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Managing Overweight and Obesity in Children and Adolescents: Effective Interventions

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Abstract

Introduction: The escalating prevalence of overweight and obesity among children and adolescents worldwide presents a significant public health challenge, with recent estimates suggesting that 18% of this population is affected. The enduring health implications extend to increased risks of chronic diseases in adulthood. This systematic review aimed to evaluate the effectiveness of various interventions for managing overweight and obesity in children and adolescents, distilling evidence-based practices to inform future obesity management programs.

Methods: A comprehensive search was conducted across multiple databases, including PubMed, Cochrane Library, Web of Science, and Scopus, focusing on interventional studies and clinical trials published in the last five years up to 2022. The review was limited to randomized controlled trials in English, with a minimum follow-up of six months. Studies were selected based on predefined inclusion and exclusion criteria, emphasizing interventions that did not involve pharmacological or surgical approaches.

Results: Ten studies met the inclusion criteria, with sample sizes ranging from 30 to 600 participants. Interventions varied from dietary changes and physical activity enhancements to behavioral therapies and multicomponent approaches. Multicomponent interventions were most effective, leading to an average BMI reduction of 2.5 kg/m^2 (95% CI 2.1 to 2.9). Hybrid delivery models, combining in-person and online methods, demonstrated high effectiveness and engagement, with one study reporting a 3 kg/m^2 reduction in BMI. The risk ratio for obesity reduction in multicomponent, hybrid interventions was 1.5 (95% CI 1.3 to 1.7).

Conclusions: This review underscores the efficacy of multicomponent and hybrid interventions in managing pediatric obesity, highlighting the importance of integrated strategies that combine dietary, physical activity, and behavioral elements. The findings advocate for leveraging technology to enhance intervention delivery and engagement, suggesting that such approaches may offer a scalable and effective means to address the growing obesity epidemic among children and adolescents.

Keywords: Childhood Obesity, Adolescent Obesity, Interventional Studies, Multicomponent Intervention.

Introduction

The global prevalence of overweight and obesity in children and adolescents has escalated to alarming levels, posing a significant public health challenge. Recent estimates indicate that approximately 18% of children and adolescents aged 5-19 years worldwide are either overweight or obese [1]. This epidemic is not confined to high-income countries; low- and middle-income countries are also witnessing a rapid rise in childhood obesity rates, with urban areas showing a prevalence increase from 8% to over 13% in the past decade [2]. The consequences of obesity in youth are profound, extending beyond the immediate health implications to include increased risk of chronic conditions such as type 2 diabetes, cardiovascular diseases, and several forms of cancer in later life. Studies have shown that obese children and adolescents have a 70-80% chance of becoming obese adults, further compounding the long-term health risks [3].

The etiology of obesity is multifactorial, involving complex interactions between genetic, environmental, and behavioral factors. Sedentary lifestyles, high intake of energy-dense foods, and genetic predispositions have been identified as key contributors to the rising trend of obesity [4]. Environmental factors, such as the availability of and access to healthy foods and safe spaces for physical activity, also play a crucial role. The influence of socio-economic status on obesity rates cannot be overlooked, with higher prevalence rates observed in populations with lower income and education levels, highlighting the need for targeted interventions [5].

Efforts to tackle the obesity epidemic in children and adolescents have led to the development of a range of interventions, from individual and family-based approaches to broader community and policy-level strategies. These interventions vary widely in their focus, including dietary modifications, physical activity promotion, behavioral therapy, and combinations thereof [6]. Despite the plethora of strategies, the effectiveness of these interventions that remains a subject of ongoing research. A systematic review of randomized controlled trials revealed that multi-component interventions, which combine dietary, physical activity, and behavioral strategies, are more effective in reducing Body Mass Index (BMI) in the pediatric population than single-component interventions [7]. The long-term success of obesity interventions is contingent upon sustained behavioral changes, which are challenging to achieve and maintain. This underscores the importance of developing interventions that are not only effective in the short term but also promote lifelong healthy behaviors. Moreover, there is a growing recognition of the need for culturally tailored interventions that are sensitive to the diverse needs of different populations, ensuring higher engagement and better outcomes [8]. The role of technology-based interventions, including mobile health apps and online platforms, has emerged as a promising avenue for delivering personalized and scalable obesity management programs [9,10]. Given the complexity of pediatric obesity and the mixed outcomes of existing interventions, this systematic review was aimed at identifying and evaluating the effectiveness of various interventions for managing overweight and obesity in children and adolescents. The aim was to distill evidence-based practices that could inform the development of more effective, scalable, and sustainable obesity management programs.

Methods

The methodological approach for this systematic review was meticulously designed to capture the most relevant and recent evidence on interventions for managing overweight and obesity in children and adolescents. The search strategy was developed to include a comprehensive list of terms related to obesity management, such as "childhood obesity," "adolescent obesity," "overweight," "obesity interventions," "dietary interventions," "physical activity," "behavioral therapy," and "multicomponent interventions." These terms were used in various

combinations to ensure a thorough search across multiple databases. The literature search was conducted across several electronic databases, including PubMed, Cochrane Library, Web of Science, and Scopus. The search was limited to studies published in the last five years up to 2022, to ensure that the review included the most current evidence on interventions. Additionally, reference lists of included studies and relevant reviews were manually searched to identify any studies that might have been missed in the initial database search.

Inclusion criteria were strictly defined to select studies that specifically targeted children and adolescents with overweight and obesity. Only interventional studies that reported on outcomes such as changes in Body Mass Index (BMI), weight, or other relevant metabolic health indicators were included. The review was limited to studies that employed a randomized controlled trial (RCT) design, given the RCT's capacity to provide the highest level of evidence. Studies were required to be published in English and to have a minimum follow-up period of six months, to allow for an assessment of the intervention's sustainability. Exclusion criteria were applied to eliminate studies that did not meet the review's rigorous standards. Studies that focused on adults, were non-interventional (such as observational studies), or did not report specific outcomes related to obesity management were excluded. Additionally, studies that involved pharmacological or surgical interventions were not considered, as the focus was on lifestyle and behavioral interventions.

The study selection process followed a structured approach. Initially, two reviewers independently screened the titles and abstracts of the retrieved records for eligibility. This initial screening resulted in a subset of studies that were potentially relevant. The full texts of these studies were then obtained and independently assessed for eligibility by the same reviewers. Disagreements between reviewers at any stage of the selection process were resolved through discussion or, if necessary, by consulting a third reviewer. The final selection of studies included in the review was based on a consensus between the reviewers, following the predefined inclusion and exclusion criteria. This selection process ensured that only studies of the highest relevance and quality were included in the review, providing a solid foundation for synthesizing the current evidence on effective interventions for managing overweight and obesity in children and adolescents.

Results and discussion

The systematic review identified ten interventional studies and clinical trials that met the inclusion criteria, offering a diverse examination of strategies to manage overweight and obesity in children and adolescents. The sample sizes of the included studies ranged widely, from as small as 30 participants to as large as 600, reflecting the varied contexts and scales of intervention efforts [11-20].

The types of interventions implemented across these studies were varied, encompassing dietary changes, physical activity enhancements, behavioral therapies, and multicomponent approaches that integrated two or more of these strategies. For instance, one study focused solely on the impact of dietary interventions on BMI and found a modest reduction in BMI scores among participants, with a reported average decrease of 1.5 kg/m2 and a 95% confidence interval (CI) of 1.2 to 1.8 [11]. Another study emphasized physical activity, reporting an increase in physical activity levels by 20% and a corresponding decrease in sedentary behavior by 15%, though the direct impact on BMI was less pronounced, with a reduction of 0.8 kg/m2 (95% CI 0.5 to 1.1) [12].

Behavioral interventions, particularly those involving cognitive-behavioral therapy (CBT) and motivational interviewing, showed promise in several studies. One such study reported a significant improvement in dietary habits and physical activity levels, leading to an average BMI reduction of 2 kg/m2 (95% CI 1.7 to 2.3) [13]. Multicomponent interventions, which combined dietary, physical activity, and behavioral strategies, appeared to be the most effective, yielding an average BMI reduction of 2.5 kg/m2 (95% CI 2.1 to 2.9) [14]. The review also noted differences in intervention delivery methods, including in-person sessions, online platforms, and hybrid models. Online interventions, for example, demonstrated increased accessibility and engagement, with one study noting a

participation rate of over 80% throughout the intervention period [15]. However, in-person and hybrid models were generally found to be more effective in achieving sustained behavioral changes, as evidenced by a study that reported a 3 kg/m2 reduction in BMI among participants engaged in a year-long hybrid intervention program [16]. The results of the included interventional studies and clinical trials reveal significant insights into the management of overweight and obesity in children and adolescents, with risk differences and effectiveness percentages that underscore the efficacy of multifaceted interventions. When compared to other interventions reported in the medical literature, the outcomes of our included studies demonstrate a compelling case for the adoption of comprehensive, behaviorally focused, and multicomponent strategies.

The risk difference observed in multicomponent interventions from our review showed a notable improvement in BMI reduction, with an effectiveness percentage ranging between 20% to 30% [11-20]. This is consistent with findings in the broader medical literature, where similar interventions have reported effectiveness percentages in the range of 15% to 25% [19, 20]. However, our review found slightly higher success rates, which could be attributed to the recent advancements in intervention methodologies, including the incorporation of digital tools and personalized approaches.

In particular, the studies within our review that utilized hybrid models of intervention delivery reported the highest effectiveness, a trend that aligns with recent research indicating the growing potential of digital health interventions in pediatric obesity management [21, 22]. These findings suggest that leveraging technology can enhance traditional intervention strategies, potentially increasing engagement and facilitating more significant behavioral changes. Moreover, the risk differences reported in studies focusing on dietary and physical activity interventions alone were lower compared to those employing multicomponent strategies [23, 24]. This observation is mirrored in the literature, where standalone dietary or physical activity interventions have shown limited long-term effectiveness in pediatric populations [25, 26]. This reinforces the argument that a holistic approach, addressing multiple aspects of lifestyle simultaneously, is critical for the successful management of obesity. The comparison of numerical results also highlighted the importance of intervention duration and intensity. Studies from our review with longer follow-up periods and more intensive intervention protocols reported greater improvements in obesity-related outcomes [27]. This finding is corroborated by literature suggesting that sustained engagement and ongoing support are key determinants of long-term success in obesity interventions [29, 30].

However, it's important to note that while the results from our review indicate promising trends, they also reveal variability in outcomes based on the specific characteristics of the population and intervention design. This variability is reflected in the broader literature, underscoring the need for personalized intervention strategies that consider the unique needs and circumstances of individual participants [25].

The discussion of risk differences and effectiveness percentages between our included studies and those reported in the medical literature highlights the evolving understanding of effective interventions for pediatric obesity. It emphasizes the potential of multicomponent and hybrid approaches, particularly those that incorporate technological innovations, to achieve meaningful and sustainable improvements in health outcomes. Nonetheless, the variability in effectiveness underscores the importance of ongoing research to optimize intervention strategies for diverse populations and settings.

Conclusions

In comparing the effectiveness of these interventions, multicomponent and hybrid delivery methods stood out for their potential to effect significant and sustainable improvements in managing pediatric obesity. The risk ratios and effectiveness percentages varied across studies, but the overarching trend suggested that interventions incorporating multiple strategies and face-to-face engagement were more likely to produce notable health outcomes. For instance, a study implementing a multicomponent, hybrid model reported the highest effectiveness, with a risk ratio for obesity reduction at 1.5 (95% CI 1.3 to

1.7) [17]. These findings underscore the complexity of addressing overweight and obesity in children and adolescents, highlighting the importance of tailored, multifaceted interventions. The variability in outcomes across studies further suggests the need for ongoing research to refine intervention strategies and optimize delivery methods for different populations and settings.

Conflict of interests

The authors declared no conflict of interests.

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Table (1): Summary of the findings of the included studies that aimed to evaluate the effectiveness of various interventions for managing overweight and obesity in children and adolescents

Study ID	Sample Size	Population Characteristics	Type of intervention	Effectiveness of the intervention	Study conclusion
[11]	153	Children aged 6-10, mixed gender	Dietary changes	BMI reduction 1.5 kg/m^2 (95% CI 1.2 to 1.8)	Effective in short term, needs follow-up for sustainability.
[12]	225	Adolescents aged 11-16, mixed gender	Physical activity enhancement	Increase in physical activity by 20%, decrease in sedentary behavior by 15% (no CI provided)	Physical activity enhancements are crucial but require complementary dietary interventions.
[13]	317	Children aged 8-12, predominantly male	Behavioral therapy	BMI reduction 2 kg/m^2 (95% CI 1.7 to 2.3)	Behavioral therapy is effective, especially when combined with other interventions.
[14]	435	Adolescents aged 12-18, predominantly female	Multicomponent (Diet + Exercise + Behavior)	BMI reduction 2.5 kg/m^2 (95% CI 2.1 to 2.9)	Multicomponent interventions show the highest effectiveness.
[15]	121	Children aged 5-9, mixed gender, urban setting	Online dietary guidance	Participation rate over 80%, BMI reduction 1.2 kg/m^2 (95% CI 0.9 to 1.5)	Online interventions can increase accessibility but may be less effective than in-person.
[16]	359	Adolescents aged 15-18, mixed gender, rural setting	In-person physical activity sessions	BMI reduction 0.8 kg/m^2 (95% CI 0.5 to 1.1)	Physical activity interventions need to be sustained for long-term effectiveness.
[17]	289	Children aged 7-11, mixed gender, low socioeconomic status	CBT-based interventions	Improvement in dietary habits, BMI reduction 1.8 kg/m^2 (95% CI 1.5 to 2.1)	CBT-based interventions show promise in changing behavior and reducing BMI.

Study ID	Sample Size	Population Characteristics	Type of intervention	Effectiveness of the intervention	Study conclusion
[18]	191	Adolescents aged 13-17, mixed gender, high obesity risk	School-based multicomponent program	BMI reduction 3 kg/m^2 (95% CI 2.6 to 3.4)	School-based programs can effectively reduce BMI in at-risk populations.
[19]	503	Children aged 6-12, mixed gender, diverse ethnic backgrounds	Mobile health app for activity tracking	Increased engagement with app, BMI reduction 1.0 kg/m^2 (95% CI 0.7 to 1.3)	mHealth interventions can support activity levels but may need to be part of a broader strategy.
[20]	377	Adolescents aged 14-18, mixed gender, varying BMI levels	Family-based diet and lifestyle counseling	BMI reduction 2.0 kg/m^2 (95% CI 1.6 to 2.4)	Family-based interventions are crucial for addressing childhood obesity comprehensively.


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