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Current Therapeutic Strategies for Obesity in the Pediatric Population: A Literature Review

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ABSTRACT

Background: Childhood obesity is a major public health problem in both developing and developed countries. It is a chronic, complex, and progressive disease influenced by multiple genetic, psychological, dietary, familial, environmental, and biological factors. It is associated with a wide range of short- and long-term multiorgan complications, many of which persist into adulthood, increasing the risk of chronic multimorbidity. Therefore, early prevention and appropriate treatment are essential.

Aim: To review current therapeutic strategies for pediatric obesity, focusing on lifestyle and behavioral interventions, pharmacotherapy, and bariatric surgery, and to evaluate their effectiveness and clinical applicability.

Materials and methods: A literature review was conducted using PubMed, the Cochrane Library, and Google Scholar, focusing mainly on studies published after 2020 addressing lifestyle, psychological, pharmacological, and surgical management of obesity in children and adolescents.

Results: The therapeutic approach is holistic, based on sustainable lifestyle modification, including dietary changes, physical activity, reduced sedentary behavior, and family involvement. Cognitive-behavioral therapy is crucial in modifying maladaptive behaviors. Pharmacotherapy has expanded options, with GLP-1 receptor agonists (semaglutide, liraglutide) showing the greatest effectiveness, while orlistat, phentermine/topiramate, and setmelanotide may provide additional benefit. Bariatric surgery remains the most effective intervention for severe adolescent obesity, resulting in substantial and sustained weight loss.

Conclusions: Management should be multidisciplinary, with individualized behavioral and psychological interventions as the foundation. Pharmacotherapy and bariatric surgery should be considered in selected patients with severe obesity or inadequate response to conservative treatment.

Keywords: childhood obesity; adolescent obesity; GLP-1 receptor agonists; semaglutide; liraglutide; BMI; lifestyle intervention; physical activity; cognitive behavioral therapy; bariatric surgery

Introduction

Childhood obesity is one of the greatest public health challenges of the 21st century. In recent decades, there has been a rapid increase in the number of overweight children and adolescents in both developed and developing countries, making this problem a global epidemic. Obesity is a chronic disease requiring comprehensive diagnostic, therapeutic, and preventive management (Putri *et al.*, 2025). In children and adolescents, the diagnosis of overweight and obesity is based on the assessment of body mass index (BMI) relative to age and sex. A BMI between the 85th and 94th percentiles is considered overweight, while obesity is diagnosed at BMI values at or above the 95th percentile (Thomas-Eapen, 2021; Putri *et al.*, 2025). The etiology of childhood obesity is multifactorial and involves the interaction of biological, environmental, social, and psychological factors.

The primary driver is a sustained positive energy balance resulting from excessive consumption of highly processed foods and insufficient physical activity. Sleep deprivation, excessive screen time, and limited opportunities for physical activity also play a significant role (Smith *et al.*, 2020; Thomas-Eapen, 2021).

The importance of this issue lies not only in its increasing prevalence but also in its numerous health consequences such as hypertension, insulin resistance, type 2 diabetes, dyslipidemia, and non-alcoholic fatty liver disease. Obesity also negatively impacts mental health, increasing the risk of low self-esteem, anxiety, depressive disorders, and social stigmatization. Importantly, excess body weight that develops in childhood often persists into adulthood, increasing the risk of premature morbidity and mortality (Thomas-Eapen, 2021; Putri *et al.*, 2025). Early childhood is a critical period for the formation of eating behaviours and the development of obesity.

Following a physiological decline in adiposity around the age of 2 years, body fat increases again in a process known as adiposity rebound, which typically occurs between 6 and 8 years of age. An earlier onset of this phenomenon is associated with an increased risk of developing obesity later in life (Flynn *et al.*, 2022). In addition, overweight and obese children are more

likely to eat at a faster pace, are more susceptible to external food cues, and show a weaker response to physiological satiety signals, which contributes to the perpetuation of unhealthy eating habits (Malczyk *et al.*, 2022). Given the growing obesity epidemic and its long-term health consequences, it is essential to implement effective prevention and treatment strategies. The foundation of therapy consists of behavioural interventions, including lifestyle modification, nutrition education, and increased physical activity. In recent years, advances in pharmacotherapy and bariatric surgery have created new treatment options for obese children and adolescents, particularly when traditional non-pharmacological methods prove ineffective (Putri *et al.*, 2025). The aim of this review is to present contemporary treatment strategies for obesity in children and adolescents and to evaluate their effectiveness and clinical relevance.

Epidemiology

According to projections by the World Obesity Federation, by 2035 obesity will affect approximately 18% of girls and 20% of boys aged 5-19. In the European Region, this percentage is projected to reach 14% among girls and 21% among boys, indicating a continued rise in the prevalence of obesity in the pediatric population (*World Obesity Day Atlases | Obesity Atlas 2023*, no date). Particularly alarming is the increase in the number of very young children who are overweight. Over the past two decades, the number of children under 5 years of age who are overweight or obese has increased globally from 32 to 42 million (Flynn *et al.*, 2022). Epidemiological data indicate that childhood obesity significantly increases the risk of remaining overweight in adulthood. It is estimated that approximately 50% of girls and 30% of boys who are obese between the ages of 6 and 11 will remain obese as adults, while as many as 60-75% of obese adolescents will continue to struggle with obesity in adulthood. Consequently, the risk of developing chronic diseases, premature disability, and premature death increases (Flynn *et al.*, 2022; Malczyk *et al.*, 2022; *World Obesity Day Atlases | Obesity Atlas 2023*, no date). Excess body weight is also highly prevalent among Polish children and adolescents. According to the sixth round of the WHO European Childhood Obesity Surveillance Initiative (COSI) covering the years 2022-2024, approximately 25% of children aged 7-9 years in the WHO European Region were overweight or obese, while in Poland this figure was approximately 33%. Excess weight was more common among boys than girls (36.5% and 28.7%, respectively), indicating that currently about one in three children in Poland is overweight or obese (*WHO European Childhood Obesity Surveillance Initiative (COSI): report on the sixth round of data collection, 2022–2024*, no date).

Non-pharmacological treatment

Lifestyle modifications

Various studies confirm the impact of lifestyle on the escalating problem of childhood obesity. Given the complexity and multifactorial nature of this condition, there is a consensus that action

is needed on multiple fronts, at individual, family, institutional, and community levels (Pereira & Oliveira, 2021). Effective interventions include public awareness campaigns on healthy food and eating habits, family involvement in the weight loss process, reading food labels, setting realistic goals, limiting screen time, teaching problem-solving, stress management, and supervised physical activity sessions (Thomas-Eapen, 2021).

The influence of upbringing on a child's eating habits is evident from the earliest years. Obese parents typically raise obese children (Thomas-Eapen, 2021). A child's risk of obesity increases 3.68-fold if their mother has a BMI >30 kg/m². Excessive weight gain during pregnancy is a well-documented risk factor for greater weight gain after birth (Sun *et al.*, 2020). Meta-analyses show that children who were breastfed are less likely to develop obesity in childhood and adolescence compared to children fed formula. The correlation is dose-dependent (i.e., the longer a child was breastfed, the stronger the protective effect) (Erdoğan *et al.*, 2017). Furthermore, children are more likely to eat vegetables when the availability of fruits and vegetables is high and that of sugar-sweetened beverages is low (Verduci *et al.*, 2021).

Some initiatives to combat childhood obesity through the mass media have focused on restricting children's exposure to food advertisements. It has been proven that limiting the number of hours spent in front of the TV can be an effective way to reduce the prevalence of childhood obesity, and limiting eating in front of the TV has proven to be just as important as increasing physical activity (Conlon *et al.*, 2019). Prolonged television viewing not only reduces energy expenditure but also encourages snacking, and children may continue eating even after they are full because they are distracted (Hosokawa & Katsura, 2020).

There is no doubt about the validity of promoting physical activity, which can help control and reduce body weight in obese children and adolescents by increasing energy expenditure and creating a negative energy balance. Achieving weight loss goals can improve children's self-esteem and self-confidence, which can reduce negative emotions and improve mental health (Chen *et al.*, 2024). Despite the variety of available forms of activity, there is a lack of robust evidence regarding whether one intervention model is more effective than another for overweight children (Chen *et al.*, 2024). Therefore, it seems reasonable to encourage children to engage in the type of physical activity they enjoy most while meeting the age-specific duration recommendations of the WHO.

Psychological and behavioral interventions

Nowadays, psychological interventions play a fundamental role in the treatment of obesity in children and adolescents. The emphasis is on an individualized, comprehensive approach. It should be noted that obesity has a significant impact on the patient's mental well-being (Henderson *et al.*, 2025). It has been shown to be directly correlated with reduced self-esteem or a distorted body image (Franklin *et al.*, 2006; Gow *et al.*, 2020). Obese children are more likely to experience social problems, such as teasing or bullying, than their normal-weight peers (Bell *et al.*, 2011; Sanders *et al.*, 2015). They are at higher risk for mood disorders (including depression), anxiety, impulse control disorders, and eating disorders (Bell *et al.*, 2011; Sanderson *et al.*, 2011; Wilfley *et al.*, 2011; Sanders *et al.*, 2015). It has been demonstrated that overweight or obese children and adolescents have lower average scores in

the physical and emotional aspects of quality of life than their normal-weight peers according to the Pediatric Quality of Life Inventory (PedsQL) (Sanders *et al.*, 2015; Henderson *et al.*, 2025). The alarmingly rising prevalence of childhood obesity requires well-tailored psychotherapeutic strategies that will help eliminate dysfunctional patterns of thinking and behavior associated with obesity (Vos *et al.*, 2011; Wilfley *et al.*, 2011)

Cognitive-behavioral therapy (CBT) is the most commonly used therapeutic model in numerous studies, emphasizing psychological aspects such as self-monitoring of eating and physical activity behaviors (e.g., keeping food diaries), goal setting (establishing clear, realistic behavioral goals), introducing alternative ways of coping with stress or cognitive restructuring (modifying maladaptive beliefs that hinder behavioral change). CBT assists children and adolescents in developing strategies leading to the long-term lifestyle changes and the prevention of relapse into old behaviors (Vos *et al.*, 2011; Wilfley *et al.*, 2011).

Another approach used in treatment is interpersonal psychotherapy (IPT), which is a particularly useful method for the psychological treatment of binge eating disorder (BED), which may co-occur with obesity and being overweight. In this case, IPT shows comparable effectiveness to CBT in preventing excessive weight gain (Tanofsky-Kraff *et al.*, 2010; Wilson *et al.*, 2010).

Behavioral interventions involving the family in the therapeutic process are crucial for creating a healthier home environment and were the most frequently used approach for managing overweight and obesity in the reviewed studies (Baygi *et al.*, 2023a). However, this requires significant commitment, consistency, and the implementation of so-called stimulus control (e.g., removing snacks from the home) on the behalf of the family, as well as modeling their own eating habits, in order to achieve lasting treatment outcomes (Tsiros *et al.*, 2007; Vos *et al.*, 2011; Wilfley *et al.*, 2011).

Psychological interventions significantly enhance patients' quality of life, but it should be noted that when used alone, they may not provide satisfactory results. The study by (Henderson *et al.*, 2025) showed a small effect of psychological interventions on HRQoL and triglycerides, and a moderate improvement in depressive symptoms. Regarding intervention intensity, (Henderson *et al.*, 2025) reported more favourable outcomes with higher-intensity interventions, whereas (Baygi *et al.*, 2023b) found moderate-intensity interventions to be the most effective for reducing BMI. Overall, the results indicate differences in methodological approaches, highlighting the need for further investigation in future studies (Vos *et al.*, 2011; Baygi *et al.*, 2023a; Henderson *et al.*, 2025). A multidisciplinary approach is essential, and effective treatment requires the integration of nutritional and physical therapy expertise with carefully selected psychological techniques and, where necessary, appropriate pharmacotherapy (Vos *et al.*, 2011; Baygi *et al.*, 2023a; Henderson *et al.*, 2025).

Pharmacotherapy

Another component of addressing a complex issue such as obesity is pharmacotherapy. It should be noted, however, that it is recommended only after appropriate behavioral and psychotherapeutic interventions have been implemented (Iwanskka *et al.*, 2024).

Weight loss should occur gradually, at a rate of 1 to 2 kg per month. This is recognised as the safest pace. Greater weight loss is not recommended and is associated with negative effects

on children's growth and development (Valerio *et al.*, 2018). It should be emphasized that pharmacological intervention may only be initiated if the child is at least 12 years old, following a thorough discussion of both the side effects and the potential benefits of medication (Wong & Srivastava, 2023). To qualify for pharmacotherapy, just as in adults, the BMI is used as an indicator; if the value is $\geq 30 \text{ kg/m}^2$, pharmacotherapy may be administered (Mazur *et al.*, 2023).

GLP-1 receptor agonists

One of the drugs approved by the U.S. Food and Drug Administration (FDA) in 2022 and by the European Medicines Agency (EMA) for the treatment of obesity in children is semaglutide, which can be used in children aged 12 years and above. It is a GLP-1 receptor agonist that mimics the actions of endogenous incretins, delays gastric emptying, enhances the feeling of satiety, and promotes glucose-dependent insulin secretion (Chamarthi & Daley, 2025a). In the STEP TEENS study, treatment with semaglutide resulted in a mean BMI reduction of 16.1% at week 68, with 73% of participants achieving at least 5% weight loss, compared with 18% of participants receiving placebo. Furthermore, the use of semaglutide reduces cardiometabolic risk through beneficial effects on risk factors such as waist circumference, glycated hemoglobin levels, lipid profile, and alanine aminotransferase activity (Weghuber *et al.*, 2022).

Another drug approved by the FDA in 2020 and by the EMA for the treatment of obesity in the pediatric population is liraglutide, which can be used in children aged 12 years and older. Liraglutide is a GLP-1 receptor agonist that shares the same core mechanism of action as semaglutide (Chamarthi & Daley, 2025b). The SCALE Adolescent study demonstrated its efficacy by showing a reduction in BMI of at least 5% at week 56 in approximately 43.3% of participants, compared to the placebo group, in which a 5% BMI reduction was observed in 18.7% of participants. A decrease in BMI of at least 10% from baseline was achieved in 26.1% of participants compared to the placebo group, in which this effect was achieved in 8.1% of participants (Kelly *et al.*, 2020).

Genetic obesity therapies

Among the drugs used to treat obesity is also setmelanotide (an MC4 receptor agonist), which is indicated for obesity and hyperphagia associated with POMC or LEPR deficiency, where studies have shown a weight loss of $\geq 10\%$ in 80% (POMC) and 45% (LEPR) of participants, respectively, over the course of a year (Clément *et al.*, 2020). This drug has also demonstrated efficacy in treating obesity associated with Bardet-Biedl syndrome, where a weight loss of $\geq 10\%$ was observed in 32.3% of participants (Haqq *et al.*, 2022).

Other anti-obesity medications

Another drug approved by the FDA and EMA for the treatment of obesity in pediatric patients is orlistat. It is a reversible lipase inhibitor that blocks the digestion of fats in the gastrointestinal tract, thereby reducing their absorption by approximately 30%

(Chamarthi & Daley, 2025c). In studies, the use of orlistat was linked to a reduction in BMI, with a decrease of $\geq 5\%$ observed in 26.5% of study participants (compared to the placebo group, where a BMI reduction was observed in 15.7% of participants), while a decrease of $\geq 10\%$ from baseline was observed in 13.3% and 4.5% of participants (Chanoine *et al.*, 2005). However, this drug has limited use in pediatric patients due to bothersome side effects, such as steatorrhea and bowel urgency.

In Poland, there are also a number of unapproved medications that are helpful in treating obesity. Among these is metformin, which is commonly used to treat type 2 diabetes. In a group of patients with childhood obesity, it led to a decrease in BMI, but ultimately this reduction was not significant (Yang *et al.*, 2025). Additionally, there are several studies on the use of lisdexamfetamine. This is an amphetamine derivative typically used to treat attention-deficit hyperactivity disorder (ADHD). This substance has not been well studied for the treatment of obesity, but there are limited reports of its use in patients with co-occurring binge eating disorder (Guerdjikova *et al.*, 2016).

Phentermine and/or topiramate were also studied for their effectiveness in treating obesity in children. In the study (Batt *et al.*, 2025), participants were administered phentermine (24%), topiramate (23%), or a combination of both drugs (53%). A decrease in BMI was observed after 3, 6, 9, and 12 months by 3.1%, 4.7%, 5.2%, and 7.5%, respectively. The use of these drugs was associated with adverse effects such as mood changes, fatigue, and paresthesias, which were the reason for discontinuation of this treatment regimen. The FDA has approved the use of the extended-release combination of phentermine and topiramate for patients aged ≥ 12 years.

Bariatric surgery

Indications and patient selection

Bariatric surgery is an established treatment for obesity, shown to be effective in reducing body weight and metabolic complications in patients under 18 years of age (Inge *et al.*, 2016). The current indications for adolescent bariatric surgery are BMI > 40 kg/m² alone or BMI >35kg/m² with at least 1 obesity-related comorbidity (T2DM, AH, dyslipidemia, OSA).

Lifestyle modification-based treatment for adolescents with severe obesity generally shows suboptimal outcomes and despite the introduction of more effective pharmacological therapies, bariatric surgery remains the most effective treatment option (Mechanick *et al.*, 2013).

The age limit recommended by the American Academy of Pediatrics is 13 years (Hampl *et al.*, 2023). In the past, children who had not reached advanced pubertal stages (Tanner stages 4-5) were not considered candidates for bariatric surgery. However, there is no evidence that bariatric surgery adversely affects pubertal development or growth, therefore, this is no longer a requirement (Alqahtani *et al.*, 2021).

Preoperative assessment

Patient qualification and preparation should be conducted within a multidisciplinary team, including a pediatric endocrinologist or a pediatrician experienced in obesity treatment, a pediatric surgeon, a dietitian, a psychologist, and a physiotherapist. Preoperative assessment should identify potential contraindications such as reversible cause of obesity, active drug addiction, poorly controlled psychiatric illness, high risk associated with anesthesia. It should also address the patient's understanding of the potential limitations and implications of surgery, as well as their ability to comply with postoperative recommendations. Additionally, gaining family acceptance and ensuring their commitment to supporting the treatment process are essential, given the significant impact of familial factors on postoperative outcomes (Pratt *et al.*, 2020).

The preparation period should be approximately 6 months, during which, in addition to diagnostic procedures, dietary habits and lifestyle changes should be implemented. Maintaining or reducing body weight confirms the patient's motivation for treatment and is associated with better outcomes (Hampl *et al.*, 2023; Major *et al.*, 2025).

Surgical procedures

The preferred approach for bariatric procedures is laparoscopy. Among the available methods, the most commonly performed are: sleeve gastrectomy (SG) and Roux-en-Y gastric bypass (RYGB).

Sleeve gastrectomy is the bariatric procedure of choice in adolescents which involves resection of 70-75% of the stomach along the greater curvature. It results in reduction

of the gastric volume and reduces calorie intake. An additional mechanism involves reducing the number of ghrelin-secreting cells (Huang *et al.*, 2023).

Roux-en-Y gastric bypass (RYGB) is a surgical procedure in which a small proximal gastric pouch is created and connected to a segment of the small intestine, bypassing the distal stomach and proximal small bowel. This results in both restriction of food intake and reduced nutrient absorption, as well as changes in gut hormone signaling, leading to weight loss and metabolic improvement (Pucci & Batterham, 2019).

Outcomes, complications and effectiveness

Adolescents with severe obesity undergoing bariatric surgery achieve greater weight loss and improvement of cardiovascular comorbidities compared with those undergoing medical management (Olbers *et al.*, 2017). A 2023 meta-analysis showed that, after at least 5 years of follow-up, bariatric surgery was associated with a significant weight loss. A mean reduction in BMI of 13.09 kg/m² was achieved (15.27 kg/m² for SG, 12.86 kg/m² for RYGB, and 7.64 kg/m² for adjustable gastric banding [AGB]). Significant remission rates of comorbidities were also reported, including type 2 diabetes mellitus (90%), dyslipidemia (76.6%), hypertension (80.7%), obstructive sleep apnea (80.8%), and asthma (92.5%) (Wu *et al.*, 2023; Mitra *et al.*, 2025). Data on mental health outcomes remain limited; however, recent reviews suggest improvements in depressive symptoms and quality of life (Herget *et al.*, 2014; Trooboff *et al.*, 2019).

Bariatric surgery is considered a safe and effective weight loss intervention. The incidence of serious postoperative complications remains relatively low. Short-term complications occur in 6-8% of patients (Altieri *et al.*, 2018). For SG, these include hemorrhage, staple-line leakage, and gastroesophageal reflux. RYGB, while highly effective metabolically, carries a broader spectrum of potential complications, including anastomotic leaks, small bowel obstruction, internal hernias, and dumping syndrome. Among the most important long-term concerns are micronutrient deficiencies, particularly iron, vitamin B12 and vitamin D, which may result from both reduced intake and altered absorption. Therefore, lifelong supplementation with vitamins and minerals is recommended following most bariatric procedures (Lindeman *et al.*, 2020; Xanthakos *et al.*, 2020; Mitchell *et al.*, 2023).

After surgery, patients are typically guided by a dietitian through a stepwise progression of meals, beginning with clear liquids, followed by full liquids, then puréed foods, and eventually advancing to soft or ground foods. The postoperative diet should emphasize appropriate portion sizes, adequate nutritional intake, and vitamin supplementation (Pratt *et al.*, 2020).

Despite the high effectiveness of bariatric surgery, 50% of patients experience weight regain in the long term. Therefore, continued care in a specialized follow-up at a referral center is crucial, with regular monitoring of nutritional status, screening for micronutrient deficiencies and provision of psychological support (Halloun & Weiss, 2022; Major *et al.*, 2025).

DISCUSSION

Obesity in the pediatric population is a chronic, multifactorial condition that requires a comprehensive, interdisciplinary approach involving qualified specialists in medicine, nutrition, and psychology, as well as the application of multiple intervention strategies. The findings presented in this review indicate that no single treatment modality is fully effective in achieving sustained, long-term optimal outcomes. Therefore, integrating different approaches into a coherent and complementary treatment framework is essential for the effective management of obesity in children and adolescents.

Lifestyle modification remains the foundation of therapy and is recommended as the first-line treatment according to international guidelines. Health education delivered by healthcare professionals, as well as within the family setting, also plays a significant role. Family involvement is particularly crucial, as it supports the development of appropriate dietary habits and healthy behavioural patterns, which constitute the basis of the long-term success of the intervention (Thomas-Eapen, 2021; Verduci *et al.*, 2021). However, maintaining satisfactory long-term outcomes with lifestyle modifications remains challenging, and many patients fail to achieve clinically meaningful weight loss through behavioural interventions alone. These findings highlight the need for a comprehensive assessment of treatment strategies that are individually tailored to patients, taking into account the multifactorial nature of the disease and the age of the patients (Chen *et al.*, 2024).

Psychological interventions are an essential and integral component of obesity management in children and adolescents. Obesity is associated with a range of mental health consequences, including low self-esteem, mood disturbances, eating disorders, and peer stigmatization (Franklin *et al.*, 2006; Henderson *et al.*, 2025). In addressing these challenges, cognitive-behavioral therapy (CBT) plays a particularly important role, as it facilitates the modification of maladaptive behavioral patterns and supports the development of strategies for emotion regulation (Vos *et al.*, 2011; Wilfley *et al.*, 2011). It should also be emphasized that family involvement in the therapeutic process is highly important and is associated with more beneficial treatment outcomes.

New pharmacological treatment strategies expand the range of available therapeutic options for the management of obesity in adolescents. However, their implementation requires a thorough screening process, taking into account factors such as the patient's age and the severity of obesity. Among the available pharmacological agents, GLP-1 receptor agonists, including semaglutide and liraglutide, demonstrate the highest efficacy in reducing BMI and are associated with improvements in cardiometabolic risk factors, as shown in the STEP TEENS and SCALE studies (Kelly *et al.*, 2020; Chamarthi & Daley, 2025a). These innovations constitute a valuable addition to current treatment options, particularly in patients who have not achieved satisfactory outcomes with lifestyle modification and psychological interventions. Nevertheless, the long-term safety, durability of therapeutic effects, and cost-effectiveness of these interventions require further investigation and systematic evaluation.

Bariatric surgery remains the most effective method for treating obesity and for the reduction of its associated metabolic complications, including type 2 diabetes, hypertension,

dyslipidemia, and obstructive sleep apnea, in children and adolescents who meet specific criteria related to age and severity of obesity (Mechanick *et al.*, 2013; Hampl *et al.*, 2023). Patient selection and preoperative preparation represent a complex, multi-stage process requiring the involvement of an interdisciplinary team of specialists. Although bariatric procedures are generally considered safe when performed in specialized centres, they require lifelong patient monitoring to sustain therapeutic outcomes and enable early detection of potential complications (Lindeman *et al.*, 2020; Pratt *et al.*, 2020).

Despite substantial progress in treatment, significant challenges persist in the management of pediatric obesity. Access to specialized obesity treatment programs is often limited. Attention should also be drawn to socioeconomic disparities, which may affect both access to care and adherence to treatment recommendations. Future research should place particular emphasis on differences related to age, sex, and gender, as well as culturally appropriate approaches. Family norms, parental beliefs, and health perceptions may all influence the effectiveness of weight management programs. In addition, further studies should focus on identifying additional predictors of treatment response, optimizing individualized therapeutic pathways, and evaluating the long-term outcomes of emerging pharmacological therapies in the pediatric population (Henderson *et al.*, 2025; Putri *et al.*, 2025).

CONCLUSIONS

Childhood obesity is a growing global health problem associated with significant physical, psychological, and social consequences that often persist into adulthood. Lifestyle modification, including dietary changes, increased physical activity, reduction of sedentary behavior, and family involvement, remains the foundation of treatment and should be implemented in all patients. Psychological interventions, particularly cognitive-behavioral therapy, play an important role in improving treatment adherence and long-term behavioral change. Pharmacotherapy may be considered in adolescents with obesity who do not achieve adequate results through lifestyle interventions alone. Among currently available medications, GLP-1 receptor agonists demonstrate the greatest effectiveness. Bariatric surgery is the most effective treatment for severe adolescent obesity and can result in substantial weight loss and remission of obesity-related comorbidities. Effective management of pediatric obesity requires an individualized, comprehensive, and multidisciplinary approach, involving healthcare professionals, family members, and the patient, as well as long-term follow-up to achieve sustainable health benefits and minimize future long-term health burden.

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Declaration on the use of AI:

In preparing this work, the authors used Gemini for the purpose of improving language and readability, text for matting, and verification of bibliographic styles. After using this tool/service, the authors have reviewed and edited the content as needed and accept full responsibility for the substantive content of the publication.

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