

# International Journal of Health Science

Acceptance date: 05/02/2025

## BARIATRIC SURGERY AS A TREATMENT FOR OBESITY AND ASSOCIATED COMORBIDITIES IN CHILDREN AND ADOLESCENTS

---

***Maria Raquel Tinoco Laurindo***

Universidade de Vassouras  
Vassouras – Rio de Janeiro

***Maria Inês Tinoco Laurindo***

Universidade Federal do Rio de Janeiro  
Macaé – Rio de Janeiro

***Júlia Maria de Paula Carvalho***

Universidade de Vassouras  
Vassouras – Rio de Janeiro

***Christianne Terra de Oliveira Azevedo***

Universidade de Vassouras

All content in this magazine is licensed under a Creative Commons Attribution License. Attribution-Non-Commercial-Non-Derivatives 4.0 International (CC BY-NC-ND 4.0).



**Abstract:** Childhood obesity is a global challenge that transcends physical aspects, extending to psychosocial impacts. The associated social stigma contributes to psychological issues, low self-esteem, and, in the long term, increases the risk of comorbidities such as cardiovascular diseases. Maternal history during pregnancy is linked to a higher risk of childhood obesity, which is why a nutritional approach from early childhood is crucial, requiring a balanced intake of nutrients during critical periods of physical and cognitive development. The American Academy of Pediatrics emphasizes the need for a comprehensive therapeutic approach, going beyond physical evaluation and including the analysis of behavioral and family factors. Pediatric obesity is associated with nutritional deficiencies, hormonal changes, and long-term risks of diseases, including type 2 diabetes and non-alcoholic fatty liver disease. In severe cases, bariatric surgery has proven effective in weight reduction and reversal of comorbidities, especially in adolescents. However, this approach carries risks, such as nutritional deficiencies, requiring careful medical monitoring. Different types of bariatric surgery, such as vertical gastrectomy and gastric bypass, are considered based on individual characteristics. Nevertheless, despite the benefits, more extensive research is needed to fully understand the long-term impacts of bariatric surgery in children and adolescents. This article aims to analyze the risks of obesity in children and adolescents, highlighting bariatric surgery as an effective intervention to reverse obesity and its associated comorbidities, based on current scientific evidence.

**Keywords:** bariatric surgery AND child obesity AND children

## INTRODUCTION

Childhood obesity is a global public health issue, associated with the development of comorbidities from childhood to adulthood, as well as being closely related to psychological problems, prejudice and low self-esteem<sup>10</sup>. The social stigma imposed on overweight and obese children has serious short- and long-term consequences, increasing the risk of body dissatisfaction, depression, anxiety and low self-esteem at an early age<sup>10,2(1)</sup>. Studies show that around one in five children worldwide are obese, and the number of young people with severe obesity is constantly increasing. This scenario contributes to the development of cardiovascular and metabolic comorbidities later in adulthood<sup>22</sup>. Early treatment of obesity acts both as a treatment for overweight and as a treatment and prevention of associated comorbidities<sup>17</sup>.

Children with obesity often have hypovitaminosis and hormonal changes. In more severe cases, the risk of vitamin D deficiency doubles<sup>6,14</sup>, increasing the risk of musculoskeletal and immunological alterations. In addition, excess adipose tissue speeds up the puberty process and can affect reproductive function, reducing fertility<sup>25</sup>. In addition, obesity increases the risk of cardiovascular disease, cancer, type 2 diabetes mellitus and non-alcoholic fatty liver disease (NAFLD)<sup>3,13</sup>. A systematic review with meta-analysis by Ogle et al. (2021) carried out between 2007 and 2011 shows a decrease in life expectancy of between 5 and 20 years in the long term, depending on the degree of severity and involvement of obesity and some concomitant comorbidities<sup>14</sup>.

The longitudinal study by Peng et al. (2023) carried out in China with 7,645 schoolchildren highlighted the importance of an appropriate nutritional approach in the fight against obesity. For both preschoolers and schoolchildren, a balanced intake of nutrients is indispensable, as these are critical periods

for formation and good physical and cognitive development, which will be crucial in the long term<sup>15</sup>. In addition, due to the variety of factors associated with the development of obesity, the American Association of Pediatrics recommends an intensive long-term therapeutic plan. It is therefore important that the individual is assessed comprehensively. In addition to the physical evaluation, the search for underlying causes, the evaluation of social history, eating behavior, habits and family history<sup>7</sup> are essential for the development of an efficient therapeutic strategy, which often depends on a surgical approach to express more concrete results.

Obesity in children and adolescents is a major health issue worldwide<sup>9</sup>, and in cases of severe obesity, bariatric metabolic surgery is a better strategy for disease control and effective weight reduction<sup>24</sup>. However, this treatment carries a risk of complications during and after surgery, which varies according to the type of surgery performed. The patient can develop nutritional deficiency, intestinal herniation, gastric reflux, gallstones, infection and ulceration, as well as the risk of mortality<sup>23</sup>.

Further studies into the implications of long-term surgical treatment on the lives of children and adolescents are still needed in order to clearly elucidate how such surgeries affect individuals at this stage of psychological and biological maturation<sup>14</sup>. Despite its benefits, there is still no consensus as to whether it is in fact a method that should be prescribed for this specific audience at<sup>13,23</sup>. The aim of this study is to assess the impact of bariatric metabolic surgery as a treatment for childhood obesity, considering its long-term benefits and risks.

## **OBESITY IN CHILDREN AND ADOLESCENTS**

Overweight and obesity have been serious global public health problems for decades. According to the World Health Organization (WHO), the number of children with an increased body mass index (BMI) has grown significantly<sup>17</sup>. Obesity is a chronic disease characterized by the accumulation of adipose tissue due to inadequate nutritional practices, leading to pathological changes<sup>8</sup>. The WHO defines childhood obesity as an individual whose BMI is higher than the 99th percentile (2-5 years) or higher than the 97th percentile (5-18 years)<sup>13</sup>. Being overweight in the early stages of an individual's biopsychosocial development leads to a number of alterations in physiological functioning and development, as it enables the development of chronic diseases<sup>14</sup>, as well as generating social stigma and psychological disorders in children and adolescents<sup>13</sup>.

The COVID-19 pandemic has significantly aggravated dietary problems, impacting the population as a whole. In 2020, around 379 million children and adolescents under the age of 19 were diagnosed as overweight or obese<sup>22</sup>. However, the increase in energy intake does not reflect a nutritional improvement, since, in a context of socioeconomic fragility, many families have started to regularly consume low-cost ultra-processed foods. These products, rich in sugars, carbohydrates and additives, act as endocrine disruptors<sup>17</sup> and are directly associated with malnutrition, due to their obesogenic and dyslipidemic potential when constantly included in the diet<sup>18</sup>.

Children with obesity are more likely to maintain a high BMI percentile in adulthood, increasing the risk of developing other diseases and aggravating pre-existing conditions<sup>23</sup>. More than 60% of children who are overweight in the pre-puberty phase maintain it into adulthood<sup>13</sup>. Prolonged obesity increases the

risk of morbidity and mortality<sup>2</sup>, cardiovascular events, diabetes, various types of cancer, kidney disease and liver disease<sup>14</sup>. Even in childhood, obesity can lead to the development of various diseases such as insulin resistance, diabetes, systemic arterial hypertension, non-alcoholic fatty liver disease (NAFLD), depression, image disorders, eating disorders, respiratory diseases and orthopedic alterations<sup>13,22</sup>.

## ASSOCIATED COMORBIDITIES

Type 2 diabetes mellitus (DM2) is defined by fasting blood glucose levels above 7 mmol/L and glycated hemoglobin (HbA1c) above 6.5%, in the absence of hypoglycemic drugs. It resolves when these parameters fall below the diagnostic limits<sup>23</sup>. In children and adolescents, DM2 is associated with serious complications such as cardiovascular disease, kidney failure, accelerated degeneration of pancreatic beta cells, retinopathy and neuropathy<sup>2</sup>.

The first line of prevention for DM2 in adults with pre-diabetes is lifestyle change interventions (LME)<sup>12</sup>. Although the ideal type of physical exercise to reduce T2DM in children and adolescents is still unclear, studies highlight the importance of musculoskeletal development, as it facilitates the elimination of glucose by the body<sup>24</sup>. In addition to VSM, which is widely recommended in the treatment of obesity and T2DM<sup>21,3</sup>, bariatric surgery has been approved by the American Diabetes Association as an effective tool in the management of the disease and weight loss<sup>22</sup>.

Childhood obesity is also strongly associated with cardiovascular diseases such as hypertension and dyslipidemia<sup>21</sup>. Hypertension in childhood often persists into adulthood, increasing the risk of cardiovascular disease<sup>14</sup>. It also affects biochemical parameters, such as cortisol and uric acid, and is related to reduced neurocognitive and functional

performance<sup>19</sup>. According to the Brazilian Society of Pediatrics (SBP), children and adolescents with blood pressure between 130/80 mmHg and 139/89 mmHg are classified as having stage I hypertension and should be evaluated for damage to target organs such as the kidneys, cardiovascular system and central nervous system<sup>11</sup>.

The American Teen-LABS study, which followed 242 adolescents aged between 13 and 19 for three years, showed that five years after metabolic and bariatric surgery (MBS), there was not only a reduction in BMI, but also a resolution of hypertension and dyslipidemia<sup>13</sup>. These results show that BMS is an effective intervention for reversing cardiac risk factors<sup>14</sup>.

## THERAPEUTIC APPROACH

The treatment of obesity in children and adolescents is essential, mainly due to the various comorbidities and disorders associated with this condition<sup>13</sup>. Social and emotional factors, family influence, impact on quality of life and treatment efficacy are determining factors in adolescents' decisions about the type of therapy to be adopted<sup>22</sup>.

The management of obesity in children and adolescents requires a multifaceted therapeutic approach that includes nutritional, physical, psychological, pharmacological and, in selected cases, surgical interventions<sup>14</sup>. The main therapeutic strategies are:

## NUTRITIONAL INTERVENTIONS

The basis of obesity treatment involves adopting a balanced diet, adapted to the patient's individual needs. Nutritional guidance should focus on reducing the consumption of ultra-processed foods, rich in sugars and fats, and promoting a diet rich in fruit, vegetables, lean proteins and whole grains<sup>17</sup>. Food education for the family is also essential to ensure adherence and sustainability of the changes<sup>13</sup>.

## PROMOTING PHYSICAL ACTIVITY

Regular exercise is essential for weight control and improving metabolic health. Physical activity adapted to the patient's age and clinical conditions is recommended, with the aim of increasing energy expenditure and promoting cardiovascular health<sup>19,13</sup>.

## BEHAVIORAL THERAPY AND FAMILY SUPPORT

Cognitive behavioral therapy, combined with family involvement<sup>15</sup>, plays a crucial role in modifying habits and promoting a healthy lifestyle to maintain changes in the long term<sup>13</sup>. Psychological support is also important to address emotional and behavioral issues associated with obesity<sup>22</sup>.

## PHARMACOLOGICAL TREATMENT

The use of medication can be considered from the age of 12, in selected cases and under medical supervision. Although the effectiveness of drugs varies, some medications have been shown to reduce body mass index (BMI) by 2 to 4%<sup>13</sup>. It is essential that pharmacological treatment is complementary to lifestyle changes and does not replace nutritional and physical interventions<sup>21</sup>.

## BARIATRIC SURGERY

Bariatric surgery is indicated for adolescents with severe obesity (BMI  $\geq 35$  kg/m<sup>2</sup> with comorbidities or BMI  $\geq 40$  kg/m<sup>2</sup>) who have been unsuccessful with conservative treatments<sup>13</sup>. Studies show that surgery can lead to significant weight reduction and improvement or resolution of associated comorbidities such as type 2 diabetes, hypertension and sleep apnea<sup>14,2</sup>.

Metabolic and bariatric surgery (MBS) has been endorsed by recent studies as a safe and effective option, even with the risk of nutritional deficiencies, which should not be a reason to postpone treatment in young people<sup>14</sup>. In

addition, multidisciplinary lifestyle interventions are fundamental as a starting point for the treatment of childhood and adolescent obesity<sup>23</sup>. However, patients with a higher BMI, high levels of glycated hemoglobin, insulin and triglycerides tend to opt for more advanced treatments, such as a combination of diet, medication and surgery<sup>22</sup>.

Pharmacological therapy, although with a variable response, shows efficacy in reducing BMI<sup>21</sup>, while combined interventions (diet, medication and surgery) show superior results compared to lifestyle changes (LBM) alone<sup>22</sup>. Intensive interventions, including EBM, can result in sustainable weight loss of 5 to 15%<sup>8</sup>.

Bariatric surgery has also been approved by the American Diabetes Association as a treatment for type 2 diabetes in cases of high BMI<sup>20</sup>, due to its direct impact on both conditions. Performing surgery before adulthood offers long-term benefits, as adolescents have a greater ability to reverse cardiac and metabolic complications compared to adults<sup>1,5</sup>.

Among the most widely used surgical techniques are the Y-of-Roux gastric bypass, laparoscopic adjustable gastric banding and laparoscopic vertical gastrectomy, all of which have shown promising results in the total or partial remission of complications associated with obesity<sup>13</sup>. Recently, the American Society for Metabolic and Bariatric Surgery updated its pediatric guidelines, eliminating the age restriction and the need to wait until pubertal maturity before performing surgery<sup>14</sup>.

However, access to BMC is still limited due to socioeconomic and ethnic disparities<sup>5</sup>. Therefore, although it is an effective and long-lasting option for the treatment of obesity and its complications in adolescents<sup>14</sup>, its application remains restricted to a specific portion of the population<sup>25</sup>.



## **TYPES OF SURGERY**

According to the randomized controlled trial (RCT) by Roebroek et al. (2019), surgical treatment of obesity, regardless of the type of procedure, promotes more significant and lasting weight loss than non-surgical approaches, reducing the development of associated comorbidities and long-term mortality<sup>17</sup>. Each surgical technique has specific indications and can present adverse complications at different times. Common contraindications include pregnancy, breastfeeding, substance abuse and conditions that prevent adherence to post-operative management<sup>23</sup>.

### **VERTICAL SLEEVE GASTRECTOMY (VSG)**

GVM is the most suitable technique for adolescents with severe obesity<sup>13</sup> and is notable for having fewer adverse effects<sup>2</sup>. This procedure involves removing approximately two thirds of the stomach, which reduces the production of ghrelin (hunger hormone) and increases levels of GLP-1 and PYY, hormones that promote satiety and improve insulin resistance. GVM results in rapid weight loss and an improvement in comorbidities such as type 2 diabetes mellitus (DM2), sleep apnea, non-alcoholic fatty liver disease (NAFLD) and cardiovascular risk<sup>23</sup>. An observational study followed young people who underwent GVM for 10 years and found that 12% developed gastroesophageal reflux disease or gallstones after five years<sup>2</sup>.

### **LAPAROSCOPIC SLEEVE GASTRECTOMY (LSG)**

GLM is a minimally invasive technique, preferred in children because of its safety, shorter surgical time and effectiveness. It is indicated for patients with a BMI between 30 and 35 (severe obesity) or at high risk of bariatric surgery<sup>9,13</sup>. Like LBM, GLM promotes significant weight loss and improvement in metabolic and cardiovascular comorbidities<sup>23</sup>.

### **LAPAROSCOPIC ADJUSTABLE GASTRIC BAND (LAGB)**

BGAL is a reversible procedure that involves placing an adjustable band around the stomach to restrict food intake. However, it does not demonstrate significant neurohormonal changes and has limited long-term efficacy<sup>23</sup>. For these reasons, its use has decreased among adults and it is banned for children under 18 in the United States<sup>13</sup>.

### **ROUX-EN-Y GASTRIC BYPASS (RYGB)**

RYGB consists of dividing the stomach into a proximal region, which is connected directly to the small intestine, bypassing most of the stomach and the proximal portion of the intestine. This procedure improves the secretion of gastrointestinal hormones and bile salts, as well as reducing food intake. Like GVM and GLM, RYGB results in rapid weight loss and an improvement in comorbidities such as DM2, sleep apnea, NAFLD and cardiovascular risk<sup>23</sup>. In an RCT published in 2020, Bonouvrie et al. evaluated 2,064 young people aged between 13 and 17 who underwent RYGB. The study showed that all patients had resolved hypertension, highlighting the potential of bariatric surgery as an effective intervention for controlling this comorbidity in adolescents with obesity<sup>1</sup>.

## **RESULTS AFTER BARIATRIC SURGERY**

Metabolic and bariatric surgery (BMS) causes significant changes in gastrointestinal neurohormonal signaling, modulating hormones related to hunger and satiety. This change results in a reduction in calorie intake and, consequently, a reduction in body weight<sup>23</sup>. In addition to the physical benefits, studies highlight positive impacts on patients' self-esteem and romantic self-perception, factors closely linked to acceptance of the new body image<sup>20</sup>.

Regarding weight loss, a RTC by Järvholm et al. (2023) followed 81 adolescents for two years and observed an average reduction of 40 kg in the first year and 2 kg in the second year, with a total BMI change of 16 kg/m<sup>2</sup><sup>11</sup>. The reduction in adipose tissue resulted in an improvement in body composition and functional capacity in the first year after surgery<sup>5,11</sup>. Similarly, the American study (OGLE et al., 2021) with 242 young people found that the greatest weight loss occurs in the first year after surgery, with a reduction of approximately 20% in BMI after five years<sup>14</sup>.

In addition to weight loss, BMS has been shown to be effective in resolving comorbidities associated with obesity. The Swiss study showed remission of type 2 diabetes mellitus and insulin resistance in 69.9% of patients, hypertension in 61.6% and dyslipidemia in 57.1%<sup>1</sup>. After three years, a reduction of more than 10 kg in weight and remission of renal dysfunction were also observed in 86% of cases. The American study complements these findings, reporting an incidence of dyslipi-

demia of less than 5% up to five years after surgery and a remission of type 2 diabetes in more than 80% of young people<sup>14</sup>.

However, it is important to note that patients undergoing BMC can develop micronutrient deficiencies, such as calcium, vitamin D, iron, B vitamins and vitamin A<sup>13</sup>. These deficiencies make periodic supplementation and continuous medical monitoring necessary, since many patients develop anemia due to malabsorption<sup>8,14</sup>.

In summary, metabolic and bariatric surgery has significant short- and medium-term resolvability<sup>8,9,17</sup>, guaranteeing an improvement in patients' quality of life, as well as long-term remission of comorbidities<sup>11,14</sup>. However, as it is a relatively new modality in this age group, there are still gaps in knowledge about its long-term effects<sup>2</sup>. More prospective and long-term follow-up studies are needed to assess the impact of this treatment in the early stages of life, including possible late complications and effects on patients' growth and development.

## REFERENCES

1. AGUILAR-CORDERO, M. J. et al. Influence of physical activity on blood pressure in children with overweight/obesity: a randomized clinical trial. *American Journal of Hypertension*, v. 33, n. 2, p. 131-136, 2020. doi: 10.1093/ajh/hpz174.
2. AL SABAH, S. et al. Long-term outcomes of sleeve gastrectomy in adolescent patients: the effect of weight loss in younger years to outcomes in adulthood. *BMC Surgery*, v. 23, n. 1, p. 103, 2023. doi: 10.1186/s12893-023-02006-6. Acesso em: 29 jan. 2025.
3. ALANIZ-ARCOS, J. L. et al. Differences in the absolute muscle strength and power of children and adolescents with overweight or obesity: a systematic review. *BMC Pediatrics*, v. 23, n. 1, p. 474, 2023. doi: 10.1186/s12887-023-04290-w. Acesso em: 29 jan. 2025.
4. BONOUVRIE, D. S. et al. Laparoscopic Roux-en-Y gastric bypass versus sleeve gastrectomy for teenagers with severe obesity - TEEN-BEST: study protocol of a multicenter randomized controlled trial. *BMC Surgery*, v. 20, n. 1, p. 117, 2020. doi: 10.1186/s12893-020-00778-9. Acesso em: 29 jan. 2025.
5. BRISSMAN, M. et al. Physical fitness and body composition two years after Roux-en-Y gastric bypass in adolescents. *Obesity Surgery*, v. 27, p. 330-337, 2017. doi: 10.1007/s11695-016-2282-1. Acesso em: 29 jan. 2025.
6. FIAMENGHI, V. I.; MELLO, E. D. Vitamin D deficiency in children and adolescents with obesity: a meta-analysis. *Jornal de Pediatria*, v. 97, n. 3, p. 273-279, 2021. doi: 10.1016/j.jped.2020.08.006. Acesso em: 29 jan. 2025.
7. GAIKWAD, S.; BHAVNAGAR WALA, A. American Academy of Pediatrics, 2023: Guideline for the Evaluation and Treatment of Children and Adolescents With Obesity. *Indian Pediatrics*, v. 60, n. 9, p. 759-761, 2023. Disponível em: <https://pubmed.ncbi.nlm.nih.gov/37705267/>. Acesso em: 29 jan. 2025.

8. GOTTARDI, L.; TINOCO, A.; ALBERTI, L. R. Laparoscopic bariatric surgery in adolescents: early and five-year clinical and laboratory assessment. *ABCD, Arquivos Brasileiros de Cirurgia Digestiva*, v. 36, p. e1748, 2023. doi: 10.1590/0102-672020230030e1748. Acesso em: 29 jan. 2025.
9. GRIGGS, C. L. et al. Weight loss after laparoscopic sleeve gastrectomy in children and adolescents. *Obesity Surgery*, v. 33, n. 10, p. 3186-3192, 2023. doi: 10.1007/s11695-023-06789-8. Acesso em: 29 jan. 2025.
10. HEROUVI, D. et al. Bariatric surgery in the management of childhood and adolescence obesity. *Endocrine*, v. 79, n. 3, p. 411-419, 2023. doi: 10.1007/s12020-023-03095-w. Acesso em: 29 jan. 2025.
11. JÄRVHOLM, K. et al. Metabolic and bariatric surgery versus intensive non-surgical treatment for adolescents with severe obesity (AMOS2): a multicentre, randomised, controlled trial in Sweden. *The Lancet Child & Adolescent Health*, v. 7, n. 4, p. 249-260, 2023. doi: 10.1016/S2352-4642(22)00373-X. Acesso em: 29 jan. 2025.
12. LEE, S. et al. Effects of exercise modality on insulin resistance and ectopic fat in adolescents with overweight and obesity: a randomized clinical trial. *The Journal of Pediatrics*, v. 206, p. 91-98.e1, 2019. doi: 10.1016/j.jpeds.2018.10.059. Acesso em: 29 jan. 2025.
13. MAFFEIS, C. et al. The treatment of obesity in children and adolescents: consensus position statement of the Italian society of pediatric endocrinology and diabetology, Italian Society of Pediatrics and Italian Society of Pediatric Surgery. *Italian Journal of Pediatrics*, v. 49, n. 1, p. 69, 2023. doi: 10.1186/s13052-023-01458-z. Acesso em: 29 jan. 2025.
14. OGLE, S. B. et al. Outcomes of bariatric surgery in older versus younger adolescents. *Pediatrics*, v. 147, n. 3, p. e2020024182, 2021. doi: 10.1542/peds.2020-024182. Acesso em: 29 jan. 2025.
15. PENG, L. et al. The relationship between family diet consumption, family environment, parent anxiety and nutrition status in children during the COVID-19 pandemic: a longitudinal study. *Frontiers in Public Health*, v. 11, p. 1228626, 2023. doi: 10.3389/fpubh.2023.1228626. Acesso em: 29 jan. 2025.
16. REITER-PURTILL, J. et al. Self-worth and developmental outcomes in young adults after pediatric bariatric surgery. *Health Psychology*, v. 42, n. 2, p. 92-102, 2023. doi: 10.1037/hea0001257. Acesso em: 29 jan. 2025.
17. ROEBROEK, Y. G. M. et al. Bariatric surgery in adolescents: a prospective randomized controlled trial comparing laparoscopic gastric banding to combined lifestyle interventions in adolescents with severe obesity (BASIC trial). *BMC Pediatrics*, v. 19, n. 1, p. 34, 2019. doi: 10.1186/s12887-019-1395-9. Acesso em: 29 jan. 2025.
18. ROUSHAM, E. K. et al. Unhealthy food and beverage consumption in children and risk of overweight and obesity: a systematic review and meta-analysis. *Advances in Nutrition*, v. 13, n. 5, p. 1669-1696, 2022. doi: 10.1093/advances/nmac032. Acesso em: 29 jan. 2025.
19. SINGHAL, R. et al. 30-Day morbidity and mortality of bariatric metabolic surgery in adolescence during the COVID-19 pandemic - The GENEVA study. *Pediatric Obesity*, v. 16, n. 12, p. e12832, 2021. doi: 10.1111/ijpo.12832. Acesso em: 29 jan. 2025.
20. SOCIEDADE BRASILEIRA DE PEDIATRIA. Hipertensão arterial na infância e adolescência: Manual de Orientação. Departamento Científico de Nefrologia, n. 2, abr. 2019.
21. SPADACCINI, D. et al. Beyond bariatric surgery and weight loss medications: A systematic review of the current practice in obesity rehabilitative inpatient programs in adults and pediatrics. *Frontiers in Nutrition*, v. 9, p. 963709, 2022. doi: 10.3389/fnut.2022.963709. Acesso em: 29 jan. 2025.
22. SUAREZ, L. et al. Advanced obesity treatment selection among adolescents in a pediatric weight management program. *Childhood Obesity*, v. 18, n. 4, p. 237-245, 2022. doi: 10.1089/chi.2021.0190. Acesso em: 29 jan. 2025.
23. TORBAHN, G. et al. Surgery for the treatment of obesity in children and adolescents. *Cochrane Database of Systematic Reviews*, v. 9, p. CD011740, 2022. doi: 10.1002/14651858.CD011740.pub2. Acesso em: 29 jan. 2025.
24. YARIGHOLI, F. et al. Safety and efficacy of one anastomosis gastric bypass in children and adolescents: a 5-year cohort study. *Obesity Surgery*, v. 33, n. 9, p. 2632-2639, 2023. doi: 10.1007/s11695-023-06749-2. Acesso em: 29 jan. 2025.
25. ZHOU, X. et al. Overweight/Obesity in Childhood and the Risk of Early Puberty: A Systematic Review and Meta-Analysis. *Frontiers in Pediatrics*, v. 10, p. 795596, 2022. doi: 10.3389/fped.2022.795596. Acesso em: 29 jan. 2025.