

Management Plan according to EOSS-P

Subjects: Pediatrics

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Childhood obesity, affecting 29% of 7–9-year-olds across 33 European countries, is a significant public health challenge. Its persistence into adulthood poses grave health risks influenced by genetic, environmental, and socio-economic factors. Belgium introduced a new care pathway in December 2023, based on the Edmonton Obesity Staging System for Pediatrics (EOSS-P), addressing four health domains and staging obesity severity. This pathway operates across three levels: primary care physicians, Paediatric Multidisciplinary Obesity Management Centres (PMOCs), and Centers of Expertise for Paediatric Obesity Management (CEPOs). Each stage of EOSS-P demands tailored interventions. Early stages involve dietary interventions, physical activity promotion, and behavior modifications. As obesity severity progresses, treatments intensify, encompassing psychological support, anti-obesity medications, and, in some cases, bariatric surgery.

Keywords: childhood obesity ; Edmonton Obesity Staging System ; multidisciplinary care

1. Stage 0—Outpatient

Intensive Health Behavior and Lifestyle Treatment

The first step in treating obesity involves dietary education and, if necessary, energy restriction ^[1]. At the initial analysis, it is important to understand the child's normal eating behavior, achievable through a weekly food diary or a questionnaire ^[2]. The objective is to formulate a personalized dietary plan for each child, with clear goals discussed with and approved by the child and their family. Emphasizing that new dietary habits are for the entire family and not exclusively for the child is vital for sustaining these changes. Beyond the family context, implementing dietary interventions in the school environment or even the broader community can contribute to better compliance with the intervention.

The National Nutrition & Health Program in France has defined eight main benchmarks to bear in mind: consuming at least five fruits and vegetables daily, incorporating three daily dairy products, including carbohydrates in every meal, consuming one to two portions of meat, fish, or eggs a day, limiting fats, sugary foods, and salt, and promoting unlimited water intake ^[3]. The American Academy of Pediatrics made a clinical practice guideline in 2023 on treating childhood obesity, based on different RCTs and reviews ^[4]. Recommendations on dietary intake were as follows: reduction of sugar-sweetened beverages, low concentrated fat, and added sugars, nutrient-dense but not calorie-dense meals with balanced proteins and carbohydrates, and increased intake of vegetables and fruits. This was also suggested in a review of 16 guidelines worldwide by Pfeiffle et al., who added that the portion size needs to be adjusted for age, gender, and physical activity ^[5]. A scoping review by Alman et al. on global guidelines revealed that the primary strategy in most guidelines is to achieve weight loss through moderate energy restriction ^{[1][6][7][8][9]}. Various approaches, such as meal planning or the Traffic Light diet, are proposed ^{[7][9][10]}. The Traffic Light diet categorizes foods playfully, designating green for low-energy foods that can be eaten freely; yellow for moderate-calorie foods to be consumed occasionally, and red for foods that should be eaten only in small amounts or rarely ^[11]. This strategy is also cited in the American guidelines ^[4]. Intensive dietary interventions like low-carbohydrate diets and very low energy diets (VLEDs) are recommended by only a few clinical practice guidelines ^{[5][7]}, specifically for children with severe obesity or existing comorbidities. Careful monitoring for adverse effects on growth and puberty is necessary, thereby limiting the use of these diets.

In cases where dietary education proves insufficient for maintaining a healthy weight, more intensive treatment may be required. A position statement from the European Association for the Study of Obesity (EASO) in collaboration with the European Federation of the Associations of Dietitians (EFAD) on medical nutrition therapy in childhood obesity was based on different systematic reviews of randomized controlled trials. They made the following recommendations:

- It is important to maintain energy deficits but at the same time meet nutritional requirements for growth ^[12].

- The reduced energy deficits are obtained through increased vegetable and fruit consumption and limitation of fruit juice consumption ^{[13][14]}.
- Energy-Dense, Nutrient-Poor foods (EDNP), like sweets, chocolates, and cookies, should not be prohibited, but consumption should be reduced. Totally avoiding these foods cannot be sustained in children ^[15].
- An age-appropriate approach regarding parental or family involvement is recommended ^[16].
- Apart from dietary interventions, focusing on weight bias and stigmatization can help improve the patient's self-esteem ^[11].

Beyond avoiding specific foods, cultivating good eating habits is also essential. Establishing regular mealtimes is crucial for teaching concepts of hunger, fullness, and satiety ^[2]. Alongside three main meals, incorporating two to three snacks in between is recommended. A systematic review on breakfast skipping indicated its association with overweight and obesity in children and with increased consumption of unhealthy foods throughout the day, thus emphasizing the importance of not skipping any meals ^[17]. Promoting regular family meals, discouraging eating in front of screens, and encouraging waiting for everyone to finish their meal can positively influence a child's attitude toward eating ^[5]. Additionally, addressing the risks of binge eating and emotional eating is crucial for comprehensive management.

The most effective exercise interventions for children, as recommended by the WHO, are those lasting 60 min or more, occurring at least three days per week for at least 12 weeks duration ^[18]. The American Guidelines on childhood obesity recommend 60 min of physical activity daily ^[19]. The type of exercise intervention should align with the child's capabilities, be age-appropriate, and be according to the physical abilities. Creating a safe, enjoyable, and non-judgmental environment ensures the child feels secure while engaging in sports.

Initially, endurance exercise combined with dietary intervention was considered the gold standard for treating childhood obesity. However, there has been a recent shift in focus, with resistance training gaining in this context ^[20]. Endurance training typically involves low-to-moderate intensity exercises, mainly relying on aerobic metabolism. In contrast, resistance training, or weight training, entails using muscular strength to work against a resistive force and mainly relies on anaerobic endurance. Both forms of exercise have proven effective, and it is recommended to alternate between them for optimal results. Additionally, under certain circumstances, specific physiotherapy can be integrated into the treatment plan.

The European Childhood Obesity Group has issued guidelines outlining recommended age-appropriate physical activity levels ^[21]. For infants under 12 months, they recommend engaging in daily play sessions lasting 5–15 min. Children between 1 and 5 years old are encouraged to be active for at least 3 h per day, distributed across shorter periods through supervised games with parents, other children, or siblings. Starting at the age of 6 years, children should have some form of moderate physical activity for 60 min daily, including 3 days of high-impact activity like running, jumping, or dancing to promote bone health.

Beyond structured sports activities, promoting activities such as commuting to school by bike or on foot, engaging in physical activity during school breaks, and encouraging outdoor play at home are additional ways to foster increased physical activity ^[10].

Screen time poses an often-underestimated risk in the persistence of obesity, even following dietary and physical interventions. Effective strategies to reduce screen time at home involve using electronic television monitoring devices, replacing traditional video games with active alternatives, implementing designated screen-free times to reduce smartphone use, and ensuring that bedrooms and eating areas remain free of electronic devices ^[22].

2. Stage 1—Outpatient

2.1. Psychological Interventions

Children at stage 1 of childhood obesity are more vulnerable to depression, bullying, low self-esteem, and anxiety, so psychological interventions have a major role in the management of these patients. Every child with obesity should be screened for those psychological consequences of obesity. To do so, different assessment tools can be used in children. The American Academy of Pediatrics recommends different questionnaires for different psychological comorbidities ^[4]. Overall behavioral functioning is assessed through the Paediatric Symptom checklist; there is both a teen and parents version ^[23]. When assessing the risk of depression, they recommend the Patient Health Questionnaire, version 2 or 9 ^[24].

The General Anxiety Related Disorders Assessment can be used for the evaluation of anxiety ^[25]. The European Childhood Obesity Group recommends the use of the Dutch Eating Behaviour Questionnaire (DEBQ) for children and the Child Behaviour Checklist (CBCL) for the parents ^{[26][27]}. They also highlight that those questionnaires need to be interpreted with caution because of the risk of false positives and negatives. Therefore, they recommend that in patients where the questionnaires are difficult to interpret, the assessment needs to be made through interviewing and observation of the patient ^[28]. There are two frequently used interventions described, cognitive behavioral therapy (CBT) and motivational interviewing (MI). They both can be implemented in group-based or individual-based interventions.

CBT is a therapy where you try to change the way you think and behave to help manage your problems. It improves a person's self-esteem and helps to preserve this in the long run. A major limitation is that it will not work alone; it is still necessary to add dietary intervention and physical activity. Motivational interviewing is a person-centered strategy where it works on the patient's own motivation to change a certain behavior ^[29]. It is the intervention mostly recommended by the American Academy of Pediatrics. It contains four processes to remember: engaging, focusing, evoking, and planning ^[30]. Examples of motivational interviewing are reflective listening and shared decision-making.

There are different strengths and limitations on group-based versus individual-based interventions ^{[31][32][33]}. The strength of group-based intervention is that it may be more effective than individual interventions, especially in younger children. It motivates the family in social support and contributes to healthier lifestyle management. A limitation is that good efficacy can only be maintained if the entire family works together and understands the importance of the interventions. It also requires longer consultations than individual interventions. An important strength of individual-based interventions is that it is adapted to the individual; the focus is on the patient and can be more intense. A major limitation is that it will be less efficacious in younger children and toddlers. At these ages, it is necessary to involve the parents because they are the main decision-makers in their child's life. Both interventions have the limitation that they work better in a multi-component approach.

2.2. Management of Mechanical Limitations

The first recommendation in patients with OSAS is to lose weight, and often, OSAS will disappear after dietary intervention, resulting in decreased weight. Children who present with OSAS and have hypertrophied tonsils and/or adenoids can be referred to an Ear–Nose–Throat (ENT) specialist for a tonsillectomy and/or adenoidectomy ^[34]. In case of persistent OSAS despite dietary interventions and/or surgery, a noninvasive way of ventilation on nasal mask continuous positive airway pressure (CPAP) can be applied during sleep ^[35].

Obesity can lead to different orthopaedic conditions in children like Perthes' disease, pes valgus foot deformities, leg axis, and spinal discomfort ^[36]. Patients having one of these complications of obesity need to be referred to orthopaedists for further management. Some will require surgery, but a combination of weight loss and physiotherapy will often work well for managing these conditions.

3. Stage 2 and 3—Outpatient

3.1. Referral to PMOC

For patients with EOSS-P stage 2 or 3, an immediate referral to a higher level of care with multidisciplinary treatment in expertise centers is recommended, due to the need for more intensive therapy and follow-up. The key distinction from the treatment of stage 0 and stage 1 patients is that treatment at this stage is consistently and immediately multidisciplinary. No time should be wasted by setting up an intervention in the first level of care. In addition to the dietary plan, physical activity, psychological help, and treatment of eventual comorbidities, anti-obesity medication (AOM) becomes an option. In every PMOC, the coordinator's primary responsibility is to contact the patient's school, sports club, and primary caregiver to keep them informed and provide useful tools to manage the patient's obesity.

3.2. Pharmacotherapy

According to the 2023 guidelines of the American Academy of Pediatrics, anti-obesity medications must have a place in the treatment of childhood obesity from a certain age ^[4]. Especially in adolescents, children with severe obesity, or children with possible life-threatening comorbidities, additional pharmacotherapy can be necessary. Before starting pharmacotherapy, consideration should always be given to the risks and benefits of those medications. In the new Belgian care pathway, starting treatment at EOSS-P stages 2 and 3 depends on the following requirements: no reduction in BMI standard deviation score after 6 months of intensive, multidisciplinary treatment in a PMOC and/or CEPO, and age above 12 years.

The use of Liraglutide, a Glucagon-like peptide 1 (GLP-1) analog, has been approved by the European Medicines Agency (EMA) for treating obesity in children aged 12 years or older. It acts on GLP-1 receptors in the hypothalamus, liver, and stomach, resulting in reduced appetite and enhanced satiety [37]. Although gastrointestinal side effects may occur initially, they are generally mild and temporary [38]. Another GLP-1 analog, Semaglutide, approved in the United States and Europe, has shown more significant weight loss than Liraglutide in adolescents [39][40]. It is administered weekly, and while it has a higher incidence of gastrointestinal side effects, they are temporary and mild. Orlistat, a gastrointestinal lipase inhibitor, is approved for treating adolescent obesity in the United States. A study found a BMI reduction of $\geq 5\%$ in 26.5% of patients after one year [41]. The combination of phentermine and topiramate, FDA-approved in 2022 for adolescent use, is under evaluation, with concerns about phentermine's cardiovascular effects and topiramate's psychiatric side effects. Tirzepatide, recently FDA-approved for adult obesity, is a potential future treatment for adolescent obesity. Administered once a week, it acts on both Glucose-dependent Insulinotropic Polypeptide (GIP) receptors and GLP-1 receptors. Ongoing evaluation will determine its efficacy and safety for adolescents.

In conclusion, as of now, the only drugs currently approved by the EMA for the treatment of adolescent obesity are Liraglutide and Semaglutide. The administration of these drugs should always be coupled with intensive health behavior and lifestyle treatment, accompanied by frequent clinical follow-up. More data on the long-term effects of anti-obesity treatment with these molecules are required, as well as establishing the needed treatment duration to prevent rebound weight gain.

4. Stage 2 and 3—Inpatient

4.1. Referral to CEPO

When outpatient treatment falls short, the social environment lacks optimal support for the child in managing obesity, or when there are multiple comorbidities challenging management outside the hospital setting, individuals are directed to inpatient centers, referred to as CEPOs. During this stage, inpatient treatment is initiated, incorporating daily follow-up, psychological support, and a combination of group, family, and individual therapies. Additionally, the same pharmacotherapy described above can be employed.

4.2. Bariatric Surgery

Bariatric surgery is implemented in the treatment options for childhood obesity in the guidelines of the American Academy of Pediatrics and is said to be the most effective treatment for severe obesity when used in combination with lifestyle changes [4]. The American Society for Metabolic and Bariatric Surgery (ASMBS) recommended selection criteria for bariatric surgery, which include the following: a BMI ≥ 35 kg/m² or 120% of the 95th percentile for age and sex with serious obesity-related medical comorbidities, or a BMI ≥ 40 kg/m² or 140% of the 95th percentile for age and sex [42][43]. The serious medical comorbidities include T2DM, sleep apnea, severe MAFLD, and idiopathic intracranial hypertension. A study on the ten-year outcome of bariatric surgery in children and adolescents also showed that there is no negative impact on pubertal development or linear growth, so a specific Tanner stage should not be considered a requirement [44]. In the European guidelines from 2014, you can consider bariatric surgery if the patient has the following characteristics: (1) BMI ≥ 40 kg/m² and at least one comorbidity; (2) Followed at least six months of the multidisciplinary treatment; (3) Skeletal and developmental maturity; (4) Capable of committing to comprehensive medical and psychological evaluation before and after surgery; (5) Willing to participate in a post-surgery multidisciplinary treatment program; and (6) Can access surgery in a unit with specialist paediatric support [45][46]. A specific age limit is not recommended, but there are few studies on bariatric surgery below the age of 12 years. So, additional research is needed before broader guidelines can be made.

The two frequently used surgery types in adolescent obesity are the vertical sleeve gastrectomy and the Roux-en-Y gastric bypass. The sleeve gastrectomy is a laparoscopic surgery that accounts for more than 80% of bariatric procedures in adolescents. It is the preferred treatment option because it is less complex, with fewer reoperations and a lower complication rate, and has a lower risk of developing nutritional deficiencies [47]. The less frequently used method is the Roux-en-Y gastric bypass, which accounts for approximately 20% of bariatric treatment in adolescents.

Complications of bariatric surgery are common but usually minor [48]. A more common, long-term complication is micronutrient deficiencies; in Roux-en-Y surgery, iron, vitamin B12, and folate deficiencies, and in vertical sleeve gastrectomy, iron and folate [47].

Postoperative management includes frequent follow-ups, dietary changes, and nutritional supplements. The recommended supplements for both surgery types are a standard multivitamin containing folate and iron, vitamin B12,

and calcium. In adolescents, frequent laboratory examinations on vitamin deficiencies are recommended because of the difficulty in medication adherence in this age group. In women, emphasis should be placed on the prevention of pregnancy in the first 18 months following bariatric surgery. The rapid weight loss and nutritional deficiencies have an impact on both the mother and the fetus. They need more nutritional supplements, and in addition, vitamin K needs to be added because of the risk of cerebral bleeding in babies born with vitamin K deficiencies.

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