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The Validity and Reliability of the Turkish Version of the X16 Balance Testing Scale for Older People

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ABSTRACT

Objective: This study aimed to determine the validity and reliability of the Turkish version of the X16 Balance Testing Scale for older people.Materials and Method: Three hundred and forty five older people were included in the study. The test-retest process was completed with all individuals for intra-rater agreement. For validity, the correlation with Berg Balance Scale (BBS) and Performance-Oriented Mobility Assessment (POMA) were applied. Results: For intra-rater agreement of the X16 Balance Testing Scale obtained as a result of the initial testing and retesting, results were found to be highly reliable (Cronbach's alpha coefficient = 0.904, 0.902, respectively). Test-retest reliability was found to be at a quite high or excellent level in all domains. A high correlation was found between the X16 Balance Testing Scale total score and the total scores of BBS and POMA (r=0.710, 0.706 respectively). Conclusion: The Turkish version of the X16 Balance Testing Scale was found to be valid and reliable in older people. Due to its simplicity and quickness to use, it is practical to be used for balance evaluation.

Keywords: Aging, Balance, Balance Testing Scale, Reliability, Validity.

Yaşlı Bireyler İçin X16 Denge Test Ölçeğinin Türkçe Versiyonunun Geçerlilik ve Güvenilirliği

ÖZ

Amaç: Bu çalışma, yaşlı bireyler için 'X16 Denge Test Ölçeği'nin Türkçe versiyonunun geçerlik ve güvenirliğini belirlemek amacıyla yapıldı. Gereç ve Yöntem: Çalışmaya 345 yaşlı kişi dahil edildi. Değerlendirici içi uyum için tüm bireylerle test-tekrar test tamamlandı. Geçerlilik için Berg Denge Ölçeği (BDÖ) ve Performans Odaklı Mobilite Değerlendirmesi (POMD) ile korelasyonu uygulandı. Bulgular: X16 Denge Testi Ölçeği'nin değerlendirici içi uyum için birinci ve tekrar test sonuçlarının oldukça güvenilir olduğu bulundu (sırasıyla Cronbach alfa katsayısı = 0.904, 0.902). Test-tekrar test güvenirliği tüm alanlarda oldukça yüksek veya mükemmel düzeyde kaydedildi. 'X16 Denge Testi Ölçeği toplam puanı ile BDÖ, POMD toplam puanı arasında yüksek korelasyon bulundu (sırasıyla r=0.710, 0.706). Sonuç: Sonuç olarak yaşlı bireylerde X16 Denge Testi Ölçeği'nin Türkçe versiyonu geçerli ve güvenilir olarak kaydedildi. Basit ve hızlı kullanımı nedeniyle denge değerlendirmesi için kullanılması pratiktir.

Anahtar Kelimeler: Denge, Denge Testi Ölçeği, Geçerlilik, Güvenilirlik, Yaşlanma.

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INTRODUCTION

The ability to establish and maintain balance starts to fall into a decline within the third decade of life and this decline tends to accelerate in the sixth decade (Granacher et al., 2012). Loss in balance performance causes falls and increases the fear of falling in older adults. Therefore, restrictions in physical activities occur and the quality of life is also adversely affected (Angın et al., 2016).

Falls are among the most important causes of morbidity and mortality, and furthermore, injuries resulting from falls can result in the forming of dependence to other people regarding the activities of daily living, a long rehabilitation process, and an economic burden (Noll, 2013). Therefore, "falls" constitute a major public health concern and are regarded as a geriatric syndrome (Masud & Morris, 2001). After experiencing falls; illness, physical disability, loss of the ability to perform activities of daily living may occur (Campbell et al., 1997). Approximately 87% of fall cases regarding older adults lead to a diminished physical activity level as a result of psychological impairments, such as fear of falling, depression and loss of confidence in terms of walking (Vellas et al., 1997). Complications caused by falls may constitute a big share of the healthcare costs. Therefore, the prevention of balance problems and falls is very important in order to improve global health (Peel, 2011).

The evaluation of balance and fall risk is significant for determining probable balance problems and thus, for decreasing risk factors. There are various functional evaluation procedures and protocols used for evaluating the risk of falls in older individuals. These include The Berg Balance Scale, The Timed Up and Go Test, The Performance-Oriented Mobility Assessment (POMA) and The Dynamic Gait Index (Berg et al., 1992). One of the most commonly used tool in clinical situations is the Berg Balance Scale (BBS), which has shown to be a reliable and valid balance test which is also sensitive and specific in terms of predicting falls in older adults (Wang et al., 2006). Initially, the BBS was developed to diagnose and determine the dysfunctions of balance in daily life in older adults (Berg et al., 1992). The BBS presents excellent values for test-retest (ICC=0.91) and has high intra-evaluator reliability (ICC=0.97) (Neuls et al., 2011). Furthermore, previous studies have confirmed the reliability of POMA in older adults as well (ICC=0.75-0.97) (Faber et al., 2006). Concurrent validity of the POMA has also been reported using BBS (r=0.91) (Berg et al., 1992). The BBS was good at identifying older people who are at risk (sensitivity 84-95.5 %) and those who are not at risk with regards to falling (specificity 76.5-95.5%). The demonstrated results for the POMA ranged from relatively poor to good (sensitivity 64-95.5%) (Schülein, 2014). Weaknesses of the BBS and POMA were determined as their extensive average time of processing. The BBS takes 15 to 20 minutes (Berg et al., 1992), while the POMA takes 10-15 minutes to complete (Tinetti, 1986). The balance performance tests provide valuable information about the health status measurements of older people by detecting various disorders and disabilities. In order to conduct the necessary health policies and interventions, a large scale assessment of "balance performance" is especially important for countries where the population of the elderly is relatively high (Ju et al., 2018). When the literature is reviewed, no appropriate balance testing scales are encountered upon for the aforementioned extensive balance screening of older individuals in society. Additionally, the duration of the existing and applied clinical balance tests for the extensive screening and evaluation of the old population is pretty overlong. Long test durations increase adjustment problems of older individuals and affect their performances negatively (Ju et al., 2018).

Considering all these factors, the X16 balance testing scale was developed for older individuals relying on the balance performance tests used clinically and frequently (Ju et al., 2018). Regarding this scale, certain balance tasks were arranged and classified to simultaneously measure the general and the individual balance performance. The test duration was limited to 5 minutes in order to help older individuals to adjust themselves to the test (Ju et al., 2018). There has been no suitable balance testing scale available for large-scale studies in community-dwelling older people in Turkey. Additionally, the X16 Balance Testing Scale is simple, practical and quick to use for balance evaluation and screening in large-scale population in Turkey. Therefore, the aim of the present study was to adopt a Turkish version of the X16 Balance Testing Scale and investigate its validity and reliability in older adults.

MATERIAL AND METHOD

2.1. Participants and Sample Selection

This study was carried out in older people with the instantaneous detection method, which is one of the general scanning models, a single scanning model. The sample of the study also formed the universe of the study. Older people living in Kırıkkale were included.

Among the general survey models, the instant situation determination method, which is a single survey model was used. The individuals were reached by the unbiased sampling method. At least 5-10 individuals should be included for each scale item when forming the sample size in scale studies (Ercan & İsmet 2004). Therefore, to examine the validity and reliability of the 16-item Turkish version of the X16 Balance Testing Scale, a minimum of 160 older adults were included in the study, which is ten times the number of items. This study included a total of 345 older adults living in the community.

The individuals who were over 65 years of age and volunteered to participate in the study signed the informed consent form were included. The study was carried out in Kırıkkale University, Department of the Physiotherapy and Rehabilitation between June 2019 and February 2020. For the study, the ethical consent was received from the Non-Interventional Research Ethics Committee of Kırıkkale University with the decree numbered 2018.12.10. The socio-demographic data (age, height, weight, gender, educational level, marital status, fall history) of all the individuals were recorded. The Mini Mental State Examination (MMSE) was used to determine the general cognitive status of older adults.

Individuals aged 65 years and above, who can read and understand Turkish, scored 24 points and above in the Mini-Mental State Examination (MMSE) (Castro-Costa et al., 2008) and thereafter, the individuals who agreed to participate were included in the present study. Individuals who currently had an ongoing inpatient treatment at a hospital, who had cognitive difficulties in understanding the desired tasks, whose test data was deficient due to various reasons, who had serious musculoskeletal system diseases/problems or neurological disorders (rheumatic diseases, Parkinson's disease, dementia, stroke etc.), and who needed aids or others' assistance during ambulation, were excluded from the study.

2.2. Translation

The translation process of the scale into the Turkish language from English was conducted via using the forward-backward method by Beaton et al. (2000). After obtaining the necessary permission in order to translate the scale from Ju et al. (2018), two experts who had advanced knowledge of English, carried out the translation procedure separately. These two separate Turkish translations were compared with each other for inconsistencies by the researchers. These two translations were back translated into English by two other independent native English speakers, who knew Turkish sufficiently and who did not work in the subscale of medicine. The translations were examined by the researchers, and a single form was created. This form was sent to five experts from the subscale in order to evaluate its content and to determine its compatibility with the Turkish language. With the opinions of the experts, necessary changes on the form were made which were related specifically to the Turkish society, afterwards, the authors of the original scale were consulted, and the scale was approved. The approved scale was applied to 10 native Turkish speaker older adults. According to their feedback, the final version of the scale was developed (Beaton et al., 2000).

The X16 Balance Testing Scale for Older Individuals is comprised of 3 subscales with 16 items in total. The subscales include static balance, postural stability, and dynamic balance. In terms of static balance, standing on the feet with open and closed eyes and standing on one foot without support are evaluated. In terms of postural stability, the standing to sitting, sitting to standing, standing to squatting, squatting to sitting are evaluated. In terms of dynamic balance, the initiation of the gait, step height-length-continuity-symmetry, gait trail, body stability during gait and rotation are evaluated. The full score for the static balance, postural stability and dynamic balance domains are determined as 4, 8 and 8 points, respectively; thus the full score for the balance performance scale is 20 points. Higher scores point at better balance performance and functional

skills (Ju et al., 2018). English and Turkish versions of the X16 Balance Testing Scale items and scoring are shown in Appendix 1.

The Berg Balance Scale (BBS) was designed for the assessment of balance and determining the risk of falls. The scale consists of 14 items aiming to evaluate the below-mentioned functions: the transition from a sitting stance towards a standing one, standing without support, sitting without support, standing and then sitting, standing with closed eyes, standing with legs closed, extending the arms forward while standing, picking up an object from the floor, turning and looking back, rotation of 360 degrees, standing on the stool and the stance with regards to keeping one foot forward and standing on the other. Each item is scored between 0-4; 0 means not being able to perform the task, while 4 means performing the task successfully. In accordance with the scores of the test, the cases are divided into groups as follows: "high fall risk (0–20 points)", "moderate fall risk (21–40 points)", "low fall risk (41–56 points)". Fifty-six, which is the highest score, is accepted to show the best balance (Kornetti et al., 2004). The Turkish validity and reliability study of the scale was conducted by Şahin et al. (2008).

The Performance-Oriented Mobility Assessment (POMA) includes gait and balance sub-scales. The total score is 28; 12 for the gait sub-scale and 16 for the balance sub-scale. It was reported to have high predictive values for injuries related to the fall risk of older individuals living in society (Tinetti, 1986). The Turkish validity and reliability study of the scale was executed by Yücel et al. (2012).

2.3. Statistical analysis

Statistical analyses was performed using the SPSS version 24.0. (SPSS Inc., Chicago, IL, ABD). Test-retest reliability was used. To determine the test-retest reliability (intra-rater) in the study, the Turkish version of the X16 Balance Scale readministered after one week considering this parameter. The test-retest process took place with all of the participants partaking in the procedure. The Interclass Correlation Coefficient (ICC) was used to evaluate the test-retest reliability. The ICC varies between 0.00 and 1.00, and while values between 0.60 and 0.80 indicate good reliability, values above 0.80 indicate an excellent reliability (Koo & Li, 2016). Cronbach Alpha Coefficient (α) was calculated for internal consistency. As an additional approach in evaluating the performance of the items in the internal consistency analysis, the relevant items were removed one by one and the mean standard deviation of the remaining items, Cronbach's Alpha Coefficient and Corrected Item-Total Correlation were calculated. It is expected that Corrected Item-Total Correlation are above 0.30 and that Cronbach's Alpha values do not increase when the item is deleted. Convergent validity was examined using correlation analysis between the X16 Balance Scale and BBS and POMA. Pearson's Correlation Coefficient was used in order to investigate the correlation between the X16 Balance Scale (first assessment) and the BBS, POMA. (Ercan & İsmet, 2004). Confirmatory Factor Analysis (CFA) was performed to determine the construct validity of the scale (Erkorkmaz et al., 2013).

RESULTS

Table 1. Socio-Demographic Characteristics and the Used Questionnaire of Individuals

Age (years), (Mean±SD)		71.57±6.06
Height (cm), (Mean±SD)		163.42± 8.72
Weight (kg), (Mean±SD)		76.16±13.75
POMA (Mean±SD)		19.43±6.21
BBS (Mean±SD)		43.14±11.00
X16 Balance Test(Mean±SD)		13.22± 5.63
Gender, n (%)	Female	208 (60.3)
	Male	137 (39.7)
Marital status	Married	225 (65.2)
	Single	120 (34.8)
Education level	Not literate	79 (22.9)
	Primary	185 (53.9)
	Middle	43(12.5)
	Hight	26 (7.5)
	University	11 (3.2)
Fall history (past 1 year)	Yes	197 (57.1)
	No	148 (42.9)

SD: Standard Deviation, n: participant, % : percentage, cm: centimeter, kg: kilogram, POMA: Performance-Oriented Mobility Assessment, BBS: Berg Balance Scale.

The mean age of the individuals was 71.57±6.06 years. Socio-demographic characteristics of the individuals are presented in Table 1.

Table 2. The Total Score, the by Items and Test-Retest Reliability and Test-Retest Correlation, Pearson Correlation Coefficients Between Items and Its Corresponding Domain and Other Domains of the X16 Balance Test Scale

Item	Kappa Coefficient (test-retest reliability)	p
1	0.896	<0.001
2	0.867	<0.001
3	0.871	<0.001
4	0.880	<0.001
5	0.919	<0.001
6	0.912	<0.001
7	0.942	<0.001
8	0.949	<0.001
9	0.875	<0.001
10	0.906	<0.001
11	0.922	<0.001
12	0.905	<0.001
13	0.883	<0.001
14	0.900	<0.001
15	0.961	<0.001
16	0.932	<0.001
The Total Score	0.964	<0.001

	Cronbach's Alpha	
X16 Balance Test Scale	1. evaluation	2. evaluation
Domain I	0.703	0.688
Domain II	0.853	0.861
Domain III	0.839	0.839
Total Score	0.904	0.902

		Domain			
Domain	Item	I	II	III	Total Score
I	1	**0.731**	0.357	0.355	0.455
	2	**0.708**	0.372	0.429	0.504
	3	**0.810**	0.467	0.440	0.562
	4	**0.683**	0.499	0.413	0.502
II	5	0.370	**0.733**	0.411	0.477
	6	0.502	**0.800**	0.554	0.693
	7	0.545	**0.854**	0.530	0.709
	8	0.482	**0.817**	0.500	0.645
III	9	0.244	0.258	**0.594**	0.313
	10	0.406	0.341	**0.609**	0.506
	11	0.403	0.395	**0.559**	0.513
	12	0.420	0.451	**0.684**	0.549
	13	0.282	0.316	**0.558**	0.377
	14	0.421	0.418	**0.627**	0.528
	15	0.235	0.337	**0.625**	0.411
	16	0.464	0.587	**0.710**	0.594

Domain I is static balance, domain II is postural stability, domain III is dynamic balance, and total score (sum of domains I, II, and III) is balance performance.

3.1. Test-Retest Reliability

There was a very high correlation between the 1st and 2nd measurement values which were obtained through the X16 Balance Testing Scale (ICC=0.964, p<0.001). For intra-rater agreement of the results obtained in the first measurement (test results) (Cronbach's alpha coefficient=0.904) and second measurement (retest results) (Cronbach's alpha coefficient=0.902) was found to have a high internal consistency. A statistically significant relationship was observed between each item of the scale and their subscale (static balance, postural stability, and dynamic balance) (p<0.05, Table 2). Item analysis and Corrected Item-Total Correlation are shown in Table 3.

3.2. Construct Validity

A moderate to high correlation was found between the X16 Balance Testing Scale total score and the BBS total score (r=0.710, p<0.001), and also the POMA total score (r=0.706, p<0.001)(Table 4).

3.3. Confirmatory Factor Analysis (CFA)

X2Chi Square; NFI: Normed Fit Index; TLI: Trucker Lewis Index; CFI:Comparative Fit Index; GFI: Goodness of Fit Index; RMSEA: Root Mean Square Error of Approximation; RMR: Root Mean Square Residual were determined in the CFA. In the CFA

Table 3. Item Analysis and Corrected Item-Total Correlation

	Mean	Std. Deviation	Scale Mean if Item Deleted	Scale Std. Deviaton if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
x1	0.853	0.355	12.079	4.917	0.458	0.901
x2	0.850	0.358	12.082	4.899	0.504	0.900
x3	0.665	0.473	12.268	4.810	0.558	0.898
x4	0.312	0.476	12.621	4.820	0.531	0.899
x5	1.403	0.548	11.529	4.713	0.656	0.895
x6	1.368	0.572	11.565	4.674	0.696	0.893
x7	1.065	0.701	11.868	4.576	0.696	0.894
x8	0.971	0.686	11.962	4.611	0.658	0.896
x9	0.735	0.448	12.197	4.827	0.554	0.899
x10	0.874	0.333	12.059	4.908	0.519	0.900
x11	0.668	0.472	12.265	4.836	0.502	0.900
x12	0.653	0.477	12.279	4.793	0.590	0.897
x13	0.774	0.419	12.159	4.835	0.578	0.898
x14	0.559	0.497	12.374	4.800	0.546	0.899
x15	0.659	0.475	12.274	4.806	0.563	0.898
x16	0.527	0.506	12.406	4.739	0.665	0.895

Table 4. Correlation between X16 Balance Test Scale with POMA Gait&Balance and BBS

		X16 BALANCE TEST			
		Domain 1	Domain 2	Domain 3	Total Score
POMA Gait	r	0.490	0.503	0.697	0.593
	p	<0.001	<0.001	<0.001	<0.001
POMA Balance	r	0.602	0.636	0.724	0.706
	p	<0.001	<0.001	<0.001	<0.001
POMA	r	0.598	0.622	0.775	0.706
	p	<0.001	<0.001	<0.001	<0.001
BBS	r	0.695	0.624	0.686	0.710
	P	<0.001	<0.001	<0.001	<0.001

p<0.001, POMA: Performance-Oriented Mobility Assessment, BBS: Berg Balance Scale
r: Pearson correlation coefficients.

for a total of 16 items, X^2/df, RMSEA, CFI, GFI, RMSEA and the RMR it was determined that values were at a coherent level. It was determined that the factor loads of the static balance sub-dimension were between 0.490 and 0.650, the factor loads of the postural stability sub-dimension were between 0.680 and 0.750, and the factor loads of the dynamic balance sub-dimension were between 0.550 and 0.740. The coherent indices of the X16 Balance Testing Scale were p<0.05; X^2/df: 2.032; RMSEA: 0.055; NFI: 0.924; TLI:0.948; CFI:0.959; GFI: 0.932; RMR was determined as 0.009 (Table 5). According to the CFA results of the scale, the correlation coefficient results are shown in Figure 1 with the PATH diagram.

Table 5. Fit Index of X16 Balance Test Scale

Measure	Ideal Fit	Acceptable Fit	Inconsistency	Values Obtained of CFA
x^2	P>0.10	0.05<P<0.10	P<0.05	P<0.05
x^2/df	<=2	2-5	5+	2.032
NFI	1	0.95 - 0.99	<0.95	0.924
TLI	1	0.95 - 0.99	<0.95	0.948
CFI	1	0.90 - 0.99	<0.90	0.959
GFI	1	0.90 - 0.99	<0.90	0.932
RMSEA	0 - 0.05	0.05 - 0.09	>0.10	0.055
RMR	0	1-5	5+	0.009

x^2 Chi Square; NFI: Normed Fit Index; TLI: Trucker Lewis Index; CFI:Comparative Fit Index; GFI: Goodness of Fit Index; RMSEA: Root Mean Square Error of Approximation; RMR: Root Mean Square Residual; CFA: Confirmatory Factor Analysis.

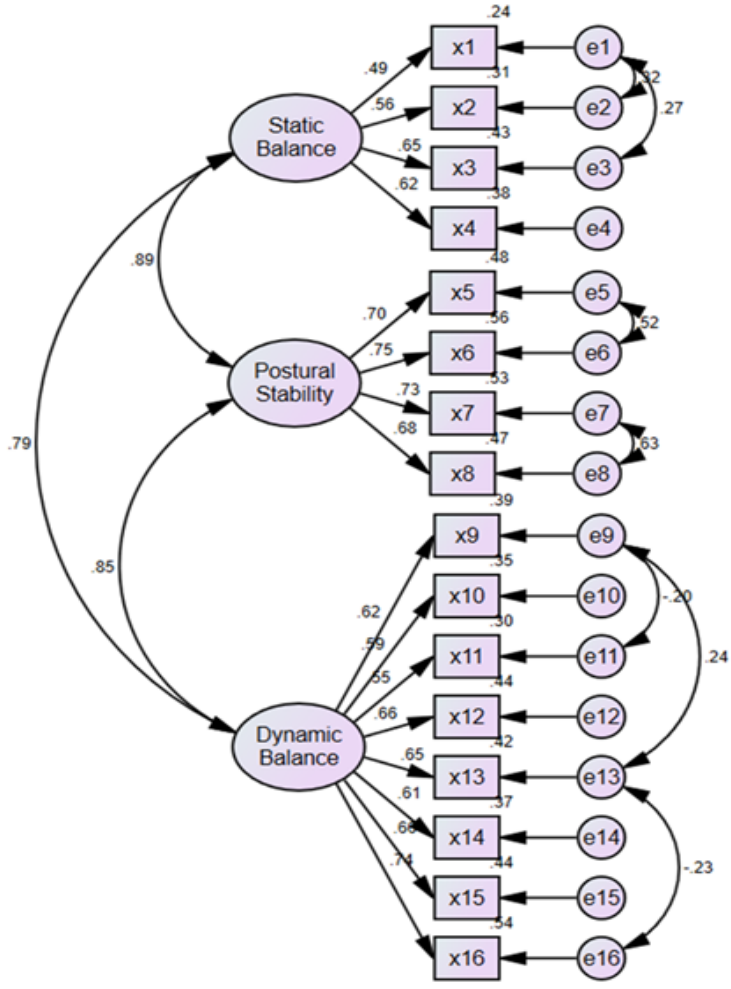

Figure 1. Comfirmatory Factor Analysis Results of The X16 Balance Testing Scale

DISCUSSION

The current study investigated the validity and reliability of the X16 Balance Testing Scale, which included the determination of static balance, postural stability and dynamic balance in older adults. The study found good-excellent Cronbach's alpha values. Furthermore, the X16 Balance Testing Scale was compared with the BBS and the POMA, which are commonly used in the clinic in order to assess the balance problems in older adults. The results of our study show that the Turkish version of the X16 Balance Testing Scale is a reliable and valid questionnaire that evaluates balance problems in older adults.

Since any adaptation of the X16 Balance Testing Scale to another language has not been made yet, the results of our study were discussed only with comparison to the original version of the scale. Balance problems and resulting falls are among the most common problems which are experienced in old age (Bolding & Corman, 2019). Therefore, it is very important to evaluate balance and fall risk in older people with appropriate scales. For this reason, the aim of this study was to confirm the suitability of the Turkish version of the X16 Balance Testing Scale, which was designed to measure balance in functionally independent older individuals among the Turkish population.

In the original study in which the X16 Balance Testing Scale for Older Individuals was developed, the test-retest reliability of the scale was determined to be highly reliable (ICC=0.93) (Ju et al., 2018). Similarly, in our study, the test-retest reliability of the X16 Balance Testing Scale was recorded to be highly reliable (ICC=0.96). Furthermore, the test-retest reliability of all the items of the X16 Balance Testing Scale was examined separately and recorded as highly reliable in our study. In the original study, correlations between each item and the subscale

(static balance, postural stability, and dynamic balance) were examined. The correlation coefficient between each item and its own subscale was recorded as the highest value, and the correlations between each item and other subscales were recorded as the lowest values. These results have also shown that the structure of the X16 Balance Testing Scale was well-designed (Ju et al., 2018). Similarly, the correlation coefficients between each item and its own subscale were observed as the highest values, and the correlations between each item and other subscales were observed as the lowest values.

In the original study, internal consistency and reliability were examined for 3 sub-sections and the X16 Balance Testing Scale total score, Cronbach's alpha coefficients were recorded to be above 0.7, and excellent internal consistency was obtained for the X16 scale and each subscale (Ju et al., 2018). Similarly, in our study, Cronbach's alpha coefficient was recorded to be 0.68 for the first subscale Cronbach's alpha coefficient was recorded to be above 0.8 for the X16 Balance Testing Scale total score for the second and third sub-sections, and good internal consistency was obtained for the older Turkish population. In our study, as an additional approach in evaluating the performance of the items in the internal consistency analysis, the relevant items were removed one by one and the mean standard deviation of the remaining items, Cronbach's alpha coefficient and Corrected Item-Total Correlation were calculated. According to the item analysis, Corrected Item-Total Correlation was above 0.30. Cronbach's Alpha values are requested not to increase when the item is deleted. All the items' Cronbach's Alpha value was 0.904, and a higher Cronbach's Alpha value was not reached when the items were deleted. This result showed that there was reliability among the items in the Turkish version of the X16 Balance Testing Scale.

CFA was used to examine whether the scale's theoretical structure and data obtained from individuals were compatible (Erkorkmaz et al., 2013). The CFA results in our study shows that the obtained data is compatible with the existing theoretical structure. The three sub-dimensional structure matched with the obtained data. These results showed that the Turkish version of the X16 Balance Testing Scale has the same structure as the original scale.

In the study in which the scale was developed, the standard balance measurements which frequently used in clinic such as the BBS, POMA or Short Physical Performance Battery were not used to investigate the validity of the X16 Balance Testing Scale and this was reported as a limitation (Ju et al., 2018). In our study however, the Berg Balance Scale and the Performance-Oriented Mobility Assessment were used for investigating the validity of the X16 Balance Testing Scale. When the standard criterion of the X16 Balance Testing Scale was examined in terms of consistency between the BBS and the POMA, there was a moderate to high correlation between both the BBS (r=0.710) and the POMA (r=0.706). Furthermore, the validity between the sub-dimensions of the X16 Balance Test, the BBS and the POMA was also examined. A moderate-level correlation was recorded between the first sub-dimension, the BBS (r=0.695) and the POMA (r=0.598), between the second sub-dimension, the BBS (r=0.624) and the POMA (r=0.622), between the third sub-dimension, the BBS (r=0.686) and the POMA (r=0.775). These results obtained in the Turkish version show the similarity in the structures of the X16 Balance Test and the BBS and POMA. While the BBS, the POMA and the X16 Balance Testing scales evaluated the degree of balance and the risk of falling, it was thought that the X16 Balance Testing scale would be a useful scale to evaluate balance and the risk of falling in older individuals since it is completed in a shorter time than the BBS and the POMA and since it is a practical scale in terms of clinical application.

Limitations

The current study has several limitations. Firstly, older adults living independently in the society were included in our study as the sample group. We think that expanding the research sample in a way that would include older individuals who also live in their own homes, in nursing homes, and in care and rehabilitation centers would be suitable in terms of forming a database pertaining to all of the older people population. Secondly, the original article of the study included participants aged 60-97 years. We could not include older people in this range, and we could not analyze according to age ranges. Because, according to the World Health Organization (WHO), individuals over the age of 65 were included in our study, since 65 years of age and above are considered chronologically

older people. Future studies may present the results of the Turkish version of the scale by age ranges with a large sample size. Another limitation of the study is that the objective measurement methods (e.g. computed dynamic posturography, biodex balance evaluation system) were not used in the evaluation of balance performance for validation. Further study is needed to include objective measurements.

Clinical relevance

This study shows that the X16 Balance Testing Scale is a valuable, balance performance and fall risk measurement tool which is easy to use, can be applied without special expertise or training and its application takes only 3-5 minutes to apply for clinicians.

CONCLUSIONS

We found the X16 Balance Testing Scale to be a highly reliable clinical tool for evaluating balance performance in older adults.

AUTHOR CONTRIBUTIONS

Conceptualization. A.A.K and M.S., Methodology: A.A.K, M.S. Investigation: A.A.K and M.S, Software: A.A.K., Statistical analysis: A.A.K., Resources: A.A.K Data curation: A.A.K, Writing-original draft preparation: A.A.K and M.S, Writing-review and editing: A.A.K and M.S, Supervision: A.A.K and M.S All authors have read and approved the final version of the article.

CONFLICT OF INTEREST

The authors declare no conflicts of interest. No funding was received for this study.

FINANCIAL DISCLOSURE

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ETHICAL APPROVAL

For the study, ethical consent was received from the Non-Interventional Research Ethics Committee of Kırıkkale University with the decree numbered 2018.12.10. The rights of human participants were protected, the procedures were conducted according to the Helsinki Decleration.

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