

Review Article

Childhood Obesity: Examining New Approaches to Tackle This Growing Health Concern

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ABSTRACT

The escalating prevalence and severity of obesity-related comorbidities in the pediatric population globally underscore the critical importance of addressing childhood obesity. Effective treatment strategies necessitate a thorough assessment of predisposing risk factors, which are characterized by a complex interplay between physical and environmental determinants. While extensive literature addresses adult obesity, a notable paucity exists regarding childhood obesity, highlighting an urgent research imperative. This review aims to comprehensively examine childhood obesity by identifying its underlying causes, exploring current diagnostic methodologies, and outlining effective management approaches. Given the increasing prevalence of this condition, the development and implementation of both individual and community-based interventions are crucial for achieving optimal prevention and management outcomes.

Key words: Childhood obesity, Intervention, Overweight, Body Mass Index (BMI), life style modification.

The increasing prevalence of nutritional disorders and nutrition-related chronic diseases (NCDs), including anaemia, micronutrient deficiencies, obesity, diabetes, cardiovascular diseases, and cancer, is a significant concern in our rapidly developing world [1]. Childhood obesity, in particular, poses a major challenge in the 21st century, with higher prevalence rates in developing countries (>30%) compared to developed nations [2]. Overweight and obesity are established health problems in both high- and low-income countries [3]. Among infants and toddlers in the United States, obesity prevalence was 10%, which significantly increased to 17% among children and adolescents [4]. Recent studies from the Indian population across different parts revealed a similar increasing trend in the proportion of children having obesity [5-8]. The differences in the trend of increase in obesity have been considered as malnutrition problems globally which requires identification and correction of underlying root causes to control nutrition-associated diseases. Hence, appropriate intervention is needed during childhood to prevent persistent obesity in adulthood that can lead to associated morbidity and mortality [9-11].

The adverse effects of childhood obesity extend to both physical and psychosocial aspects of quality of life, underscoring the importance of early evaluation and effective

management to enhance patient well-being and mitigate obesity-related healthcare expenditures [12]. Research has established an association between childhood obesity, detrimental effects on psychosocial aspects, and overall quality of life [13-14]. Common psychosocial complications in obese children include depression, appearance dissatisfaction, social stigmatisation, and reduced self-esteem [15].

CHILDHOOD OBESITY

World Health Organisation defines obesity as an excess body mass fat that predisposes an individual to increased risk of morbidity, mortality or alteration in physical, psychological, or social well-being [16]. While related, obesity and being overweight are classified as separate conditions according to body mass index (BMI). While the Centers for Disease Control and Prevention (CDC) uses age-adjusted percentiles, classifying obesity as at or above the 95th percentile of BMI for age and at risk for overweight between the 85th and 95th percentiles, some classifications use a simpler approach [17]. These classifications define overweight as at or above the 85th percentile and obesity as at or above the 95th percentile of BMI, without age adjustment [18]. In the Indian population, overweight was defined as the ≥ 85 th to < 95 th percentile, and obesity as the ≥ 95 th percentile [19].

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ETIOLOGY

The predominant cause of obesity is an energy imbalance, resulting from the interplay of lifestyle habits and dietary intake patterns. This imbalance can be further classified into two types: exogenous and endogenous. The preliminary imbalance between energy intake and outflow contributes to exogenous aetiology, whereas endogenous aetiology comprises genetic, syndromic, and systemic causes [20, 21].

Exogenous Obesity

Given the increasing prevalence of an obesogenic environment that contributes to easy weight gain, conscious and sustained efforts are necessary to ensure the fitness of today's children [22]. This necessitates addressing unhealthy behaviours and the microenvironment, which is significantly impacted by the food industry and government policies [23]. Individual behaviours include

- Consumption of sugar-sweetened beverages and energy-dense foods, packaged refined foods, excessive snacking, and reduced consumption of fruits and vegetables contribute to unhealthy dietary habits [24].
- Absence of sustained physical activity
- Reduced sleeping time and increased screen activity time [25].
- Increased television viewing in children promotes mindless snacking and exposure to food advertisements [26].

Apart from these, certain micro- and macro-environmental factors influence obesity in children. Microenvironmental factors, including family, school, and neighbourhood, are distinct from macroenvironmental factors, which are determined by the food industry and government policies.

- **Family:** Parental behaviours play a critical role in shaping children's dietary intake and physical activity patterns [27]. The fetal environment, specifically maternal diabetes, smoking, and obesity, is associated with an elevated risk of childhood obesity. Furthermore, feeding styles, sleep duration, and postnatal weight gain are recognised as predisposing factors for this condition [28, 29].
- **School:** Schools provide both educational and physical activity opportunities. However, a lack of emphasis on nutrition and physical education (including playground and sports facilities) can contribute to an obesogenic environment. The availability of unhealthy snacks, beverages, and lunches in or near schools may increase children's obesity risk [30, 31].
- **Neighbourhood:** Environmental factors such as the unavailability of healthy food, groceries, and park space, and barriers to active transportation like walking or cycling, promote obesogenic behaviours [32-33].

Endogenous Obesity

Endogenous obesity can occur due to endocrinopathies such as hypothyroidism, Cushing's syndrome, growth hormone

deficiency, hypothalamic obesity, and persistent hyperinsulinemia and can be associated with some systemic disease or genetic syndromes.

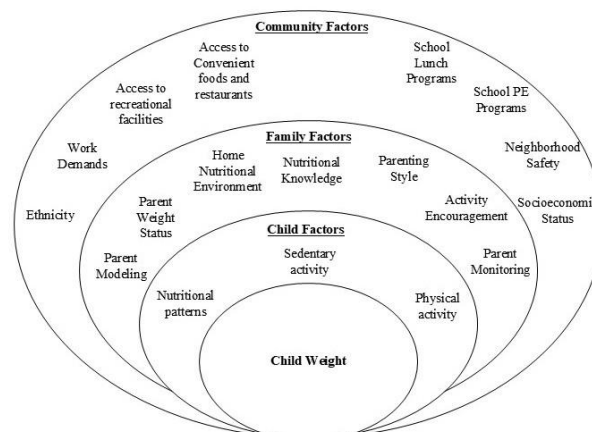


Figure 1: Factors associated with obesity in children.

DIAGNOSIS

Accurate diagnosis is fundamental to the effective management of overweight or obese children. This process involves a detailed history and physical examination to identify underlying causes and associated complications. Following a definitive diagnosis, further investigations and evaluations are initiated. Aggarwal et al. proposed a diagnostic algorithm for childhood obesity, emphasizing the critical role of history taking and physical examination. This algorithm is illustrated in the figure below

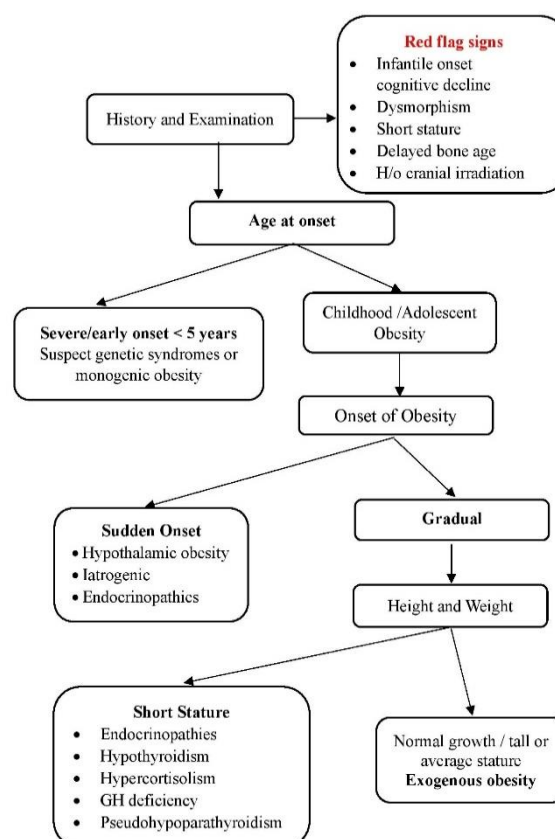


Figure 2: Approach to children with obesity.

APPROACH TO PREVENT OBESITY

Treatment modalities emphasise lifestyle and behavioural modifications as the initial intervention, with pharmacotherapy and surgical procedures reserved for refractory patients. While research supports clinical trials and approved pharmacological therapies for adult obesity, their applicability in pediatric patients remains inconclusive. Therefore, further studies are needed to explore the availability of such treatments for children. However, Brown *et al.* developed an age- and developmental stage-specific anticipatory guidance and intervention protocol (Table 1). The summary from their developmental approach based on the developmental stages of

child are mentioned below

- **Prenatal:** Mothers should ensure appropriate weight gain required for specific gestational age and should avoid tobacco usage.
- **Infancy:** Ensuring that the child weight is not gained rapidly and introduction of solid food. Care should be taken to avoid broad-spectrum antibiotics
- **Toddlers:** Self-regulation of feeding should be encouraged in toddlers with an emphasis on physical activity.
- **School-aged children:** Introducing technology-based intervention to improve their nutrition and physical activity.
- **Adolescents:** Involvement of Peer group in interventions.

Table 1: Anticipatory guidance and specific interventions by age and developmental stage.

	Nutrition	Physical activity / Other	Specific Intervention
Prenatal period	Things to Avoid		Weight gain as per Institute of Medicine guidelines
	Overnutrition, undernutrition, caffeine	Tobacco	
Newborn to 6 months	Things to Avoid		Broad-spectrum antibiotics
	Overfeeding, Television while feeding, sleep after feeding	Screen time or Television	
	Things to do		
	Breastfeeding until 6 months Breast milk or formula Feeding child at their own pace	-	
6 to 12 months	Things to Avoid		Broad-spectrum antibiotics
	-	No screen time or Television	
	Things to do		
	Breastfeeding until 6 months Introducing solid food, fruits, and vegetables Wide variety of textures and flavors and structuring meal and snack times	-	
12 to 24 months	Things to Avoid		Broad-spectrum antibiotics, emotional, and restrictive feeding habits
	Limiting Sugar-Sweetened Beverages (SSB) and eating at restaurants.	Less than 1 hour of Screen time per day	
	Things to Do		
	Eating together as a family Encouraging positive parent modelling	-	
24 to 48 months	Things to Avoid		Restrictive or emotional feeding habits
	Grazing between meals	Less than 2 hours of Screen time per day	
	Things to Do		
	Teaching Table Manners Setting 3 meals per day	-	
4 to 12 years	Things to Do		Technological intervention
	Setting basic rules and allowing them to choose after-school snacks	60 minutes of moderate to vigorous physical activity	
13 to 18 years	Things to Do		Technological and peer group interventions.
	Allowing a child to take responsibility in choosing meals	60 minutes of daily physical activity	

INTERVENTION BASED ON INDIVIDUAL APPROACH

Management of childhood obesity requires a multi-faceted approach. Interventions concerning the management of obesity in individuals can be broadly classified into pharmacological and non-pharmacological interventions.

Non-pharmacological interventions

Lifestyle modifications are considered the primary treatment approach for childhood obesity, as recommended by the National Institute for Health and Care Excellence (NICE) [35]. NICE guidelines caution against nutritionally unbalanced diets due to potential long-term safety concerns [36]. Studies have demonstrated that lifestyle modifications, including a moderate hypocaloric diet, exercise, and nutritional education, can improve the Body Mass Index (BMI) standard deviation score in children and adolescents with abdominal obesity [37].

As previously stated, sugar-sweetened beverages (SSBs) increase the risk of childhood overweight and obesity. Research demonstrates that reducing sugar intake leads to a decrease in BMI [38]. Considering this, the World Health Organization (WHO) recommends limiting dietary sugar consumption for both children and adults [39]. Similarly, the Endocrine Society advises consuming whole fruits over juices and limiting fast food, fat, and sugar intake [40].

Dietary modifications can significantly reduce the risk of childhood and adolescent obesity. One approach involves the protein-sparing modified fast (PSMF), which reduces carbohydrate and calorie intake while increasing protein. Eneli *et al.* demonstrated that PSMF significantly decreased weight and BMI in adolescents at 3 and 6 months, despite a decline in adherence and compliance [41]. Similarly, very-low-energy diets (VLEDs), defined as consuming less than 800 calories or 50% of total daily energy expenditure, have also shown efficacy. A study found that VLEDs resulted in significant weight reduction in children and adolescents when followed for at least 6 months [42].

In addition to dietary modifications, national guidelines recommend that children engage in moderate to vigorous physical activity for at least 60 minutes daily. Aerobic and resistance training have demonstrated benefits in both weight loss and waist circumference reduction [43]. A systematic review evaluating the efficacy of obesity reduction interventions found that physical activity, accessible in both school and home settings, is beneficial for children with obesity [44].

NICE guidelines advocate for family-based interventions to achieve successful weight loss in children, given the family's crucial role in child development and the influence of parental choices on child behaviour [45]. When combined with lifestyle modifications, family-based interventions, behavioural therapy, and cognitive behavioral therapy have demonstrated effectiveness in weight management [46, 47].

Pharmacological interventions

Clinicians may prescribe FDA-approved drugs (Food and Drug Administration) as an adjunct to lifestyle modifications or when lifestyle modifications fail to achieve desired weight management goals in children. Some of the commonly prescribed medications are

- 1. Orlistat:** Orlistat, an intestinal lipase inhibitor, is FDA-approved for treating obesity in children aged 12 and older. Its mechanism of action involves reducing triglyceride hydrolysis, thereby decreasing intestinal fat absorption [48]. The recommended dosage is 120 mg orally three times daily. Adverse effects associated with orlistat use include anxiety and gastrointestinal disorders. Orlistat is contraindicated in patients with chronic malabsorption syndrome and cholestasis [49].
- 2. Glucagon-like peptide-1 analogue:** This peptide, secreted by intestinal L cells throughout the day, exhibits increased production upon food ingestion. It primarily stimulates insulin release and inhibits glucagon secretion. Its mechanism of action involves slowing gastric motility and reducing appetite [50]. Liraglutide, a commonly prescribed GLP-1 analogue, is administered subcutaneously at a dosage of 0.8 mg to 3 mg [51, 52]. The European Medicines Agency (EMA) has approved its use as an adjunct to physical activity and weight management in children over 12 years of age weighing more than 60 kg [53].
- 3. Setmelanotide:** Setmelanotide, a melanocortin 4 receptor (MC4R) agonist, demonstrates potential in correcting proopiomelanocortin (POMC) mutations and other genetic conditions [54]. Studies have shown that it promotes weight loss in patients with MC4R deficiency. Due to its potential in weight management for individuals aged 6 and older with confirmed POMC deficiency, the FDA and EMA approved its use in 2020 and 2021, respectively [55].
- 4. Metreleptin:** A synthetic recombinant leptin analog has demonstrated successful weight loss in leptin deficiency [56]. Given its promising results in pediatric patients with lipodystrophy, it has been licensed for congenital leptin deficiency and generalised lipodystrophy management [57].

INTERVENTION BASED ON POPULATION APPROACH

Given the significant impact of childhood obesity on community health, its management requires a strategic combination of individual clinical interventions and broad population-based public health measures. This dual approach addresses the immediate needs of affected children and the systemic factors that contribute to the condition's widespread prevalence. This can be brought up by the policy reforms framed according to the scope and compatibility.

- Site-specific policies:** Children are being encouraged to adopt healthier habits through incentives provided by banks, stores, and professionals. This includes greater

availability of healthy snacks in stores and increased promotion of healthful choices at entertainment venues.

- **Local policies:** Reestablishing and maintaining dedicated time for recess, physical activity, and physical education, alongside the provision of suitable spaces and equipment and the promotion of active school commutes (group walks, cycling), are crucial for increasing children's physical activity.

State, National, and International policies: At the state and national levels, policies should include 1) incentives for grocery stores to offer healthy foods, 2) subsidies for healthy food in schools and childcare, and 3) strict regulations on child-directed advertising to prevent misleading information. International policies should aim to create population-level obesity control guidelines.

CONCLUSION

The prevalence of childhood obesity, a multifaceted medical condition resulting from the confluence of physical and environmental determinants, represents a growing global health crisis associated with adverse dietary and environmental trends. The timely intervention of this issue necessitates the identification of pertinent risk factors and the implementation of suitable intervention and management protocols.

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