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ORIGINAL ARTICLE

Equivalence of online and paper administration of Identification of Functional Ankle Instability (IdFAI) scale

Fonksiyonel Ayak Bileği İnstabilitesi Tanımlama Ölçeğinin çevrimiçi ve kağıt üzerinden uygulanmasının eşdeğerliği

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Abstract

Purpose: Online use of questionnaires offers many advantages over paper version such as easier participant access, lower cost, faster completion and efficient data management. Thus, it is important to collect valid and reliable data remotely in clinical care and research in order to decrease the patient and participant burden and cost of data collection. The primary aim was to develop online administration of Identification of Functional Ankle Instability (IdFAI) scale in both English and Turkish versions. Secondary aim was to test validity and reliability of the online version of IdFAI scale in both languages.

Methods: Turkish and English versions of the IdFAI scale were used with both paper and online administration. Validity of the questionnaire administration methods (paper vs online) were analysed with Cohen's d effect sizes. Additionally, limits of agreement with Bland and Altman plots and modality (questionnaire administration) order effect were analysed with t-tests. Test-retest reliability of the online versions were analysed using the Intraclass Correlation Coefficient (ICC).

Results: 60 participants equally distributed between those who speak English (30.3±5.8 years, 16 females, 24.0±3.4 kg/m2) and Turkish (27.4±7.7 years, 17 females, 23.3±3.9 kg/m2) were recruited. There was no statistically significant difference between administration methods for the IdFAI scale in both languages (English; d=0.13, Turkish; d=0.12) without any order effect (all p>0.05). Test-retest reliability was excellent for both online versions (English; ICC=0.96, Turkish; ICC=0.98).

Conclusion: The online versions of the IdFAI scale in both English and Turkish were valid and reliable, therefore being suitable for clinical and research purposes.

Keywords: Ankle instability, Outcome measure, Digital, Validity, Reliability.

Öz

Amaç: *Anketlerin çevrimiçi kullanımı, katılımcıların daha kolay erişim sağlaması, daha düşük maliyet, daha hızlı tamamlama ve etkili veri yönetimi gibi kağıt versiyonuna göre birçok avantaj sunar. Bu nedenle, hasta ve katılımcı yükünü ve veri toplama maliyetini azaltmak için klinik uygulamalarda ve araştırmalarda geçerli ve güvenilir verileri uzaktan toplamak önemlidir. Çalışmanın birincil amacı; Fonksiyonel Ayak Bileği İnstabilitesi Tanımlama (FABİT) ölçeğinin hem İngilizce hem de Türkçe versiyonlarında çevrimiçi uygulamasını geliştirmekti. İkincil amaç ise FABİT ölçeğinin çevrimiçi versiyonunun her iki dilde geçerliğini ve güvenirliğini test etmekti.*

Yöntem: *FABİT ölçeğinin Türkçe ve İngilizce versiyonları hem kağıt hem de çevrimiçi uygulamada kullanıldı. Anket uygulama yöntemlerinin geçerliği (kağıt ve çevrimiçi) etki büyüklüğü (Cohen d) ile analiz edildi. Ek olarak, uyum sınırları Bland ve Altman grafikleriyle ve modalite (anket uygulaması) sıra etkisi t-testleri ile analiz edildi. Çevrimiçi versiyonların test-tekrar test güvenirliği Sınıf İçi Korelasyon Katsayısı (ICC) kullanılarak analiz edildi.*

Bulgular: *İngilizce (30,3±5,8 yıl, 16 kadın, 24,0±3,4 kg/m2) ve Türkçe (27,4±7,7 yıl, 17 kadın, 23,3±3,9 kg/m2) konuşanlar arasında eşit olarak dağıtılmış 60 katılımcı çalışmaya dahil edildi. Her iki dilde (İngilizce; d=0,13, Türkçe; d=0,12) FABİT ölçeği için uygulama yöntemleri arasında herhangi bir sıra etkisi olmaksızın istatistiksel olarak anlamlı bir fark yoktu (tümü p>0,05). Test-tekrar test güvenilirliği her iki çevrimiçi sürüm için de mükemmeldi (İngilizce; ICC=0,96, Türkçe; ICC=0,98).*

Sonuç: *IdFAI ölçeğinin hem İngilizce hem de Türkçe çevrimiçi sürümleri geçerli ve güvenilirdi, bu nedenle klinik ve araştırma amaçları için uygundur.*

Anahtar Kelimeler: *Ayak bileği instabilitesi, Sonuç ölçekleri, Dijital, Geçerlik, Güvenirlik.*

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INTRODUCTION

Ankle sprain is one of the most common injuries in sports demanding jump-landing activities.[1,2] In volleyball, 41% of all injuries[1] and 23% of all acute injuries[3] are ankle sprains. Functional ankle instability (FAI) is defined as the involuntary ankle movement in a physiologically normal range of motion[4] and is one of the most common permanent conditions after ankle sprains with a prevalence of 40%.[5] Considering the high prevalence of ankle sprains[1-3,5], it is important to evaluate the ankle in the fastest and most efficient way possible in clinical practice. Patient reported outcome measurements (PROMs) are one of the commonly used assessment methods.[4]

Identification of Functional Ankle Instability (IdFAI) is a simple, valid, and reliable questionnaire to measure the presence of FAI across different age groups in adults.[6-8] A consensus report suggested using IdFAI for patient selection to identify ankle instability.[9] A recent systematic review investigated the methodological quality of PROMs in ankle instability found that IdFAI was one of the useful instruments for evaluating ankle instability, in individuals both with and without this condition.[10] To promote usability considering the increasing trend of multinational and multicultural research, many research teams translated the IdFAI questionnaire into different languages such as Turkish[11], Korean[12], Japanese[13], Chinese[14], Persian[15], Malay[16], Greek[17], Spanish[18], French[19], Thai[20], Brazilian[21] and Arabic[22].

Online use of questionnaires offers many advantages over paper version such as easier participant access, lower cost, faster completion and efficient data management.[23,24] Thus, it is important to collect valid and reliable data remotely in clinical care and research in order to decrease the patient and participant burden and cost of data collection. Many research teams adapted paper administered PROMs to either electronic or online versions in musculoskeletal conditions and showed them to be feasible, valid and reliable for remote use.[25-28] The importance of remote data collection also became obvious during the COVID-19 pandemic. For instance, guidelines recommended limiting direct contact between therapists and patients with COVID-19 and proposed using telerehabilitation options[29,30], which include assessment, monitoring, prevention, intervention, supervision, education, consultation, and coaching.[31] Therefore, increased need for telerehabilitation during COVID-19 pandemic warranted readily applicable remote online tools.

The primary aim of this study was to develop online administration of IdFAI scale in both English and Turkish versions. Secondary aim was to test validity and reliability of the online version of IdFAI scale in both languages. The impact of success would include useful information about remote questionnaire use, participant access, cost, time, and data management for IdFAI scale. The alternative hypothesis was that online version of IdFAI is equivalent or superior to the original paper version in both languages.

METHODS

Participants

This observational study was approved by the Sanko University Ethics Committee on 13.07.2022 (2022/07). Participants were recruited from university campuses and local community through social media advertisements and the snowball sampling method. Written and online information regarding the study was provided to all participants and written and online consents were obtained from all participants. The inclusion criteria were people between the age of 18-64, with or without a history of ankle sprain. As people with an ankle sprain are at a very high risk for developing instability, we used having an ankle sprain history as the inclusion criteria. This was to ensure the generalizability of the online administration process to all people who are at high risk and who already developed instability. Secondly, this enables a wider range of scores in IdFAI results, as people who already have an established instability are more likely to have higher scores and people with a history of an ankle injury may have less symptoms hence lower scores in IdFAI. Additionally, people who are literate in Turkish were included for the Turkish version and those who are literate in English for the English version. The exclusion criteria were having any acute injury

to the lower extremity, having any physical disability, systemic and neurological disorders.

Outcome measures

We recorded participants' descriptive information such as age, sex, lower limb dominant side, injured side, and sport discipline. Tegner activity scale is a standardized, numeric rating scale (ranging from 0 to 10) used to measure the physical activity level of people.[32] Each value in Tegner activity scale indicates the ability to perform certain activities. An activity level of 10 points corresponds to participation in competitive sports at the national level, while 6 points corresponds to participation in recreational sports and 0 points corresponds to sedentary lifestyle.

The eHealth Literacy Scale (eHEALS) was used as a check of online self-efficacy for health literacy.[33,34] It consists of two items about internet use and 8 items measuring online attitude. The Likert-type questions were arranged as 1=strongly disagree, 2=disagree, 3=undecided, 4=agree and 5=strongly agree. The first two items are not included in the calculation. Thus, total score of eHEALS ranges from 8 to 40. A high score from the scale indicates a high level of e-health literacy.

Turkish and English versions of the IdFAI scale were used to test the presence and severity of the ankle instability.[8,11] The IdFAI scale consists of ten questions concerning history of ankle instability, initial ankle sprain and instability during daily life activities.[8] Total score of IdFAI ranges from 0 to 37 and is calculated with its nine Likert-type questions by adding up each of them.[8] Three questions (questions 2, 4 and 5) are scored 0-5, two questions (questions 3 and 7) 0-3 and four questions (questions 6, 8, 9 and 10) 0-4, totalling up to 37. The first question of IdFAI is a free text question and therefore, it is not included in the calculation.[8] The higher score indicates severe FAI symptoms.[8] According to the cut-off point (10.5) of the IdFAI, individuals with a total score of 10 or lower are unlikely to have FAI, while individuals with a total score of 11 or higher are likely to have FAI.[6]

Procedures

Since the aim of the study was to test the validity and reliability of the online version of the IdFAI scale in both languages, both the Turkish and English versions of the scale were used. The paper versions of the scale were administered by the authors (AT and PKH). Google Survey was used for the online versions of the IdFAI scale (Turkish:https://forms.gle/jQZ9Yei3YkSNcTCV9, English:https://forms.gle/jR3rBi1zgdYqsGWWA).

An additional form containing the descriptive characteristics of the participants, Tegner and eHEALS were filled in either on paper or online by the participants based on their randomization. If the participant was randomized to the online version, they filled out all the forms online. If they were randomized to the paper version, they filled out all the forms on paper. Online use of the IdFAI scales were similar to traditional administration. There were some minor formatting adaptations for the online administration as previously reported 'faithful migrations' from paper to electronic platforms.[26,28] The minor formatting adaptations included presenting the response options vertically instead of horizontally, and replacing commands such as 'circle one' with 'mark one'. The online and paper versions of the IdFAI scale were compared with the randomized crossover design (Figure 1).[23] First, participants chose the language they comfortable with, and then the application of the online and paper versions of the scale was done in a randomised order.[28] For the test-retest reliability of the online versions, the scales were reapplied in 2-7 days[35] in 20 people who agreed to fill out the online version of the scale twice. This design ensured that all participants completed both online and paper versions, while a subset also contributed to the evaluation of test-retest reliability. The order was structured to avoid any potential carry-over effects between online and paper formats, and ensured that the validity of different administration modes (online vs. paper) was not influenced by the re-test.

Sample size calculation

The study sample should be representative of the intended patient group in which the electronic data capture modes of administration of PROMs will be used, particularly with regard to age, sex, and disease severity. Based on the study of Coons et al.[23], it was calculated as 24 people per group with a power of 80% and an alpha of 5% for a randomized crossover design. Final sample size was 30 per language with 20% drop out rate, and 60 in total. Sample size

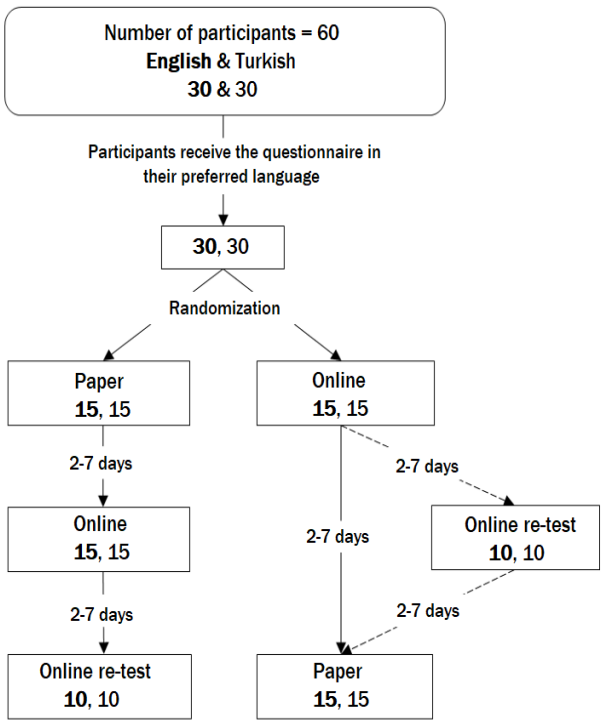

Figure 1. A typical participant journey in the study. Bold numbers refer to the English speaking participants, while others refer to the Turkish speaking participants. Participants in the right column (Online-First) initially completed the online version. To assess test-retest reliability, 10 randomly selected participants completed an online retest within 2-7 days after the first administration. Then, another 2-7 days, these participants completed the paper version. The remainig 5 participants did not complete a retest, but completed the paper version after the initial online administration within 2-7 days.

calculation for the reliability was based on expected ICC values[36] of 0.9 for excellent reliability and 0.6 for minimum acceptable reliability[37]. At least 14 participants were needed which was within the validity calculation parameters.

Statistical analysis

We commenced with calculation of descriptive statistics to profile each study group. Validity of the questionnaire administration methods were analysed with Cohen's d effect sizes with 0.2, 0.5, and 0.8 considered small, medium, and large, respectively.[38] Additionally, limits of agreement with Bland and Altman plots[39] and modality (questionnaire administration) order effect were analysed with t-tests. Test-retest reliability of the online versions were analysed using the Intraclass Correlation Coefficient (ICC, two-way random, absolute agreement), classified as <0.5, 0.5 to 0.75, 0.75 to 0.9, and >0.90 being poor, moderate, good, and excellent, respectively.[37] Statistical analysis was conducted by using SPSS (version 24.0, IBM, NY, USA), and a value of $p<0.05$ was considered statistically significant.

RESULTS

Sixty participants equally distributed between those who speak English (30.3±5.8 years, 16 females, 24.0±3.4 kg/m^2) and Turkish (27.4±7.7 years, 17 females, 23.3±3.9 kg/m^2) were recruited from university campuses and local community between August-October 2022. In the English speakers group, there were eight participants with no history of ankle sprain and 22 with history of recurrent ankle sprains (19 right, 3 left). In the Turkish speakers group, there were two participants with no history of ankle sprain and 28 with history of recurrent ankle sprains (21 right, 7 left). The demographics of the English and Turkish speakers were similar in terms of their age, sex, body mass index and physical activity level according to Tegner scale. Reported ability to use electronic health resources was also similar between groups according to the eHEALS responses. The IdFAI scores between paper and online versions were similar for the English and Turkish speakers. However, the IdFAI scores in both versions were higher for the Turkish speakers compared to the English speakers. Demographics and PROM scores were shown in Table 1.

Limits of agreements were shown in Table 2 and Figure 2 for both English and Turkish versions of the IdFAI scale. There was no systematic difference between paper and online versions of the IdFAI scale in both languages (English: d=0.13; Turkish: d=0.12), without any order effect (all $p>0.05$) (Table 2, Figure 3). Test-retest reliability was excellent for both online versions (English: ICC=0.96, 95%CI 0.90-0.98; Turkish: ICC=0.98, 95%CI 0.96-0.99) shown in Table 2.

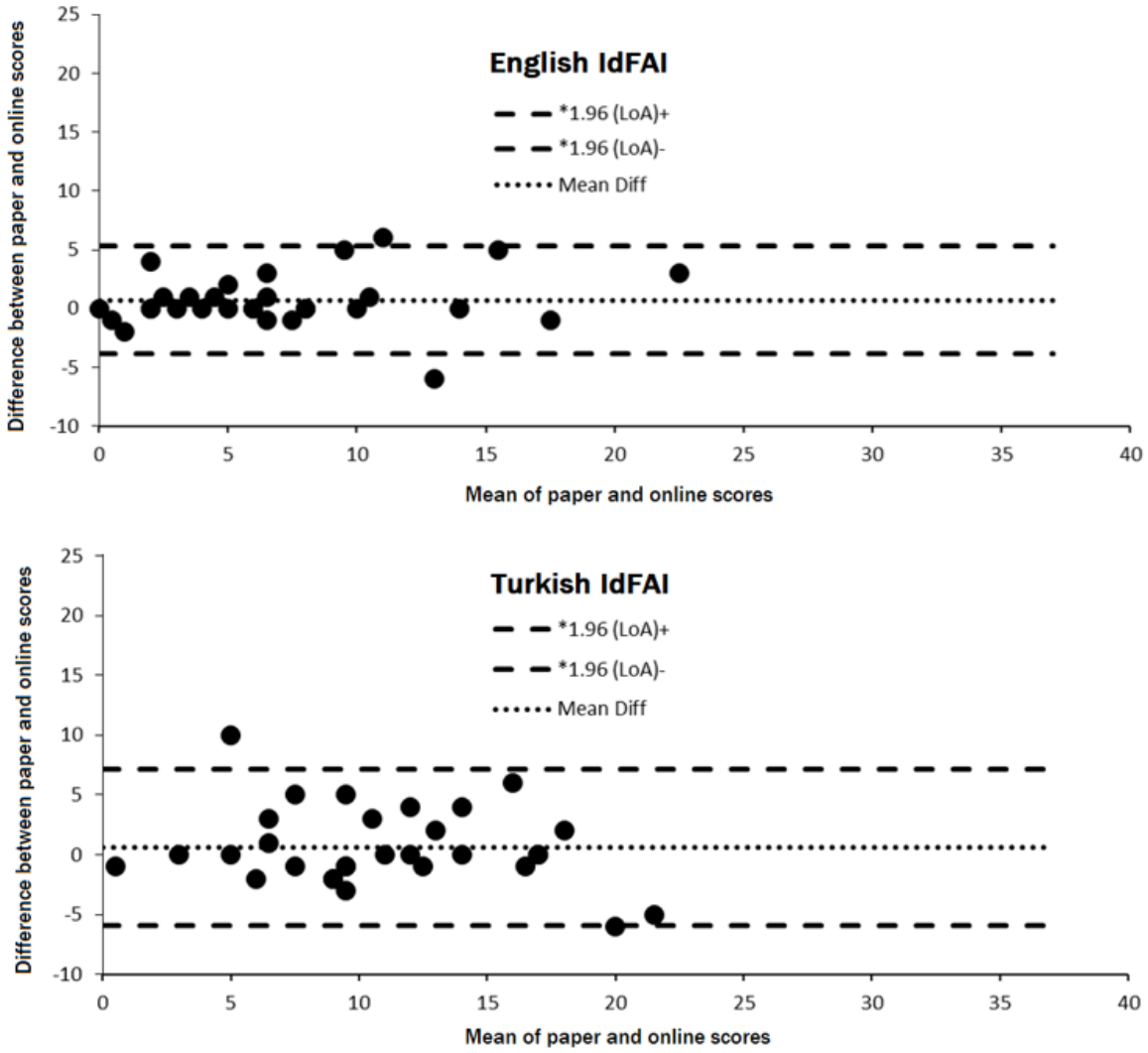

Figure 2. Bland and Altman Plots showing no systematic difference between paper and online version of the Identification of Functional Ankle Instability (IdFAI) scale in both English (above) and Turkish (below) (LoA, Limits of Agreement).

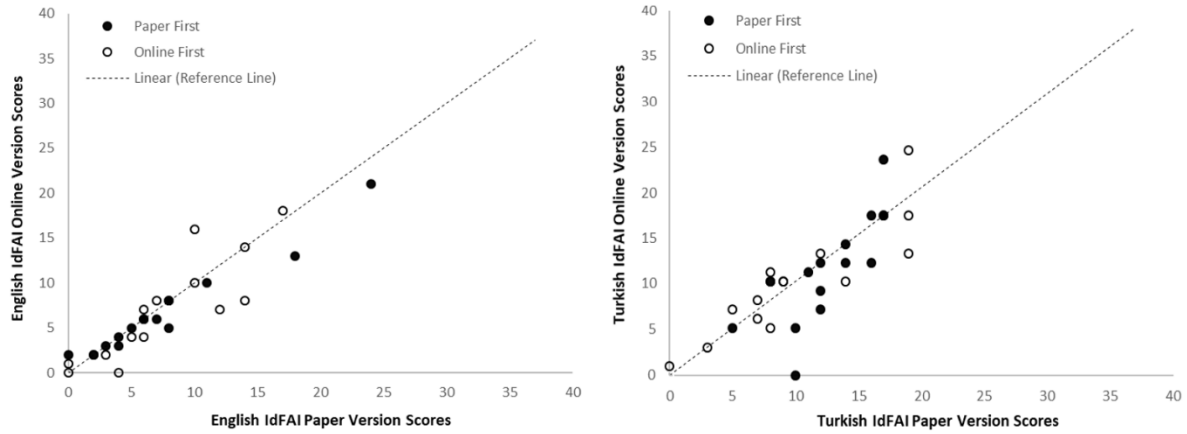

Figure 3. No order effect between paper and online version of the Identification of Functional Ankle Instability (IdFAI) scale in both English (left) and Turkish (right).

Table 1. Participants' descriptive features.

	English Speakers (n=30)	Turkish Speakers (n=30)	
	X±SD	X±SD	p
Age (years)	30.3±5.8	27.4±7.7	0.10
Body weight (kg)	70.3±12.2	68.5±14.6	0.61
Height (cm)	171.0±8.8	171.1±8.1	0.96
Body mass index (kg/m^2)	24.0±3.4	23.3±3.9	0.46
E-Health Literacy Scale score	28.5±8.2	29.3±6.2	0.66
Tegner Activity Scale score	4.2±2.1	5.5±2.5	0.06
	n	n	
Male / Female	14 / 16	13 / 17	0.80
Dominant side (Right / Left)	28 / 2	28 / 2	1.00
Injured side (No sprain history / Right / Left)	8 / 19 / 3	2 / 21 / 7	0.32
Sports disciplines			
Basketball	2	2	
Fitness	11	3	
Running	3	-	
Cycling	2	1	0.09
Tennis	1	1	
Football	-	3	
Volleyball	-	1	
Karate	-	1	
	X±SD	X±SD	
Validity			
IdFAI paper test score	7.5±5.7	11.3±5.0	0.008*
IdFAI online test score	6.8±5.3	10.6±5.7	0.008*
Reliability (n=20)			
IdFAI online test score	5.5±4.6	11.6±6.3	0.01*
IdFAI online retest score	5.0±4.8	11.8±6.2	<0.001

* p<0.05. IdFAI: Identification of Functional Ankle Instability scale.

Table 2. Psychometric properties of the online versions of the Identification of Functional Ankle Instability scale (IdFAI).

IdFAI online versions	Psychometric properties	Results	Outcomes
English	Validity (n=30)	LoA=0.70±4.58	
		d=0.13	Online use valid
		p=0.11	
	Reliability (n=20)	ICC=0.96, 95%CI 0.90-0.98	Excellent reliability
Turkish	Validity (n=30)	LoA=0.63±6.52	
		d=0.12	Online use valid
		p=0.31	
	Reliability (n=20)	ICC=0.98, 95%CI 0.96-0.99	Excellent reliability

For the analysis, limit of agreement (mean bias±1.96*SD) and Cohen's d for effect of modality, p value for modality order effect, and ICC values for reliability were reported. IdFAI, Identification of Functional Ankle Instability scale. LoA, Limits of agreement. ICC: Intra-class Correlation Coefficients. d: Cohen's d.

DISCUSSION

This study was designed to develop online administration of the IdFAI scale in both English and Turkish versions and to test their validity and reliability. This study represents the first to test the remote use of the IdFAI in both languages and showed them to be valid and reliable for online use.

There are many reported advantages of using digital versions of PROMs such as easy

access to participants, lower cost, faster completion and efficient data management.[24] Gwaltney et al.[26] reported good to excellent equivalence between digital and paper versions for over 200 PROMs. Similarly, this study showed online use of the IdFAI in both English and Turkish versions to yield equivalent results to traditional paper version without any order effect. Effect sizes between paper and online versions of the IdFAI scale in both languages were small which shows no systematic difference between administrations. Furthermore, limits of agreement analysis visually showed no systematic differences between administrations in both languages. Of note is that there is not reported minimal clinical important difference for the IdFAI scale which could give an idea how much difference between online and paper versions are acceptable. However, there are five cross-cultural studies reported minimal detectable change for the IdFAI scale. Korean[12], Greek[17], Spanish[18], French[19] and Brazilian[21] versions of the IdFAI scale reported minimal detectable change values as 3.91, 2.7, 6.4, 3.79 and 2.2, respectively. Our findings showed that the mean differences between paper and online versions in both languages were less than 1 point which is smaller than the reported minimal detectable change values and very acceptable for a scale with a range of 0-37. As a result, the online versions of the IdFAI scale in both English and Turkish were valid measurement tools.

For the reliability, the paper versions of original (English) and Turkish IdFAI have excellent ICC values as 0.92 and 0.94, respectively.[6,11] The paper versions of all other adapted IdFAI scales in other languages have ICC values ranged 0.85 to 0.99 which shows good (n=3)[15,17,19] to excellent (n=8)[11-14,16,18,20,21] reliability. Similarly, other PROMs investigating ankle instability such as Cumberland Ankle Instability Tool, Chronic Ankle Instability Scale and Ankle Instability Instrument have good to excellent ICC values as 0.96, 0.84 and 0.95, respectively.[10] This study showed that the online versions of English and Turkish IdFAI have excellent ICC values as 0.96 and 0.98, respectively. In parallel with the literature, the reliability results for the online versions of the IdFAI in both languages are in the range of reported ICC values and therefore reliable tools.

Limitations

The data distribution was a limitation of this study for both languages. Although, the data evenly distributed under and over the cut-off score (10.5), the maximum reported total score was 24 out of 37. This means the data in this study represented 65% of the total score which could limit the generalisability of the results. Additionally, higher IdFAI scores observed in Turkish speakers compared to English speakers. This difference may be attributed to cultural and lifestyle differences between the populations, which could influence the prevalence or reporting of ankle sprains. For instance, physical activity patterns, types of sports commonly played, or footwear habits might differ between the two groups, potentially affecting ankle injury risk. The non-homogeneous distribution of individuals with and without a history of ankle sprains was another study limitation. While this design was chosen to assess the IdFAI's performance in both populations. Future research should aim for a more balanced distribution of participants to better evaluate the scale's applicability across diverse clinical populations.

Conclusion

It is important to collect valid and reliable data remotely in large population based studies to decrease the burden and cost of data collection. The online versions of the IdFAI scale in both English and Turkish were valid and reliable, therefore being suitable for clinical and research purposes. Professionals and clinicians could use online versions of the IdFAI for better remote assessment.

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Conflicts of Interest: *None*

Ethical Approval: The protocol of the present study was approved by the Sanko University Ethics Committee on (issue: 2022/07 date: 13.07.2022).

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