Original investigation

The Reliability and Validity of the Turkish Version of Community Balance and Mobility Scale (CB&M-T) in Older Adults

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ABSTRACT

Purpose: The aim of our study is to evaluate the reliability and validity of the Turkish version of the Community Balance and Mobility Scale (CB&M-T) on older adults of Turkish population.

Methods: The study included 145 older adults. Test-retest reliability, internal consistency was used for reliability. Berg Balance Scale was used to test the concurrent validity of the CB&M-T. The ceiling and floor effect were calculated for content validity. To measure the test-retest reliability, the older adults were assessed again with CB&M-T one week after the first assessment. ROC (Receiver Operating Characteristic) analysis was performed determine the cut-off scores and the area under the curve (AUC) was calculated.

Results: Very high relationship was found between the 1st and 2nd evaluation total CB&M-T score. Cronbach's alpha coefficient was excellent. There were no floor and ceiling effects. High correlations were found between CB&M-T and BBS. The optimum cut-off value is calculated as 38.5 points. AUC value of 0.90 is found to be highly acceptable for individuals at fall risk.

Conclusion: This study indicates that the Turkish version of the CB&M-T scale is a reliable and valid balance and mobility scale that can be used in the rehabilitation of older adults with a high functional level. According to these results, Turkish clinicians have been brought a new scale that can be used in clinics We think that older adults with high functional levels will bring a new perspective to the literature to evaluate the fall risk, balance and mobility and to plan rehabilitation programs.

Keywords: Mobility, older adults, postural balance, reliability, validity

INTRODUCTION

As the average life expectancy increases in the world, the elderly population is increasing rapidly. With the increase in the elderly population, problems such as chronic diseases of the old age, sarcopenia, muscle strength losses, balance and coordination disorders increase. It has also been reported that postural control mechanisms are affected by the effect of locomotor performance in the aging process. Also, it was reported in previous studies that the postural control mechanisms are affected in the aging process due to the effects on locomotor performance (1, 2). Another important problem that is seen in older adults with the effect of postural control is falling. Many factors like lower extremity weakness, balance disorders, functional and cognitive disorders, visual loss, polypharmacy, and environmental factors affect the fall in older adults (3). Among the elderly, falling is an important public health problem and causes functional limitations. In the general community, one in three elderly people over 65 years old and one in two elderly people over 80 years old falls on average at least once a year (2, 4). The falling problem in older adults is associated with poor functions, and increased mortality and morbidity (3). Mobility is important for independent function and life quality in the aging process. The decrease in mobility is another risk factor which effects the functional level of individuals. Therefore, it is required that valid and reliable clinical evaluation methods must be employed in order to define and evaluate mobility levels. The Elderly Mobility Scale (5), the Rivermead Mobility Index (6), the Berg Balance Scale (BBS) (7), the Timed Up end Go (TUG) (8), and the Demorte Scales (9) are employed to evaluate balance and mobility in the elderly. The existing scales are inadequate in assessing the balance and mobility in older adults who have high functional levels. Besides, these scales cannot determine the need of physiotherapy in elderly people with high functional level who have normal social life independently

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(10). In the literature, the performance-based assessment scales are limited that can classify the fall risk levels of the individuals who are susceptible to slight changes in the balance ability and who are sensitive and older adults. One of these scales which is frequently used in clinics is the Community Balance and Mobility Scale (CB&M) (11). The CB&M Scale is a relatively challenging evaluation scale. The original of the CB&M was conducted on patients who are amputated in young and middle age with traumatic brain injuries. The Clinometric properties of the English version of the scale were found to be valid in children with traumatic brain injury, adolescents, stroke patients, knee osteoarthritis, healthy young people and older adults (10–17). Currently, the CB&M has been translated into German (18) and Korean (16), however, a Turkish translation of the CB&M scale has not been previously conducted. It was shown in previous studies that CB&M scale may evaluate a more comprehensive balance and mobility ability to perform various walking tasks, which is unlike the other clinical tests (10). For this reason, the purpose of our study is to determine the validity and reliability of the Turkish version of CB&M-T to evaluate walking, dynamic balance and mobility in older adults.

MATERIALS and METHOD

Patients and Setting

A total of 145 older adults (85 females, 60 males) who were over the age of 65 years and who were living among the community were included in the study. The study was carried out in Kırıkkale University, Department of the Physiotherapy and Rehabilitation between August 2018 and June 2019. This study was conducted by employing the Instant Screening Method, which is a single screening model among the general screening models. The individuals were contacted by employing the Accessible (Unbiased) Sampling Method.

The study was approved by Kırıkkale the University Ethical Committee (Decision no: 2018.06.07), and all the participants gave written informed consent.

The individuals whose native language was Turkish and who were literate, who could walk at least 10 m independently (assessed with 10-m Walking Test), whose Standardized Mini-Mental State Examination score was 24 and over, who had no fall history in the last six months, and who were volunteers, were included in the study. The individuals who had further-stage cardiovascular, neurological and orthopedic diseases, malignancy, and individuals who were receiving chemotherapy and radiotherapy that caused malignancy, and those who had contraindications for mobilization, who had psychiatric or cognitive disorders, were not included in the study.

Translation of CB&M scale into the Turkish language

We used the guidelines for cross-cultural adaptation in the translation process (19). Permission was obtained from the corresponding author, Liz Inness, for CB&M scale. The scale was translated into Turkish by independent native Turkish translators. These translations were examined by researchers to ctreate one single form. These translations were retranslated again into English by two bilingual and native English speakers. and who were blind

to the field of medicine. The need for cultural adaptation for Turkish translation and English re-translations, along with the original text were jointly evaluated by the translators and five physiotherapists. After the pilot study was performed with 25 older adults, the CB&M-T scale was finalised directly into Turkish without cultural adaptations.
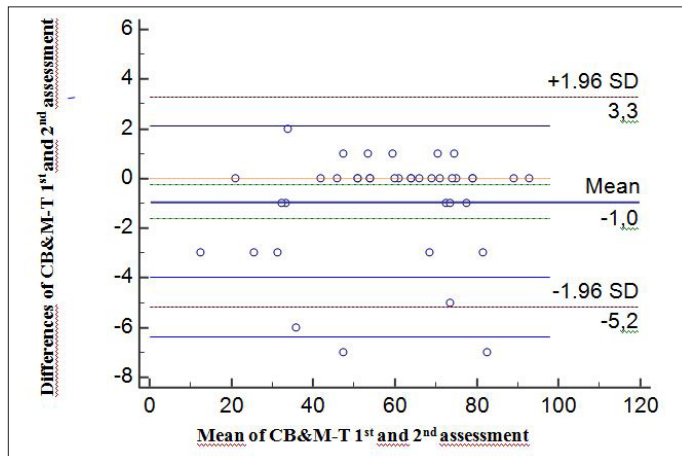
After socio-demographic data of all individuals who participated in the study (age, body mass index, background study, family history, falling history) were recorded CB&M-T and BBS were performed to the older adults by the same physiotherapist on the first day (1st assessment.) The individuals were assessed again with CB&M-T 1 week after the first assessment by the same physiotherapist (2nd assessment).

Instruments

The CB&M-T scale consists of 13 items that are employed to assess the upper-level balance and mobility. The items in the CB&M-T consist of unilateral stance, tandem walk, 180° tandem pivot, lateral foot scooting, hopping forward, crouch and walk, lateral dodging, walking and looking, running with controlled stop, forward to backward walking, 'Walk, look and carry', descending stairs, step-ups × 1 step. These items are scored between 0 and 5. except for the item of a descending staircase. It is scored between 0 and 6, and 1 extra point is given for carrying a basket while descending a staircase. Higher scores show better mobility and balance. The maximum score of 96 points.

A great deal of the CB&M-T is designed to be performed on a specific track whose sizes are certain in a clinical setting (the installation is summarized below). The therapist must have access to a step of the stairs (at least 8 steps). A track whose total area is 2 meters wide and 10 meters long is recommended for the test. The track is an 8-meter long vertical line with a start and finish points. The lines might be applied to the ground with a paint or duct tape with a 5-cm width. The 1 m, 2 m, 4 m and 6 m points must be determined. A stopwatch, a bag that has a 3.4 kg weight, and a paper circle that has a diameter of 20 cm that has a black circle 5-cm-diameter in the center are needed for the visual target to make the evaluations (11).

Berg Balance Scale (BBS) was designed to evaluate balance in a quantitative manner; and to determine the fall risk, and it was preferred since it evaluates the ability of individuals to maintain their balance when they are performing functional activities. BBS consists of 14 items that are intended to observe the protection of the body balance in a direct manner during the performance. Each item is scored between 0–4 in line with the ability of the patient to cover the requirements of time and distance that are specific to the test. In the test, the supporting ground is decreased to make it difficult; and 4 points show that the individual has the ability to complete a task independently, and 0 points show that the individual could not start the task. The test measures the level of standing without sitting, standing as feet kept together, standing in tandem position, managing the balance on one leg, the dependence and/or independence level during the positions, and the ability of the individual to change position. According to the scores that are obtained in this test, the cases are divided into groups as follows;

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Figure 1. Bland-Altman plot for test-retest reliability

Figure 2. Bland-Altman plot analyses for CB&M-T and BBS scale.

"high fall risk" (0–20 points), moderate-level fall risk (21–40 points), "low fall risk" (41–56 points); and the highest score, which is 56, is considered to indicate the best balance (7, 20).

Statistical analysis

Statistical analyses were carried out by employing the SPSS system (version 22.0, SPSS Inc., Chicago, IL, the USA). Values were defined as mean ± standard deviation (SD) or as percentages. Data distribution normality was evaluated by the Kolmogorov Smirnov test. As the statistical significance level $p < 0.05$ was taken.

Reliability

Test-retest reliability, internal consistency and Bland-Altman method was used for reliability.

ICC coefficient were accepted as follows: 0.50–0.75 as moderate agreement, 0.75–0.90 as good agreement, >0.90 as excellent agreement.

Validity

Concurrent validity was measured by employing a correlation analysis Spearman's Correlation Coefficient and Bland-Altman method between the CB&M-T scale and the BBS total score. The ceiling and floor effect were calculated for content validity. We hypothesized that the floor and ceiling effects would be less than 15% (21).
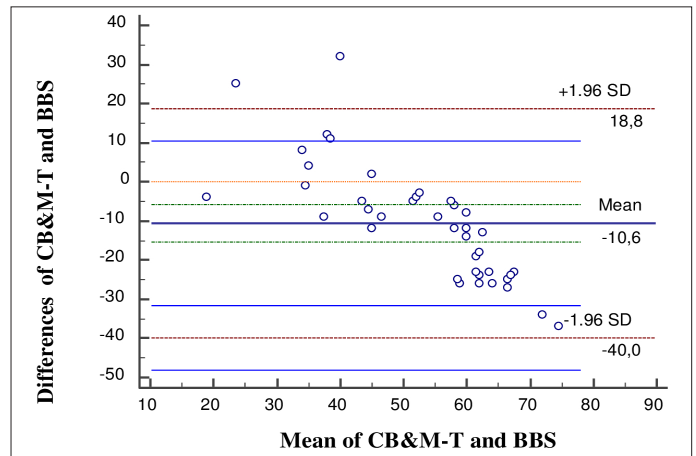
Predictive validity

The receiver operating characteristic (ROC) and area under the curve (AUC) were used to determine the cut-off scores. Older adults were divided into two groups according to the BBS to determine fall risk (group 1: BBS ≤40, group 2: BBS ≥41).

RESULTS

A total of 145 individuals, who had the mean age of 70.63±6.06 years, was participated in our study. The sociodemographic data of the individuals are given in Table 1.

Reliability and internal consistency

According to the Spearman's Correlation Analysis, 1st and 2nd evaluation, there is a very high relation between total CB&M-T

(rho=0.975). The Cronbach's Alpha Coefficient was 0.966. ICC analyses showed excellent agreement between intra-rater tests for both total CB&M-T scores (0.985; 95% CI; 0.96–0.99). 13 items had correlation values above 0.80 that indicates "excellent agreement" for intra rater reliability (Table 2). In the Bland-Altman Graph, which was employed to evaluate the agreement (consistency) of both the first and the last measurements of the CB&M-T, it was determined that the two measurements were consistent with each other (Figure 1).

Validity

Concurrent validity: High correlations were found between CB&M-T and BBS (rho=0.796, p<0.001). In the Bland-Altman graph, which was employed for the validity according to a reference, the balance between BBS, CB&M-T was evaluated. It was determined that both scales were distributed randomly around "0" and had good consistency (Figure 2).

Content validity: There were no floor and ceiling effects on clinical evaluations. There were no 96 points. There was 1 older adult with 0 (0.7%) points.

Table 1. Socio-demographic and clinical data of the participants (n: 145)

	Participants
Gender n (%)	
Female,	85 (58.6)
Male,	60 (41.4)
Age, (years) mean±SD	70.63±6.06
BMI, (kg/m²) mean±SD	28.18±4.72
Education Level n (%)	
Not literate	34 (23.5)
Primary (grade 1–5)	75 (51.7)
Middle (grade 6–8)	19 (13.1)
High (grade 9–12)	11 (7.6)
University	6 (4.2)
CB&M-T score mean±SD	47.20±20.88
BBS score mean±SD	42.88±10.51
BBS score ≤40 n (%)	51 (35.2)
BBS ≥41 n (%)	94 (64.8)

BMI: Body Mass İndex **CB&M-T:** Community Balance and Mobility Scale - Turkish; **BBS:** Berg Balance Scale

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Table 2. Intra-rater correlation coefficients for test items and total score on CB&M-T

CB&M-T Item		Correlation coefficients (rho) 1st assessment vs 2nd assessment (intra rater)
Unilateral stance	Left	0.945
	Right	0.958
Tandem walking		0.958
180° tandem pivot		0.944
Lateral foot scooting	Left	0.947
	Right	0.954
Hopping forward	Left	0.969
	Right	0.973
Crouch and walk		0.936
Lateral dodging		0.952
Walking and looking	Left	0.955
	Right	0.956
Running with controlled stop		0.967
Forward to backward walking		0.962
Walk, look and carry	Left	0.967
	Right	0.984
Descending stairs		0.966
Step-ups × 1 step	Left	0.945
	Right	0.957
Total score		0.975

CB&M-T: Community Balance and Mobility Scale - Turkish

Predictive validity: The clinical cut-off point for the CB&M-T was determined to be 38.5 points with an AUC of 0.900 (80% sensitivity and 83% specificity).

DISCUSSION

The results of our study, which was conducted to investigate and compare the predictive characteristics of the CB&M-T in the older adults who had high functional levels and who were living independently in the Turkish society, showed that the Turkish version of the CB&M-T are reliable and valid mobility scale that could be used in the rehabilitation of the older adults who had high functional level over the age of 65.

In the literature, validity and reliability studies evaluate the intra and inter-rater reliabilities of the scales. In this study, the intra-rater reliability, which is described as the compliance level between the results of evaluations that are performed at different times by the same person, was examined. As a result of this, it was seen that the reliability of the total score of the CB&M-T Scale was "very high".

In previous studies, the Cronbach α values higher than 0.80 are considered as higher internal consistency indices. Similarly, the corresponding values in the original version (11), Germany (18) and English (10) versions 0.96, 0.99 and 0.96, respectively. In line with the literature, in our study, it was determined that the Cronbach α coefficient showed excellent reliability with 0.96 for the CB&M-T scale total score.

For Content Validity, the ceiling and the floor effects are examined. The ceiling effect may be explained if more than 15% of the participants receive the highest possible scores. The floor effect means more than 15% of the participants showing the lowest possible performance. In the study for the German version that was conducted by Gordt et al. (18), no floor and ceiling effects were detected, and as a result, it was reported that this scale might be employed in studies that would be conducted on heterogeneous samples who had various physical abilities and ages. Similarly, it was also reported that there were no ceiling effects in the English version (10). In this study, no ceiling and floor effects could be detected for CB&M-T. When the fact that some of the sub-items of this scale are hard to even for healthy elderly people who live in the society is considered, it is considered that this scale may be included among the scales that might be employed for the detailed evaluations of fall risk, balance, and mobility in the older adult individuals who have high functional levels.

In the literature, in the original version, the validity of CB&M-T was evaluated by employing BBS; and a strong and positive correlation was detected between CB&M-T and BBS (10). In this study, the Turkish validity of CB&M-T was investigated by employing BBS; and a high correlation was detected between CB&M-T and BBS (rho=0.796). Similarly, BBS was employed for validity in the German version (18) and English version (10); and the corresponding values were found to be 0.78 and 0.87, respectively.

Assessment of balance and mobility in older adults is important in determining the fall risk. In the original version of the CB&M-T scale in traumatic brain injuries, the cut-off value is not specified. The cut-off point is calculated by creating two groups, for example with and without the fall story. Since the falling history of the individuals participating in our study is not taken, the classification is made according to the BBS, which is used to determine the fall risk, and for which the validity and reliability study is performed in older adults.

In the study of Balasubramanian (10), the cut-off and AUC values were calculated as 39 and 0.80, respectively, according to the fall history. The optimum cut-off value is selected from the point where the sensitivity and specificity are at the highest level in the ROC curve together and calculated as 38.5 points. AUC value of 0.90 is found to be highly acceptable for individuals at fall risk (80% sensitivity and 83% specificity). According to this cut off score, older adults with insufficient balance and mobility, which increase the risk of falling, can be distinguished.

The fact that the fear for falling of individuals within the past one year was not questioned, the inter-rater reliability and minimal detectible change and standard error of mean were not carried out are the limitations of this study. Inter rater reliability of CB&M-T can be done in future studies and determination of minimal detectible change and standard error of mean values can be determined. In addition, psychometric analysis can be made separately according to the old age stages.

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CONCLUSIONS

A result of our study demonstrate CB&M-T has very high intra-rater reliability and high validity. There is no floor and ceiling effects on clinical evaluations in older adults. According to these results, we believe that Turkish clinicians will be provided with a new scale that may be employed in clinics; and new insight will be brought to the literature in evaluating the fall risk, balance and mobility of older adults who have high functional levels and in planning their rehabilitation programs.

Informed Consent: All the participants gave written informed consent

Compliance with Ethical Standards: The study was approved by Kırıkkale the University Ethical Committee (Decision no: 2018.06.07),

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - SAA, BM; Design - SAA, MS; Supervision - MS, ESE; Fundings - MS, SAA, CSD, ESE, BM; Materials - SAA, MS; Data Collection and/or Processing - MS, SAA, ESE; Analysis and/or Interpretation - SAA; Literature Search - BM, SAA; Writing Manuscript - SAA, CSD; Critical Review - CD, SAA

Conflict of Interest: No conflict of interest was declared by the authors.

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REFERENCES

1. Hirasaki E, Kubo T, Nozawa S, Matano S, Matsunaga T. Analysis of head and body movements of elderly people during locomotion. Acta Otolaryngol 1993;113:25–30. [CrossRef]

2. Tinetti ME, Speechley M, Ginter SF. Risk factors for falls among elderly persons living in the community. N Engl J Med 1988;319:1701–1707. [CrossRef]

3. American Geriatrics Society, Geriatrics Society, American Academy of Orthopaedic Surgeons Panel on Falls Prevention. Guideline for the prevention of falls in older persons. J Am Geriatr Soc 2001;49:664–672. [CrossRef]

4. Bogle Thorbahn LD, Newton RA. Use of the Berg Balance Test to predict falls in elderly persons. Phys Ther 1996;76:576–583. [CrossRef]

5. de Morton NA, Berlowitz DJ, Keating JL. A systematic review of mobility instruments and their measurement properties for older acute medical patients. Health Qual Life Outcomes 2008;6:44. [CrossRef]

6. Collen FM, Wade DT, Robb GF, Bradshaw CM. The Rivermead mobility index: a further development of the Rivermead motor assessment. Int Disabil Stud 1991;13:50–54. [CrossRef]

7. Sahin F, Yilmaz F, Ozmaden A, Kotevoglu N, Sahin T, Kuran B. Reliability and validity of the Turkish version of the Berg Balance Scale. J Geriatr Phys Ther 2008;31:32–37. [CrossRef]

8. Podsiadlo D, Richardson S. The timed "Up & Go": a test of basic functional mobility for frail elderly persons. J Am Geriatr Soc 1991;39:142–148. [CrossRef]

9. Yürük ZÖ, Aytar A, Tüzün EH, Eker L, Yüksel İ, De Morton NA. Acceptability, reliability and validity of the Turkish version of the de morton mobility index in elderly patients with knee osteoarthritis. Turk J Geriatr 2014;17:404–409. https://pdfs.semanticscholar.org/b12a/4bf1301efe3df2b01ca1035bfbca87e901ba.pdf

10. Balasubramanian CK. The community balance and mobility scale alleviates the ceiling effects observed in the currently used gait and balance assessments for the community-dwelling older adults. J Geriatr Phys Ther 2015;38:78–89. [CrossRef]

11. Howe J, Inness E, Venturini A, Williams JI, Verrier MC. The Community Balance and Mobility Scale-a balance measure for individuals with traumatic brain injury. Clin Rehabil 2006;20:885–895. [CrossRef]

12. Wright FV, Ryan J, Brewer K. Reliability of the Community Balance and Mobility Scale (CB&M) in high-functioning school-aged children and adolescents who have an acquired brain injury. Brain Injury 2010;24:1585–1594. [CrossRef]

13. Takacs J, Garland SJ, Carpenter MG, Hunt MA. Validity and reliability of the community balance and mobility scale in individuals with knee osteoarthritis. Phys Ther 2014;94:866–874. [CrossRef]

14. Weber M, Van Ancum J, Bergquist R, et al. Measurement Properties of the Community Balance and Mobility Scale in Young-Older Adults. BMC Geriatrics 2018;18:156. [CrossRef]

15. Knorr S, Brouwer B, Garland SJ. Validity of the Community Balance and Mobility Scale in community-dwelling persons after stroke. Arch Phys Med Rehabil 2010;91:890–896. [CrossRef]

16. Lee KB, Lee P, Yoo SW, Kim YD. Reliability and validity of the Korean version of the community balance and mobility scale in patients with hemiplegia after stroke. J Phys Ther Sci 2016;28:2307–2310. [CrossRef]

17. Inness EL, Howe JA, Niechwiej-Szwedo E, Jaglal SB, McIlroy WE, Verrier MC. Measuring balance and mobility after traumatic brain injury: validation of the Community Balance and Mobility Scale (CB&M). Physiother Can 2011;63:199–208. [CrossRef]

18. Gordt K, Mikolaizak AS, Nerz C, et al. Community Balance and Mobility Scale --German version. Z Gerontol Geriatr 2018:1–9. [CrossRef]

19. Beaton DE, Bombardier C, Guillemin F, Ferraz MB. Guidelines for the process of cross- cultural adaptation of self-report measures. Spine 2000;25:3186–3191. [CrossRef]

20. Berg K, Wood-Dauphine S, Williams JI, Gayton D. Measuring balance in the elderly: preliminary development of an instrument. Physiother Can 1989;41:304–311. [CrossRef]

21. Terwee CB, Bot SD, de Boer MR, et al. Quality criteria were proposed for measurement properties of health status questionnaires. J. Clin Epidemiol 2007;60:34–42. [CrossRef]