Foot and Ankle Surgery 26 (2020) 391–397

Contents lists available at ScienceDirect

Foot and Ankle Surgery

journal homepage: www.elsevier.com/locate/fas

French translation and validation of the Cumberland Ankle Instability Tool, an instrument for measuring functional ankle instability

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ARTICLE INFO

Article history:
Received 30 November 2018
Received in revised form 25 April 2019
Accepted 2 May 2019

Keywords:
Ankle instability
Cumberland Ankle Instability Tool
CAIT
Translation
Validation
Psychometrics

ABSTRACT

Background: Ankle sprains are one of the most common musculoskeletal injuries, and can lead to chronic ankle instability (CAI). The Cumberland Ankle Instability Tool (CAIT) measures a subset of CAI, functional ankle instability (FAI). Because no French version existed, we set out to translate and validate the CAIT in French.
Methods: The CAIT was translated using a forward-backward methodology. We examined its psychometric properties and calculated a cut-off score for FAI in a sample of 102 subjects (median age 22 years).
Results: The CAIT was translated without significant problems. The CAIT-F can discriminate between those with and without FAI ($p < 0.001$), with a cut-off score of ≤ 23 points. The test-retest reliability is excellent (ICC = 0.960), as is the internal consistency ($\alpha = 0.885$). Construct validity was confirmed. No floor or ceiling effects were detected among subjects with FAI.
Conclusions: The CAIT is now available in French, and is a valid and reliable instrument.

1. Introduction

Ankle sprains are one of the most common musculoskeletal injuries, with an incidence rate of between 5 and 7 per 1000 person-years in European populations [1]. Those engaged in regular sporting activities are particularly vulnerable, with 14.9% experiencing at least one ankle sprain [2]. While most patients experience a rapid improvement in pain within the first 2 weeks, and further improvement after that, a non-negligible 5 to 33% still experience pain after 1 year. Furthermore, after a first ankle sprain, the risk of re-sprain ranges from 3 to 34% and subjective instability was reported by up to 53% of subjects [3].

Hertel coined the term chronic ankle instability (CAI), which he defined as *"the occurrence of repetitive bouts of lateral ankle instability, resulting in numerous ankle sprains"*, to describe a condition characterized by giving way of the ankle, mechanical instability, pain and swelling, loss of strength, recurrent sprains and functional instability [4]. The mechanics of chronic ankle instability are comprised of a spectrum of insufficiencies roughly divided into mechanical and functional. Mechanical ankle instability (MAI) is the result of physical changes such as pathologic laxity, impaired arthrokinematics, synovial changes and the development of degenerative joint disease. Functional ankle instability (FAI) is caused by changes to the neuromuscular system and affects the dynamic support of the ankle. Functional ankle instability is associated with deficits in proprioception, neuromuscular control, strength and postural control [4].

Functional ankle instability has proven difficult to measure [5]. While mechanical instability can be measured by clinical tests, such as the anterior draw test, functional ankle stability is primarily diagnosed through patient-reported outcome measures (PROM) [6]. The Cumberland Ankle Instability Tool (CAIT) is a

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https://doi.org/10.1016/j.fas.2019.05.002
1268-7731/

PROM that can detect functional ankle instability and provide a measure of the severity of the instability [5]. It does so through nine questions evaluating ankle pain, subjective instability during activities such as running or hopping and the ability of the ankle to cope with episodes of giving way [7]. The answers for the nine questions are added up to a total score, which goes from 0 (indicating an extreme functional instability of the ankle) to 30 points (indicating a stable ankle).

Since its inception, the CAIT has been translated and validated in Spanish, Portuguese (Brazil), Persian, Korean, Japanese and Dutch [8–13]. An overview of the results of these validations can be found in Table 1.

The objective of this study is to translate the CAIT into French and to examine its psychometric properties, so as to confirm its validity and reliability.

2. Material and methods

2.1. Translation process

The translation methodology adopted in this study is based on the work of Beaton et al. and consisted of 6 phases [14]. First, two bilingual translators, native French-speakers with English as their second language, independently translated the original tool into French. Secondly, a synthesis version was produced by the two translators. In the third phase, two different translators, this time native English-speakers who spoke French as a second language, independently translated the synthesis version back into English. After this, an expert committee reviewed the different versions and modified where appropriate. The version of the tool agreed upon by the expert committee was subsequently presented to a linguist, who also proposed several modifications. Afterwards, a pre-test was organized with 10 subjects. The final version of the instrument was named the CAIT-F, with the F signifying 'French'.

2.2. Study population

Participants were recruited from the student population of the University of Liège. This study recruited both subjects without a history of ankle trauma as well as subjects who reported to have experienced at least one sprained ankle and who experienced instability of the ankle and/or a feeling of the ankle giving way. Candidates were eligible for inclusion if they were at least 18 years old and spoke French on a daily basis. Candidates who had

Table 1
Overview of the psychometric properties of the CAIT.

CAIT version	Sample size (n)	Discriminative power	Internal consistency (α)	Test-retest reliability [ICC (95% CI)]	Construct validity (correlations with CAIT total score)	Floor and ceiling effects	Responsiveness	Cut-off score	SEM	SDC
English [9]	236			0.96	VAS: $r = 0.76$ ($p < 0.01$) LEFS: $r = 0.50$ ($p < 0.01$)			≤27		
Portuguese [13]	131		RA: 0.86 LA: 0.88	0.95 (0.93–0.97)		None observed	ES: 0.75 (95% CI: 0.49–1.00)			
Spanish [18]	108		0.766	0.979 (0.958–0.990)	SF-36 PCS: $r = 0.241$ ($p = 0.012$) SF-36 MCS: $r = -0.162$ ($p = 0.094$)		ES: 1.07			
English [21]	200							≤25		
Spanish [12]	171		RA: 0.84 LA: 0.80	RA: 0.95 (0.94–0.97) LA: 0.95 (0.9.3–0.96)		Floor: n = 0 (0%) Ceiling: n = 7 (9%)	Cohen's *d*: 0.69 (95% CI: 0.11–1.27)			
Korean [15]	168		0.89	0.94	SF-36 PCS: $r = 0.70$ ($p = 0.001$) SF-36 MCS: $r = -0.06$ ($p = 0.48$)				1.72	
Persian [14]	105		RA: 0.81 LA: 0.79	RA: 0.95 (0.91–0.97) LA: 0.91 (0.80–0.94)	FAAM-ADL: $r = 0.41$ FAAM-Sport: $r = 0.43$ VAS: RA $r = 0.80$; LA $r = 0.64$	Floor: RA = 2.6%, LA = 4.8% Ceiling: RA = 5.1%; LA = 9.5%			RA: 2.03 LA: 2.4	RA: 5.6 LA: 6.5
	30		RA: 0.77 LA: 0.73			Floor = 0% Ceiling >50%,				
Japanese [16]	111	AUC = 0.932 ($p < 0.001$)	0.833	0.826 (0.732–0.888)	Karlsson score: $r = 0.604$ ($p < 0.001$)			≤25		
English [22]	50									3.08
Dutch [17]	98		0.856	0.943	Self-reported instability: $r = -0.65$ ($p < 0.001$) NRS pain scale: $r = -0.55$ ($p < 0.001$) FAOS pain: $r = 0.42$ ($p < 0.001$) FAOS symptoms: $r = 0.37$ ($p < 0.001$) FAOS ADL: $r = 0.48$ ($p < 0.001$) FAOS sport: $r = 0.36$ ($p < 0.001$) FAOS QoL: $r = 0.43$ ($p < 0.001$)			≤11	0.82	2.28
French	102	$p < 0.001$	0.885	0.960 (0.942–0.973	SF-36 PCS: $r = 0.595$ ($p < 0.001$) SF-36 MCS: $r = -0.198$ ($p = 0.091$) FAAM- Sport: $r = 0.793$ ($p < 0.001$) FAAM ADL: $r = 0.763$ ($p < 0.001$) VAS: $r = 0.834$ ($p < 0.001$)	None observed in FAI group		≤23	1.52	4.21

VAS = visual analogue scale; LEFS = lower extremity functional scale; RA = right ankle; LA = left ankle; ES = effect size; SF-36 PCS = SF-36 physical component summary; SF-36 MCS = SF-36 mental component summary; AUC = area under the curve; NRS = numeric rating scale.

previously sprained their ankle were excluded if this had happened in the three months before recruitment, if another medical problem with the lower members was present or if they had surgery on the lower members in the past. The healthy and pathological group were matched on gender.

All participants provided informed consent. The study protocol was approved by the Medical Ethics committee of the University Teaching Hospital of Liège.

2.3. Instruments

Apart from the CAIT-F, participants completed the French versions of the Foot and Ankle Ability Measure (FAAM), the Short-Form 36-item Health Survey (SF-36), and a Visual Analogue Scale (VAS) rating self-perceived stability of their ankle [15,16].

The Foot and Ankle Ability Measure is a self-report outcome instrument designed to evaluate physical function for individuals with musculoskeletal disorders of the leg, foot and ankle. It is split into two subscales, with 21 questions on activities of daily life (ADL) and 8 questions on sports [15].

A Visual Analogue Scale is a simple and straightforward instrument, composed of a horizontal line of 10 cm in length, without markings. In this study, it was used to let the participants auto-evaluate ankle instability, on a spectrum between extreme ankle instability on the far left of the scale, to no ankle instability on the far right.

The SF-36 is an auto-administered multi-item generic health survey which measures functional health and wellbeing from the subject's perspective. It has 36 items which are categorized into 8 domains, and also produces a physical and a mental summary score [16].

2.4. Psychometric evaluation

The evaluation of the psychometric properties was carried out using the entire sample, with the exception of the evaluation of the presence of floor and ceiling effect, for which only subjects with a history of ankle instability were analyzed. For participants with a history of ankle instability, the affected or most-affected ankle was encoded. For participants without a history of ankle instability, we encoded either the left or right ankle.

2.4.1. Discriminative power

Given the fact that the CAIT-F evaluates the severity of functional ankle instability, its ability to distinguish between subjects with and without ankle instability was examined.

Following the example of previous validation studies of the CAIT, this study also calculated a cut-off score to distinguish between healthy and affected individuals. The choice of the optimal cut-off score was based on the highest Youden Index, which is calculated with the following formula: sensitivity + specificity -1 [17]. Sensitivity (true positive rate) and specificity (true negative rate) were extracted from a Receiver Operating Characteristic curve.

2.4.2. Test-retest reliability

Test retest reliability shows the extent to which the questionnaire produces the same scores for repeated measurements in subjects whose health has not changed [18]. For this, participants completed the questionnaire twice, with 1 week in-between. Additionally, they were asked whether they had experienced any health problems concerning the lower members in the time between the first and the second administration. The test-retest reliability was evaluated with the intraclass correlation coefficient (ICC – two-way mixed, absolute agreement). An ICC higher than 0.70 is considered acceptable [19].

We also calculated the standard error of measurement (SEM) and the smallest detectable change (SDC) of the questionnaire. The standard error of measurement provides a range around the observed value in which the theoretical "true" value can be found. The smallest detectable change indicates the amount of change that needs to be measured to be sure that the change measured is real, and not potentially a product of measurement error. We calculated the standard error of measurement by dividing the standard deviation of the difference between test and retest scores by the square root of 2 (SD_{diff} / $\sqrt{2}$). The smallest detectable change was calculated by multiplying SD_{diff} by 1.96 [20].

2.4.3. Internal consistency

The internal consistency of a questionnaire is defined as *"the degree of interrelatedness among the items"* [18]. This parameter is evaluated with the Cronbach's alpha coefficient. A value between 0.7 and 0.9 indicates good internal consistency without significant risk of redundancy in the items [20]. Internal consistency was evaluated on the questionnaire as a whole and when deleting a single item. We also calculated correlations between the total score and the individual items.

2.4.4. Construct validity

The evaluation of the construct validity of a questionnaire provides information on whether the questionnaire truly measures the concepts it claims to measure [18]. This is established through hypotheses on the correlations between the CAIT-F and questionnaires that measure similar concepts (convergent validity) or different concepts (divergent validity). A questionnaire has good construct validity when at least 75% of hypotheses are confirmed [19].

For the evaluation of the construct validity of the CAIT-F, the following hypotheses were formulated: we expect a moderate or strong correlation between the total score of the CAIT-F and the FAAM Activities of Daily Living score, as well as the FAAM Sport score. We also expect a moderate or strong correlation between the total score of the CAIT-F and the VAS. We hypothesize that a stronger correlation will exist between the total score of the CAIT-F and the SF-36 Physical Component Summary score than between the total score of the CAIT-F and the SF-36 Mental Component Summary score. Lastly, we postulate that we won't find a significant correlation between the CAIT-F and the SF-36 Mental Component Summary score.

Spearman or Pearson correlation were used in function of the normality of distribution of the variables. A correlation <0.3 was considered weak, between or equal to 0.3 and 0.6 moderate and >0.6 strong.

2.4.5. Floor and ceiling effects

Floor and ceiling effects are considered to be present when at least 15% of the sample obtains the highest or lowest score possible.

2.5. Statistical analysis

All analyses were carried out with IBM SPSS for Windows, version 25 (Armonk, NY: IBM Corp.).

Normality of distribution of the variables was established on the basis of the distance between mean and median, the histogram, the quantile-quantile plot and the Shapiro-Wilk test. Variables that displayed normal distribution were reported as mean ± standard deviation, and non-normal variables as median P25–P75.

Differences in clinical characteristics and the discriminative power of the CAIT-F were examined with the Student *t*-test or the Mann-Whitney *U-test*, depending on their distribution.

Results were considered statistically significant at $p < 0.05$.

3. Results

3.1. Translation

No major problems were encountered during the translation process. All differences between the translations were resolved by consensus except for 2 instances where advice from the linguistic expert (JVB) was requested before making a decision. The pre-final version of the questionnaire was then evaluated by the linguist, who proposed the following modifications:

- In item 2, "j'ai l'impression que ma cheville est instable" was changed into "ma cheville me semble instable".
- Also in item 2, the linguist advised us to keep the translation of the first response option, *"parfois quand je fais du sport (pas à chaque fois)"*, but to change the second response option to *"à chaque fois que je fais du sport"* to make the distinction between the two clearer.
- For the translation of the terms *"typically"* and *"typical"* in items 8 and 9, the linguist proposed the use of *"habituellement"* and *"habituel"*.
- Lastly, for item 9, the linguist suggested using *"après un incident habituel de torsion de cheville"* instead of *"après un incident oùje me tords la cheville"*.

The translated questionnaire was subsequently administered to 10 subjects, who reported that they did not have any issues with the comprehensibility of the questionnaire.

3.2. Population

A total of 102 subjects agreed to participate and were included in the validation part of this study. The group with a history of ankle sprains and the group without ankle problems were evenly numbered, with 51 subjects per group. The gender distribution was also identical in both groups, with 16 (31.4%) men and 35 (68.6%) women per group.

The median age of the complete sample was 22 (20–25) years, with no significant difference for age between the healthy and pathological group ($p = 0.657$). The median BMI was 23.2 (21.3–25.5) kg/m^2, once again not significantly different between the two groups ($p = 0.841$). The complete results for the clinical characteristics are detailed in Table 2.

3.3. Discriminative power

As shown in Table 2, the total score of the CAIT-F was significantly higher in the healthy group versus the group with functional ankle instability [28 (27–30) versus 16 (11–20) points; $p < 0.001$]. This confirms that the questionnaire can differentiate between individuals affected and non-affected by functional ankle instability.

To determine a cut-off score which distinguishes between the affected and non-affected individuals, we calculated the Youden Index for 26 potential cut-off scores, which are shown in Table 3. The maximum Youden index (0.922) indicates that the ideal cut-point lies at 23.5 points. This cut-point possesses a high sensitivity (0.922) and a high specificity (1.000). This means that a score of $\leq$23 points on the CAIT-F questionnaire is indicative of the presence of functional ankle instability.

3.4. Test-retest reliability

All 102 participants completed the CAIT-F twice, with one week between the two administrations. None of the subjects reported a health problem in the interval between the administrations.

An intraclass correlation coefficient of 0.960 (95% CI: 0.942–0.973) was found for the total score of the CAIT-F, indicating excellent test-retest reliability. For the individual items, the ICC's ranged from 0.909 (95% CI: 0.866–0.938) for item 7 to 0.996 (95% CI: 0.995–0.998) for item 9. The ICC's for all items are reported in Table 4.

The standard error of measurement was calculated to be 1.52 points and the smallest detectable change was 4.21 points.

3.5. Internal consistency

The Cronbach's alpha for the entire questionnaire was 0.885, indicating good internal consistency.

Table 2
Characteristics of the study population.

	All (n = 102)	FAI (n = 51)	No FAI (n = 51)	p-value
Age (years)	22.00 (20.00–25.00)	22.00 (20.00–26.00)	22.00 (20.00–25.00)	0.657[a]
BMI (kg/m^2)	23.21 (21.37–25.42)	22.86 (21.33–25.52)	23.30 (21.40–25.00)	0.841[a]
Gender				
Male	32 (31.4%)	16 (31.4%)	16 (31.4%)	1[b]
Female	70 (68.6%)	35 (68.6%)	35 (68.6%)	
CAIT-F total score	25.00 (16.00–28.00)	16.00 (11.00–20.00)	28.00 (27.00–30.00)	<0.001[a]
SF-36 PCS	60.67 (54.98–63.97)	55.00 (47.69–59.40)	63.27 (61.67–66.71)	<0.001[a]
SF-36 MCS	45.27 (35.18–51.87)	48.82 (41.19–54.62)	40.83 (32.21–48.39)	0.004[a]
FAAM Sport score	92.19 (75.00–100.00)	75.00 (62.50–84.37)	100.00 (93.75–100.00)	<0.001[a]
FAAM ADL score	97.60 (91.67–100.00)	91.67 (85.71–95.23)	100.00 (98.34–100.00)	<0.001[a]
VAS	9.00 (5.00–10.00)	5.00 (3.00–7.00)	10.00 (10.00–10.00)	<0.001[a]

[a] Mann-Whitney *U*-test.
[b] Chi-square test.

Table 3
Sensitivity, specificity and Youden index.

CAIT score	Sensitivity	Specificity	Youden index
0.00	0.000	1.000	0.000
1.50	0.020	1.000	0.020
4.50	0.039	1.000	0.039
7.50	0.059	1.000	0.059
8.50	0.098	1.000	0.098
9.50	0.157	1.000	0.157
10.50	0.235	1.000	0.235
11.50	0.353	1.000	0.353
12.50	0.373	1.000	0.373
13.50	0.451	1.000	0.451
15.00	0.471	1.000	0.471
16.50	0.510	1.000	0.510
17.50	0.549	1.000	0.549
18.50	0.667	1.000	0.667
19.50	0.745	1.000	0.745
20.50	0.765	1.000	0.765
21.50	0.804	1.000	0.804
22.50	0.902	1.000	0.902
23.50	**0.922**	**1.000**	**0.922**
24.50	0.941	0.980	0.921
25.50	0.980	0.902	0.882
26.50	0.980	0.765	0.745
27.50	0.980	0.569	0.549
28.50	1.000	0.412	0.412
29.50	1.000	0.373	0.373
31.00	1.000	0.000	0.000

The bold values indicate the place where the Youden Index is at its maximum.

We also evaluated the internal consistency when deleting a single item. The lowest alpha was found when deleting item 5 ($\alpha = 0.866$) and the highest alpha when deleting item 7 ($\alpha = 0.878$). Complete results are reported in Table 4.

Lastly, we evaluated the strength of the correlations between the total score and the individual items of the CAIT-F, also shown in Table 4. We obtained moderate to strong correlations for each item with the total score, going from $r = 0.554$ to $r = 0.834$.

3.6. Construct validity

We pre-specified 5 hypotheses on the strength of the correlations between the total score of the CAIT-F and the physical and mental component summary scores of the SF-36, the Sport and Activities of Daily Living subscales of the FAAM and the visual analogue scale. As shown in Table 5, all convergent hypotheses were confirmed when a strong correlation was found between the total score of the CAIT-F and the physical component summary score of the SF-36 ($r = 0.595$; $p < 0.001$), the Sport ($r = 0.793$; $p < 0.001$) and Activities of Daily Living ($r = 0.763$; $p < 0.001$) subscales of the FAAM and the visual analogue scale ($r = 0.834$; $p < 0.001$). The divergent validity was also confirmed since no significant correlation was found between the total score of the CAIT-F and the mental component summary score of the SF-36 ($r = -0.168$; $p = 0.091$). Lastly, the hypothesis that the correlation between the CAIT-F and the physical component summary score would be greater than the correlation between the CAIT-F and the mental component summary score was also confirmed ($r = 0.595 > r = -0.168$). Since all hypotheses were confirmed (100%), construct validity is considered to be good.

Table 5
Construct validity of the CAIT-F.

Convergent validity	r [a]	p	Divergent validity	r [a]	p
SF-36 PCS	0.595	<0.001	SF-36 MCS	−0.198	0.091
FAAM Sport	0.793	<0.001			
FAAM ADL	0.763	<0.001			
VAS	0.834	<0.001			

[a] Spearman correlations between CAIT-F total score and indicated scores.

3.7. Floor and ceiling effects

None of the 51 participants with a history of ankle instability obtained the lowest (0 points) or the highest (30 points) score, indicating the absence of both floor and ceiling effects.

4. Discussion

In the present study, the CAIT was translated into French and its psychometric properties were evaluated. This newly-translated tool will permit the evaluation of functional ankle instability in French-speaking patients.

The subjects who reported ankle instability reported significantly lower total scores on the CAIT-F compared to those who did not, confirming the ability of the questionnaire to discriminate between the two. This also allowed us to calculate a cut-off score for functional ankle instability, as has been previously done for the English, Dutch and Japanese versions [5,12,13,21]. We found that the ideal cut-off point in our population was ≤23, which is slightly lower than the Japanese cut-off (≤25) and the recalculated English cut-off (≤25) but much higher than the Dutch cut-off (≤11). This last study recruited an older sample from an orthopedic clinic, explaining the difference in the cut-off score found. This cut-off score of ≤23 can be used to establish functional ankle instability in patients.

The results for the test-retest reliability are excellent, with an ICC of 0.960 (95% CI: 0.942–0.973) for the total score, and ICC's above 0.9 for the individual items. This is in line with previously obtained results, most of which were also close to 0.95 (see

Table 4
Test-retest reliability and internal consistency of the CAIT-F.

	Test-retest reliability		Internal consistency		
	ICC	95% CI	Cronbach's alpha if item deleted	Correlation with total score	
				r [a]	p
Item 1	0.948	0.924–0.965	0.876	0.768	<0.001
Item 2	0.990	0.986–0.993	0.867	0.834	<0.001
Item 3	0.976	0.964–0.983	0.875	0.718	<0.001
Item 4	0.993	0.989–0.995	0.876	0.638	<0.001
Item 5	0.984	0.977–0.989	0.866	0.798	<0.001
Item 6	0.947	0.923–0.964	0.872	0.724	<0.001
Item 7	0.909	0.866–0.938	0.878	0.554	<0.001
Item 8	0.979	0.968–0.985	0.870	0.773	<0.001
Item 9	0.996	0.995–0.998	0.875	0.702	<0.001
Total score	0.960	0.942–0.973			

[a] Spearman correlations.

Table 1). The smallest detectable change for the CAIT-F was 4.21 points (on a scale from 0 to 30 points), which means that a patient would have to change by at least this amount before we can be sure that he/she has actually improved or deteriorated.

The same is true for the internal consistency of the CAIT-F, where the Cronbach's alpha of 0.885 found in this study is in line with previously obtained results (see Table 1), and in the range of 0.7 to 0.9 which indicates good internal consistency.

The construct validity of the CAIT-F was examined by correlations between convergent and divergent domains/scores from other questionnaires. The results obtained in this study are in agreement with earlier validations and confirm the construct validity of the CAIT-F.

Lastly, we did not find any floor or ceiling effect for the total score of the CAIT-F, as expected from previous validations.

5. Strengths

The main strength of this study lies in the rigorous methodology used to produce the French translation of the CAIT, ensuring its equivalence to the original version. A second strength is the completeness of the validation, with discriminative power, internal consistency, test-retest reliability, construct validity and floor and ceiling effects examined. On top of that, this study also produced a cut-off score, a value for the standard error of measurement and a value for the smallest detectable change.

We were able to recruit a sufficient sample size for the evaluation of the psychometrics of the questionnaire, with 102 subjects in total and 51 subjects with functional ankle instability [19].

6. Limitations

It is recommended that one of the two forward translators (English to French) should have a medical background and be familiar with the concepts in the questionnaire. Unfortunately, we were unable to find someone with this profile, and instead the forward translations were carried out by a primary school teacher and a secondary school English teacher. However, both translators did not encounter any difficulties with technical terms and concepts, given that the questionnaire is meant to be completed by people who themselves do not have a medical background. Furthermore, the presence of an expert in physical medicine and rehabilitation at the expert review meeting should have provided a safeguard for any misunderstanding of a technical nature.

7. Conclusion

This study produced a French-language version of the CAIT, and confirmed that it is a valid, consistent and reliable instrument in a sample of 102 subjects. This study also provided a new cut-off score for the diagnosis of functional ankle instability ($\leq$23 points) and calculated its standard error of measurement and smallest detectable change. The CAIT-F is ready to be used in clinical practice and for research applications.

Funding statement

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. AG is supported by a FRIA fellowship from the F.R.S.-FNRS (Belgian Fund for Scientific Research).

Ethical review committee statement

The study protocol was approved by the Medical Ethics committee of the University Teaching Hospital of Liège. All participants provided written informed consent.

Conflicts of interest

None declared.

Acknowledgements

We thank the participants who made this study possible.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.fas.2019.05.002.

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