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Review Article

Generative AI in Nutrition Education: Current Applications, Opportunities, Challenges, and Future Directions: A Narrative Review

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Abstract

Artificial intelligence is drastically entering every aspect of our lives, including education, training, and communication. There are many models in Generative artificial intelligence (GenAI) such as “large language models (LLMs) including ChatGPT, Gemini, Claude, and Copilot etc. This narrative review focuses on the current peer-reviewed articles (predominantly 2023–2026) on the AI applications, opportunities, challenges and future directions in the field of nutrition education. Most of these applications span three domains: professional training, direct-to-consumer dietary counselling and meal planning (chatbot-delivered advice, personalised diet plans), and public health nutrition communication. Evidence suggests that GenAI can improve nutrition learning's accessibility, scalability, personalisation, and engagement while providing dietetics educators with an affordable substitute for resource-intensive training techniques like standardised patients. However, studies consistently show limitations in accuracy, especially when it comes to calculations of calories and macronutrients, complex or comorbid clinical scenarios, and culturally specific dietary contexts. These limitations are accompanied by concerns about misleading information, algorithmic bias, dependency, data privacy, and the deterioration of critical thinking. Future directions include multimodal food-image analysis, retrieval-augmented generation based on validated nutrition databases, hybrid human-AI counselling models, and formal AI-literacy curriculum for the general public and dietetics students. According to the review, GenAI works best as a scalable supplement to trained nutritionists rather than as a replacement for them.

Keywords: generative artificial intelligence, ChatGPT, large language models, nutrition education, dietetics, nutrition literacy, chatbots

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Introduction

The traditional form of nutrition education relied heavily on didactic lectures, content writing, monotonous patient encounters, and in-person counselling sessions, whether these are given to students, patients, or the general population. Although these approaches are effective, they are expensive also, difficult to measure, and have limited capacity to customize.[1] The evolution in the field of generative artificial intelligence (GenAI), particularly large language models (LLMs) such as OpenAI's ChatGPT, Google's Gemini, Anthropic's Claude, and Microsoft Copilot, has developed into a very convenient tool that helps produce humanized content, simulating dialogues and producing customized educational material in no time.[2]

Since the launch of ChatGPT in late 2022, GenAI has penetrated healthcare sector and higher education at an unusually high pace, and nutrition and dietetics have been no exception.[3] Educators have started experimenting with virtual tools provided by GenAI to make their teaching more impactful.[1] Dietetics programs are making access to AI-generated for better understanding of medical nutrition therapy through clinical case studies[4] and millions of consumers are now directly turning towards chatbots for personalized dietary plans instead of seeking advice from registered dietitians.[5] On one hand there is increasing usage of GenAI assisted tools, simultaneously there is a raising concern about the accuracy, data safety, and pedagogical soundness of abrupt usage of GenAI for nutrition-related education and practice.[6, 7]

This narrative review summarizes recent research on the application of GenAI in the field of nutrition under three domains –

1. Training of Dietetics and Nutrition students and professionals

2. Personalized dietary counseling and planning meals and

3. Nutritional literacy and communication in the community.

The review is organized around four themes: current applications, opportunities, challenges, and future directions, concluding with implications for practice, curriculum designing and drafting policy.

Current Applications of Generative AI in Nutrition Education

Training Dietetics and Nutrition Professionals

One of the most developed applications of GenAI in nutrition education is the simulation of patient encounters for communication-skills training. Barker et al. (2024) developed a voice-based AI program for training of Masters students at Monash University to enable them for effective diet counseling skills and rapport building with the patients. Similar sort of program has been used at the University of Queensland's in their Dietetics counseling course (DIET7103), in which an AI based simulated case study program strengthened interviewing and counseling skills of the students.[8]

Besides training on interviewing and counselling techniques, GenAI is being used to generate clinical case material to educate students for assessment nutritional management of various types of clinical cases. In a meeting of the Academy of Nutrition and Dietetics in 2025, Dietetic students used GenAI to create hypothetical case studies to explain management of diabetes, gastrointestinal disorders, and cardiovascular problems. These cases were critically assessed for any AI-generated bias and accuracy by the students. Students found some bias or errors in the values of laboratory parameters, nutritional recommendations, and inclusion of food items that were ethnically stereotyped. Only 54% of AI-generated cases recommended consultation with Registered Dietitian (Academy of Nutrition and Dietetics, 2025). This dual usage of AI both as a source of

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knowledge and as a matter for critical evaluation, highlights a new pedagogical approach of inclusion of GenAI into the curriculum.[4]

Direct-to-Consumer Dietary Counseling and Meal Planning

A substantial amount of the literature throws light on LLMs' ability to recommend diet directly to the public. Ponzo et al. (2024)[6] compared dietary advice given by ChatGPT-3.5 for non-communicable diseases (hypertension, type 2 diabetes, sarcopenia, obesity, and non-alcoholic fatty liver disease) with international guidelines and discovered accuracy of AI ranging from 55.5% (sarcopenia) to 73.3% (NAFLD), with a declining accuracy for patients with multiple, overlapping clinical conditions. Similarly, Liao et al. (2024)[7] studied the efficacy of dietary advice given by ChatGPT on readability, completeness and understandability of college students. The study demonstrated that the obtained nutrition literacy rate ranged from 7.5% to 37.6%, though the actual accuracy rate of the model against the benchmark was 84.4%.

Comparative studies of multiple chatbots have found trends in consonance. A comparison of Gemini, Microsoft Copilot, and ChatGPT-4.0 in generating diet plans for weight-loss across different caloric ranges was done. Results were found to be inconsistent in terms of accuracy and quality of diet advised among various AI platforms (Diet Quality and Caloric Accuracy in AI-Generated Diet Plans, 2025).[9] A systematic review of 23 studies evaluated the performance of ChatGPT's in planning meals and dietary recommendations and concluded that its recommendations were well-aligned with the guidelines. Simultaneously, a need for improvement was also stated in calorie estimation, macronutrient balance and evaluation of clinical requirements (From AI to the Table, 2025).[10] Additionally, multimodal capabilities are also being examined. An assessment of ChatGPT's capacity to estimate macronutrient composition of diet from meal photos showed remarkable differences when compared to diets prescribed by dietitians. Higher variations were found in fat composition analysis of diet. (An Evaluation of ChatGPT for Nutrient Content Estimation, 2025).[10]

Public Health Nutrition Communication and Literacy

GenAI is also reshaping the delivery of nutrition information to the public, particularly in an economic manner and in multilingual settings. Adilmetova et al. (2024) evaluated multilingual performance of the ChatGPT in providing nutrition advice. Synthetic medical text was used for this purpose, which was inspired from the local languages of Central Asia. The study highlighted the potential and constraints of LLM-based model in relevance to nutrition communication.[11] Many public-health studies emphasized the role of GenAI tools in content production for nutritional education at different literacy levels in multiple languages. This is helpful in improving access to nutrition information for underserved populations (Council of Deans of Health, 2026)[12], while study performed by Joseph et al. (2025)[13] also cautioned that the multilinguistic properties of LLMs model can inadvertently legitimize misinformation or oversimplify cultural specific dietary requirements.

Opportunities

Several converging opportunities emerge from the literature. First, scalability and accessibility: GenAI-based tools can provide 24/7, low-cost nutrition guidance and simulated practice at a scale unattainable through human instructors or standardized patients alone.[1,12] Second, personalization: LLMs can tailor meal plans and dietary recommendations according to an individual's educational level and understanding, cultural background and nutritional targets. In totality, providing more patient-centered approach rather than static print materials.[2] Third, safe practice environments: AI-simulated patients or case studies allow dietetics students to practice difficult or emotionally sensitive counselling sessions repeatedly without any risk

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to real life conditions, addressing a long-standing gap in communication-skills training.[1,8]

Fourth, GenAI opens up new possibilities for critical-appraisal pedagogy to encourage analytical thinking in students. Many dietetics programs use AI-generated content that is made purposefully with some errors so that students learn to audit and identify clinical errors, out-of-date guidelines, and culturally un-appropriate dietary recommendations. This helps students develop the evaluative skills that is really very essential throughout their future career as a practitioners.[4] With this, GenAI is significantly contributing to nutrition research in the field of precision and personalized nutrition. GenAI is contributing to knowledge enhancement, studies related to food-effect analysis and diet-recommendation that is establishing strong foundation for education.[14]

Challenges

Accuracy, Reliability, and Clinical Safety

The biggest challenge in the use of GenAI is inconsistent accuracy, particularly with complex clinical cases. Ponzo et al. (2024) found discrepancies in ChatGPT's results on dietary advice. These were reasonably accurate for simple clinical conditions, but generated inappropriate recommendations when given complicated clinical conditions. So, it was concluded that chatbot cannot replace a qualified dietitian.[6] Niszczota and Rybicka (2023) similarly found an inaccuracy in the calculation of the nutritive value of the diets for the provided portions, done by ChatGPT.[15] This finding is crucial to safety as there is a possibility of providing incorrect information about allergens as well. A 2026 study that evaluated the performance of five popular chatbots (Gemini, DeepSeek, Meta AI, ChatGPT, and Grok) on evidence-based health questions, including nutrition. They found that almost half of the responses were not fully accurate, which prompted researchers to call for stronger actions on public awareness regarding the usage of GenAI tools.[16]

Misinformation, Bias, and Overreliance

As LLMs are optimised to produce fast and fluent responses, so there are chances to provide nutrition misinformation without verifying the data or claims.[13] In a study, it was observed that AI generated replicate results by producing ethnically stereotypical diet advice on cultural presumptions rather than rectifying them.[4] An increasing dependency on unaccredited sources of the population has been documented in the findings of a survey. It was a matter of great concern that a large segment of the population is relying more on AI-generated diet recommendations, rather than consulting with trained professionals.[5]

Pedagogical and Institutional Readiness

Institutional readiness for GenAI tools also needs to be scrutinised for designing a new era in the field of dietetics programs. University of Queensland (2025) study showed that although dietetics students valued AI- supported learning, they felt a need for structured training and support to use these techniques optimally. This finding is consistent with other studies, which support the need for training for both teachers and students in healthcare profession courses as learning cannot develop naturally. [17]

Ethical, Privacy, and Regulatory Concerns

Data privacy, algorithmic bias, unclear liability are other concerns with the use of GenAi in nutrition education as it can directly raise ethical issues.[18] These concerns are heightened in case of vulnerable populations, such as pregnant female or a patient belonging to low- and middle-income group who do not have access to health care facilities and therefore rely on chatbot or Gen AI tools for the information. In that case reliable nutrition information is of great concern.[13]

Future Directions

To enhance GenAI's safety and value in nutrition information and education, a lot of feasible options are available. First, the mistakes reported

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for false nutritive value calculations in numerous research studies can be decreased by retrieval-augmented generation (RAG) and better tuning on authentic databases and clinical nutrition guidelines. [10, 19] Second, multimodal AI are in developmental phase at present which identify meal image and combines it with LLM-based reasoning. A lot of validation process is required to improve its inconsistent interpretations of nutrient estimation from photos before using it in clinical or educational settings.[20]

Third, the most sustainable and promising model suggested is the hybrid human-AI model. In these models, skilled registered dietitians are the final decision makers for complex clinical cases or personalised diet counselling, though some help was taken from the GenAI to manage routine calculation and managerial tasks such as responding to FAQs, creating general meal plans, practice conversation sessions etc.[6,12] Fourth, there is a need to prepare a formal AI-literacy curricula that can train dietetics professionals and the general population about proper usage of GenAI tools as well as their advantages and limitations and when to approach professionals for guidance.[4, 8]

Finally, there is a dire need for longitudinal research and evaluations of problems on the basis of real world scenario rather than doing just one time assessment and to investigate reproducible results of GenAI in the context of different languages and food cultures.[11] It's important to make benchmarks and standards for the results generated by GenAI tools across different algorithms to provide reliable, comparable data for future studies.[19]

Conclusion

Generative AI is already reshaping nutrition education across professional training, consumer counseling, and public health communication. The evidence to date suggests that GenAI tools can meaningfully expand access, scale personalised learning, and provide safe environments for skills practice, but they also exhibit clinically relevant accuracy limitations, cultural and demographic biases, and a tendency to be used by both students and the public without adequate critical scrutiny. The available data suggests that GenAI should be positioned as a scalable adjunct rather than a replacement for nutrition experts or traditional pedagogy. This means that the tool's outputs need to be validated, its use should be explicitly taught, and its integration into curricula and consumer-facing platforms should proceed alongside ongoing human oversight.

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