Current Psychology (2025) 44:18772–18784
https://doi.org/10.1007/s12144-025-08402-w

Validity and reliability of the Turkish health literacy scale – Short form (THLS-SF) in the older people: a practical tool for assessment of health literacy

Hatice Simsek[1] · Celalettin Cevik[2] · Hakan Baydur[3] · İbrahim Kayabek[4] · Geylan Dogan[4] · Gizem Ay[4] · Gulten Ucan[3] · Pınar Okyay[5]

Received: 12 June 2024 / Accepted: 13 August 2025 / Published online: 7 October 2025

Abstract

Although various long and complex scales related to health literacy exist — including those that assess individuals' ability to exhibit appropriate behaviours to improve their health — there is no known short health literacy scale applicable to the general population, especially older adults. The aim of this study was to develop a short scale form that could measure health literacy levels in a practical and valid manner. During the development of the short form, methodological issues such as a decrease in validity and reliability, loss of content representation, and inconsistency across different groups were encountered. These issues were overcome through expert opinions, comprehensive psychometric analyses (EFA, CFA), the use of statistical criteria for item selection, and test applications across different demographic groups. The study is a methodological study conducted on 1094 cognitively and mentally healthy community-dwelling elderly individuals aged 65 and over. Data were collected through face-to-face interviews conducted by the researchers in participants' homes. The questionnaire included sociodemographic characteristics, Turkish Health Literacy Scale-32, World Health Organisation Quality of Life Questionnaire - Elderly Module and Barthel Activities of Daily Living Index. In the study, reliability and validity analyses of the 8-item short form of the THLS, which was formed with one item from each dimension, were conducted. Psychometric properties were analysed by applying confirmatory and explanatory approaches (item analysis, Rasch analysis, internal consistency, discriminant validity, known groups validity). 71.3% of the participants in the research group are in the 65–74 age group, 52.1% are women, 77.9% are primary school graduates, and 63.8% have an excellent health perception. The short form has a unidimensional structure, with floor and ceiling effects of 2.1% and 11.6%, respectively. Cronbach's alpha value of the form is 0.928, and the explained variance of the unidimensional structure is 66.8%. Confirmatory factor analysis summary fit values for construct validity are RMSEA = 0.007, CFI = 1.00, and $\chi 2$/sd = 1.04. The item difficulty and discrimination level of the created eight-item form are sufficient, Rasch analysis item difficulty and distribution properties are compatible, reliability is 0.93, and PSI is 3.59. Scale items do not show DIF in gender and age distributions, do not violate local independence, and have a unidimensional structure. The scale significantly correlates with THLS-32 and Barthel and WHOQOL-OLD ($p < 0.05$). The THLS-SF score significantly differed across gender, age, education level, income level, and health status ($p < 0.05$). In conclusion, the eight-item TSOY-SF created from the THLS-32 is a valid and reliable measurement tool for assessing health literacy when applied to older adults. The short form obtained saves time and reliably measures the basic dimensions of health literacy.

Keywords Health literacy · Elderly · Validity · Reliability

Extended author information available on the last page of the article

Introduction

Health literacy, which reflects an individual's cognitive and social skills, is a key determinant of health (Nutbeam & Lloyd, 2021). Adequate health literacy increases the capacity of individuals to take responsibility for protecting and improving their own and their family's health. Health literacy, socioeconomic status, age, ethnicity, social support, language proficiency, and the broader social context in which individuals live, learn, and work are all considered among the social determinants of health and are related to race and ethnicity (Cevik & Kayabek, 2022; Nutbeam & Lloyd, 2021; Sørensen et al., 2015). Inadequate health literacy is expected in the elderly population, and women and lower-educated individuals constitute the risk group within the elderly population (Selvakumar et al., 2023). Inadequate health literacy has been associated with more hospitalizations, more extended hospital stays, increased use of emergency health services and less use of preventive health services, low treatment compliance, poor general health status in elders, and high mortality (Baker et al., 1998; Fabbri et al., 2020). Recent studies have shown that low health literacy among older adults is associated with frailty and increased risk of falls (Li et al., 2024; Uemura et al., 2023). In addition, intervention studies have been conducted to improve health literacy in the elderly (Sardareh et al., 2024). For example, health Literacy intervention has been shown to significantly improve glycaemic control outcomes and renal function in older people with type 2 diabetes (Seangpraw et al., 2023). Therefore, assessing the health literacy levels of older adults is essential for both observational and interventional studies, and it is stated that this is a challenging and complex process (Smith et al., 2022).

Many tools have been developed to determine the level of health literacy. Some of these tools are used to evaluate general health literacy, and some are used to assess skills related to a specific situation (Sørensen et al., 2015). Historically, objective measures such as the Rapid Estimate of Adult Literacy in Medicine (REALM) have been used to assess health literacy among older adults followed by more comprehensive subjective measurement tools (Smith et al., 2022). There is a shift from functional health literacy to a more comprehensive definition that encompasses functional, interactive and critical health literacy. Interactive and critical health literacy tend to reflect higher cognitive and social skills compared to functional health literacy. One of these scales, the Health Literacy Survey Europe (HLS-EU) is widely used worldwide (Lim et al., 2021; Sørensen et al., 2015).

The Turkish Health Literacy Scale (THLS-32), based on the conceptual framework of the HLS-EU and developed by Okyay & Abacıgil consists of 32 items. The internal consistency coefficient of THLS-32 was found to be 0.927. It has been stated that the scale is also valid and reliable in elderly individuals (Okyay & Abacıgil, 2016). In recent studies conducted in Turkey, THLS-32 was used to determine health literacy in the elderly (Candemir et al., 2023; Cevik & Kayabek, 2022; Ugurlu et al., 2024). Despite its strong psychometric properties, the tool has certain limitations, such as a high number of items and low engagement from older adults during data collection. Another problem is that the currently used health literacy scales take a long time to respond and limit the enthusiasm of respondents and large-scale application. In addition, although there is a short form of the health literacy scale in other countries (Sun et al., 2023), there is no short form of the scale in Turkey. Developing a valid and reliable short form through this research will contribute to accurately measuring health literacy of people, especially older adults. In addition, HLS-EU has never been validated with THLS Rasch model statistics. Rasch analysis is a psychometric technique based on Item Response Theory and provides a framework for assessing the dimensionality, reliability and validity of health literacy measures, thus informing the development of more precise and accurate health literacy measures (Andrich & Marais, 2019).

Health literacy refers to individuals' ability to understand, evaluate and use health-related information, and is an important indicator of public health. Most scales developed to measure this concept are long and cumbersome to administer. This situation makes it difficult to use time and resources, especially in large-scale field studies. Therefore, there is a growing need for short and valid measurement tools. However, the process of developing a short form also presents certain challenges. Key issues such as maintaining the validity and reliability of the scale, adequately representing all dimensions, selecting appropriate items, and ensuring the consistency of the scale across different sociodemographic groups have been systematically addressed in this study. The developed short form has been designed to overcome these issues and is supported by comprehensive psychometric analyses.

The creation of a valid and reliable health literacy assessment tool with a low number of items specific to the elderly also forms the basis for research on health literacy among the elderly. The aim of this study was to develop a short scale form that could measure health literacy levels in a practical and valid manner. During the development of the short form, methodological issues such as a decrease in validity and reliability, loss of content representation, and inconsistency across different groups were encountered. The main objective of this study is to demonstrate that the short form (THLS-SF) is valid and reliable. In this context, the following hypotheses were tested:

H1: THLS-SF shows a high level of positive correlation with THLS-32. (Similar scale validity)
H2: The THLS-SF will be positively associated with functional independence (Barthel) and quality of life (WHOQOL-OLD). (Separate scale validity)
H3: THLS-SF scores will show significant differences according to sociodemographic variables such as age, gender, and education. (Known groups validity)
H4: The 8-item structure of THLS-SF will provide good fit indices in confirmatory factor analysis. (Construct validity)
H5: There will be sufficient internal consistency (Cronbach's $\alpha > 0.70$) among THLS-SF items. (Reliability).

Materials and methods

This study is a cross-sectional methodological study. The data for this study consist of responses to the THLS-32, collected as part of a project targeting older adults (BAUN BAP No: 2019/57). The responses to the 32-item form of the scale are distributed across 8 distinct dimensions, each containing 4 items. A single representative item was selected from each dimension to create the short form of the scale, and validity and reliability analyses were performed.

Participants

The study population comprised 6,580 individuals aged 65 and above, residing in urban and semi-urban neighborhoods of Balikesir city center. Considering the sample size should be at least 5–10 times the number of scale items (Floyd & Widaman, 1995), the recommendation that the smallest sample size should be 300 people in confirmatory factor analysis (Rouquette & Falissard, 2011), and also considering the cross-sectional part of the research, the population in the Epiinfo program is 6580 people a prevalence of 25% (Kobayashi et al., 2016; Talarska et al., 2016), a margin of error of 3%, a Type I error rate of 5%, and a design effect of 1.5 were assumed the sample size of 1071 people was calculated, and finally, 1094 people were reached by multistage sampling.

Inclusion and exclusion criteria

The study included people who Live in Bahcelievler and Gundogan neighborhoods in Balikesir city center, who are 65 years of age and above, who do not have sensory losses such as hearing or speech, or who have no consciousness problems that would prevent communication, and who volunteered to participate in the research.

Data collection and sampling procedures

This methodological research was conducted in two regions in Balikesir city center between August 2019 and July 2020. Approximately 2.5 individuals were planned to be selected from each street. To achieve this, two individuals were selected from streets with single-digit numbers, and three individuals were selected from streets with double-digit numbers. In total, 1,094 individuals aged 65 and above were included in the study. A systematic sampling protocol was developed. First, a random number was selected for each of the 439 streets. This selected number represented the first sample from the corresponding cluster (street). If a person aged 65 or older resided at the selected address, an interview was conducted. If not, the next household on the street was visited. After the first visit, two households were skipped, and the third household was visited. If an individual aged 65 or older resided at the selected address, an interview was conducted; otherwise, the next household on the street was visited. This systematic approach continued until the required number of individuals (2 or 3) for the specific cluster (street) was reached. If the required number of individuals could not be reached despite following the systematic approach, sampling resumed on the opposite side of the street using the same methodology. The process for sample selection and access is illustrated in Fig. 1.

Measures

The study variables included sociodemographic characteristics, quality of life, functional independence, and health literacy. Data were collected using the Sociodemographic Characteristics Form, Turkey Health Literacy Scale, World Health Organization Quality of Life Survey – Elderly Module, and Barthel Activities of Daily Living Index.

Sociodemographic characteristics form

The form is prepared based on literature that questions the characteristics of the elderly, such as age, gender, and educational status.

Turkish health literacy scale (THLS-32)

The scale, which was prepared based on the conceptual framework of the HLS-EU study developed by Okyay and colleagues, consists of 32 questions in 5-point Likert type. The scale has eight sub-dimensions, which are

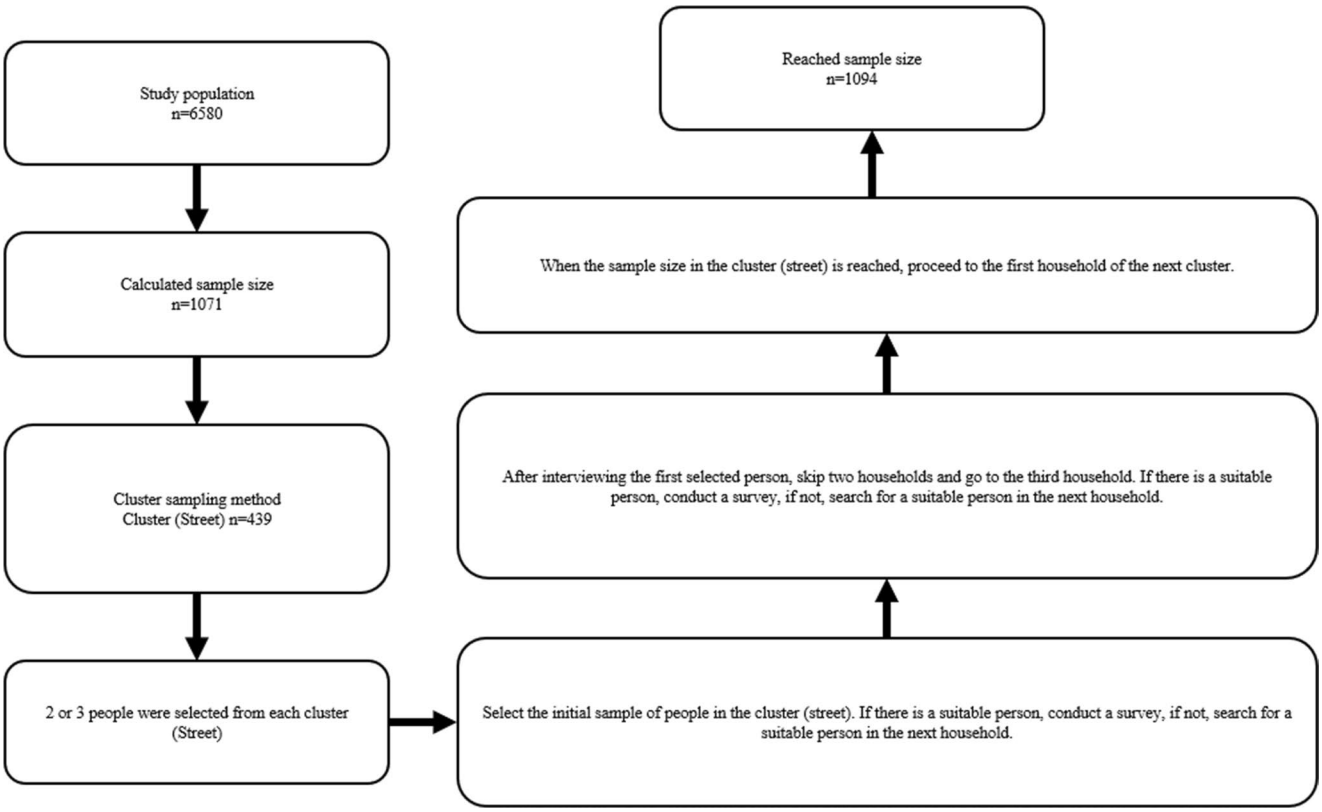

Fig. 1 Sampling method and procedure

organized into two main axes. The sub-dimensions with similar names in both axes are 'accessing health-related information, understanding health-related information, evaluating health-related information and using/applying health-related information'. 0–25 points indicate inadequate health literacy, >25–33 points indicate problematic/limited health literacy, >33–42 points indicate adequate health literacy, and >42–50 points indicate excellent health literacy (Okyay & Abacıgil, 2016).

Barthel index

The index developed by Mahoney and Barthel (1965) is a scale consisting of 10 items that evaluate the functional dependency of the individual, which was rearranged by Shah et al. in 1992 and adapted into Turkish by Kucukdeveci et al. (Kucukdeveci et al., 2000; Mahoney & Barthel, 1965). Scale scores range from 0 to 100; 0–20 points indicate complete dependence, 21–61 points indicate extreme dependence, 62–90 points indicate moderate dependence, 91–99 points indicate mild dependence, and 100 points indicate complete independence.

World health organization quality of life scale elderly module (WHOQOL-OLD)

It is a five-point Likert-type module developed by Power et al. and Eser et al. adapted to Turkish by 24 items and six sub-dimensions: sensory functions, autonomy, past, present and future activities, social participation, death and dying, and closeness, with a score between 4 and 100. Higher scores indicate a better quality of life (Eser et al., 2010; Power et al., 2005).

Hypothesis testing and statistical analyses

To evaluate the validity and reliability of the Turkish Health Literacy Scale – Short Form (THLS-SF), the following statistical analyses were conducted:

Descriptive statistics

Descriptive analyses were used to summarize the sociodemographic characteristics of participants and the overall distribution of scale scores. Frequencies, percentages, means, and standard deviations were reported where appropriate.

Item selection and psychometric evaluation (Hypotheses 4 & 5)

Classical test theory principles were applied to assess item difficulty and discrimination for each of the 32 original THLS items. Items selected for inclusion in the short form (THLS-SF) were required to exhibit:

- Moderate item difficulty (values around 0.50), and.
- High discrimination indices (ideally > 0.30), indicating strong differentiation between participants with high and low health literacy.

Reliability analysis Cronbach's alpha was computed for the total short form and its subdimensions. Item-total correlations and alpha if item deleted were also reported.

Rasch analysis Rasch modeling was conducted to further assess item fit, scale unidimensionality, and reliability. Infit and outfit mean square statistics were calculated to evaluate each item's compatibility with the model. The assumption of unidimensionality was tested using Principal Components Analysis (PCA) of residuals. Reliability indicators included person reliability, item reliability, and separation indices, which reflect the scale's ability to distinguish between varying levels of health literacy.

Construct Validity – Factor analysis (Hypothesis 4)

Exploratory Factor Analysis (EFA): Performed using principal components analysis with varimax rotation on each of the original 8 dimensions to support item selection.

Confirmatory Factor Analysis (CFA): Conducted to evaluate the model fit of the 8-item short form. Model fit indices such as RMSEA, CFI, SRMR, and χ^2/df were assessed. Acceptable model fit was considered as RMSEA < 0.08, CFI > 0.90, and SRMR < 0.08.

Convergent and discriminant validity (Hypotheses 1, 2 & 3)

Convergent validity (H1) Pearson correlation coefficients were calculated between THLS-SF and the full THLS-32 scale and its subdimensions.

Discriminant validity (H2) The correlation of THLS-SF with WHOQOL-OLD and the Barthel Index was examined.

Known-Groups validity (H3) The Mann-Whitney U test was used to compare THLS-SF scores across sociodemographic groups (e.g., age groups, gender, education level). Effect sizes (r) were interpreted as small (0.2–0.5), medium (0.5–0.8), and large (> 0.8).

Differential item functioning (DIF)

DIF analyses were conducted using Cochran-Mantel-Haenszel statistics and effect size (sP-DIF) classifications to determine item bias based on age and gender. Items with significant DIF were evaluated for potential removal.

Missing data handling

"I don't know" responses were treated as missing and excluded from the analyses using listwise deletion in multivariate tests such as CFA and Rasch analysis.

Results

Item selection analyses

Descriptive statistics, item analyses and overall reliability

71.3% of the participants in the research group are in the 65–74 age group, 52.1% are women, 77.9% are primary school graduates, and 63.8% have an excellent health perception.

The THLS-32 consists of eight dimensions located on two axes. The first axis is disease prevention/health promotion, and the second is treatment and services. Both axes question four conceptual frameworks: accessing, understanding, evaluating, and using/applying health-related information. The axes and dimensions in which each item is located are shown in Table 1. This study aimed to create a short form by selecting one item from each of the eight dimensions of the scale. Analytical classical and modern test theory methods were used in item selection to create the THLS-SF. The difficulty and discrimination values of the items in each dimension of the THLS-SF, reliability findings, and the results of the explanatory factor analysis are presented in Table 1. In the dimensions of four items, each item's difficulty values range between 0.54 and 0.76. Item discrimination values are between 0.53 and 0.94.

It is seen that the internal consistency coefficient of each dimension in the scale is over 0.7 (min: 0.815, max: 0.931), and the item-dimension correlation coefficients corrected for overlap are over 0.7. When items were deleted for each dimension, Cronbach's alpha value was marked from lowest to highest to form the basis for item selection. Then, the items in the relevant dimension were marked from highest to lowest according to the item-dimension correlation coefficient. They started from the items with the lowest alpha

Table 1 EFA and reliability analysis results of THLS-SF subscales, item analysis, reliability and validity findings with the classical test theory approach ($n=806$)

Dimentions	Item numbers	Item diff. (0–1)	Discrimination	Corrected item-total correlation	Cronbach's alpha if item deleted	Extraction	Factor loading	Selected item ranks
				Cronbach's alpha = 0.931		KMO = 0.86. Expl. Variance = %82.9		
D1	**i01**	0.76	0.94	0.836	0.911	0.826	0.909	3
	i04	0.71	0.94	0.857	0.904	0.850	0.922	**1**
	i05	0.72	0.93	0.849	0.907	0.840	0.917	2
	i07	0.74	0.87	0.814	0.918	0.801	0.895	4
D2				**Cronbach's alpha = 0.815**		**KMO = 0.79. Expl. Variance = %64.6**		
	i02	0.63	0.70	0.649	0.764	0.661	0.813	3
	i08	0.54	0.61	0.583	0.791	0.576	0.759	4
	i11	0.61	0.70	0.666	0.753	0.683	0.827	**1**
	i13	0.67	0.68	0.652	0.761	0.664	0.815	**2**
D3				**Cronbach's alpha = 0.843**		**KMO = 0.81. Expl. Variance = %68.6**		
	i03	0.67	0.76	0.708	0.790	0.719	0.848	3
	i09	0.59	0.60	0.581	0.843	0.557	0.747	4
	i12	0.67	0.73	0.714	0.787	0.726	0.852	2
	i15	0.69	0.72	0.727	0.782	0.740	0.860	**1**
D4				**Cronbach's alpha = 0.815**		**KMO = 0.79. Expl. Variance = %64.8**		
	i06	0.73	0.70	0.671	0.751	0.696	0.834	2
	i10	0.57	0.53	0.516	0.824	0.490	0.700	4
	i14	0.69	0.72	0.704	0.737	0.729	0.854	**1**
	i16	0.61	0.68	0.660	0.756	0.677	0.823	3
D5				**Cronbach's alpha = 0.898**		**KMO = 0.83. Expl. Variance = %77.1**		
	i18	0.69	0.79	0.811	0.859	0.809	0.899	3
	i20	0.71	0.91	0.821	0.852	0.826	0.909	2
	i22	0.74	0.91	0.828	0.848	0.828	0.910	**1**
	i27	0.63	0.69	0.654	0.911	0.623	0.789	4
D6				**Cronbach's alpha = 0.860**		**KMO = 0.80. Expl. Variance = %71.0**		
	i19	0.68	0.82	0.766	0.797	0.785	0.886	2
	i21	0.66	0.86	0.803	0.779	0.818	0.904	**1**
	i23	0.72	0.80	0.734	0.811	0.748	0.865	3
	i25	0.58	0.60	0.536	0.889	0.489	0.699	4
D7				**Cronbach's alpha = 0.886**		**KMO = 0.82. Expl. Variance = %74.7**		
	i24	0.72	0.82	0.747	0.855	0.743	0.862	3
	i26	0.61	0.72	0.710	0.870	0.698	0.836	4
	i28	0.64	0.82	0.797	0.836	0.796	0.892	**1**
	i32	0.69	0.76	0.753	0.853	0.749	0.865	2
D8				**Cronbach's alpha = 0.889**		**KMO = 0.83. Expl. Variance = %75.3**		
	i17	0.63	0.67	0.696	0.882	0.677	0.823	4
	i29	0.68	0.82	0.773	0.852	0.772	0.879	3
	i30	0.68	0.85	0.775	0.852	0.775	0.880	2
	i31	0.66	0.84	0.789	0.845	0.788	0.888	**1**

value when the item was deleted and the highest item-dimension correlation; items that were thought to represent each dimension were given a sequence number between 1 and 4. The items added to the analysis model of THLS-SF were selected by considering the effect levels in their dimensions.

Factor structure

Explanatory factor analysis was applied for each dimension to support reliability when choosing between items. When the results obtained are examined, it is seen that the KMO values, which indicate the sample size adequacy of the dimensions, are distributed between 0.79 and 0.86 and are above the accepted value of 0.5. In addition, it was determined that the extraction values of Bartlett's sphericity tests, which show a correlation between the items, were well above 0.5 in all sub-dimensions and, therefore, significant ($p<0.001$). In addition, it was determined that the factor loadings were at least above 0.7 in each dimension. The items analyzed for each dimension produce a single factor.

The cumulative explained variance percentages of these produced factors are at least 64.8% and at most 82.9%. Factor loadings and extraction values obtained from explanatory factor analyses are arranged from largest to smallest. The results obtained from EFA were observed to have a similar order with the item-dimension correlation in the reliability analysis and Cronbach's alpha values when the item was deleted. According to the results obtained from both analyses, the items representing the dimensions were given sequence numbers (Table 1).

THLS-SF analysis

Eight items, selected first in their dimension by classical and modern test theory approaches, were included in the final analysis for THLS-SF. Since the goodness of fit values of item 11, selected first from the second sub-dimension in the first analysis, were found to be low, item 13, ranked second, was included in the analysis for the short form.

The mean values of the eight items in THLS-SF are between 1.91 and 2.25; the floor and ceiling effect percentages are between 2.1% and 11.6%, respectively. Cronbach's alpha value is 0.928 and corrected for overlap item-total correlation coefficients are between 0.694 and 0.801. When exploratory factor analysis was applied, the KMO value was 0.94, and the Bartlett sphericity test result was significant ($p<0.001$). It is seen that the level of correlation between the items is between 0.583 and 0.730, the factor analysis loadings applied after the principal component analysis are between 0.754 and 0.854 for each item, and the cumulative explained variance percentage of the 8-item structure is 66.8 (Table 2).

When the item analysis results in Table 3 are examined, it is seen that the item difficulty values are between 0 and 1, the change in the scale is between 0.62 and 0.75, and the discrimination values of the items are between 0.75 and 0.92. The reliability criteria among the Rasch analysis summary goodness-of-fit indicators are person reliability, 0.92, and item reliability, 0.95. Person Separation Index was 3.43, and Item Separation Index was 4.56. Rasch analysis item difficulty values are distributed close to zero for each item. On the other hand, it is seen that the distributions of infit and outfit values are around one for both fit values. While the distribution for the Infit value is between 0.89 and 1.08, the distribution for the outfit is between 0.86 and 1.08. DIF analysis of each item for gender and age shows that MH chi-square values are insignificant, and effect sizes are low (Figure 2).

The results of the confirmatory factor analysis applied for scale construct validity are presented in Fig. 3 . It was determined that the factor load distribution of each scale item with the total varied between 0.722 and 0.835, and the error variances were between 0.322 and 0.479. When the CFA goodness of fit values were examined, it was determined that the χ^2 test result showed a good fit at the $p>0.05$ level, and the χ^2/degrees of freedom showed a sufficient fit at 1.04. While the RMSEA value is 0.007 and the Stand RMR value is 0.025, the CFI and GFI values are 1.000. The obtained model summary goodness of fit values is sufficient.

In Table 4, the ability of the scale to distinguish various sociodemographic characteristics was examined for known group validity. It was determined that there were significant differences between the groups in terms of gender, age, education level, income, and health status variables. Accordingly, while the health Literacy level of women and those with insufficient education is higher, it is seen that the health Literacy of young people, educated people, and those with good health conditions is significantly higher. The largest effect size is 0.809 between the educated and uneducated groups.

In addition, it is seen that the correlation coefficient with THLS-SF total and sub-dimensions is between 0.798 and 0.847. While THLS-SF shows a low significant correlation with Barthell ($r = -0.110$), it shows a low significant

Table 2 EFA and reliability analysis of selected items for THSL-SF ($n=806$)

		Cronbach's alpha = 0.928		Cumulative variance = %66.8	
Item numbers	Mean ± SD	Corrected item-total correlation	Cronbach's alpha if item deleted	Extraction	Factor loading
i04	2.14 ± 0.94	0.773	0.918	0.692	0.832
i13	2.00 ± 0.88	0.758	0.919	0.672	0.820
i14	2.07 ± 0.86	0.786	0.917	0.713	0.844
i15	2.08 ± 0.86	0.783	0.917	0.708	0.842
i21	1.91 ± 0.98	0.740	0.920	0.645	0.803
i22	2.25 ± 0.94	0.801	0.915	0.730	0.854
i28	1.87 ± 0.82	0.706	0.923	0.600	0.775
i31	1.93 ± 0.86	0.694	0.923	0.583	0.764
Floor effect = %2.1 Ceiling effect = %11.6				*KMO* = 0.94. *Barlett's* = 4307.9 *Df* = 28, $p<0.001$	

Table 3 THLS-SF item and Rasch analysis results ($n=806$)

	Item analyses		Rasch analysis			Dif analyses					
Item numbers	Item difficulty (0–1)	Discrimination (0–1)	Difficulty	Infit	Outfit	Sex (male-female)			Age (65 to 74 - 75 to 94)		
						χ^2	E.S.[95% CI]	Class	χ^2	E.S.[95% CI]	Class
i04	0.72	0.86	−0.19	1.02	1.08	0.48*	−0.02[(−0.06)-(0.02)]	AA	2.37*	0.07[(0.01)-(0.12)]	AA
i13	0.67	0.82	0.08	0.98	0.97	0.73*	0.03[(−0.02)-(0.07)]	AA	4.55**	−0.10[(−0.16)-(−0.03)]	AA
i14	0.69	0.86	−0.20	0.89	0.86	0.57*	0.01[(−0.03)-(0.04)]	AA	0.19*	0.00[(−0.05)-(0.05)]	AA
i15	0.69	0.86	−0.22	0.91	0.88	0.62*	−0.02[(−0.06)-(0.02)]	AA	0.07*	−0.01[(−0.07)-(0.04)]	AA
i21	0.64	0.80	0.54	1.04	1.04	1.89*	0.03[(0.00)-(0.07)]	AA	3.46*	0.01[(−0.03)-(0.06)]	AA
i22	0.75	0.92	−0.54	0.94	0.98	0.88*	−0.02[(−0.05)-(0.02)]	AA	1.76*	0.04[(−0.01)-(0.08)]	AA
i28	0.62	0.76	0.37	1.08	1.07	0.28*	0.00[(−0.04)-(0.04)]	AA	0.25*	0.01[(−0.07)-(0.09)]	AA
i31	0.64	0.75	0.16	1.06	1.03	0.04*	0.00[(−0.04)-(0.03)]	AA	1.19*	−0.02[(−0.08)-(0.04)]	AA
Item reliability = 0.96. Person reliability = 0.93. Item separation index = 4.67. Person separation index = 3.59											
Principal components analysis			**F1**	**F2**	**F3**	**F4**	**F5**				
Eigen value			1.54	1.42	1.18	1.06	0.98				
Proportion var			0.19	0.18	0.15	0.13	0.12				
Proportion explained			0.25	0.23	0.19	0.17	0.16				

* = $p>0.05$, ** = $p<0.05$, *E.S.[95% CI]* = Effect size [95% Confidence Interval], Class = DIF analysis clasification, A = No-DIF

correlation with WHOQOL-OLD sub-dimensions in the range of 0.073–0.281 (Table 5).

Discussion

In this study, the validity and reliability of the Turkish Health Literacy Scale Short Form (THLS-SF) was tested in individuals aged 65 and older. The findings support all hypotheses proposed in the study.

> H1: THLS-SF shows a high level of positive correlation with THLS-32 (similar scale validity).

In the correlation analyses, positive correlations above 0.70 were found between THLS-SF and the original scale (THLS-32) and its subscales. This finding indicates that the short form successfully represents the structure of the long form and measures similar constructs. Additionally, the fact that all items have high factor loadings in confirmatory factor analysis supports that the short form maintains its conceptual integrity (Hooper et al., 2008; Okyay & Abacıgil, 2016).

> H2: THLS-SF will be positively associated with functional independence (Barthel) and quality of life (WHOQOL-OLD) (separate scale validity).

A low but significant negative correlation was found between THLS-SF and the Barthel Index; positive correlations were found with some subscales of WHOQOL-OLD (e.g., sensory functions). These findings demonstrate that health literacy is associated with functional independence and quality of life, supporting the ability of THLS-SF to distinguish between separate constructs (Andresen, 2000; Fitzpatrick et al., 1998).

> H3: THLS-SF scores show significant differences according to sociodemographic variables such as age, gender, and education (known groups validity).

In the known groups analysis, THLS-SF scores were found to differ significantly according to variables such as age, education level, gender, income, and health status. In particular, education level and age emerged as the strongest variables in determining health literacy. These results demonstrate that health literacy is influenced by individual and environmental factors and highlight the scale's ability to distinguish between groups (Hasancebi et al., 2020).

> H4: The 8-item structure of the THLS-SF provides good fit indices in confirmatory factor analysis (structural validity).

The model fit indices obtained in confirmatory factor analysis (e.g., RMSEA = 0.007) are strong in terms of structural validity. The fact that all item factor loadings are between 0.76 and 0.85 and that error variances remain within acceptable limits indicates that the scale's unidimensional structure is statistically supported (Brown, 2009; Hooper et al., 2008). The unidimensionality assumption was also met in the Rasch analysis, with item fit values remaining within acceptable limits (0.8–1.2) (Boone, 2016).

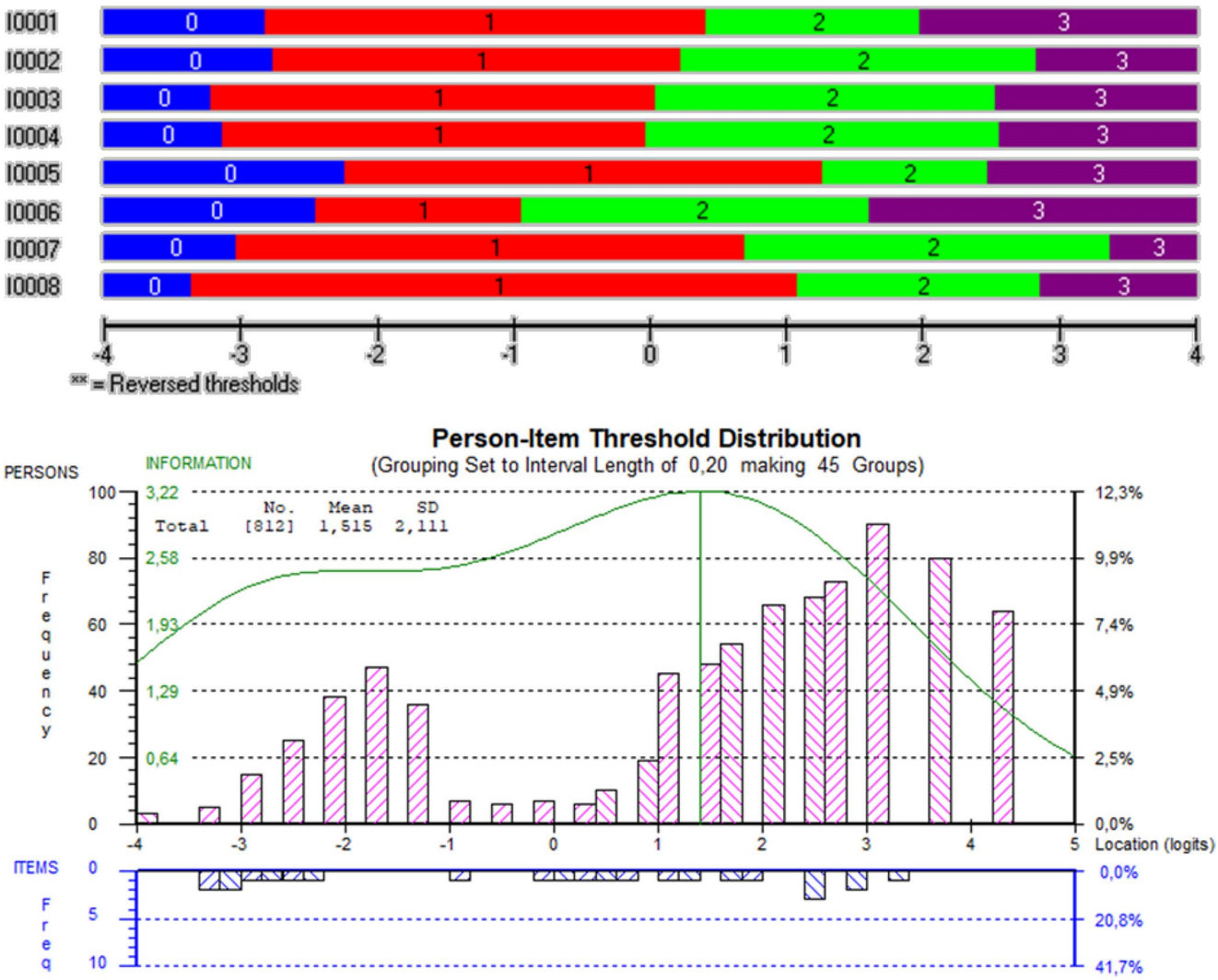

Fig. 2 Item and Person-Item Treshold Distribution map

H5: There is sufficient internal consistency among the THLS-SF items (Cronbach's α > 0.70) (Reliability).

The Cronbach's α value calculated for the THLS-SF is 0.92, indicating that the scale has high internal consistency (Nunnally & Bernstein, 1969). The high item-total correlations (0.69–0.80) and the fact that removing any item does not increase overall reliability indicate that each item makes a meaningful contribution to the scale. Additionally, the item and person reliability values obtained from the Rasch analysis, which are 0.96 and 0.93, respectively, support the reliability of the short form in the context of modern test theory (Boone, 2016).

In general, THLS-SF has demonstrated a psychometrically robust structure in both classical test theory and Rasch model-based analyses. In comparisons with different short forms in the literature, problems such as multidimensionality, DIF, and item mismatch were encountered in some scales (e.g., HLS-EU-Q16, HL-SF12); THLS-SF stands out as a unidimensional, valid, and reliable short form free from such limitations (Finbråten et al., 2018; Huang et al., 2020; Rasmussen et al., 2023).

In light of these findings, it has been demonstrated that the THLS-SF provides both convergent and discriminant validity, is robust in terms of construct validity, can distinguish between sociodemographic groups, and has high reliability. Thanks to its short, practical, and psychometrically sound structure, the THLS-SF can be used as an effective tool for measuring health literacy among older adults. This form will provide a valuable contribution to public health screenings, epidemiological research, and health service planning.

Conclusion

This study demonstrates that the Turkey Health Literacy Scale Short Form (THLS-SF) is a valid, reliable, and practical instrument for assessing health Literacy, particularly

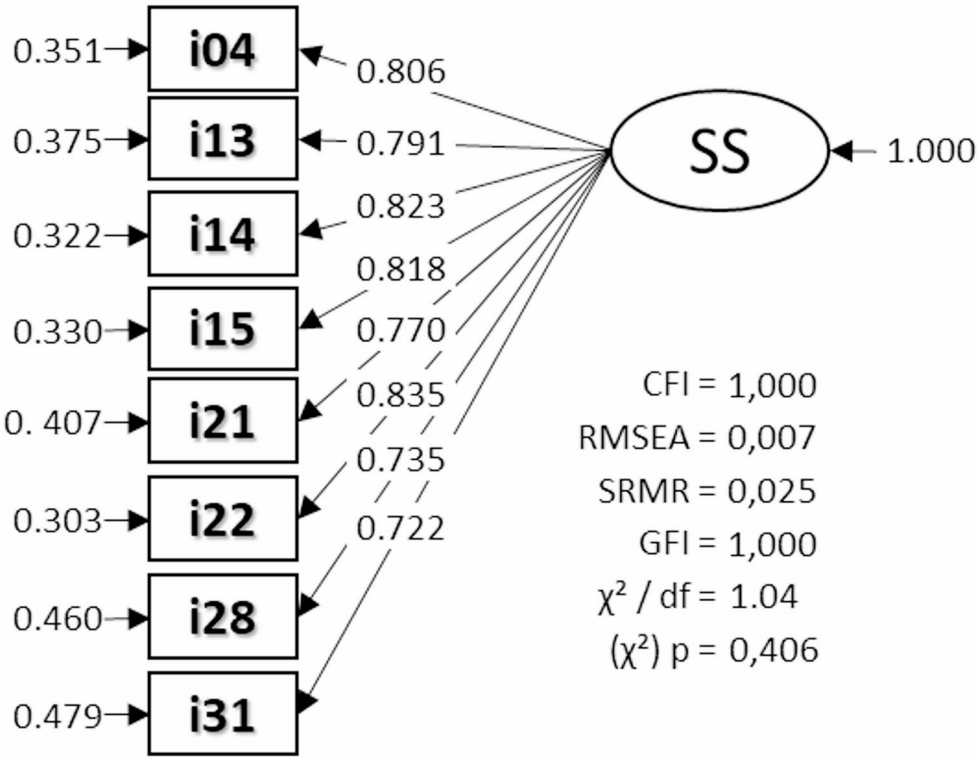

Fig. 3 THLS-SF analysis with confirmatory factor analysis

Table 4 Examination of the known intergroup discrimination status of THLS-SF (*n*= 806)>

Variables	Groups	Location parameter	Effect size
Sex	Male-Female	−1.53***	−0.155
Years	65 to 74=75 to 94	10.66***	0.456
Education	Educate-Ineducated	18.28***	0.809
Income	Adequate-inadequate	−1.53**	−0.129
Health status	Good-bad	6.09***	0.335

*$p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, Effect Size = 0.3 low, 0.5 medium, 0.08 high.

Table 5 Correlation between THLS-SF, THLS total and subdimensions, barthel index, and WHOQOL-OLD subscales (*n*= 806)

Variables	THLS - SF
THLS Total	0.83***
THLS Treatment and Services	0.80***
THLS Disease Prevention	0.84***
THLS Accessing Health-Related Information	0.81***
THLS Understanding Health-Related Information	0.79***
THLS Evaluating Health-Related Information	0.81***
THLS Applying Health-Related Information	0.80***
Barthel Index - Activities of Daily Living	–0.11***
WHOQOL-OLD Sensory Abilities	0.22***
WHOQOL-OLD Autonomy	–0.26***
WHOQOL-OLD Past, Present, and Future Activities	–0.12***
WHOQOL-OLD Social Participation	–0.15***
WHOQOL-OLD Death and Dying	-0.07*
WHOQOL-OLD Intimacy	-0.28***

$p < 0.05$*, $p < 0.01$**, $p < 0.001$**

among older adults. Its concise 8-item structure, clear language, and conceptual integrity make it an efficient alternative to more comprehensive tools, especially for time-constrained public health settings.

From a theoretical perspective, the THLS-SF not only addresses a critical gap in the measurement of health literacy among older populations but also contributes to the broader understanding of how simplified assessment tools can enable autonomy, informed decision-making, and self-efficacy in health contexts. These functions closely align with Bandura's social cognitive theory and recent research on career self-efficacy and behavioral outcomes (Saffarian-toosi & Khaleghi, 2024), indicating that health literacy can act as a mediating variable between individual agency and broader health outcomes.

Furthermore, consistent with the motivational frameworks discussed in educational psychology (Partovi, and Razavi, 2019), improving health literacy can enhance older adults' motivation to engage in preventive health behaviors. Just as game-based learning increases students' intrinsic motivation and academic success through accessible and engaging content (Partovi & Razavi, 2019), health literacy tools like the THLS-SF may improve health outcomes by lowering the cognitive and motivational barriers to understanding health-related information.

Notably, this study affirms that the THLS-SF provides predictive value beyond readily observable demographic indicators such as age, gender, income, education, and

health status. Its strong correlations with quality of life (WHOQOL-OLD) and functional independence (Barthel Index) suggest that health literacy is deeply interwoven with both psychological well-being and physical autonomy. This supports previous findings that demographic factors alone do not fully explain variance in cognitive or behavioral outcomes (Razavi, 2021), 2021), emphasizing the need for nuanced measurement tools like the THLS-SF.

By enabling continuous monitoring of health literacy levels over time, the THLS-SF can serve as a foundational instrument for longitudinal studies, public health evaluations, and health promotion interventions. It also offers practical value for identifying vulnerable groups, tailoring educational interventions, and ultimately enhancing health equity.

However, while this study focused on older adults, future research should expand the use of the THLS-SF across different age groups, individuals with chronic conditions, and diverse socioeconomic strata. Such efforts would enhance its generalizability and uncover population-specific patterns, further contributing to precision public health approaches.

In summary, the THLS-SF is a psychometrically robust tool that advances both theoretical and practical domains in health literacy research. Its simplicity, reliability, and predictive relevance position it as a key resource for researchers, clinicians, and policymakers committed to empowering populations through knowledge and reducing health disparities across demographic and social divides.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s12144-025-08402-w.

Acknowledgements We would like to express our gratitude to the authors of the original study who provided consent to conduct the validation and to all participated.

Authors contribution Hatice Simsek and Celalettin Cevik developed the study's concept and design. Hakan Baydur conducted statistical analyses. İbrahim Kayabek, Geylan Dogan and Gizem Ay verified the methods used. Hatice Simsek, Celalettin Cevik, Gulten Ucan and Pinar Okyay critically revised the methods and results. Hakan Baydur, Hatice Simsek, Celalettin Cevik and Pinar Okyay supervised the findings of this work. All authors discussed the results. Hatice Simsek, Celalettin Cevik, Gulten Ucan, wrote the manuscript draft and integrated the final revisions by Pinar Okyay. All authors contributed and approved the final manuscript.

Funding This work was supported by the Balıkesir University Scientific Research Projects Unit under Grant (No: 2019/57).

Data availability Data supporting the findings of this study will be shared with other researchers upon reasonable request.

Declarations

This research has not been pre-registered by the authors and did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. Data supporting the findings of this study will be shared with other researchers upon reasonable request. The authors have no relevant financial or non-financial interests to disclose.

Competing interests The authors have no relevant financial or nonfinancial interests to disclose.

Ethics approval In order to conduct the study, the approval was obtained from the Ethics Committee of Balikesir University Faculty of Medicine (No: 2019/97), and before the data collection process, verbal consent was obtained from the participating elderly.
This research has not been pre-registered by the authors and did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. Data supporting the findings of this study will be shared with other researchers upon reasonable request. The authors have no relevant financial or non-financial interests to disclose.

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Authors and Affiliations

Hatice Simsek[1] · Celalettin Cevik[2] · Hakan Baydur[3] · İbrahim Kayabek[4] · Geylan Dogan[4] · Gizem Ay[4] · Gulten Ucan[3] · Pınar Okyay[5]

✉ Celalettin Cevik
celalettincevik@balikesir.edu.tr

Hatice Simsek
haticesimsek@yahoo.com

Hakan Baydur
hakan.baydur@gmail.com

İbrahim Kayabek
ibrahim.kayabek10@hotmail.com

Geylan Dogan
uni.dogann@gmail.com

Gizem Ay
gizemkhvci@gmail.com

Gulten Ucan
gulten.ucan@cbu.edu.tr

Pınar Okyay
pinarokyay@hotmail.com

1 Department of Public Health, Dokuz Eylul University Faculty of Medicine, Izmir, Turkey

2 Faculty of Health Sciences, Department of Public Health Nursing, Balikesir University, Balikesir, Turkey

3 Faculty of Health Sciences, Department of Social Work, Manisa Celal Bayar University, Manisa, Turkey

4 Department of Nursing, MD, Balikesir University Institute of Health Sciences, Balikesir, Turkey

5 Faculty of Medicine, Department of Public Health, Aydin Adnan Menderes University, Aydin, Turkey