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The Application of Artificial Intelligence in Weight Loss among Obese People

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Abstract. Obesity has emerged as one of the most critical global health challenges, affecting both individuals and societies. It contributes to severe health complications such as type 2 diabetes, cardiovascular diseases, and certain cancers, while simultaneously imposing economic burdens on healthcare systems and productivity. In parallel, artificial intelligence (AI) technologies have advanced rapidly, demonstrating significant potential in medical decision-making, personalized health management, and disease prevention. This paper reviews the current applications of AI in obesity interventions for obese populations and explores future trends. Using literature review and analysis as the primary methodology, this study identifies AI applications in physical activity monitoring, dietary management, personalized intervention, and behavioural prediction. Key challenges including data privacy, algorithmic bias, and accessibility are discussed Findings indicate that AI provides promising solutions for obesity management, though sustainable and ethical integration remains essential for the future.

Keywords: obesity, weight loss, artificial intelligence, personalized healthcare, digital health

1. Introduction

Obesity has reached epidemic proportions worldwide [1]. According to the World Health Organization (WHO), over 1 billion people globally live with obesity, including 650 million adults, 340 million adolescents, and 39 million children [1]. Beyond being a chronic disease itself, obesity is a major risk factor for numerous non-communicable diseases (NCDs), such as type 2 diabetes [2], cardiovascular disease [3], hypertension, and certain cancers. On a personal level, obesity reduces quality of life, impairs mobility, and contributes to psychological distress. On a societal level, it leads to increased healthcare costs, reduced workforce productivity, and long-term economic strain [4].

Meanwhile, artificial intelligence (AI) has revolutionized healthcare by enhancing diagnosis, improving treatment accuracy, and enabling personalized interventions. In obesity management, AI has demonstrated unique capabilities in areas such as dietary tracking, physical activity monitoring, predictive modelling of weight change, and virtual coaching [5]. By leveraging machine learning, natural language processing, and computer vision, AI can provide tailored solutions for weight management, potentially improving adherence and long-term outcomes.

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Therefore, this paper focuses on the role of AI technologies in weight loss among obese populations. Specifically, it addresses two research questions:

1. What is the current status of AI applications in weight loss interventions for obese individuals?
2. What are the future directions and challenges in applying AI to obesity management?

This study adopts a literature review and analysis methodology, synthesizing findings from recent academic and clinical research. The study's significance lies in its potential to guide researchers, clinicians, and policymakers in leveraging AI for obesity prevention and treatment, thereby reducing the global burden of obesity.

2. Current applications of AI in weight loss

Artificial intelligence has become a critical component in modern obesity management, supporting individuals through data-driven, personalized strategies. Current applications of AI in weight loss can be broadly categorized into four domains: physical activity monitoring, dietary management, personalized intervention and predictive analytics, and behavioural change through virtual coaching. Each domain illustrates how computational tools can enhance precision, adherence, and long-term health outcomes.

2.1. Physical activity monitoring

Monitoring physical activity is essential for effective weight reduction, and AI-powered wearables and mobile applications are increasingly integrated into this process. Computer vision and motion recognition technologies allow for precise assessment of exercise quality, detecting improper movement patterns that may predispose individuals to musculoskeletal injuries. For example, AI-driven smartwatches and fitness trackers continuously collect physiological signals such as calorie expenditure, heart rate variability, and daily step counts [6]. These continuous streams of data are further analyzed by machine learning algorithms to identify progress trends and generate adaptive exercise recommendations. Unlike static exercise prescriptions, AI systems evolve with the user, adjusting intensity and frequency based on individual improvements. Such adaptive feedback loops have been shown to enhance exercise adherence and reduce the risk of dropout, which is a common challenge in obesity treatment programs.

2.2. Dietary management

Dietary control represents another cornerstone of weight management, and AI technologies have transformed nutritional planning and monitoring. Smartphone applications using advanced image recognition algorithms can now accurately identify food items from photographs and provide real-time calorie and macronutrient estimations [7]. These tools mitigate the limitations of self-reported dietary logs, which are often compromised by recall bias or underreporting. AI-driven diet coaching systems synthesize users' dietary history, metabolic biomarkers, and personal preferences to generate individualized meal plans that dynamically adjust to evolving health needs. Compared with traditional dietary counselling, these systems demonstrate superior precision and compliance, delivering actionable and context-specific feedback. A key advantage is the capacity for real-time adjustments; when caloric intake exceeds daily targets, the system can immediately propose modifications in subsequent meals or recommend compensatory physical activity. This dynamic responsiveness significantly enhances dietary adherence, a critical determinant of sustained weight loss.

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2.3. Personalized intervention and predictive analytics

Beyond monitoring, AI enables predictive modeling for personalized weight management. By integrating diverse health metrics—such as body mass index, body fat percentage, and metabolic rate—with behavioral data, AI systems can predict weight loss outcomes with increasing accuracy. These predictive insights facilitate early identification of potential barriers, such as plateaus in progress or risks of non-adherence, enabling timely intervention [8]. Reinforcement learning algorithms further enhance these capabilities by continuously optimizing behavioral strategies. In practice, reinforcement learning can adjust dietary, exercise, and lifestyle interventions dynamically, ensuring that recommendations remain relevant to the user's progress. Such adaptive personalization is particularly valuable in obese populations, where heterogeneity in metabolic responses and behavioral patterns is substantial. Longitudinally, predictive analytics not only maximize weight reduction but also contribute to sustainable improvements in overall health outcomes by maintaining engagement and minimizing relapse.

2.4. Behavioral change and virtual coaching

Sustainable weight management requires long-term lifestyle modification, an area where AI-based behavioral coaching has shown significant promise. Leveraging natural language processing, virtual coaches and conversational chatbots deliver personalized support through context-aware reminders, evidence-based motivational messaging, and structured interactive counseling sessions. These tools simulate aspects of human coaching but offer unmatched scalability and accessibility, especially for individuals lacking regular access to healthcare professionals. Unlike traditional interventions that rely on sporadic consultations, AI-driven virtual coaches are available around the clock, fostering consistent engagement. Clinical studies indicate that AI-enhanced behavioral coaching not only improves adherence to dietary and physical activity regimens but also increases the probability of achieving clinically meaningful weight loss [9]. Through continuous learning algorithms, these systems dynamically adjust communication styles and motivational approaches based on user responsiveness, a feature that significantly bolsters long-term compliance while reducing attrition rates.

3. Future directions and challenges

Although AI has shown remarkable potential in supporting weight loss among obese populations, several critical challenges remain before these technologies can be widely and sustainably adopted. These challenges span across data privacy and ethical concerns, accessibility of wearable technologies, integration with comorbidities, and the need for robust clinical validation. Addressing these issues will determine whether AI can effectively transition from experimental tools to mainstream obesity management solutions.

3.1. Data privacy and ethics considerations

AI-driven obesity interventions require the collection of large-scale, sensitive health data, including biometric information, lifestyle habits, and sometimes genetic markers. While these data enable highly personalized weight management strategies, they also raise significant privacy concerns. Unauthorized access or misuse of personal health records can lead to stigma, discrimination, or insurance disadvantages. Moreover, algorithmic fairness is a pressing issue. Studies have shown that biased training datasets may produce unequal recommendations across different demographic

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groups. Therefore, ensuring data security, informed consent, and transparency in algorithm design will be essential. Future AI systems must adopt privacy-preserving techniques such as federated learning or differential privacy, which allow effective model training without compromising individual confidentiality.

3.2. Wearable technology and accessibility

Wearable devices and mobile applications are central to AI-based obesity interventions, yet their adoption is limited by high costs and digital inequalities. Populations in low-income or rural regions often lack access to smartphones or advanced wearables, creating disparities in obesity management [10]. Additionally, some users face barriers due to low digital literacy, which reduces adherence and long-term engagement with AI tools. Future research should focus on designing affordable, user-friendly devices with intuitive interfaces. Partnerships between governments, healthcare providers, and technology companies could help subsidize costs and promote equitable access. Integrating AI-driven monitoring into public health programs may also expand its reach, particularly in underserved communities.

3.3. Integration with comorbidities

Obesity rarely exists as an isolated condition; it is frequently accompanied by comorbidities such as type 2 diabetes, hypertension, cardiovascular diseases, and metabolic syndrome. Current AI systems often target weight loss alone, failing to account for these interconnected health issues. This single-disease approach limits their clinical utility. Future AI models should adopt a holistic perspective by integrating multimorbidity management. For example, predictive algorithms could simultaneously optimize weight loss interventions and glycemic control in patients with comorbid obesity and diabetes. Multimodal data inputs—combining physiological, behavioral, and pharmacological data—would allow more precise, personalized recommendations that align with complex real-world health profiles.

3.4. Clinical validation

Despite promising pilot studies, most AI-based obesity interventions remain in the experimental or prototype stage. Large-scale randomized controlled trials (RCTs) are urgently needed to validate their effectiveness, safety, and long-term outcomes before clinical adoption. Without rigorous clinical evidence, AI solutions may be viewed as consumer wellness products rather than legitimate medical interventions. Future research must also evaluate cost-effectiveness, patient satisfaction, and real-world feasibility. Collaboration between clinicians, computer scientists, and policymakers will be crucial for translating AI innovations into practical, scalable healthcare tools. Only through clinical validation can AI interventions gain trust from healthcare providers and regulatory authorities, thereby paving the way for broader integration into obesity management programs.

4. Conclusion

This study focuses on the application of artificial intelligence (AI) in weight loss interventions for obese populations. As a critical global health challenge, obesity contributes to severe multisystem complications including type 2 diabetes, cardiovascular disease, and obesity-associated malignancies, while imposing substantial economic burdens across healthcare systems. AI technologies—including machine learning, computer vision, and natural language processing—have

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demonstrated substantial potential in addressing these challenges. Current applications include physical activity monitoring via wearable devices, dietary management through image recognition and personalized coaching, predictive analytics to anticipate weight loss outcomes, and virtual behavioral coaching for long-term lifestyle modification. Findings from this review indicate that AI provides highly personalized, adaptive, and scalable solutions, improving adherence, optimizing intervention strategies, and enhancing overall health outcomes. Through reinforcement learning and predictive modelling, interventions can be dynamically adjusted to individual progress, thereby ensuring sustained engagement and achieving maximal weight reduction. These advancements collectively demonstrate AI's transition from experimental prototypes to clinically-relevant tools with both therapeutic and public health benefits.

Despite its promise, AI-driven interventions continue to face significant limitations. Existing systems primarily fail to incorporate multimorbidity considerations, diminishing their clinical applicability. Persistent challenges including data privacy concerns, algorithmic bias, implementation expenses, and healthcare accessibility barriers further restrict broad-scale adoption. Future research should prioritize large-scale, randomized controlled trials to validate efficacy and safety, while developing privacy-preserving, user-friendly, and affordable AI solutions. Additionally, integrating multimodal health data and personalized interventions for patients with multiple chronic conditions represents a valuable direction. Ethical, equitable, and clinically validated AI frameworks will be essential for maximizing the long-term impact of AI in obesity management.

References

[1] Paul, M. M., Pradhan, S., Chettri, A., Khaling, S., & Vanak, A. T. (2025). Putting one health to the test: Operational challenges and critical reflections from the global South. One Health, 20, Article 100963. https: //doi.org/10.1016/j.onehlt.2024.100963

[2] Klein, S., Gastaldelli, A., Yki-Järvinen, H., & Scherer, P. E. (2022). Why does obesity cause diabetes? Cell Metabolism, 34(1), 11–20. https: //doi.org/10.1016/j.cmet.2021.12.012

[3] Kim, D., Lee, J., Park, R., Oh, C., & Moon, S. (2024). Association of low muscle mass and obesity with increased all-cause and cardiovascular disease mortality in US adults. Journal of Cachexia, Sarcopenia and Muscle, 15(1), 240–254. https: //doi.org/10.1002/jcsm.13397

[4] Afshin, A., Lee, A., Mokdad, A., Naghavi, M., Salama, J., Vos, T., Abate, K., Alkerwi, A., Al-Raddadi, R., Amare, A., Amberbir, A., Amegah, A., Amrock, S., Anjana, R., Arnlov, J., Asayesh, H., Banerjee, A., Barac, A., Baye, E., … Murray, C. (2017). Health Effects of Overweight and Obesity in 195 Countries over 25 Years.

[5] Chen, J.-S., Kurtz-Rossi, S., & Sørensen, K. (2022). Effect of health literacy and shared decision-making on choice of weight-loss plan among overweight or obese participants receiving a prototype artificial intelligence robot intervention facilitating weight-loss management decisions. Digital Health, 8, Article 20552076221136372. https: //doi.org/10.1177/20552076221136372

[6] Hesar, M. E., Seyedsadrkhani, N. S., Khan, D., Naghashian, A., Piekarski, M., Gall, H., Schermuly, R., Ghofrani, H. A., & Ingebrandt, S. (2023). AI-enabled epidermal electronic system to automatically monitor a prognostic parameter for hypertension with a smartphone. Biosensors & Bioelectronics, 241, Article 115693. https: //doi.org/10.1016/j.bios.2023.115693

[7] Alessia Salinari, Michele Machì, Yasmany Armas Diaz, Danila Cianciosi, Zexiu Qi, Bei Yang, Maria Soledad Ferreiro Cotorruelo, Santos Gracia Villar, Luis Alonso Dzul Lopez, Maurizio Battino, & Francesca Giampieri. (2023). The Application of Digital Technologies and Artificial Intelligence in Healthcare: An Overview on Nutrition Assessment. Diseases, 11(3), 97. https: //doi.org/10.3390/diseases11030097

[8] López-Gómez, J. J., Primo-Martín, D., Cebria, A., Izaola-Jauregui, O., Godoy, E. J., Pérez-López, P., Jiménez Sahagún, R., Ramos Bachiller, B., González Gutiérrez, J., & De Luis Román, D. A. (2024). Effectiveness of High-Protein Energy-Dense Oral Supplements on Patients with Malnutrition Using Morphofunctional Assessment with AI-Assisted Muscle Ultrasonography: A Real-World One-Arm Study. Nutrients, 16(18), 3136. https: //doi.org/10.3390/nu16183136

[9] Nino Mikava. (2024). EFFECTIVENESS OF HEALTH COACHING AI APPLICATIONS FOR NON-COMMUNICABLE DISEASES' MANAGEMENT: IMPACT ON BEHAVIOR CHANGE. Agora International

DOI: 10.54254/2753-8818/2025.LD27925

Journal of Economical Sciences, 18(2). https: //doi.org/10.15837/aijes.v18i2.6951
[10] Moon, N. W., Baker, P. M., & Goughnour, K. (2019). Designing wearable technologies for users with disabilities: Accessibility, usability, and connectivity factors. Journal of Rehabilitation and Assistive Technologies Engineering, 6, 2055668319862137. https: //doi.org/10.1177/2055668319862137