

Assessment of Nutritional literacy and Related Factor in Women Referring to Urban Primary Health Care Centers in Northeastern Iran

ABSTRACT

Background and Objectives: Women play an important role in choosing and preparing high-quality food suitable for family members' physical needs. This study was conducted to investigate the level of nutritional literacy and factors affecting it in women referred to urban primary health care centers in Mashhad in northeastern Iran.

Materials and Methods: In this descriptive- analytical study, the data of 440 women 15-65 years' old who referred to urban primary health care centers in Mashhad were collected using standard evaluation instrument of nutrition literacy on adults (EINLA) from 2023 to 2024 and analyzed by Stata software version 17 using the Independent sample t-test, one-way ANOVA, Spearman's correlation coefficient, and simple /multiple linear regression.

Results: The mean and standard deviation of age was 33.53 ± 11.23 . About 48.2% of the participants, had adequate nutrition literacy, and 5.5% had insufficient nutrition literacy. The highest score was related to the recognition of food groups and the lowest score was for the calculation of food units and nutritional calculation and reading of food labels. There is a significant relationship between variables of education level and job, with the participants' nutrition literacy status (P -value <0.001).

Conclusion: Many women visiting urban health centers in Mashhad lack adequate nutrition literacy, particularly those with low income and education, who should be prioritized in nutrition literacy interventions. Nutrition education should focus more on enhancing skills in calculating food units and analyzing food labels.

Paper Type: Research Article

Keywords: Women, Nutrition Literacy, Primary Health Care

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Introduction

In the past, food shortages and malnutrition-related diseases were major health problems for human societies. However, today's main challenge is the lack of awareness about healthy eating and inappropriate food consumption in many countries (1). Epidemiological studies indicate that changes in lifestyle in recent years, particularly those related to eating habits, diet, food preferences, and cooking time, can lead to an increase in the rate of non-communicable diseases (2). One out of every five deaths worldwide occurs due to unhealthy nutrition (3). It is estimated that more than 19 percent of digestive system cancers, 13 percent of heart diseases, and 10 percent of strokes worldwide are related to improper nutrition (4). Meanwhile, lack of awareness about nutrition and therefore inadequate performance of people in this field, together with other social, economic, and cultural factors, have caused problems such as malnutrition and an increased number of overweight and obese people, as well as the incidence of diabetes and various types of cancer (5-7). It is important to note that an individual's knowledge about nutrition does not necessarily determine their choices and that there is a significant gap between knowledge and behavior (8). Nutrition education interventions and information sources can help improve individuals' nutrition knowledge, but these interventions are not always tailored to the level of understanding of different populations. The disconnect between knowledge, skills, and decision-making regarding food choices and consumption can lead to failure to achieve desired outcomes (9-11).

In recent years, healthy eating behaviors have been introduced as nutrition or food literacy (12). Attention to the concept of nutrition literacy can help people effectively understand the process of obtaining information from reliable sources, processing nutrition information, and acquiring the skills needed to create appropriate nutrition behaviors (calculating and measuring food units, understanding and evaluating food content, labels, familiarizing with basic nutrition information (13).

Taylor states in her study that people in different demographic subgroups with higher nutritional health literacy are more able to understand nutritional facts and thus follow a healthy diet (14). Some studies have also shown a direct relationship between high nutritional literacy and increased consumption of fruits and vegetables, and a low level of nutritional literacy has been associated with nutritional deficiency in schoolchildren (15, 16). The best approach to improving nutritional behavior in the general population is to increase nutritional literacy about healthy diets and the dangers of unhealthy diets, especially among children, women, and the elderly (17).

Available information on the nutritional status of Iranians also shows malnutrition rates with varying degrees and severity in the country's provinces (18) and the government is trying to develop appropriate programs to improve nutritional habits to prevent obesity or underweight and also to control cardiovascular risk profiles in rural and urban areas, especially in at-risk groups (19). Over the past decades, despite numerous interventions to eliminate malnutrition, the diet of Iranians has shifted from healthy

traditional foods to unhealthy and innutritious foods (20, 21).

Several studies conducted in Iran have shown that poor nutritional status in women compared to men leads to higher abnormalities in anthropometric parameters (overweight and obesity), higher rates of metabolic disorders (blood pressure, blood lipids, and diabetes), and chronic disorders of bone and muscle structure, especially in the postmenopausal period (22-24), which is mainly influenced by women's lack of awareness about the importance of healthy nutrition and also their poor performance in nutritional behaviour(25, 26). On the other hand, the role of women as a nutritional behavior model for children (27) and as providers and converters of raw materials of healthy food to the other family members should not be overlooked (28, 29).

Previous research on the nutritional status of women in Iran does not provide comprehensive and accurate information on assessing the status of nutritional literacy in this group, and most studies have focused on the knowledge, attitude, and behavior of this group. On the other hand, to implement effective educational interventions and revise policies to promote healthy nutrition in women, it is necessary to collect and evaluate the factors affecting their nutritional behaviors. Therefore, this study aimed to investigate the status of nutritional health literacy and the role of factors affecting it among women referring to primary health centers in northeastern Iran.

Materials and Methods

Study Design and Participants

This descriptive, analytical study was conducted in six urban primary healthcare

centers in Mashhad (Khorasan Razavi Province—Northeastern Iran) between September 2023 and June 2024. The target population of this study included all women above 15 years of age who visited urban primary health care centers. Women who could read, write, and understand the material and approve the consent form were entered into the study, and questionnaires with 20% or more unanswered questions were excluded. Based on the results for Hemati et al. (1), with a significance level of 0.05 and a power of 80%, the sample size of 434 was calculated using the PASS software. Considering a 20% reduction, the sample size was increased to 521. Sampling was clustered and performed in two stages. The entire urban area (five districts) was considered the main group, and three groups were randomly selected without replacement. In each group, two centers were randomly selected.

Instrument

The socio-demographic characteristics information

The first section of the questionnaire included six questions related to age, height, weight, marital status, education level, sources of nutrition information, and history of participation in nutrition education programs at primary health care centers.

Evaluation instrument of nutrition literacy on adults (EINLA)

This study used the EINLA to measure nutritional literacy. This questionnaire was developed and standardized in Turkey by Cesur et al (30) and in Iran, Hemmati et al adapted and used it to measure the nutritional literacy of teachers(1). After translation-back translation, the reliability of the questionnaire was investigated by

calculating its internal consistency (Cronbach's alpha coefficient=0.73), showing the acceptable reliability of the tool for the Iranian population. The main part of the questionnaire consists of 35 items divided into 5 parts:

A- General nutrition information (10 items): This section evaluates individuals' knowledge of food sources, minerals, and vitamins and their impact on health and disease.

B- Reading and comprehension (6 items): It contains two short paragraphs in which the participant must answer the questions in this section based on their understanding.

C- Food groups (10 items): Participants must identify the food groups based on the numbers inserted under each image.

D- Calculation of food units (3 items): In this section, questions about the number of units of food groups needed each day.

E- Nutritional calculation and reading of food labels (6 items): The participants are expected to calculate the body mass index (BMI) based on their weight and height, then interpret information from a sample food label and recognize the calories needed and other precautions related to consuming food.

Answers to the items are 1 (correct) or 0 (incorrect/I don't know). Correct answers are scored 1 point, and wrong answers are not scored, considering the instrument's cut-off score and the perspective of the main instrument. Total scores on this questionnaire range from 0 to 35.

Three levels of nutrition literacy were identified for the study participants: people with limited or inadequate nutrition literacy (score 11), borderline nutrition literacy (score

$\geq 11 \geq 25$), and adequate nutrition literacy (1, 31).

Data Analyses

Qualitative variables were described using frequency and percentage, while quantitative variables were described using mean and standard deviation. Independent sample t-test and one-way ANOVA were used to determine the mean difference between nutritional health literacy scores and characteristics of the participants. Spearman's rank correlation coefficient was used to measure the correlation between the categorical nutritional literacy variable and other ordinal variables. The closer the correlation coefficient is to one, the higher the correlation, and its positivity indicates a direct correlation (32). Simple and multiple linear regression analyses were used to determine the relationship between the level of nutritional literacy and its subscales as the dependent variables, and demographic variables as the independent predictors. The relationship between the nutritional literacy score and participant characteristics was evaluated through simple and multiple linear regression. The dependent variable was the nutritional literacy score, while the independent variables were the participant characteristics. Initially, simple linear regression was used to select the variables with a significance level of less than 0.20 to be included in the multiple models (33). Subsequently, the multiple linear regression model was used to assess the association between participant characteristics and nutritional literacy score, adjusted for other variables. Simple linear regression provided the crude regression coefficient, while multiple linear regression provided the

adjusted coefficient. A significance level of less than 0.05 was considered for all analyses. The data analysis was conducted using Stata software version 17.

Results

Demographic characteristics

Table 1 shows the descriptive information of the women participating in the study. The mean and standard deviation of age was 33.53±11.23. The minimum and maximum ages were 15 and 75 years, respectively. Most of the women were in the age group of 31 to 45 years (42.95%). Regarding the marital status, most participants (71.82%) were married. High school and diploma education for 32.50% of women and housework jobs for

54.78% had the highest frequency. More than half of the participants did not have experience participating in educational courses for nutritional literacy. Virtual social networks had the highest percentage for acquiring nutritional health literacy alone (24.55%). In this study, 40.99% of women were overweight and 9.09% were obese.

Nutritional literacy status

The mean score of nutritional health literacy of the participants by sub-groups of each variable is also shown in Table 1. There is a significant difference in the mean score of nutritional health literacy in the subgroups of the education level, job group, and source of information ($P < 0.001$).

Table 1. Characteristics of participant

Characteristics	sub-groups	N (%)	Mean ± SD nutrition health literacy score (0-35)	P
Categorized age (year)	15-30	184 (41.82)	17.21± 4.60	0.29
	31-45	189 (42.95)	17.39± 4.41	
	46-60	59 (13.41)	18.46±4.25	
	61-75	8 (1.82)	17.88 ±2.23	
Marital status	Single	112 (25.45)	17.48±5.03	0.63
	married	316 (71.82)	17.50±4.22	
	Divorced or widowed	12 (2.73)	16.25±4.71	
Education level	Elementary education	33 (7.50)	14.67± 4.72	<0.001
	Intermediate Education	104 (23.64)	15.99±3.87	
	High school and diploma	143 (32.50)	16.78±4.14	
	Postgraduate education	45 (10.23)	18.53±4.07	
	Bachelor's degree	90 (20.45)	20.01±4.31	
	Master's degree and more	25 (5.68)	20.12±3.21	
Job	Housekeeper	241 (54.78)	16.75±4.02	<0.001
	Employee	74 (16.82)	19.38±4.11	
	Self-employment	40 (9.09)	17.38±5.60	
	Student	40 (9.09)	18.80± 5.09	
	Unemployed	45 (10.22)	17.07±4.41	
History of attending training courses	Yes	186 (42.37)	17.90±3.94	0.09
	No	245 (55.68)	17.15±4.79	
Source of information	Asking friends and acquaintances	33 (7.50)	16.18±4.47	<0.001
	Asking family members	34 (7.73)	15.94±4.89	

Characteristics	sub-groups	N (%)	Mean \pm SD nutrition health literacy score (0-35)	P
	Asking the doctor and health workers	96 (21.82)	17.10 \pm 3.87	
	Virtual social networks	108 (24.55)	16.95 \pm 4.83	
	radio and TV	35 (7.95)	15.97 \pm 4.16	
	Newspapers, periodicals, and magazines	2 (0.45)	18.5 (2.12)	
	Booklets, pamphlets, educational and promotional brochures	16 (3.64)	20.62 \pm 3.54	
	Using two sources of information	82 (18.64)	18.87 \pm 4.15	
	Using three or more sources of information	34 (7.73)	19.5 \pm 3.67	
Categorized BMI	Less than 20	35 (7.95)	17.83 \pm 5.34	0.26
	Between 20 and 25	185(42.05)	17.89 \pm 4.50	
	Between 25 and 30	180 (40.91)	16.99 \pm 4.35	
	More than 30	40 (9.09)	17.30 \pm 3.68	

The highest mean score of nutritional literacy was found among the educational groups of bachelor's and master's degrees. Among the occupational groups, the highest mean score of nutritional literacy was achieved by employees, followed by students.

Table 2 shows the information related to the nutritional health literacy score by subscales. The average total score was 23.40 \pm 6.10. Also, 46.4 % of women had borderline health literacy and only 5.5% had sufficient health literacy.

Table 2. Nutrition health literacy score and its subscales

Subscales	Number of items	Mean \pm SD	The lowest- the highest value obtained	The lowest - the highest possible value
General nutrition information	10	7/09 \pm 1/98	0-10	0-10
Reading and comprehension	6	4/83 \pm 1/35	0-6	0-6
Food groups	10	7/35 \pm 3/14	0-10	0-10
Number of food units	3	1/22 \pm 0/79	0-3	0-3
Computing literacy and reading food labels	6	2/90 \pm 1/90	0-6	0-6
Total score	35	23/4 \pm 6/1	5-34	0-35
Categorized nutrition health literacy		Frequency (%)	Cut point score	
Insufficient	-	212(48.2)	Score<11	
Medium or borderline	-	204 (46.4)	\leq Y \circ score \leq 11	
Sufficient	-	24(5.5)	Score>25	

Correlation between nutritional literacy scores and components

In the analysis of the subscales of nutritional literacy, the highest mean score was obtained

in the section on identifying food groups, and the lowest mean score in the section on calculating food units (table 3).

Table 3. Correlation between nutritional literacy scores and components

Components of nutritional literacy	Total score	p-value	R ²
General nutrition information	0/644	<0/001	0/415
Reading and comprehension	0/645	<0/001	0/403
Food groups	0/760	<0/001	0/578
Number of food units	0/384	<0/001	0/147
Computing literacy and reading food labels	0/647	<0/001	0/454

In addition, the correlation between the five subscales of nutritional literacy and the overall nutrition literacy score was significant ($P < 0.001$). The R² calculation shows what percentage of the total variance of nutritional literacy is explained by its subscales. Based on the results, 58% of the variance of the nutritional literacy score is explained by the subscale of identifying food groups.

The results of the simple and multiple linear regression analyses are presented in Table 4. Age and marital status did not show significant associations with any subscales in simple and multiple models (P ranging from 0.18 to 0.71).

Education level emerged as a strong and consistent predictor across all nutritional literacy subscales, with significant positive associations (β ranging from 0.09 to 1.26, $P < 0.0001$), indicating that higher education is linked to better nutritional knowledge in various aspects, while job status was found to have a significant positive effect on the computing literacy and reading food labels score ($\beta = 0.13$, $P = 0.04$) only in the simple model.

Participation in training courses (yes=0, no=1) also showed a notable impact in

improving three scores including the general nutrition information score (e.g., $\beta = -0.37$, $P = 0.01$ for simple model and $\beta = -0.48$, $P = 0.001$ for multiple models), computing literacy and reading food labels score (e.g., $\beta = -0.52$, $P < 0.0001$ for simple model and $\beta = -0.63$, $P < 0.0001$ for multiple models) and the total score ($\beta = -0.97$, $P = 0.002$), while it harmed the score of food groups ($\beta = 0.18$, $P = 0.009$ for simple model and $\beta = 0.12$, $P = 0.06$ for adjusted model).

The source of information was positively associated with the reading and comprehension score, food groups score, and total score in both simple and adjusted models ($P = 0.03$ to 0.001). Finally, BMI did not significantly predict nutritional literacy scores, with P above 0.05 for most subscales except in the simple linear model for food group scores ($P = 0.04$).

Subscale scores of nutritional literacy in the subgroups of the population

None of the subscales showed a significant difference in the marital subgroups ($P > 0.005$). However, the scores of all subscales in the educational subgroups were statistically significant ($P < 0.005$).

Table 4. Simple and multiple linear regression for prediction of nutritional literacy score

Dependent variable	General nutrition information score		Reading and comprehension score		Food groups score		Number of food units score		Computing literacy and reading food labels		Total score	
	β crude (P-value)	β adjusted (P-value)	β crude (P-value)	β adjusted (P-value)	β crude (P-value)	β adjusted (P-value)	β crude (P-value)	β adjusted (P-value)	β crude (P-value)	β adjusted (P-value)	β crude (P-value)	β adjusted (P-value)
	Independent variables											
Age	0.01 (0.22)	-	0.008 (0.09)	0.006 (0.18)	-0.001 (0.68)	-	0.004 (0.27)	-	0.010 (0.23)	-	0.03 (0.11)	0.02 (0.30)
Marital status	0.14 (0.48)	-	-0.06 (0.56)	-	0.03 (0.73)	-	-0.10 (0.19)	-0.04 (0.69)	-0.17 (0.38)	-	-0.16 (0.71)	-
Education level	0.34 (<0.0001)	0.36 (<0.0001)	0.29 (<0.0001)	0.28 (<0.0001)	0.18 (<0.0001)	0.17 (<0.0001)	0.11 (<0.0001)	0.09 (0.001)	0.34 (<0.0001)	0.35 (<0.0001)	1.26 (<0.0001)	1.26 (<0.0001)
Job	0.03 (0.70)	-	0.04 (0.32)	-	0.02 (0.57)	-	0.05 (0.09)	0.01 (0.69)	0.13 (0.04)	0.06 (0.31)	0.27 (0.08)	0.05 (0.74)
History of attending training courses	-0.37 (0.01)	-0.48 (0.001)	0.004 (0.97)	-	0.18 (0.009)	0.12 (0.06)	0.10 (0.10)	0.07 (0.24)	-0.52 (<0.0001)	-0.63 (<0.0001)	-0.61 (0.07)	-0.97 (0.002)
Source of information	0.002 (0.03)	0.002 (0.09)	0.003 (0.004)	0.001 (0.03)	0.0004 (0.33)	-	0.001 (0.01)	0.008 (0.03)	0.002 (0.06)	0.001 (0.24)	0.0069 (0.001)	0.005 (0.02)
BMI	-0.002 (0.95)	-	-0.002 (0.88)	-	-0.02 (0.04)	-0.005 (0.64)	-0.009 (0.36)	-	-0.02 (0.35)	-	-0.06 (0.30)	-

There was no significant difference in general nutritional information scores between the occupational groups, but participation in nutritional education programs significantly affected the general nutrition information score and nutritional computing literacy ($P < 0/005$). (Supplementary File).

Discussion

Nutritional literacy empowers women to make informed food choices for themselves and their families' nutritional needs. In this study, we assessed the levels of nutritional literacy and associated factors among women referred to urban primary health care centers.

The results showed that most women had insufficient nutritional literacy, which was inconsistent with the findings of four other similar studies (using the same instrument) in Iran, which showed average and sufficient nutritional literacy in people (1, 31, 34, 35). Of course, in these studies, there was no significant difference between gender and nutritional literacy levels. This inconsistency in nutritional literacy levels can be attributed to the difference in the climate, economic, and cultural conditions of the participants in our study (Eastern Iran) with the studies above (in the west of Iran). In the examination of independent variables in the present study, the effect of job variables, education level, and sources of information on women's nutrition literacy was confirmed, but age, BMI, marital status, and participation in training courses had no significant relationship with the level of nutrition literacy of people.

In some studies, age has been identified as an important factor in predicting the state of

nutritional literacy, and with increasing age, especially in people over 65 years old, a decrease in nutrition literacy scores is observed, which can be attributed to the decrease in physical abilities of people. Such as vision, perception, and memory disorders (36-38). However, in the age group from 15 to 56 years, mainly with age, higher levels of nutritional knowledge are observed in people due to increased learning experiences and education (39, 40).

Another significant result of this study showed that people with higher education can better obtain and understand the nutritional information they need and use it correctly when making decisions. In several studies, the level of education is an important factor in predicting nutritional knowledge and behavior (41, 42) which may be because people use more reliable references, consult with a nutritionist, and participate in educational meetings and conferences, especially at higher than high school levels. Adults with low literacy are more likely to use general information sources such as television, social media, blogs, or celebrity websites for health information than scientific sources and specialized sites such as medical sites, and the prevalence of this behavior can put health status at risk (43, 44). The low level of nutritional literacy of the majority of people interviewed in this research and their greater use of virtual networks as the main source of nutritional information can justify the association between their level of education and their low level of nutrition.

Most related studies have confirmed that employed people had a higher nutritional literacy score than people without a job and

source of income (45). Having a well-paying job is an undeniable factor that allows people to willingly pay for expenses such as nutritional counseling and buying quality and varied foods (46, 47).

Looking at the subcategory scores of the Nutrition Literacy Questionnaire, the lowest score was associated with the number of food units and reading food labels. Understanding the measurement of the required nutritional units and reading food labels can be difficult for individuals. Numerous shreds of evidence indicate that most people have problems using the information included in food labels and face many challenges, especially in choosing the type of healthy food and this issue has a lot to do with cognitive literacy and accounting skills (48-50). This category of skills is also directly related to the level of education, and people are more likely to benefit from nutritional content as education increases (51).

Although there was no significant relationship between participation in the training course and the overall score of nutritional literacy, the components of general nutrition information computational literacy, and reading food labels were affected by it. It should be considered, however, that holding training classes by healthcare workers can be effective in strengthening critical health literacy through improving dynamic interactive processes (52).

In this study, the nutritional literacy score could not predict the BMI status, but we are faced with several interpretations regarding the impact of nutritional literacy on obesity and overweight. A systematic review study showed that the level of nutrition literacy can

change the quality of the elements received with a direct effect on dietary habits and food consumption patterns and affect anthropometric indicators over time (53). It is expected that people with better nutrition literacy will follow the recommendations related to healthy diet orders, so they will be more in the normal range of their weight (52, 54). But in addition to all these factors, it is necessary to notice the economic and social levels of people and determine the attitudes, beliefs, and related social norms in understanding the complexities and contradictions of the impact of nutrition literacy on improving people's nutritional performance (55, 56).

Study Limitations and Strengths

This study was one of the first studies in Iran to examine nutrition literacy and factors affecting it exclusively in the female population. We endeavored to use valid tools and accurate statistical methods to achieve our objectives. Using reliable tools to determine the desired goals is considered one of the significant points in this research. However, there were limitations in implementation. First, the cross-sectional nature as well as the limited variables of this study do not allow a detailed examination of the causes. Second, this study was conducted only in one urban area, so the findings cannot be generalized to other places. Further studies are recommended, especially focusing on underprivileged areas.

Conclusion

Our study found low nutritional literacy among most women attending urban health center. Women with less education and no specific income have lower nutritional literacy should be included as the main target

group in nutritional behavior improvement programs. Also, considering the correlation between the components of nutritional literacy, in designing educational interventions with a Focus on improving skills such as calculating food units and understanding food product labels instead of general nutrition education, we can hope to improve people's nutritional literacy.

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Consent for publication: Not applicable

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References

1. Hemati M, Akbartabar Toori M, Shams M, Behroozpour A, Rezaei A. Measuring nutritional literacy in elementary school teachers in Yasuj: A cross-sectional study. *Armaghane danesh*. 2018;23(1):124-33.
2. Wilson SL, Gallivan A, Kratzke C, Amatya A. Nutritional status and socio-ecological factors associated with overweight/obesity at a rural-serving US-Mexico border university. *Rural and Remote Health*. 2012;12(4):1-15. <https://doi.org/10.22605/RRH2228>.
3. Al-Jawaldeh A, Abbass MM. Unhealthy dietary habits and obesity: the major risk factors beyond non-communicable diseases in the eastern mediterranean region. *Frontiers in nutrition*. 2022;9:817808. <https://doi.org/10.3389/fnut.2022.817808> PMID:35369054 PMCID:PMC8970016.
4. Organization WH. Global health risks: mortality and burden of disease attributable to selected major risks: World Health Organization; 2009.
5. Chen SH, Cheng HY, Chuang YH, Shao JH. Nutritional status and its health-related factors among older adults in rural and urban areas. *Journal of advanced nursing*. 2015;71(1):42-53. <https://doi.org/10.1111/jan.12462> PMID:24894954.
6. Zhang LiYan ZL, Lu YuHan LY, Fang Yu FY. Nutritional status and related factors of patients with advanced gastrointestinal cancer. 2014. <https://doi.org/10.1017/S000711451300367X> PMID:24388608.
7. Robinson MK, Mogensen KM, Casey JD, McKane CK, Moromizato T, Rawn JD, Christopher KB. The relationship among obesity, nutritional status, and mortality in the critically ill. *Critical Care Medicine*. 2015;43(1):87-100. <https://doi.org/10.1097/CCM.0000000000000602> PMID:25289931.
8. Heshmat R, Abdollahi Z, Ghotbabadi FS, Rostami M, Shafiee G, Qorbani M, et al. Nutritional knowledge, attitude and practice toward micronutrients among Iranian households: the NUTRI-KAP survey. *Journal of Diabetes & Metabolic Disorders*. 2015;15:1-5. <https://doi.org/10.1186/s40200-016-0260-8> PMID:27709106 PMCID: PMC5050604.
9. Farahmand M, Tehrani FR, Amiri P, Azizi F. Barriers to healthy nutrition: perceptions and experiences of Iranian women. *BMC public health*. 2012;12:1-7. <https://doi.org/10.1186/1471-2458-12-1064> PMID:23227832 PMCID:PMC3542289.
10. Spronk I, Kullen C, Burdon C, O'Connor H. Relationship between nutrition knowledge and dietary intake. *British journal of nutrition*. 2014;111(10):1713-26. <https://doi.org/10.1017/S0007114514000087> PMID:24621991.
11. King L, Watson WL, Chapman K, Kelly B, Louie JC, Hughes C, et al. Do we provide meaningful guidance for healthful eating? An investigation into consumers' interpretation of frequency consumption terms. *Journal of nutrition*

- education and behavior. 2012;44(5):459-63. <https://doi.org/10.1016/j.jneb.2011.12.004> PMID:22591579.
12. Mengi Çelik Ö, Karacil Ermumcu MS, Ozyildirim C. Turkish version of the 'food and nutrition literacy questionnaire for Chinese school-age children' for school-age adolescents: a validity and reliability study. *BMC Public Health*. 2023;23(1):1807. <https://doi.org/10.1186/s12889-023-16732-2> PMID:37716935 PMCID: PMC10505319.
 13. Aktas N, Ozdogan Y. A study of the state of knowing the nutritional literacy concept in Turkey. *Researchers World*. 2016;7(2):46. <https://doi.org/10.18843/rwjasc/v7i2/04>.
 14. Taylor MK, Sullivan DK, Ellerbeck EF, Gajewski BJ, Gibbs HD. Nutrition literacy predicts adherence to healthy/unhealthy diet patterns in adults with a nutrition-related chronic condition. *Public health nutrition*. 2019;22(12):2157-69. <https://doi.org/10.1017/S1368980019001289> PMID:31146797 PMCID: PMC6827561.
 15. Burrows TL, Lucas H, Morgan PJ, Bray J, Collins CE. Impact evaluation of an after-school cooking skills program in a disadvantaged community: back to basics. *Canadian Journal of Dietetic Practice and Research*. 2015;76(3):126-32. <https://doi.org/10.3148/cjdpr-2015-005> PMID:26280792.
 16. Doustmohammadian A, Omidvar N, Keshavarz-Mohammadi N, Eini-Zinab H, Amini M, Abdollahi M, et al. Low food and nutrition literacy (FNLIT): a barrier to dietary diversity and nutrient adequacy in school age children. *BMC research notes*. 2020;13:1-8. <https://doi.org/10.1186/s13104-020-05123-0> PMID:32532341 PMCID: PMC7291429.
 17. Abdi F, Atarodi Z, Mirmiran P, Esteki T. Review of nutritional status in Iranian population. *Focus Sci*. 2016;2(3):1-4. <https://doi.org/10.20286/focsci-020332>.
 18. Damari B, Abdollahi Z, Hajifaraji M, Rezazadeh A. Nutrition and food security policy in the Islamic Republic of Iran: situation analysis and roadmap towards 2021. *East Mediterr Health J*. 2018;24(02):177-88. <https://doi.org/10.26719/2018.24.2.177> PMID:29748947.
 19. Goshtaei M, Ravaghi H, Sari AA, Abdollahi Z. Nutrition policy process challenges in Iran. *Electronic physician*. 2016;8(2):1865. <https://doi.org/10.19082/1865> PMID:27053992 PMCID:PMC4821298.
 20. Namdar A, Naghizadeh MM, Zamani M, Montazeri A. Exploring the relationship between health literacy and fast food consumption: a population-based study from southern Iran. *BMC Public Health*. 2021;21:1-10. <https://doi.org/10.1186/s12889-021-10763-3> PMID:33879106 PMCID:PMC8056591.
 21. Sobhani SR, Omidvar N, Abdollahi Z, Al Jawaldehy A. Shifting to a sustainable dietary pattern in Iranian population: current evidence and future directions. *Frontiers in Nutrition*. 2021;8:789692. <https://doi.org/10.3389/fnut.2021.789692> PMID:35004817 PMCID:PMC8727882.
 22. Naghashpour M, Mansouri S, Vadzizadeh A, Cheraghian B, Fallahi R, Vaziri F. Determinants of nutritional knowledge, attitude, and practice among southwestern Iranian households: A community-based study. *Nutrition and health*. 2020;26(2):93-102. <https://doi.org/10.1177/0260106020905419> PMID:32180506.
 23. Hejazi J, Mohtadinia J, Kolahi S, Ebrahimi-Mamaghani M. Nutritional status among postmenopausal osteoporotic women in North West of Iran. *Asia Pacific journal of clinical nutrition*. 2009;18(1):48-53.
 24. Esmailzadeh A, Azadbakht L. Food intake patterns may explain the high prevalence of cardiovascular risk factors among Iranian women. *The Journal of nutrition*. 2008;138(8):1469-75. <https://doi.org/10.1093/jn/138.8.1469> PMID:18641193.
 25. Mirmiran P, Mohammadi-Nasrabadi F, Omidvar N, Hosseini-Esfahani F, Hamayeli-Mehrabani H, Mehrabi Y, Azizi F. Nutritional knowledge, attitude and practice of Tehranian adults and their relation to serum lipid and lipoproteins: Tehran lipid and glucose study. *Annals of nutrition and metabolism*. 2010;56(3):233-40. <https://doi.org/10.1159/000288313> PMID:20375546.
 26. Sasanfar B, Toorang F, Rostami S, Yeganeh MZ, Ghazi ML, Seyyedsalehi MS, Zendehehdel K. The effect of nutrition education for cancer prevention based on health belief model on nutrition knowledge, attitude, and practice of Iranian women. *BMC Women's Health*. 2022;22(1):213. <https://doi.org/10.1186/s12905-022-01802-1> PMID:35672814 PMCID:PMC9175379.
 27. Ahmadi F, Karamitanha F. Health literacy and nutrition literacy among mother with preschool children: What factors are effective? *Preventive medicine reports*. 2023;35:102323. <https://doi.org/10.1016/j.pmedr.2023.102323> PMID:37576847 PMCID:PMC10413137.
 28. Karimi E, Haghighatdoost F, Mohammadifard N, Najafi F, Farshidi H, Kazemi T, et al. The influential role of parents' socioeconomic status and diet quality on their children's dietary behavior: Results from the LIPOKAP study among the Iranian population. *BMC pediatrics*. 2023;23(1):188. <https://doi.org/10.1186/s12887-023-04000-6> PMID:37085814 PMCID:PMC10120167.
 29. Akbari F, Azadbakht L. A systematic review on diet quality among Iranian youth: focusing on reports from Tehran and Isfahan. *Archives of Iranian medicine*. 2014;17(8):0.
 30. Cesur B, Koçoğlu G, Sümer H. Evaluation instrument of nutrition literacy on adults (EINLA) A validity and reliability study. *Integr Food Nutr Metab*. 2015;2(1):127-30. <https://doi.org/10.15761/IFNM.1000114>.
 31. Yarmohammadi P, Morowatisharifabad MA, Rahaei Z, Khayyatzadeh SS, Madadzadeh F. Nutrition literacy and its related demographic factors among workers of Taraz Steel company, Chaharmahal and Bakhtiari, Iran. *Frontiers in Public Health*. 2022;10:911619. <https://doi.org/10.3389/fpubh.2022.911619> PMID:36033775 PMCID: PMC9412198.
 32. Myers L, Sirois MJ. Spearman correlation coefficients, differences between. *Wiley StatsRef: Statistics*

- Reference Online. 2014. <https://doi.org/10.1002/9781118445112.stat02802>.
33. Rothman KJ, Greenland S, Lash TL. *Modern epidemiology*; Wolters Kluwer Health/Lippincott Williams & Wilkins Philadelphia; 2008.
 34. Al-Hosseini MK, Khoshgoo M, Taghizadeh R, Tanha K, Shidfar F. Investigating the level of nutrition literacy and its accompanying factors in seminary students of Qom city in 2019 (Iran). 2020.
 35. Shams M, Boostani F, Maleki M, Shariatinia S, Mousavizade A, Hemmati M. Nutrition literacy in adults and its related factors: A cross-sectional study in Kohgiluyeh and Boyer-Ahmad Province, Iran. *Journal of Health*. 2020;11(1):77-87. <https://doi.org/10.29252/j.health.11.1.77>.
 36. Michou M, Panagiotakos DB, Lionis C, Costarelli V. Sex and age in relation to health and nutrition literacy levels in a sample of Greek adults. *International Journal of Health Promotion and Education*. 2020;58(5):229-41. <https://doi.org/10.1080/14635240.2019.1681289>.
 37. Aihara Y, Minai J. Barriers and catalysts of nutrition literacy among elderly Japanese people. *Health promotion international*. 2011;26(4):421-31. <https://doi.org/10.1093/heapro/dar005> PMID:21307024.
 38. Patel P, Panaich S, Steinberg J, Zalawadiya S, Kumar A, Aranha A, Cardozo L. Use of nutrition literacy scale in elderly minority population. *The Journal of nutrition, health and aging*. 2013;17(10):894-7. <https://doi.org/10.1007/s12603-013-0355-6> PMID:24257573.
 39. Bahramfard T, Salehi SO, Toori MA, Pourmahmoudi A, Jowshan M, Parvin S, et al. Nutritional literacy status and its related factors in students of Yasuj University of Medical Sciences. *Clinical Nutrition and Hospital Dietetics*. 2020;40(4):55-62. <https://doi.org/10.12873/404malekzadeh>.
 40. Sharifnia F, Ghaffari M, Rakhshanderou S. Nutritional literacy measurement among Iranian elderly population. *Journal of Advanced Biomedical Sciences*. 2022. <https://doi.org/10.18502/jabs.v11i4.8627>.
 41. Hann CS, Rock CL, King I, Drewnowski A. Validation of the Healthy Eating Index with use of plasma biomarkers in a clinical sample of women. *The American journal of clinical nutrition*. 2001;74(4):479-86. <https://doi.org/10.1093/ajcn/74.4.479> PMID:11566646.
 42. Liao L-L, Lai I-J, Chang L-C. Nutrition literacy is associated with healthy-eating behaviour among college students in Taiwan. *Health Education Journal*. 2019;78(7):756-69. <https://doi.org/10.1177/0017896919836132>.
 43. Al Tell M, Natour N, Alshawish E, Badrasawi M. The relationship between nutrition literacy and nutrition information seeking attitudes and healthy eating patterns among a group of palestinians. *BMC Public Health*. 2023;23(1):165. <https://doi.org/10.1186/s12889-023-15121-z> PMID: 36694185 PMCID: PMC 9875392.
 44. Svendsen K, Torheim LE, Fjelberg V, Sorprud A, Narverud I, Retterstøl K, et al. Gender differences in nutrition literacy levels among university students and employees: a descriptive study. *Journal of nutritional science*. 2021;10:e56. <https://doi.org/10.1017/jns.2021.47> PMID:34367630 PMCID:PMC8327390.
 45. Michou M, Panagiotakos DB, Lionis C, Costarelli V. Socioeconomic inequalities in relation to health and nutrition literacy in Greece. *International journal of food sciences and nutrition*. 2019;70(8):1007-13. <https://doi.org/10.1080/09637486.2019.1593951> PMID:30935258.
 46. Sanlier N, Kocaay F, Kocabas S, Ayyildiz P. The effect of sociodemographic and anthropometric variables on nutritional knowledge and nutrition literacy. *Foods*. 2024;13(2):346. <https://doi.org/10.3390/foods13020346> PMID: 38275713 PMCID:PMC10814858.
 47. Hemmer A, Hitchcock K, Lim YS, Kovacic MB, Lee S-Y. Development of food literacy assessment tool targeting adults with low income. *Journal of nutrition education and behavior*. 2021;53(11):966-76. <https://doi.org/10.1016/j.jneb.2021.05.007> PMID:34426065 PMCID:PMC 8922242.
 48. Rothman RL, Housam R, Weiss H, Davis D, Gregory R, Gebretsadik T, et al. Patient understanding of food labels: the role of literacy and numeracy. *American journal of preventive medicine*. 2006;31(5):391-8. <https://doi.org/10.1016/j.amepre.2006.07.025> PMID: 17046410.
 49. Viswanathan M, Hastak M, Gau R. Understanding and facilitating the usage of nutritional labels by low-literate consumers. *Journal of Public Policy & Marketing*. 2009;28(2):135-45. <https://doi.org/10.1509/jppm.28.2.135>.
 50. Gibbs HD, Ellerbeck EF, Gajewski B, Zhang C, Sullivan DK. The nutrition literacy assessment instrument is a valid and reliable measure of nutrition literacy in adults with chronic disease. *Journal of nutrition education and behavior*. 2018;50(3):247-57. e1. <https://doi.org/10.1016/j.jneb.2017.10.008> PMID: 29246567 PMCID: PMC 5845801.
 51. Ahmadi A, Torkamani P, Sohrabi Z, Ghahremani F. Nutrition knowledge: application and perception of food labels among women. *Pakistan journal of biological sciences: PJBS*. 2013;16(24):2026-30. <https://doi.org/10.3923/pjbs.2013.2026.2030> PMID:24517023.
 52. Li Q, Piaseu N, Phumonsakul S, Thadakant S. Effects of a comprehensive dietary intervention program, promoting nutrition literacy, eating behavior, dietary quality, and gestational weight gain in Chinese urban women with normal body mass index during pregnancy. *Nutrients*. 2024;16(2):217. <https://doi.org/10.3390/nu16020217> PMID:38257110 PMCID:PMC10820561.
 53. Akkartal Ş, Gezer C. Is nutrition knowledge related to diet quality and obesity? *Ecology of food and nutrition*. 2020;59(2):119-29. <https://doi.org/10.1080/03670244.2019.1675654> PMID:31590573.
 54. Li S, Zhu Y, Zeng M, Li Z, Zeng H, Shi Z, Zhao Y. Association between nutrition literacy and overweight/obesity of adolescents: a cross-sectional study in Chongqing, China. *Frontiers in Nutrition*. 2022;9:893267. <https://doi.org/10.3389/fnut.2022.893267> PMID:35634378 PMCID:PMC 9134066.

55. Gholabi F, Mohammad Baqer AA, Aghayari Hir T, Akram H. Association between nutrition literacy and diet with obesity. *Payesh (Health Monitor)*. 2019;18(4):393-404.
56. Camargo JT, Ramirez M, Gajewski BJ, Sullivan DK, Carlson SE, Gibbs HD. Nutrition literacy among Latina/x people during pregnancy is Associated with socioeconomic position. *Journal of the Academy of Nutrition and Dietetics*. 2022;122(11):2097-105. <https://doi.org/10.1016/j.jand.2022.05.011> PMID:35589070.