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Digital Environments and Obesity: The Role of Social Media, Marketing, and Sedentary Behaviors

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Abstract

The rising global prevalence of obesity coincides with the pervasive integration of digital technologies into daily life, necessitating a comprehensive review of how digital environments act as both determinants and potential solutions to this public health crisis. Current evidence reveals a complex, dualistic relationship where digital platforms can simultaneously exacerbate risk factors for obesity and serve as powerful tools for intervention and health promotion. This review highlights the existing literature to clarify these contradictory roles and inform the development of effective, evidence-based public health strategies for the digital age. This review examines the multifaceted interplay between digital environments and obesity, focusing on several key areas. It explores the structure and influence of the digital food environment, including how online marketing and food imagery shape consumer behavior and dietary choices. The analysis extends to the specific role of digital and social media marketing strategies in influencing dietary patterns, particularly among children and adolescents. Furthermore, the review covers the potential of digital tools for health promotion, including social media for goal setting and motivation, digital and family-based interventions for pediatric obesity, and exergames to reduce sedentary behavior. It also summarizes findings from key clinical trials evaluating digital support systems and cognitive behavioral therapy apps. Finally, the manuscript discusses the emerging influence of artificial intelligence on personalized food marketing and its implications for public health. Future research should prioritize longitudinal studies to assess the sustained impact of digital interventions and the long-term effects of exposure to digital food marketing. There is a critical need to investigate and develop ethical frameworks and regulatory policies to mitigate the risks of artificial intelligence driven marketing and promote digital environments that inherently support healthy choices. Finally, expanding research into tailored, equitable digital solutions that account for socioeconomic, cultural, and demographic disparities will be essential for maximizing the public health benefit of digital technologies in obesity prevention and management.

Keywords: Digital environments, Obesity, Social media, Digital marketing, Sedentary behavior, Digital interventions, Exergames, Artificial intelligence***Correspondence to:** Rhea Rony Mathew, St Martinus University, Willemstad, Curaçao.**Citation:** Mathew RR, Matha CP, Chandana KH (2026) Digital Environments and Obesity: The Role of Social Media, Marketing, and Sedentary Behaviors. *Obes Diabetes Res*, Volume 7:2. 138. DOI: <https://doi.org/10.47275/2692-0964-138>**Received:** June 23, 2026; **Accepted:** August 24, 2026; **Published:** August 28, 2026

Introduction

The intersection of digital environments and obesity has garnered increasing attention, particularly concerning how social media, marketing strategies, and sedentary behaviors influence health outcomes [1-6]. The current literature underscores a complex web of interactions where digital platforms serve both as tools for health promotion and as vectors for behaviors that may contribute to obesity [7-13].

One prominent theme in the literature is the influence of digital food imagery on eating behaviors. Andersen et al. [14] explores how the viewing, creating, and sharing of digital food photography can shape consumer eating patterns. Their review emphasizes that while food imagery is pervasive, its impact is nuanced; it does not solely exert negative effects but can influence healthy or unhealthy eating depending on context and individual engagement. This suggests that digital food photography acts as a double-edged sword, capable of promoting healthy choices or reinforcing obesogenic behaviors. Complementing this, Granheim et al. [15] systematically map the digital food environment, revealing how digital technology alters

the traditional food landscape across multiple dimensions such as marketing, availability, and desirability. Their findings indicate that digital platforms expand the reach and influence of food marketing, often promoting high-calorie, nutrient-poor foods, which can contribute to unhealthy dietary patterns associated with obesity. The shift in the food environment due to digitalization underscores the importance of understanding how digital marketing techniques shape consumer choices.

Indeed, digital marketing emerges as a significant factor in influencing dietary behaviors linked to obesity. Ali-Alsaadi et al. [16] investigates how firm-generated content and social media advertising impact fast-food consumption among adults in the UAE, finding a positive relationship between digital marketing engagement and increased fast-food intake. Similarly, Shamim and Islam [17] examine how digital influencer marketing affects consumer trust and impulsive buying, which can extend to food choices. Their work highlights that perceived message and media credibility foster trust in influencers, potentially leading to impulsive consumption of unhealthy foods promoted online. The role of social media in shaping health-related behaviors extends beyond marketing to include goal setting and



lifestyle aspirations. Singh and Sharma [18] analyze how obese individuals disclose weight-loss goals on social media, revealing that such online sharing can motivate healthy lifestyle behaviors. This indicates that social media can serve as a platform for positive health behavior reinforcement, although the overall impact depends on the nature of engagement and support networks.

Furthermore, digital interventions aimed at obesity prevention and treatment are gaining traction. Chai et al. [19] review family-based digital interventions for children, emphasizing that virtual delivery can improve accessibility and support healthy lifestyle changes. Similarly, Calcaterra et al. [20] focus on exergames—active video games—as tools to combat sedentarism in children and adolescents with obesity. Their review suggests that digital media, when used appropriately, can promote physical activity and counteract sedentary behaviors, which are critical factors in obesity management. Sedentary behavior, particularly in children and adolescents, is a recurring concern. Calcaterra et al. [20] advocates for integrating exergames into educational and health programs, emphasizing that digital media should supplement, not replace, physical activity. This aligns with broader discussions on how digital environments can either exacerbate or mitigate sedentary lifestyles, depending on their application.

The influence of social media extends into family and parenting contexts. Dessì et al. [21] explore how parenting styles and social media exposure affect children's dietary patterns, highlighting that parental feeding practices and digital media consumption are intertwined factors influencing obesity risk. These findings suggest that digital environments shape not only individual behaviors, but also familial dynamics related to nutrition and activity. In addition to direct behavioral influences, digital literacy plays a mediating role in online purchase intentions related to food. Kocarslan and Stoycheva [22] demonstrate that higher digital literacy can influence online shopping behaviors, with social media use serving as a mediating factor. This indicates that enhancing digital literacy could be a strategic approach to mitigate the impact of digital marketing on unhealthy food consumption.

The broader implications of digital marketing strategies are also examined through the lens of artificial intelligence and innovative marketing techniques. Ziakis and Vlachopoulou [23] review artificial intelligence applications in digital marketing, emphasizing their potential to optimize marketing strategies, which could include targeted advertising for unhealthy foods. Similarly, Antczak [24] discusses how digital and social media marketing influence consumer buying behavior, including food choices, further reinforcing the role of digital marketing in shaping dietary patterns linked to obesity. Finally, the literature recognizes the dual role of social media in health promotion and risk. Chaput and LeBlanc [25] address the challenges and opportunities of maintaining healthy lifestyle behaviors in the social media era, advocating for strategies that leverage digital platforms to support public health objectives while minimizing risks. This balanced perspective underscores the importance of designing digital environments that promote healthy behaviors and reduce sedentary tendencies.

In summary, the current research illustrates that digital environments significantly influence obesity-related behaviors through multiple pathways. Food marketing and imagery on social media can promote unhealthy eating, while digital interventions and active gaming offer promising avenues for promoting physical activity and healthy lifestyles. The role of social media in shaping family behaviors

and the importance of digital literacy further complicate this landscape. As digital platforms continue to evolve, understanding their impact on sedentary behaviors and dietary choices remains crucial for developing effective public health strategies aimed at combating obesity in the digital age.

Digital Food Environments and Their Impact on Consumption

The advent of digital technologies has profoundly transformed food environments, influencing consumer behaviors, food accessibility, marketing strategies, and sustainability practices [26-30]. This section offers insights from recent literature to state how digital food environments shape consumption patterns and their broader implications.

Mapping the digital food environment

Granheim et al. [15] provides a comprehensive mapping of the digital food environment, employing a systematic scoping review to analyze how eight dimensions—availability, prices, vendor and product properties, marketing and regulation, accessibility, affordability, convenience, and desirability—are evolving within a digital society. Their analysis, covering studies from 2000 to 2019, reveals a significant shift in these dimensions driven by digital technology integration. The proliferation of online platforms has altered traditional food availability and accessibility, making a wider array of food options more reachable to consumers. The study underscores that digital environments facilitate increased marketing and influence consumer perceptions, which can either promote healthy choices or contribute to the consumption of unhealthy foods.

Emerging technologies and food system transformation

The role of emerging digital technologies in reshaping food systems is highlighted [31], who identify key innovations poised to impact the UK food system over the next decade. These include digital platforms, big data analytics, and blockchain, which are expected to enhance food safety, traceability, and efficiency. Similarly, Hassoun et al. [32] discussed Industry 4.0 technologies such as artificial intelligence, internet of things, and digital twins, emphasizing their capacity to optimize food production, improving supply chain management, and addressing challenges related to food security. These technological advances are integral to creating more responsive and sustainable digital food environments, influencing consumer access and choices.

Digital food marketing and consumer behavior

The influence of digital marketing on food consumption, especially among vulnerable populations like children and adolescents, is examined by Valero-Morales et al. [33] and Lafontaine et al. [34]. Valero-Morales et al. [33] reveal that social media platforms are heavily utilized for marketing unhealthy food and beverage products, often employing techniques that appeal to youth, such as trending hashtags and influencer endorsements. This targeted marketing can significantly shape dietary preferences and consumption patterns, potentially contributing to unhealthy diets. Lafontaine et al. [34] extends this understanding by exploring how social media acts as a commercial determinant of health, particularly affecting children and adolescents. Their review indicates that social media's pervasive marketing strategies can influence health outcomes by promoting less nutritious foods.

Further emphasizing the role of digital influencers, Briana and Malindretos [35] investigate how influencer-driven e-commerce



affects generation Z's superfood consumption behaviors. Their findings suggest that influence in marketing fosters trust and engagement among young consumers, significantly impacting their purchasing decisions. This dynamic underscore the importance of understanding influencer strategies within digital food environments, as they can either promote healthy eating or contribute to the consumption of less nutritious options depending on the nature of the content.

Consumer attitudes and sustainable consumption

The intersection of digital food environments and sustainable consumption is explored by Alagarsamy et al. [36], who focuses on green consumption values and behaviors among environmentally conscious youth in Bangalore. Their study highlights that consumer attitudes towards sustainable food logistics practices are mediated by perceptions of environmental impact and food safety concerns. Digital platforms serve as critical channels for disseminating information about sustainable practices, thereby influencing consumer purchase intentions. Similarly, Çelik et al. [37] examine how food literacy and sustainable consumption behaviors, facilitated through digital environments like social media, impact nutritional status during the COVID-19 pandemic in Turkey. Their findings suggest that digital literacy and awareness campaigns can promote healthier and more sustainable dietary choices.

Bennett et al. [38] conduct a systematic scoping review to assess how the digital food retail environment influences population diets and health. They find that digital platforms, including apps and websites, are increasingly used for food purchasing, which can lead to both positive and negative health outcomes depending on the availability and promotion of healthy versus unhealthy foods. Widodo et al. [39] further explore consumer perceptions of online takeaway packaging, emphasizing that education influences how individuals perceive environmental risks associated with digital food purchases. These insights suggest that digital retail environments are pivotal in shaping dietary behaviors and environmental consciousness. The role of digital technologies in addressing food loss and waste is discussed by Kusolchoo and Ueasangkomsate [40], who highlighted the use of internet of things, blockchain, and radio frequency identification to track food throughout the supply chain, thereby reducing waste and enhancing transparency. These innovations demonstrate how digital environments can promote sustainability by optimizing resource use and minimizing food loss. Similarly, Kilemile et al. [41] review sustainable approaches to reducing food loss and waste, emphasizing the importance of integrating digital solutions within broader socio-political frameworks to achieve meaningful impact.

The COVID-19 pandemic has accelerated digital transformation in food environments, as documented by Johnsen et al. [42]. Their qualitative studies in India reveal that pandemic-related disruptions prompted increased reliance on digital platforms for food access, which both challenged and created opportunities for resilient food systems. The pandemic underscored the importance of digital environments in maintaining food security and influencing consumption patterns during crises.

In summary, the literature underscores that digital food environments are reshaping how consumers access, perceive, and choose foods. Technologies such as digital marketing, e-commerce platforms, and supply chain innovations influence dietary behaviors, often with significant implications for health and sustainability. While digital environments can promote healthier and more sustainable choices through increased information dissemination and transparency, they also pose risks related to unhealthy marketing and environmental impacts. As digital technologies continue to evolve, their integration into food systems will remain a critical area for research and policy intervention to foster healthier, more sustainable consumption patterns.

The Role of Digital Marketing in Shaping Dietary Behaviors

The advent of digital marketing has significantly transformed consumer behaviors across various sectors, including dietary choices. The influence of digital marketing on dietary behaviors is multifaceted, involving elements such as social media content, influencer strategies, personalized advertising, and cultural considerations [43-48]. The literature underscores that digital marketing strategies are not only reshaping how consumers access information but also how they form perceptions and make food-related decisions (Table 1).

One prominent aspect highlighted in the literature is the role of social media content in shaping dietary behaviors. Sutia and Fahlevi [49] emphasize that social media advertising content and sales promotion content significantly impact brand image and consumer behavior, particularly within the context of container food courts in Indonesia. Their findings suggest that engaging and targeted social media content can influence consumer preferences and purchasing patterns, which extends to dietary choices. Similarly, Wang [50] discusses how cultural differences, such as individualism and collectivism, influence online shopping preferences and engagement, implying that culturally tailored digital marketing can effectively shape dietary behaviors in cross-cultural contexts. Influencer marketing emerges as a critical

Table 1: Key mechanisms and evidence in digital marketing influences dietary behaviors.

Mechanism/focus area	Key findings	Population/context
Social media content and brand influence [49]	Engaging social media content (ads, promotions) significantly shapes brand perception and consumer food choices	Container food courts in Indonesia
Influencer marketing and trust [16, 51]	Influencer credibility, content quality, and perceived authenticity drive consumer trust and impulsive food purchasing	UAE adults; general influencer audiences
Marketing for children [52]	Use of cartoons, colors, and playful fonts in digital ads influences children's food preferences and consumption	Children and adolescents
User-generated content and peer influence [53]	Authentic peer reviews and relatable content increase trust and impact Millennials' food purchase decisions	Millennial consumers
Personalization and behavioral tracking [55]	Cookies, sensors, and artificial intelligence enable personalized and delivery, reinforcing dietary habits or introducing new choices	General online consumers
Health and sustainability messaging [56]	Eco-branding and health-conscious campaigns can promote sustainable and nutritious food choices	Environmentally conscious consumers
Cultural and demographic tailoring [50]	Cultural values (individualism/collectivism) and demographics shape receptivity to digital food marketing	Cross-cultural consumer groups
Integrated digital strategies [57]	Interactive content, real-time engagement, and immersive experiences enhance dietary behavior influence	Broader digital marketing audiences



strategy within digital marketing that affects dietary behaviors. Fating and Pusadkar [51] explore how credibility, content quality, and engagement strategies influence consumer trust and brand perception. Their findings indicate that authentic and relatable influencers tend to be more effective in shaping consumer preferences, including food choices. Ali-Alsaadi et al. [16] further support this by demonstrating that firm-generated content and social media advertising influence fast-food consumption patterns among adults in the UAE. The credibility of influencers and the perceived authenticity of their content are crucial in driving dietary behaviors, especially when influencers are seen as trustworthy sources of information.

The impact of digital marketing on children's dietary behaviors is particularly concerning and well-documented. Valderrama et al. [52] examine how digital food marketing appeals to children, noting that elements such as cartoons, bold colors, and playful fonts are designed to attract young audiences. Their research indicates that these marketing tactics can influence children's food preferences and consumption patterns, raising questions about the ethical implications of digital marketing targeted at vulnerable populations. This aligns with broader concerns about how digital marketing strategies can promote unhealthy dietary choices among children, potentially leading to long-term health implications. The role of user-generated content and peer influence in shaping dietary behaviors is also significant. Kohli and Gupta [53] analyze how trust and authenticity in influencer marketing and user-generated content impact Millennials' purchase decisions. Their research suggests that consumers are more likely to be influenced by content that appears genuine and relatable, which can include food-related posts and reviews. This phenomenon is reinforced by the findings of Ali et al. [54], who highlight that social media influencers play a transformative role in shaping consumer perceptions and purchase intentions related to food products.

Personalization and behavioral tracking are other mechanisms through which digital marketing influences dietary behaviors. Wadhwa and Bachwani [55] describe how behavioral tracking through cookies, sensors, and algorithms enables businesses to create personalized experiences. Such targeted advertising can reinforce existing dietary preferences or introduce new food choices by delivering tailored messages based on individual browsing and purchasing histories. This level of personalization enhances the persuasive power of digital marketing, making it a potent tool for influencing dietary behaviors. Furthermore, the literature indicates that digital marketing strategies are increasingly integrated with broader themes such as health consciousness and sustainability. Kulikova and Kondratenko [56] explore eco-branding and its influence on consumer behavior, suggesting that environmentally conscious marketing can promote sustainable dietary choices. While their focus is on ecological products, the principles are applicable to health-oriented food marketing, where digital campaigns can emphasize nutritional benefits or environmental impacts to sway consumer preferences.

The effectiveness of digital marketing in shaping dietary behaviors is also contingent upon the technological capabilities and strategic approaches employed by firms. Kabir et al. [57] provides a comprehensive review of digital marketing strategies, emphasizing the importance of interactive and immersive experiences that foster consumer engagement. Their insights suggest that dynamic content, influencer collaborations, and real-time interactions are essential in influencing dietary choices effectively. Cultural and demographic factors further modulate the impact of digital marketing on dietary behaviors. Wang [50] highlight that cultural differences and

demographic characteristics such as age, social media use patterns, and health literacy influence how digital marketing messages are received and acted upon. For instance, younger populations may be more susceptible to influencer marketing and user-generated content, while older consumers might respond better to personalized content emphasizing health benefits.

In summary, the literature collectively underscores that digital marketing plays a pivotal role in shaping dietary behaviors through various mechanisms, including social media content, influencer strategies, behavioral personalization, and cultural tailoring. The persuasive power of digital platforms, combined with the strategic use of credible influencers and targeted advertising, can significantly influence consumer food choices, often promoting both healthy and unhealthy dietary patterns. As digital marketing continues to evolve, understanding its impact on dietary behaviors remains crucial for developing ethical, effective, and culturally sensitive marketing strategies that promote healthier eating habits and sustainable consumption.

Social Media, Goal Disclosure, and Health Motivation

The rising prevalence of obesity and sedentary lifestyles has prompted extensive research into digital interventions aimed at promoting healthier behaviors. Among these, social media platforms have emerged as influential tools for fostering dietary motivation and encouraging physical activity, especially through mechanisms such as goal disclosure. This section overviews findings from recent studies to elucidate how social media, combined with goal-setting strategies, impacts dietary behaviors and sedentary habits, ultimately contributing to obesity prevention and management.

Digital interventions have been recognized for their potential to modify negative behaviors associated with sedentary lifestyles. Chatterjee et al. [58] conducted a comprehensive meta-analysis highlighting the effectiveness of various digital approaches in monitoring and preventing physical inactivity, unhealthy habits, and improper diets. Their findings suggest that digital tools, including social media, can serve as effective platforms for behavior change by providing real-time feedback, social support, and motivation. Further emphasizes the role of social media interventions in promoting positive nutrition behaviors. The review indicates that social media's interactive nature facilitates engagement and peer support, which are critical for sustaining dietary motivation [58].

The psychological dimensions of obesity, including mental health issues such as low self-esteem, depression, and anxiety, are also addressed in the literature [59]. These psychological factors can influence an individual's motivation to adopt healthier behaviors. Social media, with its capacity for community building and social comparison, can either exacerbate or alleviate these issues depending on how it is utilized. For instance, positive reinforcement and goal disclosure within social media groups may bolster self-efficacy and motivation, whereas exposure to stigmatizing content can have adverse effects [60]. Behavior modification theories underpin many digital intervention strategies. The health action process approach, for example, emphasizes the importance of intention and planning in behavior change [61]. Digital platforms can facilitate this process by enabling users to set, disclose, and share their goals publicly or within private groups. Such goal disclosure can enhance accountability and commitment, which are vital for maintaining dietary and activity-related behaviors. Moreover, social media's capacity to provide immediate feedback and social reinforcement aligns with behavior



change models that highlight the importance of social support and self-efficacy [58].

Social isolation, a factor linked to maladaptive eating behaviors and obesity, is another area where social media can exert influence. A recent cross-sectional study explores how perceived social isolation affects brain reactivity to food cues and subsequent eating behaviors [62]. The findings suggest that social media can serve as a virtual social environment that mitigates feelings of isolation, thereby potentially reducing maladaptive eating patterns. By fostering social connections and shared goals, social media platforms may help individuals develop healthier dietary habits and reduce sedentary behaviors. Goal disclosure on social media platforms has been identified as a key mechanism for enhancing motivation. When individuals publicly share their dietary goals, they often experience increased accountability and social support, which can reinforce their commitment to change [58]. This phenomenon aligns with the concept that social accountability enhances motivation, especially when combined with tailored feedback and encouragement from online communities. Furthermore, motivational interviewing and brief action planning, as discussed in recent clinical practice guidelines, can be adapted to digital environments to support goal setting and disclosure [63]. These approaches emphasize interpersonal communication skills that can be integrated into social media interventions to improve adherence to healthy behaviors. In clinical and community settings, strategies for promoting healthy lifestyles increasingly incorporate digital tools, including social media, to facilitate behavior assessment, goal measurement, and motivation [64]. These strategies recognize that food choices and physical activity are influenced by a complex interplay of social, psychological, and environmental factors. Digital platforms offer scalable solutions for delivering personalized interventions, fostering social support, and encouraging goal disclosure, all of which are critical for addressing obesity and sedentary behaviors.

In summary, the integration of social media, goal disclosure, and dietary motivation presents a promising avenue for tackling obesity and sedentary lifestyles. The literature underscores that social media's interactive and social nature can enhance motivation, accountability, and social support, which are essential for sustained behavior change. When combined with evidence-based behavior modification models and tailored interventions, these digital tools can effectively promote healthier dietary and physical activity behaviors, ultimately

contributing to obesity prevention and management. Future research should continue to explore how these digital strategies can be optimized to maximize engagement and long-term health outcomes.

Digital Interventions for Obesity Prevention in Children and Adolescents

The landscape of digital interventions for obesity prevention in children and adolescents has garnered increasing attention in recent years, reflecting the urgent need to address the rising prevalence of pediatric obesity through innovative, accessible, and scalable strategies. The current literature underscores a multifaceted approach that integrates mobile health, exergames, family-based digital programs, and other technological tools, highlighting their potential to complement traditional interventions and improve health outcomes in this vulnerable population (Table 2). Reddy et al. [65] provide a comprehensive overview of mobile health interventions targeting childhood and adolescent obesity in diverse settings, notably in Sub-Saharan Africa and Europe. Their analysis emphasizes the potential of mobile technologies to reach populations in low- and middle-income countries and high-income regions, suggesting that digital interventions can be tailored to various socio-economic contexts. The authors advocate for future research to explore the efficacy and scalability of these interventions, considering the unique challenges faced in different regions.

Exergames have emerged as a promising digital modality, with Valeriani et al. [66] systematically reviewing their role in weight management among overweight and obese youth. Their review of ten studies indicates that exergames can positively influence weight-related outcomes, primarily by increasing physical activity levels in a fun and engaging manner. The authors note that while exergames show promise, further high-quality research is needed to establish standardized protocols and long-term effectiveness. Family-based digital interventions also constitute a significant area of interest. Chai et al. [19] conducted a rapid review focusing on virtual delivery of obesity prevention and treatment programs involving families. Their findings suggest that digital platforms can effectively support children and families in adopting healthier lifestyles, with the added benefit of increased accessibility and convenience. The review underscores the importance of involving family members to enhance motivation and adherence to behavioral changes.

Table 2: Overview of digital intervention types and evidence for pediatric obesity prevention.

Intervention type	Core components/approach	Key outcomes
Mobile health programs [65]	SMS reminders, app-based tracking, behavioral prompts, virtual coaching	Improved accessibility, engagement, and tailored support in diverse settings (e.g., Sub-Saharan Africa, Europe)
Exergames [66]	Active video games require physical movement (e.g., dance, sports simulations)	Increased physical activity levels; positive effects on weight-related outcomes in overweight youth
Family-based digital interventions [19]	Virtual delivery of nutrition education, activity planning, and family goal setting	Enhanced family involvement, motivation, and adherence to healthy lifestyle changes
Multicomponent behavioral and nutritional apps [67]	Integration of dietary monitoring, activity logging, and behavioral counseling	Considered gold standard; supports medical nutrition therapy and sustained behavior change
Digital tools within school-based programs [73]	Online modules, gamified learning, digital monitoring integrated into school curricula	Addresses psychosocial well-being; indirect positive impact on obesity-related behaviors
Digital health behavior trials (early prevention) [71]	Apps for parent education, growth tracking, feeding guidance from infancy	Effective in preventing excessive weight gain in early childhood
Gut microbiome-focused digital monitoring [74]	Apps tracking diet, symptoms, and supplement use (pre/probiotics) for metabolic health	Emerging potential for personalized microbiome-targeted obesity management in adolescents
Digital platforms with clinical integration [68]	Web interfaces for clinician-family communication, data sharing, personalized feedback	Enhance treatment adherence and weight outcomes in clinical care settings
Socioeconomically tailored digital approaches [75]	Low-cost, accessible app features designed for low-income families	Aims to reduce disparities in obesity outcomes; highlights need for equitable design
Digital motivation and attitude modifiers [76]	Gamification, social comparison features, reward systems within apps	Improves health attitudes, self-efficacy, and sustained engagement in youth



In addition to intervention modalities, the literature highlights the importance of behavioral and nutritional components. Hassapidou et al. [67] and the European Association for the Study of Obesity position statement emphasize that multicomponent behavioral interventions, including medical nutrition therapy, are considered the gold standard for managing pediatric obesity. These interventions often incorporate digital tools to facilitate dietary monitoring, physical activity tracking, and behavioral counseling, thereby enhancing engagement and personalization. The role of digital interventions in broader public health strategies is also recognized. Wickramasinghe et al. [68] discuss the WHO European Regional Obesity Report, which highlights the impact of digital marketing and obesogenic environments on children. The report advocates for managing digital influences and leveraging digital technologies to promote healthier behaviors across the course of life.

Research into exploring the behavioral determinants of obesity further supports the integration of digital tools. Mahumud et al. [69] identify lifestyle factors such as dietary intake, physical activity, and sedentary behaviors as key contributors to obesity among adolescents globally. Digital interventions targeting these behaviors—through apps, online programs, or social media—offer scalable solutions to modify risk factors. Similarly, Wang et al. [70] provide a bibliometric analysis indicating a growing research interest in eating behaviors and their digital modulation, emphasizing the importance of understanding behavioral influences to design effective interventions. The effectiveness of digital interventions extends beyond behavioral modification. Heerman et al. [71] report on Greenlight Plus randomized trial, which demonstrated that digital health behavior interventions can effectively prevent childhood obesity when implemented early. Their findings support the integration of digital tools into pediatric care settings to promote healthy weight trajectories.

Moreover, the interaction of digital components with counseling and behavioral strategies has been systematically evaluated. Kassim et al. [72] analyze various digital components and interaction types in counseling interventions, concluding that digital engagement can enhance the effectiveness of traditional behavioral therapies. Their review underscores the importance of designing interactive and user-friendly digital platforms to maximize engagement and outcomes. The potential of digital technologies extends to addressing mental health and psychosocial factors associated with obesity. Yu et al. [73] highlight that school-based interventions, many of which incorporate digital components, constitute a significant portion of mental health support strategies for children and adolescents. These interventions can indirectly influence obesity outcomes by improving psychosocial well-being, which is often linked to health behaviors.

Emerging research also explores the gut microbiota's role in obesity and the potential of digital tools to support microbiome-targeted therapies. Luzzi et al. [74] discuss the use of prebiotics, probiotics, symbiotic, and postbiotics, noting that digital monitoring could facilitate personalized approaches to managing metabolic syndrome in adolescents with obesity. Finally, the intersection of socioeconomic factors, cognitive development, and obesity is gaining attention. Tomasi and Volkow [75] demonstrate that childhood obesity's impact on cognition and brain connectivity is exacerbated by low family income, suggesting that digital interventions should consider socioeconomic disparities to be effective and equitable. Wąsacz et al. [76] further emphasize that digital technologies can influence motivation and health attitudes, which are crucial for sustained behavioral change in children and adolescents.

In summary, the current literature affirms that digital interventions hold significant promise for obesity prevention in children and adolescents. They offer scalable, engaging, and personalized approaches that can complement traditional behavioral and nutritional strategies. However, the effectiveness of these interventions depends on careful design, cultural adaptation, and integration into broader health systems. Future research should focus on long-term outcomes, equitable access, and the optimization of digital components to maximize their impact on pediatric obesity prevention and management.

Clinical Studies

Digital environments have emerged as a promising avenue for addressing obesity, offering innovative strategies for weight management and lifestyle modification. Clinical studies have explored various digital interventions, including mobile applications, virtual environments, and automated digital health solutions, to enhance patient engagement and adherence to treatment plans. These technologies aim to make obesity treatment more accessible and effective by integrating personalized advice, cognitive-behavioral assessments, and real-time feedback.

A digital support system (NCT04323215) by Hagman et al. [77], combined with personalized weight-loss targets and daily weight measurements shared between families and clinics, proved more effective than standard care for childhood obesity treatment (Figure 1). The mean change in body mass index Z-score for the digital support group was -0.30 ± 0.39 units, which was significantly better than the standard care group's -0.15 ± 0.28 units over one year ($p = 0.0002$). This represents a relative weight loss that was twice as large in the digital support group. The digital support system's effect size on body mass index Z-score reduction was -0.16 units, which was statistically significant ($p < 0.0001$) when adjusted for sex, age, and degree of obesity at treatment initiation. After 1 year, 45.8% of patients using digital support achieved a clinically relevant weight loss (defined as a decrease of at least 0.25 body mass index Z-score units), compared to 30.5% in the standard care group ($p = 0.004$). The success rate, defined as either obesity remission or a decrease of at least 0.25 body mass index Z-score units, was 46.7% for the digital support group versus 35.5% for standard care ($p = 0.039$). Obesity remission was achieved by 25.2% of the digital support group, compared to 17.8% in the standard care group, though this difference was not statistically significant ($p = 0.09$). The digital support system showed superior treatment effects across both sexes (males and females) and all age groups (young children and adolescents). While the study was not powered for sub-analyses, findings suggested that digital support might be more beneficial in certain groups. Adolescents, for instance, showed 2.7 times better outcomes with digital support. Patients who had not received previous obesity treatment showed a greater decrease in body mass index Z-score with digital support (-0.35 ± 0.45 vs -0.20 ± 0.23 , $p = 0.03$). The attrition rate for the digital support group was 36.4%, which was lower than the standard care group's 46.1%, though this difference was not statistically significant ($p = 0.081$). Individuals in the older age range were more likely to lose to follow-up in the intervention group ($p = 0.015$). The mobile health support system, named Evira, utilized a custom-made body scale that transferred daily weight measurements via bluetooth to a mobile application. This application calculated and graphically presented body mass index Z-scores against an individualized weight loss target curve. An automatic data transfer to a web-based clinic interface allowed for close monitoring and frequent written communication between clinical staff and families. The average frequency of daily weight measurements was highest at the beginning

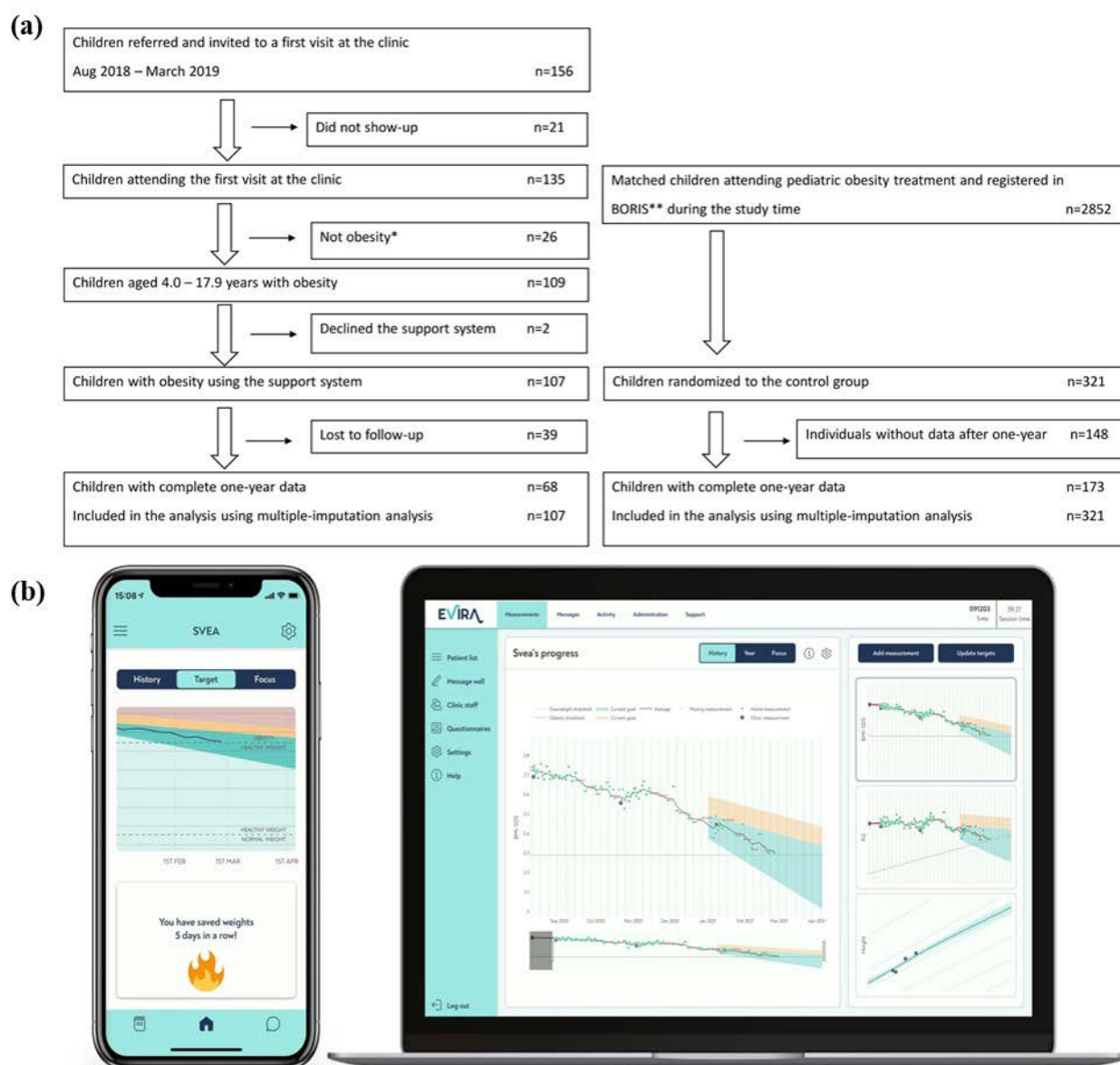


Figure 1: (a) Participant flow diagram for the digitally supported and standard care groups. (b) Schematic of the digital intervention system [77].

of treatment, with more than five measurements per person per week during the first month, stabilizing at 3.7 ± 2.2 measurements per person per week for the remainder of the year. No harm, such as depression or eating disorders, was reported from the treatment.

A study by Hu et al. [78] demonstrates that a significant portion of users of the digital Foodsmart platform achieved weight loss, with specific baseline characteristics and engagement metrics, such as improved diet quality and longer enrolment, being strong predictors of successful weight reduction (Figure 2). Over a median enrolment period of 9.9 months (interquartile range: 0.03 to 54.7 months), 59% of participants experienced weight loss. Among participants who utilized the Foodsmart platform for at least 24 months, 33.3% successfully achieved a 5% weight loss. A fully adjusted logistic regression model identified several factors significantly associated with higher odds of achieving at least 5% weight loss. For every unit increase in baseline body mass index, there was 2% higher odds of achieving 5% weight

loss (Odds ratio (OR) 1.02, 95% confidence interval (CI) 1.02 to 1.03; $p < 0.001$). A higher baseline healthy diet score was associated with 6% higher odds of achieving 5% weight loss (OR 1.06, 95% CI 1.05 to 1.08; $p < 0.001$). A greater improvement in healthy diet score was linked to 12% higher odds of achieving 5% weight loss (OR 1.12, 95% CI 1.11 to 1.14; $p < 0.001$). A longer duration of enrolment in the platform was associated with 28% higher odds of achieving 5% weight loss (OR 1.28, 95% CI 1.23 to 1.32; $p < 0.001$).

A study (NCT03465306) by Kim et al. [79] described in the CONSORT-EHEALTH submission form focused on evaluating a digital cognitive behavioral therapy intervention for obesity (Figure 3). The app/intervention was deemed effective, with all primary outcomes showing significantly better results in the intervention group compared to the control group. The primary outcome measured was the change in body weight. Secondary outcomes included changes in body mass index and body fat mass, as well as psychological and physiological indices.

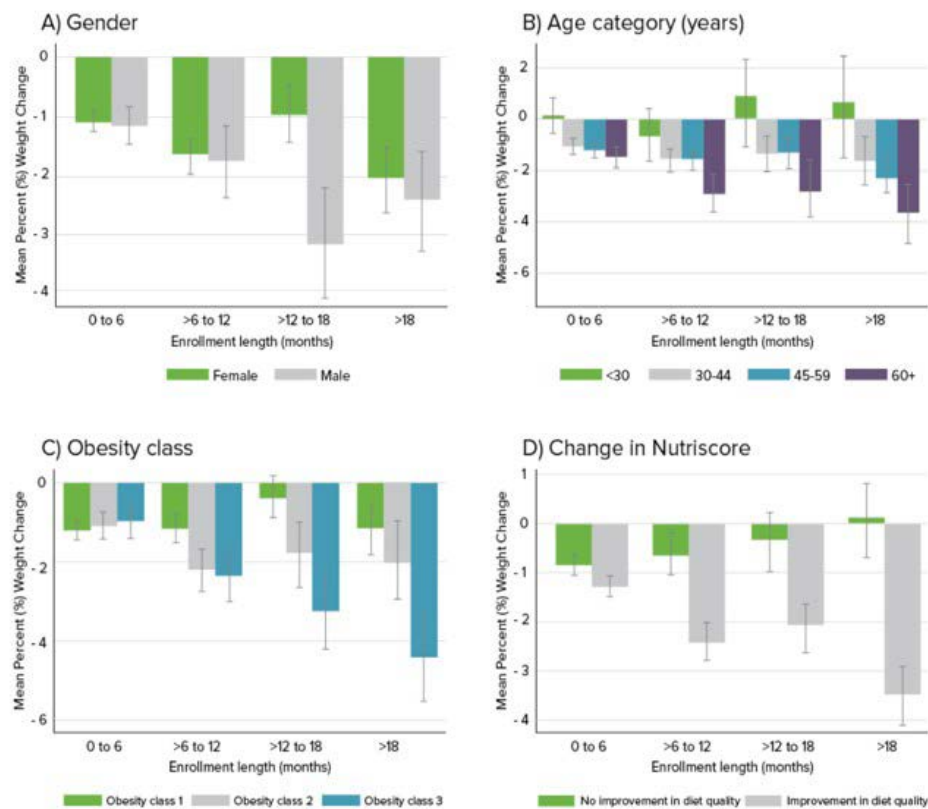


Figure 2: The mean percent weight change, presented with standard deviation, is broken down by duration of enrolment and further stratified by (A) gender, (B) age group, (C) initial obesity classification, and (D) the change in healthy diet score [78].

The study successfully demonstrated the efficacy of a multi-factorial and daily personalized cognitive behavioral therapy model delivered via a digital platform for managing body weight, body mass index, and body fat mass, noting a 'legacy effect' even after the intervention concluded. Participants had a mean age of 21.8 ($\pm$ 3.3) years and a mean body mass index of 28.0 ($\pm$ 3.2). Adherence: approximately 81 to 90% of users continued using the app as recommended after 3 months. Forty-five participants in the experimental (digital cognitive behavioral therapy) group received therapist intervention through a digital healthcare service, providing daily feedback and assignments for 8 weeks. Twenty-five participants in the control group also used the digital healthcare service but engaged in self-care without therapist intervention. Two participants withdrew, 9 did not attend the 8-week post-assessment, and 3 did not attend the 24-week follow-up due to personal reasons or unresponsiveness. A potential limitation noted was the underestimation of food calories in the app, possibly due to imprecise amounts per serving for diverse food types and potential miscalculation by users.

Exergames as Tools to Combat Sedentary Lifestyles

Exergames, which are digital games requiring physical movement, have emerged as a promising tool to combat sedentary lifestyles and obesity [80-83]. These games encourage physical activity by integrating exercise with interactive gaming, making them an engaging alternative to traditional exercise, especially for children and adolescents. Research indicates that exergames can positively impact body composition, increase physical activity levels, and reduce sedentary behavior, thus offering a potential strategy for addressing obesity and promoting healthier lifestyles.

In a study with office workers, a 1-month exergaming intervention improved blood glucose levels and strength, although no significant changes in weight or body composition were observed [84]. Exergames have been found to increase energy expenditure and physical activity levels, achieving moderate intensity physical activity, which is beneficial for combating obesity and other health issues [85]. Exergames not only promote physical health but also offer psychological benefits by providing a fun and engaging way to exercise, which can enhance motivation and adherence to physical activity routines [20]. Despite the positive outcomes, there are limitations to the effectiveness of exergames. Some studies have shown mixed results regarding their impact on body composition and physical activity levels, suggesting that while exergames increase energy expenditure, they may not always lead to significant weight loss or changes in body composition [86]. The sustainability of the effects of exergames over the long term remains uncertain, and there is a need for more high-quality research to determine their efficacy as a long-term solution for obesity prevention and treatment [87].

In summary, exergames present a novel approach to increasing physical activity and combating obesity, it is important to consider them as part of a broader strategy that includes traditional physical activities and dietary changes. The integration of exergames into school and public health programs could enhance their effectiveness, but they should not replace conventional exercise. Additionally, the potential for compensatory behaviors, such as increased food intake following exergaming, should be addressed to ensure a balanced approach to weight management and health improvement.

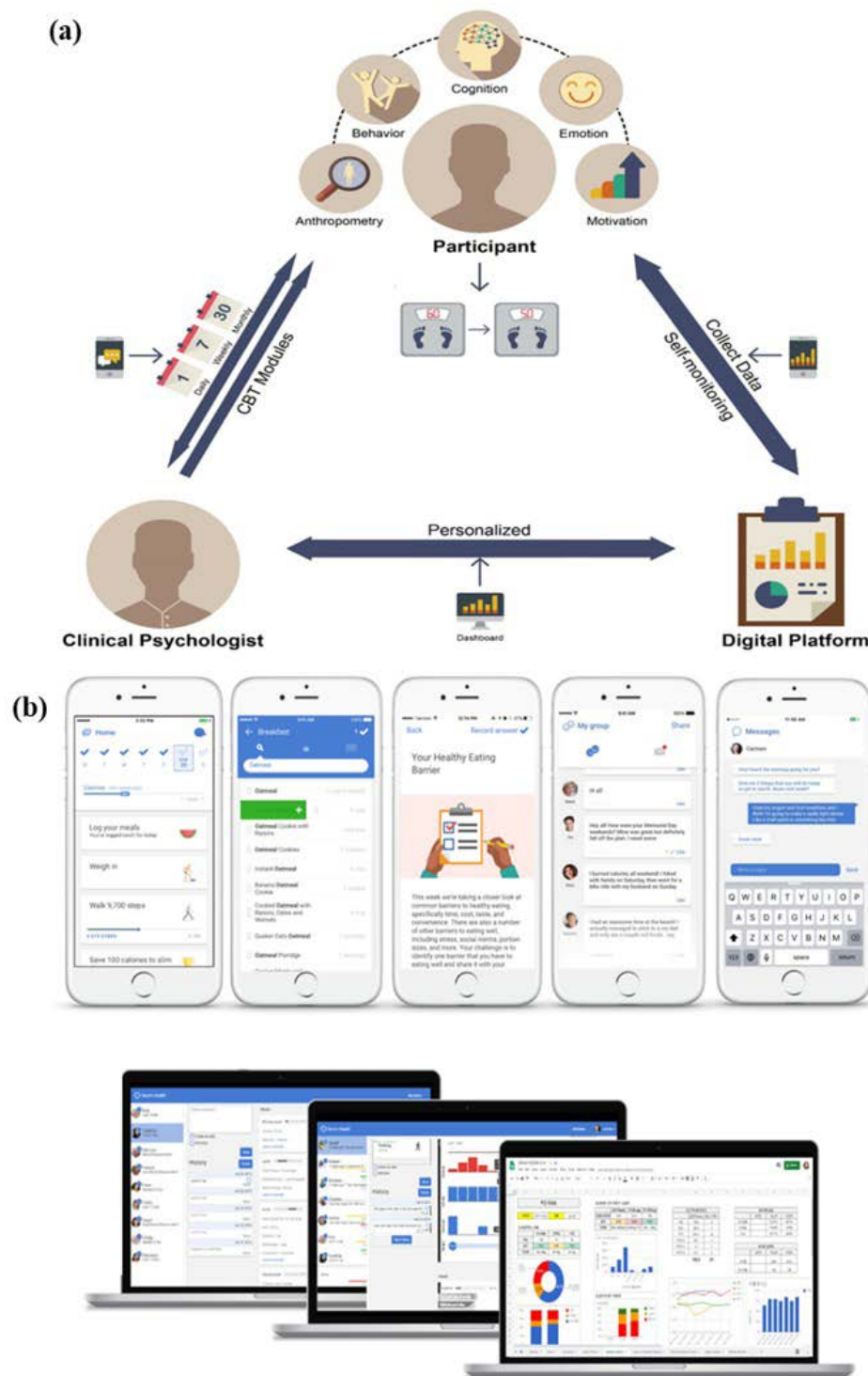


Figure 3: (a) The digital cognitive behavioral therapy process flow diagram. (b) Screen displays of the participant-facing mobile application (top) and the therapist-facing dashboard (bottom) [79].

Artificial Intelligence and Advanced Marketing Strategies in the Digital Food Landscape

Artificial intelligence is significantly transforming marketing strategies within the digital food landscape, offering advanced tools for personalized consumer engagement and predictive analytics [88-90].

These artificial intelligence driven strategies are reshaping how food products are marketed, with implications for consumer behavior and public health, particularly concerning obesity. Artificial intelligence's ability to analyze vast amounts of data allows for highly personalized marketing campaigns, which can influence consumer choices and potentially contribute to unhealthy eating habits. This intersection



of artificial intelligence, marketing, and obesity presents both opportunities and challenges for the food industry and public health initiatives.

Artificial intelligence enables food marketers to create personalized recommendations by analyzing consumer data, such as purchase histories and browsing behaviors. This personalization enhances customer satisfaction and engagement by aligning marketing efforts with individual preferences [91, 92]. Artificial intelligence tools predict consumer needs and trends, allowing marketers to optimize campaigns and product offerings. This predictive capability helps in anticipating market demands and adjusting strategies accordingly [91, 93]. Artificial intelligence is used to enhance influencer marketing by identifying and targeting specific audience segments. This approach leverages digital influencers to create authentic connections with consumers, fostering brand loyalty and engagement [94].

Artificial intelligence driven marketing strategies can influence consumer behavior by promoting energy-dense and sugary foods, contributing to obesity. The targeted nature of these campaigns, especially towards vulnerable groups like children and ethnic minorities, raises concerns about their role in the obesity epidemic [95]. Artificial intelligence also offers potential in obesity prevention through personalized health recommendations and interventions. Artificial intelligence models can predict obesity risk factors and tailor interventions to individual needs, supporting healthier lifestyle choices [96].

The use of artificial intelligence in marketing raises ethical concerns, particularly regarding consumer privacy and data security. As artificial intelligence systems collect and analyze personal data, ensuring transparency and building consumer trust are critical challenges [94]. The aggressive marketing of unhealthy food products through digital platforms necessitates regulatory oversight. Policies aimed at restricting such marketing practices could mitigate their impact on public health, particularly among children and adolescents [95].

In summary, while artificial intelligence driven marketing strategies offer significant advantages in terms of personalization and efficiency, they also pose challenges related to consumer health and ethical considerations. The potential for artificial intelligence to contribute to obesity through targeted marketing highlights the need for balanced approaches that leverage artificial intelligence's capabilities while safeguarding public health. Addressing these challenges requires collaboration between marketers, policymakers, and public health professionals to ensure that artificial intelligence technologies are used responsibly and effectively in the digital food landscape.

Conclusion

This review underscores the profoundly dualistic role of digital environments in the context of obesity. On one hand, platforms like social media and digital marketing can act as potent drivers of obesogenic behaviors by normalizing the consumption of unhealthy foods, promoting sedentary lifestyles, and employing sophisticated, personalized advertising techniques that target vulnerable populations. On the other hand, these same technologies offer innovative solutions, demonstrating efficacy as tools for weight management through digital support systems, cognitive behavioral therapy apps, family-based interventions, and engaging exergames that increase physical activity. The evidence presented reveals that the net impact on individual and public health is not inherent to the technology itself but is determined by its design, application, and context of its use. Therefore, navigating

the digital landscape requires a nuanced understanding of these competing pathways to harness its potential for health promotion while actively mitigating its risks.

Moving forward, research must transition from documenting associations to establishing causality and long-term efficacy. Priority should be given to robust, longitudinal studies that evaluate the sustained impact of digital interventions on weight trajectories and health outcomes, as well as the cumulative effects of chronic exposure to digital food marketing. Furthermore, the ethical and regulatory dimensions of this digital ecosystem demand urgent attention. Future work must focus on developing and testing effective policy frameworks—such as restrictions on marketing unhealthy foods to children online—and ethical guidelines for the use of artificial intelligence in consumer targeting to safeguard public health. Finally, to ensure equitable benefits, a critical avenue for future investigation involves co-designing and evaluating culturally adapted, accessible, and low-cost digital health solutions. These initiatives must specifically address the needs of underserved communities and consider how socioeconomic factors modulate both digital exposure and intervention effectiveness, thereby working to prevent the widening of existing health disparities in the digital age.

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None.

Conflict of Interest

None.

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