Childhood Obesity Review

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Introduction

Approximately 42 million children under the age of five are affected by obesity or overweight worldwide. Living with obesity at a young age is linked to several health and economic consequences and it is therefore important to study the causes and risk factors and identify the best prevention and treatment strategies. As childhood obesity is a multifactorial condition, it should be tackled at multiple levels, including individual, household, institutional, and community. This EUFIC Review describes what childhood obesity is and provides an overview of the current prevalence and trends. It also highlights the potential causes and risks associated with childhood obesity. Finally, as prevention strategies are key to reducing the epidemic, there is a focus on ways to prevent childhood obesity. Although the emphasis of this review is on young people (5 - 19 years), it inevitably includes references to adult obesity as well.

How is childhood obesity defined?

Obesity can be defined in simple terms as a condition of abnormal or excessive fat accumulation in the adipose (fat) tissue of the body, leading to health risks and implications. Overweight and obesity are often assessed by body mass index (BMI). This is weight (in kilograms) divided by height (in metres) squared ($\text{kg/m}^2$). For adults, the World Health Organization (WHO) defines overweight and obesity as BMI values equal or above 25 and 30 kg/m$^2$, respectively. This definition has been accepted internationally.

For children, the BMI cut-offs for overweight and obesity vary depending on age and gender. Growth patterns for boys and girls differ, affecting body composition and thus the cut-off indicating when a boy or girl has overweight or obesity. This becomes more apparent in adolescence where girls enter puberty at a younger age, and boys start to grow more prominently in height. Therefore, BMI charts (Figure 1) - instead of set BMI values - are used as a reference standard for children and adolescents. These charts show the age-related population distribution of BMI values per gender. National and international reference standards differ from each other, because they may be based on different populations and time periods.
Figure 1: The World Health Organisation (WHO) BMI chart for boys (above) and girls (below) aged 5 to 19 years old. Interpretation: The numbers of the coloured lines are standard deviations (SD) from the median (0): >1SD is overweight (equivalent to BMI 25 kg/m$^2$ at 19 years), >2SD is Obesity (equivalent to BMI 30 kg/m$^2$ at 19 years), <-2SD is thinness, and <-3SD is severe thinness.  

Prevalence and trends

Childhood obesity is a major global public health problem. In the WHO European Region, in 2009 – 2010, the national prevalence of overweight (including obesity) in children aged 6 to 9 years varied from 18% to 57% in boys and from 18% to 50% in girls (Figure 2), with 6-31% of the boys and 5-21% of the girls living with obesity.
The prevalence of childhood obesity is higher in the south of Europe, with Greece, Italy and Spain showing the highest BMI values. Moreover, in developed countries, the prevalence increases with increasing age and decreasing socio-economic status.

While global (childhood and adult) obesity is still on the rise, it has been noted that the prevalence of childhood obesity has stabilised in Western countries. Since around the year 2000 a halt in the rise of childhood obesity rates, or even a decrease in some areas, has been noticed, especially in girls and preschool children.

Monitoring the prevalence of childhood obesity is important to assess the effectiveness and success rate of intervention schemes and prevention programmes. One possible explanation for the plateau in childhood obesity rates is the positive effect of such intervention and prevention programmes. Another suggested reason is the biological plateau which implies that only a certain percentage of the population is susceptible to being affected by obesity, and that this percentage has been reached. Despite the levelling off, the numbers are high and the issue of childhood obesity is far from being solved. Moreover, an increase is still observed in the extreme obesity category and the prevalence of overweight and obesity is still increasing in low- and middle income countries.

Causes and risk factors
Obesity is a multifactorial condition linked to an energy imbalance. To keep weight stable, energy intake and energy expenditure must be in balance. Any excess energy taken in is stored as fat, which over time can lead to overweight or obesity. For a simple explanation of the concept of energy balance, and the complexity of it, please watch EUFIC’s Energy Balance video.

There is no single cause of childhood obesity and the energy imbalance occurs due to a complex interaction of several (risk) factors, including lifestyle and behaviour, genes, environment, and medication which are discussed below. The diet, health status and lifestyle behaviours of the mother are also important indicators for the health of the unborn child.

Pregnancy and early life nutrition

Women who are affected by obesity or overweight have a higher risk to conceive a large-for-gestational-age (LGA) baby, which is a risk factor for the child to develop obesity or overweight. The evidence suggests that the risk is two times higher to have an child affected by obesity compared to a lean mother. Maternal obesity during pregnancy exposes the foetus to an increased amount of nutrients and altered hormone levels, which determine the growth and body composition of the foetus, and potentially affect the programming of appetite of the child.

On the other hand, maternal undernutrition during pregnancy has also adverse effects for the baby, with long and severe dietary restriction leading to metabolic and endocrine complications. Undernutrition may not only affect the foetus’ growth, it could also affect its metabolism leading to a more increased storing of energy, thereby increasing the risk of the baby having obesity in childhood.

Breastfeeding is suggested to have a small protective effect on childhood obesity later on, but the scientific literature is inconclusive. Breast-fed babies often have a lower protein and energy intake than formula-fed infants, which likely lowers the risk of a high BMI. More research is needed to confirm this. Exclusive breastfeeding until 6 months of age is recommended by the WHO, followed by a step-by-step introduction of complementary foods. The complementary foods that are recommended include vegetables, fruits and cereals. Premature complementary feeding (at aged 4 months or less) may increase the risk of the infant living with obesity in childhood.

Lifestyle and behaviour

Lifestyle and behaviour factors play a key role in the development of childhood obesity, particularly diet, eating behaviours, physical activity, sedentary behaviour, and psychosocial factors.

Diet

An excessive daily energy intake for a sustained period of time leads to an increase in body weight and increases the risk of having obesity. There are several aspects of the diet that can lead to an increased caloric intake. For example, large portion sizes have been linked to increased energy intake, and is considered a risk factor for a high body weight.
The consumption of sugar-sweetened beverages in children, which has increased since 1970, has been associated with a high daily energy intake, fat accumulation, and an increased risk of developing obesity.\textsuperscript{13,16,21,22,23,24} Intervention studies in children and adolescents have shown that consumption of sugar-sweetened beverages results in greater weight gain and increases in BMI, compared with non-calorically sweetened beverages.\textsuperscript{25}

On the other hand, the intake of fruit and vegetables has a small, but protective, effect due to their low energy density.\textsuperscript{21} However, compared to the recommended 5 portions per day, on average, only 3.4 and 4.2 servings are consumed by 14-18-year-old girls and boys, respectively.\textsuperscript{26,27,28}

Eating behaviours

Certain eating behaviours such as skipping breakfast, frequent snacking, and binge eating are linked to an increased prevalence in overweight and obesity in childhood.\textsuperscript{21,29,30}

Skipping breakfast is associated with increased adiposity, hence the recommended daily breakfast consumption by health care providers.\textsuperscript{21} Eating breakfast is linked with increased satiety and, as a result, a lower caloric intake throughout the day. Those who do not eat breakfast are more likely to partially compensate for these calories in later meals. Eating breakfast is also thought to activate the body's energy metabolism earlier on the day, allowing for a longer period to metabolise energy, rather than only later in the day. The evidence is however limited; observational studies have shown an association between breakfast eating and a lower body weight, but randomised control trials showed mixed results. A limitation in this area of research is that a breakfast as such is not consistently defined across studies.\textsuperscript{29}

The phenomenon of binge eating in children is not exactly the same as binge eating in adults, and has been described in literature as a loss of control (LOC).\textsuperscript{31} The prevalence of LOC ranges from 2 to 10% of children and is often the result of emotional eating. Children experiencing many food restrictions, imposed by their parents, are more prone to LOC.\textsuperscript{31}

Physical activity and sedentary behaviour

A sufficient level of \textit{physical activity}, protects against obesity and can help children to prevent and cope with stress.\textsuperscript{22,32} As children grow up, their observed physical activity level goes down.\textsuperscript{24} At least 60 minutes of physical activity a day has been recommended by the WHO for 5 to 17-year-old children, including vigorous-intensity activity that strengthens muscle and bone at least 3 times per week.\textsuperscript{33} However, children increasingly spend time on sedentary activities, often interacting with electronic media.\textsuperscript{22,24,34} In the past, this was mainly watching television. Now, time is spent on computers, laptops and other electronic devices claiming a significant part of the screen time to which children are exposed to.\textsuperscript{34}

Different mechanisms for the link between sedentariness and overweight have been described in literature: 1) sedentariness lowers the resting metabolic rate, which increases the risk of energy overconsumption, 2) sedentariness in the form of screen-time displaces physical activity and therefore
energy expenditure, and 3) sedentary behaviours result in increased energy intake.\textsuperscript{34}

Screen time can also be linked to an increased exposure to advertising of products high in saturated fat, sugar and salt\textsuperscript{22,35-37}. Children and adolescents are vulnerable to such messages, which may lead to the development of unhealthy dietary preferences and an increased risk of obesity.\textsuperscript{16,24,35,36}

Sleep

It is suggested that school aged children get between 9 and 11 hours sleep per night, but this is not always achieved.\textsuperscript{34,38} Sleep duration is inversely related to having overweight.\textsuperscript{34,39} This could be due to direct metabolic effects as well as indirect mechanisms in which tiredness during the day could lead to increased sedentary behaviour and snacking.\textsuperscript{34} Furthermore, the use of smartphones creates cognitive, physiological, and emotional arousal, and thereby decreases sleep quality with notifications, sound alerts, and the urge to be connected to social media which possibly interrupts sleep.\textsuperscript{40}

Psychological factors and the social environment

Psychological factors, such as impulsivity, depression, self-esteem, and anxiety, and the social environment, including family, social acceptance, and social functioning, have been linked to the development of childhood obesity.\textsuperscript{31} However, the evidence for a causal relation is limited. These factors may translate to behavioural and emotional issues found in many children with obesity. At the same time, overweight or obesity may lead to psychological and social problems.\textsuperscript{31}

The family context and structure, including parental and familial attitudes, activity, dietary patterns, as well as familial stress, play an important role in the onset of childhood obesity.\textsuperscript{31} Familial stress may be due to a mental illness of the parents, but can also be associated with a low socio-economic status. Moreover, parents may not always be aware of, or may underestimate or even neglect their child’s psychological health problems.\textsuperscript{31}

Several mechanisms that link psychological issues with eating behaviours have been described. Some children tend to overeat due to poor self-regulation and impulsivity, e.g. children with attention deficit hyperactivity disorder (ADHD), while others use emotional eating as a coping strategy to reduce negative feelings.\textsuperscript{31} An underlying physiological factor related to stress is the release of cortisol, a stress hormone associated to an increased energy intake and preference for foods high in fat, sugar and salt.\textsuperscript{22,31,41,42} A neurobiological explanation involves dopamine, a neurotransmitter that plays a key role in mediating the rewarding effect of food. A low dopamine level is associated with increased energy intake.\textsuperscript{31}

Genetics

The ‘thrifty gene hypothesis’ suggests that, during evolution, genes inducing an efficient energy metabolism in terms of fat storage, economical energy usage, and appetite control have been selected for survival in periods of famine.\textsuperscript{8,43} However, in modern society, without shortage of food and little need for physical activity, these genes may contribute to the present obesity epidemic.\textsuperscript{8,43}
Much research has been carried out investigating the link between genetics and BMI or adiposity, and a number of genes have been identified, of which mutations lead to phenotypes of abnormal eating behaviour and/or energy expenditure with a positive energy balance.\(^\text{12}\) Evidence from studies with mono- and dizygotic twins (sharing 100% and 50% of their genes, respectively) and adoption studies with twins (same genes, different environments) suggest that 40-70% of the risk for obesity can be explained by genetic differences.\(^\text{44}\) However, a large part of the genetic variation in BMI remains unexplained, and cases where a single gene is causing obesity are extremely rare.\(^\text{12, 45}\)

While the genetic make-up of individuals explains the predisposition for obesity, it is the interaction with the environment that determines whether people live with obesity.\(^\text{42}\)

**Environment**

Both the physical and social environment have a great impact on the choices that one makes affecting health, including body weight. The physical environment includes built infrastructures, like bicycle lanes, stairs, sports clubs, and restaurants, but also the surrounding landscape and even the climate.

An environment, physical and social, that stimulates unhealthy dietary behaviours and little physical activity is often referred to as the ‘obesogenic environment’.\(^\text{24-27}\) The physical obesogenic environment includes both diet- and physical activity related elements. Dietary examples are the availability of large portion sizes or fast food restaurants with few healthy meal options. Examples for physical activity are labour-saving technologies that reduce the necessity of physical activity and increase sedentary behaviour, the walkability and safety of an area, recreational facilities, and public transport services.\(^\text{22, 24, 46, 47, 48}\)

A child’s home environment is important in the development of a healthy lifestyle. Throughout childhood, children are influenced by, and often mimic, the behaviours of their parents.\(^\text{31, 35}\) Parents with an unhealthy lifestyle could therefore contribute to their child developing obesity. A low socio-economic status (SES), reflected by a low income and education of the parents, is a strong risk factor for childhood obesity.\(^\text{13, 22, 46, 49-50}\) Maternal education is inversely associated with childhood obesity, i.e. in general the higher the education of the mother, the lower the child’s risk of developing obesity, but this association differs between countries.\(^\text{16, 50, 51}\)

As children get older, the influence of home environment and of parents reduces. Instead, peers and factors outside the home become more influential.\(^\text{11, 26, 52-53}\) The school environment becomes important in the development of healthy or unhealthy lifestyle behaviours, in particular the health education and physical activity programmes provided, and the selection of foods available. This includes the presence of water taps and the assortment of snacks in vending machines. There also seems to be an association between BMI and social networks at school, with similar friendship groups sharing the same behaviours, including diet and physical activity patterns.\(^\text{47}\) This effect could be partially explained by the friends being exposed to the same environmental factors.\(^\text{47}\)

**Consequences**
Childhood obesity is linked to serious physical and mental health, and economic consequences. Some of which are current, while others become more apparent and severe later in life. On an individual level, there is not only the struggle with excess body weight, but children also suffer from stigma and bullying. On a societal level, the costs associated with childhood obesity and related diseases are substantial.

Physical health consequences

Children who are affected by obesity tend to carry it over into adulthood. The higher the BMI and age, the higher the risk of persistence of obesity later in life. Several organs and metabolic processes are compromised by excess body weight, which could cause severe complications already at a young age. For example, childhood obesity is a risk factor for the development of metabolic syndrome, with a higher BMI corresponding to a higher risk. Metabolic syndrome comprises a cluster of risk factors that are strongly associated with the development of type 2 diabetes and cardiovascular disease (CVD). They include abdominal obesity, high triglyceride levels, low HDL cholesterol levels, hypertension, and impaired glucose tolerance. The development of CVD, including atherosclerosis, coronary heart disease and stroke could also be accelerated by childhood obesity.

Obstructive sleep apnoea often occurs in children with obesity due to fat tissue around the neck pressing and narrowing the airway. Children with obesity may also have an increased risk of developing asthma and asthmatic attacks although the underlying mechanisms are still unclear.

Musculoskeletal problems are another health consequence of childhood obesity. Increased body weight can result in overloading of the musculoskeletal system, causing possible discomfort, pain, skeletal malformation, including hip, knee and foot, and reduced mobility and balance. While adults have a higher bone density with increasing body weight, in children this seems to be the opposite when bone density is corrected for age and size. This means that children who are affected by obesity or overweight have relatively weaker bones, making them more vulnerable to fractures.

Another consequence of childhood obesity is the triggering of an earlier entrance into puberty, which may be unsettling or stressful for a child.

Psychosocial / Mental health consequences

Stigmatisation and discrimination are psychosocial consequences that accompany childhood obesity. This can result in decreased self-esteem, a higher risk of developing a depression, self-blame, shame and helplessness, a higher risk of being socially isolated, and inadequate performance at school. Stigmatisation is partly mediated through media, where people who are have obesity are linked with a negative image. This can result in children with obesity being subjected to teasing and bullying.

Economic consequences

Childhood obesity is accompanied by significant health costs due to the increase in associated non-
communicable diseases, such as diabetes and CVD. In the European Union (EU), every year approximately 7% of the national health budget is spent on the obesity-linked diseases.\textsuperscript{36} In England alone, an estimated £5.1 billion was spent by health services on overweight and obesity-related ill-health in 2014/15.\textsuperscript{64} As an increased proportion of the population lives with obesity, an increased proportion of national healthcare expenditure needs to be spent on the prevention and treatment of obesity and obesity-related health problems. Focusing prevention and treatment programmes on children could therefore prevent the development of obesity-related diseases and the accompanied costs.\textsuperscript{65}

### Prevention and treatment

Due to its multifactorial nature, prevention and treatment of childhood obesity are more likely to be effective with a multidisciplinary and a multi-actor approach.\textsuperscript{13,24,57,66}

#### Prevention

Prevention programmes can target an individual’s behaviour, but in the case of childhood obesity, a wider focus that also includes parents, primary care givers, teachers, decision makers, businesses, and the wider community, is needed.\textsuperscript{8,57} All these actors can help children to develop a healthy lifestyle with healthy eating and activity habits - either by being a role model or by providing a supportive environment.\textsuperscript{52,67} Small changes that are realistic and achievable are recommended for long-term success.

**Suggestions and recommendations for parents/care givers:**

- Serve appropriate portion sizes– use smaller plates.\textsuperscript{46}
- Avoid using food to stimulate or reward good behaviour or to satisfy the emotional needs of children- reward a child with stickers or active play.\textsuperscript{52,68}
- Encourage physical activity.\textsuperscript{47,69}
- Encourage children to try new foods, so they learn to accept and appreciate a wide range of tastes. Rejection of novel foods or foods with a bitter taste is normal, especially in younger children, and multiple exposures will increase the acceptance.\textsuperscript{52}
- Develop a supportive social environment for the child, such as family meals, no eating in front of the television, and regular (physical) activities.\textsuperscript{70}
- Get involved in school- and community-based prevention programmes.\textsuperscript{70,71,72}

As children spend a lot of time in school, it is a key target environment for prevention programmes. These include health education, improvement of school meals, accessibility to drinking water, and physical activity programmes.\textsuperscript{8,36,46,48,57,73,75,75} Studies suggest that school-based interventions to prevent weight gain are effective on the short-term, but evidence is lacking to confirm this for the long-term.\textsuperscript{56,75,76,77} The longer the school-based programme, the greater the effect.\textsuperscript{75} The key success factor for school-based prevention programmes is that they are easy to implement and inexpensive.\textsuperscript{47} There is some evidence that the combination of diet and physical activity interventions at schools are more effective than either a diet
or physical activity intervention alone. \(^{77,78,79}\)

Suggestions and recommendations for school-based interventions:

- Promote healthy eating by providing balanced lunches and nutritious snacks. \(^2\)
- Include healthy snack options in vending machines. \(^8\)
- Provide access to free drinking water. \(^2\)
- Provide daily and mandatory physical education. \(^48\)
- Make playgrounds available and accessible, encourage being active during break and lunch periods. \(^73\)
- Put focus on health education within the classroom. Include interactive activities, like cookery classes to teach children about nutrition and healthy food options. \(^78\)

An example of a multi-actor childhood obesity prevention programme is EPODE - Ensemble, Prévenons L’Obésité des Enfants. EPODE started as a French project, gathering multiple stakeholders, including the local authorities, the media, health professionals, associations, families, teachers, restaurants, school caterers, etc., aiming to create sustainable public/private partnerships. \(^80,81\) Due to its promising potential, it has currently been implemented in more than 500 communities spread over 6 countries (France, Belgium, Spain, Greece, South Australia and Mexico) as part of the EPODE European Network (EEN). \(^81\) Success of the project is due to its four-pillar system: political commitment, resources, support services, and scientific evidence. \(^81\) A significantly lower (9.12\%) prevalence of children who live with obesity between 2005 and 2009 has been shown in the French EPODE pilot towns, as compared to similar control town. \(^82\)

Governmental and community level interventions are also important in the prevention of childhood obesity. On a national level, regulations that target environmental risk factors could be implemented. These include legislation on meals and physical activity programmes at schools, marketing and advertising to children, and taxation of certain nutrients/foods. \(^13,24,27,54,57,63,73,83,84,85\) Voluntary actions are taken by the private sector, for instance in the areas of food advertising and marketing to children and reformulation of food products. The EU Platform for Action on Diet Physical Activity and Health is an example of a European-level initiative whose members voluntarily commit to activities that fight obesity and related chronic diseases.

Social networks and media could be used to help prevent childhood obesity, as they play a crucial role in developing lifestyle and eating behaviours among children. \(^47\) For example, health promotions could be published online via social media to raise awareness and provide information about healthy eating. \(^47,63,74,86\)

Treatment

Different types of (non-)pharmacological body weight treatment options are available and selected based on the child’s BMI and potential comorbidities like hypertension, hyperlipidaemia, or impaired glucose tolerance. \(^3,8,26\) The main goal of treatment interventions is to induce a change in body composition and weight status, while a secondary goal is to reduce obesity-related complications. \(^61\)
Non-pharmacological treatment

Lifestyle intervention and behaviour change therapy have been shown to successfully and significantly decrease weight in children who have obesity.\(^8\)\(^9\)\(^54\)\(^56\)\(^67\)\(^72\)\(^83\) Lifestyle and habits are formed and then preserved (ie. habits can be altered sustainably) through several behaviour change techniques.\(^8\) It usually starts with the identification of the (underlying) cause of the problem, by a qualified health professional, who then selects the appropriate strategy for change.\(^63\) Motivational interviewing is often applied and includes reflective listening, informing, advising, and making decisions and setting goals together.\(^8\)\(^47\) The goals, focusing both on diet and physical activity, should be clear, attainable, and slowly build up in volume and intensity.\(^63\)\(^70\) Goal accomplishments should be rewarded, with less attention placed on punishments.\(^67\) Interventions are more successful when the level of supervision is high and they seem to be more effective in reducing unhealthy behaviours than increasing healthy behaviours.\(^9\)\(^87\) The effectiveness of interventions in children does vary between age groups, gender and weight status.\(^77\)

Dietary changes are important in treating childhood obesity. Any caloric restrictions should not be too drastic, however, as this could result in a failure to keep up with the diet, and/or with impairment of growth and development due to nutrient restriction.\(^2\)\(^67\)\(^87\) A reduced intake of sugar-sweetened beverages and energy-dense/nutrient-poor foods are recommended.\(^2\)\(^54\)\(^67\) Also, an appropriate intake of plant-based foods, including whole grains, fruits, and vegetables has proven to be related to a healthy lifestyle and a lower amount of body fat.\(^28\)

Intervention groups targeting diet alone or diet in combination with physical activity are more successful in reducing BMI than interventions focusing only on physical activity.\(^8\)\(^54\) Still, physical activity is an important aspect of treating childhood obesity as it does not only improve fitness level and muscle strength, but also mental health, by improving self-confidence and body image, and by reducing stress.\(^54\)\(^63\)\(^67\)\(^73\) Moreover, it supports sustained weight loss by increasing energy expenditure in muscles.\(^54\)\(^63\)\(^67\)

Promising results have been observed when targeting sedentary behaviour, by reducing screen time to a maximum of 2 hours per day.\(^8\)\(^22\)\(^54\)\(^67\)\(^77\) Such interventions decrease sedentary behaviours and induce weight loss and reduction of body fat.\(^32\) Banning televisions and computers from the bedroom is advised.\(^22\)\(^54\)

A multi-behavioural approach is considered the best approach in non-pharmacological treatment. An example of a multi-behavioural approach is the ‘5-2-1-0’ or ‘5-2-1-almost none’ message, which stands for:

- 5 portions of fruit/vegetable;
- a maximum 2 hours of screen time;
- a minimum 1 hour of physical activity; and
- limited sugar-sweetened beverages per day.\(^76\)\(^77\)

Surgery
Childhood obesity has become such a major problem that bariatric surgery (surgery to treat obesity) is now sometimes recommended for adolescents.\(^9\) Surgery is only used in children who are severely affected by obesity, with serious complications and after psychological examination, as bariatric surgery will result in the need for lifelong dietary and lifestyle changes and specific nutritional requirements.\(^2\)\(^,\)\(^8\)\(^,\)\(^54\)\(^,\)\(^88\) One method of bariatric surgery, gastric bypass surgery, restricts food intake by reducing the size of the gastric pouch and reducing the amount of nutrients absorbed.\(^89\) A second method, gastric banding, involves an adjustable band placed around the stomach, creating a small pouch and thereby restricting the amount of food that can be consumed.\(^89\) Both methods have been performed in older children and adolescents, and have shown to reduce a significant amount (>25%) of body weight.\(^8\) However, surgery does not target the multifactorial, and in part unknown, causes of obesity, but offers symptom relief and reduces the risk of obesity-related diseases. Moreover, there is a risk that the child has not given a voluntary and therefore valid consent for the surgery. It is crucial that patients and parents understand that the intervention is irreversible with possible unanticipated negative consequences several years later. Therefore, the weight loss effect of bariatric surgery may not outweigh the accompanied risks for all individuals.\(^61\)

Pharmacotherapy

Pharmacotherapy, the use of medication, is not often used as a treatment option, only when behaviour and lifestyle interventions fail to significantly reduce BMI.\(^8\)\(^,\)\(^67\) Pharmacological treatments are usually implemented in older children, at least 12 years of age, and are applied in combination with lifestyle interventions.\(^8\)\(^,\)\(^54\) Although there is some evidence for modest effects, pharmacotherapy is associated with more adverse effects than lifestyle intervention alone.\(^8\)

Conclusion

Childhood obesity is a global burden on physical health, mental well-being and economies, making prevention and treatment highly important. While the prevalence may be beginning to plateau in some countries, levels remain high, and addressing the issue at multiple levels is crucial to improve the health of the population. With obesity being caused by multiple factors, a multi-stakeholder approach is vital in order to tackle the epidemic.