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Association between sources of nutrition information and self-perceived nutrition competence of healthcare professionals: a cross-sectional study

Yaxian Shi[1*], Guiling Huang[2] and Jeannette M. Beasley[3]

Abstract

Background Healthcare professionals other than dietitians are widely perceived as credible sources of nutrition information by patients, despite many of these professionals having received limited nutrition training. Little is known about where healthcare professionals obtain nutrition information and how reliance on various sources of nutrition information relates to their self-perceived nutrition competence. This study aimed to investigate the association between the frequency of accessing nutrition information from evidence-based and non-evidence-based sources and healthcare professionals' self-perceived nutrition competence.

Methods A cross-sectional online survey was conducted using a questionnaire adapted from the NUTrition COMPetence (NUTCOMP) tool. Independent variables included self-reported frequencies of accessing various nutrition information sources in the preceding 30 days, measured by Likert-scale questions. The primary outcome was self-perceived nutrition competence assessed by NUTCOMP scores. A robust linear regression model was created to evaluate associations between NUTCOMP scores and frequencies of accessing different nutrition information sources, adjusting for age, sex, profession, education level, workplace, and previous nutrition education. The statistical significance level was set at 0.05.

Results A total of 450 healthcare professionals working in healthcare facilities across China were enrolled, including 302 (67.11%) nurses and 124 (27.56%) doctors. The median NUTCOMP score was 120 (interquartile range 102–141). The most popular information sources were colleagues ($n = 293$), social media ($n = 222$), and professional websites ($n = 121$). More frequent access to nutrition information from colleagues ($\beta = 3.75$, $p < 0.001$), friends or family members ($\beta = 2.71$, $p = 0.02$), and academic webinars or continuing education ($\beta = 3.92$, $p = 0.002$) were significantly associated with higher NUTCOMP scores.

Conclusions Healthcare professionals in China frequently accessed nutrition information from both evidence-based and non-evidence-based sources. Frequencies of accessing nutrition information from colleagues, friends or family members, and academic webinars or continuing education were positively associated with self-perceived nutrition

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competence. The association observed with non-evidence-based sources highlights the need to better understand how information-seeking behaviors influence professional confidence and clinical practice. Future research is needed to develop strategies to strengthen evidence-based nutrition information sharing that may enhance nutrition competence.

Keywords Continuing medical education, Nutrition education, Information sources, Artificial intelligence, Social media, Professional competence

Background

Food and nutrition play significant roles in the prevention and management of numerous diseases, and medical nutrition therapy is an essential and cost-effective component of health care that has been shown to improve patient outcomes [1]. However, it is widely recognized that insufficient nutrition knowledge prevents healthcare professionals (HCP) from integrating high-quality nutrition care into patient care [2, 3]. Internationally, it is recognized that this knowledge gap stems from limited nutrition education. In the United States, the majority of medical schools reported failure to provide the recommended minimum amount of nutrition training [4]. In response, a voluntary commitment was recently secured from leading medical schools in the United States to provide students with at least 40 h of nutrition education, effective in the fall of 2026 [5]. Other countries lack specific minimum nutrition training requirements [6]. In addition, there are no specific requirements of nutrition competency for non-dietitian, non-doctor HCPs, such as nursing staff [1, 7]. Despite the long-standing global concern regarding the lack of integration of comprehensive, evidence-based nutrition training into medical education, HCPs continue to be perceived as a trustworthy source of nutrition information [3, 8]. In many contexts, HCPs, other than registered dietitians (RDs) and registered dietetic technicians (DTRs), often have to assume responsibilities usually performed by RDs and DTRs, especially in countries like China where access to RDs and DTRs is limited [9]. In 2022, the density of RDs and DTRs in China was only 0.67 per 100,000 people, compared to 33 per 100,000 in the United States, and only about half of Chinese RDs worked in healthcare facilities [10]. As a result of the shortage of RDs and DTRs, compiled with a growing demand for nutrition care related to the increasing burden of chronic diseases, physicians and other HCPs in China often have to fulfill the role of RDs and DTRs and provide nutrition care, although a study indicated that only 40% of the Chinese residents interviewed showed adequate knowledge in clinical nutrition [11].

Meanwhile, food- and nutrition-related topics are gaining popularity on social media, in addition to the emerging use of generative artificial intelligence (AI) for nutrition advice, reflecting a growing public awareness of the importance of food and nutrition [12–14]. There has been increasing concern over the low-quality or inaccurate information regarding nutrition and dietetics posted on social media or generated by AI which may lead to harmful dietary practices that worsen health conditions [15–17]. While there is a growing body of literature investigating the impact of nutrition misinformation on patients' diet and health [12, 18, 19], it should be noted that nutrition misinformation could pose a dual threat to patient care: it may not only affect patients' perception of food and nutrition but also compromise the professional knowledge base of HCPs whom patients often turn to for nutrition recommendations. Research has shown that HCPs might even be involved in the spreading of health misinformation [20]. Unlike the general population who may rely on social media, AI, and HCPs as the main sources of nutrition information [21], HCPs have additional sources of nutrition information, such as continuing education, peer-reviewed publications, and guidelines. These sources provide evidence-based information but may require memberships or subscriptions to the organizations, thereby precluding the public from accessing them. Previous research revealed a gap between HCPs' self-perceived nutrition competence and their application of evidence-based nutrition knowledge [22, 23], but little research has assessed the sources of nutrition information among HCPs and their association with HCPs' nutrition competence and practice, especially in light of the limited evidence-based nutrition education they received [24, 25].

The aim of this study was to explore the sources of nutrition information accessed by HCPs in China and to assess the association between sources of nutrition information and self-perceived competence in providing nutrition recommendations. The hypothesis was that greater reliance on evidence-based nutrition information sources, as evidenced by higher accessing frequency, was associated with a higher level of self-perceived nutrition competence. The findings of this study could be used to inform the development of targeted interventions and policies that promote the use of evidence-based nutrition resources among HCPs, thereby improving the quality of nutrition care and patient outcomes.

Methods

Study design and setting

This was a cross-sectional study conducted in November 2025 using an anonymous online survey created and administered through Qualtrics (Utah, the United States). The completed STrengthening the Reporting of

OBservational studies in Epidemiology (STROBE) checklist can be found in Supplementary File 1. Participants were recruited through colleague-facilitated sharing in WeChat group chats (Shenzhen, China) and a link to the anonymous questionnaire was provided. Additionally, in-person recruitment was conducted during grand rounds in multiple healthcare facilities to improve participant engagement. The inclusion criteria included HCPs working in healthcare facilities in China at the time of the completion of the questionnaire. The exclusion criteria included non-HCPs and HCPs working remotely or outside of healthcare facilities in China (e.g., private practice practitioners).

The sample size was determined based on several considerations. Sample sizes of previous similar studies assessing self-perceived nutrition competency ranged between 90 and 557 participants, and the response rate varied between 14.9% and 98% [22, 26]. Due to the absence of prior research evaluating the association between self-perceived nutrition competence and reliance on different sources of nutrition information, an effect size of 0.15 was assumed. Using an alpha level of 0.05 and a statistical power of 0.80, a regression model with 15 predictors, which included demographic statistics and different information sources, required a sample size of 139, as calculated using G*Power 3.1.9.6 [27]. A large sample was needed to enhance representativeness and capture participants from different specialties. Therefore, the decision was made to double the sample size to maximize the statistical power and allow for potential incomplete data, which resulted in a sample size of 300. Due to the mixture of enrollment methods employed, the actual number of potential respondents, as well as the accurate response rate, was difficult to determine.

An informed consent form was provided to all potential respondents at the beginning of the questionnaire, and all participants provided informed consent before proceeding to survey questions.

Instrumentation

The questionnaire (Supplementary File 2) was divided into three sections. The first section was adapted from a validated questionnaire called NUTrition COMPetence (NUTCOMP) [28]. The NUTCOMP questionnaire is a validated and reliable tool to assess the self-perceived competence of primary HCPs and has been used in multiple studies [22, 23, 26, 29, 30]. The original questionnaire comprises 35 questions using five-point Likert scales and evaluates four constructs of nutrition competency from "not confident at all/completely disagree" (1 point) to "extremely confident/completely agree" (5 points): confidence in knowledge about nutrition and chronic disease (7 questions), confidence in nutrition skills (11 questions), confidence in communication and counseling about nutrition (9 questions), and attitudes towards nutrition care (8 questions). The total score ranges from 35 to 175, with a higher score indicative of a higher level of self-perceived nutrition competence. To adapt the questionnaire for use among the Chinese HCPs, "the Australian Guide to Healthy Eating" in 2 questions was changed to "the Dietary Guidelines for Chinese Residents". The questionnaire was translated into Chinese by researchers and presented in a bilingual format, and pilot testing was conducted on 8 HCPs to enhance clarity and content validity. Participants in the pilot testing were interviewed after they finished the questionnaire, and feedback was collected. The interview with pilot testing respondents followed an interview guide developed prior to pilot testing (Supplementary File 3). As a result of the pilot testing, several explanations or examples were added in parentheses following the questions to optimize comprehension. Those who completed the pilot testing were asked not to retake the questionnaire and their responses were excluded in the final analysis.

The second section involved 5 questions to assess the sources of nutrition information and the frequencies of accessing and sharing nutrition information with patients. The questions were developed by the authors and evaluated through pilot testing with participants and follow-up interviews. Initially, there were 6 sources of nutrition information identified by the authors through consultation with HCPs: websites of government agencies and professional associations, peer-reviewed publications or guidelines, academic webinars or continuing education, colleagues, social media, friends and/or family members. During pilot testing interviews, participants identified large language model AI as another source of nutrition information, leading to its inclusion. The frequencies of accessing and sharing nutrition information from each source were assessed using 5-point Likert scale questions with the following levels: rarely (1 to 2 times in the past 30 days), occasionally (once per week), sometimes (2 to 3 times per week), frequently (4 to 5 times per week), and always (more than 5 times per week). The final section collected demographic data of respondents, including profession, level of healthcare facility, year of practice, previous experience of nutrition training, education level, age, and sex.

Statistical analysis

Any responses that did not complete the first section of the questionnaire (the NUTCOMP tool) were classified as incomplete and excluded from the analysis. All suspiciously duplicate answers flagged automatically by Qualtrics were manually reviewed and removed. Categorical statistics, including profession, workplace, year of

Table 1 Demographic characteristics of healthcare professionals enrolled in the study ($N=450$)[a]

Variables	*n* (%)
Age (years)	**34 (29–38)**[b]
18–30	145 (32.2)
31–40	192 (42.7)
41–50	41 (9.1)
51–60	8 (1.8)
>60	3 (0.7)
Not available	61 (13.6)
Sex	
Male	86 (19.1)
Female	354 (78.7)
Not available	10 (2.2)
Profession	
Physician	48 (10.7)
Surgeon	63 (14)
Traditional Chinese Medicine	11 (2.4)
Nurse	302 (67.1)
Registered dietitian	1 (0.2)
Technician/allied health professional	17 (3.8)
Pharmacist	1 (0.2)
Other	7 (1.6)
Education	
Associate's degree	35 (7.8)
Bachelor's degree	321 (71.3)
Master's degree	71 (15.8)
Doctorate	17 (3.8)
Other or not available	6 (1.3)
Workplace	
Primary/community hospital	7 (1.6)
Secondary hospital	11 (2.4)
Tertiary grade B/C hospital	22 (4.9)
Tertiary grade A hospital	400 (88.9)
Other	10 (2.2)
Year of practice	
Less than 5 years	107 (23.8)
6–10 years	104 (23.1)
11–15 years	121 (26.9)
16–20 years	69 (15.3)
More than 20 years	43 (9.6)
Not available	6 (1.3)
Previous nutrition education	
Never received nutrition education	228 (50.7)
Non-degree course including nutrition content	108 (24)
Nutrition-focused non-degree course	44 (9.8)
Degree including nutrition content	38 (8.4)
Nutrition-focused degree	9 (2)
Not available	23 (5.1)

[a]Values are described as count (%) unless otherwise stated

[b]Median and interquartile range

practice, previous experience of nutrition training, education level, and sex, were reported in frequencies and percentages. For the purpose of analysis, physicians, surgeons, doctors of traditional Chinese medicine, and doctors from other specialties were combined into a single category labeled "doctor". Technicians, or allied health professions, included occupational therapists, physical therapists, speech-language pathologists, and respiratory therapists. Continuous statistics, including age and the total and construct scores derived from NUTCOMP, were reported as means and standard deviations (SDs) or as medians with interquartile ranges (IQRs), depending on normality assessed using the Shapiro-Wilk test. The internal consistency of the questionnaire was evaluated using the Cronbach's alpha. The Kruskal-Wallis test was employed to compare NUTCOMP construct and total scores between different professions, and post hoc tests were performed using Dunn's test with Bonferroni correction. Comparison of NUTCOMP total scores between respondents who accessed nutrition information in the last 30 days and those who did not was conducted using Mann-Whitney U test.

Frequencies of accessing and sharing nutrition information from various sources were scored from 1 point (rarely) to 5 points (always). Individuals received a score of 0 for each source that was not accessed or if they had not accessed nutrition information from any source in the last 30 days. The correlations between frequencies of accessing and sharing nutrition information from various sources were evaluated by Spearman's correlation. A robust linear regression model was built to examine the association between frequencies of accessing nutrition information from different sources and NUTCOMP total scores adjusting for age, sex, profession, education level, workplace, and previous nutrition education. Variance inflation factors were used to test for multicollinearity of the predictors. The significant level was set at 0.05. All analyses were conducted in R version 4.5.2 [31].

Results

A total of 547 responses were recorded, and 450 responses were deemed valid and included in the final analysis. The demographic characteristics of participants are summarized in Table 1. The median age was 34 years (IQR 29–38 years), and 78.67% were female. Nurses comprised the largest professional group (67.11%), followed by surgeons (14%) and physicians (10.67%). Most participants held a bachelor's degree (71.33%), with 15.78% holding a master's degree. The majority of respondents worked in tertiary grade A hospitals (88.89%), and years of practice were evenly distributed across the sample population. Approximately half of the participants (50.67%) reported not receiving any nutrition education, while 24% of participants reported having taken

non-degree courses including nutrition content and 8.44% of participants held a degree that incorporated nutrition content. Only 9.78% of participants completed nutrition-focused non-degree courses and 2% of participants obtained a nutrition-focused degree.

Table 2 shows the NUTCOMP scores across constructs and by profession. The median NUTCOMP total score of the sample population was 120 (IQR 102–141). Nurses reported higher median total score (median 122.5, IQR 103.5–144) compared to doctors (median 119.5, IQR 99–141) and technicians (median 104, IQR 92–117). A significant difference in total scores was observed across professions, although the effect size of profession on total score was minimal ($p = 0.04$, $\eta^2 = 0.01$). Post hoc analysis showed a significant difference in total score between technicians and nurses (-2.86, $p = 0.03$), while no other significant pairwise differences were found (Fig. 1).

In terms of construct scores, there were no significant differences in the scores of nutrition skills or attitudes across professions. However, significant differences in knowledge scores ($p = 0.01$, $\eta^2 = 0.01$) and communication scores ($p = 0.02$, $\eta^2 = 0.01$) across professions were detected. Post hoc analyses showed knowledge scores differed significantly between nurses and technicians (-3.17, $p < 0.01$), while communication scores differed significantly between doctors and technicians (-2.67, $p = 0.05$) and between nurses and technicians (-2.97, $p = 0.02$).

Overall, 74% of respondents ($n = 333$) reported accessing nutrition information within the previous 30 days (Table 3). Among these respondents, colleagues ($n = 293$, 88.0%) and social media ($n = 222$, 66.7%) were the most commonly reported sources. Professional websites ($n = 121$, 36.3%), continuing education ($n = 114$, 34.2%), and friends or family members ($n = 107$, 32.1%) were reported with similar popularity, whereas peer-reviewed publications ($n = 98$, 29.4%) and AI ($n = 92$, 27.6%) were less commonly reported. Across most nutrition information sources, respondents most commonly reported accessing information "occasionally" or "once per week," followed by "sometimes" or "2–3 times per week." Social media was the only information source for which the proportion of respondents reporting access "sometimes" (32.9%) exceeded that reporting access "occasionally" (31.1%). By contrast, engagement with academic webinars or continuing education was relatively infrequent, with most respondents reporting participation "rarely" (23.7%) or "occasionally" (40.4%). The frequency patterns of sharing nutrition information from various sources closely paralleled those of accessing information from the same sources (Table S1 in Supplementary File 4). The strong correlation between accessing and sharing behaviors was reflected in Spearman's rank correlation coefficients, including 0.87 for colleague, 0.992 for friend or family member, 0.994 for peer-reviewed publication, 0.996 for AI, 0.99 for professional websites, 0.993 for academic webinars or continuing education, and 0.96 for social media. General dietary recommendations were the most popular type of nutrition information accessed as reported by 86.5% of information seekers ($n = 288$), followed by weight management ($n = 265$, 79.6%), disease-specific nutrition recommendations ($n = 218$, 65.5%), nutrition supplements ($n = 176$, 52.9%), and nutrition support ($n = 163$, 48.9%) (Table 4). In general, participants who accessed nutrition information in the past 30 days reported significantly higher NUTCOMP total scores than those who did not (median difference 21, 95% CI [confidence interval]: 16 to 27, $p < 0.001$). The Cronbach's alpha for the NUTCOMP and frequency questions was 0.92 and 0.91, respectively, indicating a high internal consistency.

Table 2 NUTCOMP scores of self-perceived nutrition competence across constructs and professions ($N = 450$)[a]

Construct[b]	Doctor[c] ($n = 124$)	Nurse ($n = 302$)	Technician[d] ($n = 17$)	Other[e] ($n = 7$)	All Professions ($N = 450$)	*p*-value
Knowledge (7–35)	21 (17–27)	22 (18–28)	16 (15–21)	23 (19–27)	22 (17–28)	**0.01**
Nutrition Skills (11–55)	35 (28–43)	35 (29–44)	27 (24–36)	34 (31.5–45)	35 (28.5–44)	0.06
Communication and Counseling (9–45)	28 (24–37)	29 (25–36)	25 (20–27)	33 (29.5–34.5)	28 (24–36)	**0.02**
Attitudes (8–40)	36 (32–40)	36 (32–40)	36 (32–39)	36 (32.5–39)	36 (32–40)	0.97
Total Scores (35–175)	119.5 (99–141)	122.5 (103.5–144)	104 (92–117)	127 (112-141.5)	120 (102–141)	**0.04**

[a] All scores were reported as median and interquartile range (Q1–Q3)

[b] Numbers in parentheses under the "Construct" column indicated the possible score ranges

[c] The doctor category included physicians, surgeons, doctors of traditional Chinese medicine, and doctors from other specialties

[d] The technician category included occupational therapists, physical therapists, speech-language pathologists, and respiratory therapists

[e] The other category included RDs, pharmacists, and healthcare professionals not included in the above categories

Bold values indicated statistical significance at $p < 0.05$

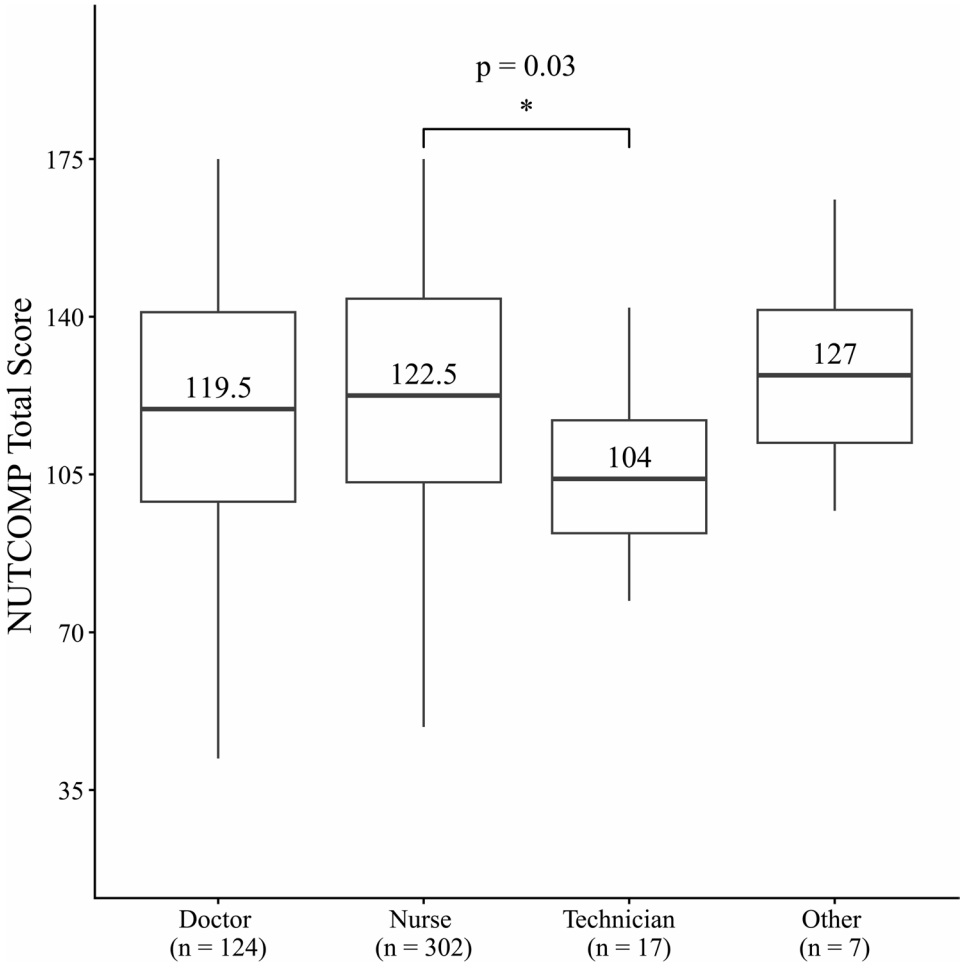

Fig. 1 Comparison of NUTCOMP total scores between healthcare professionals

Table 3 Frequency of accessing nutrition information from different sources in the past 30 Days ($n = 333$)[a]

Sources	Rarely	Occasionally	Sometimes	Frequently	Always
Colleague ($n = 293$)	45 (15.4)	105 (35.8)	76 (25.9)	47 (16.0)	20 (6.8)
Social media ($n = 222$)	17 (7.7)	69 (31.1)	73 (32.9)	50 (22.5)	13 (5.9)
Professional website ($n = 121$)	22 (18.2)	44 (36.4)	27 (22.3)	21 (17.4)	7 (5.8)
Continuing education ($n = 114$)	27 (23.7)	46 (40.4)	19 (16.7)	13 (11.4)	9 (7.9)
Friend or family member ($n = 107$)	12 (11.2)	35 (32.7)	31 (29.0)	20 (18.7)	9 (8.4)
Peer-reviewed publication ($n = 98$)	16 (16.3)	37 (37.8)	28 (28.6)	10 (10.2)	7 (7.1)
Large language model AI ($n = 92$)	10 (10.9)	41 (44.6)	20 (21.7)	13 (14.1)	8 (8.7)
Other ($n = 11$)	5 (45.5)	2 (18.2)	1 (9.1)	2 (18.2)	1 (9.1)

[a]Values are described as count (%) unless otherwise stated

Table 4 Types of nutrition information accessed by healthcare professionals ($n = 333$)

Types of Nutrition Information	*N* (%)
General dietary recommendations (e.g., healthy eating patterns, vegetarian diet)	288 (86.5)
Weight management	265 (79.6)
Disease-specific nutrition recommendations (e.g., diabetic diet, diet for chronic kidney disease, diet for oncology patients)	218 (65.5)
Nutrition support (e.g., enteral and parenteral nutrition)	176 (52.9)
Nutrition supplements (e.g., multivitamins, minerals, protein powders, glucosamine, fish oil, lutein)	163 (48.9)
Other	20 (6.01)

Table 5 Robust regression results predicting NUTCOMP total scores from demographic characteristics and sources of nutrition information

Predictor Variable	β (95% CI)	Robust SE	*p*-value
Age (years)	0.06 (-0.34 to 0.46)	0.20	0.78
Sex (Ref = Male)			
Female	-1.35 (-10.00 to 7.30)	4.41	0.76
Profession (Ref = Nurse)			
Doctor	-2.68 (-11.75 to 6.39)	4.63	0.56
Technician	-13.36 (-28.00 to 1.29)	7.47	0.07
Other	-1.80 (-23.80 to 20.20)	11.23	0.87
Education (Ref = Associate's degree)			
Bachelor's degree	-0.04 (-10.83 to 10.74)	5.50	0.99
Master's degree	2.82 (-10.54 to 16.17)	6.82	0.70
Doctorate	-5.86 (-24.52 to 12.81)	9.52	0.54
Workplace (Ref = Primary/community hospital)			
Secondary hospital	6.06 (-21.12 to 33.24)	13.87	0.66
Tertiary grade B/C hospital	-7.42 (-30.63 to 15.80)	11.84	0.53
Tertiary grade A hospital	-1.90 (-23.06 to 19.26)	10.80	0.86
Other healthcare facilities	-26.74 (-76.96 to 23.48)	25.62	0.30
Previous nutrition education (Ref = Never received nutrition education)			
Non-degree course including nutrition content	10.31 (3.98 to 16.64)	3.23	**0.002**
Nutrition-focused non-degree course	13.14 (4.18 to 22.09)	4.57	**0.004**
Degree including nutrition content	0.80 (-8.60 to 10.20)	4.80	0.87
Nutrition-focused degree	24.53 (6.44 to 42.63)	9.23	**0.008**
Sources of nutrition information			
Colleagues	3.75 (1.83 to 5.67)	0.98	**< 0.001**
Friends or family members	2.71 (0.49 to 4.92)	1.13	**0.02**
Social media	0.87 (-1.03 to 2.77)	0.97	0.37
Large language model AI	-0.20 (-2.57 to 2.16)	1.20	0.87
Professional websites	1.85 (-0.55 to 4.26)	1.23	0.13
Peer-reviewed publications	-0.04 (-2.67 to 2.58)	1.34	0.98
Academic webinars or continuing education	3.92 (1.41 to 6.44)	1.28	**0.002**
	Multiple R-squared:		0.3739
	Adjusted R-squared:		0.3311

Bold values indicated statistical significance at $p < 0.05$

Due to multicollinearity between age and year of practice, as well as between information-accessing and information-sharing behaviors, the robust linear regression model included age and frequencies of accessing nutrition information from various sources instead of year of practice and frequency of sharing nutrition information from various sources. After adjustment for demographic characteristics (Table 5), HCPs who completed a non-degree course including nutrition content (β = 10.31, 95% CI: 3.98 to 16.64, $p = 0.002$), a nutrition-focused non-degree course (β = 13.14, 95% CI: 4.18 to 22.09, $p = 0.004$), or those who obtained a nutrition-focused degree (β = 24.53, 95% CI: 6.44 to 42.63, $p = 0.008$) reported significantly higher NUTCOMP scores. In terms of nutrition information sources, frequencies of accessing information from colleagues (β = 3.75, 95% CI: 1.83 to 5.67, $p < 0.001$), friends or family members (β = 2.71, 95% CI: 0.49 to 4.92, $p = 0.02$), and academic webinars or continuing education (β = 3.92, 95% CI: 1.41 to 6.44, $p = 0.002$) were associated with a significantly higher level of self-perceived nutrition competence. Age, sex, profession, education level, and workplace were not significantly associated with self-perceived nutrition competence.

Discussion

Healthcare professionals in this study reported moderate self-perceived confidence across three domains of nutrition competence-nutrition knowledge, nutrition skills, and communication and counseling. Of all four constructs of nutrition competence (nutrition knowledge, nutrition skills, attitudes towards nutrition, and confidence to counsel in nutrition), nutrition knowledge received the lowest scores, a pattern consistent with findings from two studies conducted among primary care providers and pharmacists [26, 29]. Respondents showed strongly positive attitudes towards nutrition care, indicating broad recognition of the importance of nutrition in patient care, similar to what was reported in previous

studies [22, 26, 29]. Previous research mostly focused on the self-perceived confidence of physicians, pharmacist, and/or medical students [22, 26, 29]. In contrast, the current study included all HCPs involved in patient care, recognizing that all HCPs might have direct contact with patients and be asked for nutrition advice. One recently published study enrolled general practitioners, medical students, nurses and RDs, but it did not compare self-perceived nutrition competence across professions [23]. In the present study, a significant difference in self-reported nutrition competence existed only between nursing staff and technicians, however, the difference was no longer significant after adjusting for other factors such as previous nutrition education. One study by Chua and colleagues [29] found that year of practice as a categorical variable was positively associated with nutrition knowledge, nutrition skills, and NUTCOMP total scores after adjustment. Another study by Al-Gassimi et al. [22] also reported a higher level of confidence in nutrition knowledge, nutrition skills, and communication and counseling in physicians aged 45 years or older. A similar association was not observed in the present study when age was modeled as a continuous variable, suggesting the discrepancy might result from the different types of variables used. Another possible explanation for this discrepancy may be the correlation between age and cumulative engagement in nutrition-related continuing education. HCPs with greater age and professional experience may have more opportunities to participate in such educational activities over the course of their careers, potentially contributing to greater confidence in delivering nutrition-related care. Other demographic variables, including sex, profession, education level, and workplace were not found to be significantly associated with self-perceived nutrition competence.

Multiple studies examined the association between prior nutrition education and self-reported nutrition competence [22, 23, 26, 29, 30]. The proportion of HCPs reporting no prior nutrition education ranged widely from 16.7% to 79.7% [22, 29]. Nearly half of respondents in the present study reported not receiving any nutrition-related education. In some studies, the authors reported that previous nutrition education, either with limited nutrition content or focusing exclusively on nutrition, was associated with higher levels of self-perceived competence in all domains except attitudes towards nutrition care [22, 26, 29]. In contrast, Aloud et al. [30] reported a positive association between previous nutrition education and attitudes. Sarybay and colleagues [23] found a significant association between pre-practice nutrition education and current nutrition knowledge, but no significant association between nutrition education and confidence in providing nutrition care. Interestingly, in the current study, all forms of previous nutrition education except obtaining a degree including some nutrition content, were found to be associated with higher levels of self-perceived nutrition competence, compared to having no nutrition education. Multiple studies found that nutrition training incorporated into medical education significantly improved self-perceived nutrition competency among nursing and medical students; however, the assessment was usually done immediately following the completion of the courses [32–34]. While considerable efforts have been made to incorporate nutrition training into medical education [1, 5], the long-term impact of nutrition education received before entering practice remains to be elucidated. Overall, these findings suggest that current recommendation of nutrition training within medical education might be insufficient to enhance HCPs' confidence in providing nutrition care. On the other hand, continuing education, whether with limited nutrition content or focusing exclusively on nutrition, might have a more significant and positive impact on HCPs' self-perceived nutrition competence. Researchers have suggested incorporating nutrition into every stage of medical education-from residency to fellowship and continuing medical education-as a strategy to enhance the knowledge and strengthen the competencies of HCPs, given that nutrition knowledge acquired during medical school may be lost without ongoing practice or reinforcement [35, 36]. It is noted that mandatory nutrition courses have not yet been implemented in medical schools in China, nor have international medical students enrolled in Chinese medical schools completed dedicated nutrition courses [37]. Although the "Outline of the Healthy China 2030 Plan", issued in 2016 by the State Council of China, emphasized professional development and nutrition education, its focus was limited to public nutrition education and the accreditation system of RDs and DTRs [38]. The absence of nutrition training requirements for HCPs other than RDs and DTRs has received limited attention; this gap might have a negative effect on HCPs' confidence in incorporating nutrition therapy into clinical practice, thereby potentially limiting their ability to optimize patients' outcomes.

Whereas previous studies typically focus on the relationship between previous nutrition education and self-reported nutrition competence [22, 29], the association between reliance on different nutrition information sources and self-perceived nutrition competence has not been previously assessed. Most existing research on nutrition information sources has focused on non-HCPs or the general population [39–41]. The present study found that HCPs frequently sought nutrition information from both evidence-based and non-evidence-based sources, including friends and family members, social media, and colleagues who were also HCPs, which was similar to that found in the general population [21,

39–41]. Despite the popularity of these sources, there has been concern regarding the credibility and quality of nutrition information obtained from non-evidence-based sources [12]. Nutrition-related content on social media was found to vary widely in quality across different topics [42, 43]. A qualitative study by Segado-Fernández and colleagues [25] identified health literacy and critical thinking as key competencies required to identify and combat nutrition misinformation. Additionally, it was reported that less than half of medical staff in Chinese tertiary hospitals demonstrated adequate nutrition literacy [44]. Although analysis of information quality from various sources was outside the scope of the present study, the popular types of nutrition information accessed, including general dietary recommendations and weight management, highlight HCPs' interest in obtaining practical nutrition advice. Given the inadequate nutrition education HCPs receive, their ability to critically appraise the quality of nutrition information from non-evidence-based sources might be limited, which might compromise the quality of nutrition care.

While colleagues, friends and family members were treated as non-evidence-based sources in the present study, the variability in information quality across these sources should be recognized. RDs and DTRs, the only HCPs who have completed extensive training in evidence-based nutrition, are a reliable evidence-based source of nutrition information. However, considering the severe RD shortage in China and that only one RD was included in the final analysis, it was assumed that colleagues were likely to be HCPs from disciplines other than nutrition and dietetics in the present study. The present findings highlight the irreplaceable value of RDs and DTRs, not only as evidence-based nutrition care providers but also as an accessible and reliable source of nutrition information for other HCPs. As nutrition-focused HCPs, their role in combating nutrition misinformation and delivering quality nutrition care cannot be readily replaced by other HCPs solely through increased nutrition-related education. Unfortunately, the shortage of RDs and DTRs is another underrecognized global issue [10, 45, 46]. Priority should therefore be given to expanding the workforce of RDs and DTRs, improving access to RDs and DTRs, and strengthening appropriate referral pathways. Although multiple studies have demonstrated the clinical effectiveness and cost-effectiveness of RD-involved disease management [46, 47], the contribution of RDs and DTRs should be evaluated within the broader context of the healthcare system, considering their role as peer educators.

AI has emerged as a promising tool for providing tailored and evidence-based medical and nutrition suggestions [13, 48]. However, ChatGPT has recently updated its usage policies to restrict provision of tailored medical advice [49]. Although nutrition information might not be considered medical advice, recent research suggested a substantial prevalence of inappropriate dietary advice generated by AI, underscoring the need for close supervision of HCPs and caution in interpreting and applying AI-generated nutrition advice [50]. Therefore, evidence-based sources like professional websites, continuing education, and peer-reviewed publications should be prioritized as reliable sources for nutritional information. Interestingly, professional websites and peer-reviewed publications, both of which were regarded as evidence-based sources, were not found to be significant predictors of self-perceived nutrition competence in the study population. One possible explanation lies in the cognitive demands required to appraise the information and translate it into practical recommendations. Nutrition studies are complex and their design varies, making critical thinking and application of findings to patient care integral to the translation of nutrition research [51]. Adequate nutrition literacy is required to evaluate the applicability of the results from nutrition research. The conflicts of interest in nutrition research are also a concern, as sponsorship from the food industry may bias the results or jeopardize the quality of the study, meaning these may require expertise for appropriate interpretation [52, 53]. Additionally, research on drug information sources for physicians implied that credibility and easy access might be significant factors affecting the selection of information sources [54], which may help explain the popularity of non-evidence-based sources. The reliance on easily accessible peer-oriented sources suggested that the convenience of a source may bypass traditional evidence-based hierarchies, and its influence on clinical practice requires further investigation. Therefore, structural guidance that increases the practicality of the results, in addition to access to high-quality evidence-based nutrition information and improved disclosure and transparency, may bridge the gap between acquisition and application.

To the best of our knowledge, this is the first study to investigate the correlations between reliance on different sources of nutrition information and self-reported nutrition competence among HCPs. The large sample size, together with involvement of multidisciplinary HCPs, enhanced the generalizability of the findings and provides insights into previously unrecognized information-seeking behaviors of HCPs that may affect their practice and patient outcomes. This study, however, has several limitations. First, sampling selection bias and non-response bias could not be ruled out due to the study design. Respondents of this study might be more interested in nutrition-related topics compared to non-respondents. The inadequate enrollment of RDs, DTRs and pharmacists could compromise the representativeness of the two professional groups, despite an effort to reach

out to pharmacology and nutrition departments. Most participants in this study worked in tertiary grade A hospitals, limiting the applicability of these findings to rural settings and primary care medical centers, where the RD shortage and limited availability of evidence-based nutrition information sources may be more pronounced. Second, although the original NUTCOMP questionnaire is a validated instrument used in multiple studies, the fact that the tool was adapted and translated into Chinese for use among HCPs in China may compromise the validity and reliability of the tool. Although the results indicated good internal consistency and pilot testing was done to increase validity, further studies are needed to validate the use of the modified NUTCOMP questionnaire. Finally, it should be noted that self-perceived nutrition competence may not reflect objective ability to provide nutrition care, and currently no validated tool exists to assess HCPs' actual nutrition competence.

This study has several implications. First, the present findings reinforce the necessity of mandatory competency-based nutrition education for all HCPs including but not limited to doctors. Given the significantly positive association of continuing education with perceived nutrition competence, a minimum number of nutrition-focused continuing education credits should be recommended per licensure renewal cycle. Current nutrition training requirements during medical education may be insufficient to consolidate their self-perceived nutrition competence, especially given that HCPs are regarded as popular and trusted sources of nutrition information by patients. Policymakers should recognize that improving HCPs' nutrition competence cannot fully substitute for the specialized expertise of RDs and DTRs. Therefore, nutrition education for non-dietitian HCPs should prioritize promoting interdisciplinary nutrition care and recognition of the irreplaceable role of RDs and DTRs, rather than attempting to train non-dietitian HCPs as nutrition experts [1].

Next, the healthcare system should address the shortage of RDs and DTRs and strengthen interdisciplinary referral pathways, recognizing their unique role as peer educators to combat nutrition misinformation and improve the overall quality of nutrition care. RDs and DTRs can bridge the gap between scientific evidence and day-to-day clinical recommendations. Given the global shortage of RDs and DTRs, and particularly the gap in China, there is a dual imperative: to expand the dietetics workforce through targeted training and retention incentives; and to formalize reimbursable referral pathways that integrate RDs and DTRs into multidisciplinary teams.

Future research should focus on the objective evaluation of nutrition competence among non-dietitian HCPs. Given the lack of validated assessment tools, RDs are well positioned to contribute to the development, validation, and benchmarking of such instruments owing to their specialized expertise in evidence-based nutrition care. In particular, future research should evaluate HCPs' ability to identify nutrition misinformation across diverse information channels and examine how peer education, interdisciplinary collaboration, and reliance on different nutrition information sources may affect their practice. An in-depth examination of the types and quality of nutrition information obtained by HCPs would facilitate the development of educational programs that meet HCPs' learning needs and interests. Uncovering the factors that motivate HCPs to engage with different nutrition information sources will inform strategies to enhance the dissemination, accessibility and prioritization of evidence-based nutrition information. Studies are also needed to evaluate patients' comprehension and application of that knowledge conveyed by HCPs. Comparative effectiveness studies should investigate potential differences in patient understanding and behavioral outcomes associated with nutrition counseling delivered by different disciplines (e.g., RDs versus physicians or nurses). By prioritizing patient-centered implementation outcomes, future research can help bridge the gap between the provision of nutrition recommendations and the adoption of sustained dietary behaviors, ultimately informing evidence-based strategies to increase the effectiveness of nutrition care delivery. Finally, the long-term influence of nutrition training before entering practice on HCPs' confidence and ability to deliver nutrition care should be evaluated to inform the development and optimization of education programs. Such research would provide a more comprehensive understanding of how nutrition education, peer learning and interdisciplinary nutrition care can be optimally integrated within the healthcare system.

Conclusions

Healthcare professionals in China frequently accessed nutrition information from both evidence-based and non-evidence-based sources, with colleagues, social media, and professional websites emerging as the three most commonly used sources. The frequency of accessing nutrition information from colleagues, friends or family members, and academic webinars or continuing education was positively associated with higher levels of self-perceived nutrition competence. Future research is needed to investigate how exposure to different types of nutrition information sources affects their clinical practice.

Abbreviations

AI	Artificial Intelligence
CI	Confidence Interval
DTR	Dietetic Technician, Registered
HCP	Healthcare Professional
IQR	Interquartile Range
RD	Registered Dietitian
SE	Standard Error

Supplementary Information

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Supplementary Material 1.

Supplementary Material 2.

Supplementary Material 3.

Supplementary Material 4.

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Authors' contributions

YS and JB contributed to the study conception and design. YS led the pilot testing and follow-up interviews. YS and JB contributed to questionnaire revision. GH performed data collection and contributed to the interpretation of the results. YS conducted data analysis and drafted the manuscript. JB provided critical revision of the manuscript. All authors approved the final version of the manuscript.

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Data availability

The data used during the current study are not publicly available due to the study protocol, and is available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

This study was conducted in accordance with the principles of the Declaration of Helsinki. The study protocol was reviewed and approved by the Medical Ethics Committee at Zhongnan Hospital of Wuhan University, under an expedited review process (No. 2025312 K). Electronic informed consent was obtained from all participants prior to survey initiation.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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References

1. Eisenberg DM, Cole A, Maile EJ, Salt M, Armstrong E, Broad Leib E, et al. Proposed nutrition Competencies for medical students and physician trainees: a consensus statement. JAMA Netw Open. 2024;7(9):e2435425. https://doi.org/10.1001/jamanetworkopen.2024.35425.
2. Crowley J, Ball L, Hiddink GJ. Nutrition in medical education: a systematic review. Lancet Planet Health. 2019;3(9):e379–89. https://doi.org/10.1016/s2542-5196(19)30171-8.
3. Albin JL, Thomas OW, Marvasti FF, Reilly JM. There and back a gain: a forty-year perspective on physician nutrition education. Adv Nutr. 2024;15(6):100230. https://doi.org/10.1016/j.advnut.2024.100230.
4. Khiri N, Howells K. Nutritional education in medical curricula and clinical practice: a scoping review on the knowledge deficit amongst medical students and doctors. J Hum Nutr Diet. 2025;38(2):e70031. https://doi.org/10.1111/jhn.70031.
5. The U.S. Department of Health and Human Services. FACT SHEET: Secretary Kennedy and Secretary McMahon celebrate medical school commitments to increase nutrition training for future doctors. (2026). https://www.hhs.gov/press-room/fact-sheet-sec-kennedy-sec-mcmahon-celebrate-med-school-commitments-to-increase-nutrition-training-for-future-doctors.html. Accessed 28 May 2026.
6. Cardenas D, Díaz G, Cadavid J, Lipovestky F, Canicoba M, Sánchez P, et al. Nutrition in medical education in Latin America: Results of a cross-sectional survey. J Parenter Enter Nutr. 2022;46(1):229–37. https://doi.org/10.1002/jpen.2107.
7. DuBois S, Spencer A, Nava A, Kaminski M, Gonzalez AL, Arensberg MB. Nourish the mind: The need for nutrition-focused education in nursing to improve health outcomes. J Prof Nurs. 2025;61:160–7. https://doi.org/10.1016/j.profnurs.2025.08.002.
8. Adamski M, Truby H, K MK, Cowan S, Gibson S. Using the internet: Nutrition information-seeking behaviours of lay people enrolled in a massive online nutrition course. Nutrients. 2020;12(3). https://doi.org/10.3390/nu12030750
9. Vrkatić A, Grujičić M, Jovičić-Bata J, Novaković B. Nutritional knowledge, confidence, attitudes towards nutritional care and nutrition counselling practice among general practitioners. Healthc (Basel). 2022;10(11). https://doi.org/10.3390/healthcare10112222
10. Yajie Z, Xiaoli W, Ya L, Xiuhua S, Rong X, Huilian Z, et al. An exploration of registered dietitian accreditation system development in China. BMC Med Educ. 2022;22(1):846. https://doi.org/10.1186/s12909-022-03802-z.
11. Chen H, Shui Y, Tan Y, Dai D, Chen L, Jiang K, et al. Bridging gaps in oncology nutrition education and teaching: a comprehensive analysis of resident physicians in China. J Cancer Educ. 2024;39(5):537–45. https://doi.org/10.1007/s13187-024-02434-9.
12. Diekman C, Ryan CD, Oliver TL. Misinformation and disinformation in food science and nutrition: impact on practice. J Nutr. 2023;153(1):3–9. https://doi.org/10.1016/j.tjnut.2022.10.001.
13. Ponzo V, Goitre I, Favaro E, Merlo FD, Mancino MV, Riso S, et al. Is ChatGPT an effective tool for providing dietary advice? Nutrients. 2024;16(4). https://doi.org/10.3390/nu16040469
14. Ruani MA, Reiss MJ, Kalea AZ. Diet-nutrition information seeking, source trustworthiness, and eating behavior changes: An international web-based survey. Nutrients. 2023;15(21). https://doi.org/10.3390/nu15214515
15. Kabata P, Winniczuk-Kabata D, Kabata PM, Jaśkiewicz J, Połom K. Can social media profiles be a reliable source of information on nutrition and dietetics? Healthc (Basel). 2022;10(2). https://doi.org/10.3390/healthcare10020397
16. Denniss E, Lindberg R, McNaughton SA. Quality and accuracy of online nutrition-related information: a systematic review of content analysis studies. Public Health Nutr. 2023;26(7):1345–57. https://doi.org/10.1017/s1368980023000873.
17. Niszczota P, Rybicka I. The credibility of dietary advice formulated by ChatGPT: Robo-diets for people with food allergies. Nutrition. 2023;112:112076. https://doi.org/10.1016/j.nut.2023.112076.
18. Usta Ulutaş P, Okan Bakır B. The type of social media is a greater influential factor for orthorexia nervosa than the duration: a cross-sectional study. BMC Public Health. 2025;25(1):827. https://doi.org/10.1186/s12889-025-21335-0.
19. Warner EL, Basen-Engquist KM, Badger TA, Crane TE, Raber-Ramsey M. The online cancer nutrition misinformation: a framework of behavior change based on exposure to cancer nutrition misinformation. Cancer. 2022;128(13):2540–8. https://doi.org/10.1002/cncr.34218.
20. Fotsch R. Who to believe? Consequences for physicians and nurses who spread misinformation. J Nurs Regul. 2022;13(1):70–2. https://doi.org/10.1016/s2155-8256(22)00036-9.
21. Subramaniam M, Lau JH, Asharani PV, Abdin E, Roystonn K, Wang P, et al. Sources of information on diabetes and its demographic correlates: a nationwide survey among Singapore residents. Health Promot Int. 2022;37(5). https://doi.org/10.1093/heapro/daac107

22. Al-Gassimi O, Shah HBU, Sendi R, Ezmeirlly HA, Ball L, Bakarman MA. Nutrition competence of primary care physicians in Saudi Arabia: a cross-sectional study. BMJ Open. 2020;10(1):e033443. https://doi.org/10.1136/bmjopen-2019-033443.
23. Sarybay U, Kabibolla S, Adilmetova G, Nassyrov R, Meyerbekova A, Sarría-Santamera A, et al. Level of nutrition competencies among healthcare professionals and medical students in Kazakhstan. BMJ Nutr Prev Health. 2025;8(1):e000972. https://doi.org/10.1136/bmjnph-2024-000972.
24. Lotto M, Jorge OS, Cruvinel A, Cruvinel T. Implications of the health information pollution for society, health professionals, and science. J Appl Oral Sci. 2024;32:e20240222. https://doi.org/10.1590/1678-7757-2024-0222.
25. Segado-Fernández S, Lozano-Estevan MDC, Jiménez-Gómez B, Ruiz-Núñez C, Jiménez Hidalgo PJ, Fernández-Quijano I, et al. Health literacy and critical lecture as key elements to detect and reply to nutrition misinformation on social media: Analysis between Spanish healthcare professionals. Int J Environ Res Public Health. 2022;20(1). https://doi.org/10.3390/ijerph20010023
26. Kelly D, Chawke J, Keane M, Conway H, Douglas P, Griffin A. An exploration of the self-perceived nutrition competencies of pharmacists. Explor Res Clin Soc Pharm. 2022;8:100203. https://doi.org/10.1016/j.rcsop.2022.100203.
27. Faul F, Erdfelder E, Buchner A, Lang AG. Statistical power analyses using G*Power 3.1: tests for correlation and regression analyses. Behav Res Methods. 2009;41(4):1149–60. https://doi.org/10.3758/brm.41.4.1149.
28. Ball LE, Leveritt MD. Development of a validated questionnaire to measure the self-perceived competence of primary health professionals in providing nutrition care to patients with chronic disease. Fam Pract. 2015;32(6):706–10. https://doi.org/10.1093/fampra/cmv073.
29. Chua AYJ, Lee ES, Lee PSS, Lew JK, Sim SZ. Self-perceived nutrition competence of primary care physicians in Singapore: a cross-sectional study. Prim Health Care Res Dev. 2025;26:e11. https://doi.org/10.1017/s1463423624000689.
30. Aloud A, Sekhar C. Self-perceived nutritional competency of primary healthcare physicians in Qassim, Saudi Arabia. Cureus. 2024;16(3):e56145. https://doi.org/10.7759/cureus.56145.
31. R Core Team. R: A language and environment for statistical computing. R Foundation for Statistical Computing; 2025.
32. Thang CK, Guerrero AD, Garell CL, Leader JK, Lee E, Ziehl K, et al. Impact of a teaching kitchen curriculum for health professional trainees in nutrition knowledge, confidence, and skills to advance obesity prevention and management in clinical practice. Nutrients. 2023;15(19). https://doi.org/10.3390/nu15194240
33. Regmi A, Mao X, Qi Q, Tang W, Yang K. Students' perception and self-efficacy in blended learning of medical nutrition course: a mixed-method research. BMC Med Educ. 2024;24(1):1411. https://doi.org/10.1186/s12909-024-06339-5.
34. Johnston EA, Beasley JM, Jay M. Training medical students in diet assessment and brief counseling. Adv Med Educ Pract. 2021;12:1337–42. https://doi.org/10.2147/amep.S333370.
35. Johnston E, Mathews T, Aspry K, Aggarwal M, Gianos E. Strategies to fill the gaps in nutrition education for health professionals through continuing medical education. Curr Atheroscler Rep. 2019;21(4):13. https://doi.org/10.1007/s11883-019-0775-9.
36. Aspry KE, Van Horn L, Carson JAS, Wylie-Rosett J, Kushner RF, Lichtenstein AH, et al. Medical nutrition education, training, and competencies to advance guideline-based diet counseling by physicians: a science advisory from the American Heart Association. Circulation. 2018;137(23):e821–41. https://doi.org/10.1161/cir.0000000000000563.
37. Amakye WK, Bozovic S, Faraque A, Yao M, Ren J. Nutrition education in medical school: the case of international medical students in China. BMJ Nutr Prev Health. 2020;3(2):308–19. https://doi.org/10.1136/bmjnph-2020-000117.
38. Gao C, Xu J, Liu Y, Yang Y. Nutrition policy and Healthy China 2030 Building. Eur J Clin Nutr. 2021;75(2):238–46. https://doi.org/10.1038/s41430-020-00765-6.
39. Boesenecker SJ, Mathies V, Buentzel J, Huebner J. Nutrition and physical activity in cancer patients: a survey on their information sources. J Cancer Res Clin Oncol. 2023;149(7):3823–33. https://doi.org/10.1007/s00432-022-04282-w.
40. Quintiliano-Scarpelli D, Lehmann N, Castillo B, Blanco E. Infant feeding and information sources in Chilean families who reported baby-led weaning as a complementary feeding method. Nutrients. 2021;13(8). https://doi.org/10.3390/nu13082707
41. Quaidoo EY, Ohemeng A, Amankwah-Poku M. Sources of nutrition information and level of nutrition knowledge among young adults in the Accra metropolis. BMC Public Health. 2018;18(1):1323. https://doi.org/10.1186/s12889-018-6159-1.
42. Buschulte K, El-Hadi S, Höger P, Ganter C, Wijsenbeek M, Kahn N, et al. Is YouTube a sufficient source of information on sarcoidosis? Respir Res. 2024;25(1):334. https://doi.org/10.1186/s12931-024-02956-2.
43. Wang X, Sun Y, Qu X, Lei T, Song Y, Deng J. Is YouTube™ a useful source of information on home parenteral nutrition? BMC Public Health. 2025;25(1):684. https://doi.org/10.1186/s12889-025-21929-8.
44. Mo G, Zhu E, Guo X, Kong S, Ma J. Nutrition literacy level of medical personnel in tertiary hospitals: evidence from a cross-sectional study. Arch Public Health. 2024;82(1):124. https://doi.org/10.1186/s13690-024-01350-0.
45. Naicker VN, Muchiri JW, Naidoo K, Legodi MH. Application of the workload indicators of staffing need (WISN) to assess dietetic workforce needs in South African central and tertiary public hospitals. Sci Rep. 2025;15(1):1707. https://doi.org/10.1038/s41598-025-85683-y.
46. Moloney L, Rozga M, Steiber A, Handu D. The effectiveness of medical nutrition therapy in prevention and treatment of chronic disease: A position paper of the Academy of Nutrition and Dietetics. J Acad Nutr Diet. 2026;126(2). https://doi.org/10.1016/j.jand.2025.10.010
47. Babashahi S, Carey N, Stenner K, Hart K, Jani Y, Edwards J, et al. A model-based cost-effectiveness analysis of prescribing by dietitians and therapeutic radiographers in England. Eur J Health Econ. 2026;27(1):117–33. https://doi.org/10.1007/s10198-025-01813-3.
48. Tordjman M, Liu Z, Yuce M, Fauveau V, Mei Y, Hadjadj J, et al. Comparative benchmarking of the DeepSeek large language model on medical tasks and clinical reasoning. Nat Med. 2025;31(8):2550–5. https://doi.org/10.1038/s41591-025-03726-3.
49. OpenAI. Usage policies. https://openai.com/policies/usage-policies/ (2025). Accessed May 27, 2026.
50. You Q, Zhou L, Ma Y, Guo J, Wang Y, Shi L, et al. Comparison of ChatGPT-3.5, ChatGPT-40 and DeepSeek in generating dietary plans for patients with chronic kidney disease: A focus on nutritional accuracy and dietary inflammation. Nutrition. 2025;142:112957. https://doi.org/10.1016/j.nut.2025.112957.
51. Vitolins MZ, Case TL. What makes nutrition research so difficult to conduct and interpret? Diabetes Spectr. 2020;33(2):113–7. https://doi.org/10.2337/ds19-0077.
52. Cullerton K, Adams J, Forouhi NG, Francis O, White M. Avoiding conflicts of interest and reputational risks associated with population research on food and nutrition: the Food Research risK (FoRK) guidance and toolkit for researchers. BMJ. 2024;384:e077908. https://doi.org/10.1136/bmj-2023-077908.
53. Mozaffarian D. Conflict of interest and the role of the food industry in nutrition research. JAMA. 2017;317(17):1755–6. https://doi.org/10.1001/jama.2017.3456.
54. Seidel P, Rolander B, Eriksson AL, Lindahl U, Wallerstedt SM, Hägg S, et al. Drug information sources in professional work-a questionnaire study on physicians' usage and preferences (the drug information study). Eur J Clin Pharmacol. 2023;79(6):767–74. https://doi.org/10.1007/s00228-023-03494-4.

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