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Prevention of Childhood Obesity: A Multifactorial and Interdisciplinary Approach

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Abstract

Background. Childhood obesity has increasingly become one of the most significant public health challenges worldwide, with substantial ties to long-term metabolic and cardiovascular complications.

Aim. This review aims to analyze the main risk factors leading to the development of obesity among the pediatric population and to summarize current preventative strategies.

Materials and methods. A narrative literature review was conducted using the PubMed, QiS, and JEHS databases, including original studies, systematic reviews, and meta-analyses published between 2015 and 2025. Studies not published in English, conference abstracts, and articles lacking full-text access were excluded.

Results. Current studies suggest that childhood obesity is largely influenced by genetic predisposition, sedentary lifestyle, excessive screen time, insufficient sleep, unhealthy dietary patterns, and socioeconomic determinants. Interactions between biological, behavioral, and environmental factors emphasize the multifactorial and intergenerational nature of pediatric obesity.

Conclusions. Prevention strategies should include early nutritional interventions, promotion of regular physical activity, limitation of screen time, sleep hygiene education, school-based health programs, and active involvement of caregivers. Interdisciplinary measures are essential to influence individual behaviors and environmental factors and reduce long-term health consequences.

Key words: childhood obesity, pediatric obesity, prevention of childhood obesity, health education, lifestyle, diet, physical activity, sleep, intervention.

Content

1. Introduction

Research shows that 5-year-old children with a normal BMI have a 6% probability of becoming obese by age 14, while children with a BMI at the 99th percentile have a 72% risk. Nearly half of obese 14-year-olds were already overweight by the age of 5, and 75% had a BMI above the 70th percentile. Infants born with higher birth weight tend to maintain elevated BMI throughout childhood and adolescence, with nearly 44% becoming overweight or obese by their teenage years. Children weighing more than 4000g at birth who were already overweight at the age of 5 face a significantly higher likelihood of developing obesity over the next nine years.

Parental body mass is also crucial. Children with at least one obese parent are more likely to become obese as adults. For obese children aged 3 to 5, the likelihood of becoming obese adults is about 24% when their parents are not obese, whereas if at least one parent is obese, the risk increases to 62%.

Children whose mothers were obese before pregnancy face a 264% higher risk of becoming obese, while those born to overweight mothers have an 89% higher risk. Both a mother's pre-pregnancy BMI and excessive weight gain during pregnancy contribute to an increased likelihood of obesity in her child.

These research results demonstrate the importance of reducing a future mother's body weight to healthy levels. Regular monitoring of fetal growth, including assessment of its weight and the mother's weight, is essential. It is also crucial for both parents to maintain a healthy body weight during the child's development. Research findings show that actions to prevent childhood obesity should be taken even before conception, during pregnancy, and continued from birth through adulthood [1, 2, 3, 4, 5, 6].

2. Methods

A narrative literature review was conducted, focusing on studies published between 2015 and 2025. Relevant literature was identified through PubMed, QiS, and JEHS databases. The following keywords and their combinations were used: childhood obesity, pediatric obesity, prevention of childhood obesity, health education, lifestyle, diet, physical activity, sleep, intervention.

Original research articles, systematic reviews, and meta-analyses focusing on childhood obesity prevention were considered eligible. Studies were selected based on their relevance, methodological quality, and contribution to understanding pediatric obesity prevention. Studies not published in English, conference abstracts, and articles lacking full-text access were excluded.

3. Research results

3.1. Dietary role in the prevention of childhood obesity

Diet as an important pillar of childhood obesity prevention should be applied not in the postpartum period, but also before and during pregnancy, ensuring proper fetal growth. An infants should be breastfed until 6 months, then the diet should be extended by adding fresh home-made complementary foods; breastfeeding should continue until 2 years and beyond. Children should avoid extra sugar, highly salted food, sugar-sweetened beverages, packed fruit juices, and packaged food. Foods should be prepared without added solid fats or trans-fat, and free sugars should be restricted to <5% of total energy intake. Regular monitoring of infant growth can detect early excessive weight gain. Parents should avoid overfeeding and force-feeding. Engaging children in meal preparation can facilitate lifelong healthy dietary habits [7,8,9,10,11]. Early nutritional patterns influence metabolic programming, appetite regulation, and long-term adiposity risk.

3.2. Physical activity in prevention of pediatric obesity

Physical activity reduces visceral adipose tissue, helps build muscle mass, and boosts basal metabolic rate. Exercise helps maintain the balance between calories consumed and burned. Regular physical activity reduces stress, anxiety, and emotional eating, which can affect children and adolescents. Exercise also improves motor and cognitive development.

The recommendations for children and adolescents: engage in at least 20 minutes, optimally 60 minutes, of vigorous physical activity at least 5 days per week in order to improve metabolic health and reduce obesity risk. High-intensity interval training or resistance exercises (20 minutes/day) should be incorporated ≥3 times/week. Recommended sleep duration by age: 0–5 years – ≥11 hours, 5–10 years – ≥10 hours, 10+ years – ≥9 hours [7, 12].

3.3. The role of screen time in the prevention of pediatric obesity

Strong evidence links screen time with adiposity. Exposure to blue light, especially in the evenings, desynchronizes the circadian rhythm, disrupting carbohydrate metabolism via stress axis activation, appetite dysregulation, pancreatic clock and clock gene dysregulation, gut microbiota modification, reduced adiponectin, and decreased spontaneous physical activity. This leads to insulin resistance, overweight, and obesity [23]. Evening light exposure delays melatonin secretion, shifting sleep phase and disrupting the circadian rhythm further. Children spending >2 hours/day with screen exposure are particularly affected [24].

Recommended screen time: none up to 2 years of age, ≤1 hour/day from 1–5 years, ≤2 hours/day from 5–10 years. For 10–18-year-olds, screen time should be balanced with other age-specific developmental goals [7].

3.4. Preventing pediatric obesity by sleeping better

There is strong evidence linking inadequate or poor-quality sleep with increased risk of overweight and obesity in children. Sleep characteristics associated with obesity include duration, quality, and sleep onset time. The study of sleeping may open new routes in the prevention of obesity. Childhood is the preferred time to establish sleep hygiene habits, as this period shapes long-term lifestyle and circadian preferences. Dysregulation of the circadian rhythm, especially on school days ("social jetlag"), correlates with higher BMI, poorer diet quality, and increased consumption of processed foods. Metabolic effects of nighttime eating are more detrimental than identical calories consumed during the day [24]. A higher overall waist circumference and fat mass index regardless of overall sleep duration and lifestyle choices are also observed in adolescent suffering from social jetlag.

Circadian misalignment also affects ghrelin and leptin levels, impairs insulin sensitivity, and shifts cortisol and melatonin secretion, contributing to blood glucose and lipid disturbances. [24]. Sleep deprivation promotes chronic low-grade inflammation, further encouraging adipogenesis and insulin resistance.

Sleep disturbances can also lead to mental health disorders, including anxiety, depression, and behavioral problems. These outcomes may trigger unfavorable eating patterns, exacerbating

weight gain. This forms a vicious cycle: excess body weight promotes further dietary dysregulation, which in turn perpetuates obesity [25].

The recommended steps for children and adolescents are:

1. Establishing bedtime before 9 p.m..
2. Avoiding sleep aids.
3. Maintaining daily physical activity and outdoor time.
4. Ensuring a darkened bedroom environment.
5. Limiting or removing electronic devices from the bedroom.
6. Maintaining consistent sleep hours.
7. Following a steady pre-sleep routine.
8. Avoiding caffeine-containing products.

Even mild sleep deprivation can increase calorie intake the next day, particularly high-calorie, low-nutrition foods like sweets or sugary drinks. Adequate sleep is crucial for healthy growth and obesity prevention. Polish recommendations on sufficient sleep duration for children is presented in Table 1. [12, 13, 14].

Table 1. Recommended sleep duration in children and adolescents according to age group

Age	Hours of sleep per 24h
0-12 month	15-18
1-3 years	12-14
3-6 years	11-12
6-12 years	10-11
over 12 years	8-9

3.5. School-based interventions with health education

School-based health education interventions have the potential to improve BMI outcomes among adolescents. Effective programs should address the biological, psychosocial, environmental, and behavioral determinants of diet and physical activity. In addition to school-level efforts, parents should be actively engaged through multi-component strategies aimed at preventing obesity and overweight in adolescents. [15, 16, 17, 18]

Figure 1. From „A systematic review and meta-analysis of school-based interventions with health education to reduce body mass index in adolescents aged 10 to 19 years".

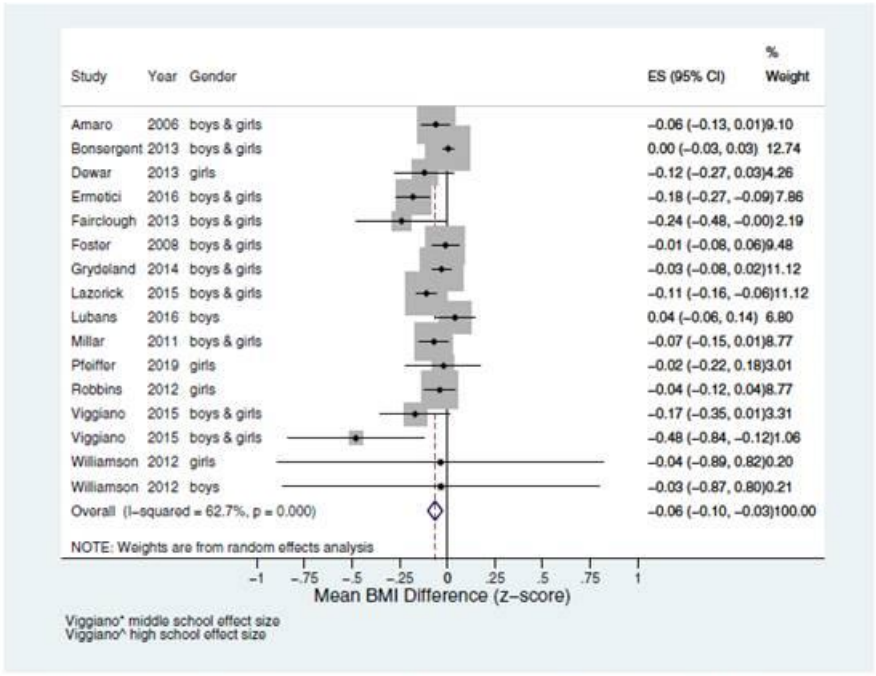

Fig. 2 Meta-analysis of 14 studies showing the effect of educational interventions on BMI z-score. The pooled estimate shows significant difference between intervention and control in change in BMI z-score

On average, BMI z-score decreased by 0.06 in intervention groups. [16].

Conclusions based on findings in primary school children: a small significant intervention effect was found between groups in BMI z-scores, overall the findings were inconsistent, and the heterogeneity observed across all outcomes was not explained by subgrouping. Furthermore, the meta-analyses of the included interventions to prevent childhood obesity were inconclusive regarding moderate-to-vigorous physical activity (MVPA), sedentary behaviour (SB), nutrition behaviour and for BMI kg/m2 compared with the control condition. This review highlights the need to better understand how implementation of multi-component interventions deals with various intervention targets—perhaps it is just too much for schools to take on. [30].

Figure 2. From „The Effectiveness of School-Based Interventions on Obesity-Related Behaviours in Primary School Children: A Systematic Review and Meta-Analysis of Randomised Controlled Trials".

Table 2. Effectiveness of interventions at changing obesity-related behaviours and BMI/BMI z-score.

Outcome 1: MVPA (mins/day)	**Studies (*n*=)**	**INT (*n*=)**	**C (*n*=)**	**I^2**	**MD (95% CI)**
Device-measured	16	4523	3921	41%	1.53 (0.49, 2.57)
Self-reported	2	372	361	0%	12.37 (8.51, 16.22)
MVPA min/day (≤6 months)	4	280	285	0%	4.84 (0.81, 8.88)
MVPA min/day (>6 months)	14	4546	3997	74%	1.89 (0.09, 3.40)
Theory-based	9	3481	3102	74%	2.19 (0.04, 4.34)
No theory	9	1414	1266	49%	2.15 (−0.53, 4.82)
Outcome 2: SB (mins/day)	**Studies (*n*=)**	**INT (*n*=)**	**C (*n*=)**	**I^2**	**MD (95% CI)**
Device-measured	11	3966	3456	55%	−0.91 (−2.30, 0.48)
Self-reported	1	40	52	N/A	1.40 (−25.95, 28.75)
ST min/day (≤6 months)	2	186	192	0%	1.29 (−5.67, 8.24)
ST min/day (>6 months)	10	3820	3316	59%	−1.00 (−2.42, 0.42)
Theory-based	6	3091	2691	20%	−0.46 (−1.93, 1.02)
No theory	5	915	817	65%	−4.51 (−8.68, −0.34)
Outcome 3: BMI z-score	**Studies (*n*=)**	**INT (*n*=)**	**C (*n*=)**	**I^2**	**MD (95% CI)**
Only targeting one outcome	5	1465	1565	68%	−0.05 (−0.10, 0.01)
Targeting > 1 outcome	11	5935	5386	57%	−0.04 (−0.08, 0.00)
≤6 months	2	293	314	52%	−0.02 (−0.15, 0.10)
>6 months	14	7107	6637	61%	−0.04 (−0.08, −0.01)
Theory-based	6	3253	3287	68%	−0.08 (−0.13, −0.02)
No theory	10	4147	3664	47%	−0.02 (−0.06, 0.02)
Outcome 4: BMI (kg/m^2)	**Studies (*n*=)**	**INT (*n*=)**	**C (*n*=)**	**I^2**	**MD (95% CI)**
Only targeting one outcome	8	2451	2469	12%	−0.04 (−0.23, 0.16)
Targeting > 1 outcome	12	4700	4174	67%	−0.04 (−0.14, 0.06)
≤6 months	5	491	502	42%	−0.07 (−0.35, 0.22)
>6 months	15	6660	6141	59%	−0.03 (−0.13, 0.06)
Theory-based	6	2596	2596	75%	−0.10 (−0.22, 0.02)
No theory	14	4555	4047	30%	0.04 (−0.09, 0.18)

Abbreviations: INT = intervention, C = control, MVPA = moderate-to-vigorous physical activity, SB = sedentary behaviour, ST = sedentary time, MD = mean difference, BMI = body mass index.

3.6. Behavioral change

Behavioral change interventions include strategies such as goal setting, where children are guided to create realistic and achievable goals and work actively toward achieving them. They also involve teaching problem-solving and coping skills to help children manage challenges that may contribute to unhealthy eating habits and obesity, including stress, peer pressure, or emotional triggers for eating.

Additionally, behavioral interventions support children in developing self-regulation and self-monitoring skills, helping them recognize and modify unhealthy behaviors. These programs often incorporate reinforcement techniques, social support networks, and parental involvement, which are crucial for maintaining changes over time.

Because these components often overlap with other intervention approaches, isolating the specific effect of behavioral change can be difficult. However, evidence suggests that behavioral strategies can reduce emotional and stress-related eating, improve adherence to healthy diet and activity routines, and strengthen long-term lifestyle habits. Moreover, once

initial improvements are made, strategies such as continuous goal setting, regular self-monitoring, reinforcement, and long-term maintenance support the sustainability of positive outcomes and prevent relapse into unhealthy behaviors [12, 17, 19, 20, 21, 22].

3.7. Pharmacological interventions in pediatric obesity

The regulatory status of medications for pediatric obesity varies considerably across countries. In the United States, five drugs are currently approved: orlistat (for adolescents aged ≥12 years for long-term obesity management), liraglutide (≥12 years for chronic obesity), semaglutide (≥12 years for chronic obesity), phentermine (short-term use ≤12 weeks for adolescents >16 years), and phentermine/topiramate (≥12 years for chronic obesity) (26). In contrast, in Poland, only liraglutide is currently authorized, at a daily dose of 3 mg, approved by the European Medicines Agency (EMA) for adolescents aged 12–18 years with obesity (27). Lifestyle interventions remain the first-line approach for pediatric patients.

Regarding efficacy, in a 2025 metaanalysis, the mean weight reduction at 56 weeks (95% CI) for several pharmacological interventions was reported as follows: semaglutide 12.55 kg (10.17–16.19), phentermine/topiramate 10.16 kg (8.06–12.30), sibutramine 5.86 kg (4.10–7.62), probiotics 3.23 kg (1.11–5.36), orlistat 2.66 kg (2.06–3.28), metformin 2.29 kg (0.26–4.37), and GLP-1 receptor agonists 1.93 kg (1.17–2.72) (28). To account for diffrences between studies, baseline BMI values were standardized to a median of 35.3 kg/m2, and placebo responses were excluded to ensure an accurate assessment of the drug's efficacy. Among these, GLP-1 receptor agonists demonstrated the most rapid response. Evidence also suggests that GLP-1 receptor agonists and orlistat are particularly effective in children with non-metabolic obesity, with slightly better outcomes in males [28].

The safety profiles of orlistat, GLP-1 receptor agonists, and phentermine ± topiramate have been assessed in meta-analyses. Each drug class is associated with specific gastrointestinal adverse effects: orlistat increases the risk of oily stools, fecal incontinence, bloating, and abdominal pain; GLP-1 receptor agonists increase the risk of constipation, nausea, vomiting, and abdominal pain; phentermine ± topiramate shows a low incidence of serious adverse events and is generally well tolerated over short-term use. Overall, all three interventions provide favorable efficacy for weight reduction in the pediatric population, with phentermine ±

topiramate appearing particularly suitable for short-term treatment due to its relatively low risk of severe adverse events [29].

Despite these findings, significant gaps remain in the evidence base regarding pharmacological management of obesity in both pediatric and adult populations. Given the rising prevalence of overweight and obesity among children and adolescents, further high-quality studies are needed to optimize and expand treatment options for this vulnerable group.

4. Conclusions

The prevention of childhood obesity should address multiple factors, including eating habits, nutrition, physical activity, school-based education, sleep hygiene and factors related to pregnancy. Maintaining a healthy body weight in children should be the responsibility of the environment in which they grow and develop. From an early age, children should be educated and supported, reinforcing healthy behaviors that help them maintain an appropriate body weight. These interventions are intended to promote a healthy transition into adulthood, as preventing obesity in childhood reduces the risk of obesity later in life. As a result, they may contribute to increased life expectancy and the maintenance of a high quality of life.

Table 2. Summary of risk factors and preventive strategies.

Domain	**Major risk factors**	**Preventative strategies**
Genetic and prenatal factors	Parental obesity, maternal pre-pregnancy obesity, excessive gestational weight gain, high birth weight (>4000 g), genetic predisposition	Preconception weight optimization, healthy pregnancy lifestyle, monitoring fetal growth, parental weight management
Early life nutrition	Formula feeding, early introduction of high-calorie foods, overfeeding, high sugar intake, ultra-processed foods	Exclusive breastfeeding for 6 months, continued breastfeeding ≥2 years, healthy complementary feeding, limiting added sugars and trans fats, parental education

Dietary patterns in childhood	Excess caloric intake, sugar-sweetened beverages, frequent snacking, low fruit and vegetable intake, fast food consumption	Balanced diet, home-prepared meals, restriction of free sugars (<5% energy), reducing processed foods, involving children in meal preparation
Physical inactivity	Sedentary lifestyle, low energy expenditure, lack of organized sports, reduced outdoor play	≥60 min of moderate-to-vigorous physical activity daily, muscle-strengthening activities ≥3 times/week, promotion of active transport and outdoor play
Screen time and sedentary behavior	Prolonged screen exposure (>2 h/day), evening blue-light exposure, reduced physical activity, disrupted circadian rhythm	Limiting screen time according to age, screen-free bedrooms, parental supervision, replacing screen time with active leisure
Sleep disturbances	Insufficient sleep duration, poor sleep quality, late sleep onset, social jetlag, circadian misalignment	Age-appropriate sleep duration, consistent bedtime routine, sleep hygiene education, removal of electronic devices from bedroom
Psychological and behavioral factors	Emotional eating, stress, poor self-regulation, unhealthy coping strategies	Behavioral interventions, goal setting, self-monitoring, problem-solving skills training, family-based suport
School environment	Limited physical education, unhealthy school meals, lack of health education	School-based health programs, nutrition education, promotion of physical activity, healthy school food policies

Socioeconomic determinants	Low socioeconomic status, food insecurity, limited access to healthy food and safe recreational areas	Community interventions, improving access to healthy foods, public health policies, social support programs
Family environment	Poor parental modeling, lack of caregiver involvement, unhealthy home environment	Active caregiver participation, family-based lifestyle interventions, parental education, creating supportive home habits

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