languages and cultures enables standardize the diagnosis of this condition [14].

Specifically, the adaptation of the AII would contribute to this domain considering that, according to our knowledge, this is the first study that provides an adaptation of this instrument.

The present study aimed to perform the cultural/linguistic adaptation of the AII instrument and to investigate its psychometric properties. This instrument was originally developed to evaluate/classify individuals with CAI [9]. In the process of linguistic and semantic adaptation, it was not necessary to make substantial changes, highlighting the Portuguese version of the AII as an instrument of easy understanding and interpretation. For the analysis of test-retest reliability, a week interval was established to guarantee that the participant's condition remained stable [20]. The rho values showed indicators of excellent test-retest reliability for all questions (0.99-1.00) being slightly higher to the values obtained in the original version [9]. The results of the present study demonstrate values of rho equal to 1 revealing total coherence in the responses at both times [13]. Our experience as researchers leads us to hypothesize that these results could be explained by the fact that higher education students usually take these types of studies very seriously, responding very carefully to all questions in both moments. Furthermore, all students completed the questionnaire in person and not on-line, which likely contributed to a more serious/rigorous answers [24]. It is also possible the time interval used between assessments (1-week) and the short length of the AII facilitate an eventual recall of some answers by the participants. However, this time interval was important to reduce the likelihood of changes in participants' clinical condition, since all were physically active and could get some injury in a longer period than this. Moreover, a study compared two time intervals for test-retest reliability of health status instruments (2 days vs 2 weeks) and no statistically significant differences were found in test-retest results between the two time intervals [23], which supports our methodological option of one-week time interval. When analysing the internal consistency of all test items of the Portuguese version of AII, a good internal consistency (KR-20=0.79) was identified, slightly lower than the original version using Cronbach's  $\alpha$  ( $\alpha = 0.89$ ). Since a greater variability of inter-subject responses is associated with a higher internal consistency values [21], the value obtained in this study can be explained by a smaller variability of responses, in relation to the concept to be measured (presence of CAI). The results obtained in our study should be compared with those of the original version with some caution, because the statistical tests used were not the same.

The binary scale of the items imposed the use of the tetrachoric correlation coefficient in test-retest reliability and the use of Kuder-Richardson in the internal consistency [18]. The statistical tests used by the original author (Intraclass correlation coefficient and Cronbach's  $\alpha$  coefficient) are indicated when the items are continuous variables [21].

Currently, the scientific community already has access to the cultural and semantic adaptation of the CAIT [6] and the IdFAI [22] for Brazilian-Portuguese language. However, none of the three recommended self-reported tools [14], were adapted to European-Portuguese. Since, cultural adaptation of an instrument is always necessary when it is applied in another country (although the same language is spoken in that country) [2], this study adds the possibility of carrying out more comprehensive experimental and epidemiological studies in Portugal, using the European-Portuguese version of the AII.

In this study, no criterion validation was performed, and the same occurred in the study that originated this instrument. Although this condition is always important when reporting on a concurrent alternative, cheaper and also clinically valid, the fact is that there is no gold standard method to accurately identify functional ankle instability [11]. Another apparent weakness of the present study is related to the sample size. Although our sample is relatively small, we have guaranteed that the minimum standard of subject-to-variable ratio was higher than 5 (81 subjects/12 items = 6.75) [4]. Further, when running a confirmatory factor analysis with binary items we always need very large samples which in many instances are not possible because hundreds of cases with ankle instability are not within the reach of the researcher. Moreover, the absence of a factor analysis does not limit the relevance of the present instrument. One has to bear in mind that with just nine items a three-factor solution could only emerge after considering several model constraints which are beyond the original paper. In any case, what counts most is that with nine dichotomous items a clinician is able enough to identify different facets of ankle instability. It should be also noted that in the present study only participants with unilateral ankle sprain were included. Despite the International Ankle Consortium do not state recommendations regarding this issue, it should be considered that subjects with bilateral impairments would be less able to identify clearly the instability in the less affected side. However future studies should confirm this hypothesis.

Globally, future studies are expected to focus on building, validating and adaptation of more self-report measurements [16], so evidence-based treatment

recommendations can be made in different populations and regions. One possible next step could be the cross-cultural adaptation of the CAIT to European-Portuguese context, once it has been established that when the CAIT and the AII are used together, they can accurately identify individuals with CAI [11].

## Conclusions

Through this study it was possible to confirm the content equivalence of the Portuguese version of the AII, revealing a good internal consistency and an excellent test-retest reliability.

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**Appendix I.** Final version of the AII Portuguese version, reviewed by the panel of judges, for left and right ankle

Instrumento de avaliação da instabilidade do tornozelo

ID: \_\_\_\_\_

Este formulário será usado para categorizar a instabilidade do seu tornozelo. Por favor, preencha o formulário na totalidade. Se tiver alguma dúvida, por favor, pergunte ao investigador. Obrigado pela sua participação.

1. Alguma vez já torceu o seu tornozelo?  
 Sim       Não
2. Alguma vez consultou um médico por causa de uma entorse do tornozelo?  
 Sim       Não
- 2.1. Se sim, como é que o médico classificou a sua entorse mais grave do tornozelo?  
 Ligeira (grau I)     Moderada (grau II)     Severa (grau III)
3. Alguma vez utilizou algum auxiliar de marcha (como muletas) por incapacidade de suportar o peso corporal devido a uma entorse do tornozelo?  
 Sim       Não
  - 3.1. Se sim, na entorse mais grave do tornozelo, quanto tempo utilizou o auxiliar de marcha (muletas) referido anteriormente?  
 1 a 3 dias       4 a 7 dias       1 a 2 semanas       2 a 3 semanas       > 3 semanas
4. Alguma vez teve a sensação de o seu tornozelo ceder/falhar?  
 Sim       Não
  - 4.1. Se sim, quando foi a última vez que o seu tornozelo cedeu/falhou?  
 < 1 mês atrás     1 a 6 meses atrás     6 a 12 meses atrás     1 a 2 anos atrás     > 2 anos atrás
5. Alguma vez sentiu o seu tornozelo instável durante a marcha em superfície plana?  
 Sim       Não
6. Alguma vez sentiu o seu tornozelo instável durante a marcha em piso irregular?  
 Sim       Não
7. Alguma vez sentiu o seu tornozelo instável durante atividades recreativas ou desportivas?  
 Sim       Não
8. Alguma vez sentiu o seu tornozelo instável ao subir escadas?  
 Sim       Não
9. Alguma vez sentiu o seu tornozelo instável ao descer escadas?  
 Sim       Não

Original version – Ankle Instability Instrument

ID: \_\_\_\_\_

Instructions

This form will be used to categorize your ankle instability. A separate form should be used for the right and left ankles. Please fill out the form completely. If you have any questions, please ask the administrator of the survey. Thank you for your participation.

Left limb  Right limb

1. Have you ever sprained an ankle?  
 Yes       No
2. Have you ever seen a doctor for an ankle sprain?  
 Yes       No
- 2.1. If yes, how did the doctor categorize your most serious ankle sprain?  
 Mild (grade I)     Moderate (grade II)     Severe (grade III)
3. Did you ever use a device (such as crutches) because you could not bear weight due to an ankle sprain?  
 Yes       No  
3.1. If yes, in the most serious case, how long did you need to use the device?  
 1 a 3 days       4 a 7 days       1 a 2 weeks       2 a 3 weeks       > 3 weeks
4. Have you ever experienced a sensation of your ankle “giving way”?  
 Yes       No  
4.1. If yes, when was the last time your ankle “gave way”?  
 < 1 month       1 a 6 months ago     6 a 12 months ago     1 a 2 years ago     > 2 years
5. Does your ankle ever feel unstable while walking on a flat surface?  
 Yes       No
6. Does your ankle ever feel unstable while walking on uneven ground?  
 Yes       No
7. Does your ankle ever feel unstable during recreational or sport activity?  
 Yes       No
8. Does your ankle ever feel unstable while going up stairs?  
 Yes       No
9. Does your ankle ever feel unstable while going down stairs?  
 Yes       No