

Obesity as a 21st century pandemic

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Abstract – According to the World Health Organization (WHO), overweight and obesity are defined as an abnormal or excessive accumulation of fat that poses a health risk to the patient. Obesity was recognised as a disease by the WHO in the late 40s, and as the number of obese adults and children is increasing globally it is reaching pandemic proportions. The WHO considers the fight against obesity as one of its top priorities because obesity is not only a global problem but also a risk factor for the development of other serious chronic diseases (hypertension, coronary heart disease, type 2 diabetes, hypercholesterolaemia, hypertriglyceridaemia, musculoskeletal disorders, osteoarthritis, sleep disturbances, psychiatric disorders, cancers). Increasing physical inactivity, sedentary lifestyle and changes in dietary habits involving increased intake of energy-dense foods also contribute to the development of obesity. Obesity, as part of the metabolic syndrome is considered a pandemic based on its globally increasing prevalence. More than half of the population living in Europe and North America is overweight and obese. It is predicted that by 2035, approximately 1.9 trillion people worldwide will be obese, making obesity a current topic as a 21st century pandemic, and we deal with it in our paper [3,4,5,9,15,21,27,28,31]. The aim of this review is to report the latest findings on overweight and obesity in relation to the development of cancer, the rise of overweight and obesity during the COVID-19 pandemic, and the impact of overweight and obesity on the severity of the COVID-19 disease process.

Keywords – Cancer, COVID-19, Overweight, Obesity, 21st Century Pandemic

I. INTRODUCTION

As obesity is not only a global problem but also a risk factor for the development of other serious chronic diseases such as hypertension, coronary heart disease and other cardiovascular diseases, type 2 diabetes, hypercholesterolaemia, hypertriglyceridaemia, musculoskeletal disorders, osteoarthritis, sleep disorders, mental disorders and cancer, The World Obesity Federation and WHO

have launched a global campaign called: “The World Obesity Day“. This world day is celebrated every year on 4 March. Its aim is to increase public knowledge about obesity and its complications, improve prevention, treatment and care, provide practical solutions to help achieve and maintain a healthy weight and thus contribute to reducing the global nature of the disease. The theme of this year's World Obesity Day was: “Changing Perspectives: Let's Talk About Obesity“. The first

World Obesity Day was celebrated in 2015. Until 2019, it was celebrated annually on 11 October. From 2020, it will be celebrated annually on the new date of 4 March. The World Obesity Federation is an advisory council to the WHO approved by the World Health Assembly [22,30,32].

II. MATERIALS AND METHOD

As this review article discusses several aspects of overweight and obesity in relation to cancer development, the rise of overweight and obesity during the COVID-19 pandemic, and the impact of overweight and obesity on the severity of the COVID-19 disease process, multiple searches of electronic databases (PubMed, Web of Science, Wiley Online Library, Springer) were performed using various keywords such as "obesity and cancer", "obesity and chronic inflammation", "obesity and adipose tissue", "obesity and insulin resistance", "obesity as pandemic", "childhood obesity and COVID-19", "adult obesity and COVID-19", "obesity and severity of COVID-19", in order to identify relevant key documents and studies. Relevant information was also searched through the websites of official state institutions (WHO, The World Obesity Federation, The International Agency for Research on Cancer, The National Institutes of Health (USA), The National Cancer Institute (USA), Ministry of Health of the Slovak Republic, Public Health Institute of the Slovak Republic and its regional institutes).

III. RESULTS

Obesity and cancer

According to Pati et al. (2023), Belladelli – Montorsi – Martini (2022), Das and Webster (2022), Ayed et al. (2023) the incidence of cancer is approximately 4 – 8% (postmenopausal breast, colorectal, endometrial, uterine and ovarian, and renal cancers, oesophagus, stomach, pancreas, liver, gallbladder, prostate, bladder) associated with the presence of obesity, and obesity is also a significant risk factor for mortality (17 % increase in risk of death) from these cancers. We can say that obesity not only increases the risk of cancer and worsens the prognosis of treatment, but also increases the risk of cancer recurrence, metastasis, resistance to anti-cancer therapy and subsequent mortality. Obesity may also potentiate the side effects of anti-cancer therapy. Bardou et al. (2022)

report that the presence of excess visceral fat or abdominal obesity is a greater risk factor compared to excess subcutaneous fat [2,4,5,18].

Childhood overweight, obesity and the COVID-19 pandemic

The COVID-19 pandemic and its associated isolation from normal daily life has created an unfavourable environment for maintaining a healthy lifestyle. Pietrobelli et al. (2020) in a longitudinal observational study, conducted in Verona (Italy) published in 2020 observed lifestyle changes (diet, sleep, physical activity) in 41 obese children and adolescents during the coronavirus disease 2019 pandemic lockdown. The selected group was observed before the isolation order and after 3 weeks of isolation. It was found that during the lockdown, the study group experienced a significant increase in the intake of potato chips, red meat, sugary drinks, decreased time spent on sports activities, increased time spent on sleeping and watching TV, tablet, computer which are factors leading to further development of overweight and obesity [20].

A systematic review and meta-analysis by Anderson et al. (2022) studied the impact of the COVID-19 pandemic and associated risk factors for the development of obesity (physical inactivity, poor diet, stress, poverty) on weight change in children and adults. They looked at 74 longitudinal studies (3 213 776 participants) that included measurements before and during the pandemic and assessed change in weight, body mass index (BMI), and waist circumference. 31 studies included the paediatric population, 41 studies included adults and 2 studies included both groups i.e. both children and adults. There was a significant increase in weight gain, BMI and increased prevalence of obesity in both children and adults, with the increase being greater in children[1].

COVID-19 infection in obese children and adults

The systematic review and meta-analysis by HUANG et al. (2020) investigated the effect of obesity on the risk of severe disease course in patients with COVID-19. A total of 45 650

participants from 33 studies were included. Obesity was found to increase the risk of hospitalization, intensive care unit admission, the need for invasive mechanical ventilation, and death in patients with COVID-19 [11].

The multicentre cohort study by Valenzuela et al. (2022) investigated the association between obesity and short-term (admission to intensive care unit, need for invasive mechanical ventilation, superinfection, acute kidney injury, death) and post-acute effects of infection (neurological, respiratory, cardiac symptoms, delayed or long-term complications at 4 weeks after the appearance of COVID-19 symptoms) in hospitalized children. Results from 3 hospitals were included in the study. 216 children with COVID-19 infection were included, 67 of whom were also obese. The results of the study showed a higher rate of need for oxygen use, invasive mechanical ventilation, admission to the intensive care unit, superinfections during hospitalization, and a higher risk of post-acute effects of the infection (dyspnea, muscle weakness) in obese children [25].

Regular physical activity is not only important to prevent the development of overweight and obesity, but also has the potential to reduce the risk of severe COVID-19. The retrospective observational study by Sallis et al. (2021) compared hospitalization rates, the need for intensive care unit admission, and mortality in a sample of 48,440 adult patients diagnosed with COVID-19, divided into 3 groups according to the level of regular physical activity they performed during the 2 years before the pandemic and before they became ill with COVID-19: 1. Patients who were permanently inactive before COVID-19 (physical activity 0-10 min/week), 2. Patients who did some physical activity before COVID-19 (physical activity 11-149 min/week), 3. Patients who did physical activity regularly before COVID-19 (physical activity more than 150 min/week). It was found that persistently inactive patients who suffered from COVID-19 had a higher risk of hospitalization, admission to the intensive care unit, and death due to COVID-19. The study highlights the importance of regular physical activity in preventing the severe course and consequences of COVID-19 infection [23].

Obesity can also impact the effectiveness of the COVID-19 vaccine. The study by Faizo et al. (2022) carried out in Saudi Arabia investigated the

efficacy of COVID-19 vaccines in inducing neutralizing anti-SARS-CoV-2 Spike (S) antibodies and the neutralizing capacity of antibodies produced by obese individuals (n=73) who received two doses of either homologous or heterologous COVID-19 vaccines and normal BMI controls (n=46) who also received two doses of either homologous or heterologous COVID-19 vaccines. A reduction in neutralizing humoral immunity induced by the COVID-19 vaccine was found in obese subjects, with a significant reduction in the neutralizing capacity of antibodies generated by obese subjects compared to controls, highlighting the importance of booster doses in this specific patient group [6].

IV. DISCUSSION

According to Pati et al. (2023), 3 biological mechanisms are known to be involved in the risk of cancer development in obese patients. The first mechanism is adipose tissue, which is able to release chemical mediators and enzymes. Increased synthesis of estradiol from androgens is described. It is the increased synthesis of estrogens by adipose tissue that is associated with an increased risk of breast, endometrial, ovarian or other cancers. The second mechanism described is related to insulin resistance and hyperinsulinaemia in obese patients. Insulin resistance is a condition in which peripheral tissues do not respond adequately to insulin leading to compensatory hyperinsulinaemia, impaired glucose tolerance, impaired fasting glycaemia and later the development of type 2 diabetes mellitus. Hyperinsulinaemia is associated with the risk of developing colon, kidney, prostate and endometrial cancers. The third mechanism is the presence of chronic inflammation in obese patients. Adipocyte hypertrophy, cell death, and chronic subclinical inflammation of adipose tissue occur as a result of adipose tissue hypertrophy. It is described that chronic inflammation taking place in adipose tissue triggers cancer progression. Changes in levels of the inflammatory cytokines IL-6, TNF α , and C-reactive protein (IL-6, TNF α , and C-reactive protein) have been found in overweight and obese patients. These factors contribute to oxidative stress and subsequent DNA damage, increasing the risk of cancer development [18,19].

The National Institutes of Health (NIH) (a part of the U.S. Department of Health and Human Services) is the nation's medical research agency

contains also the National Cancer Institute (NCI) which is the federal government's principal agency for cancer research and training. According to the institute, obese people have the greater risk for at least 13 types of cancer. The same information has also been published by the WHO through its specialized cancer agency the International Agency for Research on Cancer (IARC). The WHO European Regional Obesity Report 2022 summarised the links between obesity and cancer risk. Published information includes findings that at least 40% of cancers are potentially preventable, the two most serious causes of cancer that can be influenced include smoking and obesity, and obesity is thought to cause at least 13 different types of cancer [12,13,17].

Obesity is associated with the presence of chronic inflammation and insulin resistance in the body. It is chronic inflammation and insulin resistance that are thought to be involved in the development of cancer. Adipose tissue dysfunction caused by overaccumulation of fat leads to increased production of pro-inflammatory cytokines, reproductive hormones and lipid metabolites, and to insulin resistance. All these changes increase the risk of cancer growth and recurrence [4,18].

Childhood obesity represents one of the most serious global challenges of the 21st century, as it is a significant risk factor for the early onset of obesity-related complications and serious diseases such as breathing difficulties, increased risk of fractures, hypertension and other cardiovascular diseases, insulin resistance and psychological problems. At the same time, obese children are predicted to become obese adults with a higher probability of disability and premature death in adulthood without the necessary lifestyle and dietary adjustments. The rising prevalence of childhood obesity is a consequence of changes in society, specifically changes in dietary habits towards increased intake of energy-dense foods high in fats, sugars and low in vitamins, minerals and micronutrients. At the same time, there has been a decrease in physical activity levels due to sedentary lifestyles [26,27,28].

The fact that the structure of the food trade changed in the second half of the 20th century, for example, small producers were pushed out of the

main trading areas, leading to a reduction in the variety of products produced, has also contributed negatively to the change in diet. At the same time, there has been a significant decrease in the production of own vegetables in EU Member States and an increase in the trend of importing vegetables. The concept of 'Community Supported Agriculture', introduced in the second half of the last century to reverse the damage caused by industrialised agriculture and global trade, and to provide farmers with a stable livelihood while providing consumers with fresh, healthy and safe food at a fair price, can help to improve this situation [7,8,14,].

Preventing childhood overweight and obesity is a high priority because a healthy lifestyle can prevent it. Prevention is also the most realistic option to reduce further increases in the childhood obesity epidemic. Von Hippel and Workman (2016) examined the impact of summer vacation on the development of overweight and obesity in a sample of 18,170 American children, finding that it is the vacation period that is more risky for the development of overweight and obesity than the school year, when a fixed structure and time is provided in terms of diet, physical activity and sleep patterns. It is these 3 factors that are most significant in terms of the risk of developing overweight and obesity [10,26].

Because physical activity improves immune system function, reduces the risk of systemic inflammation, improves cardiovascular health, increases lung capacity, muscle strength, and improves mental health, it may also positively influence the course of other chronic diseases [23].

V. CONCLUSION

Studies show that obesity not only increases the risk of cancer and worsens the prognosis of treatment, but also increases the risk of cancer recurrence, metastasis, resistance to anti-cancer treatment and subsequent mortality. Obesity may also potentiate the side effects of anticancer treatment. Childhood obesity is a significant risk factor for the early incidence of serious obesity-related diseases such as respiratory problems, increased risk of fractures, hypertension and other cardiovascular diseases, insulin resistance and

psychological problems. Without the necessary lifestyle and dietary modifications, obese children will become obese adults with a higher probability of disability and premature death in adulthood. Diet, physical activity and sleep habits are the 3 factors that are most important in terms of the risk of overweight and obesity, and it is the COVID-19 pandemic that had a negative impact on these 3 factors, with a resulting increase in overweight and obesity, as evidenced by the available studies. At the same time, the results of the studies also show that obese patients who got COVID-19 had a more severe disease process. In the context of vaccination against COVID-19 infection, a lower neutralizing capacity of the antibodies produced by the obese patients has been documented.

Most of the causes that lead to overweight and obesity are preventable. The most effective prevention includes reducing the amount of calories consumed from fats and sugars, increasing the proportion of fruit, vegetables, legumes, whole grains and including regular physical activity in the daily lifestyle. Regular physical activity of 60 minutes a day is recommended for children and 150 minutes a week for adults. The WHO has summarised the actions to support a healthy diet and regular physical activity to prevent the development of obesity in a global strategy called: "WHO Global Strategy on Diet, Physical Activity and Health". The strategy was approved by the World Health Assembly (WHA – the WHO's top decision-making institution, which meets annually in May in Geneva with the participation of delegations from all member countries) in 2004 and in the 2011 Political Declaration on Non-Communicable Diseases (NCDs). At the same time, in the 2030 Agenda for Sustainable Development, heads of states and governments committed to develop national actions to reduce early mortality from non-communicable diseases by one-third by 2030 through prevention and treatment. In the fight against obesity, the WHO has also accepted the "Global action plan on physical activity 2018–2030: more active people for a healthier world" which contains globally implementable policy interventions to increase physical activity. To prevent the development of obesity, the Slovak Republic has approved "The National Action Plan on Obesity Prevention for 2015-2025" [16,24,27,28].

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