BMC Pediatrics

RESEARCH

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Validity and reliability of the European health literacy child form in Turkish children

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Abstract

Purpose The objective of this study was to assess the validity and reliability of the European Health Literacy Scale Child Form in Turkish children and to examine the instrument's psychometric properties.

Design and methods A total of 843 students aged 9–11 years in primary and secondary school were included in this scale adaptation study. In the validity analyses of the Health Literacy Scale Child Form-Turkish form (HLS-Child-Q15-TR), language and content validity were used to determine cultural compatibility, and exploratory and confirmatory factor analysis were used in structural analyses. Reliability was investigated by examining internal consistency and test-retest reliability.

Results The content validity of the HLS-Child-Q15-TR was found to be high. The model fit values of the confirmatory factor analysis results of the three-factor model consisting of health care, disease prevention and health promotion dimensions of the HLS-Child-Q15-TR were found to be satisfactory (x2/df = 2.68, CFI = 0.945, GFI = 0.965, and RMSEA = 0.045). HLS-Child-Q15-TR item-total correlations were above 0.30 and Cronbach's alpha coefficient was 0.831. The test-retest correlation coefficient of the HLS-Child-Q15-TR was 0.98 and stable over time.

Conclusions HLS-Child-Q15-TR is valid and reliable in Turkish children aged 9–11 years. It is recommended that the valid and reliable HLS-Child-Q15-TR be used to measure the health literacy levels of Turkish children under 12 years of age.

Practice implications HLS-Child-Q15-TR valid and reliable instrument for use with Turkish children aged 9–11 years. HLS-Chıld-Q15-TR will make an important contribution to the Turkish culture in evaluating the health literacy levels of children 9–11 years age in Turkey.

Keywords European health literacy scale child form, Child health, Validity, Reliability, Health literacy

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Introduction

The World Health Organization (WHO) defines health literacy as the capacity to access information and the skills necessary to understand, interpret and utilize the information collected in order to protect and maintain one's health [1]. Health literacy is a significant indicator of an individual's ability to benefit from health services. It is also a key factor in determining whether individuals have an awareness of their health rights and services, can comprehend health education materials and can utilise other aspects of health services [2].

WHO has found that health literacy is a critical determinant of health and that individuals' life skills and competencies should be enhanced through the school curriculum [3]. Children are the recipients of complex information and messages that contain a large number of health-related elements that are conveyed from different sources from an early age [4]. This information may be provided by their parents about healthy eating, physical activity, disease prevention or general health risks. It may also be provided in schools through discussions with friends and peers. The promotion of health literacy in early life is recognised as a significant method of ensuring the maintenance of health literacy and good health throughout life. Nevertheless, there is a paucity of evidence regarding children's health literacy, partly due to a lack of appropriate measurement tools [5, 6]. Despite the existence of tools designed to evaluate children's health literacy, there is an absence of a tool that has been validated for the purpose of assessing self-reported health literacy in a systematic and comparable manner [5, 6]. However, there are a limited number of measurement tools available for the measurement of health literacy levels, especially for children under the age of 12 years [5]. Therefore, it is stated that there is a need for age and culturally appropriate measurement tools to determine health literacy in children [5, 6].

The European Health Literacy Scale (HLS-EU-Q47) is a widely used instrument for the assessment of health literacy in adults over the age of 15 [7]. The German version of the age-adapted European Health Literacy Scale Child Form (HLS-Child-Q15) of the HLS-EU-Q47 was also developed for children aged 9–10 years and psychometric analyses were also conducted [8, 9]. Following the development of the German version of the HLS-Child-Q15, the Dutch, French, and Portuguese versions of the scale have been adapted to reflect the cultural nuances of various societies in recent years [10–12].

As a result of the literature review conducted in Turkey, it was determined that there were 37 measurement tools to determine the health literacy level of children, and 21 of these tools included high school students, 13 included middle school students, 1 included both middle school and primary school students, and 2 included primary school students [13]. As a result of the literature review, no measurement tool that can determine the level of health literacy of children under the age of 12 was found. In line with the results of this review, it was determined that there is a need for comparable, valid and reliable age-appropriate scales that can be developed and used for children aged 12 and under in order to determine the level of child health literacy in Turkey [13, 14]. As a result of the research, it is thought that the introduction of the child form of the European Health Literacy Scale, which previously had German, Dutch, French and Portuguese versions, into Turkish culture will make a significant contribution to the evaluation of the health literacy levels of children aged 9–11 years of age in Turkey.

The aim of this study was to analyse the validity and reliability of the European Health Literacy Scale Child Form in the Turkish population and to examine its psychometric properties.

Methods

Participant and sample

The objective of this study is to adapt the European Health Literacy Scale (HLS) Child Form to Turkish children and to assess its psychometric properties. The study was conducted with male and female students aged 9–11 years in a primary school and a secondary school in the Menteşe district of Muğla province. The study involved 942 students, comprising 474 primary school and 468 secondary school students. A total of 843 students were included in the study. Power analyses of the scales to be used in the study were conducted using the WebPower program. A total of 843 students were deemed sufficient for structural equation modelling, with 96% power for an acceptable RMSEA value (RMSEA = 0.00-0.05) [15]. In the study, the data collection form was applied twice to 40 randomly selected students in order to measure the test-retest change over time. Students who provided incomplete responses to the data collection form and who expressed a desire to withdraw from the study despite having obtained parental consent were excluded from the study.

Ethics

In order to facilitate the adaptation of the European Health Literacy Scale Child Form to Turkish children, the necessary permissions were obtained from the author of the German form of the scale via email. Prior to the commencement of data collection, the necessary permissions were obtained from the Mugla Sitki Kocman University Medical and Health Sciences Ethics Committee (23.05.2022/220073), the Ministry of National Education, and the Provincial Directorate of National Education. As the students involved in the study were below the age of

16, written informed consent was obtained from the parents or legal guardians of each student.

Measurements

The data of the study were collected the Sociodemographic Data Form and the European Health Literacy Children's Turkish Form (HLS-Chıld-Q15-TR).

The sociodemographic data form The Sociodemographic Data Form was developed by the researchers in accordance with the existing literature. The form includes questions on age, gender, grade, general health status, general physical status and mental health status, family economic status, mother and father education and employment status [16].

The European health literacy scale child form (HLS-Child-Q15) HLS-Child-Q15 is an age-adapted version of the HLS-EU-Q47, which was created to assess health literacy in adults [7]. The HLS-Child-Q15 scale was developed to assess the subjective health literacy of children aged 9–10 years in terms of health, disease prevention and health promotion [8]. Each item of the scale employs a 4-point scale, where 1 = very easy, 2 = easy, 3 = difficult, 4 = very difficult. A code of 5 was added to the scale for the response 'I don't know'. The HLS-Child-Q15-DE has a three-factor access (items 1–4), understanding (items 5–11), implementation (items 12–15) model to explain the theoretical structure. The scale also has a three-factor model of health care (items 1, 5, 6, 12, 13), disease prevention (items 2, 7, 8, 11, 14) and health promotion (items 3, 4, 9, 10, 15). The Cronbach's alpha coefficient of the HLS-Child-Q15-DE was calculated as 0.79. The correlation of the measurements obtained from the scale was performed by the halving method, and it was found that the correlation with the other half was high ($r = .771$). In addition to the German population, the scale has been adapted for use with the Dutch, French and Portuguese populations [10–12]. The Cronbach's alpha coefficient of the Dutch adaptation of the HLS-Child-Q15 was 0.86 [11], while the Cronbach's alpha coefficient of the French adaptation was 0.83 [11] and the Cronbach's alpha coefficient of the Portuguese adaptation was 0.87 [12]. The Turkish version of the European Health Literacy Scale (HLS) Child form, adapted to the German population (HLS-Child-Q15-DE), was applied to children aged 9–11 years as HLS-Child-Q15-TR.

Data collection

The data were collected using the Sociodemographic Data Form and the HLS-Child-Q15-TR, which were adapted for use in this study.

Data were collected between March and May 2022 using the Sociodemographic Data Form and HLS-Child-Q15-TR. Once permission had been granted by the institution, primary and secondary school students and their parents were provided with detailed information about the study. It was explained that participation in the study was completely voluntary, that the information would remain confidential, and that it would not be used in any other study or application. As the participants in the study were under the age of 16, consent was obtained from their parents or legal guardians. After the consent was obtained, the forms were distributed to the students at the times deemed appropriate by the school administration, under the supervision of a teacher and with the participation of the first researcher and were collected at the end of the application. The data collection process was repeated with the same students at two-week intervals. The application period for the data collection forms lasted 15 min.

Data analysis

The data were transferred to the computer environment and SPSS 22.0 and AMOS 20 package programmes were used for analyses. Descriptive statistics such as number, percentage, mean and standard deviation were employed to evaluate the data. The World Health Organisation's [17], scale adaptation guidelines were used for language validity and the content validity index [18] was used for content validity. To test the reliability of the measurements obtained from the scale, internal consistency and correlation analyses were employed. To assess its invariance over time, a test-retest was conducted with a two-week interval. Exploratory and confirmatory factor analyses were applied to test the construct validity of the measurements obtained from the scale, and model fit indices were evaluated [19]. The AMOS 20.0 for Windows package programme was employed for the purpose of conducting confirmatory factor analysis [20].

Language validity The study was conducted in five stages (forward translation, expert opinion, backward translation, pre-test/cognitive interview and final version) in accordance with the World Health Organisation (WHO) translation guidelines. A systematic approach was employed [17]. In this context, HLS-Child-Q15 was translated into Turkish by two language experts. Subsequently, the HLS-Child-Q15-TR was translated back into its original language by two language experts. Following this process, individual cognitive interviews were conducted with six primary school students in the third and fourth grades and three secondary school students in the fifth grade. During these interviews, all of the translated HLS-Child-Q15 scale items were discussed, and the participants were asked to think aloud, interpret, and reflect on the meanings and expressions of the items. Furthermore, the interviewer sought to ascertain the applicability

of the scale to Turkish-speaking children by discussing the response categories and asking questions about the general comprehensiveness of the scale. Following cognitive interviews with a total of nine students, it was determined that the scale form was comprehensible, and the final applicable version of the scale was named HLS-Child-Q15-TR [21].

Content validity The HLS-Child-Q15-TR was sent to 10 experts in the field of public health and paediatric nursing, and 'Expert Opinion' was requested for both translating the scale back to its original language and evaluating its content/scope validity. The opinions of the experts were evaluated with the content validity index. After this stage, the scale was piloted with 15 primary school 3rd and 4th grade students and 15 secondary school 5th and 6th grade students.

Construct validity Confirmatory Factor Analysis (CFA) and Exploratory Factor Analysis (EFA) are two methods commonly employed in the development and adaptation of scales. In the absence of a known relationship between items, EFA is recommended. However, if the relationship between items and factors is known, CFA is the preferred method [22, 23].

In scale adaptation studies, Confirmatory Factor Analysis (CFA) should be employed as a primary method, given that the factors and related items are known. However, if the theoretical model fit values are low as a result of CFA, the factor structures of the measurement tool should be examined by using Exploratory Factor Analysis (EFA). It is necessary to compare the fit values of the theoretical structure of the measurement tool with the structure revealed in the explanatory factor analysis in order to decide upon the most appropriate model [23–25].

In exploratory factor analysis, items with eigenvalues greater than 1 are considered factors and the total variance explained by these structures is calculated. The suitability of the data set for factor analysis is evaluated using the correlation matrix, Kaiser-Meyer-Olkin (KMO) test and Bartlett sphericity test. Once the number of variables to be included in the factor and the distribution of variables according to these factors have been determined, a general name is given to the factors. In the event that unrelated variables are grouped together in a single factor, the variable with the highest factor load is taken as the basis for the factor. Furthermore, any item that appears in more than one factor with a difference of less than 0.1 is considered an overlapping item, and these items are removed from the scale [25].

In order to ascertain the fit of the models created in the context of confirmatory factor analysis with the data, the values associated with the x^2 (Chi-square), chi^2/sd, goodness of fit index (GFI), comparative fit index (CFI) and root mean square error of approximation (RMSEA) were utilised. The $\chi 2/sd$ value should be 2 or less, and if it is 5 or less, this value will be accepted [26]. GFI and CFI values between 0.90 and 0.95 indicate an acceptable fit [23, 27]. If the RMSEA value is below 0.05, it indicates a perfect fit. If it is below 0.08, this indicates an acceptable fit. Values between 0.08 and 0.10 indicate a moderate fit, while values greater than 0.10 indicate poor fit [23, 24, 27].

Reliability analyses: The reliability of the HLS-Child-Q15-TR version was evaluated through the examination of internal consistency coefficients, item-total correlations, and test-retest correlations. The internal consistency of the HLS-Child-Q15-TR and its subscales was quantified using Cronbach's alpha. Cronbach's alpha coefficients were evaluated as follows: >0.90 excellent, 0.80–0.90 good, 0.70–0.80 acceptable, 0.60–0.70 questionable or adequate. A Cronbach's alpha coefficient of 0.50–0.60 is considered poor, while a coefficient of less than 0.50 is deemed unacceptable [28–30]. For the HLS-Child-Q15-TR, item-total correlations of >0.20 and inter-measurement correlations of >0.70 at 2-week intervals were determined as acceptable levels for test-retest application [31, 32].

Results

The mean age of the children was 9.71 ± 0.95 years, with 48.6% being girls. It was determined that only 33.1% of the children's mothers were employed, 96.7% of their fathers were employed, and 65.8% of their families' income met their expenses (Table 1).

Item difficulty

The analysis of the distribution of the students' responses to the HLS-Child-Q15-TR items reveals that 11.9% of the students answered "I don't know" to item 1, which includes the question "Finding a way to recover quickly when you have a cold" (Supplement 1). It was determined that those who responded with 'I don't know' exhibited greater difficulty with items 2, 3, 5, 10, 11 and 14 compared to the other items. Supplement 1 illustrates that items 4, 6, 8, 9, 13 and 15 exhibited a high proportion of positive responses.

Validity analyses

Prior to administration to the participants, the European Health Literacy Scale Child Form underwent a series of validation procedures. The first stage involved adaptation of the scale to Turkish language and culture. The second stage entailed assessment of content validity. The third stage was devoted to construct validity, while the fourth stage was dedicated to reliability analyses.

Table 1 Distribution of sociodemographic and individual characteristics of the participants

Variables	*n*	%
Age		
8	81	9.6
9	274	32.5
10	310	36.8
11	178	21.1
Gender		
Female	410	48.6
Male	433	51.4
Mother's employment status		
Not working	279	33.1
Working	564	66.9
Father's employment status		
Not working	33	3.9
Working	810	96.1
Income level of parents		
Income less than spending	44	5.2
Income equal to spending	555	65.8
Income more than spending	244	28.9
Level of evaluation of physical health		
Passing	62	7.4
Good	168	19.9
Very good	261	31.0
Excellent	352	41.8
Level of evaluation of mental health		
Passing	75	8.9
Good	186	22.1
Very good	213	25.3
Excellent	369	43.8
Total	843	100.0

Language and content validity

The Turkish-German questions of the HLS-Child-Q15-TR were cross-referenced between the translated and back-translated versions, and language adaptation was made in a way to remain closest to the original. Minor improvements were made in line with the opinions of the experts. These changes were made in accordance with the World Health Organization (WHO) guidelines for translation, which employ a five-stage systematic approach, including forward translation, expert opinion, backward translation, pre-test/cognitive interview, and final version. Following the assessment of language and content validity, the HLS-Child-Q15-TR items were subjected to a qualitative pre-test with nine students between the ages of 8 and 11 years. During this process, the scale items were discussed and the students' comments regarding any expressions that were not understood were recorded. Following the qualitative pre-test, the HLS-Child-Q15-TR version was administered to 30 students aged 9–11 years, with a Cronbach Alpha coefficient of 0.862. In the evaluation of the content validity of HLS-Child-Q15-TR, it was determined that the opinions of the experts were consistent, and that the content validity (S-CVI = 1.00) of the final version of HLS-Child-Q15-TR was high.

Exploratory factor analysis

In order to examine the factor structure of the HLS-Child-Q15-TR in Turkish children, exploratory factor analysis was applied with a cut-off factor loading of 0.32 (Table 2). It was determined that the KMO value (0.90) was at a high level for factor analysis, there were three eigenvalues greater than 1 and the total explained variance was 46%. Upon examination of the factor distributions of the HLS-Child-Q15-TR in Turkish children, it was determined that the HLSC_TR5, HLSC_TR6, HLSC_TR9, HLSC_TR12, HLSC_TR13 and HLSC_TR15 items were included in the first factor, HL. The items HLSC_TR2, HLSC_TR4, HLSC_TR7, HLSC_TR8, HLSC_TR11 and HLSC_TR14 were found to be included in the second factor, while HLSC_TR1, HLSC_TR3 and HLSC_TR10 were included in the third factor (Table 2). However, it was determined that the HLSC_TR15 item in the first factor exhibited overlapping factor loadings in the second factor, and that the HLSC_TR8 item in the second factor exhibited overlapping factor loadings in the first factor. The first factor internal consistency coefficients of HLS-Child-Q15-TR were 0.690, 0.736 for the second factor and 0.589 for the third factor, while the internal consistency coefficient of the 15-item scale was 0.831. The single-measure intraclass correlation coefficient of the HLS-Child-Q15 was calculated as 0.247 (95% CI: 0.225-0.270), and the average was 0.831 (95% CI: 0.814-0.847). As illustrated in the Table 2, the three-factor structure that emerged in the Turkish versions of the HLS-Child-Q15, as in the German version, was found to be incompatible with both healthcare, disease prevention and health promotion, and accessing, understanding and applying health information.

Confirmatory factor analysis

The results of the confirmatory factor analysis of the structure of the HLS-Child-Q15-TR, as revealed in the exploratory factor analysis and the single-factor, three-factor constructs used in the German version, namely health care, disease prevention and health promotion, and three-factor constructs used in the German version, namely accessing, understanding and applying health information, are presented in Table 3. The single-factor structure of the HLS-Child-Q15-TR was found to have fit values below the acceptable level ($x2/df = 4.30$, CFI = 0.886, GFI = 0.941, RMSEA = 0.063). The fit values of the Turkish structure of the HLS-Child-Q15-TR, as revealed in the exploratory factor analysis ($x2/df = 2.84$, CFI = 0.938, GFI = 0.963, RMSEA = 0.047), were found to be acceptable. The fit values of the construct of accessing,

Table 2 Results of exploratory factor analysis of HLS-Child-Q15-TR

How easy or difficult is it for you to…	Item no	*n*	Mean ± SD	Factors			
				1	1	2	3
… understand when and how you should take your medicine when you are ill?	HLSC_TR5	843	3.14 ± 1.08	0.542	0.398		
… understand what your doctor says to you?	HLSC_TR6	843	3.47 ± 0.74	0.583	0.541		
… understand what your parents tell you about your health?	HLSC_TR9	843	3.53 ± 0.77	0.600	0.662		
… do what your parents tell you to do so that you can get well again?	HLSC_TR12	843	3.52 ± 0.77	0.646	0.651		
… take your medicine in the way you're told to?	HLSC_TR13	843	3.55 ± 0.79	0.573	0.761		
… have a healthy diet?	HLSC_TR15	843	3.54 ± 0.75	0.572	0.482	0.432	
… find out what you can do so that you don't get too fat or too thin?	HLSC_TR2	843	3.27 ± 1.06	0.492		0.682	
… find out which food is healthy for you?	HLSC_TR4	843	3.58 ± 0.74	0.417		0.634	
… understand why you sometimes need to see the doctor even though you are not ill?	HLSC_TR7	843	3.23 ± 1.13	0.653		0.560	
… understand why you need vaccinations?	HLSC_TR8	843	3.43 ± 0.98	0.619	0.386	0.511	
… judge what helps a lot for you to stay healthy and what does not help much?	HLSC_TR11	843	3.17 ± 1.07	0.623		0.556	
… take your medicine in the way you're told to?	HLSC_TR14	843	3.32 ± 1.09	0.531		0.406	
… find out how to recover quickly when you have a cold?	HLSC_TR1	843	2.68 ± 1.24	0.457			0.558
… find out how you can best relax?	HLSC_TR3	843	3.17 ± 1.08	0.443			0.785
… understand why you need to relax sometimes?	HLSC_TR10	843	3.19 ± 1.09	0.535			0.729
Eigenvalue				4.65	4.65	1.23	1.01
Variance explained (%)				31.01	31.01	8.20	6.78
KMO	0.897						
x^2	2675.79						
p	< 0.001						
Cronbach alpha		843	49.90 ± 7.98	0.831	690	0.736	0.589
Corrected Item-Total Correlation				0.33-0.56	0.38-0.52	0.33-0.53	0.32-0.47
	Extraction Method: Principal Component Analysis.						

Table 3 Confirmatory factor analysis of HLS-Child-Q15-TR and goodness of fit indices of the models

Models	X^2/df	NFI	RFI	IFI	TLI	CFI	GFI	RMSEA	%95 GA RMSEA
One Factor HLS-Child-Q15-TR Model	4.30	0.857	0.833	0.887	0.867	0.886	0.941	0.063	(0.056-0.069)
Exploratory Factor Analysis 3 Three Factor Model	2.84	0.909	0.890	0.939	0.926	0.938	0.963	0.047	(0.040-0.054)
Theoretical Three-Factor Access-Understand-Apply Model	4.15	0.867	0.839	0.896	0.893	0.895	0.945	0.061	(0.058-0.068)
Theoretical Three-Factor Health Care-Disease Prevention-Health Promotion Model	4.04	0.870	0.844	0.899	0.878	0.899	0.945	0.060	(0.054-0.067)
Theoretical Three-Factor Health Care-Disease Prevention-Health Promotion Recommended Model	2.68	0.915	0.895	0.945	0.932	0.945	0.965	0.045	(0.038-0.052)

Table 4 Reliability analyses of HLS Child-Q15-TR and its sub-dimensions

HLSChildQ15-TR	Mean ± SD	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha
HLSChildQ15-TR	49.87 ± 8.00	0.38.4–0.56.2		0.831
Health Care				0.633
HLSC_TR1	2.68 ± 1.24	0.314	0.647	
HLSC_TR5	3.14 ± 1.08	0.434	0.561	
HLSC_TR6	3.47 ± 0.74	0.443	0.569	
HLSC_TR12	3.52 ± 0.77	0.434	0.570	
HLSC_TR13	3.55 ± 0.79	0.420	0.575	
Disease Prevention				0.701
HLSC_TR2	3.27 ± 1.06	0.416	0.669	
HLSC_TR7	3.23 ± 1.13	0.533	0.618	
HLSC_TR8	3.43 ± 0.98	0.453	0.655	
HLSC_TR11	3.17 ± 1.07	0.480	0.643	
HLSC_TR14	3.32 ± 1.09	0.407	0.673	
Health Promotion				0.604
HLSC_TR3	3.17 ± 1.08	0.418	0.512	
HLSC_TR4	3.58 ± 0.74	0.226	0.605	
HLSC_TR9	3.53 ± 0.77	0.401	0.530	
HLSC_TR10	3.19 ± 1.09	0.414	0.515	
HLSC_TR15	3.54 ± 0.75	0.351	0.552	

understanding and applying health information used in the German version of the HLS-Child-Q15-TR (x2/df = 4.15, CFI = 0.895, GFI = 0.945, RMSEA = 0.06) were found to be below acceptable levels. 1). The fit values of the three-factor construct of healthcare, disease prevention and health promotion (x2/df = 4.04, CFI = 0.899, GFI = 0.945, RMSEA = 0.060) were below the acceptable levels indicated in Table 3. Although the Turkish structure of the HLS-Child-Q15-TR, as revealed by exploratory factor analysis, demonstrated a satisfactory fit with the theoretical models, the item 'Finding a way to get better quickly when you have a cold' in the health care sub-dimension of the scale was included in another dimension (Table 2). While the sub-dimension of disease prevention did not present any problems, items pertaining to the sub-dimensions of health promotion and disease prevention were included within the same sub-dimension. For example, the item "understanding what your family tells you about your health" was included within the health promotion sub-dimension, while the item "finding out which foods are healthy" was included within the disease prevention sub-dimension (Table 2). The expert panel consulted for the content validity of the HLS-Child-Q15-TR expressed the opinion that the structure of the scale had altered the theoretical structure. Consequently, modifications to the model of the constructs used in the German version of the HLS-Child-Q15-TR were examined. Consequently, error covariance was incorporated between the items HLSC_TR11 and HLSC_TR14, and HLSC_TR12 and HLSC_TR15, which exhibited high covariance values in the health promotion dimension within the structure of health care, disease prevention and health promotion. The outcome of the analysis led to the development of a proposed model for three-factor health care, disease prevention and health promotion. The proposed model demonstrated a satisfactory level of fit, as indicated by the fit values x^2/df = 2.68, CFI = 0.945, GFI = 0.965, and RMSEA = 0.045 (Table 3).

Reliability analyses

The internal consistency and item analyses of HLS-ChildQ15-TR and its sub-dimensions are presented in Table 4. As indicated in the table, the mean score for HLSChildQ15-TR was 49.87 ± 8.00, with item total

Table 5 Comparison of participants' sociodemographic and individual characteristics with general health literacy scores

Variables	*n*	Mean	SD	Statistics
Age				
8	81	37.13	7.82	F = 4.45
9	274	39.04	7.96	*p* = .004
10	310	40.49	7.84	
11	81	37.13	7.82	
Class				
3rd grade	233	36.85	8.37	F = 41.08
4th grade	277	42.68	5.92	*p* < .001
5th grade	333	38.68	8.06	
Gender				
Female	410	39.54	7.95	t = 0.18
Male	433	39.44	7.80	*p* = .859
Income level of parents				
Income less than spending	44	38.63	8.52	F = 0.60
Income equal to spending	555	39.68	7.80	*p* = .553
Income more than spending	244	39.20	7.93	
Level of evaluation of physical health				
Passing	62	33.40	9.01	F = 29.12
Good	168	36.76	7.58	*P* < .001
Very good	261	40.14	7.15	
Excellent	352	41.39	7.43	
Level of evaluation of mental health				
Passing	75	34.68	8.61	F = 23.65
Good	186	37.16	7.76	*P* < .001
Very good	213	40.02	7.37	
Excellent	369	41.34	7.36	

correlations in the range of 0.38.4–0.56.2 and a Cronbach Alpha coefficient of 0.831. The Cronbach alpha coefficients for the healthcare, disease prevention and health promotion dimensions were 0.633, 0.701 and 0.604, respectively. The halving Cronbach's alpha coefficients for the HLSChildQ15-TR were 0.707 for the first part and 0.730 for the second part (Supplement 2). The Pearson correlation coefficient of the HLSChildQ15-TR was found to be 0.959, while the Spearman Rho correlation coefficient was 0.976 in the retest conducted with a total of 40 students two weeks after the first application (Supplement 3). Furthermore, it was determined that the test-retest item correlations of the scale items were found to exceed 0.80 (Supplement 4).

Distribution of health literacy levels

The mean HL score of the sample based on HLS-EU-Q47 health literacy indices was calculated as 39.49 ± 7.87. The mean scores of the students ranged between 3.33 and 50.0. The health literacy categories of the students, as determined by the HLS-EU-Q47 index, were as follows: inadequate HL (5.1%), problematic HL (13.4%), adequate HL (35.5%) and excellent HL (46%). A statistically significant difference was identified between the students' age, grade, physical and mental health assessment levels, and health literacy scores (Table 5). Following the application of multiple comparisons, it was determined that the health literacy scores of 10-year-old children were higher than those of 8-year-old children ($p = .004$). Additionally, the health literacy scores of fourth-grade students were found to be higher than those of third-grade students ($p < .001$). The health literacy scores of primary school students were found to be higher than those of both the third grades ($p < .001$). Furthermore, it was found that students who defined both physical and mental health at a higher level exhibited higher health literacy scores than those who defined both physical and mental health at a lower level ($p < .01$).

Discussion

The present study was conducted to examine the validity and reliability analyses and psychometric properties of the HLS-Child-Q15-TR in Turkish children aged 9–11 years. The results demonstrated that the content validity was high and that the fit values of the proposed model, which consisted of three factors representing healthcare, disease prevention and health promotion, were at a satisfactory level. The item-total correlations of the HLS-ChildQ15-TR were found to range from 0.384 to 0.562, while the Cronbach Alpha coefficient was 0.831. The alpha coefficients of the health care, disease prevention and health promotion dimensions were above 0.60, the test-retest correlation coefficient was 0.90 and the test-retest item correlations of the scale items were above 0.80. These results demonstrate that the HLS-Child-Q15-TR is a valid and reliable instrument for use with Turkish children aged 9–11 years.

Item analysis

In the German [8], French [10] and Dutch [11] adaptations of the HLS-Child-Q15, item difficulties ranged between 20 and 80%. The proportion of responses classified as "easy" or "very easy" for the items comprising the HLS-Child-Q15-TR, which pertain to topics such as understanding the importance of maintaining a healthy weight, identifying healthy foods, comprehending medical advice, appreciating the necessity of vaccination, grasping familial guidance on health matters, adhering to medication regimens, following instructions in traffic safety, and adopting a nutritious diet, exceeds 85%. These results demonstrate that the scale is comprehensible for Turkish children aged 9–11 years. However, the item difficulty in the statement "finding a way to recover quickly when you have a cold" is 31.4%, indicating that children in this age group may have difficulty with this item.

Language and content validity

The linguistic validity of the HLS-Child-Q15-TR was guaranteed by employing a five-stage systematic

approach, which included forward translation, expert opinion, backward translation, pre-test/cognitive interview, and the final version, in accordance with the World Health Organization [17, 18] guidelines for translation. The content validity of the HLS-Child-Q15-TR was found to be high [33]. Eight children aged between 9 and 11 years were interviewed, and it was established that children's health-related knowledge and their actions to maintain health were associated with their parents' health practices.

Construct validity

The results of the explanatory factor analysis of the HLS-Child-Q15-TR indicated that the KMO value was high and the total explained variance exceeded 40%. However, the three-factor access, understanding and implementation of the HLS-Child-Q15-DE did not fit the data. Nevertheless, as in the HLS-Child-Q15-DE, the three-factor structure of health care, disease prevention and health promotion is explained by the harmonised structure. Nevertheless, the items "understanding what your family tells you about your health" and "eating healthy" in the health promotion dimension of the health care, disease prevention and health promotion construct, and the item "finding out which foods are healthy" in the health care sub-dimension and the item "finding out which foods are healthy" in the disease prevention sub-dimension of the health promotion dimension of the health care, disease prevention and health promotion construct emerge. Furthermore, it was established that the third factor's internal consistency coefficients in this structure were below the acceptable threshold [28–30]. Following the adaptation study of the scale to the French population, it was demonstrated that the statistics exhibited a high internal consistency. Furthermore, the results of the explanatory factor analysis indicated the presence of a two-dimensional factor structure that differed from the theoretical structure. This led to the conclusion that the scale could be reduced to 12 items [10]. The adaptation study of the scale to the French population revealed that the statistics exhibited a high internal consistency. Furthermore, the explanatory factor analysis determined a two-dimensional factor structure that differed from the theoretical structure, leading to the reduction of the scale to 12 items [10]. Although a three-factor structure emerged in the exploratory factor analysis, the third factor internal consistency coefficient ($\alpha = 0.589$) was below the acceptable level. It can be stated that this situation is not conducive to the theoretical structure of the HLS-Child-Q15-DE [22–27].

Despite the satisfactory fit values of the 3-factor structure (RMSEA = 0.047), as revealed by the exploratory factor analysis of the HLS-Child-Q15-TR, the experts consulted for the content validity of the HLS-Child-Q15-TR indicated that the structure was not entirely optimal. The HLS-Child-Q15-TR indicated that the proposed three-factor structure of health care, disease prevention and health promotion of the HLS-Child-Q15-DE was valid for the HLS-Child-Q15-TR (RMSEA = 0.045, 90% CI = 0.038–0.052) [22–27].

Reliability

The internal consistency of a scale is determined by item analysis, and it is recommended that the item-total correlations of the scale should be above 0.30. In order to ensure the total reliability of the scale, it is necessary to ensure that the Cronbach Alpha value of each item is 0.70 and above. The minimum acceptable Cronbach alpha value for the sub-dimensions of the scale is 0.60 or above [28–30]. The test-retest correlation provides an indicator of stability over time. Test-retest reliability estimates, which are quite similar, have been observed to vary between 0.70 and 0.90 [33, 34]. In the initial investigation into the psychometric properties of the HLSChild-Q15-DE, it was reported that its internal consistency was satisfactory [8].

Following the adaptation of the scale to Dutch culture, it was determined that it exhibited high internal consistency and a satisfactory item-total score correlation [11]. This was observed in the HLS-EU- The PTc demonstrated satisfactory internal consistency following its adaptation to Portuguese culture [12], and similarly exhibited high internal consistency following its adaptation to French culture [10]. The item-total correlations of the HLS-ChildQ15-TR were found to be in the range of 0.384–0.562, with a Cronbach Alpha coefficient of 0.831 and halving Cronbach Alpha coefficients above 0.70. The Cronbach alpha coefficients for the health care, disease prevention and health promotion dimensions of the HLS-ChildQ15-TR were found to be above 0.60, indicating an acceptable level of reliability for these sub-dimensions. The test-retest correlation coefficient of the HLS-ChildQ15-TR is above 0.90, indicating that the scale is stable over time. Furthermore, the test-retest item correlations of the scale items are above 0.80, suggesting that the items are also stable. In the study in which the HLS-Child-Q15-DE was developed, it was stated that its reliability was measured with a one-time evaluation. However, it is important to investigate test stability by conducting at least one follow-up survey [8]. This result is of particular significance as it represents the inaugural investigation into the test-retest correlation of the HLS-Child-Q15.

Distribution of health literacy levels

The health literacy categories of the students were calculated according to the HLS-EU-Q47 index, with the results indicating that 18.5% of the students exhibited

inadequate health literacy, while 81.5% demonstrated adequate health literacy. In the adaptation to the French culture, it was found that health literacy scores were higher with increasing age and in males [10]. In the adaptation to the Dutch culture, health literacy scores were higher with increasing age and class [11]. The findings of the adaptation of the HLS-Child-Q15-TR to the French and Dutch cultures are comparable to those of the aforementioned studies. In this adaptation, the health literacy scores of 10-year-old children were found to be higher than those of 8-year-old children. Furthermore, similar to the findings of the HLS-Child-Q15 adapted to the Dutch culture, the scores of children in the 4th grade of primary school were found to exceed those of 3rd grade students in this study [11]. Consequently, it can be hypothesised that there is a positive correlation between age and grade, and health literacy scores. Finally, no significant differences were observed according to gender. In this study, those who defined their physical or mental health as being in a better state had significantly higher health literacy scores than those who defined their health as being in a worse state. It can be hypothesised that the increase in the health literacy level of the students is related to the level of evaluation of their health.

Strengths and limitations

HLS-EU-Q47 was also developed for children aged 9–10 years and psychometric analyses were also conducted German version of the HLS-Child-Q15. The scale have been adapted to reflect the cultural nuances of Dutch, French, and Portuguese versions of various societies in recent years. It is thought that HLS-Chıld-Q15-TR will make an important contribution to the Turkish culture in evaluating the health literacy levels of children aged 9–11 years in Turkey. The results demonstrate that the HLS-Child-Q15-TR is a valid and reliable instrument for use with Turkish children aged 9–11 years.

While this study conducted factor structure and reliability analyses of the HLS-Child-Q15-TR, it is important to note that the first limitation is that it does not cover the criterion validity and convergent validity findings by using a parallel form. Secondly, it should be noted that the HLS-Child-Q15-TR was administered in a region of Turkey with a high level of education. Consequently, the findings may not be representative of Turkish children in different regions. Thirdly, conducting further qualitative interviews with a larger number of children may facilitate the emergence of a more comprehensible structure for analysing children's responses. In addition, the planned test-retest of the HLS-Child-Q15-TR was not conducted with at least 20% of the sample, as originally intended, but only with 40 students.

Conclusion

This study demonstrated that the HLS-Child-Q15-TR exhibited satisfactory content validity and that its three-factor construct, encompassing healthcare, disease prevention, and health promotion, was valid in Turkish children aged 9–11 years. The item-total correlations and internal consistency Cronbach's alpha coefficients of the HLS-ChildQ15-TR were deemed to be acceptable and reliable, and the test-retest correlation coefficient of the HLS-ChildQ15-TR was found to be high, indicating that the scale was invariant over time. It is recommended that the HLS-Child-Q15-TR, which has been demonstrated to be both valid and reliable, be used for the measurement of health literacy levels in Turkish children under the age of 12. In future studies, it would be beneficial to measure the stability of the test-retest procedure of the HLS-Child-Q15-TR by including 20% of the sample. The present study was conducted in Fethiye, a region of Turkey with a high level of educational attainment. Further studies are required to validate the factor structure of the HLS-Child-Q15 in different languages and settings. It is recommended that the HLS-Child-Q15-TR be applied in other regions of Turkey to investigate its factor structure, reliability, criterion validity and convergent validity using a parallel form.

Abbreviations

HLS-EU-Q47	The European Health Literacy Scale Questionare 47
HLS-Child-Q15-DE	European Health Literacy Scale Child Questionare 15- Deutsch
HLS-Chıld-Q15-TR	European Health Literacy Scale Child Questionare 15- Turkish

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12887-025-05592-x.

Supplementary Material 1

Acknowledgements

The authors acknowledge the cooperation of the Turkish Ministry of Education, as well as the many principals, teachers, parents and students who participated in this study.

Author contributions

I.A.: Conceptualization, Data curation, design of the work, the acquisition, analysis, nterpretation of data, he creation of new software used in the work, drafted the work or substantively revised it; O.A: Conceptualization, Data curation, design of the work, the acquisition, analysis, nterpretation of data, he creation of new software used in the work, drafted the work or substantively revised it.

Funding

The authors received no financial support for the research, authorship, and publication of this article.

Data availability

The datasets used and/or analysed during the current study available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving research study participants were approved by the Ethics Committee of Mugla Sitkı Kocman University (23.05.2022/220073). As the students involved in the study were below the age of 16, written informed consent was obtained from the parents or legal guardians of each student.

Consent for publication

Not Applicable.

Competing interests

The authors declare no competing interests.

Received: 12 July 2024 / Accepted: 12 March 2025
Published online: 22 March 2025

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