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REVIEW ARTICLE

OBESITY IN CHILDREN

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Abstract

Obesity is a non-infectious chronic illness which occurs from childhood. Its incidence is caused by many factors (one of them is genetic predisposition). However, the most significant and governable part is lifestyle. Particularly problematic is the fact that 80% of obese children and adolescents remain obese in adulthood. The goal of this article is to inform experts and the wider public about the significant risk factors regarding overweight and obese children. There can be complications caused by obesity, such as diabetes mellitus, hypertension or dyslipidemia. The most important thing is prevention. In today's Czech Republic, the number of overweight children and adolescents is at a standstill but it is not dropping. Significant obesity risk factors include energy-rich diet, excessive intake of simple sugars, sedentary lifestyle, hours spent watching television and insufficient time spent outdoors. The illness is multifactorial, thus the treatment is multidisciplinary. It is more important to prevent this illness than rely on the possibilities of therapy.

Keywords: *Activity; Children; Health complications; Nutrition; Obesity; Overweight; Risk factors*

INTRODUCTION

Obesity has been known for millennia. It is a problem that has reached a standstill in many countries. It is similar in the Czech Republic, where the incidence of overweight and obesity is at a standstill but it is not dropping. Other possible causes of weight gain, as well as therapeutic possibilities, are being searched for. We rarely succeed without the co-operation of the obese patient. When a child is obese, the parents play a very important role because a child is not always independent and capable of decision-making (due to his or her age). It is necessary to apply preventative programmes because the most efficient therapy is prevention.

Our society has been facing obesity for millennia, which is proven by preserved statues, drawings and paintings. However, it has recently started to be perceived as a problem. In the 20th century, the increase in the incidence of obesity was mainly associated with the accessibility of the abundance of groceries. The groceries are often very rich in energy and the ingredients are not always ideal. According to the WHO (2018), more than 340 million children and adolescents between 5 and 19 worldwide were overweight in 2016. The prevalence dramatically increased from 4% in 1975 to 18% in 2016. Being overweight and obese are associated with a higher number of deaths than being underweight (WHO, 2018).

The goal of this article is to inform experts and the wider public of the significant factors regarding the increase in body weight in children, the assessment criteria

of overweight and obesity in the developmental period and adolescence, and therapeutic possibilities.

MATERIALS AND METHODS

We used document content analysis. Relevant sources were searched for in the scientific databases ProQuest, PubMed, Scopus. The search was carried out using the keywords "obesity", "overweight", "children", "nutrition", "risk factors" and the Boole operators "and" and "or". In the first phase, we found 3,049,664 studies. After result filtering and removing duplicates and studies that did not deal with the issue in the required context, we were left with 60 relevant studies. The data collection and result analysis were carried out between September 2019 and January 2020.

Obesity is a multifactorial illness that is characterized by fibrosis of the fat tissue, i.e. its accumulation. Its incidence and development are influenced by internal and external factors, such as genetic predisposition (Hainer et al., 2006; Skytthe et al., 2002; Stunkard et al., 1986), metabolic influences, social-economic status, environment (Yanovski, 2015), lifestyle, nutrition and diet, activity, or mental well-being. The influence of genetic factors can be between 60% and 80% (Segal et al., 2009).

The fact that up to 80% of obese adolescents remain obese in adulthood is a significant social problem. Obesity is associated with an increased risk of cardiovascular diseases (CVD), type 2 diabetes mellitus, and several oncological illnesses. The treatment is not always successful. It is also very costly, so the best remedy in the fight against obesity is prevention. This was one of the reasons why the WHO created a preventative strategy for the fight against non-infectious illnesses in 2014. In 2007 in the EU, a strategy for the fight against overweight and obesity was published (Commission of the European Communities, 2007).

There are purely genetic types of obesity, but this type occurs very rarely in our society. Such genetic syndromes are usually accompanied by organic changes and mental retardation (Kaur et al., 2017). Also, ill endocrine organs occur in a small part of obesity cases (Yanovski, 2015). Medicines that affect the centre of hunger in the hypothalamus can sometimes be the cause. If the use is chronic, they can affect the increase of body weight (Maayan and Correll, 2011). However, we must not omit the effect of risky behaviour, i.e. positive energetic balance that is often caused by excessive energy intake and insufficient compensation by physical activities, i.e. sedentary lifestyle (Gubbels et al., 2013; Ottevaere et al., 2011). Studies have also pointed out the negative effect of insufficient sleep on overweight, especially due to the increased feeling of hunger and craving, decreased leptin secretion and thyrotrophic hormones, and the increased concentration of ghrelin (Gangwisch et al., 2005; Kries et al., 2002; Spiegel et al., 2004). All of these factors interact with genetic predispositions and the final result can be different (Bouchard et al., 1990; Hainer et al., 2000). Regarding adults, we can point out the influence of smoking on being overweight, i.e. quitting smoking. People who smoked and consumed caffeine had increased thermogenesis. Smokers also suppressed food cravings, and upon quitting smoking, the prevalence of obesity increased (CDC, 2004; Jessen et al., 2005).

We must not forget to mention socio-cultural and economic situations, which significantly affect an individual's development. The surroundings of their residence affect, for example, the regularity of physical activity (Hawkins et al., 2009). In particular, this influence can be seen in relatives who live in different countries, for example Asians and Hispanics who were born and live in the USA are more frequently obese than those who migrated to the USA (Popkin and Udry, 1998). Each of the mentioned obesity risk factors can individually have a small effect, but if they are combined the effect increases and body weight grows. It is important to mention the result of the interaction between risk factors and genetics (Friedman, 2003).

We have heard about the fact that obesity is caused by positive energy balance, but there are differences between individual nutrients and their ingredients. Simple sugars are most associated with obesity, much more so than other carbohydrates. In particular, quickly metabolized carbohydrates – which are the simple ones – are unsuitable. Groceries that contain these have a high glycemic index. The most suitable of the simple sugars is lactose. It

belongs among the dairy products that should a healthy diet should contain. The problem is that during the carbohydrate and total food breakdown, the excessive amount of glucose changes into fatty acids, which are stored in fat tissue. Although the fructose in metabolism is not dependent on insulin, it evokes leptin resistance, so saccharose intake, in particular, should be moderate (Bierman, 1979; Ramdath et al., 2018; Zadák, 2002).

Other nutrients that can cause overweight are fats, which arise from fatty acids. Saturated and monosaturated fatty acids negatively affect the formation of fat tissues. A positive effect can be seen in poly-unsaturated acids, such as omega-3 (Couet et al., 1997).

We did not only study the effect of carbohydrates and fats on the development of obesity (the fibrosis of the fat tissue), but also the third of the macronutrients, i.e. proteins. We found that excessive protein intake in early age can increase the risk of obesity later (Rolland-Cachera et al., 1995). However, other studies pointed out weight increase and not fat, i.e. an abundance of protein at a child's early age can support the increase of fat and non-fat tissues (Günther et al., 2006; Hoppe et al., 2004). It is also a fact that higher protein intake is often recommended for weight-loss diets in adults, where it decreases fat tissue formation (Aller et al., 2014).

Regarding prevention, it is necessary to focus mainly on individual periods in childhood when nutrition is significant regarding obesity. There are five periods:

The first period is focused on prenatal development and it is necessary to concentrate on the pregnant woman's nutrition. Genetics is significant, and weight is affected in the prenatal period by 40–70%.

The second period is between birth and toddler-age. The breastfeeding period is very important because it is a prevention for the increase in weight (Priego et al., 2014; von Kries et al., 1999). The first 1,000 days are most important because metabolic programming occurs (Tláskal et al., 2015). It is important to focus on decreasing the intake of simple sugars (mono- and disaccharides) because they positively correlate with weight increase between 2 and 3 years of age (Tláskal et al., 2015).

The third period is pre-school age. Preferences, tastes and food habits are stabilized but, in some cases, we can see neophobias. In particular, the excessive simple sugar intake can become a problem, as well as the intake of saturated fatty acids and the insufficient intake of polyunsaturated fatty acids (Tláskal et al., 2009; 2015).

The fourth period is the early school-age when a child is not under its family's supervision and becomes more independent. There is a risk of the child making unsuitable choices of beverages and snacks when he or she buys them without his or her family. Preventative programmes in schools can help.

The fifth period is the late school-age – adolescence. In this period, eating habits are fixed. Individuals often monitor their appearance, so this period is risky in relation to eating disorders, which can occur if they want to lose weight. Eating regularity can be preventative, as well as choosing quality food. On the other hand, eating fast food, the absence of micronutrients, and sweet non-alcoholic beverages can increase the risk of obesity (Swinburn et al., 2004).

The Czech Republic was involved in a study of seven-year-old children using paediatric doctors. This study was part of the COSI project (Childhood Obesity Surveillance Initiative), which was created by the WHO Europe. They monitored body weight, height, gender, age, waist and hip girth, BMI, food intake, familiar obesity anamnesis, parent's education, etc. The monitoring was carried out from 2008. In 2016, the 4th round was carried out in selected paediatric institutions. We can assume from the results of this project that the main factors associated with a higher level of the incidence of obesity in children are the mother's lower level of education, less frequent breakfasts, lesser consumption of whole milk, less time spent outside, more time spent in front of the television or computer, as well as obesity in the family and higher birth weight. We can also positively assess the fact that the prevalence of overweight and obesity in these children does not increase, but unfortunately it does not decrease either. Since 2008, the prevalence of obesity in boys has increased and the prevalence of overweight has decreased. The total prevalence of overweight and obesity is at a standstill. For this reason, many other preventative and therapeutic programmes will be necessary. In some countries, such as China or Mexico, the incidence of

overweight is increasing (Hernández-Cordero et al., 2017; Jia et al., 2017). Other international studies in which the Czech Republic is involved include HBSC (Health Behaviour in School-aged Children), which focuses on the health and lifestyle of school-aged children.

The COSI project included measuring waist girth, which is one of the risks of developing diabetes mellitus or cardiovascular diseases. They found that 24% of children with normal weight (by BMI) had an increased waist and hip girth proportion. This is why measuring waist girth in paediatric consulting rooms is a very suitable supplementary parameter that can signal the risk of overweight and obesity and associated complications. This fact is pointed out by Sedlak et al. (2015), who speak about the so-called latent obesity. A child's BMI indicates normal weight, but fat tissues are polymerous. The fat tissue fibrosis can most frequently be seen while measuring the thickness of the epicanthus or using bioelectrical impedance analysis (BIA). This problem is especially associated with insufficient physical activity and insufficient stimulation of the musculoskeletal system (Sedlak et al., 2015; 2017). Several studies show that it is necessary to perform more detailed measurements because BMI value is not clinically reliable in diagnosing hidden obesity. The BIA, DEXA (dual-energy X-ray absorptiometry) measurements or magnetic resonance are suitable. Considering time consumption, the most suitable method is measuring girths or using a calliper (Forsum et al., 2013; Peterson et al., 2017).

Particularly in adulthood, obesity is associated with a group of indicators called the metabolic syndrome. However, this problem does not concern only adults but children and adolescents as well. Diagnostics is still a problem. The metabolic syndrome (MS) is a group of pathological indicators, such as hypertension, disturbed glucose metabolism (insulin resistance, diabetes mellitus), dyslipidemia (increased TAG level, decreased HDL level) and obesity. In childhood, the syndrome is difficult to identify because the criteria are not clearly defined (Higgins and Adeli, 2017; Weiss et al., 2013).

Metabolic syndrome can appear in children and has similar indicators as in adults. The MS definition has not been established for the age group between 6 and 10 years (Weiss et al., 2013). For the age group between 11 and 16 years, the indicators have been defined: BMI over the 90th percentile, waist girth in boys over the 90th percentile, in girls over the 80th percentile, increased TAG level over 1.7 mmol/l and decreased HDL level in boys under 1.03mmol/l, in girls under 1.29 mmol/l; blood pressure higher than 130/85 mmHg and glycaemia on an empty stomach over 5.6 mmol/l. In adolescents over 16 years, the criteria for waist girth are different: in boys, more than 84 cm, and in girls, more than 80 cm. Other criteria are equal to the younger group (Bussler et al., 2017). Some indicators of metabolic syndrome can occur in children with normal weight. For this reason, metabolic syndrome in childhood is more associated with the values of the lipid spectrum than body weight or waist girth (Gustafson et al., 2009; Wiegand et al., 2004). Changes in the lipid spectre and increased values in blood pressure are present in many obese children. This combination is risky due to the subsequent cardiovascular complications that are associated with obesity (Šamánek and Urbanová, 2003). Data show that 4% of overweight children and 15% of obese children suffer from hypertension (Procházka et al., 2018). The recommendations from 2016 state that measuring blood pressure during preventative check-ups should be performed in all children from 3 years, and it should be part of regular examinations of overweight/obese children (Lurbe et al., 2016). Values over the 90th percentile include blood pressure or pre-hypertension, over the 95th percentile they include hypertension. From 16 years, children's blood pressure is assessed as equal to that of adults (Lurbe et al., 2016).

Non-pharmacological treatments of metabolic syndrome are especially focused on the decrease in body weight in childhood as well. The combination of nutrition ordinances, behavioural therapies and physical activity has the best results (Kanai et al., 1990). It is ideal to follow DASH diet, which focuses on the intake of fruit and vegetables, lean meats, semi-skimmed dairy products and a reduction of salt intake (Rocchini et al., 1988; Sacks et al., 2001). Another possibility is pharmacological therapy.

A very significant problem is insulin resistance and abnormal increase of splanchnic fat (Bremer et al., 2012; Calì et al., 2009; De-

spres et al., 1995; Fabbrini et al., 2009; Fox et al., 2004), which is more resistant to insulin (Morrison et al., 2008). It is important to measure waist girth in childhood because subcutaneous fat is important as well as its ratio with splanchnic fat (Gustafson et al., 2009; Morrison et al., 2008). Nutrition is also seen as prevention. It should be rich in fruit and vegetables, which are a source of antioxidants and fibre, which leads to the decrease of metabolic syndrome development risks (Lusis et al., 2008; Malik et al., 2004).

CONCLUSIONS

Obesity is a significant social problem that has been present for a long time and will continue to be present in the future. Our task should be to make an effort to prevent the incidence of obesity in children and decrease the number of those who are already obese. We cannot influence genetic predisposition, so we need to focus on those factors that we can influence. In particular, we need to support protective factors, such as correct nutrition and pregnant women's weight, breastfeeding, learning eating habits and physical activities. We also need to beware of the risk factors, such as inactivity, watching television and sitting at a computer, energy-rich foods, and excessive intake of simple sugars. The most significant point in the fight against childhood obesity is prevention.

A child alone cannot assess the gravity of being overweight. It is necessary for adults not to underestimate their role in their child's development and enable their child to be healthy in the future.

Conflict of interests

The author has no conflict of interests to declare.

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