

# Health issues related to overweight and obesity problem among children and adolescents

## Zdrowotne znaczenie problemu nadwagi i otyłości wśród dzieci i młodzieży

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**Wprowadzenie.** Otyłość wieku rozwojowego po wielu latach staje się otyłością dotykającą ludzi dorosłych, która wraz z przedłużaniem czasu jej trwania prowadzi do wielu powikłań skracających czas życia pacjentów.

**Cel pracy.** Przedstawienie wczesnych oraz odległych powikłań otyłości jako problemu zdrowotnego u dzieci i młodzieży oraz zasad prewencji, by ustrzec przed nadwagą i otyłością.

**Opis.** Do powikłań zaliczyć można powikłania: pulmonologiczne, endokrynologiczne, ortopedyczne, gastroenterologiczne, sercowo-naczyniowe, onkologiczne, skórne, ze strony układu immunologicznego, psychospołeczne, nefrologiczne, neurologiczne. Należy również zwrócić uwagę na zespół metaboliczny, który jest silnym czynnikiem ryzyka powikłań sercowo-naczyniowych, jak i determinantem cukrzycy typu drugiego. Postępowanie profilaktyczne można podzielić na trzy poziomy: prewencję pierwotną, wtórną oraz trzeciorzędową. Ważne staje się kontrolowanie masy ciała, stosowanie diety. Jej redukcja bądź utrzymanie stabilnego poziomu przez określony czas wpływa na poprawę wszystkich komponentów zespołu metabolicznego. Aby zmniejszyć ryzyko rozwoju otyłości należy przyzwyczajać do aktywnego trybu życia, wpajając zasady zdrowego odżywiania.

**Podsumowanie.** Ważne jest stałe informowanie społeczeństwa o zagrożeniach ze strony nadmiernej ilości tkanki tłuszczowej, a także czynnikach wywołujących to schorzenie. Skuteczne działania prewencyjne przyczynią się do zmniejszenia rosnącej liczby dzieci z nadwagą, poprawią stan zdrowia dzieci już otyłych, przez co zmniejszy się późniejsza chorobowość i śmiertelność wśród populacji dorosłej.

**Słowa kluczowe:** nadwaga, otyłość, dzieci, młodzież, powikłania, profilaktyka

**Introduction.** Obesity of the developmental age after many years becomes obesity affecting adults, which, together with the extension of its duration leads to many complications that shorten the life of the patients.

**Aim.** This work shows short- and long-term complications of obesity as a health problem in children and adolescents and the principles of prevention against overweight and obesity.

**Description.** The complications can be: pulmonary, endocrine, orthopedic, gastroenterological, cardiovascular, oncological, skin, immune, psychosocial, nephrological and neurological. Metabolic syndrome should also be mentioned as it is a strong risk factor for cardiovascular complications and a determinant for the type 2 diabetes mellitus. Preventive action can be divided into three levels: primary, secondary and tertiary prevention. Controlling the body weight and appropriate diet are very important. Weight reduction or maintaining its stable level over a period of time affects the improvement of all the components of the metabolic syndrome. To reduce the risk of developing obesity one should get used to active lifestyle and adjust to the principles of a healthy diet.

**Summary.** It is important to continuously inform the public about the dangers of excessive amounts of fatty tissue, as well as of the factors that cause this disorder. Effective preventive actions reduce the growing number of overweight children; improve the health status of obese children, which in consequence will decrease the number of health problems and mortality rate among the adult population.

**Key words:** overweight, obesity, children, adolescents, complications, prevention

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### Introduction

Some authors indicate the progressive stages of the development of obesity and its complications such as: obesity, metabolic syndrome, basic obesity,

obesity with insulin resistance and with glucose intolerance, type 2 diabetes mellitus [1, 3-7]. Obesity of the developmental age, after many years, becomes adult obesity, which, together with the extension of its

duration leads to many complications that shorten the life of the patients [3, 8]. If these complications are diagnosed late in adulthood, or are disclosed fully, then you should be aware that their development has begun with the development of childhood obesity [3].

Obese people compared to the slim ones have a 3-times higher risk of high blood pressure, gallbladder calculi, dyslipidemia and sleep apnea; a 10-times higher risk of developing type 2 diabetes mellitus; more than two times higher risk of osteoarthritis, coronary heart disease, and cancer (of the uterus, colon, pancreas, breast) [2, 3, 9].

Obesity imitatively causes endocrine disorders. In addition to insulin resistance there appear: growth hormone deficiency, testosterone excess in women and deficiency in men, hyper-reactivity of hypothalamic-pituitary-adrenal axis [3]. Obesity is also treated as a pre-diabetic state for type 2 diabetes mellitus, which is reflected in epidemiological studies (more than 90% of people with diabetes suffer from obesity). The presence of excess fat associated with obesity may accelerate the development of type 2 diabetes mellitus also among children and adolescents. This is a result of the early and chronic insulin resistance, which in effect leads to an impairment of secretion activity of pancreatic islet B-cells [3, 4, 7].

According to the recommendations of the American Diabetic Society in 2006, in children who are overweight, the diagnosis of the type 2 diabetes mellitus among the first or second line relatives represents a significant risk factor for this disease and is an indication for regular diabetic screenings starting as early as at 10 years of age. From the pediatricians' perspective this is another condition for perceiving the obese child in the context of his family [3]. The Polish Diabetes Association (2006) recommends the glucose tolerance test for obese children every two years, in order to detect abnormalities in the carbohydrate metabolism [3].

Among the increasing number of children with obesity the non-alcoholic fatty liver (Non-Alcoholic Fatty Liver Disease – NAFLD) is diagnosed [3]. The liver due to its location is not only the first metabolic station for the absorption of nutrients, but also the liver itself is subjected to the specific effects of the hormonal factors that are released from the pancreas and visceral adipose tissue [3]. The NAFLD scope includes a number of changes within the liver parenchyma, from mildly fatty liver through accompanying the steatosis hepatitis, fibrosis of the parenchyma, to cirrhosis and eventual liver failure. In some countries, the number of obese children with NAFLD ranges from 23 to 53%, while the negative course of the disease is found in approximately 20% of patients. Non-alcoholic fatty liver is a disease, which over the years

may not produce any symptoms; it is often detected quite accidentally during the abdominal ultrasonography or after finding elevated liver enzyme values in serum [3].

Obesity adversely affects the mental state and is the quickest recognized complication in children [3]. Ridicule, malicious remarks among peers contribute to the formation of complexes and alienation [6]. Lack of acceptance causes reluctance to socialize with other people. Children very often compensate the lack of acceptance from colleagues with their own pleasures, such as snacking, which causes further weight gain, and deepens their complexes. Typically such situations lead to neuroses and coincide with frequent difficulties and school failures [4].

### **Aim of the study**

This work shows short- and long-term complications of obesity as a health problem in children and adolescents and the principles of prevention, cautions against overweight and obesity.

### ***Short- and long-term complications of obesity in children***

Not all of the following complications of obesity (table I) have to affect our children. All of them however may harm them if they enter adult life as obese persons [3, 4].

### ***Metabolic syndrome (MS)***

Metabolic syndrome at the developmental age constitutes a simultaneous threat to the pathology of obesity. Early studies suggest small incidence of MS in children [3]. The situation is quite different in children suffering from overweight. According to the U.S. studies NHANES III the prevalence of metabolic syndrome among obese adolescents is 28.7% and only 6.1% among teenagers in the overweight group, however, in 89% of overweight teenagers there has been found at least one MS element – and in 56% of them at least two elements [3]. MS is a strong risk factor for cardiovascular complications and type 2 diabetes mellitus determinant [3, 10].

In the modifications of the recognition criteria for MS in adults one can notice lowering the threshold criteria for blood pressure, and fasting glucose values [10]. The National Cholesterol Education Program (ATP III) of 2001 suggests the presence of at least three of the following elements to help you in diagnosing MS [3]:

- concentration of triglycerides over 150 mg/dl;
- central obesity (waist circumference >102 cm in men and >88 cm in women);
- blood pressure over 135/85 mmHg;

- fasting glucose over 110 mg/dl;
- concentration of HDL – cholesterol below 40 mg/dl in men and below 50 mg/dl in women.

Criteria for MS formulated by International Diabetes Federations in 2005 have been amended as regards to the threshold values and they currently include [3]:

- increased concentration of triglycerides (>150 mg/dl) or treatment of this disorder;
- central obesity (waist circumference >80 cm in women and 94 cm in men in European population);

Table I. Short- and long-term complications of obesity in children. Modified according to: [3]

Pulmonological	<ul style="list-style-type: none"> <li>• Bronchial asthma (much more severe than in slim children)</li> <li>• Sleep apnea syndrome</li> <li>• Increased anesthetic risk</li> <li>• Limited tolerance for the physical activity</li> </ul>
Endocrinological	<ul style="list-style-type: none"> <li>• Deficiency of the growth hormone</li> <li>• Precocious puberty</li> <li>• Diabetes mellitus type 2</li> <li>• Hypogonadism in boys</li> <li>• Polycystic ovary syndrome in girls</li> <li>• Menstrual disorders</li> <li>• Insulin resistance</li> <li>• Metabolic syndrome</li> </ul>
Orthopedic	<ul style="list-style-type: none"> <li>• Flat feet</li> <li>• knee and hip joints overload syndrome</li> <li>• varicose veins of the lower limbs</li> <li>• Gout</li> <li>• Slipped Capital Femoral Epiphysis</li> <li>• Blount disease (pigeon-toed tibia)</li> </ul>
Gastroenterological	<ul style="list-style-type: none"> <li>• Fatty liver</li> <li>• Gastro-oesophageal reflux</li> <li>• Gallstones</li> <li>• Impaired peristalsis of intestines, constipation</li> </ul>
Cardiovascular	<ul style="list-style-type: none"> <li>• Hypertension</li> <li>• Atherosclerosis of the blood vessels</li> <li>• Strokes in adulthood</li> <li>• Coagulopathy</li> <li>• Endothelial dysfunction</li> </ul>
Oncological	<ul style="list-style-type: none"> <li>• Increased risk of breast cancer</li> <li>• Increased risk of colorectal cancer</li> </ul>
Dermal	<ul style="list-style-type: none"> <li>• Skin stretch marks</li> <li>• Hirsutism</li> </ul>
Immunological	<ul style="list-style-type: none"> <li>• Elevated level of inflammation</li> </ul>
Psychosocial	<ul style="list-style-type: none"> <li>• Poor self esteem</li> <li>• Fear</li> <li>• Depression</li> <li>• Social isolation</li> <li>• Worse performance at school</li> <li>• Appetite disorders</li> </ul>
Nephrological	<ul style="list-style-type: none"> <li>• Fibrosis of the kidney glomeruli</li> </ul>
Neurological	<ul style="list-style-type: none"> <li>• Pseudo tumor of the brain</li> </ul>

- elevated blood pressure (>130/85 mmHg) or treatment of hypertension;
- fasting glucose more than 100 mg/dl or treatment of previously recognized type 2 diabetes.

In a multi-racial and multi-ethnic group of overweight and obese kids Weiss et al. found MS in 38.7% of the children with average obesity (BMI z-score >2.0 and <2.5) and in 49.7% of the children suffering from major obesity (BMI z-score >2.5) [3]. For the purpose of defining the metabolic syndrome the authors took into account the centile values for BMI, HDL-cholesterol, triglycerides and also for blood pressure corresponding to age and gender. In comparison Fichna et al. evaluated elements of the metabolic syndrome in a group of 140 obese children, 31% of the children had high blood pressure and abnormal lipid and carbohydrate metabolism [3]. The differences in research criteria chosen by the authors in regards to MS in the developmental age and in different populations contribute to difficulties in comparing them. There is no unambiguously accepted definition of MS for children and adolescents, the difficulty in its formulation arises primarily from the developmental and growth changes as this age makes it difficult for the selection of the cut-off values for the risk factors [3].

### Prevention and treatment of obesity and its complications at the developmental age

Prophylactic treatment to prevent the development of obesity in children and adolescents can be divided into three levels [3]:

- primary prevention also known as the first-order prevention;
- secondary prevention also known as the second-order prevention;
- tertiary prevention.

Primary prevention includes activities aimed at the prevention of obesity even before its occurrence and involves environmental modifications resulting from lifestyle risk factors. Primary prevention involves two types of actions [3]:

1. actions that are intended to reduce the frequency or the level of causal risk factors for developing obesity in groups of people or entire populations;
2. actions aimed at the prevention of obesity in individuals demonstrating early symptoms, associated with excessive body weight.

Secondary prevention activities put the main emphasis on screening with the main objective to identify children with undiagnosed overweight and obesity, and children with high risk of their development (among whom the first-degree relatives were diagnosed with obesity, type 2 diabetes mellitus, stroke,

coronary disease, hypertension, lipid metabolism disorder and myocardial infarction). Screening may refer to the families at high risk or might relate to the general population [3].

Tertiary prevention includes activities aimed at preventing or delaying the development of complications of obesity. It also puts emphasis on screening for the detection of early stages of complications of obesity when intervention along with treatment is more effective. Prevention at this stage needs good control parameters of its efficiency, where next to the body weight the selected metabolic components are also needed. Tertiary prevention is implemented by [3, 11]:

- proper metabolic control;
- control of the blood pressure;
- education regarding the healthy lifestyle.

A key element in the prevention and treatment of obesity is constant weight control. Its reduction or maintenance at a stable level for a specified period of time in children and adolescents influences the improvement of all components of the metabolic syndrome: reduces hypertension, dyslipidemia, and glycaemia [2, 3]. All the prophylactic efforts should aim at the prevention of obesity and insulin resistance. The recommended lifestyle changes include [3]:

- increasing physical activity;
- reducing the amount of consumed kilocalories (including fats);
- consuming adequate amounts of foods rich in fiber.

The lack of physical activity in adults is a risk factor for the development of type 2 diabetes mellitus, independent of the body weight. In children however low physical activity is associated with an increased risk of overweight. Many children, without doubt, spend more time in front of TV and computer than adults [3]. This is related not only to the lack of physical activity, but also to watching food advertisements. Borzekowski et al, found that even a 10-30-second advertisement is able to affect the food choice in children aged 2-6 years [3]. Analyzing the Italian data M. Caroli found that 2 hours a day spent in front of TV provide children with about 25 000 ads per year, with 36% of the ads related to eating (88% of the ads recommend products rich in fat, sugar and salt) [3]. In children and adolescents the moderate and low-energetic diet is important, as it should create a negative energy balance. It is recommended to take 5 meals a day with limited amounts of sweets, sweet fruit, fat and replacing white bread with whole wheat bread [1, 12, 13]. Recording the kind and amount of consumed food in individual meals gives excellent effects. The Institute of Food and Nutrition in Warsaw has developed a special

picture album, which in natural colors and dimensions shows the sample food compositions, and the healthy eating pyramid [12, 13]. Such an album makes it easier for the doctor to assess the patient's diet, but unfortunately it is not available at home. Using the diet alone does not always lead to a lasting weight loss; better results are achieved by combining diet with physical activity [13].

In recent years, the world's views on the importance of physical activity for health have changed. It has been considered as an essential element of a healthy lifestyle, disease prevention, as well as coping with stress [14-16]. In case of physical therapy in children and adolescents it is recommended to carry out exercises under the supervision of qualified medical personnel. Exercises should be scheduled in convenient conditions and time of day [13]. Exercises should be tailored to the individual child's potential and provide satisfaction [13, 17]. Children subconsciously feel how much activity they need. The so-called spontaneous motor activity of the child is associated with the inner need to move and can last for 3-5 hours a day [4, 18]. Not only the therapist's support is important but also the parents' [13, 19].

There is a great need for family education programs, which would teach parents about the risk of obesity and encourage them to make a joint effort with their children in the application of appropriate physical activity and diet [3]. It has been known that the prevention of children's obesity should begin as early as during pregnancy particularly during perinatal period, especially in families where obesity has been experienced along with the risk factors for type 2 diabetes mellitus. Studies show that babies breastfed for a period longer than 3 months are less likely to develop obesity [13]. Mother's milk contains less protein than artificial nutrients which supply the child with three times too much protein in relation to the daily recommended dosage [13].

In order to reduce the risk of developing obesity, a child should get used to an active lifestyle from the kindergarten period [3]. It is also important to inculcate principles of healthy eating by providing information about calories in consumed products. One should keep in mind that healthy eating habits will protect children from the implementation of restrictive diets [3]. Food should not be applied as a form of comfort, soothing stress or reward. If parents fail to comply with this condition, the child will always associate such situations with the need for food.

Among the drugs that have gained recognition in the prevention of type 2 diabetes mellitus in obese children and adolescents, metformin is worth noticing. A study carried out by the Diabetes Prevention Program shows a reduction in the risk of developing

diabetes by about 30% of the patients taking this drug [3]. It can be suspected that the essential role was played by a dietary and pharmacological liver protection, as well as breaking the insulin resistance [3]. So far, other medicines have not found recognition in the prevention of obesity or metabolic syndrome in children and adolescents. At this age symptomatic pharmacotherapy is used, in the form of angiotensin converting enzyme inhibitors in hypertension or mild drugs protecting the liver with fatty characteristics [3].

## Summary

Lifestyle-related diseases are no longer the domain of adults. Effective preventive efforts contribute not only to weight reduction in the increasing number of overweight children, but also improve the health of obese children, and later decrease the prevalence for mortality among adult populations. Without doubt it is better to prevent obesity than to treat it. Thus it is so important to inform the public about the risks originating from excessive amounts of fatty tissue, as well as about the factors that cause this disorder.

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