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Use of digital tools in nutritional management in pediatrics and adolescent medicine

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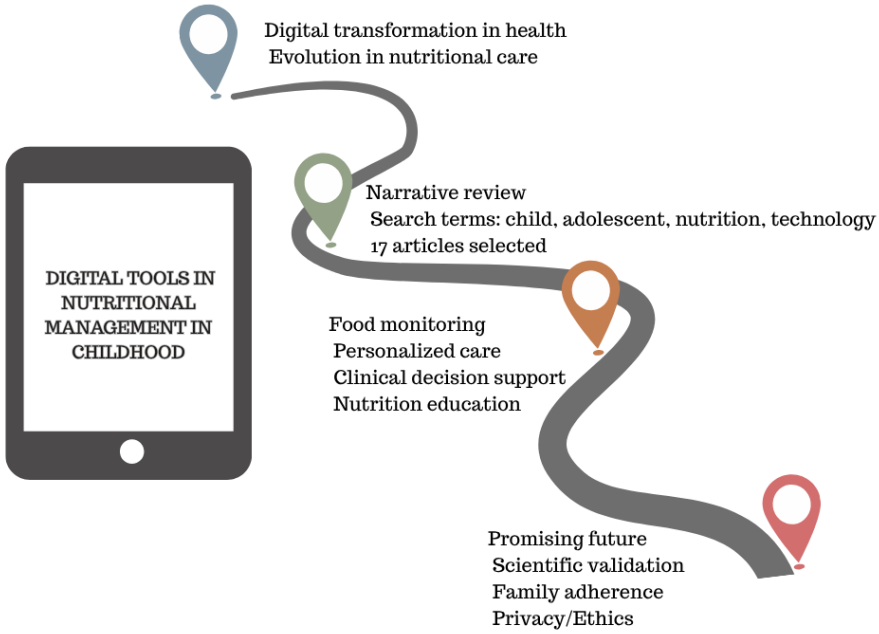
Graphical Abstract



Highlights

- *AI supports child nutrition with a focus on health, obesity, and breastfeeding.*
- *Currently, AI use is centered on parental monitoring and guidance.*
- *Ethics and personal data security remain challenges in AI applications.*

Abstract

The advancement of digital technologies has transformed the healthcare field, offering new possibilities for behavioral interventions and health promotion. In nutrition, these tools have been applied to support dietary management among children and adolescents, with the potential to personalize care and enhance engagement. The aim of this study was to analyze the use of digital tools as part of nutritional care for children and adolescents. A narrative literature review was conducted through searches in the MEDLINE/PubMed, Scielo, and Bireme databases, including studies published in the past ten years in Portuguese, English, and Spanish. Systematic reviews, meta-analyses, and full studies on child and adolescent nutrition associated with digital technologies were included. Of the 170 articles retrieved, 17 were selected. The use of mobile applications, digital games, telehealth platforms, and exergames was identified in the prevention and treatment of childhood obesity, promotion of breastfeeding, diet therapy for specific clinical conditions, and nutrition education. Evidence indicates that these tools have the potential to personalize interventions, monitor dietary intake and physical activity, and support clinical decision-making. Despite their promise, challenges remain, including digital access inequality, the need for scientific validation, child and family adherence, data privacy and security, and ethical limitations in the use of Artificial Intelligence in pediatric populations. Digital technologies show promising potential for nutritional support in children and adolescents, with the ability to enhance intervention effectiveness. However, further studies are needed to assess long-term impacts, ensure ethical safety, and strengthen the integration of these solutions into clinical practice.

Keywords: Technological Systems. Nutrition. Child Feeding. Adolescent Nutrition.

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INTRODUCTION

The advancement of digital technologies has led to significant changes in healthcare, which are widely documented in the scientific literature. Digital tools are increasingly incorporated into behavioral change interventions — structured strategies that employ artifacts such as mobile applications, web platforms, and wearable devices (e.g., activity trackers) to modify specific health-related behaviors[1]. These digital interventions are grounded in well-established theoretical models of behavior change, such as the Social Cognitive Theory and the Transtheoretical Model, which posit that continuous engagement and personalized feedback can improve adherence to healthier practices and sustain desirable behaviors[2,3].

Given the widespread use of digital technologies in healthcare, in 2021, the World Health Organization (WHO) published the *Global Strategy on Digital Health 2020–2025*, which established a framework to support countries in adopting and scaling digital health solutions as an integral part of healthcare systems. Its goals include improving access, coverage, quality, efficiency, and equity. The document emphasizes strengthening governance, investing in technological and operational infrastructure, ensuring data security and privacy, and developing digital competencies among both health professionals and the general population. It also highlights the importance of sustainable public policies, clear regulation, stable financing, and multisectoral cooperation, promoting digital innovation as a key tool for achieving universal health coverage and the Sustainable Development Goals (SDGs)[4]. In this context, the use of digital technologies has been recognized as a global strategy to expand the reach of public health actions, reduce inequalities, and optimize communication between professionals and service users[5,6].

Specifically in the field of Nutrition, digital technologies can support nutritional management by facilitating the monitoring of growth and development and the establishment of healthy eating habits. These resources allow for personalized interventions, increased engagement of children and adolescents, and data collection to support clinical and educational decision-making. Recent literature indicates that nutrition-related apps and digital platforms can promote healthy eating behaviors, encourage physical activity, and improve communication between patients, families, and professionals—particularly in programs addressing childhood obesity and breastfeeding promotion[3,7,8].

Therefore, technological resources are viewed as promising tools to support dietitians in managing pediatric and adolescent populations. The objective of this study is to analyze the use of digital tools as part of nutritional care directed at children and adolescents.

Digital tools can assist in nutritional management by facilitating the monitoring of growth, eating habits, and adherence to recommended practices[9-12]. Among these technologies, mobile applications, monitoring platforms, and exergames — digital games combined with physical activity — stand out as engaging tools to promote healthy behaviors.

Despite advances, significant challenges remain in the adoption of these tools. Digital access inequality, the need for scientific validation of solutions, protection of minors' data, and the ongoing training of professionals are critical issues to be addressed[13-15]. Furthermore, although many of these tools incorporate elements of Artificial Intelligence (AI), such as predictive algorithms and data analytics, the full implementation of "pure" AI remains limited in pediatric clinical practice[10,16]. These limitations reinforce the need for ethical regulation and methodological validation of digital technologies to ensure applicability, safety, and equitable access[17,18].

Given the relevance of this topic, the objective of this study is to analyze the use of digital tools as nutritional support resources in professional practice with children and adolescents.

METHODOLOGY

This study consists of a narrative review with a theoretical foundation, allowing for a broad exploration of the topic and methodological contextualization of the existing studies. This approach was particularly relevant to the present study due to the heterogeneity of methods and focuses found in the literature on the subject.

The search covered the period from 2016 to 2025

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in the MEDLINE/PubMed, Scielo, and Bireme databases. The search strategy included the following terms in the title and/or abstract fields, combined with Boolean operators according to DeCS/MeSH descriptors: "child feeding/child nutrition" OR "child nutrition" OR "adolescent nutrition" AND "technological systems/technology" OR "information technology." Inclusion criteria comprised full-text scientific articles, including systematic reviews and meta-analyses, published in Portuguese, Spanish, or English. Exclusion criteria were narrative reviews and articles outside the period 2016–2025 or unrelated to the study theme.

RESULTS

Based on the defined search criteria, 170 articles were identified, and 17 were selected for inclusion, as outlined in Figure 1.

The studies presented in Figure 2 address the use of digital technologies for nutrition management and health promotion among children and adolescents. Notably, they highlight the development of mobile applications and digital platforms aimed at encouraging physical activity, improving eating habits, and controlling body weight. In addition, telehealth has been employed as a means of family-based intervention, and Artificial Intelligence has been applied to breastfeeding practices, as well as in the assessment and monitoring of nutritional status. Educational intervention tools — such as message-based communication through mobile applications — were also used, demonstrating positive effects on dietary behavior. Overall, methodological advances in clinical and nutritional research have been observed, underscoring the potential of technological innovations to enhance health promotion and care practices.

Several studies have used digital tools to assist in managing childhood obesity[5,11], a condition with a rising global prevalence. Other studies have focused on tools that encourage healthy behaviors, particularly related to dietary practices[2,3,6,7,19].

Research has also explored digital tools designed to support nutritional care during illness or surgical recovery[8,20]. These tools reinforce the importance of appropriate nutrition for improving nutritional status and addressing specific dietary needs at different stages of life.

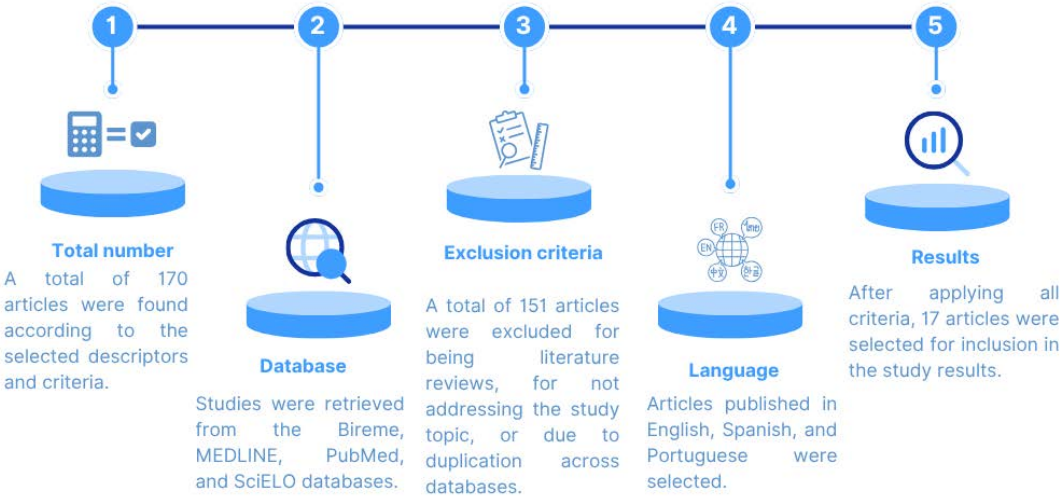

Figure 1 - Results of the study selection process for inclusion in the narrative review.

Table 1- Studies selected for the period 2016–2025.

SOURCE	CONTENT	EXPLANATORY NOTE
Vasconcelos *et al.*, 2016[11]	Technological approach to support the fight against childhood obesity through motivation for physical exercise and the adoption of healthy habits.	Evidence that children are internalizing the concepts of an active lifestyle and healthy eating. Proven effectiveness of the automatic validation strategy for exercises performed by users within the game context.
Parvez *et al.*, 2018[2]	Describes an ideal technology and behavioral adoption of single and combined water, sanitation, hygiene, and nutrition (WASH) interventions in a rural Bangladesh efficacy trial.	Adherence was key to evaluating the impact of WASH interventions on health. Rigorous implementation achieved high technology and behavioral adoption in households under both individual and combined WASH and nutrition interventions.
Alcântara *et al.*, 2019[3]	Digital technologies for promoting healthy eating habits among adolescents.	Among included studies, three digital games, two web-based interventions, two online obesity prevention programs, and one multimedia-based nutrition counseling were identified. These showed that digital technology experiences improved participants' knowledge and/or behaviors toward healthy eating.
Chai *et al.*, 2019[5]	Promoting fidelity and acceptability of a family-based, technology-assisted telehealth nutrition intervention for child weight management.	A family-focused, technology-based telehealth intervention using a website, Facebook, and SMS demonstrated high fidelity and acceptability among families with school-aged children in New South Wales, Australia.
Fuemmele *et al.*, 2020[20]	Development of an app to motivate dietary behavior change in adolescents with cancer.	The results of the feasibility evaluation of the "Mila Blooms" app were positive. Most participants remained engaged throughout the intervention weeks (93.8%), and their feedback was generally favorable regarding the app's ease of use and perceived benefits. Although few behavioral changes were observed during this initial phase, the study demonstrated that the app is both feasible and appealing, with no adverse effects. In summary, gamification showed potential to promote healthy behaviors, and the lessons learned may be useful for future development of app-based health interventions for adolescents. Smartphone apps can be used to encourage health behavior change and expand the reach of behavioral interventions.
Al-Jawaldeh A *et al.*, 2022[19]	The article presents a debate on the formulation of a new global policy framework for adolescent nutrition, emphasizing the urgency of specific guidelines for this age group. The authors highlight existing gaps in current policies and propose strategies to enhance the effectiveness of health interventions.	Although this is a commentary/proposal, the article highlights that current global policies still do not give sufficient specific attention to adolescent nutrition, despite this being a critical period during which multiple forms of malnutrition emerge—including obesity associated with micronutrient deficiencies or impaired linear growth. The article points to examples of countries that have already implemented programs for adolescents (such as iron-folic acid supplementation, nutrition education, and integration with school health), which show progress, but notes that the scale of these policies and their adaptation to local realities remain limited. The author suggests the creation of a global policy framework that includes measurable targets for adolescent nutrition, improved trend data, intersectoral approaches, and direct adolescent involvement in actions.
Zahid, Sughra *et al.*, 2022[16]	Effect of AI-based diet-related mobile applications on the nutritional status of children after cardiac surgery and comparison of their diet-related issues with those of their peers following a conventional diet.	The study indicated that the use of the diet-related mobile application improved the nutritional status of children after cardiac surgery. Therefore, the findings suggest that AI had a positive influence on the nutritional status of these children.
Oliver-Roig *et al.*, 2022[21]	Predict exclusive breastfeeding during postpartum hospital stay using AI algorithms and explain the behavior of the breastfeeding model to support decision-making.	Machine learning tools accurately predicted exclusive breastfeeding during hospitalization and enabled the identification of nonlinear relationships and prediction variations according to specific case characteristics. The model revealed specific risk groups linked to current and previous infant feeding experiences. The results highlighted opportunities to improve maternal care related to the support conditions in participating hospitals.

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continuation - Table 1.

SOURCE	CONTENT	EXPLANATORY NOTE
Lara-Mejía *et al.*, 2022[17]	A scoping review was conducted with the aim of identifying and mapping existing methodologies for monitoring digital marketing of food and beverages targeted at infants, children, and adolescents (ICA). Studies from 2011 to October 2021 were considered. Out of 420 sources evaluated, 28 studies from 81 countries met the criteria. Most (24) were published since 2015, with a predominant focus on promotional techniques and the nutritional content of foods and beverages high in fat, salt, or sugar (HFSS) aimed at adolescents.	This study reveals significant methodological variation among digital marketing monitoring studies for ICA, both in terms of the digital media observed (social networks, apps, websites, etc.) and in how nutritional content and promotional techniques are assessed. An important finding is that many studies focus on adolescents, while less attention is given to infants and young children. A lack of scalable and standardized methodologies that can be used in regulatory and surveillance policies across different contexts was also noted. The article suggests that, to protect infants, children, and adolescents, it is necessary to develop digital monitoring systems that accurately reflect the real exposure environment, are capable of capturing subtle persuasion techniques, and are adapted to local contexts, enabling more effective regulatory interventions.
Meneses *et al.*, 2022[7]	A nutritional intervention was conducted using the WhatsApp messaging application with 290 adolescents from public schools in the Federal District, Brazil. For 42 days, participants received daily messages promoting healthy eating habits, based on the Dietary Guidelines for the Brazilian Population. One month after the intervention, 94 students responded to a self-administered questionnaire to assess message recall, satisfaction, and feasibility of the intervention.	Although message recall was lower than expected, with 48% of participants remembering at least one message, satisfaction was high, with 77.7% of adolescents expressing a high level of satisfaction. Additionally, 54.3% reported always reading the messages, and 66.0% did not share the messages with others. A significant association was observed between recall and satisfaction (p=0.002), as well as between reading and recall of messages (p=0.005). The results indicate that, despite limited recall, the intervention was well received by adolescents, suggesting that nutritional interventions via messaging apps can be viable and effective in promoting healthy eating habits among youth.
Pervanidou, *et al.*, 2023[8]	Impact of the digital platform ENDORSE, which incorporates AI features to monitor BMI z-score, metabolic parameters (systolic and diastolic blood pressure, glucose, glycated hemoglobin, insulin, HOMA-IR, total cholesterol, LDL-c, HDL-c, triglycerides, AST, ALT, SGPT, SGOT, cortisol, and ACTH), and dietary practices of children and adolescents, as reported by their families.	After 12 weeks of monitoring, the implementation of the digital program resulted in a statistically significant reduction in metabolic parameters such as glycated hemoglobin, AST and ALT, HOMA-IR, SGPT, and cortisol. Emotional eating as a reward decreased, and guidance on healthy eating increased, contributing to weight control and the promotion of healthier eating habits.
Till S *et al.*, 2023[6]	An interdisciplinary scoping review was conducted, including stakeholder consultation, to map the use of digital technologies in maternal and child health (MCH) in low- and middle-income countries, especially in Africa. A total of 284 initial articles were identified, of which 141 met the inclusion criteria. Digital interventions covered health education (such as breastfeeding and child nutrition), monitoring of health service use by community health workers, maternal mental health, and nutritional or health outcomes for mothers and children. The media used were varied: apps, SMS, voice messages, web applications, social networks, videos/films, sensor devices, or wearables.	The study shows growth in the use of digital technologies for maternal and child health in low- and middle-income countries, with potential to improve education, monitoring, and service follow-up. However, challenges were identified, such as limited community participation in technology design, a focus on nuclear families that may not reflect local realities, excessive reliance on textual communication, and gaps in evidence regarding long-term effectiveness, cost-effectiveness, scalability, and sustainability of interventions.
Wu, *et al.*, 2024[12]	Evaluation of infant stool consistency in breastfed babies conducted by mothers and by an AI-based application.	Automated evaluation of infant stool consistency was significantly more accurate than that of mothers (95.8% vs. 66.9%, respectively). AI-based stool assessment may be useful in clinical studies and home monitoring to provide accurate and objective results regarding children's stool consistency.

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continuation - Table 1.

SOURCE	CONTENT	EXPLANATORY NOTE
Danziato-Neto *et al.*, 2024[22]	Researchers investigated the association between quadriceps muscle thickness, measured by ultrasound, and the nutritional status of critically ill patients in the intensive care unit (ICU) of a high-complexity trauma hospital. The cross-sectional observational study included 30 critically ill trauma patients admitted between February and March 2022. Quadriceps muscle thickness was quantified by ultrasound at a predefined site between the iliac crest and the proximal border of the patella. The results showed variability in quadriceps muscle thickness among nutritional status groups, with statistical significance achieved after excluding the overweight group. Additionally, a positive correlation was found between quadriceps muscle thickness and the adequacy of mid-upper arm circumference, indicating that ultrasound may be a valuable technique for monitoring muscle integrity in critically ill patients.	The importance of assessing quadriceps muscle thickness via ultrasound as a tool for monitoring muscle integrity in critically ill patients is highlighted. The analysis revealed that patients with moderate malnutrition had significantly lower quadriceps muscle thickness compared to other nutritional status groups. Furthermore, the positive correlation between quadriceps muscle thickness and the adequacy of mid-upper arm circumference suggests that ultrasound can complement other anthropometric assessments in identifying changes in muscle mass. These findings indicate that ultrasound is a promising tool for evaluating muscle health in critical care settings.
Woods N, *et al.*, 2025[23]	The accuracy of multiple imputation (MI) for estimating nutrient intake from 24-hour dietary recalls (ASA24) was evaluated. The analysis revealed that MI accuracy was generally low, with imprecise estimates for most nutrients, especially when the percentage of missing data was high. MI did not significantly outperform other imputation approaches, such as single imputation or case deletion. The results suggest that MI may not be the best strategy for handling missing data in dietary intake studies.	Multiple imputation (MI) is indicated as an unreliable strategy for estimating nutrient intake from 24-hour dietary recalls. The accuracy of the estimates was low, with many imputations falling within only 10% of the true values. Furthermore, MI did not significantly outperform other imputation approaches in terms of accuracy. These findings suggest that alternative methods, such as single imputation or case deletion, may be more effective for handling missing data in dietary intake studies.
Estecha-Querol S, *et al.*, 2025[24]	A review of existing frameworks on adolescent nutrition (ages 10–19) was conducted, and through a nominal group technique and co-design sessions with young people, essential components for a new global framework were identified. Participants emphasized the need for a model that considers all forms of malnutrition and all levels of influence on adolescent nutrition. The proposed framework highlights an action-oriented approach, offering practical guidelines to improve adolescent nutrition. It is designed to be adaptable to different contexts and accessible to a wide range of stakeholders.	The importance of developing a global framework for adolescent nutrition that is comprehensive, practical, and adaptable is emphasized. Participants identified 37 strengths and limitations across 15 existing frameworks, categorizing them into three themes: theory, usability, and visibility. The majority of participants (90%) agreed that a new framework was needed. Youth partners highlighted the need for greater representation of young voices in frameworks and programs related to adolescents. The proposed framework aims to provide practical guidance for improving adolescent nutrition, rather than merely explaining its determinants, and is designed to be accessible and engaging for a wide range of stakeholders.
Mehrjoyan, *et al.*, 2025[25]	A participatory framework was developed to identify and prioritize multidimensional solutions aimed at improving the nutritional behavior of female students aged 13 to 17 in Khuzestan Province, Iran. Using the nominal group technique and stakeholder consultation, determinants of nutritional behavior were identified and practical solutions were proposed. The Analytic Hierarchy Process (AHP) was applied to rank the proposed solutions based on feasibility and impact.	The importance of participatory and culturally adapted approaches to improving nutritional behavior among adolescents is emphasized. The analysis identified key determinants such as family eating habits, cultural influences, and access to healthy foods. Proposed solutions included nutrition education programs, family involvement, and school policies that promote healthy food environments. The application of the Analytic Hierarchy Process (AHP) enabled the ranking of these solutions based on feasibility and impact, providing a solid foundation for future interventions.

Abbreviations: AI – Artificial Intelligence; BMI – Body Mass Index; HOMA-IR – Homeostatic Model Assessment of Insulin Resistance; LDL-c – Low-Density Lipoprotein Cholesterol; HDL-c – High-Density Lipoprotein Cholesterol; SGPT – Serum Glutamic Pyruvic Transaminase; SGOT – Serum Glutamic Oxaloacetic Transaminase; ACTH – Adrenocorticotropic Hormone; TGO – Aspartate Transaminase; TGP – Alanine Transaminase; ML – Machine Learning.

DISCUSSION

It was observed that there are few publications employing technological tools specifically focused on nutritional management in children and adolescents. Most of the identified studies address the development of applications, games, and digital recording tools designed to assist parents, caregivers, or health professionals in monitoring and guiding nutritional care. These digital solutions were applied in the treatment of childhood obesity, the promotion and maintenance of breastfeeding, and the remote evaluation of children's health conditions. Considering that the prevalence of childhood obesity has been increasing worldwide over recent decades[26], the selected studies showed that mobile applications hold potential as tools to support dietary and physical activity monitoring in children, providing real-time feedback, alerting caregivers, and encouraging healthier food choices[27,28].

Smart applications and devices, such as fitness watches and wristbands, were used in several studies to provide important information for tracking eating and physical activity behaviors — an essential component in addressing childhood obesity. These technologies contribute to adjustments in nutritional monitoring plans and the promotion of healthier lifestyles within the contexts analyzed[13,29,30]. However, it is important to note that these findings were observed in specific populations and cannot be generalized to all children.

Despite their potential, limitations and challenges remain regarding the implementation of such technologies, especially in pediatric populations, given the need for continuous supervision[31], the variability in children's nutritional requirements, and the dynamic nature of growth at these ages[32]. Some tools used in the studies may not adequately account for physiological changes typical of childhood and adolescence, leading to nutritional recommendations that require critical evaluation. Furthermore, adherence to these tools depends heavily on parental collaboration and the motivation of children and adolescents — factors identified as crucial for the success of interventions[33]. Another key issue concerns data privacy and security, as these systems collect sensitive health and dietary behavior information, requiring strict control to prevent misuse.

Several studies also emphasized ethical concerns regarding the use of technology in healthcare, particularly in the human–technology relationship, data privacy, confidentiality, consent, and security. The use of self-learning systems remains an evolving concept, as even experts in the field cannot fully predict their consequences in terms of accuracy, reliability, and adherence to intended use. Consequently, there is broad consensus among authors that human supervision remains essential[13,15,31,34].

Artificial Intelligence (AI) has shown increasing and promising use; however, in the current landscape, it also presents bioethical risks. As with all emerging technologies, digital health applications directed at children and adolescents require the prior implementation of ethical operational standards that ensure safety, privacy, and responsible application. It is essential to embed ethical and security frameworks into technological development, given the particular vulnerabilities of this age group — such as limited autonomy, underdeveloped decision-making capacity, and incomplete understanding of risks and benefits[18,35,36]. Therefore, while the reviewed studies indicate that technology holds significant potential to support nutritional management in pediatric and adolescent populations, its effective implementation depends on a critical appraisal of the ethical limitations identified and on active collaboration among parents, healthcare professionals, and app developers.

Currently, the use of digital tools represents a promising strategy in healthcare and is becoming increasingly essential for improving nutritional practices and follow-up. However, their effectiveness depends on the integration of technological advancements, scientific validation, and ethical guidelines that guarantee data protection and user safety. It is imperative that such technologies be validated and applied under professional supervision, respecting the specificities of growth and development in children and adolescents. Accordingly, the future use of these tools must prioritize a balance between innovation and responsibility, ensuring that digital progress contributes safely and effectively to nutritional care in pediatric and adolescent health.

CONCLUSION

Globally, it is undeniable that technology is gaining ground in the healthcare field. These approaches include the development of applications, consultation protocols, and professional training for the use of technology aimed at improving nutritional management, diagnostic precision, efficiency of care, and research accuracy across various health areas.

In nutrition, digital tools are already being applied in several domains, such as the assessment of food intake and eating behavior in children and adolescents, the prevention and treatment of childhood obesity, diet therapy for children after surgery, breastfeeding promotion, food and nutrition education activities in schools, health education strategies for students, and behavioral interventions in adolescents with cancer.

Therefore, it can be concluded that digital tools have become increasingly prominent in healthcare, especially in pediatric nutrition, showing a positive outlook for advancement—particularly in the monitoring of children's diet and nutritional status. However, this field still requires further studies to improve its effectiveness and reliability. It is essential to address ethical aspects such as data privacy, algorithm reliability, and potential behavioral impacts on children.

Thus, the use of such resources as tools for nutritional support appears promising, as monitoring applications, telemedicine, and interactive platforms are already a reality. Nevertheless, future studies are needed to evaluate the effectiveness of these technologies and to examine their long-term impacts on eating behavior and child health.

CRediT author statement

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All authors have read and agreed to the published version of the manuscript.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the workreported in this paper.

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