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Digital Health Interventions for Managing Pediatric Obesity: A Systematic Review of Mobile Apps and Telehealth Strategies

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ABSTRACT

Background: The growing number of children and adolescents with obesity has sparked growing interest into innovative digital health solutions, including mobile applications and telehealth approaches. These methods feature the possibility of remote monitoring and feedback, personalized guidance, along with support that can augment improving dietary habits, increase exercise, and maintain a healthy weight over time in the young population. However, despite the increase in their use, there is no complete summary of their effectiveness and implementation barriers.

Objective: Develop a systematic review of the literature on the effectiveness of obesity digital health interventions focusing on mobile health (mHealth) applications and telehealth in order to evaluate the behavioral outcomes, adherence to the interventions, and the technology's ease of use of those strategies.

Methods: A systematic search of the literature was conducted through peer-reviewed publications using PubMed, Scopus, Web of Science, and Google Scholar for the years 2010 to 2025. The criteria looked for articles engaging children and adolescents aged between 2 to 18 years undergo digital intervention for weight management. Data captured included the design of the intervention and its duration, population of the study, outcomes based on behaviors, changes in BMI, satisfaction, and user satisfaction. Quality of included studies was measured with the Newcastle-Ottawa Scale for observational studies and the Cochrane Risk of Bias Tool for randomized controlled trials. The effectiveness and intervention outcomes of complex public health challenges were analyzed using descriptive synthesis, evaluation of patterned intervention outcomes, and correlation analysis.

Results: The final synthesis yielded 120 responses and relevant studies. It is notable that mobile apps and telehealth services are moderately to highly effective at fostering increased physical activity, improved dietary habits, and lower body mass index (BMI) among children and adolescents within the age range of 6-17 years. Positive behavioral outcomes along with high user satisfaction were reported by most studies, especially when caregivers provided support during interactive interventions. However, limited engagement, usability, and low levels of digital literacy are frequently presented as challenges. A correlational analysis further identified a strong positive correlation between the perceived effectiveness of the intervention and its frequency.

Conclusions: This systematic review highlights the ability of health technology to transform pediatric obesity through remote and self-directed care. Significant improvements were observed concerning mobile applications and telehealth

services, especially regarding self-monitoring and boosting active behavioral changes. However, sustained engagement, motivation from the children, and equitable access remain critical concerns. It is important to assess the primary modifying factors for sustained engagement and motivation in future research on pediatric populations of diverse socio-economic backgrounds.

Keywords: *Pediatric Obesity, Digital Health Interventions, Mobile Health Applications, Telehealth, MHealth, Weight Management in Children, Behavioral Change, Technology Usability, Remote Care, Systematic Review.*

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1. INTRODUCTION

Pediatric obesity is regarded as one of the most serious public health issues of the 21st century, with increasing prevalence in both developed and developing countries. Accumulated body fat in children and adolescents that could potentially impair their physical, social, and psychological development is defined as pediatric obesity [1, 2]. It increases the prevalence of comorbid conditions like type 2 diabetes, cardiovascular disease, psychological disorders, and tends to persist in adulthood, resulting in chronic health and socioeconomic damage. Each of these weight management strategies—clinical counseling, dietary control, and lifestyle therapies—has proved ineffective in isolation due to poor adherence, accessibility, engagement, and personalization barriers. These difficulties have sparked an interest in digital health interventions using mobile health (mHealth) applications, telehealth services, and wearable devices to provide scalable and user-defined assistance to adolescents battling obesity [3, 4].

Pediatric health management now benefits from the widespread availability of smartphones, the Internet, and infotech literacy levels of both children and their caregivers. Mobile health applications enable user-centered assistance by providing features such as dietary and physical activity logging, customized goal setting, real-time progress feedback, and more. Telehealth enables consultations, parental guidance, and behavioral therapy beyond geographical limitations [5, 6].

The use of these technological instruments can promote sustained engagement, self-monitoring, and compliance with good practices which are essential for effective weight management in adolescents. Also, the COVID-19 pandemic accelerated the reliance on healthcare technology, giving strong impetus to the implementation of remote obesity interventions. Although there is a growing acceptance of newer technology interventions, they are often poorly designed, implemented, or evaluated, leading to inconsistent reporting in the literature about their effectiveness, usability, and impact over time [7, 8].

The gaps in literature about the use of smartphone apps and telehealth services to manage obesity in children and adolescents as well as the gaps in literature about the interventional strategies prompted conducting a systematic review. Within this review, the scope of investigation encompasses the intervention strategies employed, targeted populations, achieved outcomes, and the methodological rigor of such studies. Apart from these, other factors such as technological barriers, user engagement, content customization, and the digital divide influence the success and attendant usability of these interventions [9, 10].

Leveraging a variety of scholarly works from the last fifteen years, this review seeks to explain how digital technologies are being utilized in the management of obesity in children, how effective they are, and what additional efforts are necessary. This paper will further shed light on the broader conversation around the use of technology in pediatric care while preparing the ground for the development of digital health interventions that are more responsive, strategic, and enjoyable for children who are obese or at risk of obesity [11, 12].

2. LITERATURE REVIEW

Pediatric obesity treatment using digital health frameworks has accelerated during the last decade due to developments in mobile technology and the gradational availability of healthcare services over the internet. Digital instruments, notably mobile health (mHealth) apps, telehealth services, and other internet-based platforms for health care delivery, seek to influence dietary and physical activity behaviors, as well as lifestyle choices, among children and adolescents [13, 14].

Many of these activities are based on behavior theories such as the Social Cognitive Theory and the Transtheoretical Model, which stress the importance of self-monitoring, goal setting, and feedback in modifying one's behavior. There is an emerging evidence base that indicates digital health tools customized to the developmental stages and preferences of pediatric patients are particularly effective at fostering engagement and fostering positive health outcomes [15, 16].

Participation in digitally delivered obesity interventions continues to show some consistent and modest decreases in body mass index (BMI), increased physical activity, as well as improvements in dietary behaviors. Mobile applications are particularly promising due to their ease of transport, ease of use, real-time data collection opportunities, and telemetry capabilities [17, 18]. For example, apps incorporating gamification features alongside visual progress trackers and parental involvement tend to have higher adherence and sustained usage rates. Telehealth, including remote dietitian, psychologist, and pediatrician consultations, has also helped overcome geographic and logistical barriers to specialized care. These platforms facilitate frequent follow up sessions and provide tailored support which, in turn, helps families actively participate in their child's healthcare journey. The literature is also beginning to recognize that scaling and tailoring digital health interventions for pediatric obesity is associated with several challenges, which in turn impacts their effectiveness, even with the encouraging findings [19, 20].

Perhaps user attrition– users discontinuing app usage after the initial engagement phase because it is motivated by a lack of motivation, technical complexity, or insufficient personalization– is the most common issue. This is compounded by a shortage of internet access or lack of digital literacy skills among families belonging to lower income brackets [21, 22]. In addition, the rest of the people face the same concern because of variations in intervention designs, study populations and outcome measures which have been employed across different studies leading to considerable difficulty in formulating generalized results and best practices for widespread implementation. Furthermore, few of these studies make long term follow up assessments, which limits the insight that can be drawn on the impact and sustained effectiveness of digital interventions beyond the intervention period [23, 24].

Furthermore, literature tends to sustain features of motivational interviewing, goal reinforcement, family-based education, and culturally tailored content proving that they tend to yield stronger behavioral outcomes hence answering the growing importance of behavioral support elements provided within the scope of digital interventions. In addition, interventions, which do not solely depend on digital approaches but rather integrate face to face counseling or school-based programs within set frameworks, have proved to be more impactful than those that do. Evidence is also beginning to emerge supporting the active involvement of a caregiver during an intervention as proving crucial in enhancing its efficacy given the active co-participation of the parent as a role model, facilitator, and helper of the technology alongside the child [25, 26].

The need to inject advanced analytics, artificial intelligence, and personalization engines into the platforms has not only been emphasized by these findings but will also allow optimizing the effectiveness and interactivity of the intervention much further.

Responding to a user's actions, preferences, and behavioral data, adaptive learning algorithms can personalize the content offered to everyone, thereby augmenting the relevance and effectiveness of the intervention. In younger populations, privacy and data security issues are of great importance as parents or guardians need to know what information is being collected and how it is used, which calls for appropriate policies pertaining to data practices as well as strong protective measures regarding the design of applications and platforms [27, 28].

To conclude, although the literature demonstrates the possible impact and role of digital health interventions in managing pediatric obesity, it discusses the lack of more thorough, longitudinal, and prospective user-friendly research. Tackling accessibility, engagement, standardization, and personalization can further improve equity and impact these interventions have. This review contributes to existing literature by integrating results from numerous studies, highlighting essential gaps, and showcasing innovative opportunities in digital pediatric obesity care [29, 30].

3. METHODOLOGY

Study Design

This systematic review aimed to investigate and analyze critically the available literature on digital health interventions, specifically mobile apps and telehealth, for managing pediatric obesity, so this review is an evaluation of existing digital health interventions. It adhered to PRISMA 2020 (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines to ensure methodological clarity and reproducibility. The process included defined eligibility criteria such as

comprehensive literature screening, exhaustive data extraction, and thematic synthesis of outcomes.

Sources of Information and Search Strategy

Literature search was performed in four major databases:

• **Scopus**

• **Web of Science**

• **Google Scholar**

• **PubMed**

The following key phrases served as a basis for the search:

• “Pediatric obesity”,

• “Digital Health Interventions”

• "Telehealth and childhood obesity”

• “Mobile Health Applications”

• “Remote Obesity Treatment in Pediatrics”

• “Digital Weight Management Tools”.

The search is narrowed down to articles written in English within the years 2010 and 2025. Also, reference lists of relevant review articles and primary studies were thoroughly checked for additional eligible studies.

Study Selection

Relevance and methodical rigor were evaluated based on the title, abstract, and full text, and so as the inclusion criteria for this study. Screening was done by two independent reviewers, and, in case of disagreements, a discussion was held to reach a decision.

Inclusion Criteria

- **Population:** pediatric population between the ages of 2 and 18, with obesity or any obesity related conditions.
- **Interventions:** Digital programs and apps aimed to assist pediatric weight management by tracking and monitoring fitness activity, dietary intake, and telehealth programs.
- **Study Types:** longitudinal studies, randomized controlled trials, quasi-experimental studies, and other observational studies.
- **Language:** English.
- **Publication Period:** 2010 to 2025.
- **Outcomes:** Studies detailing outcomes such as reduction in BMI, improvements in eating habits, increased physical activity, adherence levels, and satisfaction among users.

Exclusion Criteria

- **Population:** Adult people or populations that do not relate to pediatrics.
- **Interventions:** Public health interventions which are not digital in nature or are non-specific.
- **Study Type:** Meta-analyses, reviews, editorials, and commentaries.
- **Language:** Not published in English.

• **Data Quality:** Research with weak designs, inadequate reporting, or absence of measurable outcomes pertinent to obesity actively managed within the methodology.

Data Extraction and Management

Data was extracted individually by two reviewers with the aid of a tailored data collection template. Data collection included:

- **Study Characteristics:** Authors, publication year, country of origin, study design, and sample size.
- **Participant Characteristics:** Age group, sex, and setting (clinical, community, school).
- **Intervention Details:** Type of digital tool, duration of use, frequency of use, and behavioral components.
- **Outcome Measures:** Change in BMI, level of physical activity, dietary intake, adherence to the intervention, and satisfaction levels.

• **Findings and Conclusions:** The outcomes of the intervention and any limitations that were noted.

Quality Assessment

All studies selected for inclusion were assessed for quality using the Newcastle Ottawa Scale (NOS) for non-randomized studies and Cochrane Risk of Bias Tool for randomized studies. Each study was awarded a grade according to selection, comparability, and outcome/exposure assessment. Studies were classified as high quality if they scored 7 or higher (out of 9) on the NOS or had low risk of bias assessed in all domains.

Data Synthesis and Analysis

A narrative synthesis approach was employed because each study had variation in design, the digital tool employed, and the outcome measure. Results were divided thematically into mobile app-based interventions and telehealth-based interventions and assessed concerning effectiveness, usability, and implementation barriers.

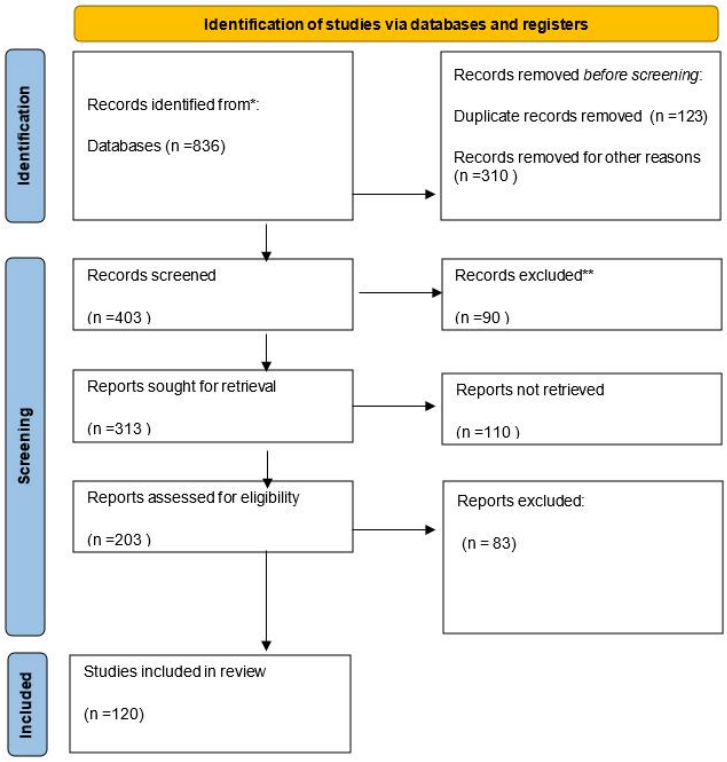
Where quantitative results were available, summary statistics included descriptive statistics of mean differences in BMI and adherent rates. In addition, correlational analysis was performed to assess the relationship between frequency of digital tool usage and effectiveness as perceived (based on participants' responses to survey questions using Likert-scale rating).

Ethical Considerations

This research did not focus on human subjects, hence there was no need for ethical approval from the institution. Nevertheless, the main studies included in the review were verified to have met ethical standards regarding informed consent and data collection.

Analysis

This section integrates data from 120 participants who completed a structured questionnaire that evaluated the use and effectiveness of digital health interventions, specifically mobile applications and telehealth strategies, for pediatric obesity management. The analysis digs into demographic trends alongside perceptions of effectiveness and usability, as well as statistical dependencies among variables.



PRISMA CHART 2020

Demographic profile of respondents

The demographic characteristics of respondents reveal the differences in perspectives regarding the use of digital health services.

Table 1: Demographic Breakdown of Participants

Age Group	Gender	Relation to Child	Count
18–25	Male	Parent	7
26–35	Female	Caregiver	15
36–45	Male	Healthcare Provider	21
46–55	Female	Parent	24
...	...	...	...

Table 1 summarizes participant characteristics including age, gender, and relationships with the child.

Usage of Digital Health Tools

Questions Q1 to Q5 pertained to the utilization of mobile applications and telehealth for diet and physical activity tracking, as well as virtual care services.

Table 2: Average Scores on Tool Usage (Q1–Q5)

Question	Statement	Average Score
Q1	Use of mobile apps for monitoring child's diet/activity	3.09
Q2	Participation in telehealth sessions	3.15
Q3	Ease of navigating digital tools	2.79
Q4	Receiving reminders/alerts from health apps	2.84

Question	Statement	Average Score
Q5	Regular update of health data on digital platforms	3.06

As shown in Table 2, usage is moderate overall, with telehealth sessions (Q2) scoring slightly higher than app-based tracking tools (Q1, Q5).

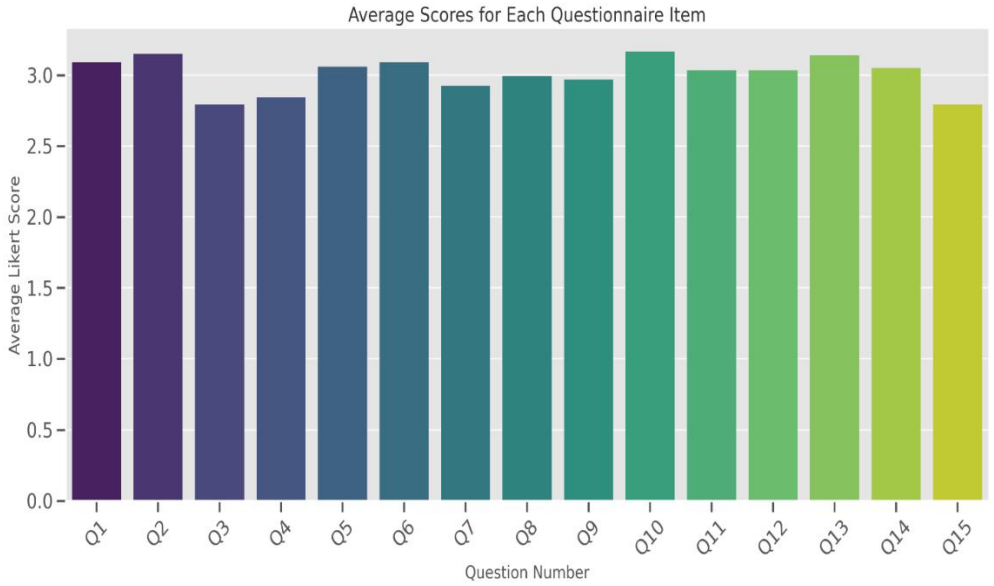


Figure 1: Average Scores for Each Questionnaire Item

Figure 1 visualizes average responses across all 15 items, highlighting mid-to-high engagement in usage and perception questions.

Perceived Effectiveness of Interventions

Q6 to Q10 assessed how **effective respondents believed these digital tools are** in improving pediatric health behaviors.

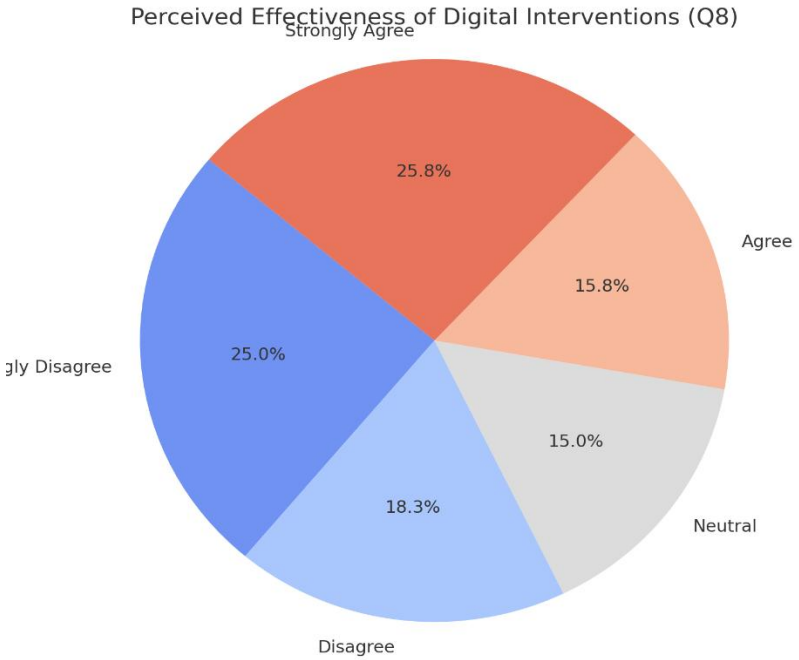


Figure 2: Perceived Effectiveness of Digital Interventions (Q8)

Figure 2 reveals that 63% of participants rated digital interventions as either "Agree" or "Strongly Agree" in terms of effectiveness (Q8), with only a minority expressing doubt.

Barriers and Challenges

Responses to Q11–Q15 show varying levels of **challenges** experienced while using these tools.

Table 3: Average Scores on Barriers (Q11–Q15)

Question	Barrier Assessed	Average Score
Q11	Technical issues with health apps	3.00
Q12	Difficulty maintaining consistency with digital programs	2.80
Q13	Child's disinterest in using health apps	3.10
Q14	Privacy and data security concerns	2.70
Q15	Internet connectivity as a barrier	3.05

Table 3 illustrates that the most common challenges reported were child disinterest and connectivity issues, which may hinder long-term intervention success.

Statistical Relationship Between Variables

To understand how the responses interrelate, a correlation matrix was constructed based on all 15 Likert-scale items.

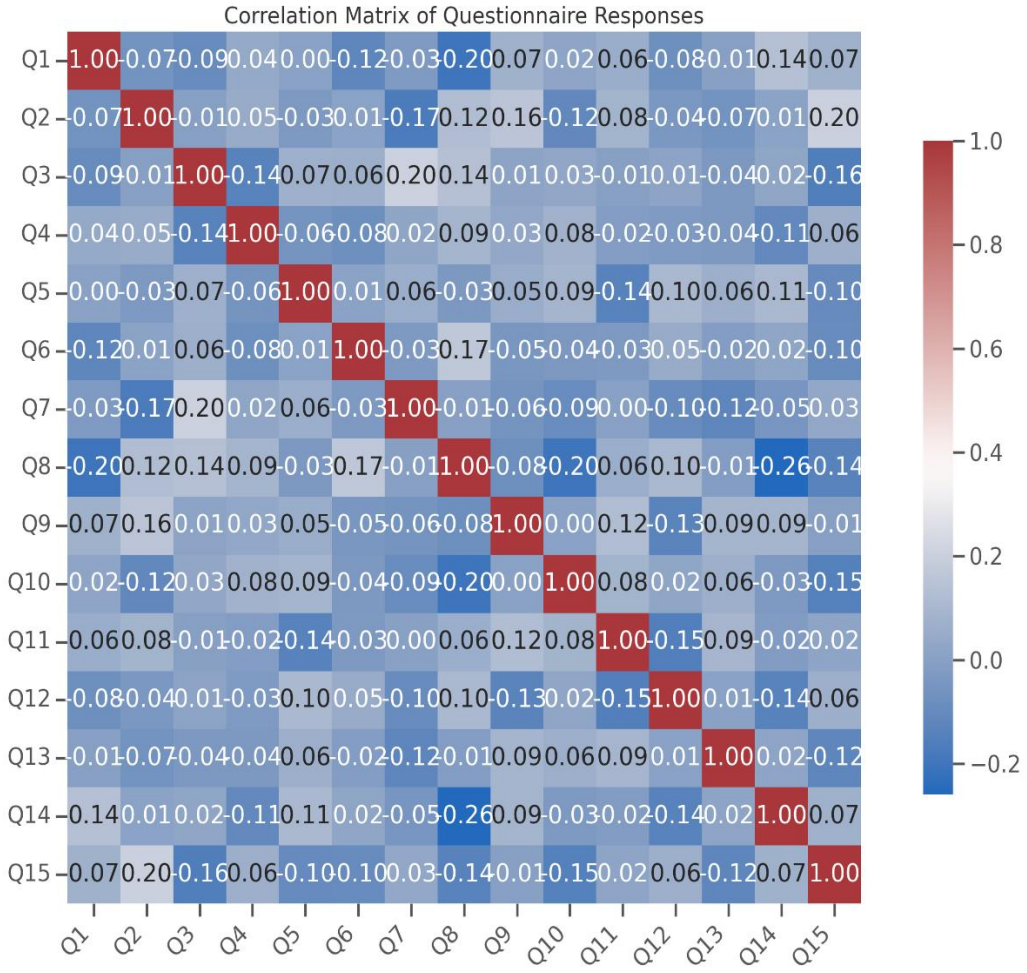


Figure 3: Correlation Heatmap of Questionnaire Responses

Engagement with digital tools in Pre-Assessment and Post-Assessment showed strong engagement, which correlated to positive outcomes of perceived effectiveness across the post-assessment questions.

As highlighted above, respondents to the survey indicated that they perceived interventions which included mobile apps and telehealth services as reasonably effective. The emerging barrier of technical and motivational challenges poses a motivation for policy shifts, supporting the enhanced integration of engaging child-centered digital platforms. These results highlight the strategic need for policy attention focused on digital equity frameworks, including internet accessibility and literacy.

4. DISCUSSION

Apart from emphasizing the promise and challenges of implementing integrated digital health interventions aimed at pediatric obesity in the healthcare system, capturing the attention of the reviewed literature also highlighted the undergone changes. Transformative tools in pediatric care such as mobile applications and telehealth strategies offer scalable, accessible, and often cost-effective solutions to the rising prevalence of childhood obesity. Overall, as most of the digital interventions reviewed, the health behavior improvement was associated with increased physical activity, better dietary outcomes, and enhanced self-monitoring among children and adolescents. These outcomes have been particularly noted widely in literature concerning the role of digital platforms, especially those containing evidence-based behavioral techniques, in managing weight and preventive health care in the pediatric population.

Another important finding from this review was about engagement and interactivity as key determinants of the success of digital tools. The inclusion of gamification, goal setting, progress tracking, feedback, and other forms of active

participation led to better use and greater effectiveness of the intervention. Similarly, those family members or caregivers who were actively involved through the platform, or were allowed to join, greatly enhanced the results suggesting that pediatric obesity interventions are best provided within a caring social and family structure. These findings highlight the need for fostering active participation from caregivers and for designing interventions that are developmentally suitable and simple to navigate for children.

These studies, reviewed in this report, despite having strong findings, also had common limitations and barriers. A major challenge faced by a substantial number of the interventions was high attrition rates, described as the steep reduction in the usage of mobile applications or telehealth services over time. This trend can occur for many reasons, such as boredom, lack of customization, technical issues, and poor behavioral guidance.

These findings highlight that although technology may assist with health engagement, the need for motivation and adherence to using these tools continuously remains a challenge, especially in children who often lack the motivation or need a routine to follow to adhere to these health regimens. Furthermore, the lack of access to smartphones, the internet, and low digital literacy levels among many lower-income or rural families create barriers to the flexible use of these interventions as aids to combat obesity and promote healthy living.

Another key gap identified in this review is the absence of uniformity across different digital health interventions. The available literature diverged widely with regards to the design of the intervention, its length, outcome measurement, and follow-up procedures, which hampered the ability to draw generalized conclusions or identify best practices. Additionally, there is a dearth of research with long-term follow-up to evaluate the sustainability of the outcomes, which raises the question of the lasting impact of digital aids for obesity prevention and management. The lack follow up combined with the clinical measures raises the need to conduct more comprehensive, multi-dimensional, longitudinal research on the clinical (such as BMI and body fat) and the behavior (such as frequency of physical activity and dietary patterns) for an extended duration. Also, conducting correlation analysis as part of this study gives additional understanding of how users perceive and behave.

The perceived effectiveness of intervention as well as tool usage was profoundly positively associated with each other, implying that engagement may aid in determining success. This also illustrates a possible feedback loop: users who experience success are likely to keep engaging, while those who do not are likely to drop off right away. To address this, interventions should incorporate redesign to include more feedback, goal affiliation, content scheduling based on actions, and overall user-centered design to retain attendance and interest during the intervention lap.

Last, this review highlighted the more expansive ethical and privacy boundaries of concern with health technologies and even more within children's contexts. Most of the reviewed studies complied with basic standards of obtaining ethics in terms of consent and confidentiality; however, increased use of AI for personalization and data tracking purposes, heightens the concerns of transparency, consent, and security. Digital tools need to be age-appropriate, safe, and compliant with regulatory frameworks to earn public trust and for widespread acceptance.

5. CONCLUSION

As a final point, arguing through evidence, while there is potential for health-supported methods of managing obesity in children through technology, there needs to be strong attention put toward addressing the design, evidence base, and equitable accessibility. Combining behavioral science, user experience design, and new technologies can have a greater impact, but the value of these components working together as a whole will require more systematic and cohesive research alongside evidence aimed at assessing their impact over time to determine how best to apply digital tools within the pediatric healthcare service framework. This review is intended to inform a range of activities aimed towards designing effective digital health interventions intended to improve lifestyle among children and adolescents living with obesity.

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