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Psychometric properties of the Persian version of nutrition literacy scale in the elderly

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Abstract:

INTRODUCTION: Aging and chronic diseases associated with nutrition are increasing in the world; therefore, access to a tool for assessing nutritional literacy in the elderly is necessary. Therefore, the present study was carried out with the aim of psychometric evaluation of nutritional literacy in the elderly.

MATERIALS AND METHODS: This study was carried out to psychometric testing of the Nutrition Literacy Scale (NLS), through the validity and reliability of the tool in 280 elderly people (60 years of age and older) in Tehran. The validity of this tool was determined through the methods of translation, face and content and reliability of the tool through the methods of test-retest and internal consistency. Finally, the tool was analyzed using SPSS software version 16.

RESULTS: In this study, content validity index (CVI) was calculated for each item; CVI average was 0.86.5. To determine the reliability of the tool, interclass correlation coefficient was calculated by measuring the instrument's stability, and it was 0.92. Exploratory factor analysis confirmed the existence of six factors in the questionnaire, which was named nutritional information, healthy nutrition, calorie intake, organic foods, saturated fats, and unit size, which explains 43% of the total variance. Furthermore, in the internal consistency assessment, the questionnaire was completed by 280 elderly people, and the Cronbach's α coefficient was 0.80.

CONCLUSION: Based on the results obtained in the reliability and validity assessment, NLS in Iranian elderly has a desirable reliability and validity. This questionnaire has been translated into Persian for the first time. The results of this study provide a standard tool for assessing nutritional literacy status in Persian language communities.

Keywords:

Elderly, nutritional literacy, reliability, validity

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Introduction

In many countries, the population above 60 years of age has more rapid growth than other age groups due to the increase in life expectancy and decrease in mortality rate.^[1] In 2050, 80% of old population will live in low- and average-income countries. For example, up to 2050, most of this old population (120 million people) will live in China.^[2] It is predicted that elderly population of Iran in 2050 reaches to more than 26 million people (21.7%).^[3]

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In 2014, chronic diseases were accounted for 76% of deaths in Iran.^[4] The burden of chronic diseases on the healthcare systems is high and considerable. On the other hand, self-care and the responsibility of patients as well as patients' social networks should be considered in healthcare management.^[5,6]

Food consumption models, lifestyle behaviors, and body weight are associated with the progress of chronic diseases such as diabetes Type II, certain cancers, and cardiovascular diseases.^[7] Some studies have shown that the improvement of nutrition has considerable effect on the

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health of people.^[8] The correction of nutrition can significantly increase efficiency and independence of elderly people and help them in controlling different side effects of old age and different treatments.^[9]

Understanding the importance of nutrition and healthy food behavior is important for preventing and managing many chronic diseases. The studies have shown that literacy is an important and effective factor in food habits.^[10] Many authors consider nutritional literacy as a kind of health literacy which indicates the ability to interpret and use nutrition information.^[10,11]

Nutritional literacy is an important factor in food habits, especially among the deprived people^[12] such that high nutritional literacy skills have positive relationship with the healthy food habits.^[13] Nutritional literacy can be defined as the ability of people for gaining, processing, and understanding nutritional information and required skills for suitable nutrition decision-making.^[10]

In the study by Aihara and Minai in the elderly aged over 75 years, nutritional literacy evaluated through terms of the ability to obtain basic diet information, specifically the participant's knowledge of the contents of the Japanese Food Guide Spinning Top.^[14] In the study by Zoellner *et al.* among adults, survey instruments included the Newest Vital Sign and an adapted version of the Health Information National Trends Survey.^[15]

Although nutritional literacy has a great impact on the health of the elderly, there is no adequate and concise tool for measuring the nutritional literacy of the elderly. Hence, preparing a valid tool is necessary to measure this concept. The first version of nutritional literacy tool has been designed using the information obtained from food and nutrition center of Mayo clinic, agriculture ministry of United States for nutrition policy and improvement, and other nutrition websites. The validity and reliability of this tool was assessed with Cronbach's alpha 0.84 in the US.^[16] The reliability and validity of this tool should be confirmed to use it in the country. Therefore, this study aims to determine the psychometric properties of nutritional literacy Persian version.

Materials and Methods

This research is a methodological study which was conducted among the elderlies of Tehran (60 years of age and older) in 2018. Methodological study was used to develop, validate, test, and evaluate the research instruments and methods. 10 samples was estimated for each question for construct validity^[17], Totally 280 samples.

Therefore, considering 10 sample for each item, 280 samples were selected. Samples were selected using

cluster random sampling. First, be referring to the staff centers, a list of covered healthcare centers was prepared. Then, one center was selected from each staff with simple random sampling, and samples size was determined with systematic random sampling. Inclusion criteria in this study were voluntary and informed consent to participate in research, minimum writing and reading literacy, having family case in healthcare system, and able to complete the questionnaire by the elderly, and exclusion criteria was incomplete questionnaire. This research was conducted by obtaining introduction letter from related organizations, and the participation of people and study units was voluntary, and they ensured that the information was confidential.

Nutrition Literacy Scale (NLS) has designed using information obtained from Mayo food and nutrition clinic, US ministry of agriculture for nutrition policy, and other related nutrition websites^[18] and was completed between 2004 and 2006 by 341 patients in four separate administrations. Three groups of patients were part of a University-Based Family Medicine Practice. One of these groups (Group 4) specifically included overweight and obese patients. The validity and reliability of this tool was assessed with Cronbach's alpha 0.84 in the US.^[16] Questionnaire includes 28 questions related to organic food and calorie consumption. Its items reflect the individuals related to healthy nutrition, saturated fats, and unit size. Questions of each section are sorted from easy to difficult. Closing method has been used in NLS. Closing method is a valid method for understanding.^[19] NLS asks for correct answer to complete a statement from a 4-item list. The required time to complete questionnaire is 10 min. NLS has 28 items, and the score of each item is either 1 (true) or 0 (false). Total scores were considered in the analysis. The highest percent shows the highest nutritional literacy, and the lowest percent is the lowest nutritional literacy. Scores between 0 and 14 show insufficient nutritional literacy, 15–21 are borderline nutritional literacy, and 22–28 show the sufficient nutritional literacy. This questionnaire has been used in a similar study by Patel *et al.* to evaluate the nutritional literacy in the elderly.^[18]

Tool validity

Translation validity

Forward-backward standard method of WHO was used to translate questionnaire.^[20] To determine translation validity, the main questionnaire was first translated by two proficient Iranian translators from English to Persian. In the next step, 2 English language experts translated the Persian questionnaire again to English (backtranslation). Then, NLS main version was compared with the translated versions to determine whether the concepts are unique. After adjusting translations, the initial version of questionnaire was prepared in Persian with good quality.

Face validity

To determine face validity, Persian questionnaire was completed by 10 elderly people to evaluate its fluency, clarity, resolution, and fit. Regarding the feedback of this group, the required changes were done to increase resolution and understanding of the questionnaires.

Content validity

Content validity of questionnaire was confirmed with qualitative and quantitative methods. In qualitative content analysis, NLS was evaluated by 7 experts in this field (including 3 nutrition specialists, 4 health education and health promotion experts) based on the Persian language grammar, and using simple and easy words. In quantitative content analysis, Content Validity Ratio (CVR) and Content Validity Index (CVI) were evaluated by 7 experts.

Regarding CVR, each question from 28 questions evaluated with three terms: "Essential," "Useful but not essential," and "Not necessary," and responses were calculated based on CVR formula.^[21]

$$CVR = \frac{n_e - \frac{N}{2}}{\frac{N}{2}}$$

n_e = The number of panelists indicating "essential."

N = The total number of panelists.

Relatedness, resolution, and simplicity were used as three criteria to calculate CVI using 5-point Likert scale. Finally, CVI score was calculated by the total number of concessions with rank 3 and 4 on the total number of specialists.^[22] Then, questions with CVR of 0.99 and CVI of 0.79 and higher were preserved in questionnaire.

Construct validity

Exploratory factor analysis (EFA) was used to determine construct validity. The questionnaire was distributed among 280 elderly people (60 years and higher) based on the inclusion criteria. EFA was done by principle component analysis (PCA) using Varimax rotation. To keep an item in the EFA, cutpoint of 0.3 was considered. After extracting factors and items in each factor, their consistency with concepts and main dimensions of nutritional literacy was studied.

Tool reliability

To evaluate the tool stability, questionnaire was given to 30 elderly people with 15 days interval, and then, interclass correlation coefficient (ICC) was calculated. Cronbach's alpha was calculated to measure internal consistency.

Results

In this research, data of 280 elderly people were gathered, coded, and entered into computer. Then, the data were analyzed using SPSS software 16. SPSS was designed by Statistical Package for the Social Sciences (SPSS) company for use at Stanford University Chicago.^[23] Majority of the elderly were in the age group of 60–65 (41.9%), 65–70 (28.9%), and 70 years and higher (29.3%). 143 of them were female (53%) and 127 were male (47%). Most of them had primary school education (59.3%) and only 21 people (7.8%) had university degree. The occupation study showed that 137 of them were employed (50.7%) and 133 of them were unemployed (49.3%). 159 (58.9%) elderly people had moderate and 111 (41.1%) had weak economic conditions.

In qualitative face validity, required changes were done by considering the feedback of elderly people to provide more resolution and understanding.

In qualitative content validity, question number 13 was changed based on the advice of experts and researcher opinion to make it more understandable. Table 1 shows CVI and CVR were calculated for each question. Average CVI was measured as 0.86. Since all questions had CVR higher than 0.99 and CVI higher than 0.78, all questions were kept.

To study factor structure of NLS in elderly people of Iran, EFA was used with principle components method and Varimax rotation. Kaiser–Meyer–Olkin (KMO) and Bartlett's test were used to evaluate the possibility of factor analysis on data. KMO measure of sampling adequacy was 0.79. Results of Bartlett sphericity test indicated the significant correlations between items ($\chi^2 = 1184/606$, $df = 378$, $P < 0.001$). These results indicate the adequacy of sample size and justify the factor analysis. Table 2 shows 6 extracted factors from the scale and variance of factor analysis including nutritional knowledge with variance of 16.724%, healthy nutrition with variance of 7.293%, calorie use (5.107%), organic food (4.696%), saturation fats (4.430%), and portion size (4.213%) which totally explain 43% of total variance. Cut point of 0.3 was considered for factor loads.

Discriminant and known-group validity

Discriminant validity showed that male older people scored significantly higher on all compared to female older people. The known-group was used for discriminant validity of the NLS.

Table 3 shows the variables of gender and education level. Participants with higher educational levels scored significantly higher on the total score ($P < 0.001$) and all factors.

Table 1: Content Validity Ratio and Content Validity Index of Nutrition Literacy Scale

Number	Items	CVR	CVI		
			Relevant	Clarity	Simplicity
1	Healthy eating is strongly advised to us for.....of heart	0.99	0.86	0.71	0.86
2	No food can alone all nutrients that we need for.....	0.99	0.86	0.86	0.71
3	Eating.....of foods ensures that we received all required nutrients for health	0.99	1	0.86	0.86
4	Grains, fruits and vegetables are foods that form the basis for afood regime	0.99	1	0.86	0.71
5	For a healthy diet, it is recommended that to eat 5fruit and vegetable each day	0.99	1	0.71	0.71
6	For a healthy diet, it is recommended that to eat 5 fruit and vegetable each	0.99	1	0.71	0.71
7	Foods like butter have high amount offat that can increase cholesterol	0.99	1	1	1
8	Cholesterol can be influenced by foods withhigh trans-fat	0.99	0.86	0.86	0.71
9	Experts often say avoid high trans-fat foods because they are.....	0.99	0.86	0.86	1
10	Experts often say to foods with high transfat because they make you fat	0.99	0.86	0.86	1
11	Fiber is a part of plant which you're.....does not digest and absorb it	0.99	0.71	0.86	1
12	Whole grains are.....relative to processes grains	0.99	0.86	0.86	1
13	A good diet should have approximately 25–30.....fiber per day	0.99	0.71	0.86	0.86
14	Calcium is.....for bone health	0.99	1	1	1
15	By increasing age, minerals; therefore, your bones become thinner	0.99	1	0.71	0.71
16	Even in the old people, vitamin D is.....to preserve the bone health	0.99	1	0.86	0.86
17	Foods with added sugar are sometimes called food without.....	0.99	0.71	0.86	0.86
18	To prevent from bacteria, keep eggs in refrigerator	0.99	0.86	0.86	1
19	To prevent illness from bacteria, keep eggs in	0.99	0.86	0.86	1
20	Farmers who cultivate organic foods do not usemethods for eliminating weeds	0.99	0.71	0.86	0.86
21	Farmers who cultivate organic foods, instead of pesticides, use techniques like alternative cultivation to control.....	0.99	0.71	0.86	0.86
22	Organic foods arethan common foods	0.99	0.86	0.86	0.86
23	50% calorie of a/an.....has 180 calories than 10 gr of it is fat	0.99	1	0.71	0.71
24	A 63.5 kg woman, needs 51.....protein per day	0.99	1	0.86	0.86
25	Using.....fat free in a sandwich can reduce the fat really	0.99	0.71	0.86	0.86
26	My doctor told me “fat free” does not mean.....	0.99	0.86	0.86	0.71
27	My doctor told me to select a smaller.....to control weight	0.99	1	0.86	0.86
28	My doctor told me to select a smaller portions to control.....	0.99	1	0.86	0.86
CVI average			0/86.5		

CVR=Content Validity Ratio, CVI=Content Validity Index

Table 4 shows that there is a significant consistency between before and after tests scores in test–retest results ($P < 0.001$). ICC was 0.92 and Cronbach’s α coefficient was 0.67–0.76.

Discussion

Given the importance of nutritional literacy in the elderly, this study investigated the psychometric properties of the NLS questionnaire. In each study, research tool is an instrument by which researcher gathers data carefully, and after analysis, achieves required conclusions. Therefore, research tool is one of the important components of the research which should pass all standardizations steps. Researchers in this research tried to evaluate the Persian version of nutritional literacy questionnaire and determine its reliability and validity for cultural adjustment. Nutritional literacy tool was confirmed by psychometric analysis to evaluate the nutritional literacy of the elderly. Validity is a degree of results’ accuracy and shows that how correctly the study has measure what it intends to

measure.^[24] Face validity is the objective judgment about the structure of the tool and determines that if the scale is accepted by respondents.^[25] Therefore, regarding the feedback of the elderly, required changes were made to make the questions more understandable.

Content validity study by expert is one of the best ways to gather evidence to support a tool.^[26] Therefore, to determine content validity of a test, its effective factors should be determined by experts.^[27] In quantitative content analysis, CVR and CVI were studied by 7 experts.

Regarding CVR higher than 0.99, and according to Lawshe table,^[21] and accepting items based on CVI score higher than 0.79,^[28] the questions had suitable content validity. Regarding the results of this step, 28 items were confirmed.

EFA was used to study the factor structure of NLS in elderly people of Iran. EFA is done by PCA to study the interconnectedness of variables and determine the classes with high connection.^[29] Varimax rotation

Table 2: Factor loading of the Nutrition Literacy Scale items

Items	Component					
	1	2	3	4	5	6
Item 15	0.554					
Item 17	0.541					
Item 11	0.538					
Item 19	0.527					
Item 18	0.507					
Item 2	0.502					
Item 14		0.687				
Item 5		0.658				
Item 16		0.584				
Item 6		0.577				
Item 4		0.453				
Item 3		0.449				
Item 12		0.416				
Item 1		0.397				
Item 27			0.595			
Item 28			0.533			
Item 26			0.432			
Item 23			0.428			
Item 22				0.765		
Item 20				0.584		
Item 21				0.419		
Item 10					0.623	
Item 9					0.576	
Item 25					0.413	
Item 7					0.401	
Item 8					0.318	
Item 24						0.675
Item 13						0.640
Eigenvalues	4.683	2.042	1.430	1.315	1.240	1.180
Variance (%)	16.724	7.293	5.107	4.696	4.430	4.213
Cumulative (%)	16.724	24.017	29.125	33.820	38.250	42.463

Extraction method: Principal component analysis. Rotation method: Varimax with Kaiser Normalization. Rotation converged in 12 iterations

was used to determine the conformity and naming the extracted factors.^[30] KMO and Bartlett tests were used to carry out factor analysis on data. KMO should be near to 1 to indicate the adequate sample size for factor analysis.^[31] Adequate sample size by KMO method in this study was 0.79. If this index is higher than 0.7, it indicates the suitable correlations in data for factor analysis. Bartlett test was used to confirm adequacy of the samples.^[32] Results of the research showed the significant correlations among the items ($\chi^2 = 1184.606$, $df = 378$, $P < 0.001$). These results indicated adequate sample size and factor analysis. Extracted factors were 6 factors including nutritional literacy, healthy nutrition, calorie use, organic foods, saturated fats, and unit size which explain 43% of total variance.

Reliability is a degree of results' uniqueness during certain time and conditions with a similar method. Repeatability and reproduction of results were measured.^[33] Constancy and internal consistency were evaluated to determine

Table 3: Comparison of known groups: mean and standard deviation of Nutrition Literacy Scale based on the gender and educational level

Sociodemographics	Categories	F1		F2		F3		F4		F5		F6	
		Mean (SD)	P	Mean (SD)	P	Mean (SD)	P	Mean (SD)	P	Mean (SD)	P	Mean (SD)	P
Gender	Male	3.72 (1.42)	0.02	4.89 (1.62)	0.02	1.72 (1.16)	0.03	1.09 (0.95)	0.05	2.71 (1.04)	0.03	1.18 (0.81)	0.02
	Female	3.35 (1.28)		4.48 (1.56)		1.27 (1.10)		0.81 (0.94)		2.47 (0.96)		0.95 (0.82)	
Educational level	Low	3.02 (1.20)	0.001	4.29 (1.51)	0.001	1.17 (0.89)	0.001	0.62 (0.79)	0.001	2.28 (0.74)	0.001	0.73 (0.79)	0.001
	High	4.25 (1.24)		5.63 (1.35)		2.31 (1.11)		1.48 (0.94)		3.16 (1.09)		1.54 (0.65)	

SD=Standard deviation

Table 4: The internal consistency and stability reliability of the Nutrition Literacy Scale Farsi version

Dimensions	Number of items	Cronbach's α coefficient	ICC
F1	6	0.75	0.87
F2	8	0.76	0.86
F3	4	0.67	0.83
F4	3	0.71	0.76
F5	5	0.70	0.85
F6	2	0.74	0.80
Total	28	0.80	0.92

ICC=Interclass correlation coefficient

the reliability of tool. Test-retest was used to evaluate the tool constancy.^[34] In this study, like other studies to test test-retest reliability, the intra-class correlation coefficient (ICC) was calculated to be 0.92. Acceptable value for ICC is greater than 0.7,^[35] Therefore, we can conclude that the tool has suitable reliability.

Internal consistency is one of the ways of methods to measure reliability which only needs one retest to provide an estimation of test reliability.^[36] Internal consistency evaluation (Cronbach's alpha) of all questionnaire items showed the suitable correlations between different items by participants. Cronbach's alpha was 0.80 which is higher than 0.7.^[37] This result is consistent with the results of Diamond study that NLS indicates an accepted internal adaptation with Cronbach's alpha of 0.84.^[16]

Conclusion

Regarding the importance of nutritional literacy effect in suitable decision-making and chronic diseases related to nutrition, it is necessary to confirm NLS validity and reliability. This study tried to determine the validity of the tool to provide suitable evidence to ensure the validity. Based on the results of validity and reliability evaluation, NLS has good reliability and validity in elderly people. This questionnaire was translated to Persian for the first time. The result of this study is a standard tool to evaluate the nutritional literacy evaluation among Persian speaking communities. On the other hand, completing this questionnaire by people in a short time is possible. Therefore, it can be used in the future research. Using this tool is recommended to health system policy-makers to study the nutritional literacy to improve health.

Limitations

1. Given that the target group was the elderly, this study did not examine other age groups. Therefore, to generalize the results to other people, all age groups must participate in the study
2. Concurrent, convergent, and divergent validity were not performed due to lack of standard and similar questionnaire.

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Conflicts of interest

There are no conflicts of interest.

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