VALIDITY AND RELIABILITY OF THE TURKISH VERSION OF 'AACHEN FALLS PREVENTION SCALE' IN OLDER INDIVIDUALS

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Abstract

Introduction: This study aimed to develop a Turkish version of the Aachen Falls Prevention Scale and determine its psychometric properties (reliability and validity).

Materials and Method: This methodological study involved 200 individuals aged ≥ 65 years from selected Family Health Centers in Manisa, Turkey, who were categorised as fallers and non-fallers. The study proceeded with distribution and item analyses of the scale, followed by reliability and validity assessments, including criterion validity, confirmatory factor analysis, known groups, and parallel form validity for construct validity.

Results: The Turkish version of Aachen Falls Prevention Scale demonstrated a sensitivity of 71.0% and specificity of 75.0% for the first part of the index score and a sensitivity of 75.0% and specificity of 55.0% for the third part. Confirmatory factor analysis for the single-factor structure of the first section yielded a chi-square/degrees of freedom ratio of 1.13, a comparative fit index of 0.939, and a root mean square error of approximation of 0.025. According to the results of known-groups analysis, the 1st and the 3rd parts of the scale were discriminative for all known groups whereas the 2nd part was not sensitive to some variables.

Conclusion: The study findings indicate highly satisfactory psychometric results for the Aachen Falls Prevention Scale. Specifically, the tool showed superior predictive capability for fall risk in older individuals compared to balance tests, such as the Tinetti test. Consequently, the Aachen Falls Prevention Scale can effectively assess fall risk among Turkish-speaking older adults in hospitals and primary healthcare settings.

Keywords: Accidental Falls; Aged; Geriatric Assessment; Sensitivity and Specificity.

INTRODUCTION

The world is undergoing continuous demographic transition characterised by increasing life expectancies and declining fertility rates, resulting in a significant shift in the age structure of the population. Consequently, both the proportion and absolute number of older individuals are steadily rising (1). In Turkey, the proportion of population aged ≥65 years increased from 8.5% in 2017 to 10.2% by 2023(2).

Geriatric syndromes are prevalent among older individuals owing to the cumulative effects of disorders across multiple systems and their decreased ability to compensate for these conditions. Common geriatric syndromes include falls, cognitive impairment, delirium, depression, polypharmacy, and urinary incontinence. Falls are a significant cause of mortality and morbidity in older adults and pose a substantial public health challenge due to their frequency, associated morbidity, and healthcare costs (3). Risk factors for falls in olderindividuals have been published in several recent reviews (4,5).

The tools utilised for assessing fall risk in older adults should effectively identify those at a high risk of falling and accurately distinguish between fallers and non-fallers to mitigate the incidence of falls (6,7). In a recent systematic review, Park stated that the predictive validity of tools currently used for fall risk assessment in older adults is inadequate (7), and the timed up and go (TUG) test, which is most commonly used to evaluate fall risk in daily clinical practice in Turkey, is not recommended tobe used alone to assess fall risk. Among the instruments used to assess fall risk in Turkey, only the performance-oriented mobility assessment (POMA) (Tinetti Balance) test has demonstrated psychometric validity in community-dwelling older individuals. Therefore, there is a need for new fall risk assessment instruments with proven validity in older adults.This study aimed to adapt the "Aachen Falls Prevention Scale"(AFPS) into Turkish and to determine the psychometric properties (validity and reliability) of the developed Turkish version.

MATERIALS AND METHOD

This is a cross-cultural adaptation study of the AFPS for Turkish speaking older adults.

Subjects

The research population comprised older adults aged ≥ 65 years who visited the five selected urban Family Health Centers(FHCs) at Manisa city centre, Turkey. The sample size was calculated as 99 participants for each group, considering a Type 1 error rate of 0.05 and an effect size of 0.40 for two-tailed hypothesis. The study included a sample of 200 older adults, categorized as 100 individuals who had experienced a fall within the past year and 100 who had not. Given the increasing frequency of falls with advancing age, 25% of the included individuals were selected from the age group 65–69 years, whereas 75% were selected from the age group of ≥ 70 years. Sample selection was performed using convenience sampling from the applicants of the five selected FHSs; 20 individuals with a fall history within the past year and 20 individuals without such a history were selected for each of the five FHCs during the intended period of 8 consecutive days of data collection. An older adult who experienced a fall was matched with a non-faller within a ±3 years age range to mitigate the potential confounding effect of age.

Participation rate

Of the adults invited to participate in the study, 43 refused to participate and 27 were unable to complete the interviews. Consequently, the participation rate in the first phase of the research was 75.0%. The overall sample size (n=200) was determined using new volunteers from the same FHCs during the same data collection period.

Inclusion and exclusion criteria

Inclusion criteria for this study were older adults ≥ 65 years of age, being cognitively competent,

and registered with the FHC from which the sample was selected. The participants' cognitive competence was assessed using the Mini-Mental State Examination. Older adults who did not meet the cognitive competence criteria were excluded.

Definition of fall

A fall, as defined by the World Health Organization, is "an event which results in a person coming to rest inadvertently on the ground, floor, or other lower level"(8). First, the participants were explained the definition of falling and were then encouraged to respond to the questions based on their experiences. If an individual had experienced two or more falls within the past year, it was considered a recurrent fall.

Instruments

The questionnaire battery included a sociodemographic and health survey, the AFPS, the Tinetti Balance and Gait Assessment, and the Frailty Scale.

Aachen Falls Prevention Scale

The AFPS was developed by Dr. Pape and colleagues in 2015 (9).The key distinguishing feature of the Aachen Falls Prevention Scale is encompassing both balance and risk assessment. A significant advantage of this scale in practical application is its ability to be utilized as a self-rated measure when necessary. The scale comprises three parts:

Part 1: The first part is referred to as the AFPS "Fall Index Score". It consists of 10 yes/no questions. Participants receive 1 point for each "yes" response and 0 points for each "no" response, resulting in a possible score range of 0 to 10. The cutoff score for this part was set at 4. Individuals scoring ≤ 4 are considered to have a low risk of falling, whereas those scoring ≥ 5 are categorised as having a high risk of falling (9).

Part 2: The second part is termed the AFPS "20-Second Standing Test". In this part, individuals are asked to stand still without holding onto anything, and the duration is measured. If a person can stand for ≥ 20 s, they are considered to be at low risk of falling.

Part 3: The third part is named the AFPS "Perceived Fall Risk Assessment". In this part, individuals rate themselves on a scale from 1 to 10 regarding their perceived risk of falling. Knobe et al. (10) determined a cutoff point of 4, while Rasche et al. (11) set a cutoff of 5 for this section.

Tinetti Balance and Gait Assessment Test

The Tinetti Balance and Gait Assessment Test, originally developed by Mary Tinetti in 1986 called Performance-Oriented Assessment of Mobility Problems in Elderly Patients, was later renamed the Tinetti Balance and Gait Assessment (12). The validity and reliability of the Turkish version were demonstrated by Onal et al. (13). This test comprises two parts with a total of 16 items: the first part includes 9 items assessing balance and the second part includes 7 items assessing walking ability. The scores range from a minimum of 0 points to a maximum of 28 points. The cutoff score for the total Tinetti score is set at 18. Individuals scoring ≤ 18 points are considered to have poor balance and gait.

The FRAIL Scale

The FRAIL Scale was developed by Moray in 2012 (14) and its validity and reliability in Turkish populations were evaluated by Hymabaccus in 2023 (15). This scale consists of 5 items and yields a total score ranging from 0 to 5. A score of 0 indicates non-frail, 1–2 points is considered pre-frail, and a score>2 indicates frail (14, 15).

Procedure

1. Translation and adaptation of the Aachen Falls Prevention Scale into Turkish

After obtaining official permission to adapt the AFPS into Turkish from the developers of the

instrument, a "consensus" version was created based on two independent forward translations from English to Turkish by a field expert. In cultural adaptation studies, it is commonly recommended that consensus versions, developed after forward translation from English to Turkish, undergo backward translation. This process allows for comparison and ensures conceptual equivalence by discussing the backward translation with the original developers of the scale. However, in this study, the developer of the scale did not request a backward translation, as indicated in the correspondence. Therefore, in accordance with the developer's preference, backward translation was not deemed necessary.

Following the development of the consensus version, five older individuals were individually recruited for "cognitive debriefing interviews" to evaluate their comprehension of the latest Turkish version and identify any perception problems. Based on the wording revisions agreed upon by the participants, the necessary changes were made to create the final Turkish field version of the AFPS. The Turkish version of the scale is provided in Appendix 1.

2. Application of the study questionnaires battery to the study population

The sociodemographic and health survey was initially administered face-to-face to the participants at a convenient location in the Family Health Center. Following the application of the Tinetti test, the AFPS was administered in three parts: First, participants answered the 10 questions in the "Fall Index" section (part 1) of the AFPS. Second, participants were instructed to stand motionless without holding onto anything, and their standing time was measured in the "20-Second Standing Test" (part 2). A standing time of < 20 s indicates a higher fall risk. In the third and final part of the AFPS, known as the "Perceived Fall Risk", participants rated their own perceived risk of falling on a scale from 1 to 10.

3. Psychometric analyses

A summary of the reliability and validity analyses conducted on the AFPS is presented in Table 1 (n=200). Distributional characteristics of the scale were assessed for floor and ceiling effects, skewness, and kurtosis. A maximum value of 15% was used to determine acceptable floor and ceiling effects (16), while skewness and kurtosis values of 1.0 were established as the acceptable thresholds (17).

Validity and reliability analyses

A confirmatory approach was employed for the reliability and validity analyses conducted in this study. A summary of the methods used for reliability and validity analyses of the AFPS is presented in Table 1.

a-Reliability analyses

Internal consistency analysis was performed to assess the reliability of the first section of the scale (AFPS Index Score). The internal consistency of the scale was evaluated using two complementary methods: (1) calculating the Kuder-Richardson 20 (KR-20) values considering the dichotomous response options of the items and (2) item-total correlation coefficients.

b-Validity analyses

The validity of the Turkish version of AFPS was assessed using criterion validity and construct validity.

b1-Criterion validity

Criterion validity was examined separately for each of the three parts of the AFPS. Criterion validity is conventionally tested with a gold standard; in this study, a fall in the previous year was used as the gold standard (experiencing a falling incident within the past year). Sensitivity, specificity, positive predictive value, negative predictive value, positive likelihood ratio (+LR), negative likelihood ratio (−LR), and Youden's Index were calculated for the criterion validity analyses.

Table 1. Summary table of the methods used in the reliability and validity analyses for the Aachen Falls Prevention Scale

AFPS	Variable type	Characteristics of a distribution	Reliability	Validity
Part 1: Fall Index Score	Numeric (10 items) or Dichotomous (cut off value:4/5) (9)	-Mean ± SD -IQR -Skewness -Kurtosis -Floor and ceiling effect	-Internal consistency (KR-20). - Item Analysis (If item deleted KR-20 and Corrected item-total correlation)	- Criterion validity *(sensitivity/ specificity)* - Construct validity *(Exploratory Factor Analysis, Confirmatory Factor Analysis and Known-groups validity).*
Part 2: 20 second Standing Test	Dichotomous (yes/ no)	n / %	na*	- Criterion validity *(sensitivity/ specificity)* - Construct validity *(exploratory factor analysis, confirmatory factor analysis, known-groups validity, and concurrent -parallel forms- validity.*
Part 3: Perceived Fall Risk Assessment	Numeric (1 item) or Dichotomous (cut off value:4/5)(10)	-Skewness -Kurtosis -Floor and ceiling effect	na*	- Criterion validity *(sensitivity/ specificity)* - Construct validity *(known-groups validity).*

na: not applicable

When analysing the criterion validity of the first part, which was a numerical index, the index score was dichotomised from the 4/5 cutoff value, as suggested by the scale developers (18). A dichotomous outcome, such as "*can stand up/ cannot stand up"* was used for testing the criterion validity of part 2 (20 s standing test) of AFPS.

Concurrent validity, a subtype of criterion validity, was also tested using the Tinetti Balance for part 1 and part 2 scores of the AFPS.

b2-Construct validity

The construct validity of the scale was assessed using known-groups validity and confirmatory factor analysis (CFA).

In the known-groups validity analysis, variables for which significant differences in mean scale scores were expected among the subcategories were used (19). The scores from the first and third sections of the AFPS were used in the known-groups validity analyses.

CFA was applied only to the first part of the AFPS. The acceptable values for the goodness of fit parameters used in the CFA were considered as follows: Comparative fit index (CFI) and Tucker-Lewis Index (TLI) >0.95; root mean square error of approximation (RMSEA) ≤0.06, and chi-square/ degrees of freedom <2.0 (20).

Statistics

SPSS version 26.0 (IBM Corp.) was used for conventional statistical analyses, while Jamovi version 2.3 was employed for CFA analysis using the diagonally weighted least squares (DWLS) method. A Type I error threshold of <0.05 was applied to all statistical analyses.

4. Ethical issues and permissions

All participants provided informed consent to participate in the study. Ethical approval was obtained from the Ethics Committee of the Faculty of Medicine(approval number: 20.478.486/1570, dated November 2, 2022).

RESULTS

Among the study participants, the proportion of women was 82.0% among those with a history of falling and 41.0% among those without. The mean age was 74.18± 6.37 for those with a history of fall and 72.67 ± 5.09 for those without. The other features of this study are presented in Table 2. Among older adults with a history of falling, 26% had a history of recurrent falls.

The distribution characteristics of the AFPS are presented in Table 3. Skewness and kurtosis values indicate a robust distribution, and floor and ceiling effects show acceptable measurement ability of parts 1 and 3 of the scale.

The overall KR-20 value was 0.58, which is a measure of the internal consistency of the Fall Index of the AFPS. The range of the item-scale correlations for the 10 items of the Fall Index was between 0.17

Table 2. Study sample characteristics

Variable	Category	Faller% (n=100)	Non-faller% (n=100)	p value
Gender	Women	82.0	41.0	<0.001*
	Men	18.0	59.0	
Age group	65–69	24.0	28.0	0.490*
	70-74	37.0	41.0	
	75 +	39.0	31.0	
Level of education	Elementary school and below	69.0	53.0	0.053*
	Middle school	4.0	9.0	
	High school and above	27.0	38.0	
Social class (based on current or previous employment status of the head of the household)	Upper Social Class	26.0	39.0	0.05*
	Lower/Middle Social Class	74.0	61.0	
Current employment status	Retired	53.0	72.0	0.001*
	Neither currently employed nor retired	46.0	23.0	
	Employed	1.0	5.0	
Marital status	Married	45.0	72.0	<0.001*
	Not married	55.0	28.0	
Social assurance	Yes, covered through spouse	47.0	24.0	0.003*
	Yes, covered through self	52.0	73.0	
	No social assurance	1.0	3.0	
Income perception	income < expenses	50.0	50.0	0.594*
	income = expenses	47.0	49.0	
	income > expenses	3.0	1.0	
Smoking	Yes	11.0	16.0	<0.001*
	Quit	16.0	44.0	
	No	73.0	40.0	

Table 2. Continued...

Variable	Category	Faller% (n=100)	Non-faller% (n=100)	p value
Alcohol consumption	Yes	5.0	6.0	0.756*
	No	95.0	94.0	
Frequency of meeting with relatives	Most of the time	84.0	87.0	0.486*
	Sometimes	8.0	9.0	
	Very rarely	8.0	4.0	
Frequency of meeting with neighbors	Most of the time	66.0	72.0	0.593*
	Sometimes	8.0	8.0	
	Very rarely	26.0	20.0	
Body mass index	Underweight/Normal (BMI<25.0)	29.0	37.0	0.023*
	Overweight (BMI=25.0-29.99)	31.0	41.0	
	Obese (BMI>29.99)	40.0	22.0	
Self-rated health	Good	70.0	77.0	0.533*
	Moderate	17.0	13.0	
	Poor	13.0	10.0	
Perceived health transition (compared to previous year)	Better	23.0	19.0	0.753*
	No Change	24.0	27.0	
	Worse	53.0	54.0	
Chronic diseases	No chronic diseases	12.0	18.0	0.344*
	One chronic disease	33.0	36.0	
	Two or more chronic diseases	55.0	46.0	
Polypharmacy (Five or more medication)	Yes	56.0	71.0	0.028*
	No	44.0	29.0	
Frequency of having adequate / balanced nutrition	Most of the time	78.0	84.0	0.279*
	Rarely/Occasionally	22.0	16.0	
Frequency of forgetting to drink water	Rarely forgets	61.0	69.0	0.027*
	Occasionally	24.0	10.0	
	Most of the time	15.0	21.0	
Difficulty falling asleep	Rarely has difficulty	46.0	60.0	0.140*
	Occasionally	23.0	17.0	
	Most of the time	31.0	23.0	
Trouble waking up early	Rarely wakes up	37.0	53.0	0.053*
	Occasionally	25.0	15.0	
	Most of the time	38.0	32.0	

*Chi Square

Table 3. The distribution characteristics of the Aachen Falls Prevention Scale

	n (%)	Mean	STD	IQR*	Skewness	Kurtosis	Floor effect (%)	Ceiling effect (%)
Part 1 (Fall Index Score)								
	na	4.53	2.02	3/6	0.16±0.17	-0.45±0.34	1.5	0.0
Part 2 (20 Second Standing Test)								
Successful	188 (94.0)	na	na	na	na	na	na	na
Failed	12(6.0)	na	na	na	na	na	na	na
Part 3 (Self Assessment of Fall Risk)								
	na	4.71	2.28	3/6	0.03±0.17	-0.78±0.34	10.5	1.5

na: not applicable

*Interquartile range

Table 4. The criterion validity of the Aachen Falls Prevention Scale

Reference: *Faller/Non-faller in the past one year.*	Sensitivity[†] %	Specificity[‡] %	PPV [††] %	NPV [‡‡] %	+LR[†††]	-LR[‡‡‡]
Part 1 (Fall index score) *(Cut off value:4/5)*[(9)]	71.0 (71/100)	75.0 (75/100)	73.95 (71/96)	72.11 (75/104)	2.84	0.39
Part 2 (20 sec. Standing test) *(can/can not stand up)*	10.0	98.0	83.3	52.12	5.0	0.91
Part 3 (Self assessment of fall risk) *(Cut off value: 4/5)*[(10)]	75.0	55.0	62.5	68.7	1.67	0.45

[†]: True positive / (True positive +False negative)

[‡]: True negative / (True negative + False positive)

[††]: Positive predictive value= True positive/ (True positive+ False positive)

[‡‡]: Negative predictive value= True negative/ (True negative+ False negative)

[†††]: Sensitivity / (1-Specificity)

[‡‡‡]:(1-Sensitivity) /Specificity

to 0.33 and none of the "if item deleted" KR-20 values of the items exceed overall KR-20 value of the Fall Index,indicating significant contribution of all the items to the fall index.

The criterion validity analyses of the three parts of the AFPS are presented in Table 4 with "presence or absence of previous fall experience" as the reference (criterion) test. The sensitivity and specificity for the first part of the AFPS were within moderately acceptable limits, while the specificity for the second part was nearly perfect, and the sensitivity for the third part was moderate. Part 2 had the highest +LR. However, part 1 emerged as the most effective test, considering both the positive and negative LRs. Sensitivity increased to 0.94 for part 1 and 0.88 for part 3 when recurrent falls were used as the reference test (not shown in the table).

The ROC curves for the AFPS index score (first part) yielded an area under the curve (AUC) of 0.809 (95% CI: 0.748–0.861), while for the AFPS perceived fall risk score (third part), the AUC was 0.712 (95%

Table 5. Known-Groups Validity of the Aachen Falls Prevention Scale

Independent variable	Variable categories	Part 1 Fall index score (ES) †	Part 2 20 sec. Standing test (Successful %)	Part 3 Self-assessment of Fall risk (ES) †
Age group	65-69/70-74/75+	0.02	98.1/96.2/88.6	0.008
Gender	Women / Men	0.88***	94.3/93.5	1.26***
Marital status	Married/Not married	0.74***	95.7/91.6	0.54***
Level of education	Elementary and below/ Middle/ High and above	0.04*	91.0/92.3/100.0*	0.02
Social class	Upper /Lower -Middle	0.69***	100.0/91.1*	0.50**
Body mass index	Normal / Overweight /Obese	0.03*	90.6 / 97.2 / 93.5	0.01
Perceived health compared to peers	Good/Moderate/Poor	0.09***	97.3 / 90.0 / 78.3*** (post hoc: a>b>c)	0.04**
Difficulty falling asleep	Rarely / Occasionally/ Most of the time	0.07***	96.2/90.0/92.6	0.04**
Frequent awakenings from sleep	Rarely/Occasionally/ Most of the time	0.07***	97.8/87.5/92.9	0.07***
Number of people living in the household	Alone/ Two or more	0.64*	90.4/95.3	0.50**
Feelings of loneliness	Rarely/Occasionally/ Most of the time	0.23***	98.0/97.4/87.7*	0.12***
Polypharmacy	Yes/No	0.55***	87.7/97.6**	0.16
Number of chronic diseases	1 or less/ 2 or more	0.36**	97.0/91.1	0.29*
Previous employment status	Upper Social Class / Lower Social Class	0.69***	100.0/91.1*	0.50**
EQ5-D	Healthy/Non healthy	0.98***	100.0/86.8***	0.84***
Frailty	Yes/No	0.97***	73.5/98.2***	0.87***

†Cohen'sEffect sizes (d) for comparing two group means based on group mean comparisons and eta-squared (η^2) for comparing three group means.
Significant at level: *p<0.05 **: p<0.01 ***: p<0.001

CI: 0.644–0.774). Both curves were statistically significant (p<0.01). The difference between the AUCs of the two ROC curves was 0.097 (95% CI: 0.020–0.174), which was statistically significant (p=0.01).

The AUCs of the "Fall Index" of the AFPS and Tinetti Balance scale differed significantly (p<0.001), with the Fall Index being superior (0.194, 95% CI 0.118–0.271). This indicates that the AFPS more effectively predicts decline than the Tinetti scale.

Construct validity of the AFPS was assessed using CFA analysis and known-groups validity. The RMSEA was 0.025 (90% CI: 0.00–0.059), chi-square/degree of freedom was 1.13 (39.8/35.0), and the CFI was 0.94 for the one-dimensional model.

According to the known-groups analysis, the first and third parts of the AFPS showed discriminative ability across all known groups, whereas the 20-seconds standing test (second part) did not exhibit sensitivity to certain variables (Table 5).

DISCUSSION

The AFPS is one of the most recent self-assessment tools for assessing fall risk in older adults, which is adapted and validated. This study demonstrates that the Turkish version of the scale not only maintains acceptable conceptual equivalence with the original AFPS but also exhibits comparable reliability and initial validity findings. Both criterion validity and known-groups approaches provide robust evidence to support the clinical utility of the scale. This meticulous and comprehensive adaptation process ensured that most translation-related issues were resolved satisfactorily. Cognitive debriefing interviews with older adults facilitated the identification and rectification of elements that were culturally inappropriate for Turkey, ensuring the scale's cultural relevance and applicability.

Although the first and third parts of the AFPS are numerical variables, both their numerical and dichotomous properties were used in the validity analyses by applying cutoff points suggested in previous studies (10, 11,21).

The distribution characteristics of the first and third parts of the scale, including skewness, kurtosis values, and the presence of ceiling and floor effects, are within acceptable limits. These results confirm the measurement precision and reliability of these components.

Internal consistency could only be assessed for the first part, which consisted of ten items; the overall KR-20 value was close to the acceptable limit of 0.58. More importantly, no problematic items were identified in the first part, as indicated by the item-total correlation results and KR-20 values when any item was removed. The corrected item-total correlations for the individual items in the first part were >0.20 (except for one item). Additionally, the internal consistency coefficient (KR-20) remained stable or decreased when an item was removed (22).

Criterion validity of the "parts" of the AFPS were assessed using the "previous fall history" of an older adult as a reference test. When fall history was used as the reference test, the validity of the three parts of the AFPS was evaluated separately by calculating the LRs. The diagnostic power of part 1 was at an acceptable level (though not excellent); only the +LR value of part 2 was good, and part 3 was not considered an effective test. Ideally, a test with high diagnostic power is expected to have a +LR value >10.0 or a -LR value <0.1. At the very least, the +LR value should be >2.0 and the -LR value should be <0.5 (23).

The sensitivity and specificity values reported in studies by Knobe (10) and Rasche (11) examining the psychometric properties of the Aachen scale were similar to our results. In our study, the sensitivity and specificity results for perceived fall risk (part 3) were 0.75 and 0.55, respectively, compared to 0.56 and 0.64 in Knobe's study, and 0.67 and 0.88 in Rasche's study. In terms of +LR ratios, our results (+LR=1.66, -LR=0.45) were superior to those of Knobe (+LR=1,5 -LR=0,68) and similar to those of Rasche et al. (+LR=5.58, -LR=0.38).

We also compared the predictive ability of the first part (index score) and third part (perceived fall risk) of the AFPS using an ROC curve. The AUC value for the first section was significantly larger than that of the third section, indicating that the index score (part 1) is more predictive of fall risk than perceived fall risk (part 3). The AUC for the AFPS index score was 0.809 (95% CI: 0.748–0.861), while the AUC for the AFPS perceived fall risk score (part 3) was 0.712 (95% CI: 0.644–0.774). Both curves were statistically significant (p<0.01). The AUC for primary outcome of the AFPS were 0.692 and 0.873 as reported by Knobe (10) and Rasche (11), respectively, which are similar to our findings.

We tested the concurrent validity of the first part of the Aachen scale using the Tinetti Balance Test and found that part 1 of the AFPS was superior to

the Tinetti test when comparing the AUC of the ROC analyses. This indicates that balance tests such as Tinetti's may not be as predictive as the first part (index score) of the Aachen scale.

In CFA, a one-factor solution showed satisfactory goodness-of-fit indices for part 1 of the AFPS. The chi-square/degrees of freedom were found to be 1.13 (less than 3.0), the CFI was 0.97 (greater than 0.90), and the RMSEA was 0.025 (less than 0.08) (20).

To demonstrate the known-groups validity of the first and third parts of the AFPS, variables indicating factors related to the risk of falling, such as sex, age, employment status, number of people living in the household, individuals' perception of loneliness, number of medications being used (polypharmacy), number of chronic diseases, and frailty status, were tested. According to Cohen's guidelines, effect sizes of approximately 0.2, 0.5, and 0.8 were considered small, medium, and large, respectively (24). For eta-squared (η^2), values of approximately 0.01, 0.06, and 0.14 were considered small, medium, and large, respectively (25).

Known-groups validity analyses showed statistically significant relationships between the first and third dimensions of the Aachen Scale for all the independent variables. However, while female sex, marital status (not-married/widowed), high frailty, anxiety, depressive mood, and polypharmacy exhibited high effect sizes, medium effect sizes were observed for the variables of social class, number of people living at home, and body mass index (BMI). Advanced age and number of chronic diseases in older individuals and those living alone were statistically significant; however, both presented weak effect sizes.

The results of the known group comparisons for advanced age, female sex, lower social class, living alone, being unmarried/widowed, frailty, polypharmacy, number of chronic diseases, being

overweight and obese, and anxiety/depression are consistent with the findings of previous studies (4,5,8).

LIMITATIONS

This study has some methodological limitations, including;

(1) Sample selection and environment in which procedures were applied. The older adults accepted for the study were selected from those who applied to Family Health Centers for any health problem, which may not represent the broader community of older adults.

(2) Additionally, administering the questionnaires and conducting risk assessments in a Family Health Center setting might have affected the level of cooperation of older adults.

(3) Data were collected at Family Health Centers because the Provincial Health Directorate's research committee denied our request to interview the older individuals at their homes, citing patient privacy concerns. Consequently, home safety (home ergonomics) measures in the participants' homes could not be evaluated.

CONCLUSION

The findings of this study showed that the psychometric results of the Turkish version of the AFPS, particularly part 1, were highly satisfactory. Notably, we demonstrated that the tool can predict the risk of falling in older individuals more successfully than commonly used balance tests, such as the Tinetti test. Therefore, the AFPS can be effectively used to assess fall risk among Turkish-speaking older adults in both hospital and primary healthcare settings. This attribute is particularly beneficial in primary healthcare settings, where ease of use and patient autonomy are essential. Effective fall risk assessments are crucial in countries such as Turkey, where physical dependency is high among the older people.

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Appendix 1. Turkish Version of 'Aachen Falls Prevention Scale'

Bölüm 1

1) İşitme veya görme ile ilgili sorununuz var mı?

1. Evet

2. Hayır

2) Son zamanlarda kendinizi güvende hissetmediğiniz veya düştüğünüz oldu mu?

1. Evet

2. Hayır

3) Düşmekten korkuyor musunuz?

1. Evet

2. Hayır

4) Uyku, kalp sorunları, idrar söktürücü veya yatıştırıcı ilaçlar alıyor musunuz?

1. Evet

2. Hayır

5) İstemsiz olarak idrar veya dışkı kaçırıyor musunuz?

1. Evet

2. Hayır

6) Unutkanlığınız var mı?

1. Evet

2. Hayır

7) Zaman zaman kendinizi yalnız hissediyor ve hayatınızın değersiz olduğunu düşünüyor musunuz?

1. Evet

2. Hayır

8) Düzenli olarak (baston, yürüteç gibi) yürümenize yardımcı araçlar kullanıyor musunuz?

1. Evet

2. Hayır

9) Parkinson, Artrit veya Romatizma gibi hastalığınız var mı?

1. Evet

2. Hayır

10) Evinizde düşmeye neden olabilecek engeller, faktörler (parçalı halı-kilim, kaygan zemin, karanlık ortam, kapı eşikleri, yerlerde alçak cisimler vb) var mı?

1. Evet

2. Hayır

Bölüm 2

Serbestçe durun, kimseye yaslanmayınveya tutunmayın, kolunuz, üst bedeniniz veya bacaklarınız ile dengenizi düzeltici bir hareket yapmanız gerekene kadar geçen süreyi ölçün.

1. 20 saniye veya daha fazla

2. 20 saniyeden az

Bölüm 3

Sonuç ve öz değerlendirme

Düşme ihtimalinizi 1 ila 10 (10 …maks. Risk) arasında nasıl derecelendirirsiniz?...................