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Overweight and obesity in children and adolescents: causes and strategies for prevention


Nadwaga i otyłość u dzieci i nastolatków – przyczyny i możliwe sposoby zapobiegania jej rozwoju

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Abstract

Childhood obesity is a significant healthcare problem leading to numerous complications in adulthood. A PubMed database search was conducted to identify articles on modifiable risk factors contributing to the rising incidence of obesity and overweight in the paediatric population. This article discusses increased consumption of unhealthy snacks or sweetened beverages, larger portion sizes and caloric content, general changes in the quality of products intended for children, the marketing of processed foods, and the influence of family eating patterns as key factors shaping unhealthy dietary habits among children and adolescents. Subsequently, low physical activity is discussed as another modifiable factor contributing to the development of obesity. Next, the use of dietary supplements that falsely create a sense of diet augmentation is also discussed. Strategies to reduce overweight and obesity in children should be comprehensive and encompass both parental and national initiatives. Above all, media promotion of highly processed, low-quality foods should be limited and replaced with campaigns promoting healthy alternatives. Education at school and at home should aim to increase awareness and develop healthy eating habits. Physical activity should be encouraged in all age groups. If non-pharmacological interventions are ineffective, individualised pharmacological treatment should be considered, which currently includes liraglutide or – less preferably – orlistat. Failure to take early preventive measures could exacerbate the obesity epidemic in Poland and increase the number of patients with numerous obesity-related complications, placing a burden on the future healthcare system.

Keywords: obesity, children, overweight, meals, food perception

Streszczenie

Otyłość wśród dzieci stanowi znaczący problem zdrowia publicznego, prowadzący do licznych powikłań w wieku dorosłym. Przeanalizowano bazę danych PubMed w celu identyfikacji artykułów dotyczących modyfikowalnych czynników ryzyka wpływających na zwiększenie częstości występowania otyłości i nadwagi w populacji dziecięcej. W artykule omówiono zwiększone spożycie niezdrowych przekąsek i słodzonych napojów, zwiększone porcje i kaloryczność posiłków, pogorszenie jakości produktów przeznaczonych dla dzieci, marketing żywności przetworzonej, a także wpływ rodzinnych wzorców żywieniowych jako czynniki kształtujące nieprawidłowe nawyki żywieniowe wśród dzieci i młodzieży. Przedstawiono również niską aktywność fizyczną jako kolejny z modyfikowalnych czynników rozwoju otyłości. Omówiono stosowanie suplementów diety jako środków fałszywie uzupełniających niedobory wynikające z nieprawidłowo prowadzonej diety. Strategie prowadzące do ograniczenia zaburzeń masy ciała u dzieci powinny być kompleksowe i obejmować zarówno działania rodziców, jak i inicjatywy ogólnokrajowe. Przede wszystkim należy ograniczyć promocję medialną produktów wysokoprzetworzonych i niepełnowartościowych, wprowadzając w ich miejsce zdrowe zamienniki. Edukacja szkolna i w warunkach domowych powinna być ukierunkowana na zwiększanie świadomości i tworzenie prawidłowych nawyków żywieniowych. Konieczna jest promocja aktywności fizycznej we wszystkich grupach wiekowych. W przypadku nieskuteczności interwencji nefarmakologicznych należy indywidualnie rozważyć leczenie farmakologiczne. Obecnie w populacji pediatrycznej stosuje się liraglutyd, rzadziej – jako mniej preferowany – orlistat. Brak podjęcia wczesnych działań zapobiegawczych może

doprowadzić do pogłębiania się epidemii otyłości w Polsce i zwiększenia liczby pacjentów z jej licznymi powikłaniami, co w przyszłości będzie stanowić obciążenie dla systemu ochrony zdrowia.

Słowa kluczowe: otyłość, dzieci, nadwaga, posiłki, postrzeganie żywności

INTRODUCTION

The diagnosis of obesity is primarily based on the assessment of body mass index (BMI). In children and adolescents, the diagnosis relies on age- and sex-specific percentile charts. Obesity is defined as a BMI at or above the 97th percentile, while overweight corresponds to the 85th–96.9th percentile for age and sex⁽¹⁾. According to World Health Organization (WHO) standards, obesity in children aged 5–19 years is diagnosed when BMI-for-age exceeds 2 standard deviations (*SD*) above the age-specific median. Overweight is diagnosed when BMI-for-age exceeds 1 *SD* above the median. In children under 5 years of age, the weight-for-height ratio is used. Obesity is then defined as a value of this index greater than 3 *SD* above the median for age, while overweight as more than 2 *SD* above the median for a given age⁽²⁾.

Data suggests that in 2022 the problem of overweight and obesity worldwide affected more than 390 million children and adolescents aged 5–19 years, including 160 million diagnosed with obesity. Among children under 5 years of age, 35 million were diagnosed with overweight in 2024. According to the WHO, obesity among children and adolescents is rapidly growing. The number of children with obesity aged 5–19 has increased from 31 million (approximately 2% of children) to 160 million (8%) since 1990⁽¹⁾. In Poland, in 2016, overweight and obesity were diagnosed in 18.8–24.6% of boys aged 7–18 years and 14.3–17.4% of girls in the same age group. Obesity was diagnosed among 4.3–8.8% of boys and 2.7–4.2% of girls aged 7–18 years⁽³⁾. Data from 2022–2023 indicate that in the age group of 7–9 years, the proportion of children with overweight was 17.3–18.9%, while obesity affected 10.3–15.9%⁽⁴⁾.

Childhood obesity is associated with numerous comorbidities, including non-alcoholic fatty liver disease, type 2 diabetes mellitus, dyslipidaemia, and others. Moreover, obesity is a stigmatising condition that adversely affects social functioning and psychological well-being in children⁽⁵⁾. Both the somatic and psychological health consequences of childhood obesity may persist into adulthood, increasing the need for various medical interventions and contributing to a greater healthcare burden.

The development of obesity in childhood is influenced by multiple factors, including familial patterns of unhealthy eating behaviours and low levels of physical activity (e.g. a predominantly sedentary lifestyle)^(5,6). Reducing the prevalence of obesity in children and adolescents requires, among other strategies, education aimed at promoting healthy eating habits.

This review examines the factors contributing to obesity among children and adolescents. Early education regarding appropriate dietary patterns promotes adherence to healthy habits in adulthood and helps prevent obesity and its long-term consequences. Moreover, the introduction of pharmacological treatment may support therapeutic effectiveness and reduce obesity prevalence in children and adulthood.

METHODOLOGY

A search of the PubMed database was conducted using the terms “obesity and childhood or children” in combination with “meals”, “snacks”, “fast food”, “beverages”, “portion size”, “food advertisements”, and “physical activity”. All identified articles were screened by the authors, and those considered most relevant and of highest scientific value were selected for further analysis. Initially, article abstracts were reviewed by two authors, and full texts were evaluated when the abstracts contained substantial and pertinent information. Preference was given to the most current literature on the topic, specifically articles published between 2004 and 2025. Original research articles, meta-analyses, and systematic reviews relevant to the subject were included. Studies not published in English, letters to the editor, and conference abstracts were excluded.

SNACKS AND BEVERAGES

The term “snack” is not precisely defined. It is generally understood as a food or beverage consumed between main meals. Among children, snacks contribute approximately 231–565 kcal per day, accounting for about 12.9–41.8% of total daily energy intake. On average, children consume three snacks per day, most often in the afternoon and at home⁽⁷⁾. In a study conducted by Gage et al., children were reported to consume as many as 8.2 snacks per day on average⁽⁸⁾. Over the years, an increase in the energy density of snacks has been observed⁽⁹⁾, which may contribute to excessive caloric intake. This imbalance between energy intake and expenditure is a key factor in the development of obesity. Findings regarding the impact of snacking on body weight remain inconsistent. One study among girls aged 8–12 years found no association between the consumption of high-energy snacks and body weight or BMI; only the intake of carbonated soft drinks was significantly associated with BMI⁽¹⁰⁾. In another study, conducted by Strashok et al., involving 133 children with obesity, a higher prevalence of irregular eating patterns and the habit of snacking on bakery products and sweets during the day were reported⁽¹¹⁾.

It appears that increased consumption of between-meal snacks may contribute to the development of unhealthy eating patterns, which in turn may increase the risk of overweight and obesity persisting into adulthood.

PORTION SIZE

In recent years, an increase in food portion sizes has been observed. A study evaluating changes in portion size between 1977 and 1996 found that the caloric content of salty snacks had risen from 132 to 225 kcal, soft drinks from 144 to 193 kcal, and cheeseburgers from 397 to 533 kcal⁽¹²⁾. A meta-analysis by Sani et al. demonstrated that offering children larger portion sizes resulted in an average increase of 86 kcal per meal⁽¹³⁾. Another study found that larger portions led to an additional daily energy intake of approximately 186 kcal in children⁽¹⁴⁾. Such increases may promote a positive energy balance, ultimately resulting in excessive body weight. Larger portion sizes contribute to the development of obesity in the paediatric population. In a study involving 30 children, doubling the portion size resulted in overeating and a 25% increase in energy intake at lunch⁽¹⁵⁾. Notably, the children were unaware of their increased consumption, suggesting difficulty in accurately perceiving portion size. Furthermore, when children served themselves, they consumed approximately 25% less energy compared with situations in which a double portion was pre-plated for them⁽¹⁵⁾. Interventions aimed at reducing portion size have been associated with decreases in body weight⁽¹⁶⁾. The “portion size effect” can be explained by the so-called “unit bias”⁽¹⁷⁾ – the cognitive tendency in which individuals perceive a single unit of food as the optimal amount to consume, regardless of its actual size. Pre-portioned items (e.g. a plate of food, a candy bar) are therefore often consumed in full. Additionally, children have particular difficulty estimating the portion sizes of amorphous foods that lack a defined shape⁽¹⁵⁾. When judging portions, children tend to rely primarily on the height and diameter of the container rather than the actual mass or volume of the food, which further contributes to inaccurate portion size perception⁽¹⁷⁾. These misperceptions may reinforce unhealthy eating patterns and contribute to obesity in the population.

NUTRITIONAL SHIFT AND MARKETING INFLUENCE

A “nutritional shift” is currently being observed worldwide. This transition involves changes from the consumption of traditional, minimally processed foods to diets dominated by ultra-processed food products, typically high in added sugars, salt, and saturated fats. As a result, the prevalence of conditions such as arterial hypertension, type 2 diabetes mellitus, coronary artery disease, certain cancers, and obesity has increased⁽¹⁸⁾.

Fast-food restaurants have also become increasingly popular among both children and their parents. Marketing

strategies employed by major fast-food chains, combined with the high palatability and convenient availability of these foods, likely contribute to this trend. These meals are inexpensive, easy accessible, and require no preparation time. Evidence suggests that increased access to fast-food outlets is associated with a higher risk of obesity⁽¹⁹⁾. However, a meta-analysis assessing the impact of fast-food restaurant density on overweight did not demonstrate statistically significant results⁽²⁰⁾.

Packaged and processed foods are often particularly appealing to children due to advertising techniques. Colourful packaging, cartoon characters, and celebrity endorsements strongly influence children’s purchasing preferences, as children are more susceptible to such cues and often do not recognise the persuasive intent of advertising⁽¹⁸⁾.

Eating behaviours also play an important role in the development of obesity. Behaviours such as eating meals while watching television, skipping breakfast, and frequently consuming meals outside the home have been associated with an increased risk of excessive body weight⁽²¹⁾.

Collectively, these factors create conditions for the development of body weight disorders by associating pleasant experiences with high-calorie, low-quality meals, which can irreversibly shape the eating patterns not only of current consumers but also of future generations.

EDUCATION AND FAMILY

Children learn eating behaviours primarily from their parents and the broader family environment. In a study conducted among mothers of infants aged 6–18 months, a strong relationship was found between maternal dietary patterns and the child’s diet. The intake of snacks, fruits, and vegetables by mothers was significantly associated with their consumption by the infants⁽²²⁾. Early exposure to healthy foods may support their acceptance later in life. Therefore, providing nutrition education to both children and parents is essential.

This is supported by studies demonstrating that nutrition education interventions targeting both children and caregivers can reduce the risk of obesity in later life. In a study of 437 children, the implementation of early-life nutrition education that included parental training resulted in approximately 40% of participants remaining non-obese 10 years after the intervention⁽²³⁾. Family meals also play a beneficial role in maintaining healthy eating habits. They are associated with increased intake of fruits and vegetables, a reduced risk of disordered eating, and improved mental well-being. A meta-analysis by Hammons and Fiese demonstrated that having three or more family meals per week was associated with a lower risk of overweight and decreased consumption of unhealthy foods⁽²⁴⁾.

DIETARY SUPPLEMENTS

Currently, trends promoting the need to supplement numerous macro- and micronutrients or vitamins are widely

observed. Children are particularly vulnerable to advertising due to their limited medical knowledge and trust in the influencers they follow. Moreover, adults may be inclined to increase the consumption of supplements, especially when they are aware that their diet is unhealthy. Increased consumption of dietary supplements marketed as “healthy”, e.g. in the form of jelly beans, lollipops or candies, may lead to excessive intake of simple carbohydrates, sweeteners, and artificial colourants, which may paradoxically predispose individuals to overweight or obesity, and may also justify the continuation of an incorrect diet⁽²⁵⁾. In some cases, overconsumption of dietary supplement may even be harmful or lead to intoxication⁽²⁶⁾. Both medical professionals and patients or consumers need to remember that dietary supplements should be recommended or taken only when there is an actual need (e.g. vitamin D) and should not replace a properly balanced diet.

LACK OF PHYSICAL ACTIVITY

Lack of adequate physical activity in both children and adults is a significant factor contributing to the development of obesity. A study by Ługowska et al., involving 245 children divided into two groups – one engaging in standard physical activity (4 hours per week) and the other with increased physical activity (10 hours per week) – assessed changes in BMI from the 4th to the 6th grade⁽²⁷⁾. The results demonstrated a 25% increase in the prevalence of overweight and obesity among children with standard levels of physical activity, while a slight decrease was observed in the group with higher activity levels. Notably, girls in the standard-activity group were particularly prone to becoming overweight or obese. In another study, Liu et al. reported overweight or obesity in nearly half of Chinese boys and over one-third of girls aged 6–18⁽²⁸⁾. They also noted a significant relationship between low physical activity and obesity, particularly among children aged 9–11. These findings show that low physical activity is a global issue contributing to the development of obesity. It is essential to highlight the importance of physical activity in childhood, as well as the potential long-term consequences of its absence.

DISCUSSION

This review presented the most common modifiable factors contributing to overweight and obesity in children. It is important to recognise that untreated childhood obesity can lead to numerous complications that persist and intensify into adulthood. Moreover, obesity increases the burden on healthcare systems and may subsequently limit access to medical services due to elevated demand. Therefore, preventive measures aimed at reducing the incidence of obesity are essential, beginning in childhood. Priority should be given to educational interventions targeting not only children but also their parents to raise

awareness of the consequences of inappropriate dietary behaviours. Additionally, reducing the availability of highly processed snacks and sugar-sweetened beverages is necessary, alongside implementing regulatory measures to limit their sale and marketing. Promoting healthy, minimally processed snacks such as fruits and vegetables should be encouraged, as well as promoting the consumption of “healthier” alternatives to confectionery products, for example, dark chocolate instead of traditional milk chocolate⁽²⁹⁾. Promotion of water as the preferred beverage over sweetened drinks could be supported through collaboration with public figures, including athletes, who may positively influence younger audiences.

Restricting or prohibiting the use of untested or inappropriate dietary supplements in children may also reduce the risk of potential adverse effects, and funds saved from their purchase could be redirected toward healthier food options. Furthermore, effective promotion of physical activity is necessary. This may include increasing the amount of mandatory physical education in schools, encouraging participation in physical education classes among all students, promoting physical activity during school breaks and lunch periods, and improving access to extracurricular activity opportunities. Such interventions may help improve current conditions and instil healthy physical activity habits in younger generations.

When non-pharmacological treatment options have been exhausted, pharmacological therapy may be considered. The development of modern pharmacological treatments for obesity has accelerated significantly in recent years. In addition to medications approved for the treatment of obesity in adults, certain drugs are also available for children in specific age groups. In the USA, obesity medications approved for children ≥ 12 years include orlistat, liraglutide, semaglutide, and the phentermine–topiramate combination^(30,31). In Poland, both liraglutide and orlistat are registered, although the latter is associated with more potential complications due to its mechanism of disrupting fat absorption. Liraglutide, a GLP-1 analogue that slows down gastrointestinal transit and suppresses hunger, is generally preferred⁽³²⁾. This drug may be crucial in the treatment of morbid obesity or obesity unresponsive to other forms of therapy. Nevertheless, it should be remembered that the foundation of treatment remains caloric restriction and increased physical activity, and medications alone will not ensure treatment success.

CONCLUSIONS

Efforts to counteract the rising incidence of obesity among children should be multifaceted and undertaken before complications develop. Strategies should include limiting access to unhealthy snacks and drinks, reducing the size of meal portions, and decreasing the consumption of highly processed foods. Moreover, restrictions on junk-food marketing and the promotion of healthy alternatives should be

implemented not only at the family level but also at the national level. Physical activity should be recommended not only as a treatment, but as a preventive measure and a preferred way of spending free time. In case of ineffective non-pharmacological interventions, individualised drug therapy should be considered. Failure to take early preventive action may lead to a worsening obesity epidemic, and an increased number of patients requiring highly specialised treatment in the future.

Conflict of interest

The authors do not report any financial or personal connections with other persons or organisations which might negatively affect the content of this publication and/or claim authorship rights to this publication.

Author contribution

Original concept of study; collection, recording and/or compilation of data; analysis and interpretation of data; writing of manuscript: ACD, ADD. Critical review of manuscript; final approval of manuscript: MS, GWK, LC.

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