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Cross-Cultural Adaptation and Validation of the Balance in Daily Life Scale in Frail Older Adults: A Turkish Study

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Research Article

Keywords: Balance in Daily Life Scale, frail older adults, balance, psychometric properties, validity, reliability

Posted Date: October 9th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-10899901/v1

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Additional Declarations: No competing interests reported.

Abstract

Aim

This study aimed to adapt the Balance in Daily Life Scale (BDL) into Turkish for frail older adults and to evaluate its validity and reliability.

Methods

This methodological study was conducted between May and July 2025 with 330 frail older adults who attended the Physical Therapy and Rehabilitation Clinic of a state hospital in eastern Türkiye. Data were collected using a Demographic Information Form and the Balance in Daily Life Scale. Content validity, construct validity, internal consistency, and test–retest reliability were evaluated.

Results

The Kaiser–Meyer–Olkin (KMO) value was 0.889, and Bartlett's test of sphericity was statistically significant ($\chi^2 = 1459.248$, $p < 0.001$). Confirmatory factor analysis supported the original seven-item, unidimensional structure of the BDL, with factor loadings ranging from 0.510 to 0.860. The model demonstrated acceptable-to-excellent fit ($\chi^2/df = 2.85$, RMSEA = 0.072, CFI = 0.99, SRMR = 0.027, TLI = 0.98, and RMR = 0.022). Internal consistency was high, with Cronbach's $\alpha = 0.900$ and McDonald's $\omega = 0.873$. Test–retest reliability was also excellent ($r = 0.965$, $p < 0.001$; ICC = 0.982), and no statistically significant difference was found between the first and second administrations ($p = 0.246$).

Conclusion

The Turkish version of the BDL retained the original seven-item, unidimensional structure and demonstrated satisfactory validity, high internal consistency, and excellent temporal stability. The scale may be used as a valid and reliable instrument for assessing balance during daily-life activities among frail older adults in Türkiye.

1. Introduction

Ageing is a natural process characterised by progressive problems that bring about many changes in physiological, psychological and sociological spheres [1]. Frailty in old age is a geriatric syndrome in which the physiological reserves of the individual decrease, functional capacity declines, and the individual becomes sensitive to even minor stressors. This change is particularly evident in frail older adults, and their sensitivity to stressors increases. As a result, frail older adults become more vulnerable to individual and environmental stimuli and the disrupted homeostatic balance leads to problems in all functional areas [2–4]. This situation particularly affects cognitive functions, leading to a decline in

mental performance and memory loss over time [5]. On the other hand, sarcopenia, energy loss and other musculoskeletal problems that occur pave the way for trauma and negatively affect all functional areas of individuals [5–8]. Sensory impairments such as vision and hearing loss, which are common in frail older adults, cause posture and balance disorders [9]. This impairs the existing performance of individuals and makes walking and balance control difficult [9, 10]. This process limits the independence of frail older adults and makes it difficult for them to maintain their daily lives [1, 11]. Increased physical weakness during the frailty period leads to impairments in basic functions such as eating and walking, thereby increasing physical dependence [12]. Increased dependence on daily living activities causes psychological problems such as anxiety, depression, and insomnia as well as impaired social functioning in vulnerable individuals [13–15]. As a result of all these negative factors, functional capacity and life quality of individuals decrease; consequently, balance in daily living activities is also impaired [16]. Balance is the strongest determinant in performing daily living activities in frail older adults [17]. Balance directly affects walking and overall movement performance in older adults; therefore, maintaining balance and preventing falls is crucial for preserving daily life activities [18]. Studies have shown that older adults with high levels of balance are more independent in their daily activities, they experience fewer symptoms, and they have a higher quality of life [19, 20]. However, physiological losses that occur with age impair balance and increase the risk of trauma [21, 22]. This situation causes frail older people to face more health problems and repeated, long-term hospitalisations, which increases care costs and mortality rates [2–4]. All these negative factors make it even more important to protect older people and increase their independence [1].

Therefore, assessing balance in daily life activities in frail older adults by using objective and reliable tools is of great importance in both clinical practice and the rehabilitation process. Accurate assessment of balance in daily life activities contributes to preventing recurrence of trauma, increasing the effectiveness of the rehabilitation process, and facilitating the reintegration of individuals into their environment. The current scale can be used to assess motor functions such as memory, visual and auditory attention, postural adaptation, walking, rotation, and sitting [23]. However, there is no measurement tool specifically developed to assess balance in daily life among frail older adults in Turkey. In light of this information, it is important to adapt the Balance in Daily Life Scale for older adults into Turkish. This study was conducted to test the validity and reliability of the *“Balance in Daily Life Scale (BDL)”* for older adults into Turkish.

2. Methods

2.1. Design

This methodological study was conducted to adapt the Balance in Daily Life Scale (BDL) into Turkish and to evaluate its psychometric properties in frail older adults.

2.2. Participants and Sample

The study population consisted of older adults who attended the Physical Therapy and Rehabilitation Clinic of a state hospital in eastern Türkiye between May and July 2025. Participants were eligible for inclusion if they were aged 65 years or older, had a total score of 7–10 on the Edmonton Frailty Scale, were able to walk 20 m independently while bearing their full weight on both feet with or without a walking aid, had no significant praxis impairment that could prevent them from completing the tasks, were able to understand simple instructions, and had no major memory impairment [24]. During the study period, 620 individuals were screened for eligibility. Of these, 230 were excluded because they did not meet the eligibility criteria, including being younger than 65 years, inability to understand simple instructions, or the presence of significant memory impairment. Additionally, there were 60 individuals who declined to be a part of the research project. Consequently, the study was completed with 330 participants who met the eligibility criteria and completed the assessment. It is suggested that the sample size be a minimum of five to ten times the number of elements, according to the literature that deals with scale adaptation [25, 26]. As the BDL consists of seven items, this criterion corresponds to a sample size of 35–70 participants. Therefore, the final sample of 330 participants was considered adequate for the psychometric analyses.

2.3. Data Collection Tools

Data collection tools of the study consisted of the *"Demographic Information Form"* and the *"Balance in Daily Life Scale"*.

2.3.1. Demographic Information Form: This form includes a total of 13 questions, such as participants' gender, age, educational status, alcohol and smoking consumption status, marital status.

2.3.2. Balance in Daily Life Scale (BDL): The Scale was developed by De Labachelerie et al. in 2024 to evaluate physical balance during daily life activities. The BDL consists of seven performance-based tasks. Each task is rated on a four-point rating scale as normal (1), adequate (2), abnormal (3), or very abnormal (4) [23]. Due to the prevalence of health problems (hearing impairment, osteoarthritis, etc.) in older individuals, the proposed scoring system allows for the calculation of a score if at least four of the seven recommended items are completed. Calculation of the scale: Score = total test responses × [7 / (number of completed and scored items)].

2.4. Adaptation process

The Turkish adaptation of the BDL was conducted in three stages. In the first stage, the original seven-item scale was independently translated from English into Turkish by two language experts proficient in English. The Turkish version was then evaluated for content validity by a panel of 10 experts, including one Turkish language specialist, two psychologists, two public health nursing specialists, two fundamentals of nursing specialists, and three internal medicine nursing specialists. Based on expert evaluations, minor revisions were made to improve linguistic clarity and expression; however, no items were removed because the content validity index of each item was above 0.80. Following these revisions, the Turkish version was back-translated into English by two English language experts. Comparison of the original and back-translated versions indicated semantic consistency. In the second

stage, a pilot application was conducted with 30 participants [26, 27]. Corrected item-total correlation coefficients and Cronbach's alpha internal consistency coefficient were evaluated. Corrected item-total correlations above 0.30 and a Cronbach's alpha coefficient above 0.70 were considered acceptable. No items were removed because all item-total correlations and the reliability coefficient exceeded the predefined threshold values. In the final stage, the Turkish version of the BDL was administered face-to-face in the clinical setting. Participants performed the seven daily-life tasks included in the BDL, and their performance was evaluated according to the standardized scoring criteria of the scale. During the face-to-face assessments, the researchers recorded the participants' data and BDL scores directly into Google Forms. Thus, Google Forms was used only as a data-recording tool during face-to-face data collection and not as a self-administered online survey. Data obtained from 330 participants were used for confirmatory factor analysis to evaluate the construct validity of the Turkish version.[28, 29]. n addition, the BDL was re-administered to 30 participants after a 15-day interval to assess test–retest reliability [26, 30].

2.5. Statistical Analysis

Data collected face-to-face and recorded in Google Forms by the researchers were exported to Microsoft Excel and subsequently transferred to IBM SPSS Statistics version 27 for statistical analysis. Descriptive statistics were expressed as number, percentage, mean, standard deviation, minimum, and maximum values, as appropriate. Content validity was evaluated using the item-level Content Validity Index (I-CVI) and Scale-level Content Validity Index (S-CVI). The suitability of the data for factor analysis was assessed using the Kaiser–Meyer–Olkin (KMO) measure and Bartlett's test of sphericity. A KMO value of ≥ 0.60 and a statistically significant Bartlett's test were considered indicative of suitability for factor analysis [26]. Because the original BDL has an established seven-item, unidimensional structure, confirmatory factor analysis (CFA) was performed using LISREL without conducting exploratory factor analysis. Model fit was evaluated using χ^2/df, the Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), Tucker–Lewis Index (TLI), Standardized Root Mean Square Residual (SRMR), and Root Mean Square Residual (RMR) [26, 28, 29, 31]. Internal consistency reliability was evaluated using Cronbach's alpha and McDonald's omega coefficients and corrected item-total correlations. Cronbach's alpha and McDonald's omega coefficients of ≥ 0.70 and corrected item-total correlations of ≥ 0.30 were considered acceptable [26, 32]. Temporal stability was evaluated using test–retest analysis in 30 participants at a 15-day interval. The relationship between the first and second measurements was evaluated using Pearson's correlation coefficient, differences between the mean scores were examined using the paired-samples t-test, and test–retest reliability was further assessed using the intraclass correlation coefficient (ICC). Statistical significance was set at $p < 0.05$.

2.6. Ethical Considerations

Ethical approval

for the study was obtained from the Fırat University Non-Interventional Research Ethics Committee (No. 2025/07 – 04). Institutional permission was also obtained from the hospital where the study was

conducted. Permission to adapt the BDL into Turkish was obtained from the developer of the original scale via email. The study was conducted in accordance with the principles of the Declaration of Helsinki. Participants were informed about the purpose and procedures of the study, and verbal consent was obtained before data collection.

3. Results

The mean age of the participants was 69.40 ± 5.96 years, and the mean duration since chronic disease diagnosis was 4.70 ± 6.75 years. Of the participants, 54.5% were female, 86.4% were married, 39.1% were primary school graduates, and 78.8% reported an income equal to their expenses. In addition, 38.2% lived with their spouse and children, 71.5% did not smoke, and 96.4% did not consume alcohol. Overall, 64.8% had at least one chronic disease, 72.4% did not require assistance with daily activities, and 35.5% had been hospitalized once during the previous year (Table 1).

3.1. Validity Findings

3.1.1.Content Validity

The content validity values for the items in the current study ranged from 0.90 to 1.00, and the scale's overall content validity value was determined to be 0.99.

3.1.2. Construct Validity

Before conducting factor analysis, the suitability of the data was assessed using the Kaiser–Meyer–Olkin (KMO) measure and Bartlett's test of sphericity. The KMO value was 0.889, and Bartlett's test of sphericity was statistically significant ($\chi^2 = 1459.248$, $p < 0.001$), indicating that the data were suitable for factor analysis. Because the original BDL has an established seven-item, unidimensional structure, confirmatory factor analysis (CFA) was performed directly without conducting exploratory factor analysis (EFA). The CFA results showed that factor loadings ranged from 0.510 to 0.860, supporting the original unidimensional structure of the Turkish version of the BDL (Table 2).

3.1.2.1. Confirmatory Factor Analysis

Confirmatory factor analysis demonstrated an acceptable-to-excellent fit for the unidimensional structure of the Turkish version of the BDL. The model fit indices were $\chi^2 = 31.43$ (df = 11, $p < 0.05$), $\chi^2/df = 2.85$, RMSEA = 0.072, CFI = 0.99, SRMR = 0.027, TLI = 0.98, and RMR = 0.022 (Table 3). The path diagram of the factor structure is presented in Figure 1.

3.2. Reliability findings

The Cronbach's alpha coefficient for the total BDL was 0.900, and the McDonald's omega coefficient was 0.873, indicating high internal consistency. Corrected item-total correlation coefficients ranged from

0.516 to 0.786, with all values exceeding the recommended threshold of 0.30 (Table 2).

Test–retest reliability was evaluated in 30 participants at a 15-day interval. The correlation between the first and second administrations was high and statistically significant ($r = 0.965$, $p < 0.001$). In addition, there was no statistically significant difference between the mean scores obtained at the first and second administrations ($t = 1.185$, $p = 0.246$). The intraclass correlation coefficient (ICC) was 0.982, indicating excellent test–retest reliability (Table 4).

4. Discussion

Balance impairment is an important clinical concern in frail older adults because age-related physiological changes, declining functional capacity, and reduced psychomotor performance may increase the risk of falls and limitations in activities of daily living [23, 33]. Therefore, valid and reliable instruments that assess balance within the context of everyday activities are important for both clinical assessment and rehabilitation. The present study evaluated the psychometric properties of the Turkish version of the Balance in Daily Life Scale (BDL), which assesses balance performance across seven routine daily-life tasks. The findings demonstrated that the Turkish BDL retained the original unidimensional structure and showed satisfactory validity and reliability among frail older adults.

Content validity is an important component of cross-cultural scale adaptation because it evaluates whether the translated items adequately represent the intended construct and are appropriate for the linguistic and cultural characteristics of the target population [34, 35]. I-CVI and S-CVI values of ≥ 0.80 are generally considered acceptable indicators of content validity [36, 37]. In the present study, the I-CVI values ranged from 0.90 to 1.00 and the S-CVI was 0.99. These findings indicate a high level of agreement among the experts and support the linguistic, cultural, and conceptual appropriateness of the Turkish version of the BDL [36, 38, 39].

The suitability of the data for factor analysis was evaluated using the Kaiser–Meyer–Olkin (KMO) measure and Bartlett's test of sphericity. A KMO value greater than 0.60 and a statistically significant Bartlett's test are generally considered indicative of adequate data for factor analysis [40, 41]. In the present study, the KMO value was 0.889 and Bartlett's test of sphericity was statistically significant ($\chi^2 = 1459.248$, $p < 0.001$), indicating that the data were suitable for factor analysis. Because the original BDL has an established seven-item, unidimensional structure, confirmatory factor analysis (CFA) was performed directly without conducting exploratory factor analysis. Factor loadings ranged from 0.510 to 0.860, and all items exceeded the recommended threshold of 0.40 [42] Thus, none of the items required removal, and the original seven-item structure was retained in the Turkish version.

The CFA findings further supported the construct validity of the Turkish BDL. The model demonstrated acceptable-to-excellent fit, with $\chi^2/df = 2.85$, RMSEA = 0.072, CFI = 0.99, SRMR = 0.027, TLI = 0.98, and RMR = 0.022. According to commonly used model-fit criteria, χ^2/df values below 5 and RMSEA values below 0.08 indicate acceptable fit, whereas CFI and TLI values above 0.95 and SRMR values below 0.05

indicate excellent fit [26, 28, 29, 31]. Taken together, these findings demonstrate that the original unidimensional structure of the BDL was adequately reproduced in the Turkish sample.

Reliability analyses also provided strong evidence for the internal consistency of the Turkish BDL. Cronbach's α was 0.900 and McDonald's ω was 0.873, indicating high internal consistency. In the original study, Cronbach's α was reported as 0.86 [23]. The reliability coefficient obtained in the present study was therefore comparable to, and slightly higher than, that reported for the original version. In addition, corrected item-total correlation coefficients ranged from 0.516 to 0.786. Since all values exceeded the commonly recommended threshold of 0.30, each item contributed adequately to the overall measurement construct[43]

The temporal stability of the Turkish BDL was also supported by the test–retest findings. The scale was re-administered to 30 participants after a 15-day interval, and a high positive correlation was observed between the first and second administrations ($r = 0.965$, $p < 0.001$). Furthermore, there was no statistically significant difference between the mean scores obtained at the two measurement points ($t = 1.185$, $p = 0.246$). The ICC was 0.982, which indicates excellent test–retest reliability according to established criteria [44]. These findings demonstrate that the Turkish version of the BDL produces stable and consistent scores over time

4.1. Limitation of the study

This study has several limitations. First, the study was conducted in a single clinical center and included frail older adults who met specific functional and cognitive eligibility criteria. Therefore, the findings may not be generalizable to older adults with different levels of frailty, functional capacity, or cognitive status, or to populations receiving care in other clinical settings and geographic regions.Second, the present study primarily evaluated the factorial structure, internal consistency, and temporal stability of the Turkish BDL. Convergent or criterion validity was not examined using other established performance-based balance measures. Future studies should therefore evaluate the relationships between the Turkish BDL and established balance or mobility measures and investigate its predictive validity for clinically relevant outcomes such as falls and functional decline. Finally, further studies involving multicenter samples and older adults with different levels of frailty are recommended to provide additional evidence regarding the broader applicability and psychometric performance of the Turkish BDL

5. Conclusion

The Turkish version of the BDL is a seven-item, unidimensional instrument that demonstrated satisfactory validity and reliability for assessing balance during daily-life activities among frail older adults. The original factor structure was retained, and the scale showed high internal consistency and excellent temporal stability.

The Turkish BDL may provide healthcare professionals and researchers with a brief and practical instrument for assessing balance performance during routine daily-life activities in frail older adults. It

may be useful in clinical assessment, rehabilitation planning, and research involving balance and functional performance in this population. Further studies in different clinical settings and frailty groups are recommended to confirm its broader applicability and predictive validity.

Declarations

Ethics approval and consent to participate

The Ethics Committee of a university (2025/07 – 04) gave their approval, and the hospital where the research was carried out gave their institutional authorization. Both of these approvals were received.

Consent to Participate

All participants were informed about the purpose and procedures of the study prior to participation. Verbal informed consent was obtained from all human participants before they were included in the study.

Consent for publication

Not applicable.

Clinical trial number

not applicable

Competing interests

The authors declare that they have no competing interests.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Author Contribution

GBT: Conceptualization, Methodology, Investigation, Writing – original draft, Writing – review & editing. Supervision ZÖ: Conceptualization Investigation, Writing – original draft,Writing – ŞK: Conceptualization Investigation, Writing – original draft,Writing –

Acknowledgement

GBT: Conceptualization, Methodology, Investigation, Writing – original draft, Writing – review & editing. Supervision ZÖ: Conceptualization Investigation, Writing – original draft,Writing – ŞK: Conceptualization Investigation, Writing – original draft,Writing

Data Availability

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Tables

Table 1. Descriptive characteristics of the participants

Characteristics	Number (n=330)	%
Gender		
Female	180	54.5
Male	150	45.5
Marital status		
Married	285	86.4
Single	45	13.6
Educational status		
Literate	71	21.5
Primary education	129	39.1
Secondary education	52	15.8
High school	58	17.6
Undergraduate	20	6.1
Income status		
Income<expense	48	14.5
Income=expense	260	78.8
Income>expense	22	6.7
The person participant lives with		
Alone	35	10.6
Spouse	101	30.6
Children	38	11.5
Spouse and children	126	38.2
Spouse, children, daughter-in-law, grandchildren	30	9.1
The status of smoking		
Yes	94	28.5
No	236	71.5
The status of consuming alcohol		
Yes	12	3.6
No	318	96.4
Body Mass Index		

Low	31	9.4
Normal	205	62.1
High	94	28.5
Presence of chronic disease		
Yes	214	64.8
No	116	35.2
Need for support in daily tasks		
Yes	91	27.6
No	239	72.4
The status of being hospitalized within the past year		
Never	21	6.4
Once	117	35.5
Twice	104	31.5
Three times and more	88	26.6
	Mean±SD	Min-Max
Years since the diagnosis of the existing disease	4.70±6.75	0-50
Age (yr)	69.40±5.96	65-90

Table 2. Mean, Item Correlation Coefficient, and CFA Factor Loadings Results

Scale Items		Mean±SD	Corrected Item-total Correlations	**Factor Load Value**
				BDL
Item 1	Picking up the phone when it rings (While doing something else)	1.95± 0.93	0.516	0.510
Item 2	Carrying a shopping bag (Walking at least 10 metres with a load weighing at least 2 kg)	2.12± 0.92	0.749	0.840
Item 3	Entering and leaving a room (when the door is open or closed)	1.68± 0.80	0.708	0.740
Item 4	Setting a table for four (Preparing items such as plates and glasses at hip and eye level)	2.09± 1.01	0.690	0.700
Item5	Moving a chair (moving a chair 2 metres away closer to the table)	1.81± 0.88	0.758	0.860
Item6	Sitting down and standing up from a chair (A chair without armrests, without support)	1.85± 0.91	0.751	0.770
Item7	Carrying a pot filled with water (10 cm above knee height and three-quarters full)	2.11± 1.00	0.786	0.820
Cronbach's alpha : 0.900				
Omega reliability values: 0.873				

Table 3. Confirmatory Factor Analysis Results

Fit criteria	Found	Appropriate	Acceptable	Sonuç
x^2/df (**CMIN/DF**)	2.85	<2	<5	Acceptable fit
RMSEA	0.072	<0.05	<0.08	Acceptable fit
CFI	0.99	>0.95	>0.90	Excellent fit
SRMR	0.027	<0.05	<0.08	Excellent fit
RMR	0.022	<0.05	<0.08	Excellent fit
TLI	0.98	>0.95	>0.90	Excellent fit

CFI: Comparative Fit Index; RMSEA: Root Mean Square Error of Approximation; RMR: Root Mean Square Residual; SRMR: Standardized Root Mean Square Residual; TLI: Tucker Lewis Index

Table 4. Test-retest results and mean scores (n=30)

Scale	Scale Score Means		Analysis Results				
	First Implementation X ± SD	Second Implementation X ± SD	r	p	t	p	ICC
BDL Total	1.86±0.50	1.83±0.48	0.965	<0.001	1.185	0.246	0.982

BDL = Balance in Daily Life Scale; r = Pearson correlation coefficient; t = paired-samples t-test; ICC = intraclass correlation coefficient.

Figures

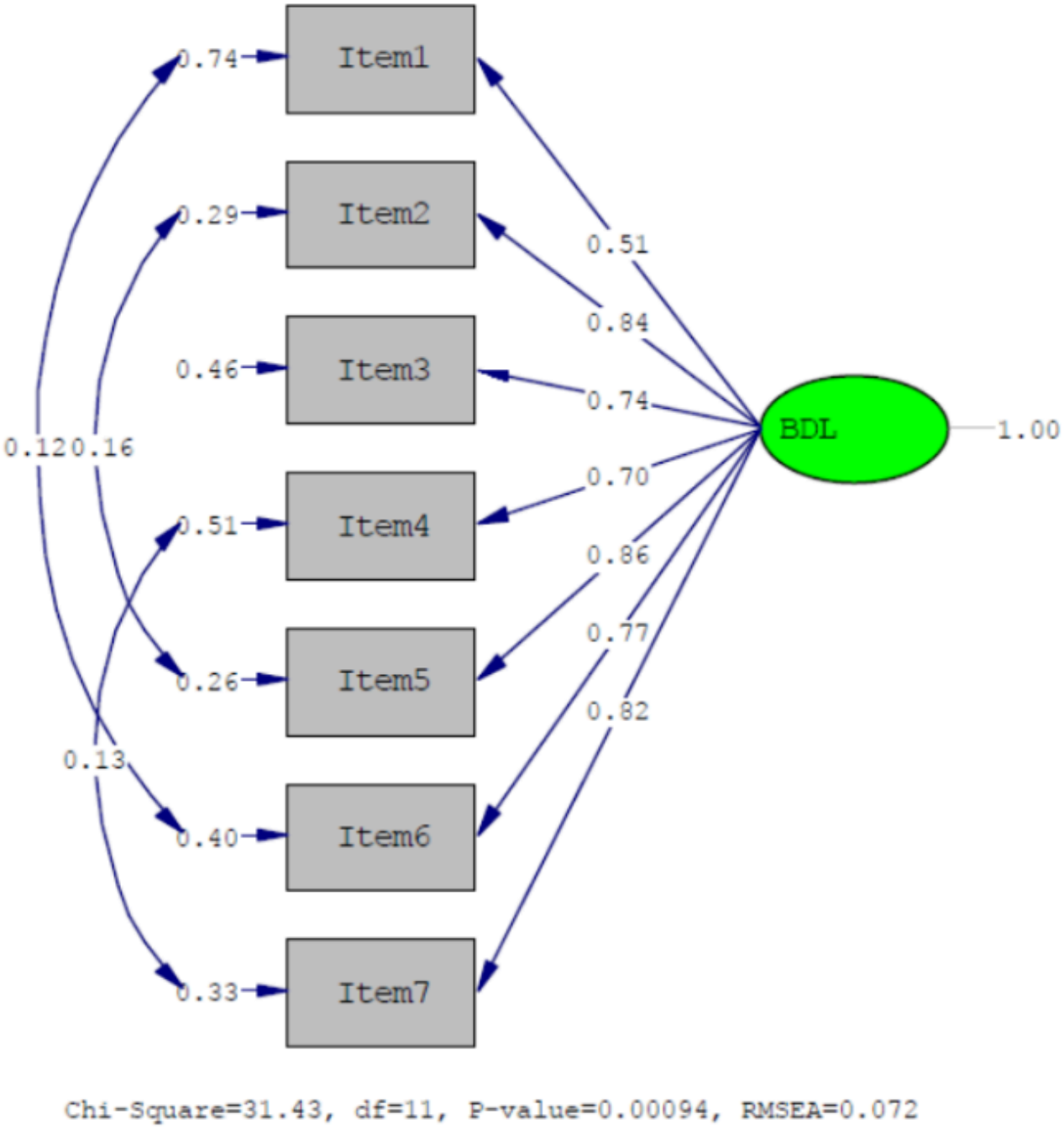


Figure 1

PATH Diagram Regarding the Factor Structure of the Scale