



## *Development and Validating of a Quest for Predicting Nutrition Literacy Promoting Behavior Based on the Theory of Planned Behavior in Southern Iran, 2017*

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### ABSTRACT

**Background:** The evidence suggests nutrition style as a key determinant of health. On the other hand, nutrition literacy is a key determinant of nutrition decisions and behaviors. This study aimed to develop and validate an inventory in order to predict nutrition literacy promoting behavior based on the theory of planned behavior (TPB) in the youth. **Methods:** In this cross-sectional study, 203 students (100 females and 103 males) were selected using the randomized cluster method from dormitories in Shiraz University of Medical Sciences. They were supposed to complete Nutrition Literacy Promoting Behavior based on TPB (TPB-NLPB) questionnaire. The tool was developed using relevant scientific literature and its validity was confirmed by the experts' panel (n = 6). The instrument includes four subscales: attitude toward behavior, subjective norm, perceived behavioral control, and behavioral intention. The reliability and validity of the instrument were assessed by exploratory and confirmatory factor analysis and Cronbach's alpha coefficient. **Results:** The coefficients of Cronbach's alpha ( $\alpha = 0.87$ ), Guttman method ( $\lambda_1 = 0.84$  to  $\lambda_6 = 0.91$ ), and convergent validity (0.74) were estimated ( $P < 0.01$ ). The exploratory factor analysis demonstrated five factors, which clarified 64.91% of the scale's variance. Second-order confirmatory factor analysis pointed out that the factor was well matched up onto the principal factor. Consequently, the five-factor model was appropriate for the data using fit index techniques for adjusting the scale. **Conclusions:** The results confirmed the well-adjusted reliability and psychometric properties of the TPB-NLPB and its usefulness for the relevant studies.

**Keywords:** Nutrition; Literacy; Validity; Reliability; Theory

### Introduction

Nutrition, as one of the key factors in lifestyle, plays a crucial role in promoting health and preventing from many chronic diseases (Ciliska et

al., 2006, Hu et al., 1997, Schaller and James, 2005, Stefanogiannis et al., 2005, Warber et al., 2000). Food choices and eating habits are a continuous

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behavior in human life. Evidence has shown that knowledge of the nutritional content of a meal affects the individuals' nutrition behavior (Hawthorne *et al.*, 2006). However, some studies suggested that few people consider food labels, while many people do not have the ability to read and understand the nutritional facts on the label (Satia *et al.*, 2005, Wasowicz-Kirylo and Stysko-Kunkowska, 2011). Furthermore, divergent sources of dietary and nutritional information (e.g. food labels, and Internet) can provide various options to choose the type of food (McKay *et al.*, 2006, Prentice and Jebb, 2003). At the same time, people take greater responsibility for their self-care health and make informed decisions about their own health (Sogie-Thomas, 2006). However, nutrition information is complex and may require high levels of cognitive skills (King *et al.*, 2012).

Health literacy is considered as one of the basic skills required for challenging health-related decisions. However, evidence indicates deficiencies in individuals' knowledge and ability for self-management and particularly health literacy related to the nutrition (Gibbs *et al.*, 2015). Nutrition literacy can be defined as a degree in which individuals have the capacity to obtain, process, and understand basic nutrition information (Zoellner *et al.*, 2009). Studies revealed some of the causes or factors involved in nutritional literacy such as following nutritional standards, interpretation of food labels, and appropriate decisions about diet (Gibbs and Chapman-Novakofski, 2013, Zoellner and Carr, 2010). Nutritional literacy as a skill-based process causes people to identify and transform nutrition messages into knowledge. In general, food choices in people having sufficient nutritional knowledge are healthier (Parmenter *et al.*, 2000, Yajima *et al.*, 2001).

Although health literacy plays a vital role in decision-making related to health and nutrition, it still has not an ideal situation in the communities. According to surveys, approximately 80 million of American adults (36%) (Berkman *et al.*, 2011) and 56.6% of the participants in five Iranian states had inadequate health literacy (Tehrani Banihashemi *et al.*, 2007). In Zollner's study, 24% of the participants

reported very low, 28% reported low, and 48% reported adequate nutrition literacy (Zoellner *et al.*, 2009). Another study also indicated that adults in Jiangxi Province in Eastern China had low level of nutrition literacy (Du *et al.*, 2010).

Theories of health behavior help us to identify behavior determinants and design targeted educational intervention (Sharifirad *et al.*, 2008). The predictive power of the theory of planned behavior (TPB) was proved in many social and health behavior studies, such as food behavior, physical activity, self-care, and screening tests (Kassem *et al.*, 2003). It is also one of the most important models in the field of food choices (Shepherd and Towler, 1992). The TPB assumes individuals as logical actors, so that they process the information before performing a behavior. During this process, basic individual beliefs and consequently, individual behavior may change (Rashidian *et al.*, 2006). Accordingly, the most important predictor of adopting a behavior is individuals' intention to perform that behavior. The intention is determined by the attitude toward behavior (ATB), subjective norm (SN), and perceived behavioral control (PBC) (Sharma, 2016).

Based on the literature, it is necessary to develop and improve tools that can accurately assess individuals' nutrition literacy in public health systems (Ndahura, 2012). Therefore, the present study aimed to develop and validate the Nutrition Literacy Promoting Behavior based on TPB (TPB-NLPB) questionnaire in the youth in southern Iran in 2017.

## Materials and Methods

This cross-sectional study aimed at developing and validating the TPB-NLPB. In this study, the cluster random sampling method was used to select 203 students (103 men and 100 women), who were in four dormitories of Shiraz University of Medical Sciences in southern Iran.

*Sample size determination:* The sample size was calculated using 1:5 N/p ratio, i.e., the ratio of the number of item to participants. This indicated that five responders were required for each question on the scale (De Vet *et al.*, 2005). Therefore, the 37-

item questionnaire required a sample size of 185 participants. The inclusion criteria were active students of the undergraduate levels, who were willing to participate in the study. Exclusion criteria included having an incomplete questionnaire.

*Development the instrument:* The assessment tool for nutrition literacy was a self-administered inventory. This questionnaire was prepared by the research team through literature review to achieve the research goals (Francis *et al.*, 2004, Ndahura, 2012, Pettersen *et al.*, 2009, Song, 2014, Vanderlee and Hammond, 2014, Zoellner *et al.*, 2009). Then, the face and content validity of the initial version of the questionnaire were evaluated and confirmed by a panel of experts (n = 6) after some revisions. The content validity ratio (CVR) and content validity index (CVI) values were also calculated. In the next step, face validity was assessed using a pilot test on 10 participants from the study target group; these participants were not interviewed in the next step. The necessary revisions were made to the final application test. Finally, for the main stage of the research, the tool was used on a sample of 203 people from the research population.

The TPB-NLPB included four subscales: attitude toward behavior (12 items, e.g., information on the nutrition labels are not related to the food quality), subjective norm (5 items, e.g., if I do not use nutrition labels for food choices, I feel I am under social pressure), perceived behavioral control (13 items, e.g., I do not understand the meaning of nutritional information on the food products), and behavioral intention (7 items, e.g., I intend to become acquainted with recommendations of the WHO for fruits and vegetables until the next month). Each item should be responded on a five-point Likert scale. For positive questions, scores of five, four, three, two, and one were assigned to “Strongly agree”, “Agree”, “Neither agree nor disagree”, “Disagree”, and “Strongly disagree” options, respectively. The negative items were scored reversely. The attainable scores could range from 37 to 185.

*Data collection:* When collecting the data, the researcher visited dormitories of Shiraz University

of Medical Sciences, introduced herself to the students, and explained the study objectives. The Persian TPB-NLPB was then distributed among the participants and the questionnaires were answered anonymously with a response rate of 98%.

*Data analysis:* All statistical analyses were conducted using the SPSS-23. To assess the questionnaire reliability, its internal consistency was determined. In this approach, a Cronbach's alpha coefficient of  $\geq 0.7$  was achieved that represented acceptable reliability for the instrument (Jones *et al.*, 2004). The reliability of the TPB-NLPB was also assessed using the split-half method, and the Spearman-Brown coefficient was calculated for the whole scale and its halves. This index is normally used in questionnaires with a large number of questions (Seif, 2004).

The CVR was used to quantify the experts' agreement. In general, a CVR score of 0.80 or higher indicates good content validity (Lawshe, 1975). In this study, the CVR mean for essentiality criterion and the CVI means for simplicity, clarity, and relevance criteria were calculated as 0.91, 0.91, 0.95, and 0.98, respectively. As a result, questions that had problems were reviewed and revised after consulting with the experts in health education and nutrition sciences. Next, the students answered the modified questionnaire. In addition, confirmatory factor analysis and fitness indicators were used to confirm the validity of the questionnaire.

*Ethical considerations:* Regarding the ethical considerations, the participants were assured that their information would be kept confidential. Later, informed consent forms to enter the study were obtained from all participants. All participants received verbal explanation about the study objectives and procedures and then signed written informed consents for taking part in the study. The participants were also reassured about the anonymity and confidentiality of their information. All procedures of the study were in accordance with the ethical standards of the institutional or the national research committee and with the 1964 Helsinki declaration. Its later amendments including informed consent and confidentiality of

all personal information were also in accordance with the ethical standards.

## Results

A total of 203 students were investigated; 103 men (51.0%) and 100 women (49.0%) with a mean age of 22.32 years ( $SD = 2.18$ ). The mean weight of the male and female participants were 70.33 kg ( $SD = 12.41$ ) and 57.13 kg ( $SD = 8.20$ ), respectively. The mean height of the male and female participants were also 176.82 cm ( $SD = 0.70$ ) and 161.85 cm ( $SD = 0.05$ ), respectively. All the students replied to TPB-NLPB. **Table 1** shows the demographic characteristics, comparing total score of TPB-NLPB and its classified scores made between males and females regarding their gender and the study field; it did not reveal any statistically significant difference between the samples except in the study field (See **Table 1**).

*Internal consistency:* The coefficients of Cronbach's alpha ( $\alpha = 0.87$ ), Guttman method ( $\lambda_1 = 0.84$  to  $\lambda_6 = 0.91$ ), and convergent validity (0.74) were estimated, which were significant at  $P < 0.01$ . The discriminative power in the TPB-NLPB of sub-scales with overall score using Kolmogorov–Smirnov and Shapiro–Wilk tests of the normality demonstrated a normal distribution of data ( $K-S = 0.170$ ,  $S-W = 0.085$ ,  $P > 0.05$ ). Mean overall score of TPB-NLPB was 129.08 ( $CI = 127.11-131.05$ ),  $SD = 14.24$ , Skewness = 0.022, Kurtosis = 0.953, with a minimum and maximum of 86 and 173, respectively. Discriminative power testing showed that the domains had a normal distribution.

Regarding the criterion validity, Pearson's correlation coefficients were significant and appropriate for all the sub-domains of TPB-NLPB. This finding could suggest some specificity of these domains.

*Contrast validity:* According to **Table 2**, the Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity were conducted to evaluate the factorability. The KMO was 0.788 and the Bartlett's test of sphericity was less than 0.001, meaning that Exploratory Factor Analysis (EFA) could be applied to the obtained factors (See **Table 2**). The diagonals of the anti-image correlation

matrix were all over 0.54, confirming inclusion of each item in the factor analysis. Finally, the communalities were all above 0.4.

The exploratory factor analysis demonstrated that 37 items of TPB-NLPB were organized into five factors, explaining 64.91% of the scale variance (Initial eigenvalue = 1.090). This scree plot shows that five factors explain the most variability since the line starts to straighten almost after factor five (See **Figure 1**).

Second-order confirmatory factor analysis indicated that the factors were designed well upon a principal factor. According to **Table 3**, the rotated factor matrix pattern of Varimax was considered for the TPB-NLPB's subscale questions. In this regard, questions with factor loadings above 0.35 were selected (See **Table 3**).

Covariates exist between some items, i.e., item ATB5 between factors No. 1 and 2; item ATB10 between factors No. 1 and 2; and item PBC7 between factors No. 1 and 5 in Persian version of TPB-NLPB. This may indicate that the covariate item of these factors can be reconstructed. Additionally, no items were removed. **Table 4** presents the study descriptive statistics. The skewness and kurtosis results were within a tolerable range for assuming a normal distribution. Furthermore, Varimax rotation was applied and the least correlations between each of the composite domains were reported.

*Confirmatory factor analysis:* The maximum likelihood with robust standard errors and chi-square (ML) were used for estimation of the method available in AMOS-22. The aim was to confirm fitness of the five-factor model that emerged from EFA. The adequacy of the model was examined using the comparative fit index log likelihood, Akaike's information criterion (AIC), finite sample corrected AIC (AICC), Bayesian information criterion (BIC), consistent AIC (CAIC), root mean square error of approximation (RMSEA), goodness-of-fit statistic (GFI), adjusted GFI, incremental fit index (IFI), and comparative fit index. These values for the five-factor 37-item model suggest that the model provides a moderately good fit. Consequently, the five-factor

model was appropriate for the data and the fit index techniques were appropriate for adjusting the scale. According to **Table 5**, indexes of the model's goodness of fit refer to integrity of the five-factor model with data. The  $\chi^2$  degree of freedom was less than two in efficient models; it is better when it is closer to zero. The root mean square error of approximation (RMSEA) must be less than 0.05 to indicate a good model (Asadollahi *et al.*, 2013, Asadollahi *et al.*, 2016). The model pointed out goodness of fit of TPB-NLPB. Additionally, AIC, AICC, CAIC, and BIC (Schwarz criterion) values are shown in bold face

to indicate that the corresponding model is favored by the criterion.

Measures closer to 1 in the comparative fit index, GFI, the adjusted GFI, and the incremental fit index, refer to the model's goodness and fit (Baumgartner and Homburg, 1996, Doll *et al.*, 1994). In our study, these measures were more than 0.90 (see **Table 5**). Results from the factor analysis indicated that all the item loadings were significant at the  $P < 0.05$  level and all were above 0.7. This indicates further improvement for generalizability of the revised model to samples in academic settings.

**Table 1.** Demographic characteristics of the TPB-NLPB (n = 203,  $P \leq 0.05$ )

Categories	N	%	M	F	Weight (kg)	Height (cm)	95% CI <sup>a</sup>	TPB-NLPB	SD	p-value
Gender										
Male	103	51	-	-	70.0	177	126.1-131.3	129.48	15.19	0.69
Female	100	49			56.2	162	126.4-132.4	128.70	13.32	
Total	203	100	103	100	63.38	169	127.1-131.0	129.08	14.24	
Field of Study										
Nursing	24	11.8	18	6	64.96	172	123.48-134.77	129.13	9.85	<0.001
Public Health	9	4.4	2	7	51.11	161	133.01-150.10	141.56	9.86	
Occupational health	12	5.9	8	4	68.05	172	113.19-133.97	123.58	5.50	
Midwifery	13	6.4	1	12	55.00	166	116.21-136.25	126.23	13.09	
Anesthesia technician	7	3.4	6	1	61.85	175	117.48-140.81	129.14	13.75	
Operating room technician	15	7.4	13	2	68.74	172	118.50-131.77	125.13	8.88	
Radiology	32	15.8	15	17	63.41	167	126.32-136.24	131.28	7.23	
Physiotherapy	25	12.3	11	14	64.00	170	118.74-132.22	125.48	10.63	
Laboratory sciences	22	10.8	10	12	65.81	173	127.06-134.03	130.55	5.66	
Speech therapy	14	6.9	5	9	60.71	167	119.57-143.29	131.46	11.06	
Occupational therapy	16	7.9	7	9	62.83	171	126.31-136.44	131.38	11.49	
Health information technology	3	1.5	0	3	58.50	160	81.06-199.61	140.33	2.65	
Management	3	1.5	3	0	65.33	175	107.16-156.17	131.67	12.58	
Environmental health	8	3.9	4	4	65.13	171	109.49-130.01	119.75	8.62	
Classified Scores of TPB-NLPB										
Moderate=75-111	20	9.9	10	10	61.01	169	98.03-105.01	103	1.02	0.12
Competent=112-148	166	81.8	87	79	64.11	170	110.21-131.1	129	1.64	0.15
Very Competent=149-185	17	8.4	6	11	64.47	166	153.08-161.88	157	1.02	0.20
Subdomains of TPB Model <sup>b</sup>										
Attitude Toward Behavior			44.17	44.63	48.0	46.60	43.43-45.83	44.4	5.89	0.58
Subjective norm			15.20	14.42	15.67	16.20	13.75-15.09	14.82	3.37	0.10
Perceived behavioral control			45.63	46.59	50.68	47.20	45.43-47.75	46.10	6.40	0.26
Behavioral intention			23.69	23.48	26.33	25.60	22.89-24.79	23.76	4.70	.082

<sup>a</sup> 95% Confidence Interval for Mean. <sup>b</sup> Mean scores for subdomains

**Table 2.** Kaiser-Meyer-Olkin (KMO) and Bartlett's test of TPB-NLPB

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.788
	Approx. Chi-Square	2689.188
Bartlett's test of sphericity	df	666
	Sig.	<0.001

**Table 3.** Varimax rotated factors matrix of the TPB-NLPB (n = 203)<sup>a</sup>

Items	Components				
	1	2	3	4	5
Attitude Toward Behavior 1		.517			
Attitude Toward Behavior 2		.576			
Attitude Toward Behavior 3		.670			
Attitude Toward Behavior 4		.651			
Attitude Toward Behavior 5	.463	.363			
Attitude Toward Behavior 6	.599				
Attitude Toward Behavior 7	.569				
Attitude Toward Behavior 8	.614				
Attitude Toward Behavior 9	.567				
Attitude Toward Behavior 10	.557	.241			
Attitude Toward Behavior 11	.660				
Attitude Toward Behavior 12	.648				
Subjective norm 1				.448	
Subjective norm 2				.598	
Subjective norm 3				.552	
Subjective norm 4				.737	
Subjective norm 5				.659	
Perceived behavioral control 1					.601
Perceived behavioral control 2					.487
Perceived behavioral control 3					.651
Perceived behavioral control 4					.746
Perceived behavioral control 5					.540
Perceived behavioral control 6					.582
Perceived behavioral control 7	.355				.505
Perceived behavioral control 8					.746
Perceived behavioral control 9					.701
Perceived behavioral control 10					.566
Perceived behavioral control 11					.637
Perceived behavioral control 12					.363
Perceived behavioral control 13					.588
Behavioral intention 1			.427		
Behavioral intention 2			.474		
Behavioral intention 3			.610		
Behavioral intention 4			.688		
Behavioral intention 5			.685		
Behavioral intention 6			.638		
Behavioral intention 7			.674		

<sup>a</sup>: Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.. Rotation converged in 11 iterations.

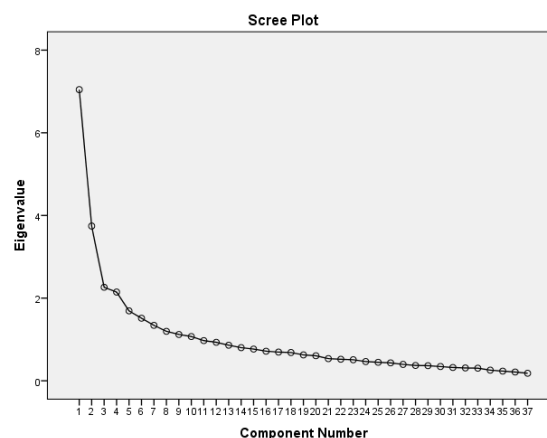
**Table 4.** Descriptive Statistics for the five TPB-NLPB Factors (N = 203)

Domains	No. of items	Mean (SD)	Skewness	Kurtosis	Alpha
Attitude Toward Get Nutrition Information	4	15.65 (.248)	-.281	.643	.761
Attitude Toward Use Nutrition Labeling	8	28.75 (.648)	-.059	.100	.763
Subjective Norms	5	14.82 (.441)	-.277	-.310	.746
Perceived Behavioral Control	13	46.10 (.143)	.165	.239	.780
Behavioral Intention	7	23.76 (.723)	-.539	.827	.825

**Table 5.** The goodness of fit indices model of the TPB-NLPB

Indices	Value	df	Value/df
Deviance	1108.00	198	5.59
Scaled Deviance	202.001	198	
Pearson Chi-Square	1302.00	198	6.57
Scaled Pearson Chi-Square	201.00	198	
Log Likelihood <sup>b</sup>	317.00		
Akaike's Information Criterion	605.00		
Finite Sample Corrected AIC	641.00		
Bayesian Information Criterion	317.01		
Consistent AIC	349.00		
Root Mean Square Error of Approximation	.001		
Goodness-of-Fit Statistic	.908		
Adjusted Goodness of Fit Index	.918		
Incremental Fit Index	.922		
Comparative Fit Index	.891		

<sup>a</sup>: Information criteria are in small-is-better form; <sup>b</sup>: The full log likelihood function is displayed and used in computing information criteria.

**Figure 1.** Scree plot of eigenvalue vs. number of PCA for TPB-NLPB

## Discussion

A gap exists in availability of a valid scale for measuring nutrition literacy in Iranian society. Thus, this study aimed to develop and validate an inventory

in order to predict TPB-NLPB in the youth as a theoretical framework. Since nutritional literacy should be considered in planning and evaluating nutritional health promotion interventions in the

community, the tools used in this study can be a good response to this necessity.

The desirability of CVR and CVI values in this study revealed that the Persian version of TPB-NLPB followed a proper and logical trend. Reliability means repeatability, which was assessed through various methods (Kaplan RM, 2013). Cronbach's alpha coefficient ( $\alpha = 0.87$ ) and Guttman method ( $\lambda_1 = 0.84$  to  $\lambda_6 = 0.91$ ) were also used to determine the internal consistency, which showed good reliability of the questionnaire. Cronbach's alpha coefficient was 0.825 for the subscale of attitudes toward reading food labels among the Mid-Western University students (Song, 2014). This coefficient was 0.54 in a study assessing the functional, interactive, and critical nutritional literacy of Ugandan teenage students (Ndahura, 2012). Therefore, reliability of that tool was doubtful for re-application among the Ugandan student population and other populations. The Cronbach's alpha coefficient was 0.69-0.80 in a study on the critical nutrition literacy of 473 students (Guttersrud *et al.*, 2014). The Cronbach's alpha coefficient of the Nutritional Literacy Scale (NLS) was also 0.84; therefore, the questionnaire had appropriate and acceptable internal consistency (Diamond, 2007). These differences may be due to age, language, socioeconomic, and cultural differences among the target group populations. The high internal consistency coefficient in the current study shows the stability and reliability of this questionnaire for studies concerned with the Iranian young population.

In this study, the statistic (KMO = 0.704) and Bartlett test (less than 0.001) indicated the factorability of this questionnaire. In Ndahura's study, the KMO was greater than 0.6 and the Bartlett was significant ( $P \leq 0.05$ ) (Ndahura, 2012).

In this study, the results of exploratory factor analysis showed that 37 items of the TPB-NLPB were divided into five factors for students, representing 64.91% of the scale variance. The indices' scores of the confirmatory factor analysis showed an acceptable fit for the questionnaire. Similar studies on health literacy also showed a satisfactory fit for the Health Literacy

Questionnaire (Maindal *et al.*, 2016, Nolte *et al.*, 2017, Osborne *et al.*, 2013).

Covariates exist between some items: item ATB5 between factors No. 1 and 2 as well as item ATB10 between factors No. 1 and 2. So, these two questions should be revised. Item PBC7 had a covariate between factors No. 1 and 5, which is because of its length (34 Persian words); it is likely that understanding the question's concept was ambiguous for the participants. Therefore, this item should be reduced.

Overall, EFA and confirmatory factor analysis results confirmed that the five distinguished factors were the underlying responses to the constructed and Persian version of the TPB-NLPB with 37 items divided into five factors. However, the original factor structure proposed by the TPB was not preserved (Ajzen, 1985). The TPB approach extends health promotion behavior in four basic dimensions, i.e., ATB, SN, PBC, and BI. Nevertheless, in this study, dimensions of the theory were divided into the five domains. The ATB domain was separated into two sub-domains of "Attitude Toward Get Nutrition Information (ATGNI; Item NO. 1-4)" and "Attitude Toward Use Nutrition Labeling (ATUNL; Item NO. 5-12)".

Correlation coefficients were calculated for all TPB-NLPB constructs; the strongest correlation was between T-TPB and BI constructs ( $r = 0.752$ ,  $P < 0.01$ ), while the weakest correlation was between ATGNI and BI constructs ( $r = 0.258$ ,  $P < 0.05$ ). Meanwhile, a study reported the strongest correlation coefficient between motivation and attitude toward using nutrition labeling ( $r = 0.731$ ,  $P < 0.01$ ) and the weakest correlation coefficient between motivation and perceived behavioral control ( $r = 0.246$ ,  $P < 0.01$ ) (Song, 2014). In our study, the strongest and weakest correlation coefficients between the constructs were significantly greater than the ones reported by Song.

Considering the strengths of our study, its novelty in the Iranian society and other Persian-speaking countries such as Tajikistan, Afghanistan, and Central Asia can be mentioned. Furthermore, most our tool indicators had good validity and



reliability and our response rate (98%) was high. In addition, the findings of this study can help to develop and validate other theory-based studies. However, limitations of this study were existence of limited references to verify the validity and reliability of the deigned questionnaire based on the literature. In addition, the questionnaire was self-administered and relied on the individuals' self-report data that may have led to some degrees of bias in the results. However, the participants' level of education, their appropriate collaboration, and the researcher's explanations minimized the amount of bias.

### Conclusions

According to the findings, TPB-NLPB has a good validity and reliability for students and can be used to measure their nutrition literacy based on the TPB. Moreover, due to the increasing prevalence of nutrition-related diseases, the availability of this scale is helpful in measuring the individuals' nutrition literacy to plan and evaluate nutrition health promotion interventions and health policy-making for young people and students in the developing countries of the Middle East and Central Asia. The study should be conducted in other demographic groups, such as students-based population and athlete's youth, in larger sample size, and in divergent society.

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### Authors' Contributions

Kaveh MH designed the study and revised the content, scientific writing, discussion, and conclusion. Makiabadi E designed and conducted the study, wrote the draft and discussion. Asadollahi A analyzed the data and interpreted the methods and results. Ostovarfar J contributed in

conducting the study. All authors reviewed the paper and confirmed it.

### Conflict of Interest

The authors declare that they do not have any conflict of interest.

### References

- Ajzen I 1985. From intentions to actions: A theory of planned behavior. In *Action control*, pp. 11-39. Springer.
- Asadollahi A, Saberi LF & Faraji N 2013. Validity and reliability of male andropause symptoms self-assessment questionnaire among elderly males in Khuzestan province of Iran. *Journal of mid-life health*. **4** (4): 233.
- Asadollahi A, Saberi LF, Havasi A & Kaveh M-H 2016. Psychometric Properties of the Persian Version of the Quality of Life in Epilepsy Inventory in the Later Life. *Journal of epilepsy research*. **6** (2): 59-65.
- Baumgartner H & Homburg C 1996. Applications of structural equation modeling in marketing and consumer research: A review. *International journal of research in marketing*. **13** (2): 139-161.
- Berkman ND, et al. 2011. Health literacy interventions and outcomes: an updated systematic review. *Evidence report/technology assessment*. **199** (1): 941.
- Ciliska D, et al. 2006. The effectiveness of nutrition interventions for prevention and treatment of chronic disease in primary care settings: a systematic literature review. *Toronto: Dietitians of Canada*. At: [www.dietitian.org](http://www.dietitian.org).
- De Vet HC, Adèr HJ, Terwee CB & Pouwer F 2005. Are factor analytical techniques used appropriately in the validation of health status questionnaires? A systematic review on the quality of factor analysis of the SF-36. *Quality of life research*. **14** (5): 1203-1218.
- Diamond JJ 2007. Development of a reliable and construct valid measure of nutritional literacy in adults. *Nutrition journal*. **6** (5): 1475-2891.
- Doll WJ, Xia W & Torkzadeh G 1994. A confirmatory factor analysis of the end-user

- computing satisfaction instrument. *MIS quarterly*. 453-461.
- Du W, et al.** 2010. Surveys on the nutrition literacy of 802 adults in Jiangxi province. *Journal of hygiene research*. **39 (6)**: 735-738.
- Francis J, et al.** 2004. Constructing questionnaires based on the theory of planned behaviour: A manual for health services researchers. Centre for Health Services Research, University of Newcastle upon Tyne.
- Gibbs H & Chapman-Novakofski K** 2013. Peer reviewed: Establishing content validity for the nutrition literacy assessment instrument. *Preventing chronic disease*. **10**.
- Gibbs HD, et al.** 2015. Measuring nutrition literacy in breast cancer patients: Development of a novel instrument. *Journal of cancer education*. **31 (3)**: 493-499.
- Guttersrud Ø, Dalane JØ & Pettersen S** 2014. Improving measurement in nutrition literacy research using Rasch modelling: examining construct validity of stage-specific 'critical nutrition literacy' scales. *Public health nutrition*. **17 (04)**: 877-883.
- Hawthorne KM, Moreland K, Griffin IJ & Abrams SA** 2006. An educational program enhances food label understanding of young adolescents. *Journal of the American dietetic association*. **106 (6)**: 913-916.
- Hu S-P, Wu M-Y & Liu J-F** 1997. Nutrition knowledge, attitude and practice among primary care physicians in Taiwan. *Journal of the American college of nutrition*. **16 (5)**: 439-442.
- Jones G, et al.** 2004. The Polycystic Ovary Syndrome Health-Related Quality of Life Questionnaire (PCOSQ): a validation. *Human reproduction*. **19 (2)**: 371-377.
- Kaplan RM SD** 2013. Psychological testing: Principles, applications, and issues. 8th ed. Independence, KY: Cengage Learning;.
- Kassem NO, Lee JW, Modeste NN & Johnston PK** 2003. Understanding soft drink consumption among female adolescents using the Theory of Planned Behavior. *Health education research*. **18 (3)**: 278-291.
- King L, et al.** 2012. Do we provide meaningful guidance for healthful eating? An investigation into consumers' interpretation of frequency consumption terms. *Journal of nutrition education and behavior*. **44 (5)**: 459-463.
- Lawshe CH** 1975. A quantitative approach to content validity. *Personnel psychology*. **28 (4)**: 563-575.
- Maindal HT, et al.** 2016. Cultural adaptation and validation of the Health Literacy Questionnaire (HLQ): robust nine-dimension Danish language confirmatory factor model. *SpringerPlus*. **5 (1)**: 1232.
- McKay DL, Houser RF, Blumberg JB & Goldberg JP** 2006. Nutrition information sources vary with education level in a population of older adults. *Journal of the American dietetic association*. **106 (7)**: 1108-1111.
- Ndahura NB** 2012. Nutrition literacy status of adolescent students in Kampala district, Uganda. Høgskolen i Oslo og Akershus.
- Nolte S, et al.** 2017. German translation, cultural adaptation, and validation of the Health Literacy Questionnaire (HLQ). *PloS one*. **12 (2)**: e0172340.
- Osborne RH, Batterham RW, Elsworth GR, Hawkins M & Buchbinder R** 2013. The grounded psychometric development and initial validation of the Health Literacy Questionnaire (HLQ). *BMC public health*. **13 (1)**: 658.
- Parmenter K, Waller J & Wardle J** 2000. Demographic variation in nutrition knowledge in England. *Health education research*. **15 (2)**: 163-174.
- Pettersen S, Kjoellesdal JG & Aarnes SB** 2009. Measuring Critical Nutrition Literacy. *Annals of nutrition and metabolism*. **55**: 90.
- Prentice AM & Jebb SA** 2003. Fast foods, energy density and obesity: a possible mechanistic link. *Obesity reviews*. **4 (4)**: 187-194.
- Rashidian A, Miles J, Russell D & Russell I** 2006. Sample size for regression analyses of theory of planned behaviour studies: case of prescribing in general practice. *British journal of health psychology*. **11 (4)**: 581-593.

- Satia JA, Galanko JA & Neuhouser ML** 2005. Food nutrition label use is associated with demographic, behavioral, and psychosocial factors and dietary intake among African Americans in North Carolina. *Journal of the American dietetic association*. **105 (3)**: 392-402.
- Schaller C & James EL** 2005. The nutritional knowledge of Australian nurses. *Nurse education today*. **25 (5)**: 405-412.
- Seif A** 2004. Educational measurement, assessment and evaluation. Tehran: Doran Publications.
- Sharifirad G, Mohebbi S & Matlabi M** 2008. Survey of the feet care based on Health Belief Model in diabetes type II patients referring to the Diabetes research center of Kermanshah in 2006. *Journal of Birjand University of medical sciences*. **15 (4)**: 84-90.
- Sharma M** 2016. Theoretical foundations of health education and health promotion. Jones & Bartlett Publishers.
- Shepherd R & Towler G** 1992. Nutrition knowledge, attitudes and fat intake: application of the theory of reasoned action. *Journal of human nutrition and dietetics*. **5 (6)**: 387-397.
- Sogie-Thomas B** 2006. Understanding Health Literacy: Implications for Medicine and Public Health. *Journal of the national medical association*. **98 (6)**: 980.
- Song X** 2014. Influence of nutrition literacy on college-age population's dietary behavior. In *Department of Journalism and Mass Communications College of Arts and Sciences*, p. 83p. Kansas State University: Manhattan, Kansas.
- Stefanogiannis N, et al.** 2005. Nutrition and the burden of disease in New Zealand: 1997–2011. *Public health nutrition*. **8 (4)**: 395-401.
- Tehrani Banihashemi S-A, et al.** 2007. Health literacy and the influencing factors: a study in five provinces of Iran. *Strides in development of medical education*. **4 (1)**: 1-9.
- Vanderlee L & Hammond D** 2014. Does nutrition information on menus impact food choice? Comparisons across two hospital cafeterias. *Public health nutrition*. **17 (6)**: 1393-1402.
- Warber JI, Warber JP & Simone KA** 2000. Assessment of general nutrition knowledge of nurse practitioners in New England. *Journal of the American dietetic association*. **100 (3)**: 368-370.
- Wasowicz-Kirylo G & Stysko-Kunkowska M** 2011. Attributes of nutritional information labelling that determine attractiveness of labels and correctness of inferences made about food healthfulness. *Procedia-social and behavioral sciences*. **30**: 722-728.
- Yajima S, Takano T, Nakamura K & Watanabe M** 2001. Effectiveness of a community leaders' programme to promote healthy lifestyles in Tokyo, Japan. *Health promotion international*. **16 (3)**: 235-243.
- Zoellner J & Carr D** 2010. Exploring nutrition literacy and knowledge among a national sample of school nutrition managers. *Journal of child nutrition & management: a publication of the American School Food Service Association*. **34 (2)**.
- Zoellner J, Connell C, Bounds W, Crook L & Yadrick K** 2009. Peer reviewed: nutrition literacy status and preferred nutrition communication channels among adults in the lower Mississippi Delta. *Preventing chronic disease*. **6 (4)**: 8-16.