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Research Article

Adaptation of the Physical Literacy Scale for Adults into Turkish and Examination of its Psychometric Properties

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Abstract

Physical literacy is a multidimensional construct encompassing physical competence, motivation, confidence, knowledge, and understanding, enabling individuals to engage in lifelong physical activity. This study aimed to adapt the Physical Literacy Scale for Adults (PLAS), originally developed by Naylor, et al. (2024), into Turkish and to evaluate its psychometric properties. The study used a convenience sampling method to include 454 adult participants (40.1% female, 59.9% male; mean age = 30.38 years). The translation process employed the translation–back translation technique, ensuring semantic and conceptual equivalence. Construct validity was examined through exploratory factor analysis (EFA) and confirmatory factor analysis (CFA), while internal consistency was assessed using Cronbach's alpha. The EFA revealed a five-factor structure—Motivation, Social, Confidence, Physical (Coordination and Strength), and Knowledge—explaining 64.64% of the total variance. The CFA results indicated acceptable model fit (χ^2/df = 2.062, RMSEA = .06, CFI = .90, GFI = .85, SRMR = .07). Cronbach's alpha coefficients ranged from .76 to .87 across subscales, with an overall reliability of .88. These findings suggest that the Turkish version of PLAS is a valid and reliable instrument for assessing physical literacy in adult populations.

Introduction

Physical literacy has emerged as a key concept in promoting lifelong participation in physical activity [1-5]. Defined as a multidimensional construct that combines physical competence, Motivation, self-confidence, Knowledge, and understanding, physical literacy provides individuals with the tools to make informed and autonomous decisions about engaging in physical activity throughout their lives [6-9]. Rather than focusing solely on physical performance, this concept adopts a holistic perspective that emphasizes personal development, well-being, and the adaptability of movement skills to various environments and challenges [10-12]. In this context, physical literacy plays a critical role in shaping healthy behaviours, supporting mental and emotional resilience, and encouraging long-term engagement in physical activity [13-17].

The growing global prevalence of sedentary lifestyles, chronic diseases, and mental health issues has led to increasing emphasis on the importance of active living beyond childhood and adolescence [18-21]. However, although the physical literacy literature strongly emphasizes youth development, the adult population remains underrepresented. Adults face unique challenges that may hinder their ability to engage regularly in physical activity, such as time constraints, reduced leisure opportunities, and other life responsibilities [22-24]. Therefore, understanding the physical literacy profiles of adult individuals is crucial for effectively guiding public health strategies, targeted interventions, and policy development processes.

Over the past two decades, the theoretical foundations of physical literacy have evolved into a multidimensional construct that emphasizes the interaction between physical, psychological, cognitive, and social domains [25-27]. However, efforts to assess and quantitatively measure physical literacy in adults remain limited and inconsistent. Most existing measurement tools are adapted from scales designed for children or focus solely on one or two dimensions of physical literacy. Consequently, there is still a lack of comprehensive and psychometrically valid measurement tools specifically developed for the adult population. Furthermore, only a few existing tools have been adapted to languages other than English, restricting their global applicability.

As in many other countries, promoting an active lifestyle among adults is a public health priority in Türkiye. National studies indicate a significant decline in individuals' participation in physical activity during the transition to

adulthood, which is associated with an increase in obesity, cardiovascular diseases, and other preventable health problems [28-32]. Therefore, culturally appropriate tools are needed to accurately assess physical literacy to design effective intervention programs and monitor the process. These tools should reflect the multidimensional nature of physical literacy and be sensitive to the population's cultural, social, and behavioural characteristics.

In line with this need, the present study aims to adapt the Physical Literacy in Adults Scale (PLAS) into Turkish and to evaluate its psychometric properties across various adult samples [33]. In this process, the translation of the scale into Turkish, back-translation, and cultural adaptation steps was carried out meticulously, followed by analyses of statistical properties such as reliability, internal consistency, and construct validity. This study aims to develop a valid Turkish version of the original scale that preserves its theoretical integrity while adapting it to the Turkish context. Furthermore, validating this scale is expected to significantly contribute to future research, program evaluations, and policy development efforts, thereby supporting the promotion of lifelong physical activity participation in Türkiye.

Method

This section includes the characteristics of the study group and the details of the scale adaptation process.

Research design

This is a scale adaptation study. The data obtained were examined for expert validity, construct validity, multiple correlations, and internal consistency.

Study group

The study group in this research was formed using a convenience sampling method. Convenience sampling, which is based on accessibility and practicality, is often preferred to quickly collect data on certain research topics [34]. The sample group comprised 40.1% female (n = 182) and 59.9% male (n = 272) participants. The participants ranged in age from 18 to 71. The average age of the participants was 30.38 years (Table 1).

There is no consensus in the literature regarding the appropriate sample size for validity and reliability scale studies [35]. While some studies argue that a sample of 100 participants is sufficient to determine the factor structure [36], others suggest that the sample size should range between 100 and 250 participants [37]. Additionally, some sources state that a sample size including five participants per item is adequate [38].

Table 1: Demographic Characteristics of the Participants.

Variable	Category	*n*	%	Age Range	Mean Age
Gender	Female	182	40.1%		
	Male	272	59.9%		
Total		454	100%	18–71	30.38

In this study, the number of participants reached for conducting factor analyses meets both the absolute criteria and the recommendations of Kline [39], who suggests having at least twice as many participants as the number of items, as well as Tavşancıl's [38] criterion of five participants per item. Therefore, it can be concluded that the sample size obtained in this study is sufficient for performing the necessary factor analyses for the scale.

The Istanbul Aydın University Ethics Committee approved the study, Faculty of Social and Human Sciences (Meeting No: 2024/11, Date: 18.10.2024).

Data collection tools

For the Turkish adaptation study of the "Physical Literacy Scale for Adults," the "Physical Literacy Scale for Adults (PLAS)" developed by Naylor, et al. [33] was used.

Physical Literacy Scale for Adults (PLAS)

The Physical Literacy Scale for Adults (PLAS) was developed in 2024 by Naylor, et al. As a result of the exploratory and confirmatory factor analyses conducted by Naylor, et al. [33], a six-factor, 23-item model with a good fit was obtained. The model demonstrated good fit in both the exploratory analysis ($\chi^2(130) = 254.770$, $p < 0.001$; TLI = 0.965; RMSEA = 0.040 (95% CI: 0.031, 0.049)) and the confirmatory analysis ($\chi^2(130) = 252.005$, $p < 0.001$; TLI = 0.957; RMSEA = 0.046 (95% CI: 0.036, 0.056)). In this context, the Physical Literacy in Adults Scale – PLAS) was presented as a valid psychometric measurement tool for individuals aged 18 to 75. The PLAS aims to provide a holistic assessment by covering the four core domains of physical literacy: physical, psychological, social, and cognitive.

Translation process: Adapting the Physical Literacy Scale for Adults into Turkish began with gathering information about the original scale. The scale developers were contacted via email to request permission to adapt to Turkish, and the necessary approval was obtained. The translation–back translation method was adopted for the adaptation process. In this context, the 23-item scale was first translated into Turkish by the researchers and then independently translated by three experts in the field. The researcher's translation was compared with the experts to evaluate consistency in terms of language and meaning.

Two experts with advanced English proficiency then back-translated the Turkish draft of the scale into English and compared this version with the original scale. The researcher and translators jointly examined the original and back-

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translated items for semantic equivalence and concluded that the conceptual integrity between both versions was preserved.

The finalised Turkish scale draft was presented to four field experts for evaluation of its adequacy in measuring physical literacy in adults. Based on the expert feedback, the scale's content validity was established. The positive evaluations from all experts indicated that the Turkish version of the scale was ready for validity and reliability analyses. Note: Item 16 ("I am not physically strong") was reverse-scored to ensure consistency with the intended direction of the Physical subscale. This adjustment aligns the scoring with the theoretical framework of the scale, ensuring accurate interpretation during analysis. This process also supports the scale's content validity based on expert opinion.

Data analysis

All participants were informed about the study's objectives before analysis, and informed consent was obtained. Data analysis was conducted using SPSS version 25 and AMOS software. The dataset was initially screened for errors, outliers, violations of normality assumptions, and multicollinearity. No anomalies were detected during this preliminary inspection.

Exploratory Factor Analysis (EFA) was performed using the principal component analysis method with varimax rotation to examine construct validity. Factors with eigenvalues greater than 1 were retained, in line with standard practice [40]. Internal consistency was assessed through Cronbach's alpha coefficients to determine the reliability of the scale and its sub-dimensions.

Subsequently, Confirmatory Factor Analysis (CFA) was conducted using AMOS to test the structural validity of the factor model derived from the EFA. The following model fit indices were evaluated: chi-square to degrees of freedom ratio (χ^2/df), Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), Normed Fit Index (NFI), Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), Incremental Fit Index (IFI), and Standardized Root Mean Square Residual (SRMR). A χ^2/df ratio below 5 indicates an acceptable fit, while values below 2.5 suggest an excellent fit [41]. RMSEA values below .06 indicate a high level of model fit, and values up to .10 are considered acceptable. CFI, NFI, and IFI values close to or above .90 denote good model fit, while GFI and AGFI values above .90 further support model adequacy [42,43]. Additionally, SRMR values below .08 indicate a satisfactory model fit [41]. Criterion validity was assessed through Pearson product-moment correlation coefficients, examining the relationships between the total scale score and its sub-dimensions.

Findings

Findings regarding the validity and reliability study of the physical literacy scale for adults.

Factor analysis and Varimax rotation techniques determined the scale's construct validity. The factor analysis results are presented in Table 2.

Note: The following table presents factor loadings after Varimax rotation, with items grouped under their respective subscales (Motivation, Social, Confidence, Physical [Coordination & Strength], and Knowledge). This layout is intended to enhance clarity for readers and improve interpretability for future users of the scale.

As part of the validity analyses, the Kaiser–Meyer–Olkin (KMO) measure was calculated to determine sampling adequacy and was found to be .861. This value indicates that the data are adequately suited for factor analysis. Additionally, Bartlett's Test of Sphericity was found to be significant [$\chi^2(253) = 2630.017$, $p < .001$], indicating that the relationships among the variables are sufficient for conducting factor analysis.

The exploratory factor analysis (EFA) obtained a five-factor structure with eigenvalues greater than 1. This structure explains 64.64% of the total variance. The factor loadings of the five-factor scale ranged from .52 to .90.

When examining the Cronbach's alpha internal consistency coefficients for the factors, Motivation = .87, Social = .80,

Table 2: Factor Analysis Results of the Physical Literacy Scale for Adults.

Item No	Factor Common Variance	Motivation	Social	Confidence	Coordination & Strength	Knowledge
1	.69	.76				
2	.59	.66				
3	.68	.79				
4	.70	.72				
5	.68	.70				
6	.71		.78			
7	.78		.85			
8	.77		.85			
9	.38		.58			
10	.55			.52		
11	.52			.67		
12	.71			.83		
13	.54			.67		
14	.61			.74		
15	.58				.67	
16	.43				.59	
17	.59				.70	
18	.73				.80	
19	.77				.76	
20	.60				.65	
21	.79					.86
22	.82					.90
23	.56					.66
Total Explained Variance: % 64.64		16.01	14.83	12.25	11.85	9.67
Cronbach's alpha – Total scale: .86		.87	.80	.76	.84	.79
KMO: .861 Bartlett's Test of Sphericity [X^2 = 2630,017 sd=253 p = .000].						

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Confidence = .76, Coordination and Strength (Physical) = .84, and Knowledge = .79, the overall reliability of the scale was determined to be .86.

Confirmatory Factor Analysis (CFA) Results

A confirmatory factor analysis (CFA) was conducted to determine how well the five-factor structure of 23 items revealed through exploratory factor analysis fit the collected data. The results of the CFA for the scale are presented in Table 3.

Table 3 presents findings related to the confirmatory factor analysis (CFA). Based on the analysis, the chi-square value (χ^2 = 453.740) and the degrees of freedom (df = 220) yielded a χ^2/df ratio of 2.062. This value indicates that the model is an adequate fit for the data.

When evaluating the fit indices, the RMSEA was calculated as .06, which falls within acceptable limits. The CFI value was .90, the GFI value was .85, and the AGFI value was .85. Additionally, the SRMR value was .07. The IFI value was .90, further supporting the adequacy of the model's overall fit. These findings demonstrate that the five-factor structure obtained through confirmatory analysis is statistically acceptable.

Figure 1 presents further details on the structural relationships of the model. The figure includes the factor loadings of the items on their respective latent variables and the correlation coefficients among the factors. The correlation coefficients between the five factors in the model ranged from .39 to .91. These values indicate significant and strong relationships among the factors. Considering all these data together, the five-factor structure of the scale offers a theoretically sound and statistically adequate model.

Table 4 presents the correlation relationships between the total scale score and the sub-factors. Based on the findings, there is a positive and significant correlation between the total score and all sub-factors ($p < .01$). The highest correlation was observed between the total score and the motivation factor

Table 3: CFA Results.

X^2	sd	(x^2/sd)	RMSEA	CFI	GFI	AGFI	SRMR	IFI
453.740	220	2.062	.06	.90	.85	.85	.07	.90

Table 4: Correlation Table Between Total Scale Score and Sub-Factors

Variables	1	2	3	4	5	6
1. Total	1.00	**.82****	**.54****	**.74****	**.76****	**.60****
2. Motivation		1.00	**.40****	**.48****	**.55****	**.42****
3. Social			1.00	**.17****	**.21****	**.30****
4. Confidence				1.00	**.44****	**.31****
5. Coordination & Strength					1.00	**.41***
6. Knowledge						1.00

**$p < .01$

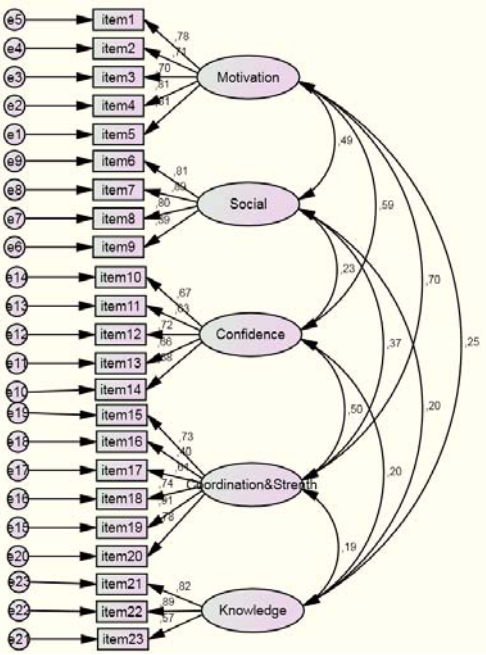

Figure 1: Path Diagram of the Physical Literacy Scale for Adults.

(r = .82). In contrast, the lowest correlation was found between the total score and the social factor (r = .54). These results support the holistic structure of the scale and indicate that the sub-factors reflect different dimensions of the physical literacy construct measured by the scale.

Discussion

This study aimed to adapt the Physical Literacy in Adults Scale (PLAS), developed by Naylor, et al. [33], into Turkish and to evaluate its psychometric properties in various adult samples. The original scale consists of 23 items and 6 factors. Higher scores on the scale indicate higher levels of physical literacy in adults. Following the analyses applied to the scale, it was observed that, unlike the original version, the "Coordination" and "Strength" factors should be considered as a single factor in the Turkish version. Based on expert opinion, using the term "Physical" for this factor in the Turkish version was deemed appropriate. Accordingly, the Turkish version consists of 23 items and 5 factors.

The Kaiser–Meyer–Olkin (KMO) value and Bartlett's Test of Sphericity were applied as part of the scale's validity study. The KMO value was found to be .861. A KMO value above .60 indicates that the data are suitable for factor analysis. Additionally, the findings from Bartlett's test show that the data come from a normal distribution (Field 2013).

As a result of the Exploratory Factor Analysis (EFA), a five-factor structure with eigenvalues above 1 was obtained, differing from the original scale. This structure explains 64.64% of the total variance. In multi-factor scales, a total variance explanation rate of 30% or more is considered

sufficient [34,41]. Additionally, the first factor explained 16.01% of the variance, the second 14.83%, the third 12.25%, the fourth 11.85%, and the fifth 9.67%. The factor loadings of the five-factor scale ranged from .52 to .90. A factor loading above .45 is considered a good criterion for scale items [34].

The Cronbach's alpha internal consistency coefficients for the factors were calculated as follows: .87 for the Motivation factor, .80 for the Social factor, .76 for the Confidence factor, .84 for the Coordination and Strength factor, and .79 for the Knowledge factor. The overall reliability of the scale was determined to be .86. Cronbach's alpha values above .70 indicate high internal consistency and reliability [44].

The first factor was named "Motivation", as in the original scale, and includes items 1–5. The second factor, also in line with the original, is defined as "Social" and includes items 6–9. The third factor is again "Confidence" and comprises items 10–14. Unlike the original, the fourth factor is named "Physical" and includes items 15–20. This factor is evaluated and scored in a single item in the original scale. Item 16 ("I am not physically strong") should be reverse scored. The fifth factor remains "Knowledge," including items 21–23. PLAS is designed to yield a total physical literacy score. It is not intended for subscale scores to be reported independently. Each item is scored according to the assigned value on the Likert scale (e.g., 1. Not at all appropriate). The participants' mean should be calculated for each subscale (1–5). After calculating the average scores, add the mean scores of all subscales to obtain the total physical literacy score. Scores can range from 4 to 35, with higher scores indicating higher physical literacy.

As a result of the Confirmatory Factor Analysis (CFA), the χ^2/df ratio was 2.062. In terms of fit indices, a χ^2/df less than 2.5 indicates excellent fit [32,45-48]. Accordingly, the fit index values show the scale has an excellent fit.

When examining other fit indices, the RMSEA value was calculated as .06, which is within acceptable limits as it is below .10 [49]. The CFI value was .90, GFI .85, AGFI .85, SRMR .07, and IFI .90—all supporting the adequacy of the model's overall fit [43,49]. These findings show that the five-factor structure obtained from the confirmatory analysis is a statistically acceptable and well-fitting model.

In the criterion validity analyses, correlation coefficients between the scale's sub-factors and the total score ranged from .17 to .82 and were statistically significant. These results indicate that the scale has a multi-component structure consisting of different factors and that the sub-factors contribute significantly to its overall structure. Based on the findings from the validity and reliability analyses of the Turkish version of the PLAS, this 23-item, five-factor scale is a valid and reliable tool for measuring physical literacy in adults.

In addition to its strong psychometric properties, the adapted Turkish version of the PLAS offers valuable opportunities for practical application. It can be utilized in community health initiatives to monitor and evaluate physical literacy trends among adults, thereby guiding public health strategies. Furthermore, the scale has the potential for integration into workplace wellness programs across various sectors in Türkiye, supporting employee well-being and engagement in physical activity. Educational institutions, particularly adult learning centres and universities, may also benefit from using the scale as part of their curricula to assess and enhance physical literacy. These practical applications reinforce the interdisciplinary relevance of PLAS and its role in promoting lifelong participation in physical activity.

Conclusion

The findings of this study demonstrate that the Turkish adaptation of the Physical Literacy Scale for Adults (PLAS) is a valid and reliable tool for assessing physical literacy among adult populations. Unlike the original six-factor structure, the Turkish version revealed a five-factor model—Motivation, Social, Confidence, Physical (Coordination and Strength), and Knowledge—supported by expert opinion and statistical analyses. The scale showed high internal consistency and acceptable model fit indices, confirming its psychometric soundness. This adapted scale fills an important gap in the literature by providing a culturally appropriate instrument to measure physical literacy in Turkish adults. It also presents practical utility in various fields, such as adult education, public health monitoring, and corporate wellness initiatives in Türkiye. It can support targeted interventions, curriculum development, and national policy efforts to enhance physical activity and health literacy in adults. It can be a valuable resource for researchers, educators, and policymakers aiming to promote lifelong physical activity and design effective health and education interventions.

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