BMES BIOMEDICAL ENGINEERING SOCIETY

LETTER TO THE EDITOR

Revolutionizing Personalized Protein Energy Malnutrition Treatment: Harnessing the Power of Chat GPT

Urooj Khan[1]

Abstract

Protein energy malnutrition (PEM) is a global public health concern, and personalized treatment approaches are crucial for improved outcomes. This study explores the transformative potential of Chat GPT, an AI language model, in revolutionizing personalized treatment for PEM. By providing accurate information, personalized dietary recommendations, food choices, psychological counseling of the patient and real-time monitoring and support, Chat GPT can enhance the effectiveness of PEM interventions. Along with the benefits it is also important to acknowledge its potential flaws and limitations. The study emphasizes the importance of collaboration between AI technology and healthcare professionals to leverage Chat GPT's capabilities effectively. By combining human expertise with AI capabilities, personalized PEM treatment can be revolutionized, leading to improved patient outcomes and a comprehensive approach to addressing this global public health concern. The study highlights the significant impact of Chat GPT in providing tailored guidance and continuous support throughout the treatment process, empowering individuals and improving their overall well-being.

Keywords PEM · AI · ChatGPT · Protein deficiency

Introduction

Protein-energy malnutrition (PEM) is a prevalent nutritional disorder characterized by insufficient protein and caloric intake, leading to a range of adverse health consequences. This condition primarily affects populations residing in resource-limited settings, such as developing countries experiencing food scarcity, poverty, or political conflicts. The significance of PEM as a public health concern cannot be overstated, necessitating a comprehensive understanding of its etiology, manifestations, and potential interventions [1].

✉ Urooj Khan
  uroojkhan162@gmail.com

1 Department of Human Nutrition and Dietetics, Faculty of Allied Health Science, Superior University, Sargodha Campus, Sargodha, Pakistan

Kwashiorkor

One of the primary forms of PEM is known as kwashiorkor, which represents a severe manifestation of malnutrition resulting from inadequate protein intake, despite sufficient caloric consumption. Kwashiorkor commonly affects children, particularly during the weaning phase when they transition from breast milk to a diet lacking in protein-rich foods [1].

Marasmus

Another form of PEM is marasmus, which occurs due to an insufficient intake of both protein and calories. This condition is predominantly observed in infants and young children. Marasmus manifests as extreme wasting of muscle and adipose tissues, leading to a visibly skeletal appearance [1].

To address the complex issue of PEM, a multidimensional approach is required. Nutritional interventions focused on increasing protein and caloric intake are paramount, often necessitating the provision of therapeutic foods fortified with essential nutrients. Additionally, community-based education programs should be implemented to enhance awareness about proper nutrition and promote sustainable agricultural

practices. In resource-limited settings, it is crucial to develop strategies that address the underlying causes of malnutrition, such as poverty, food insecurity, and inadequate healthcare infrastructure. Moreover, healthcare professionals play a vital role in the identification, management, and prevention of PEM. Early screening and diagnosis, accompanied by tailored treatment plans, can significantly improve patient outcomes. Close monitoring of weight, height, and other anthropometric measurements is crucial for assessing nutritional status and evaluating the effectiveness of interventions [2, 4].

Artificial Intelligence (AI) has emerged as a new source of hope across various fields, including healthcare, and holds significant potential in addressing complex challenges such as PEM. It can provide accessible and accurate information about PEM, its causes, symptoms, and preventive measures.

Chat GPT can offer basic nutritional guidance and dietary recommendations along with the information about protein-rich foods, suggest meal plans, and help individuals understand the importance of a balanced diet, thus can contribute to the prevention and management of PEM. Moreover, coping with PEM can be emotionally challenging. AI can offer empathetic responses and provide emotional support, alleviating feelings of isolation or frustration by engaging the patient in simple conversations, offer encouragement, and direct individuals to relevant support resources, such as counseling services or support groups [3].

Furthermore, Chat GPT can analyze the collected data on PEM cases, demographics, and treatment outcomes. This information can contribute to research efforts, help identify trends or patterns, and inform policymakers and healthcare professionals about the effectiveness of interventions and potential areas for improvement. Table 1 illustrates some latest studies in relation to the effectiveness of Chat GPT for the management of PEM.

Potential Flaws and Limitations of ChatGPT in the Management of PEM

1. Inability to Conduct Physical Examinations: ChatGPT relies solely on textual interactions and lacks the ability to perform physical examinations or assess vital signs, which are crucial for diagnosing and monitoring PEM accurately. Without access to comprehensive patient data, including laboratory tests and anthropometric measurements, ChatGPT's recommendations may not be entirely reliable or tailored to individual needs.

2. Potential for Bias in Data and Responses: AI systems like ChatGPT learn from vast amounts of text data, which may contain biases or inaccuracies. If the training data includes biased information or reflects systemic disparities, ChatGPT's responses could perpetuate or amplify those biases. This can have unintended consequences, particularly in sensitive areas such as nutritional guidance, where personalized and culturally appropriate advice is essential.

3. Limited Ability to Handle Complex Cases: PEM can present in various forms, ranging from mild to severe, and may involve underlying medical conditions. ChatGPT's capabilities may be limited when confronted with complex cases that require in-depth medical knowledge and expertise. In such situations, human healthcare professionals with specialized training are crucial for accurate diagnosis, treatment planning, and ongoing management.

4. Lack of Emotional Intelligence: PEM not only affects physical health but also has emotional and psychological implications. ChatGPT, being an AI language model, lacks emotional intelligence and may not adequately address the emotional and mental well-being of individuals with PEM. Empathy and emotional support from trained healthcare professionals are vital components of the treatment process that cannot be fully replicated by AI systems.

5. Reliance on User Inputs: The accuracy and reliability of ChatGPT's responses depend on the quality and accuracy of user inputs. If users provide incomplete or inaccurate information, the system may generate inappropriate or misleading recommendations. Additionally, individuals may misinterpret or misapply the guidance provided by ChatGPT, further compromising the reliability of its assistance

Table 1 Previous studies of ChatGPT with malnutrition

Agenda	Effectiveness	References
Suggestion of protein rich foods [5]	Effective	Khithani et al. (2021)
Proposing protein oriented meal plans [6]	Effective	Podszun et al. (2023)
Accuracy and reliability [7]	Mostly accurate but not 100%	Johnson et al. (2023)
Motivation and counseling [8]	Effective	Xie et al. (2023)

Conclusion

AI technology, such as ChatGPT, has the potential to support aspects of treating protein-energy malnutrition (PEM) by suggesting diets, directed diagnosis, giving food options, patients counseling and much more. However, it is important to acknowledge its potential flaws and limitations. In a nutshell, ChatGPT should be seen as a complementary tool rather than a replacement for human healthcare professionals. Collaborative efforts between AI technology and skilled medical practitioners are essential to ensure accurate diagnoses, personalized treatment plans, and holistic care for individuals affected by PEM.

Declarations

Conflict of interest The authors declares no conflict of interest.

References

1. Grover, Z., and L. C. Ee. Protein energy malnutrition. *Pediatric Clin.* 56(5):1055–1068, 2009.

2. Scholes, G. Protein-energy malnutrition in older Australians: a narrative review of the prevalence, causes and consequences of malnutrition, and strategies for prevention. *Health Promot. J. Aust.* 33(1):187–193, 2022.

3. Agarwal, M., P. Sharma, and A. Goswami. Analysing the applicability of ChatGPT, bard, and bing to generate reasoning-based multiple-choice questions in medical physiology. *Cureus.* 15:6, 2023.

4. Arslan, S. Exploring the potential of chat GPT in personalized obesity treatment. *Ann. Biomed. Eng.* 5:1–2, 2023.

5. Khithani, V., T. Maurya, R. More, S. Surve, and B. Varghese. A Survey of Techniques for Fitness Products Recommendation using Chatbot. PCE JCE_.:4..

6. Podszun, M., and B. Hieronimus. Can ChatGPT generate energy, macro-and micro-nutrient sufficient meal plans for different dietary patterns?

7. Johnson, D., R. Goodman, J. Patrinely, C. Stone, E. Zimmerman, R. Donald, S. Chang, S. Berkowitz, A. Finn, E. Jahangir, and E. Scoville. Assessing the accuracy and reliability of AI-generated medical responses: an evaluation of the Chat-GPT model.

8. Xie, Y., I. Seth, D. J. Hunter-Smith, W. M. Rozen, R. Ross, and M. Lee. Aesthetic surgery advice and counseling from artificial intelligence: a rhinoplasty consultation with ChatGPT. Aesthet. Plast. Surg. 2023;1–9.

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.