



# Narrative Review of Childhood Obesity Prevention Strategies

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## ABSTRACT

Childhood obesity remains one of the most significant public health challenges worldwide, with its prevalence increasing across both developed and developing countries. This narrative review examines a wide range of childhood obesity prevention strategies, emphasizing cultural considerations, dietary practices, tailored interventions, evaluation methods, and sustainability. The review identifies how ethnic-specific norms, family involvement, and community participation shape intervention outcomes, particularly among high-risk populations such as Hispanic communities. Diverse dietary practices underscore the importance of culturally tailored and multisectoral approaches, while the evaluation of interventions highlights the need for standardized metrics to assess success. Although numerous programs especially school- and community-based initiatives have achieved short-term reductions in body mass index and behavioral improvements, long-term sustainability remains a critical challenge due to funding limitations, community resistance, and weak institutionalization. Comparative analyses of global and European interventions reveal mixed outcomes, indicating that multi-level, culturally sensitive, and family-centered strategies yield the most promising results. The review concludes that innovative, sustained, and collaborative efforts integrating behavioral, environmental, and policy approaches are essential for achieving meaningful reductions in childhood obesity worldwide.

**Keywords:** Childhood obesity prevention, Cultural considerations, Dietary interventions, Community-based strategies and Public health sustainability.

## INTRODUCTION

Overweight and obesity in childhood remain a growing worldwide concern, sharply increasing even in poorer countries once restricted primarily to high-income regions [1]. High prevalence rates and an established link to higher mortality and morbidity from chronic non-communicable diseases in adulthood underscore the critical need for effective prevention approaches [3]. International estimates indicate that in 2016, 42 million children under 5 years of age were overweight or obese, and 50 million girls as well as 74 million boys aged 5–19 years were so affected [6]. European data from 2015 to 2017 reveal a prevalence of 9–43% for overweight and 2–21% for obesity among children aged 6–9 years, with higher figures generally observed in southern European countries. The imbalance between energy intake and expenditure leading to a positive energy balance stands as the foremost cause of excess weight gain. Although more than 600 genes currently under investigation are associated with overall obesity risk and/or body-fat distribution, most obesity cases are attributable to a combination of gene-environment interactions that affect energy metabolism parameters [2]. Key environmental factors include aspects influencing food availability, social behaviors, and family habits; these act through epigenetic mechanisms [15]. Treatment of obesity remains difficult and often ineffective in both adults and children [13]. Hence, primary prevention emerges as the paramount strategy to reduce both the individual and social burden of the disease. Since most overweight adults become obese and adverse health outcomes are closely associated with the duration of obesity, preventing excessive weight gain during early life stages is especially crucial [14]. Inducing early behavioural changes involving family, schools, and policy makers appears a promising strategy to curb the trend and reduce the risks associated with overweight and severe obesity in adolescence and adulthood [3]. Developing effective interventions capable of ensuring a healthier future for new generations and markedly reducing long-term health costs represents one of the greatest challenges for paediatric healthcare providers [1, 2].

## **Epidemiology of Childhood Obesity**

Overweight and obesity in childhood are rapidly growing epidemic phenomena affecting both high- and low-income countries [2]. Estimates from 2016 indicate that globally there were approximately 42 million children younger than five years and millions of older children and adolescents with obesity [1]. The high prevalence and persistence of the excess weight condition from childhood to adulthood are strongly linked to chronic diseases later in life, underscoring the importance of preventive strategies [16]. Among developed European countries, there is a clear north-south gradient of childhood overweight and obesity prevalence, with the lowest proportions in northern countries and the highest in southern ones [13]. Excess weight results from an imbalance between energy intake and expenditure influenced by environmental factors, cultural traditions, social behaviours, and genetics [2]. Most cases are associated with the interaction of genes and environment rather than genetics alone. Childhood obesity treatment remains challenging with limited long-term success, further emphasizing the need for effective prevention [8]. Prevention has therefore become a key strategy to reduce the risk of overweight and obesity during childhood [8]. A meaningful approach consists of promoting behavioural changes starting early in life and continuing throughout childhood and adolescence. Such changes should be supported by families, schools, society, media, and political institutions [9]. Developing effective interventions to prevent childhood obesity and reduce long-term health costs represents a major challenge [7].

### **The Importance of Prevention**

According to the World Health Organization, childhood overweight and obesity are significant health challenges, escalating the risk of developing non-communicable diseases such as diabetes, cardiovascular disease, and hypertension at an earlier stage than historically observed [4]. Globally, the number of overweight children under five has increased from 32 million in 1990 to 42 million in 2013, a trend projected to persist without concerted preventive efforts [1, 2]. Consequently, prevention strategies are paramount, as the health complications associated with childhood obesity frequently extend into adulthood, thereby amplifying the long-term burden of disease and societal costs compared to adult-onset obesity [6]. Preventing childhood obesity necessitates a multifaceted approach that disrupts the progression of associated risk factors [8]. Recent research underscores a variety of successful behavioural and community strategies designed to deter the development of overweight or obesity in children [3]. Whilst the circumstances surrounding the rise in childhood obesity are multifactorial and differ substantially across age groups, cultural backgrounds, genders and ethnicities, interventions that reduce sedentary behaviour and promote physical activity are widely advocated as key components of effective prevention frameworks. Additionally, community and school-based initiatives play a critical role by cultivating environmental support for healthier behaviours and by potentially motivating behavioural changes at the individual level [7]. Although early prevention often focuses on establishing healthy body weight and body mass index, the associated improvements in overall well-being, including mental health, self-esteem, absenteeism from school and family connectedness, represent critically important outcomes [2]. Such considerations further reinforce the value of prevention as an overarching strategy against childhood obesity and its allied health risks [3].

### **Behavioral Strategies**

Behavioral strategies represent individual-level preventive actions against childhood obesity, encompassing nutrition education, physical activity promotion, and parental involvement [11]. Nutrition education aims to enhance children's comprehension and ability to implement healthy eating choices [14]. Schools, the community, and home each offer valuable platforms for delivering such educational programs, with involvement from nutritionists, dietitians, and teachers improving efficacy [18]. School curricula often integrate content on food groups, nutrition labels, energy content, key nutrients, and healthy eating patterns [4]. Promotion of physical activity focuses on stimulating children to engage in regular, appropriate exercise. Strategies vary according to age and capability, from active play and learning modes of transportation at younger ages to combined physical education classes and extracurricular organized exercise in older children [5]. Parents can also contribute by encouraging activity at home and facilitating transportation to activity venues [6]. Parental involvement offers another vital behavior change pathway, particularly for younger children due to their limited autonomy over daily decisions [7]. This involvement often requires tailored approaches, as parents confront multiple, simultaneous challenges that decrease motivation to alter routines [9].

### **Nutrition Education**

Nutrition education for healthy food choices plays an important role in childhood obesity prevention [5]. School-based nutrition education interventions focusing on changing dietary intake and physical activity are the most promising obesity prevention strategies in children [10, 11]. After-school cooking camps provide adolescent children with valuable hands-on nutrition education [15]. Among adolescents, involvement in food preparation at home is positively associated with fruit and vegetable intakes and may be protective against obesity [16]. Nutrition education is an integral part of both international obesity prevention and health promotion initiatives

[18]. Children who learn to eat healthy at a young age are more likely to maintain these healthy eating habits through adulthood [17]. Research shows that children who incur the majority of their calories from fast-food restaurants tend to consume diets higher in total fat, saturated fat, cholesterol, sodium, and sugar yet are also more likely to be deficient in essential nutrients such as calcium, zinc, and dietary fiber [15]. A survey of parents also shows that eighty-nine percent of respondents indicated an interest in learning new ways to prepare fresh fruits and vegetables to encourage healthier eating habits among their children [13]. A study evaluating the relationship between food preparation and diet quality among children indicates that although involvement in food preparation enhances diet quality, the adolescent barriers and motivators may differ from those identified in adult populations [8].

### **Physical Activity Promotion**

The global rise in childhood obesity necessitates a multifaceted prevention approach, with physical activity promotion emerging as a critical component [1]. Population data demonstrate that a majority of children and adolescents fail to meet recommended physical activity targets, exacerbating obesity-related health challenges. Given that physical inactivity is linked to elevated risks of non-communicable diseases (NCDs) and poor psychological health, increasing activity levels during childhood is integral to long-term wellbeing [6]. While past decades witnessed improvements, recent trends indicate a plateau, underscoring the urgent need for effective interventions [5]. Schools constitute a strategic platform for promoting physical activity due to their capacity to reach children from varying socio-economic and cultural backgrounds [6]. School-based initiatives provide structured opportunities through curricular and extra-curricular programmes, sports education, and active commuting schemes [6]. The comprehensive impact of such programmes is enhanced when implemented over extended periods and coupled with teacher involvement and family support, factors identified as critical enablers of sustained behavioural change [3]. In this context, interventions that concurrently promote healthy eating and physical activity have demonstrated particular promise in bolstering fitness and mitigating excess weight gain [7].

### **Parental Involvement**

Parental involvement comprises the actions parents undertake to promote healthful lifestyle habits and reduce obesity risk in their children [5]. Interventions that successfully support health-behavior modification in young people commonly engage parents extensively, addressing both diet and physical activity [4]. Research demonstrates that involving parents in goal setting, motivational counseling, role modeling, and physical-environment restructuring facilitates reciprocal empowerment, shared commitment, and intrinsically motivated behavioral change among both parents and children [8]. These strategies yield positive, sustained adjustments in diet and activity levels [7]. Since parents significantly influence children's behaviors via family functioning, parenting styles and practices, role modeling, and control over the home environment, interventions that educate parents about healthful lifestyle habits and assist them in refining parenting skills are likely to benefit both generations [8]. Nonetheless, active parental engagement remains a formidable challenge in intervention implementation [9]. ODES framework that is, options, design, evaluation, and sustainability guides planning of family-based interventions [1]. Options must strike a balance between ongoing services and potentially effective new programs, with clear attention to the program's core components [1]. The design phase includes specifying measurable objectives drawn from theory and past research, with careful consideration of feasibility, alignment with previous findings, and inclusion of family-specific measures to evaluate success [9]. Evaluation strategies should incorporate multiple behavioral indicators collected through reliable and valid methods; short-term outcomes may serve as early success markers [5]. Finally, sustainability plans must anticipate the mechanisms necessary to maintain uninterrupted delivery of each essential intervention component, addressing potential discontinuities that could undermine effectiveness [6]. Practical recommendations for effective recruitment and engagement of parents and children influence intervention participation and are crucial to the overall success and impact of family-based childhood obesity programs [2]. The considerable body of evidence supporting family-based childhood-obesity prevention interventions reveals a dominance of applications targeting children aged 2 to 10 years, with noticeably fewer programs focused on either prenatal or adolescent groups [8]. Common settings include the home, healthcare environments, and community establishments [9]. Most interventions concentrate on diet and physical activity, with lesser attention to media use and sleep; only a minority explicitly targets all four behaviors simultaneously [7]. This review also identifies fewer interventions designed for diverse populations, such as racial minorities, children at the extremes of the age spectrum, and those residing in developing countries [6]. Expanding the availability of prevention interventions for these underrepresented groups, along with addressing additional behavioral domains, is essential to develop a more comprehensive and tailored foundation for community and family-based prevention strategies [9].

### **Community-Based Interventions**

Community-based intervention strategies, such as school-based programs and community campaigns, address childhood obesity by shifting emphasis from individual behaviors to the role of the community in establishing an environment that supports healthy choices [13]. Although community approaches have been defined in many different ways, a community intervention is intended to influence the health or health behavior of an entire community by affecting community-level factors, such as community norms, community awareness and attitudes, or community policies [15]. Children face much of the influence regarding obesity at school because they spend a large amount of their daytime hours there [17]. School-based programs tend to focus on children of school age by providing education and modifying the environment, such as making price changes to healthier foods or an increase in physical activity. One review of 47 school-based obesity programs suggested that implementing obesity-related programs targeting both nutrition and physical activity can be effective in significantly reducing BMI, especially if they are longer in duration [14]. Other examples of community-based interventions include smart growth community design and other local government regulations [11]. These initiatives target the community's environment with the goal of reducing obesity, such as modifying the built environment to increase access to recreational facilities and active transportation [12]. The broad variation in types of community-based interventions reflects the variety of factors that contribute to childhood obesity and helps address the different community and individual needs [13].

### **School Programs**

Childhood obesity is a major public health issue with increasing prevalence worldwide. School-based interventions offer a platform to address eating habits and physical activity as part of everyday routines [6]. Increasing physical activity and improving nutrition habits promise to decrease the risk of chronic diseases, including obesity, metabolic syndrome, diabetes, and cardiovascular disease [8]. The school environment can support and encourage healthy eating and motivate students to be physically active, potentially reducing the risk of obesity through changes in lifestyles and habits. Numerous systematic reviews and meta-analyses have examined the impact of school-based interventions on childhood obesity and healthy nutrition, reinforcing their effectiveness for obesity prevention [4]. Data indicate a lack of multi-pronged programs combining nutrition and physical activity components [6]. A tiered, stage-based planning process is proposed for strengthening strategies and ensuring sustainability over time [3]. Parental involvement has a positive influence on children's nutrition and physical activity behaviors; yet, only a minority of school-based interventions involves parents [9]. When family components are included, BMI improvements are more significant [7]. Approaches to engage parents, such as motivational interviewing and food diaries, show promise but require further assessment [10]. Environmental changes appear impactful: more than 50% of programs include environmental modifications, and the majority report positive effects on weight or BMI. Most environmental interventions have been implemented after 2008, indicating a focus of research on this area. Education, parental involvement, and environmental modification remain integral to successful intervention [3]. The school nurse functions as the initial contact concerning child health and an important resource for schools in responding to obesity [12]. The role includes screening, assessment, patient and family education and counseling, liaison with providers, and delivery of interventions, carried out through individual treatment plans, consultation, health education, peer involvement, and advocacy [11]. Limitations exist in funding and school infrastructure, hindering strategies to increase physical activity, improve nutrition, and implement behavioral interventions, as well as programs that aim simultaneously at these components [1]. Addressing childhood obesity thus requires a coordinated effort involving schools, families, and communities [2]. Favorable results of school-based programs are defined variously as weight loss, reduction in BMI, increase in physical activity levels, increase in healthy eating habits, and decrease in consumption of unhealthy foods or drinks. The overlap of favorable outcomes with intervention objectives (school environment, physical activity, nutrition, or education) confirms the positive contribution of school-based programs to obesity prevention [10, 11, 12].

### **Local Government Initiatives**

Local government initiatives are pivotal in mitigating childhood obesity by influencing environments, policies, and programs [5]. State health departments, uniquely positioned within administrative and political structures, can provide resources and support for community-based efforts to enhance food and physical activity environments [13]. The interplay of government agencies, community organizations, and the private sector is essential for effective interventions [28]. The increase in childhood obesity across the US during the past decades has focused policy attention on the role of government in prevention [14]. State public health authorities possess statutory power to implement initiatives that reshape the environments encouraging inactivity and excessive caloric intake [14]. They are responsible for enacting regulations and ordinances consistent with the political climate, available evidence, and community support [6]. A review of legislation shows that obesity prevention occupies a broad

agenda of health priorities, with provisions addressing food quality, access, and marketing, as well as a variety of approaches to enhancing opportunities for physical activity in schools and neighborhoods [2].

### **Community Engagement**

Community engagement is crucial in combating childhood obesity, as it is a complex public health issue requiring multi-level cooperation [15]. Communities play a vital role in supporting healthy behaviors and environmental changes conducive to long-term health; their responsiveness, however, varies greatly [10]. While the general population acknowledges the seriousness of childhood obesity and the central role of schools in prevention, fewer believe their own community is effectively addressing the problem [9]. Community coalitions can implement local solutions such as events and forums, health promotion campaigns, and partnerships with nonprofit and faith-based organizations to distribute educational materials. Schools constitute key community settings for prevention since most children attend them regularly and they shape knowledge, attitudes, beliefs, and behaviors [8]. State administrations often initiate child obesity prevention campaigns within government and community agencies [4].

### **Policy Approaches**

Healthy dietary intake substantially prevents obesity and promotes health equity [11]. Environments supporting obesity contribute to the epidemic by reducing opportunities to engage in healthy behaviors [10]. Policy and environmental obesity-prevention strategies that effectively improve nutrition merit dissemination to rural communities [25]. Public policies at multiple levels encourage healthier choices by shaping built environments, economic conditions and supply chains [12]. Three priority areas are food and beverage availability and access, marketing and advertising, and business practices, including pricing, placement, portion size and sugar content. Successful policy and environmental strategies demonstrate feasibility, represent best practice, have widespread applicability and target multiple levels of influence [15]. Rural adaptations accommodate food-source distance, tailor to local food culture and build community partnerships [16]. Childhood obesity prevention challenges require a multidimensional, multidisciplinary, multisetting and multi-strategy approach. Integrating nutrition and physical activity, targeting many levels and settings, engaging multiple stakeholders and maintaining long-term efforts represent effective prevention [8]. Basing strategies on best practices and addressing social determinants of health enhances effect [17]. Programs that include media and technology, cultural adaptations and linkage to health care support disseminate best practices and complement individual and combined approaches to bolster community-wide impact [9]. Screening in primary health care enables prompt early intervention [19]. Community-wide, school and family contexts create support and reinforce healthy behaviors [3, 7]. Public and private organisations develop comprehensive partnerships that foster sustainability [8]. Nutritional strategies encompass dietary and multi-component approaches undertaken by families, schools, communities and health care providers [18]. Providers maintain regular contact with children, track growth, deliver prevention messages, treat obese children and refer them for specialised care [1]. Schools constitute an ideal setting to prevent obesity by promoting physical activity, offering nutritious foods and providing nutrition education [6]. Targeting children at this stage enables the establishment of lifelong healthy behaviours [1]. School-based interventions demonstrate mixed but generally successful outcomes with modest behavioural changes [4]. International programmes differ from United States efforts and generally succeed in preventing overweight and obesity [11]. Insufficient data preclude recommendations about best school-based practices; further research is necessary to pinpoint effective components [7]. Current approaches introduce challenges and suggest future research avenues to reduce childhood obesity worldwide [12]. Interventions occurring during regular school hours involving children from kindergarten through high school with reported outcomes serve as eligible programmes. Inaccessible, outside-school interventions fall beyond the scope [10].

### **Regulatory Measures**

Many jurisdictions have introduced comprehensive legal strategies aimed at addressing adult obesity; however, a smaller number have specifically focused on childhood obesity prevention [13]. The majority of adopted child-oriented legislation mandates the issuance of annual body mass index (BMI) reports to parents, but also encompasses provisions for the promotion of physical activity, nutritional standards for school meals, conformance with national nutritional guidelines, financial incentives for health-promoting businesses or schools, enhancements to urban planning, health education curricula, encouragement of breastfeeding programs, and the employment of health impact assessments [15]. Regulatory interventions spearheaded by governmental entities remain a critical component of a comprehensive strategy to prevent childhood obesity [14]. States, local authorities, and various agencies have begun placing substantial emphasis on implementing laws and policies designed to enhance access to healthy foods and facilitate increased opportunities for physical activity [16]. Similarly, many countries have adopted regulatory measures to oppose the obesity epidemic plunging the world into crisis [10]. They have implemented innovative restrictions on advertising unhealthy foods and beverages, have reduced subsidies for derived products, and have rolled out tax schemes to boost healthy alternatives [17].

### **Incentives for Healthy Choices**

Offering rewards or compensation for making healthy choices can either motivate or deter healthy behaviors [13]. When used correctly, incentives offer powerful tools for modifying behavior [5]. Incentives must, above all, be adequate [8]. Redirecting the routine reward structure proposed by society such as honoring binge drinkers and active parents being ignored could provide an incentive for positive change [15]. Discounting the sales tax on healthier food and beverage items would directly affect a consumer's pocketbook and be publicly visible [3]. Offering reward programs for physical activity is another approach that has shown promise [7].

### **Food Labeling Policies**

Food labeling can include government text and nutrition facts on food or drink packaging, describe nutritional interventions in the broader food environment, and can encompass in-store information and tray-line menu labeling [29]. For example, unhealthy food consumption is promoted by food packaging designs targeted to children, and food manufacturers could be incentivized to reduce such marketing through voluntary or mandatory schemes [14]. By drawing attention to the current legislation affecting food marketing to children and adolescents, it may be easier to enact new laws that can effectively protect the younger population [18]. As with other health promotion strategies, a system of incentives or penalties for adherence or lack of compliance could help regulations have an impact on the food marketing landscape [16]. Regulations that have resulted in the reduction of ultra-processed food marketing include the following three categories: food product restrictions, time/space television advertising restrictions, and tax-based disincentives [14].

### **Healthcare Provider Involvement**

Public health efforts to prevent childhood obesity have gained the attention of policy makers, practitioners, and advocates [19]. School, community, and policy-based prevention strategies have been examined extensively, but a focus on health care providers' roles has been comparatively underexplored [19, 20]. Health care providers may be uniquely positioned in the obesogenic environment to initiate early prevention efforts through assessment, anticipatory guidance, referral, and ongoing support [20]. In the primary care setting, providers have an opportunity to assess lifestyle behaviors and anticipate developmental stages during well-child visits [19]. They also have the opportunity to counsel parents on health risks and support parental efforts in establishing healthy behaviors and environments [18]. In pediatric settings, providers can conduct screening and assessment of obesity-related behaviors, engage in motivational interviewing, educate families on the health effects of excess body weight, and refer patients to appropriate weight management programs [19, 20]. To improve adherence to guidelines, clinical decision support tools (CDS) have been implemented, offering evidence-based recommendations based on patients' information and providing ancillary tools such as surveys, educational materials, and handouts addressing feeding behaviors, food insecurity, family meals, and physical activity [20]. Provider engagement with electronic health records (EHR) has also increased rates of routine weight assessment and counseling [18]. Health care professionals are therefore well positioned to identify behavioral and dietary risks early and to address areas in which family or practitioner support may be useful [18].

### **Screening and Assessment**

Providers in pediatric settings are encouraged to heighten awareness by proactively assessing for excess weight during well-child checks, particularly for children aged 6 years and older, to identify elevated BMI levels and associated comorbidities [25]. While early identification is paramount, a prevailing barrier remains the assessment and treatment of obesity beyond infancy [23]. Guidelines suggest counseling on improved dietary and physical activity habits, behavioral changes, and the promotion of breastfeeding as strategies to diminish overweight and obesity risks among children [21, 9]. Primitive techniques for pediatric obesity screening in primary care emphasize the importance of standardized procedures that detect excess adiposity through a combination of measurements and indicators, as consistency in approaches can enhance the accuracy of overweight and obesity identification [17].

### **Counseling and Support**

Health care providers, including primary care physicians, nurses, and dietitians, are well positioned to prevent childhood obesity and offer counseling and support to children, youth, and their families [14]. These professionals should assess children's weight and provide healthy weight maintenance advice to patients and caregivers. Counseling messages provided at routine healthcare visits are valuable, but adherence may be poor without shared goal-setting or close follow-up with a healthcare provider [13]. Health care is pivotal in obesity prevention through screening, brief assessment, and counseling [15]. Physicians report that the most difficult patients to treat are obese children and adolescents [15]. Many physicians feel they lack the adequate knowledge required to carry out comprehensive childhood obesity prevention, assessment, and treatment, prompting calls for improved medical education and increased emphasis on childhood obesity during training [22]. Individual counseling for childhood obesity has been advocated as an alternative approach when prevention at the policy and community

levels has been unsuccessful; therefore, health providers often play a vital role in the weight management of overweight children and youth [23]. Providing advice about weight and lifestyle is difficult [13]. The obesity stigma, the sensitivity of the issue, time constraints, lack of knowledge about appropriate language, and a shortage of health professionals interested and trained in counseling children and families about their lifestyle are among the identified barriers [11]. A patient or parent who is receptive to discussing the issue, healthcare providers' confidence about the topic, provider skills in sensitively addressing the issue, and appropriate tools or resources are the facilitators to discussion [19].

### **Media and Technology**

New media and technologies have become part of the daily lives of a large proportion of children and adolescents and represent an innovative strategy for childhood obesity prevention that deserves further exploration [12]. In addition to being widely accessible, these modes of prevention have the benefit of overcoming many barriers. An increasing number of researchers are investigating the use of social media in health promotion [26]. For example, public health agencies use Facebook, Twitter, and Instagram to enhance knowledge about healthy an adequate diet and active lifestyle and to increase participation in related programs [26]. Mobile health (mHealth) consists of the use of portable devices, communication sensors, and digital technologies to monitor individuals' health and provide tailored information, primarily to promote healthy lifestyle behaviors and improve access to care [24]. Applications for mobile phones represent a relatively new area and a promising possibility for preventing obesity [29]. Several studies have been conducted to test applications, either separately or in combination with wearable devices, focusing on increasing physical activity, improving dietary choices, promoting weight loss, increasing self-monitoring, and preventing obesity in the pediatric population; however, more research is necessary to investigate their long-term effects [19].

### **Social Media Campaigns**

Social marketing strategies that contribute to community-based obesity prevention programs are an effective social marketing campaign can influence children's media use and improve the level of physical activity [27]. A number of studies have evaluated interventions aimed at reducing childhood obesity through social marketing approaches to behavior change [25]. Among them, a clustered randomized intervention study in a preschool setting demonstrated the effectiveness of a community-based social marketing intervention in preventing overweight and obesity in preschool children [25]. People tend to look for authentic and authoritative sources to keep themselves updated and develop an active understanding of health promotion but are not motivated enough to eat healthily [26]. The MyPlateMyWins campaign was launched through Twitter in January 2016 by MyPlate, the US government's primary food group icon. The strategies involved in the campaign suggest minor adjustments in behavior to meet the overall motivation that encourages people toward their lifelong healthy eating target [24]. Theoretically, the Twitter campaign enables readers to meet their needs and encourages intention to develop healthy eating habits [23].

### **Mobile Health Applications**

Mobile health, or mHealth, initiatives use mobile phone and tablet technologies to address medical and public health issues and are built on the ability of these devices to deliver information and services anytime, anywhere [26]. Such programs are among the first to be a truly global innovation in health care and have proliferated rapidly across low-, middle-, and high-income countries [25]. Although the numerous social and entertainment applications available for mobile platforms have led to a massive increase in overall use by young people, mHealth functions implemented with direct applicability to public health have yet to take hold [26]. One key obstacle to widespread adoption of mHealth initiatives targeted to youth relates to limited access to only mobile phones [23]. A growing body of evidence indicates that mobile phone-based interventions can impact a variety of health behaviors (e.g., weight management and physical activity; sexual and reproductive health; smoking) associated with the major causes of morbidity and mortality worldwide [25]. However, use of mHealth programs among children and adolescents is far more limited than has been reported for adults [21]. A recent narrative review conducted by Gómez-Donoso and colleagues examined the role of mobile applications in childhood obesity prevention and treatment [27]. The mHealth literature on the subject reveals initial evidence of effectiveness in both areas, with a stronger focus on intervention and treatment rather than prevention [20]. While study heterogeneity precludes clear summative conclusions, available evidence indicates that apps targeting intermediate variables related to food intake and physical activity have the potential to facilitate healthy behavior change among children and adolescents, avoiding excess weight gain and its associated neurocognitive and immunological sequelae [27].

### **Cultural Considerations**

The high prevalence of childhood obesity among Hispanics raises questions about potential cultural norms that influence excessive weight gain and the applicability of mainstream interventions to this population [27]. In the

United States, Hispanic individuals typically develop obesity at a younger age than other ethnic groups and experience higher rates of related comorbidities such as diabetes, hypertension, and heart disease [26]. This pattern reflects similar trends among adult Hispanics in the United States, who also have disproportionately high obesity rates compared to non-Hispanic whites [21]. Evaluating the efficacy of mainstream childhood obesity prevention efforts for Hispanic populations reveals mixed outcomes; for example, the New York City Department of Health and Mental Hygiene's "Be Fit NYC" initiative successfully decreased obesity rates among non-Hispanic white students but failed to produce a significant decline among Hispanic youth. Ethnic-specific norms also require careful consideration [25]. In a community-based screening at the Children's Hospital of Philadelphia, one-third of overweight Hispanic children were reported by their physicians to have normal weight status, an error rate significantly higher than that found for non-Hispanic white children [23]. This discrepancy aligns with previous findings that Hispanics tend to underestimate their own weight status more commonly than whites and suggests that prevention programs targeting Hispanics should integrate culturally diverse norms of body weight [28]. The Hispanic concept of "familismo," which emphasizes deep familial commitment and strong group identification, may also be particularly salient, as it underscores the role of family endorsement in fostering healthier attitudes and behaviors [28].

### **Diverse Dietary Practices**

A fundamental cause of obesity is an imbalance between energy intake and expenditure, highlighting the therapeutic role of dietary modifications and physical activity [28]. Dietary intervention with a multisectoral approach has yielded positive outcomes in altering obesity-related dietary risk factors among obese children and adolescents [23]. These changes include reductions in sugar-sweetened beverage consumption, high-fat foods, and snacks, alongside increased fruit and vegetable intake. Encouragingly, children from racial and ethnic minority groups show similar acceptance of such interventions [28]. Owing to the complexity of multidisciplinary approaches, it remains challenging to isolate the specific impacts of nutrition care [29]. Multicultural societies encompass a wide spectrum of dietary practices and illnesses that do not conform to standard intervention protocols [27]. Culturally tailored components within these interventions frequently address language barriers, food choices, family relationships, and rapport building; however, none incorporate all four aspects [26]. Among these factors, language considerations and food preferences emerge as the most critical elements for enhancing cultural relevance and effectiveness in obesity-prevention strategies [30].

### **Tailored Interventions**

Unfortunately, as at June 2024, there is very limited information available on the topic "Childhood Obesity Prevention Strategies: A Narrative Review" for the specific section "" [25]. If you would like, I can provide a summary, extract, or any other information instead [25].

### **Evaluation of Interventions**

It is imperative to evaluate prevention efforts to confirm successful supporting and reinforcement of the intended outcomes, such as changes in weight-related behaviours or a reduction in the prevalence of childhood obesity [28]. This may involve assessment of process measures, such as uptake and dose delivered, as well as outcome measures, including body size, food and activity knowledge, dietary and physical activity behaviors [27]. The most appropriate evaluation metrics for a particular prevention programme or policy depend on the sector, type and aims of the intervention [26]. For instance, a local authority campaign promoting school travel to enhance physical activity could be assessed using process indicators, like the number of schools participating and participating pupils, or outcome measures, such as the proportion of pupils actively travelling to school [10]. Reported evidence relating to the priority interventions and supportive actions selected for implementation during the child and young people's obesity pathway has demonstrated a range of successful outcomes [11]. Improvements in associated outcomes, such as increased uptake of breastfeeding, reductions in the proportion of infants breastfed, increases in the consumption of fruit and vegetables or percentage of children walking to school, have been documented [13]. Systematic consideration of these, alongside relevant evidence on effectiveness and implementability, is valuable when formulating a local prevention delivery plan [2]. Maintaining or reducing levels of childhood obesity is the primary objective of any prevention strategy [25]. However, this cannot typically be measured within short time scales, as both obesity and changes in body weight develop over extended periods [24]. For an obesity prevention policy or programme to be considered successful, it must at least maintain existing levels within the target age groups. Therefore, careful identification of the target groups most at risk is essential to effectively plan such measures [23].

### **Metrics for Success**

A standardized set of metrics for assessing the success of childhood obesity prevention strategies is critical to comparing the effectiveness of different approaches [21]. Measuring changes in weight status, physical activity participation, sedentary behavior, nutritional habits, and psychosocial indicators forms the cornerstone of

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evaluation [20]. Public health targeting requires reliable metrics for growth, assessment, and population distribution of risk [18]. Several systematic reviews have assessed the effectiveness of weight management programmes for young children (under age two) in reducing obesity, highlighting the importance of early interventions [2]. Early life interventions should target multiple socio-ecological levels, especially parents and organizations, span all stages from birth to school age, and combine physical activity with diet and sedentary behavior [5]. Multiple intervention functions are advisable [26]. School-based strategies represent recognised scoping points for community interventions [9]. A tiered, stage-based plan can strengthen such approaches each year, enhancing longevity and sustainability. Parental involvement is a crucial determinant, with 75% of interventions involving parents reporting significant weight or BMI reduction [23]. Motivational interviewing and food diaries incorporated into parental education may improve outcomes, although feasibility and cultural barriers require further investigation [10]. Over half of the interventions have included environmental changes, with 75% reporting significant BMI or weight outcomes, signalling a promising avenue [24]. Deployment of environmental strategies has accelerated since 2008, reflecting a recent emphasis on such methods in global school-based programmes [3]. Public health evaluation uses standard anthropometry to calculate prevalence and investigate its correlates in research, with additional prescription, screening, and assessment methods appropriate to clinical settings [25]. Frequency changes in screening and national survey programmes have weighed the relative merits of Body Mass Index (BMI) and other anthropometric measures for community implementation [29]. Those are crucial components of well-established guidelines, each aligned with clear objectives [30].

#### **Long-term Outcomes**

Child obesity prevention strategies have demonstrated some effectiveness in achieving short-term changes in behaviour, weight, or body mass index [10]. Nonetheless, the durability of these effects remains uncertain [13]. Long-term follow-up data are frequently unavailable or, when provided, suggest that initial gains often do not persist beyond a year or two, particularly if the interventions were restricted to a single phase of the early life course [2]. These findings align with observations from other groups that comprehensive interventions need to extend across multiple early life stages (e.g., early childhood, primary school, adolescence) to yield lasting impact [15].

#### **Challenges in Implementation**

Implementation of prevention strategies faces substantial challenges [12]. Resources for initiating programs, particularly in community settings, are limited [11]. Obtaining political support and influence is a significant hurdle for starting and sustaining all interventions [10]. Community buy-in and ongoing support are critical determinants of a strategy's longevity and impact [19]. Conflicting interests create substantial resistance to sustainability [19]. Moving to the next phase involves balancing efforts among supply and demand-side targets. Sustained commitment from the population, program staff, governments, funding agencies, and the private sector is essential [10, 19].

#### **Funding Limitations**

The prevention of childhood obesity remains a pronounced public health concern due to its prevalent persistence into adulthood and the associated risk of numerous chronic diseases [13]. Despite the urgency necessary to curb the epidemic, implementation of effective prevention strategies can be hindered by multiple factors, chief among these being funding limitations [12]. Mid-level public health programs frequently encounter interruptions when funding ceases, even after community partners have actively contributed to design and delivery processes [12]. All intervention programs must therefore consider sustainability from their inception, integrating efforts to secure funding and plan for long-term maintenance [10].

#### **Community Resistance**

Potential for community support or resistance often determines the success of a community-based health programme [14]. Communities actively involved in identifying their problems and in developing strategies to address them are more likely to welcome new programmes as a continuation of their efforts to improve health [17]. Communities that feel threatened by a proposed programme or do not perceive a problem may resist [13]. In a study of the factors influencing childhood obesity, community stakeholders identified several issues, including reduction of time for physical education programmes in schools; limited availability and access to affordable community-based and after-school programmes, particularly for families of low socioeconomic status; a decrease in outdoor play centres in the neighbourhood due to sociodemographic factors, such as less desirable neighbourhood; limited availability of healthy foods in local stores and supermarkets; and concern over a decrease in organised activities and sports for children due to funding cuts [15].

#### **Sustainability Issues**

Limited funding can stop many community initiatives that rely on public resources [1]. Even if large start-up funds are acquired, maintenance funds are needed for long-lasting community programs [29]. Tighter preventive

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budgets can result in less spending on resources for communities, families or individuals that might lower the risk of obesity. Community resistance can also limit prevention efforts [28]. Responses range from compliance and endorsement to altercation and protest [3]. This opposition may be to the intervention itself, such as fences around playgrounds, or to a lesser priority being given to other community needs [23]. Several strategies can be evaluated to an extent. For example, certain practices may be seen to encourage children to make healthy choices or prevent unhealthy weight gain or obesity [25]. Yet long-term outcome data remain an area of critical importance. A successful intervention should be sustainable and involve local populations [29]. Sustainability, which has long been an important issue in Public Health and Health Promotion but is only a recent focus of the literature in relation to health promotion program evaluation, includes the notion of program institutionalization into ongoing community and local health services and has been emphasized as a concern for obesity prevention [25]. In a qualitative study, the sustainability of health promotion programs directed at infants and young children, a highly vulnerable group for ensuring long-term health and well-being, was explored through the perceptions of the health promotion providers [28]. While there was marked consistency in the view of the challenges to and factors involved in sustainability, none of the participants was able to identify specific measures taken to promote sustainability or called for a formal plan to be developed for each initiative [11].

#### **Future Directions**

The need for successful efforts to maintain healthy weight throughout childhood and adolescence is urgent [15]. Novel and innovative approaches are necessary to address the problem [14]. Research gaps highlighted throughout this review identify potential areas where additional research is critical to advance the field and improve prevention strategies for future generations [13].

#### **Innovative Approaches**

In light of the challenges in tackling childhood obesity, innovative strategies with the potential to reverse the epidemic are urgently needed [1]. Establishing cultural, technological, and ecological conditions that support children in maintaining a healthy lifestyle is a high priority for intervention, from which effective strategies may branch out [10, 17]. Innovation is also needed to create public health research environments conducive to success and to enable knowledge advancement to keep pace with and inform public health reform [2].

#### **Research Gaps**

Several gaps must be addressed to advance childhood obesity prevention [4]. Interventions should target multiple levels of the socio-ecological model, emphasizing parents and policy or organizational levels [26]. Efforts should extend over long periods, ideally across all stages of early life, focusing on physical activity combined with diet and sedentary behavior [1, 29]. Utilizing multiple intervention functions is recommended to comprehensively address the issue [2]. Despite recognizing the important community role in supporting healthy behaviors, initiatives often focus primarily on individuals, overlooking opportunities for family and community engagement [10, 11]. Studies tend to emphasize one or two strategies rather than integrating behavioral, community, policy, healthcare, media, and cultural approaches [22]. Comprehensive programs that combine multiple strategies may prove more effective [9].

#### **Case Studies**

Real-world examples of successful childhood obesity prevention interventions provide valuable insights into the development and implementation of effective strategies [6]. The interconnectedness of single behavioral interventions, community strategies, and policy approaches is evident in the design of government-driven programs in Australia and the United States, which focus on improving the nutritional quality of school lunches and facilitating access to sport and leisure facilities [5, 3]. These initiatives incorporate components such as physical activity promotion and healthier food options in schools, demonstrating the synergy between behavioral and policy measures [2]. Additionally, school nutrition education programs contribute to the reduction of excess weight in obese children, highlighting the potential impact of educational activities in obesity prevention [30]. Muslim communities have developed holistic strategies that address physical activity, dietary habits, and lifestyle modification, accompanied by monitoring and evaluation mechanisms to assess effectiveness [29]. Psychosocial interventions targeting obese children encompass a range of approaches from non-specialist dietetic guidance to intensive specialized multidisciplinary programs, revealing the importance of tailored support based on individual needs [28]. Furthermore, community consultation and engagement constitute a vital component of comprehensive obesity prevention efforts, aligning with the principles outlined in community-based interventions and policy approaches [27].

#### **Successful Interventions**

Successful interventions to prevent childhood obesity use multi-pronged strategies based around nutrition, physical activity, and parental involvement, often implemented through school-based programs [10]. Nutrition changes include education and dietary adaptations such as increased fruit and vegetable consumption, portion

control, and decreased intake of sugary beverages and fast food [15]. Physical activity modifications encompass education about its benefits, incorporation of more exercise during the school day, and setting measurable activity goals [15]. Parental involvement enhances effectiveness through education, motivational interviewing, and tools like food diaries [7]. Community-level strategies prevalent since 2008 also support individual efforts; approximately 75% of interventions with a community or environmental component report significant BMI or weight improvements. Future programs should prioritize adaptable, culturally sensitive approaches, involving target populations in design, and aim for sustainable implementation with ongoing evaluation [4].

### **Lessons Learned**

Several key lessons have been learned from diverse studies on childhood obesity prevention [23]. Behavioral models and physical activity promotion combined with dietary guidance are popularly applied in interventions conducted within preschool and early child care facilities [28]. Parent-focused and home-based initiatives have potential to influence BMI during infancy and toddlerhood. Lifestyle counseling that targets mothers during the first year of their child's life also appears promising [27]. Additionally, strategies should be tailored by factors such as maternal education and age. Overall, early intervention, parental involvement, and community-based approaches emerge as important components in effective prevention for young children [2].

### **International Perspectives**

The childhood obesity epidemic is spreading worldwide, prompting diverse countries to develop intervention programs aimed at curbing the trend [25]. Although various school-based programs have achieved notable success, the sustainability of these efforts over extended periods remains uncertain due to a paucity of long-term studies [26]. Tailoring interventions to the specific sociocultural and environmental contexts of each country is essential for maximizing effectiveness [23]. Collaboration among healthcare workers and researchers facilitates the exchange of valuable insights and promotes the adoption of cost-effective, evidence-based approaches. Sustained support and continuous monitoring are indispensable for preserving the achievements of implemented strategies and driving progress in reducing childhood obesity globally [10].

### **Global Strategies**

The issue of childhood overweight and obesity has become a global public health crisis [10]. School-based interventions have been developed and implemented to combat this growing concern. A systematic literature review conducted by Ickes et al. included [20] studies that met criteria such as being primary research, school-based, and reporting outcome data [21]. International interventions generally targeted elementary-aged students and were less likely to target low-income populations or last two or more years [22]. Successful outcomes included positive changes in student body mass index, demonstrating that various approaches can be effective. Future interventions should incorporate culturally specific strategies, environmental components, parental involvement, and consider long-term, frequent interventions with follow-up to assess sustained impact [24]. Obesity affects health and quality of life globally, with higher rates in adults but increasing prevalence in children, especially in developed and urbanized areas [17]. In 2010, approximately 43 million children were overweight or obese worldwide, including 35 million in developing countries [25].

### **Comparative Analysis**

The current systemic review was conducted to evaluate the effects of diverse childhood obesity interventions on children's weight status in European Member States (MSs) [6]. A search in MEDLINE, CINAHL, Cochrane, and PsycINFO yielded 502 articles published between 2006 and 2016, with 21 meeting inclusion criteria: peer-reviewed, English language, addressing weight or weight proxies, transmitting outcome or follow-up findings, and containing at least one European country as a setting [6]. Studies were categorized as community, school, or e-health interventions [7]. In each intervention group, most studies had indeterminable effects; fewer successfully prevented weight gain or obesity, with some even facilitating weight increase. Community-based interventions appeared most effective, school settings yielded mixed outcomes, and e-health interventions showed the lowest success rate. Examples include the GOAL study in Finland, which integrated physical activity promotion with a nutrient-dense, low-caloric diet to combat rapid weight increase among 15-year olds; and the CHOPPS study, where a 5-year community and school intervention targeting children across three age cohorts demonstrated efficacy in maintaining weight status and enhancing obesity-related behaviors [1]. Whether involving parental or community participation, the most successful strategies combined nutrition education with physical activity promotion [10]. The heterogeneity of interventions precluded meta-analysis [12]. The limited number of European studies focusing solely on clear weight-related outcomes restricted detection of successful programs [10]. Moreover, the contrast between increased documentation of childhood obesity incidence and limited investment in data acquisition and program implementation must be considered when assessing prevention strategies [30].

## CONCLUSION

Childhood obesity presents a complex, multifactorial challenge requiring coordinated global and local responses. Evidence from the literature underscores that interventions combining nutrition education, physical activity promotion, and parental involvement are the most effective in reducing obesity-related outcomes. Culturally tailored strategies that consider family dynamics, dietary habits, and language differences enhance the relevance and impact of prevention programs, particularly within diverse populations such as Hispanic and low-income communities. Evaluation remains a cornerstone of success, with standardized metrics such as BMI, dietary patterns, and physical activity levels critical for tracking progress. However, short-term improvements often fade without long-term reinforcement, highlighting the need for sustainable funding, community engagement, and institutional support. Comparative studies across regions reveal that while school- and community-based interventions offer significant potential, their success depends on continuous adaptation to sociocultural and environmental contexts. Looking forward, the fight against childhood obesity demands innovative approaches that integrate public health policy, technology, and cultural understanding. Governments, educators, health professionals, and families must collaborate to create environments that foster lifelong healthy habits. Sustained, inclusive, and evidence-based strategies hold the key to reversing the global childhood obesity epidemic and securing healthier futures for generations to come.

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