

# Evaluation of cross-cultural adaptation and validation of the Persian version of the health literacy for school-aged children scale: Methodological study

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## Abstract

**Background and Aims:** Health literacy (HL) is an essential determinant of health in children. Inadequate HL causes problems for individuals and society, such as more hospitalizations, medication errors, poor health, and higher mortality and health care costs. A valid and reliable scale is needed to measure this population's HL. This study evaluated the cross-cultural adaptation and validation of the Persian version of the HL for School-Aged Children (HLSAC) Scale.

**Methods:** In this methodological research, the HL scale of school-aged children was translated from English to Persian using the Backward-Forward translation protocol. The content validity, face validity, construct validity (Exploratory Factor Analysis [EFA] and Confirmatory factor analysis [CFA]), plus reliability, were evaluated by Internal consistency and stability methods. Two hundred forty samples from south of Tehran were selected by multi-stage sampling method to assess the construct validity. Data analysis was performed using SPSS v24 and Jamovi v2.2.

**Results:** A qualitative evaluation of face and content validity showed that experts and the target group approved all items on the scale. The results of EFA indicated the existence of one factor, explaining 47.17% of the total variance of the scale. The CFA results showed that the one-factor model of the Persian version of the HL scale for children is almost acceptable. ( $\chi^2/df = 2.94$ , Root Mean Square Error of Approximation = 0.09, Normed-Fit Index = 0.89, Tucker-Lewis Index = 0.89, Comparative Fit Index = 0.92). Cronbach's alpha coefficient for the whole scale was 0.80, and the Intraclass Correlation Coefficient value for the whole scale was calculated as 0.78 using the single-rating, absolute-agreement, 2-way mixed-effects method.

**Conclusion:** The study validates the HLSAC Scale, affirming its suitability for assessing HL in Persian-speaking child populations.

## KEYWORDS

cross-cultural adaptation, health literacy, Iran, scale, school-aged children, validation

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## 1 | INTRODUCTION

The concept of health literacy (HL) was first introduced by Simonds who emphasized the importance of HL on national health and the provision of the most basic HL education.<sup>1</sup> According to the World Health Organization and the Health Promotion Glossary, HL is cognitive-social skills that motivate and enable individuals to access, understand and use information that leads to maintaining and promoting their health.<sup>2</sup> HL includes three general elements: (a) health knowledge, health care, and health systems. (b) processing and using information related to health and health care; and (c) the ability to maintain health through self-management and collaboration with health providers.<sup>3</sup> Inadequate HL has consequences at the social and individual levels. For example, difficulties in understanding and interpreting health information lead to frequent hospitalizations, misuse of medications, poor health, and increased mortality, which are associated with increased health care costs for the community.<sup>4,5</sup>

HL is an essential skill for children, especially school-age children, who are developing their cognitive, social, and emotional abilities. Healthy lifelong behaviors and habits are formed during this period, and adequate HL skills can consciously support a healthy lifestyle. By developing a good level of HL. They will be independent clients of the health system in the future, so they can contribute to reducing the adverse consequences of inadequate HL. Some possible reasons why HL is important for school-age children are: (a) HL can help them prevent or manage chronic diseases, such as asthma, diabetes, or obesity, by following healthy behaviors and adhering to treatment plans; (b) HL can help them cope with stress, anxiety, or depression, by recognizing the signs and seeking help when needed; (c) HL can help them avoid risky behaviors, such as smoking, drinking, or drug use, by understanding the consequences and resisting peer pressure; (d) HL can help them participate in health-related activities, such as physical education, nutrition education, or health fairs, by being curious and engaged; and (e) HL can help them communicate effectively with health care providers, teachers, parents, or peers, by asking questions and expressing their needs and preferences.<sup>6,7</sup>

HL in childhood includes the development of skills beyond theoretical and practical knowledge. It includes critical thinking, self-awareness, and skills that take responsible actions to improve their skills and the health of others.<sup>8</sup> While promoting HL in children is included exclusively in the WHO Policy Summary and the Shanghai Declaration,<sup>8,9</sup> there is little information on HL status in children. The main reason is the lack of a valid and reliable scale for measuring HL among children.<sup>10,11</sup>

The most common HL measurement scales are the Test of Functional HL in Adults (TOFHLA), the Functional, Communicative and Critical HL Scale (FCCHL), Newest Vital Sign (NVS), Maternal HL and Pregnancy Outcome (MHLAP), Heart Failure-Specific HL Scale (HF-specific HL scale) indicated that it is mainly used in the population group of adults or patients.<sup>11</sup> On the other hand, several attempts have been made to design a HL scale for teenagers. Still, they have limitations such as a large number of items, comprehensiveness, and consistency with the culture of the community. In

addition, information regarding the validity and reliability of some of them is limited.<sup>11-17</sup> Therefore, it is recommended that researchers develop new measures so that a full range of conceptual dimensions of HL and validation studies are considered to create solid evidence for measuring HL in children. Therefore, paying particular attention to their brevity is necessary while compiling new scales used in different social, economic, and cultural societies. In the meantime, Paakkari et al. developed the HL for School-Aged Children (HLSAC) scale in 2014 based on the conceptualization of the HL. This short, comprehensive, theory-based scale includes all the essential components of HL, including theoretical knowledge, practical knowledge, critical thinking, self-awareness, and citizenship. It is designed to meet the HL needs of children. Although the HLSAC scale has been translated and its reliability and validity have been studied in some countries, including Turkey, Poland, Denmark, and Italy, assessing these features in its translated versions in other languages is necessary.<sup>18</sup>

HL has attracted policymakers' attention due to its essential role in how people make decisions in health-related fields as one of the crucial scales to improve the health level of society and raise the quality of life. However, in Iran, the available evidence shows limited HL among children<sup>19,20</sup>; the results of the study by Jafari et al. on students aged 6–18 old years showed that most of them had an inadequate level of HL. Therefore, it is necessary to evaluate and promote the status of HL in children.<sup>19</sup> Given the importance of HL in children as a prospective adult population and to identify their needs and examine the impact of HL promotion interventions in this population, access to a valid and reliable scale for assessing HL is essential. Therefore, this study aimed to evaluate the cross-cultural adaptation and validation of the Persian version of the HLSAC Scale (HLSAC-P) in Iran.

## 2 | METHOD

The present study is methodological research. The face validity, content validity, and construct validity of the translated scale were examined. Reliability was also assessed in terms of Internal Consistency and Stability. Further details of each step are given below.

### 2.1 | Study population and sampling

The study population was all students living in the south of Tehran, and the study setting was a comprehensive health center in the south of Tehran. Sampling was performed by a multi-stage method. Since the comprehensive health centers in the south of Tehran are located in five districts 10, 11, 16, 17, and 19, two centers were randomly selected from each district, and the researcher referred to these centers for sampling. Purposive sampling was used for face and content validity and reliability. While for construct validity, the required samples were selected from these centers by simple random sampling by preparing the list of all eligible school-age children in the health centers' databases. Inclusion criteria were students aged

12–16 years old living in the southern part of Tehran and willing to participate in the study. In this way, the researcher retrieved the telephone numbers of the samples using the mentioned databases. The students and their parents were invited to cooperate and attend the center during the phone call. Since the study participants were under 18 years of age, to obtain informed consent, the consent form was provided to the parents to be signed. Also, verbal informed consent was obtained from the children before completing the questionnaire. Two general recommendations regarding the minimum sample size required for factor analysis exist. The first recommendation is based on the absolute number of cases (N), and the second recommendation states the importance of the subject-to-variable ratio ( $p$ ). In this regard, Guilford suggests that N should be at least 200,<sup>21</sup> and MacCallum et al. recommended that the subject-to-variable ratio should not be less than 5.<sup>22</sup> Although a larger sample is better in terms of representation, implementing a scale in clinical settings and health centers usually has some difficulties. Therefore, in this study, 240 eligible samples completed the scale by self-report. The data gathering was done from September to November 2021.

## 2.2 | Data collection scales

Data were collected by demographic form and the HLSAC scale. The demographic scale consisted of seven questions to collect information about the target group's age, sex, educational background, mother's education, mother's employment status, father's education, and father's employment status.

The HLSAC scale was designed in 2014 by Paakkari et al. in Finland for school-aged children. The HL Scale for school-aged children is self-administrated. It contains five components of HL, including Theoretical knowledge (questions 1 and 5), Practical knowledge (questions 4 and 7), Critical thinking (questions 9 and 3), Self-awareness (questions 8 and 10), and Citizenship (questions 6 and 2). The questions are answered using a 4-point Likert scale (1 = not true at all, 2 = not entirely true, 3 = somewhat true, 4 = absolutely true). The level of HL is classified according to the score obtained in three groups: "low" (score 10–25), "medium" (score 35–26), and "high" (score 40–36). The scale's reliability has been confirmed by Cronbach's  $\alpha$  of 0.93.<sup>18</sup>

## 2.3 | Translation of HLSAC scale

After correspondence with Dr. Paakkari and obtaining permission, the scale was translated using the standard Forward-Backward method. Thus, initially, the scale was translated from English to Persian by two translators who were fluent in Persian and English independently and simultaneously. In the second stage, the translations were compared by a third bilingual independent translator regarding ambiguities and discrepancies in words, sentences, and meaning. In this way, the translations were compared, and corrections were applied based on experts' opinions. In the third stage, the

prepared Persian version was given to two translators who were fluent in Persian and English (independent of first-time translators) to translate Persian into English. The two back-translations were compared by a multidisciplinary committee, including two community health specialists, one pediatric health specialist, and one methodologist, regarding the format, wording, and grammatical structure of the sentences, similarity in meaning, and relevance.

## 2.4 | Face validity

Face validity is the extent to which a measurement method appears "on its face" to measure the construct of interest.<sup>23</sup> In a qualitative face validity assessment, the opinions of 10 school-aged children were received to find the difficulty level in understanding phrases and words, the appropriate fit and relationship of items, the possibility of ambiguity, and the need to delete or merge items. Also, five community health specialists, one pediatric health specialist and, two psychometric specialists examined the scale regarding whether it appears to measure what it is intended to.

## 2.5 | Content validity

Content validity assesses how well a set of scale items matches the relevant content domain of the construct it is trying to measure.<sup>23</sup> Content validity was evaluated qualitatively using a panel of five community health specialists, one pediatric health specialist, and two psychometric specialists. Their opinions about the proper position of the items, the use of appropriate words, the observance of grammar, and the proper scoring of the scale and its instructions were obtained, and their comments were the basis for the necessary changes.

## 2.6 | Construct validity

Construct validity examines the adequacy of the scale to measure the existing construct. Do the scale items support or not the theoretical and practical definition of the scale?<sup>24</sup> Exploratory factor analysis (EFA) and Confirmatory factor analysis (CFA) was used to investigate the construct validity of the scale. Using EFA, items of scale that show the highest correlation with each other are covered by one factor. A key question in factor analysis is determining the number of factors that must be extracted and maintained to explain as much data as possible. Several solutions have been proposed to determine the number of factors to be kept, including the general rules of eigenvalues greater than or equal to 1 or using a Scree plot. Recently it has been recommended to use parallel analysis where the eigenvalues of random data are compared with the eigenvalues of real data sets. Parallel analysis can perform significantly better than the other two methods in identifying the ideal number of factors.<sup>25</sup>

The Kaiser-Meyer-Olkin sampling adequacy index test was performed to ensure the samples' adequacy. Also, the Bartlett

sphericity test was used to determine if there is enough correlation between the items on the scale to integrate them and whether the obtained correlation matrix is significantly different from zero. In the present study, the minimum factor load required to maintain each item in the factors extracted from factor analysis was considered 0.5. Next, the CFA was applied to the ten items to assess the prior model.<sup>18</sup> The fit of the model to the data was tested via the following: Chi-square test, Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), Normed-Fit Index (NFI), and Tucker–Lewis Index (TLI). CFA was conducted with Jamovi 2.2.

## 2.7 | Reliability

The Stability was assessed by test-retest method with a time interval of 2 weeks on 20 samples, and the Intraclass Correlation Coefficient (ICC) was calculated using the single-rating, absolute-agreement, 2-way mixed-effects model. Internal consistency of the final scale was assessed using Cronbach's alpha coefficient in a sample of 240 people in the target group.

## 2.8 | Ethical considerations

This study was evaluated and approved by the Research Ethics Committee of the School of Medicine-Tehran University of Medical Sciences (Ethical code: IR.TUMS.MEDICINE.REC.1400.307). The necessary permissions were obtained from the authorities of the study settings and the developer of the original scale. The students and their parents were informed about the study objectives, their freedom to withdraw from the study, and the confidentiality of their data. Informed consent was obtained from the students and their parents. All methods were carried out in accordance with relevant guidelines and regulations.

## 2.9 | Data analysis

Mean and standard deviation were used to describe quantitative variables, and frequency tables were used to describe qualitative variables. Analysis of demographic characteristics of the research sample, EFA, Parallel Analysis, and reliability were performed in SPSS v24 and CFA was performed in Jamovi v2.2 software. The missing data for each item was replaced with the mean responses to that item.

## 3 | FINDINGS

### 3.1 | Characteristics of the participants

One hundred twenty-three of the 240 school-age children selected as a sample for this stage were boys. The mean and standard

**TABLE 1** Demographic characteristics of students in the south of Tehran in 2021 ( $n = 240$ ).

Characteristics		Frequency	
		(%)	N
Gender	Girl	117	48.75
	Boy	123	51.25
Educational grade	Sixth	33	13.75
	Seventh	10	4.17
	Eighth	31	12.92
	Ninth	89	37.08
	Tenth	77	32.08
Father's educational level	Illiterate	4	1.67
	Elementary	50	20.92
	Diploma	46	19.25
	University	139	58.16
Mother's educational level	Illiterate	5	2.1
	Elementary	41	17.15
	Diploma	75	31.38
	University	118	49.37
Father's employment status	Employed	218	91.98
	Unemployed	3	1.27
	Retired	16	6.75
Mother's employment status	Employed	81	33.89
	Housewife	153	64.02
	Retired	5	2.09
Age, Mean (SD)		14.26 (1.29)	
Weight, Mean (SD)		55.37 (12.4)	
Height, Mean (SD)		1.64 (0.11)	

deviation of the age of samples was  $14.26 \pm 1.29$  years, with an age range of 12–16 years. The educational level of the majority was ninth grade (37.08%); other personal characteristics of the samples are presented in Table 1.

### 3.2 | Content validity and face validity

The scale was reviewed based on the experts' opinions, and the necessary corrections were applied to each item. For example, in item 10 the word “choices” was changed to the word “decisions” and in item 4 the phrase “health care personnel” was changed to “doctor and nurse.” Also, item 2, with the phrase “When necessary I am able to give ideas on how to improve health in my immediate surroundings (e.g. a nearby place or area, family, friends)” was modified to “If necessary, I can offer suggestions to improve the health of my family, friends and people around me.” Also, qualitative face validity showed

that experts and the students approved of the scale's difficulty level, appropriateness, and lack of ambiguity.

### 3.3 | Construct validity

EFA and CFA were used to evaluate the construct validity of the HLSAC-P scale. Parallel analysis showed only one factor (Figure 1). The results of the KMO size showed the adequacy of sampling for EFA use (KMO = 0.897). The KMO value indicates that the zero-order correlation matrix of the elements is larger than the matrix. Factors can be extracted from the matrix. In the Bartlett test,  $\chi^2 = (45) 867.13$  was obtained ( $p < 0.001$ ). The significant value of Bartlett's test of sphericity showed that the data correlation matrix in the sample is not zero, and therefore, factorization is justifiable. After Promax rotation, the distribution of cumulative variance showed that one factor (HL) consisting of all 10 items had 47.17% of the total variance (Table 2). All the items had loading values above 0.5, ranging from 0.588 to 0.766, meaning that all have a common variance with each other. For CFA, the adaptive fit indices (TLI, NFI, and CFI) and the parsimonious fit indices (RMSEA and  $\chi^2/df$ ) were given in Table 3. The model had good item loadings and, considering the large sample size and the fact that no error covariances were allowed between any of the items, it also had a reasonably good fit to the data (RMSEA = 0.09, CFI = 0.92, TLI = 0.89, NFI = 0.89).

### 3.4 | Reliability

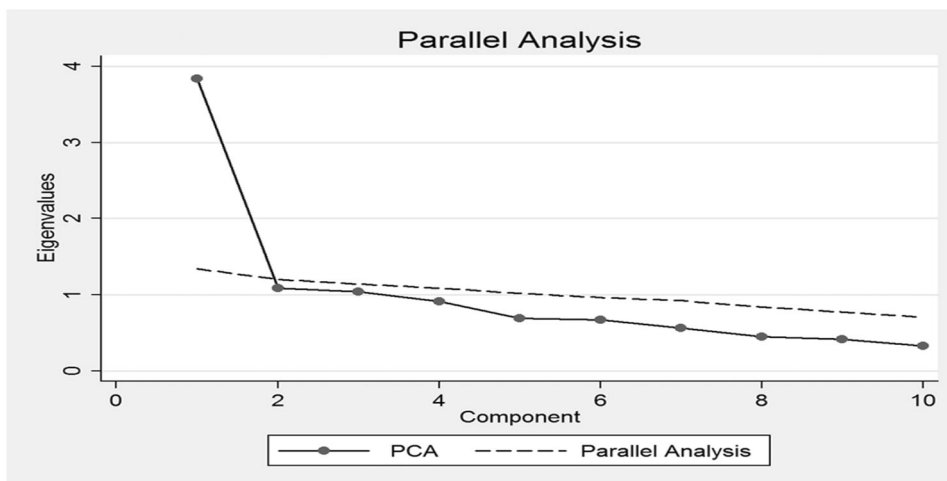
Table 4 shows the reliability of the HLSAC-P scale using Cronbach's alpha coefficient and ICC. Cronbach's alpha coefficient was calculated in 240 samples, which was 0.80 for the whole scale. The ICC value computed using the single-rating, absolute-agreement, 2-way mixed-effects model for the entire HLSAC-P scale was 0.78, indicating good reliability.

## 4 | DISCUSSION

This study aimed to investigate the cross-cultural adaptation and validation of HLSAC-P and provide a valid scale for use in studies related to HL of school-aged children in the Persian-spoken populations. Most existing scales for children's HL have focused only on functional HL, while the HLSAC is designed to assess children's subjective HL. HLSAC is a short, comprehensive, theory-based scale that measures the five essential components of HL. It has been developed through an iterative, systematic, and validity-driven process that addresses the current and future HL needs of school-aged children. Therefore, the scale has the advantage of being concise without compromising its content and aspects, which is important for large-scale studies. Long scales may cause fatigue and boredom among children, which may reduce the reliability of the study. HLSAC is based on a testable conceptualization of HL that emphasizes its multidimensional nature. This conceptualization defines HL as a broad range of knowledge and competencies that people seek, evaluate, construct, and use. According to this conceptualization, HL can be clearly defined, operationalized, and translated into pedagogical practices.<sup>18</sup>

Two most important criteria for evaluating any scale are its reliability and validity, this study investigated the validity of the HLSAC-P scale, including content validity, face validity, construct validity, and reliability. The results of this study showed that the HLSAC-P scale has good reliability and validity. This finding was consistent with the results of the psychometrics of this scale in Turkey, Poland, Denmark, and Italy.<sup>26-29</sup>

In this study, the qualitative method assessed the scale's content validity because the quantitative content validity assessment methods with two indices of Content Validity Ratio and Content Validity Index leads to the elimination of scale items in most cases that make the scale different from the original one.<sup>30</sup> Although checking the scale's content validity is very important, these were not investigated in a similar study in Poland<sup>27</sup> and Denmark.<sup>28</sup>



**FIGURE 1** Parallel Analysis for differentiated factors through exploratory factor analysis of HL for School-Aged Children scale.

**TABLE 2** Results of exploratory factor analysis of HL for School-Aged Children scale ( $n = 240$ ).

Dimensions	Items	Item content	% of variance	Factor loading
Health literacy	1	I have good information about health	47.17	0.647
	2	When necessary I am able to give ideas on how to improve health in my immediate surroundings (e.g. a nearby place or area, family, friends)		0.766
	3	I can compare health-related information from different sources		0.644
	4	I can follow the instructions given to me by health care personnel (e.g. nurse, doctor)		0.588
	5	I can easily give examples of things that promote health		0.695
	6	I can judge how my own actions affect the surrounding natural environment		0.719
	7	When necessary I find health-related information that is easy for me to understand		0.694
	8	I can judge how my behavior affects my health		0.720
	9	I can usually figure out if some health-related information is right or wrong		0.692
	10	I can give reasons for choices I make regarding my health		0.688

**TABLE 3** Fit indices for confirmatory factor analysis model ( $n = 240$ ).

Model fit indices	CFI	TLI	NFI	RMSEA	$\chi^2/df$
Confirmatory factor analysis	0.92	0.89	0.89	0.09	2.94
Thresholds for acceptable fit	>0.90	>0.90	>0.90	<0.08	<3
Thresholds for good fit	>0.95	>0.95	>0.95	<0.05	<2

**TABLE 4** Cronbach's alpha coefficient and intra-cluster correlation, confidence interval, and significant probability.

Component	Cronbach's $\alpha$	ICC	CI = %95		p Value
			Lower Bound	Upper Bound	
Health literacy	0.80	0.78	0.48	0.91	<0.001

Considering that it would be more appropriate to conduct an EFA first to introduce possible cultural differences in the adapting process,<sup>31</sup> EFA and then CFA was used to evaluate the construct validity in the present study. The results of EFA showed that one factor is named HL. In the result of CFA, while the CFI and  $\chi^2/df$  values were acceptable, the other fit indices (e.g., TLI, NFI, and RMSEA) were close to acceptable thresholds. Newsom J. (2018) believed that "these values should not be written in stone, and there may be models that do not quite reach these values and for which there are no better alternatives and for which there do not seem to be theoretically sensible improvements possible."<sup>32</sup>

Although using factor analysis for assessing construct validity is one of the strengths of the present study, in the Lithuanian version,

the construct validity has not been examined.<sup>33</sup> The construct validity of this scale has been examined in the Turkish, Danish, and Italian versions with CFA.<sup>26,28,29</sup> This study summarized 10 items on the HLSAC scale in one factor. The results of the present study are consistent with those of Mazur et al. who performed the EFA for the Polish version of the HLSAC scale, in that they also identified a one-factor structure that explained 43.4% of the total variance of the scale.<sup>27</sup>

The reliability of the HLSAC-P scale was calculated using Cronbach's alpha coefficient and ICC, and the results show good scale reliability. The reliability of the original scale was also assessed by Cronbach's alpha and the test-retest method, and the results were satisfactory.<sup>18</sup> While the reliability in the Turkish, Polish, and Danish versions of the scale has been reported using only Cronbach's alpha coefficient.<sup>26-28</sup> The reliability in the Italian version has been reported with the omega coefficient.<sup>29</sup> Therefore, the present study findings regarding the scale's reliability are consistent with the scale's reliability in the abovementioned studies.<sup>26-29</sup>

Research on the measurement of School-Aged Children's HL is fundamental, not just for the sake of making a methodological contribution to the field but also for the health of the School-Aged Children themselves. However, assessing and promoting HL in school-aged children is a neglected area of education, research, and practice in societies, including Iran. Assessment of HL in school-aged children can help their health improvement in several ways. It can help children develop the abilities, skills, and knowledge to find, understand, and use health information and services effectively and efficiently. It also can help children adopt healthy behaviors and prevent or manage chronic diseases. Furthermore, it can help children become more aware of their own health needs and rights, as well as

the health needs and rights of others. It can also help children become more critical and reflective health information and services consumers. Lastly, It can help children enhance their academic performance and future aspirations.<sup>34,35</sup> Therefore, assessment of HL in school-aged children is an important step to identify their strengths and weaknesses, and to provide them with appropriate interventions and support to improve their health outcomes.

#### 4.1 | Study limitations

The present study had some limitations. This study was accomplished in the age group of 12–16 years in comprehensive health centers in the south of Tehran, so it is necessary to evaluate the validity and reliability of the scale in other age groups of children and other urban and even rural areas. Also, criterion validity was not evaluated in this study; thus, the researchers recommend assessing this type of validity in future studies. This study was also conducted during the Covid-19 epidemic restriction; consequently, we confronted some difficulty reaching the samples, trying to solve the problem by convincing students and their parents. Although the results of EFA in this study indicated the existence of one factor explaining 47.17% of the total variance of the scale. However, this limitation can be ignored due to the small number of items which is the advantage of scale.

## 5 | CONCLUSION

Valid and reliable scales can promote HL and facilitate health-related interventions. Given the importance of this issue, one of the first requirements of studies in the field of HL is access to scales with good reliability and validity and culturally appropriate ones. The results of the present study confirmed the good validity and reliability of the HLSAC-P scale for measuring the HL of Iranian school-aged children. The HLSAC-P scale can be used by health professionals and researchers in large-scale studies on children to determine HL and factors affecting HL.

#### AUTHOR CONTRIBUTIONS

All authors have read and approved the manuscript and ensure this is the case. Naeimeh Sarkhani affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; and that no important aspects of the study have been omitted.

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#### CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

#### DATA AVAILABILITY STATEMENT

The data sets generated and analyzed during the current study are not publicly available due to keeping participants' information confidential but are available from the corresponding author on reasonable request.

#### ETHICS STATEMENT

The study was evaluated and approved by the Research Ethics Committees of the School of Medicine- Tehran University of Medical Sciences (Ethical code: IR.TUMS.MEDICINE.REC.1400.307). The necessary information on the research objectives, data confidentiality, and the voluntary nature of the study was provided to the participants. Written informed consent was also obtained from the students and their parents. All methods were carried out following relevant guidelines and regulations.

#### TRANSPARENCY STATEMENT

The lead author Naeimeh Sarkhani affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

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