



# Nutrition Literacy and Health Status of Medical Students: A Systematic Review



## ARTICLE INFO

### Article Type

Systematic Review

### Authors

Ramezankhani A.<sup>1\*</sup> PhD

Vahidi Sh.<sup>1</sup> MSc

### How to cite this article

Ramezankhani A, Vahidi Sh. Nutrition Literacy and Health Status of Medical Students: A Systematic Review. Health Education and Health Promotion. 2023;11(2):231-238.

<sup>1</sup>Department of Public Health, School of Public Health and Safety, Shahid Beheshti University of Medical Sciences, Tehran, Iran

### \*Correspondence

Address: Department of Public Health, School of Public Health and Safety, Shahid Beheshti University of Medical Sciences, Student Boulevard, Shahid Shahriari Square, Tehran, Iran. Postal Code: 1983969411  
Phone: +98 (21) 22432040-41  
Fax: +98 (21) 22432037  
aramazankhani@sbmu.ac.ir

### Article History

Received: March 24, 2023

Accepted: May 18, 2023

ePublished: June 5, 2023

## ABSTRACT

**Aims** Health literacy is considered a fundamental ability needed when making difficult health-related decisions. Also, people with nutrition literacy can convert nutrition messages into knowledge and tend to make healthier eating choices. This systematic review aimed to summarize the literature on nutrition and health literacy to enhance the medical students' knowledge about the importance of health and nutrition literacy.

**Information & Methods** In this study systematic review, research articles published in English were reviewed using relevant terms in PubMed, CINAHL, Web of Science, EMBASE, Scopus, and CINAHL databases. The articles were selected based on the inclusion and exclusion criteria, repetition, purpose, and relevance to the topic. Furthermore, the "Consensus-based Standards for the selection of health Measurement Instruments" checklist was used to select and evaluate the reviewed articles.

**Findings** A total of 2978 articles were reviewed. Ultimately, 15 articles were approved and included in the study. Six studies were conducted on nursing students, six were on students of pharmacy and other clinical fields, and three studies examined medical students. The average nutrition and food literacy scores were sufficient, whereas the nutrition knowledge score was moderate.

**Conclusion** A total of 2978 articles were reviewed. Ultimately, 15 articles were approved and included in the study. Six studies were conducted on nursing students, six were on students of pharmacy and other clinical fields, and three studies examined medical students. The average nutrition and food literacy scores were sufficient, whereas the nutrition knowledge.

**Keywords** Literacy; Health Literacy; Health Status; Medical Students; Systematic Review

## CITATION LINKS

[1] Health literacy: A prescription to ... [2] Nutrition literacy and its related demographic ... [3] Health literacy as a public health goal: A challenge ... [4] Assessment of nutrition literacy by two diagnostic methods ... [5] Health and nutritional literacy of New Zealand ... [6] Nutritional literacy status and its related factors in students of ... [7] Evaluation of nutrition literacy and nutrition ... [8] The nutritional knowledge of Australian ... [9] Discussing the effects of poor health literacy on ... [10] Nutritional knowledge levels of nursing students ... [11] Nutrition literacy program for improving public ... [12] Measuring nutritional literacy in elementary school teachers ... [13] Nutritional knowledge of medical staff ... [14] Reliability and validity of a revised version ... [15] Enhancing nutrition-related literacy, knowledge and ... [16] The relationship between nutrition knowledge and ... [17] A comparative study of nutritional status, knowledge attitude and practices ... [18] Just a subtle difference? Findings from a systematic ... [19] Nutrition knowledge and attitude in medical ... [20] Nutritional knowledge and attitudes among ... [21] Nutrition literacy tailored interventions may improve ... [22] Evaluation of the nutritional knowledge of undergraduate ... [23] A comparison of the nutritional knowledge of ... [24] The effects of nutrition awareness and knowledge ... [25] Pharmacology and biochemistry undergraduate ... [26] Nutritional knowledge and attitudes of dental ... [27] Evaluation instrument of nutrition literacy on ... [28] Measuring nutrition and food literacy in adults ... [29] Nutrition and health literacy: A systematic ... [30] Development and preliminary testing of the Food Choice Priorities ... [31] Nutrition knowledge, the attitude and ... [32] The nutrition knowledge ... [33] Food safety knowledge, attitude ... [34] Food literacy programmes in secondary schools: A systematic ... [35] Nutrition literacy is associated with healthy-eating ... [36] The situation of food security and related factors in female teachers of ... [37] Nutrition literacy predicts adherence to healthy/unhealthy diet patterns in adults with a ... [38] COSMIN checklist for systematic reviews of the hospital preparedness instruments in ... [39] Rating the methodological quality in systematic reviews of studies on measurement properties ... [40] The COSMIN checklist for evaluating the methodological ...

## Introduction

Health literacy is defined as the degree to which individuals can obtain, process, and understand basic health information and services needed to make appropriate health decisions [1, 2]. It is essential to a person's ability to make wise health choices and regarded as a fundamental ability required when making difficult health-related decisions [3, 4]. According to the healthcare community, poor health literacy can impede the proper treatment of preventable diseases [5]. Individuals with low levels of literacy struggle to understand health-related information and take actions that can reduce risks and symptoms [6]. Consequently, inadequate health literacy interferes with provider-patient dialogue and affects the overall healthcare experience [7]. Meanwhile, evidence suggests deficiencies in people's knowledge and self-management skills, particularly in relation to nutrition and health literacy [8, 9].

The ability to access, process, and comprehend fundamental nutrition information is known as nutrition literacy [10-12]. According to literature, nutrition literacy can be developed or influenced by various factors, such as adhering to dietary guidelines, interpreting food labels, and making wise dietary decisions [13-16]. Skilled individuals in nutrition literacy can recognize and convert nutrition messages into knowledge. Generally, those with adequate nutritional understanding tend to make healthier eating choices [17, 18].

Factors such as poor utilization of health care services, inferior health status, noncompliance with medical advice, the inability to manage chronic diseases, lack of self-care, frequent hospitalizations, rising health costs, and higher mortality rates have been associated with low levels of health and nutrition literacy [19]. It is estimated that more than 19% of gastrointestinal cancers, 13% of heart diseases, and 10% of strokes worldwide are related to improper nutrition [3]. A high level of health and nutrition literacy among medical doctors can optimally promote healthy nutrition to prevent certain diseases, assist patients when recovering from illnesses and surgeries, and teach patients how to manage chronic illnesses with healthy food choices. Healthy nutrition helps to prevent obesity and chronic diseases, such as diabetes mellitus and cardiovascular diseases [20].

Medical students have received less research attention on food literacy and nutrition knowledge. It is especially important, as they will eventually appear in the public arena as therapists or paramedics and gain social trust and scientific status.

This systematic review aimed to summarize the literature on nutrition and health literacy to enhance the medical students' knowledge about the importance of health and nutrition literacy in practice and define the shortcomings and

opportunities found in certain scientific researches [13, 21].

## Information and Methods

### Search strategy and article selection

Research articles published in English were analyzed using relevant terms in PubMed, CINAHL, Web of Science, EMBASE, Scopus, CINAHL databases, and the Google Scholar motor engine. The search was conducted using keywords and Medical Subject Headings (MeSH). Search terms applied in the screening of articles included "nutrition literacy", "food literacy", "Nutrition Knowledge", "Nutritional", "Food Knowledge", "Students", "Medical Students", and "Clinical Students". Combinations with the operators "and" and "or" were also examined. All articles related to the topic were reviewed.

### Inclusion and exclusion criteria

The inclusion criteria included articles in which the levels of literacy and knowledge of both nutrition and food among healthcare students was examined regardless of age, income, study design, gender, and sample size (Healthcare, medical, and basic science students were selected as the target community because of their close connection to nutrition science). Also included in the study were researches in which the literacy or knowledge of either nutrition or food was measured with appropriate tools, studies that had no limitations and deficiencies in research findings, and studies that examined graduate students in the fields of healthcare or basic social sciences.

The exclusion criteria included studies in which people other than healthcare students were examined, and in which the mean or percentage of instruments was unclear. Furthermore, articles whose full text was not available were excluded from the study. Articles with review data, case reports, and manuscripts were also rendered as irrelevant and excluded from the study.

### Data extraction and screening

Two trained authors assisted in the search for and extraction of data. The authors selected abstracts based on quality and the inclusion and exclusion criteria. After reviewing the abstracts, the results of the studies were analyzed. Consequently, the two authors consulted each other, reached a consensus, and then mentioned the reasons behind the inclusion or exclusion of articles with conflicting content. The method of the presented topics presented, including the analysis, interpretation and collection of findings, was based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). After the initial search, the articles were checked for the repetition and consistency of their titles and abstracts. The content and relevance of the text was then evaluated. Therefore, all selected articles were of high quality and based on the inclusion and exclusion criteria (Figure 1).

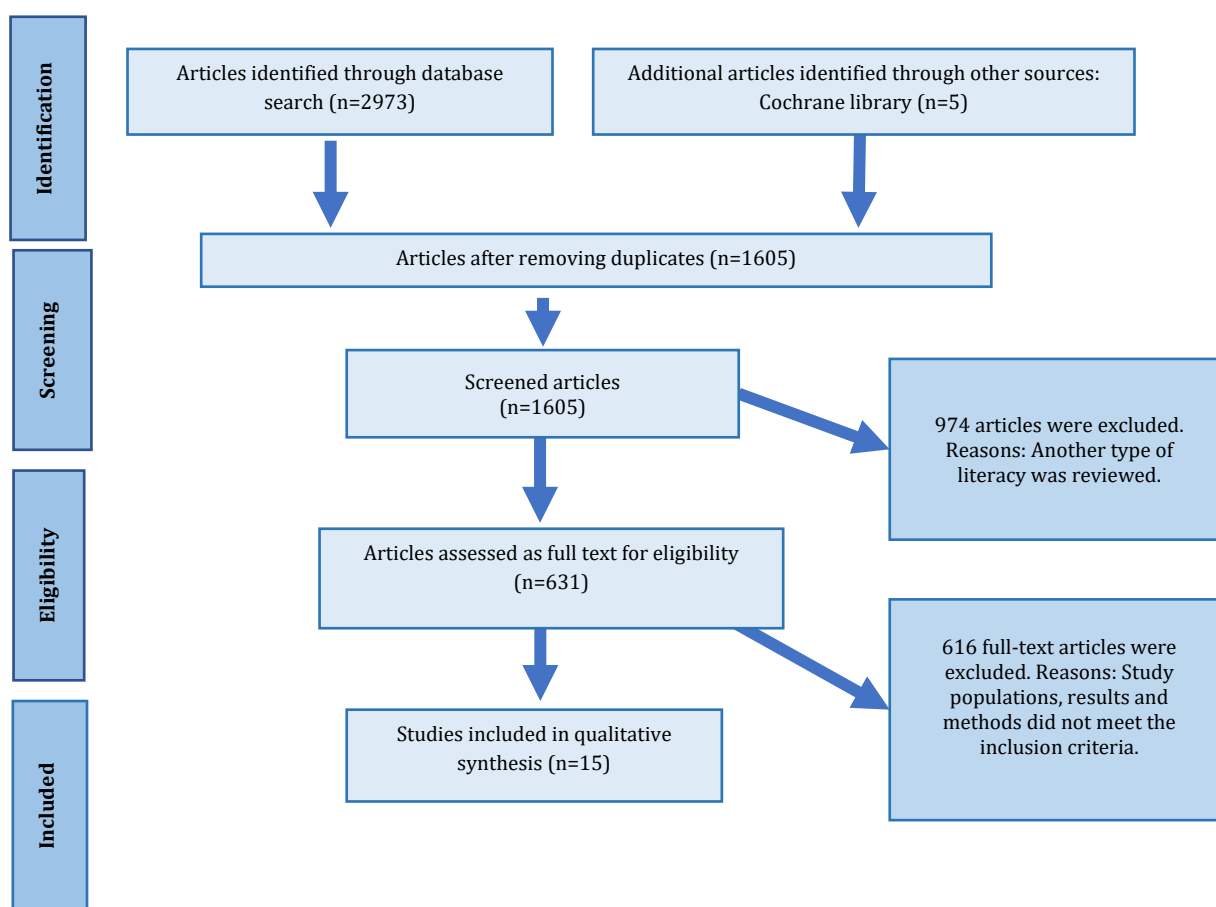


Figure 1) Article selection diagram

### Article quality evaluation

The quality of the final articles was evaluated separately by two researchers with experience in systematic review research. The results were then discussed in a joint meeting. In cases where there was a difference of opinion, the discussion continued until a final agreement was reached between the two researchers.

In order to select and check the quality of the articles, the "CONsensus-based Standards for the selection of health Measurement INstruments" (COSMIN) checklist was used. The articles were classified as poor (1-3), good (4, 5), and excellent (6) based on the score obtained for each criterion.

## Findings

### Article selection, article type and target population

A total of 2978 articles were reviewed. Eventually, 15 articles were approved and included in the study (Figure 1). Twelve articles examined nutrition knowledge, one studied both nutrition literacy and nutrition knowledge [22], and two articles researched nutrition literacy [5, 6].

For the studied population, a total of 4108 students were examined. Six articles were on nursing students

[5, 7, 10], three studies focused on medical students [6, 10, 13], and six studies examined students of pharmacy and other fields of clinical studies [23, 24] (Table 1).

### Article content and study design

Two studies focused on nutrition literacy, both of which revealed an average level of nutrition literacy among the studied subjects. One study by Mengi and Semerci [7] examined both nutrition literacy and nutrition knowledge, demonstrating a sufficient level of nutrition literacy and good level of nutrition knowledge among the students. Twelve studies reviewed nutrition knowledge, two of which demonstrated low levels of nutrition knowledge [10, 22]. Overall, nutrition knowledge was average. Five studies showed that nutrition knowledge was higher than 50% [13, 17, 20, 25]. Most studies mentioned the positive role played by the related academic field and degree in nutrition literacy (Table 1). Among the reviewed studies, fourteen were cross-sectional, and one did not specify. Three studies were conducted before 2010. In all studies, the objectives and methodologies were well presented [8, 13, 26].

### Nutrition assessment tools

In two studies, the reliability levels of the tools were not determined. In six studies, the questionnaire was self-designed. The tools applied to evaluate nutrition

literacy, were targeted at nursing students, whereas those used to measure nutrition knowledge were targeted at medical and clinical students. The “Evaluation Instrument of Nutrition Literacy on Adults” tool (EINLA) was applied to measure

nutrition literacy [27]. However, in order to measure nutrition knowledge, most studies used either the “General Nutrition Knowledge Questionnaire” (GNKQ) [14] or other modified questionnaires [28] (Table 2).

**Table 1)** Main nutritional findings of the reviewed articles

Authors, Year	Subjects/Number of Participants/Study design	Summary of findings
<b>Nutrition literacy</b>		
Mearns <i>et al.</i> , 2017 [5]	Nursing students/103/Cross-sectional study	The average nutrition literacy score was 56.7. In many cases, literacy among nurses was sufficient.
Bahramfar <i>et al.</i> , 2020 [6]	Nursing students/397/Cross-sectional study	50.9% and 48.12% of students had borderline nutrition literacy and sufficient nutrition literacy, respectively, and only 1% had insufficient nutrition literacy.
<b>Nutrition literacy and nutrition knowledge</b>		
Mengi & Semerci, 2022 [7]	Nursing students/309/Cross-sectional study	The total nutrition literacy score was 28.6, and 91.6% had sufficient nutrition literacy. The nutrition knowledge score was 57, and 50% had a good level of nutrition knowledge.
<b>Nutrition knowledge</b>		
Pietz <i>et al.</i> , 1980 [26]	Dental students/230/Cross-sectional study	About 69% of the respondents answered correctly about nutrition. The students of the last semesters were more literate.
Brett <i>et al.</i> , 1986 [13]	Medical and clinical students/120/Cross-sectional study	51% of clinical students of nutrition gave the correct answer. This percentage was 58.5% for medical students.
Schaller & James, 2005 [8]	Nursing students/103/Cross-sectional study	The knowledge score of nurses was around 60%.
Shah <i>et al.</i> , 2011 [23]	Dental students, diet and nutrition/124/Not mentioned	Dietetics and nutrition students' knowledge of nutrition was more appropriate, and they followed the national nutrition guidelines.
Buxton & Davies, 2013 [10]	Nursing students/166/Cross-sectional study	About 45% of the students had below average nutrition knowledge scores.
Chepulis & Mearns, 2015 [22]	Nursing students/197/Cross-sectional study	The overall nutrition knowledge scores were low and average.
Spexoto <i>et al.</i> , 2015 [25]	Pharmacy and biochemistry students/381/Cross-sectional study	About 80% of the students had average nutrition knowledge. The students' semester was an effective factor.
Kliemann <i>et al.</i> , 2016 [14]	Resident and dietetics students/552/Cross-sectional study	Nutrition knowledge scores of dietetics students and residents were acceptable and higher than other students.
El-Ahmady & El-Wakeel, 2017 [24]	Pharmacy students/423/Cross-sectional study	Nutrition literacy was average. Female students had superior nutrition knowledge.
Ul Haq <i>et al.</i> , 2018 [17]	Medical students/701/Cross-sectional study	Nutrition knowledge was average. Chinese students had more nutrition knowledge.
Dolatkhah <i>et al.</i> , 2019 [19]	Medical students/202/Cross-sectional study	Most participants had poor nutrition knowledge, which varied significantly by age.
Bawazir <i>et al.</i> , 2022 [20]	Interns/100/Cross-sectional study	Nutrition knowledge was average.

**Table 2)** Nutrition assessment tools

Authors, Year	Tools	Formal NKQ used	Validity/reliability of questionnaires
<b>Nutrition Literacy</b>			
Mearns <i>et al.</i> , 2017 [5]	EINLA	Self-designed	Yes
Bahramfar <i>et al.</i> , 2020 [6]	EINLA	Yes	Yes
<b>Nutrition Literacy and Nutrition knowledge</b>			
Mengi & Semerci, 2022 [7]	EINLA and NKSA	Yes	Yes
<b>Nutrition knowledge</b>			
Pietz <i>et al.</i> , 1980 [26]	Normal and therapeutic nutrition	Yes	Yes
Brett <i>et al.</i> , 1986 [13]	Factual question regarding energy per macronutrient, kilojoules, daily intake of different nutrients, nutrition assessment	Self-designed	Not mentioned
Schaller & James, 2005 [8]	Basic questions about several types of food	Self-designed	Yes
Shah <i>et al.</i> , 2011 [23]	Diet advice questions as professionals to the patients or people	Self-designed	Yes
Buxton & Davies, 2013 [10]	Modified version of nutrition knowledge questions for nurses	Yes	Yes
Chepulis & Mearns, 2015 [22]	Information regarding food nutrient groups, calories versus kilojoule, Glycemic index, BMI, and BMR	Yes	Yes
Spexoto <i>et al.</i> , 2015 [25]	The nutrition policy and nutrition knowledge scale	Yes	Yes
Kliemann <i>et al.</i> , 2016 [14]	GNKQ	Yes	Yes
El-Ahmady & El-Wakeel, 2017 [24]	Questions were based on basic nutrition knowledge and concepts	Self-designed	Not mentioned
Ul Haq <i>et al.</i> , 2018 [17]	NKAP	Yes	Yes
Dolatkhah <i>et al.</i> , 2019 [19]	GNKQ	Yes	Yes
Bawazir <i>et al.</i> , 2022 [20]	online self-designed questionnaire	Self-designed	Yes

EINLA: Evaluation Instrument of Nutrition Literacy on Adults, NKSA: Nutrition Knowledge Scale for Adults, GNKQ: General Nutrition Knowledge Questionnaire, NKAP: Nutrition Knowledge, Attitude And Practices Questionnaire



### Article quality

The qualities of the selected 15 articles were evaluated via the COSMIN checklist. Twelve studies were rated as good, while the remaining three studies

received a positive score in only one area and were rendered as poor. In most of the studies, both the predictive validity and concurrent validity of the criteria were strong (Table 3).

**Table 3)** Review of articles via the COSMIN checklist

Authors, Year	Reliability		Construct validity					Content and face validity	Rating
	Internal consistency	Test-retest (ICC)	Hypothesis testing		Criterion Predictive and concurrent	Structural			
			Discrimination	Convergent		CFA	EFA		
Mearns <i>et al.</i> , 2017 <sup>[5]</sup>	*	*	-	*	*	-	*	-	Good
Bahramfar <i>et al.</i> , 2020 <sup>[6]</sup>	*	*	-	*	*	*	-	*	Good.
Mengi & Semerci <sup>[7]</sup>	*	-	-	*	*	-	-	-	Good
Pietz <i>et al.</i> , 1980 <sup>[26]</sup>	*	*	-	*	*	-	*	-	Good
Brett <i>et al.</i> , 1986 <sup>[13]</sup>	-	-	-	-	*	-	-	-	Poor
Schaller & James, 2005 <sup>[8]</sup>	-	*	-	-	*	-	-	*	Good
Shah <i>et al.</i> , 2011 <sup>[23]</sup>	-	*	-	-	*	*	-	-	Good
Buxton & Davies, 2013 <sup>[10]</sup>	*	*	*	*	*	-	-	*	Good
Chepulis & Mearns, 2015 <sup>[22]</sup>	-	-	-	-	*	-	-	-	Poor
Spexoto <i>et al.</i> , 2015 <sup>[25]</sup>	*	-	*	*	*	*	-	-	Good
Kliemann <i>et al.</i> , 2016 <sup>[14]</sup>	*	-	-	*	-	*	-	-	Good
El-Ahmady & El-Wakeel, 2017 <sup>[24]</sup>	*	*	-	-	*	-	-	-	Good
Ul Haq <i>et al.</i> , 2018 <sup>[17]</sup>	*	*	-	*	-	*	-	-	Good
Dolatkhah <i>et al.</i> , 2019 <sup>[19]</sup>	*	*	*	*	-	*	-	*	Good
Bawazir <i>et al.</i> , 2022 <sup>[20]</sup>	-	-	-	-	*	-	-	-	Poor

EFA: Exploratory Factor Analysis, CFA: Confirmatory Factor Analysis

## Discussion

In this systematic review, different aspects of studies associated with food and nutrition literacy and nutrition knowledge were examined. The evidences collected here indicate that medical students had inadequate health and nutrition literacy, whereas nursing students obtained an average score<sup>[29]</sup>. Accordingly, Bahramfar *et al.*'s study in Iran showed that the average nutrition literacy score of students was 24.9 out of 35. One percent of students had inadequate nutrition literacy, and the remaining 50.9% and 48.12% had borderline and adequate nutrition literacy, respectively. Nutrition literacy was related to effective factors in the nutritional health of the students<sup>[6]</sup>. A study by Mearns *et al.* was obtained results similar to our findings, showing that the nutrition literacy score of nursing students was average, and those who had proper literacy were more informed about healthy fats<sup>[5]</sup>. Nutrition literacy has also been associated with social differences between populations<sup>[30]</sup>. A research in Iran showed that about 23% of teachers had insufficient dietary literacy. Nevertheless, their average nutrition literacy score was sufficient<sup>[12]</sup>.

The present study displayed that most clinicians had sufficient nutrition literacy. In support of these findings, the development of nutrition literacy can effectively prevent the increase of diet-related diseases and improve nurses' relationship with food<sup>[22]</sup>. Many nursing students with good nutrition literacy scores also obtained an average score in nutrition knowledge, revealing a direct relationship between nutrition knowledge and literacy<sup>[7]</sup>. Health professionals, including nurses, provide nutritional

information to the community. A study on nutrition knowledge among nursing students found that the average nutrition knowledge score was low to moderate and around 60%, which can be improved through professional nutrition magazines and books<sup>[8]</sup>. In contrast to our study, another study showed that the nutrition knowledge score of nursing students was high (close to average) compared to other students<sup>[31]</sup>. According to Phillips' findings, most nursing students were unfamiliar with the basic principles of nutrition<sup>[32]</sup>.

The collected evidence in this study showed that medical students had poor nutrition knowledge. Accordingly, another study showed many deficiencies in the nutrition knowledge of medical students<sup>[19]</sup>. Based on a survey in China, it was observed that nutrition knowledge among medical students was related to their nationality. The knowledge of Chinese students, especially that of seafoods and traditional foods, was more than that of international students in many cases<sup>[17]</sup>. According to another study, nutrition literacy was average among medical students. The nutrition and diabetes axis had the highest percentage of correct answers (55.6%), whereas the nutrition and heart disease axis had the lowest correct answers (44%)<sup>[20]</sup>.

This systematic review showed that, based on a survey on different clinical students, dietetics students had significantly higher nutrition scores compared to other students. Young people and women scored higher in the nutrition knowledge questionnaire compared to older men and women<sup>[14]</sup>. Spexoto *et al.* reported that about 80% of pharmacy and biochemistry students had average

nutrition knowledge, and 77.1% paid attention to their diet. Meanwhile, first-year students had less nutrition knowledge, low physical activity and did not pay attention to a healthy diet [25]. According to the findings of another survey, student groups had different strengths and weaknesses in terms of nutrition knowledge. Dental students were more concerned about dental erosion, and nutrition students were more focused on obesity. This study recommends oral and dental health nutrition classes for nutritionists and general health nutrition classes for dentists [23]. El-Ahmady & El-Wakeel stated that there is a positive correlation between nutrition literacy and healthy nutritional practice, and that nutrition knowledge alone is not a driver for nutritional practice and healthy food use. The study also noted that practicing healthy eating habits can affect nutritional practice [24].

It is important to know the factors that reliably affect food literacy. The evidence obtained in this study demonstrated that students' regular participation in food-related activities at home and with their parents increased their knowledge about food. Furthermore, students faced certain challenges with regard to food literacy acquisition, such as the lack of food and nutrition education (both at home and in schools), hindering time limitations, and complex food relationships [30, 33]. A systematic review demonstrated that students who had nutrition knowledge and healthier eating habits showed a significant relationship between food literacy and healthy diet behavior in the long term [34].

Surveys among teachers have shown that those with fewer years of work experience but higher education had a higher level of nutrition literacy [12, 35]. However, experience can also effectively increase nutrition literacy. According to a recent survey in Iran, it was determined that about 75% of the workers in a steel company had sufficient nutrition literacy. The average nutritional literacy score was significantly higher in people with higher education [35, 36]. Moreover, people with adequate monthly salaries obtained a higher average score in determining food groups and overall nutrition literacy [2, 11]. The information mentioned above is of vital importance because medical students, i.e., practicing doctors in the near future, will have to interact with people from all walks of life. Therefore, they must develop and enhance their nutrition literacy to provide proper service to the community [37].

In this systematic review, the COSMIN checklist provided information about the quality of the 15 selected studies, such that twelve studies rated good and the remaining three studies rated poor, as they received a positive score in only one area. Furthermore, in most of the studies, both the predictive validity and concurrent validity of the criteria were strong. According to literature, the COSMIN checklist is a standardized instrument used

to assess the methodological quality of studies based on measurement properties [38-40].

This article is the first review to assess nutrition literacy among medical students. Evaluating the quality of the articles using the standard method and adhering to the PRISMA guidelines positively affected the reliability of the study results. As for the current study's limitations, the cause of high or low nutrition literacy and health knowledge could not be investigated because most of the studies were cross-sectional. Presenting prospective studies can help better understand the causes. Another limitation was that there were many differences in the methods used to measure nutrition literacy. However, the researchers responsible for article selection tried to carefully select the articles based on the inclusion and exclusion criteria and the purpose of the research. In addition, the included studies were limited to those published in English. Therefore, research theses and articles in other languages were not reviewed.

Most of the reviewed articles had focused on nutrition knowledge and attitude. Therefore, further studies aimed at assessing nutrition literacy are necessary. Medical students' academic years provide an excellent opportunity for learning and increasing nutrition literacy. To better understand food literacy in the studied community and determine the effective factors, longitudinal studies can be conducted to determine food behaviors among health workers.

## Conclusion

Medical students have a low to moderate level of nutrition literacy. Moreover, many of these students have insufficient nutrition knowledge.

**Acknowledgements:** We are very grateful to all those who contributed to this project.

**Ethical Permission:** Not applicable.

**Conflict of Interests:** No conflict of interest was reported in this study.

**Authors' Contribution:** Ramezankhani A (First Author), Introduction Writer/Methodologist/Discussion Writer (50%); Vahidi Sh (Second Author), Introduction Writer/Methodologist/Discussion Writer (50%)

**Funding/Support:** No organization funded this research.

## References

- 1- Kindig DA, Panzer AM, Nielsen Bohlman L. Health literacy: A prescription to end confusion. Washington: National Academies Press; 2004.
- 2- Yarmohammadi P, Morowatisharifabad MA, Rahaei Z, Khayyatizadeh SS, Madadzadeh F. Nutrition literacy and its related demographic factors among workers of Taraz Steel company, Chaharmahal and Bakhtiari, Iran. *Front Public Health*. 2022;10:911619.
- 3- Nutbeam D. Health literacy as a public health goal: A challenge for contemporary health education and communication strategies into the 21st century. *Health Promot Int*. 2000;15(3):259-67.
- 4- Sampaio H, Carioca A, Sabry S, Sabry M, Pinto F, Ellery T. Assessment of nutrition literacy by two diagnostic methods

in a Brazilian sample. *Nutr Clin Diet Hosp*. 2014;34(1):50-5.

5- Mearns GJ, Chepulis L, Britnell S, Skinner K. Health and nutritional literacy of New Zealand nursing students. *J Nurs Educ*. 2017;56(1):43-8.

6- 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. *Nutr Clin Diet Hosp*. 2020;40(4):55-62.

7- Mengi Çelik Ö, Semerci R. Evaluation of nutrition literacy and nutrition knowledge level in nursing students: A study from Turkey. *BMC Nurs*. 2022;21(1):359.

8- Schaller C, James EL. The nutritional knowledge of Australian nurses. *Nurs Educ Today*. 2005;25(5):405-12.

9- Palumbo R. Discussing the effects of poor health literacy on patients facing HIV: A narrative literature review. *Int J Health Policy Manag*. 2015;4(7):417.

10- Buxton C, Davies A. Nutritional knowledge levels of nursing students in a tertiary institution: Lessons for curriculum planning. *Nurs Educ Pract*. 2013;13(5):355-60.

11- Rochman C, Nasrudin D, Helsy I, Hermita N, Darmalaksana W, editors. Nutrition literacy program for improving public wellness. *J Phys: Conf Ser*. 2018;1028:012031.

12- Hemati M, Akbartabar Toori M, Shams M, Behroozpour A, Rezaei A. Measuring nutritional literacy in elementary school teachers in Yasuj: A cross-sectional study. *Armaghan-e Danesh*. 2018;23(1):124-33. [Persian]

13- Brett A, Godden D, Keenan R. Nutritional knowledge of medical staff and students: Is present education adequate?. *Hum Nutr Appl Nutr*. 1986;40(3):217-22.

14- Kliemann N, Wardle J, Johnson F, Croker H. Reliability and validity of a revised version of the general nutrition knowledge questionnaire. *Eur J Clin Nutr*. 2016;70(10):1174-80.

15- Makiabadi E, Kaveh MH, Mahmoodi MR, Asadollahi A, Salehi M. Enhancing nutrition-related literacy, knowledge and behavior among university students: A randomized controlled trial. *Int J Nutr Sci*. 2019;4(3):122-9.

16- Huang Z, Huang B, Huang J. The relationship between nutrition knowledge and nutrition facts table use in China: A structural equation model. *Int J Environ Res Public Health*. 2021;18(12):6307.

17- Ul Haq I, Mariyam Z, Li M, Huang X, Jiang P, Zeb F, *et al*. A comparative study of nutritional status, knowledge attitude and practices (KAP) and dietary intake between international and Chinese students in Nanjing, China. *Int J Environ Res Public Health*. 2018;15(9):1910.

18- Krause C, Sommerhalder K, Beer Borst S, Abel T. Just a subtle difference? Findings from a systematic review on definitions of nutrition literacy and food literacy. *Health Promot Int*. 2018;33(3):378-89.

19- Dolatkhan N, Aghamohammadi D, Farshbaf Khalili A, Hajifaraji M, Hashemian M, Esmaeili S. Nutrition knowledge and attitude in medical students of Tabriz university of medical sciences in 2017- 2018. *BMC Res Notes*. 2019;12(1):157.

20- Bawazir Z, Alrasheedi A, Aljehany B. Nutritional knowledge and attitudes among physician interns graduated from King Abdul-Aziz university, Jeddah, Saudi Arabia. *Healthcare*. 2022; 10(9):1788.

21- Marchello NJ, Daley CM, Sullivan DK, Nelson Brantley HV, Hu J, Gibbs HD. Nutrition literacy tailored interventions may improve diet behaviors in outpatient nutrition clinics. *J Nutr Educ Behav*. 2021;53(12):1048-54.

22- Chepulis LM, Mearns GJ. Evaluation of the nutritional knowledge of undergraduate nursing students. *J Nurs Educ*. 2015;54(9):S103-6.

23- Shah K, Hunter M, Fairchild R, Morgan MZ. A comparison of the nutritional knowledge of dental, dietetic and nutrition students. *Br Dent J*. 2011;210(1):33-8.

24- El-Ahmady S, El-Wakeel L. The effects of nutrition awareness and knowledge on health habits and performance among pharmacy students in Egypt. *J Community Health*. 2017;42:213-20.

25- Spexoto MCB, Ferin GG, Campos JADB. Pharmacology and biochemistry undergraduate students' concern for a healthy diet and nutrition knowledge. *Nutr Hosp*. 2015;31(4):1813-23.

26- Pietz CL, Fryer BA, Fryer HC. Nutritional knowledge and attitudes of dental students. *J Am Dent Assoc*. 1980;100(3):366-9.

27- 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.

28- Yuen EY, Thomson M, Gardiner H. Measuring nutrition and food literacy in adults: A systematic review and appraisal of existing measurement tools. *Health Lit Res Pract*. 2018;2(3):e134-60.

29- Carbone ET, Zoellner JM. Nutrition and health literacy: A systematic review to inform nutrition research and practice. *J Acad Nutr Diet*. 2012;112(2):254-65.

30- Vilaro MJ, Zhou W, Colby SE, Byrd Bredbenner C, Riggsbee K, Olfert MD, *et al*. Development and preliminary testing of the Food Choice Priorities Survey (FCPS): Assessing the importance of multiple factors on college students' food choices. *Eval Health Prof*. 2017;40(4):425-49.

31- Azizi M, Aghaee N, Ebrahimi M, Ranjbar K. Nutrition knowledge, the attitude and practices of college students. *PhysEducand Sport*. 2011;9(3):349-57.

32- Phillips MG. The nutrition knowledge of medical students. *J Med Educ*. 1971;46(1):86-90.

33- Sanlier N, Konaklioglu E. Food safety knowledge, attitude and food handling practices of students. *Br Food J*. 2012;114(4):469-80.

34- Bailey CJ, Drummond MJ, Ward PR. Food literacy programmes in secondary schools: A systematic literature review and narrative synthesis of quantitative and qualitative evidence. *Public Health Nutr*. 2019;22(15):2891-913.

35- Liao LL, Lai IJ, Chang LC. Nutrition literacy is associated with healthy-eating behaviour among college students in Taiwan. *Health Educ J*. 2019;78(7):756-69.

36- Parvin S, Salehi SO, Jowshan MR, Akbar Tabar Tori M, Malekzadeh JM, Pirooz R, *et al*. The situation of food security and related factors in female teachers of Yasuj education school board. *Armaghan-e danesh*. 2020;25(4):515-28. [Persian]

37- 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 Nutri*. 2019;22(12):2157-69.

38- Aminizadeh M, Farrokhi M, Ebadi A, Masoumi GR, Beyrami Jam M, Khankeh HR. COSMIN checklist for systematic reviews of the hospital preparedness instruments in biological events. *J Nurs Meas*. 2021;29(3):441-61.

39- Terwee CB, Mokkink LB, Knol DL, Ostelo RW, Bouter LM, de Vet HC. Rating the methodological quality in systematic reviews of studies on measurement properties: A scoring system for the COSMIN checklist. *Qual Life Res.* 2012;21:651-7.

40- Mokkink LB, Terwee CB, Knol DL, Stratford PW, Alonso J, Patrick DL, *et al.* The COSMIN checklist for evaluating the methodological quality of studies on measurement properties: A clarification of its content. *BMC Med Res Methodol.* 2010;10(1):1-8.