

# Self-Perceived Nutritional Competency of Primary Healthcare Physicians in Saudi Arabia 2024 : Systematic Review

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## Abstract

### Background:

One of the major challenges of medical education is the lack of consensus on the best method of learning and integrating nutrition into clinical practice. The literature on nutrition education reveals a gap in the development of innovative teaching models to enhance clinical nutrition knowledge and training. Over nutrition plays a vital role in the development of a spectrum of non-communicable diseases. Diet-related disorders have a huge impact on personal health as well as the country's economy for the management of such disorders. Globally, 11 million deaths are attributable to suboptimal diet annually. Furthermore, in 2014, more than 1.9 billion adults were overweight, while 462 million were underweight. This coexistence of under nutrition, along with overweight and obesity, or diet-related chronic diseases, is referred to as the double burden of malnutrition. This burden is universal and presents an imperative to improve the nutrition capacity of the health workforce. Nutrition is a powerful tool for the prevention and management of diet-related chronic diseases, the nutrition-related components of diseases including cancer, obesity, and diabetes are frequently not adequately addressed in actual physician practice

**Aim of this systematically review:** To evaluate the primary healthcare physicians' nutrition competency, Saudi Arabia 2024.

**Methods:** A systematic review was conducted. We searched PubMed, Web of Science, Science Direct, EBSCO, and the Cochrane library. Using QCRI, study articles were first screened by title and abstract before a full-text analysis was done.

**Results:** The usability and outcome of Self-Perceived Nutritional Competency of Primary Healthcare Physicians in Saudi Arabia are based on Vision 2030. 6 articles were selected that compliant with the theme of this present systematic review (Table 1).

**Conclusion:** Primary Healthcare Physicians need to improve their nutritional competency knowledge, this will allow them to get the most level of nutritional knowledge and skills to provide individuals with the suitable nutritional recommendations and also successfully support patients to enhance their dietary behaviors and health conditions. PHC physicians should have continuous nutrition educational training programs to ensure the continuous provision of sound nutritional advice to patients and the public leading to a positive impact on public health.

**Keywords:** Self-Perceived, Nutritional, Competency, Primary Healthcare, Physicians, Saudi Arabia.

## **Introduction**

Doctors may lack enough knowledge of fundamental nutrition science facts and awareness of prospective nutrition interventions if they do not feel competent, at ease, or equipped to offer nutrition advice [1]. Poor diet was the cause of 25.6% of adult fatalities and 17.4% of adult disability-adjusted life years (DALYs) in the Kingdom of Saudi Arabia (KSA) in 2017 [2]. Type 2 diabetes affects 13.2% of the population, raised blood pressure affects 15.2% of the population, and obesity is on the rise. Reaching 28.7% of the population [3] there is a gap in studying the relationship between nutrition and other disciplines and their role in the patient care process. It has been found that clinical nutrition cannot be learned as an isolated subject. [4] Using integrated case studies, we attempted to enable nutrition students to acquire knowledge from different disciplines and discuss its impact on the nutritional aspect of the case.[5] Interdisciplinary teaching that is provided by the process of vertical integration has been found to assist students in acquiring a complete picture of the learned topic instead of receiving incoherent information.[6]

Any research carried out by a medical expert that helps patients alter their eating habits and subsequently their indicators of disease is referred to as nutrition care [7]. Within typical consultations, these procedures may involve nutrition assessment, nutrition guidance, and nutrition counseling [8]. In other nations, it has been demonstrated that patients' eating behaviors improve when receiving nutrition care from primary care physicians [9]. Patients also view primary care physicians' advice on nutrition as trustworthy and credible, much more so than dietitians' [10].

While several studies have reported healthcare practitioner's' perceptions about dietary counseling, a comprehensive review of literature including primary healthcare practitioners of has previously not been conducted.[11] In addition to the valuable role of dietitians, who are instrumental in the education of patients with existing chronic dis-eases, it has been recognized worldwide that primary healthcare practitioners can also play a fundamental role in the provision of evidence-based nutrition information to patients.[12] the term 'primary healthcare practitioners' describes medical doctors/physicians, pharmacists, nurses and/or dentists. Primary healthcare practitioners are regarded as a relatively large, affordable, and accessible community for whom the implementation of strategies to guide the provision of nutrition care could be advantageous.[13] This is apparent in rural settings where access to dietitians may be limited.[14] An understanding about the knowledge, skills and attitudes .[15]

Nutrition is an essential part of human development and well-being. Also, nutrition can be a threat to human health; diet-related disorders have a huge clinical impact on a wide variety of health conditions ranging from dental caries to colorectal cancer (CRC). Thus, it is an important aspect of primary healthcare physicians, as their cornerstone role is in awareness and prevention [16]

One study conducted in KSA and Egypt compared problem and case-based learning during the clinical clerkship. This study showed that both methods were feasible and applicable. However, 70% of students reported that case-based learning was more effective during clinical training, in particular.[17] One post-test experimental study carried out at the University found that case-based teaching enhanced students' perceptions of the physiology course. That study showed a real increase by  $P < 0.04$  in CBL students' performance over traditional education.[18]

“The ultimate test of a good clinical nutrition program in medical education lies in the enthusiastic, knowledgeable, and effective application of nutrition in the management of patients .” This nationwide survey of nutrition related attitudes and clinical practices clearly demonstrates the need for improving both the base of knowledge of clinical nutrition and its application to patient care by all primary-care physicians. The attitudes, practices, and demographic characteristics that we have identified suggest these educational approaches for improving the competence of primary-care physicians and medical students in clinical nutrition. [19]

## **Methodology**

### **Aim of the study:**

To evaluate the primary healthcare physicians' nutrition competency, Saudi Arabia 2024 : a systematic review

### **Study design:**

Systematic reviews using Online searching engines were using databases to identify relevant articles through the included electronic databases: Google Scholar, PubMed, and Saudi Digital Library (SDL), data extracted from published articles were systematically analyzed for determining the Self-Perceived nutritional competency of Primary Healthcare Physicians in Saudi Arabia to achieving higher level.

### **Search Strategy**

A systematic literature search of five major databases, including PubMed, Web of Science, Science Direct, EBSCO, and Cochrane library, was conducted to include the eligible literature. Our search was limited to the English language and was adjusted for each database as required. The eligible studies were determined through the following keywords that were adjusted into Mesh terms in PubMed; " Self-Perceived, Nutritional Competency , primary health care in Saudi Arabia , Physicians" The appropriate keywords were paired with "OR" and "AND" Boolean operators. The search results comprised English, full-text publications, freely available articles, and human trials.

### **Searches and Data Sources**

A comprehensive search was performed to obtain studies on Self-Perceived Nutritional Competency of Primary Healthcare Physicians in Saudi Arabia. The databases used in the search included ProQuest and Competency, and the Primary Healthcare used were 'Self-Perceived ', 'Nutritional ', 'Saudi Arabia' . These keywords were used to find articles with matching terms in their abstracts or titles. To discover the most recent studies and literature on our review topic, the search was limited to articles published between 2020 and 2024.

### **Selection Criteria**

Our review comprised the studies with the following criteria:

- Mainly cross-sectional, cohort, and retrospective cohort studies and study designs that provided qualitative or quantitative data about Self-Perceived Nutritional Competency of Primary Healthcare Physicians in Saudi Arabia.

### **Exclusion criteria included the following:**

- Studies not conducted in the English language.
- Studies with no free access.

### **Data Extraction**

We used Rayyan (QCRI) to detect the duplicate aspects of the search strategy outcomes. The researchers evaluated the titles and abstracts for suitability by screening the pooled search results using a set of inclusion/exclusion criteria. The reviewers assessed the whole texts of the papers that satisfied the requirements for inclusion. The authors engaged in the discussion to settle any disagreements. To include the eligible study, a data extraction form was created. The authors extracted data about the study titles, authors, study year, study design, study population, participant number, Self-Perceived Nutritional Competency of Primary Healthcare Physicians in Saudi Arabia, and the key findings and studies were excluded if they were published before 2020.

**The process of selecting the articles**, which are contained in this review.

Presents method used for selecting eligible studies for this review. In the first stage, Pro Quest and Scopus returned 200 articles. After duplicate articles and those published before 2020 were removed, 74 remained. Non-peer-reviewed articles (55) and articles not mainly about Self-Perceived Nutritional Competency of Primary Healthcare Physicians Saudi Arabia, (20) were then excluded. After excluding studies with sample sizes under 80 and response rates under 60%, 6 articles were included in this review.

**Table1: Summary of Findings of the Self-Perceived Nutritional Competency of Primary Healthcare Physicians in Saudi Arabia .**

Author, Date, Country	Region	Study design	Study aim	Results
Valdés et al (2024) [20]	Cuba	A preventive and community approach.	To analyze the primary health care specialist's professional mode of action and their role in nutritional education.	<p>The primary health care specialist plays a fundamental role in nutritional education. His professional conduct is based on ethical principles, including responsibility, respect, confidentiality, integrity, and honesty. In addition, they assume the role of educators and health promoters, acting as facilitators of change. Its primary goal is to empower patients, their families, and communities to make informed decisions that promote positive changes in their eating habits and lifestyles.</p> <p><b>Conclusions</b> The nutritional education these specialists provide enables any person to make correct decisions regarding their diet and lifestyle, positively impacting their health and well-being. It is essential to strengthen the education and training of primary health care specialists in nutrition to guarantee comprehensive and effective care.</p>
Lepre et al (2024) [21]	Australia, New Zealand, the UK and Northern Ireland	A three-round modified online Delphi survey of experts in healthcare practice, education and training, and experts by experience	To establish consensus on nutrition competencies using a Delphi process to inform a framework for nutrition education in medicine.	<p>Nutrition in medical education and care There was agreement in round 1 that nutrition is important across all care settings, though primary care was identified as the ideal setting in the context of disease prevention. The perceived relevance of nutrition care increased across the continuum of roles in medical practice, ranging from 76.5% for medical students to 94.1% for general practice registrars and specialist GPs. The majority (65.9%) of panellists indicated that the primary role of a doctor in nutrition care is to coordinate care, though there was some agreement that their role may also include nutrition assessment and brief dietary advice. Few panelists indicated that doctors do not have a role in nutrition care, or that they should be the main provider of said care .</p> <p><b>Conclusions</b> The findings suggest doctors need the knowledge and skills to consider the findings from nutrition screening and assessment, coordinate nutrition care</p>

				<p>when an individual may benefit from further assessment or intervention and provide support for advice delivered by other experts as part of a multidisciplinary approach. This study defined 25 nutrition competencies for medicine. The service user panel identified an additional seven skills and attributes considered important in the receipt of nutrition care. This informs broad concepts and skills that may be taught in a nutrition context but could be included in other domains. The findings from this study suggest doctors need the knowledge and skills to consider the findings from nutrition screening and assessment, coordinate nutrition care when an individual may benefit from further assessment or intervention and provide support for advice provided by experts in nutrition as part of a multidisciplinary approach.</p>
<p><b>Arafa et al. (2022) [22]</b></p>	<p>Saudi Arabia</p>	<p>A cross-sectional Study.</p>	<p>To investigate primary care doctors' understanding of nutrition and cancer protection, particularly in relation to diet and tumor progression</p>	<p>The average score for proper knowledge for physicians is good but lower than anticipated. Primary care physicians therefore have good understanding about the connection between diet and cancer, but not enough; they should participate in ongoing nutrition education and training programmes to guarantee that patients and the general public receive safe and effective nutritional recommendations. The mean correct knowledge score for physicians is good but less than expected (26.5+5.8) 73.6%. Multiple regression revealed that age, position, and nationality to be significantly associated with knowledge of cancer prevention (P&lt;0.05) among physicians.</p> <p><b>Conclusions</b></p> <p>Primary care physicians have a good knowledge about the relation between nutrition and cancer but less than expected. Consultant and non-Saudi nationality physicians more knowledgeable, age and in turn years of experience have a significant role for determining the knowledge level. As primary care physicians are the first defense in health care, they should have continuous nutrition educational training programs to ensure safe and sound nutritional advice not only to patients but also for public. Spreading out the nutrition topics particularly those related to cancer, over a longer period of time delivers the chance to strengthen, apply and practice counseling skills along the curriculum. Further researches are required to appraise the long-term impact of nutrition education curricula primary care physicians' real-time and/or simulated dietary counseling performance, physician practice patterns and eventually patient outcomes.</p>

<p><b>Bawazir, et al (2022) [23]</b></p>	<p>Saudi Arabia</p>	<p>A cross-sectional Study.</p>	<p>To evaluate the dietary attitude and knowledge of recent King Abdul-Aziz University graduates who work as medical interns.</p>	<p>Among the knowledge axes, the nutrition and diabetes axis had the highest percentage of accurate responses, whereas the nutrition and heart disease axis had the lowest percentage. The medical nutrition curriculum only satisfied about half of the participants. It could be seen in their skills, dispositions, and assurance when giving patients nutritional advice. In our study, the results showed a clear gap between the nutritional knowledge and attitude of the intern physicians. This gap could be reduced through continuous nutritional training, workshops, and educational lectures that include encouraging medical students for proper nutritional practices. The current study differed from previous studies in these results .</p> <p><b>Conclusions</b> Nutrition curricula in medical schools must be improved to suit the needs of students and support their skills to make them more confident in providing nutritional advice to patients and to improve the processes of examination, diagnosis, and carrying out appropriate intervention for health conditions. Enhancing medical curricula with better and higher-quality nutritional content, increasing the hours of nutritional education, adding some optional lectures on nutrition for doctors interested in improving their nutritional knowledge, encouraging physicians to practice proper nutritional practices with patients, and training them to practice nutritional counseling with patients properly could be significant and appropriate.</p>
<p><b>Aldubayan et al (2021) [24]</b></p>	<p>Saudi Arabia</p>	<p>A cross-sectional study</p>	<p>To Identifying weaknesses in nutritional knowledge among Saudi physicians may guide them to improve their nutritional knowledge</p>	<p>In current study, we selected a specific group of physicians of different specialties who we thought would be interested to a certain extent in clinical nutrition since they were working in departments where nutritional care is highly relevant. Of the 443 physicians reached, the majority responded, with a rate of 75% (n = 332). This rate was the highest among what was reported in several previously published studies. Saudi male physicians comprised the highest proportion of the total population (87% and 73.5%, respectively). It was determined that 27.7% of participating physicians were specialized in internal medicine, and the others were distributed between surgery, pediatrics, ICU, obstetrics and gynecology, orthopedic, otolaryngology, emergency medicine, family medicine, medical interns, and other specialties. These differences however did not affect the response rate or the knowledge scores</p> <p><b>Conclusions</b></p>

				Findings of the study show that primary care physicians require further nutrition education. Nutrition, on the other hand, should be a primary focus of continuing medical education. As the nutrition care process is essential for patient care, especially hospitalized critically ill patients, it is recommended to hire more clinical dietitians in medical settings in Saudi Arabia as part of a multidisciplinary team to ensure effective delivery of services. Nutrition should be reinforced as an important component of continuing medical education. There is a need for hiring more dietitians in health care settings in Saudi Arabia as an integral part of a multidisciplinary team delivering medical care services.
<b>Al Shammari. et al (2021), [25]</b>	Saudi Arabia	A-questionnaire-based cross-sectional survey	To study the nutritional knowledge, as well as knowledge of primary health-care providers (PHC) employed in Saudi Arabia's Hail City.	<p>Physician's recommendation plays an important role in patients diet-related behaviors, as well as their food consumption pattern. However, several factors such as inadequate time with the patient, minimal nutritional education, low reimbursement, as well as lack of comfort counseling about dietary patterns have been noticed. The study received a relatively low number of responses. 75% of doctors thought their knowledge was "good." Likewise, staff who work at PHC facilities had completely ordinary nutritional education and were aware of the fundamental nutritional information food related content, pregnancy, lactation, diabetes, hypertension,</p> <p><b>Conclusion</b> PHC physicians in the city of Hail, Saudi Arabia were found to be generally aware about nutrition and its importance in health care systems. However, seeking to results of this study, we conclude that, Further improvements in nutritional knowledge are needed to provide better patient care. Additionally, medical students, as well as a full fledge medical practitioner should constantly participate in nutrition promoting programs including nutrition-based courses in continuous medical education (CME), because the nutrition awareness among physicians will pass their knowledge to patients and can further help in decreasing the prevalence of diseases, ultimately reduction in high rate of drug consumption. Adequate knowledge of nutrition is essential for physicians to work as active team member to upkeep the nutritional requirements of the patients.</p>

## **Rustle and Discussion**

The usability and outcome of Self-Perceived Nutritional Competency of Primary Healthcare Physicians in Saudi Arabia are based on Vision 2030. 6 articles were selected that compliant with the theme of this present systematic review (Table 1). Among the 6 reviewed articles, articles have explained the Self-Perceived Nutritional Competency of Primary Healthcare Physicians in Saudi Arabia ; articles assess the prospective role of CHI in achieving Vision 2030 goals in the healthcare system. Different Self-Perceived Nutritional Competency of Primary Healthcare Physicians in Saudi Arabia was explained in different articles, articles highlight the strengths and weaknesses of physicians in Saudi Arabia. Finally, articles have provided recommendations for Nutritional Competency of Primary Healthcare Physicians in Saudi Arabia.

The main evidence demonstrated by most of the reviewed studies (Table 1) is that Self-Perceived Nutritional Competency of Primary Healthcare Physicians in Saudi Arabia just reasonable nutrition knowledge and are aware of the only basic nutritional knowledge for providing nutrition care [26]. Nutritional care is an important aspect of healthcare, especially for non-communicable diseases. Integration of physician knowledge, skill, communication, and attitude plays a very important role in preventive and therapeutic intervention [27 ] The inadequacy of the nutritional curriculum among medical students was reflected in their knowledge, attitudes, and confidence in providing nutritional counseling to patients[ 28]

A study conducted in Jeddah in 2019 stated that 35.6% continued medical education on nutrition, and a smaller percentage could be due to the smaller sample size and the study conducted four years ago [26]. Another metacentric study among eight developed countries was published in 2019 and revealed that only 39% of participants received training on nutrition [29]

Similar studies were conducted in GCC countries like Kuwait [29], Qatar [20], and Saudi Arabia [18], wherein, respectively, 60%, 64%, and 52.1% of participants were queried regarding nutrition knowledge. Less scores in Al-Zahrani's earlier published study in 2009 [30]. In our study, a higher nutrition knowledge score of 71.4% was observed [22]

So, Intern physicians and Primary care physicians need to improve their clinical nutrition knowledge and would benefit from higher levels of nutrition knowledge and skills to be able to provide patients with appropriate nutrition advice and to effectively support patients to improve their dietary behaviors and health conditions. They should have continuous nutrition educational training programs to ensure the continuous provision of sound nutritional advice to patients and the public leading to a positive impact on public health.[16]

A smaller proportion of physicians, 40.8% (n = 60), were confident about the question of recently published peer-reviewed evidence regarding nutrition and chronic diseases in our study. In the same context as the finding, some systematic reviews were conducted on educational interventions for the improvement of nutrition care in the United States of America (USA) in 2016 [30], another study in the same dimension from the United Kingdom (UK) published in 2020 [29], and another study from physicians from New Zealand and Australia [28] highlighted that PHCC physicians require nutrition education and access to evidence-based information.

## **Conclusion**

Although Self-Perceived Nutritional Competency of Primary Healthcare Physicians in Saudi Arabia reported having limited access to nutrition treatment regarding the quantity and duration of each visit, they felt comfortable offering it to patients with diseases linked to food. It is necessary to use tactics that advance nutrition knowledge and abilities to boost doctors' ability to provide nutrition care. To guide continuing medical education and training at medical school, it would be good to reach an agreement on the acceptable degree of dietary knowledge.

## References

1. Vasiloglou, M. F., Christodoulidis, S., Reber, E., Stathopoulou, T., Lu, Y., Stanga, Z., & Mougiakakou, S. (2020). What healthcare professionals think of “nutrition & diet” apps: an international survey. *Nutrients*, *12*(8), 2214.
2. Global Burden of Disease Cancer Collaboration. (2017). Global, regional, and national cancer incidence, mortality, years of life lost, years lived with disability, and disability-adjusted life-years for 32 cancer groups, 1990 to 2015: a systematic analysis for the global burden of disease study. *JAMA oncology*, *3*(4), 524.
3. Ji, Q., Chai, S., Zhang, R., Li, J., Zheng, Y., & Rajpathak, S. (2024). Prevalence and co-prevalence of comorbidities among Chinese adult patients with type 2 diabetes mellitus: a cross-sectional, multicenter, retrospective, observational study based on 3B study database. *Frontiers in Endocrinology*, *15*, 1362433.
4. Farha, R. J. A., Zein, M. H., & Al Kawas, S. (2021). Introducing integrated case-based learning to clinical nutrition training and evaluating students’ learning performance. *Journal of Taibah University Medical Sciences*, *16*(4), 558-564.
5. Fooladi, E. C., Tuomisto, M., & Haapaniemi, J. (2023). Food in science, science in food—Interdisciplinarity in science/chemistry and home economics lower secondary curricula across three countries. *International Journal of Science Education*, *45*(17), 1485-1505.
6. Vieira, M. C. C., Gouveia, R. C., & Dias, A. L. (2022). Interdisciplinary teaching activities for high school integrated to vocational education promoting reflections on industry 4.0 technologies and their implication in society. *Journal of Technical Education and Training*, *14*(1), 75-89.
7. Cecchini, A. L., Biscetti, F., Rando, M. M., Nardella, E., Pecorini, G., Eraso, L. H., ... & Flex, A. (2022). Dietary risk factors and eating behaviors in peripheral arterial disease (PAD). *International Journal of Molecular Sciences*, *23*(18), 10814.
8. American Diabetes Association. (2022). Standards of medical care in diabetes—2022 abridged for primary care providers. *Clinical Diabetes*, *40*(1), 10-38.
9. ElSayed, N. A., Aleppo, G., Aroda, V. R., Bannuru, R. R., Brown, F. M., Bruemmer, D., ... & Gabbay, R. A. (2023). 5. Facilitating positive health behaviors and well-being to improve health outcomes: standards of care in diabetes—2023. *Diabetes Care*, *46*(Supplement\_1), S68-S96.
10. Badorrek, S., Franklin, J., McBride, K. A., Conway, L., & Williams, K. (2024). Primary care practitioner and patient perspectives on care following bariatric surgery: A meta-synthesis of qualitative research. *Obesity Reviews*, e13829.
11. Labarta, A. C., Irvine, T., & Peluso, P. R. (2023). Exploring clinician attitudes towards treating eating disorders: Bridging counselor training gaps. *Journal of Counselor Preparation and Supervision*, *17*(1), 2.
12. Downes, L., & Tryon, L. (2023). *Health Promotion and Disease Prevention for Advanced Practice: Integrating Evidence-based Lifestyle Concepts*. Jones & Bartlett Learning.
13. Zhang, X., Tang, Z., Zhang, Y., Tong, W. K., Xia, Q., Han, B., & Guo, N. (2024). Knowledge, attitudes, and practices of primary healthcare practitioners regarding pharmacist clinics: a cross-sectional study in Shanghai. *BMC Health Services Research*, *24*(1), 677.
14. Carter, C., Harnett, J. E., Krass, I., & Gelissen, I. C. (2022). A review of primary healthcare practitioners’ views about nutrition: implications for medical education. *International journal of medical education*, *13*, 124.
15. Zabidin, N. S., Belayutham, S., & Che Ibrahim, C. K. I. (2024). The knowledge, attitude and practices (KAP) of Industry 4.0 between construction practitioners and academicians in Malaysia: A comparative study. *Construction Innovation*, *24*(5), 1185-1204.

16. Judijanto, L., & Solihah, E. (2024). BALANCED NUTRITION PROGRAM: IMPROVING THE QUALITY OF LIFE OF PEOPLE THROUGH A HOLISTIC NUTRITION POLICY. *ZAHRA: JOURNAL OF HEALTH AND MEDICAL RESEARCH*, 4(2), 243-255.
17. Badrawi, N., Hosny, S., Ragab, L., Ghaly, M., Eldeek, B., Tawdi, A. F., ... & El-Wazir, Y. (2023). Radical reform of the undergraduate medical education program in a developing country: the Egyptian experience. *BMC Medical Education*, 23(1), 143.
18. Vedi, N., & Dulloo, P. (2021). Students' perception and learning on case based teaching in anatomy and physiology: An e-learning approach. *Journal of Advances in Medical Education & Professionalism*, 9(1), 8.
19. Balaram, K. (2023). *Evaluation of a Nutrition Education Intervention to Impact Hospital Executive Chefs' Self-Efficacy to Create Healthier Menu Offerings* (Doctoral dissertation, University of Kansas).
20. Valdés, M. B. N., Machuca-Contreras, F., Carreño, A. P., & Barreto, J. C. G. (2024). The professional practice of the primary health care specialist and his role in nutrition education. *Revista Información Científica*, 103, 4697.
21. Lepre, B., Mansfield, K. J., Ray, S., & Beck, E. J. (2024). Establishing consensus on nutrition competencies for medicine: a Delphi study.
22. Arafa, M. A., Amin, H. S., Farhat, K. H., Rabah, D. M., Alarifi, F. F., Mostafa, N. S., ... & Albekairi, A. (2022). Nutritional Related Knowledge of Cancer Prevention among Primary Health Care Physicians. *Asian Pacific Journal of Cancer Prevention: APJCP*, 23(3), 1041.
23. Bawazir, Z., Alrasheedi, A., & Aljehany, B. (2022, September). Nutritional knowledge and attitudes among physician interns graduated from King Abdul-Aziz university, Jeddah, Saudi Arabia. In *Healthcare* (Vol. 10, No. 9, p. 1788). MDPI.
24. Aldubayan, K., Alsamani, A. S., Aladel, A., & Almuhtadi, Y. (2021, December). Physicians' knowledge of clinical nutrition discipline in Riyadh Saudi Arabia. In *Healthcare* (Vol. 9, No. 12, p. 1721). MDPI.
25. Al Shammari, E., Ashraf, S. A., Al Shammari, R., Al Rashidi, A., Awadelkareem, A. M., & Abd Elmoneim, O. E. (2021). Nutritional knowledge and awareness of primary health care physicians working in hail region, Saudi Arabia: A cross-sectional study. *Current Research in Nutrition and Food Science*, 9(2), 402.
26. Almaqhawi, A. (2024). Knowledge and Competence Regarding the Management of Chronic Kidney Disease among Family Medicine Professionals in the Eastern Province of Saudi Arabia: A Cross-Sectional Study. *International Journal of Environmental Research and Public Health*, 21(7), 880.
27. Ruthsatz, M., & Candeias, V. (2020). Non-communicable disease prevention, nutrition and aging. *Acta Bio Medica: Atenei Parmensis*, 91(2), 379.
28. Mogre, V., Stevens, F. C., Aryee, P. A., Amalba, A., & Scherpbier, A. J. (2018). Why nutrition education is inadequate in the medical curriculum: a qualitative study of students' perspectives on barriers and strategies. *BMC medical education*, 18, 1-11.
29. D'Adamo, C. R., Workman, K., Barnabic, C., Retener, N., Siaton, B., Piedrahita, G., ... & Berman, B. M. (2022). Culinary medicine training in core medical school curriculum improved medical student nutrition knowledge and confidence in providing nutrition counseling. *American Journal of Lifestyle Medicine*, 16(6), 740-752.
30. Hargrove, E. J. (2016). *Nutrition knowledge and attitude towards nutrition counseling among osteopathic medical students* (Master's thesis, Ohio University).