

## OBESITY – COMPLICATIONS ON THE BODY IN CHILDREN AND ADULTS

*Mariana CORMAN, Ala POGORLETCHI, Natalia MIHAILOV,  
Institute of Physical Education and Sport, State University of Moldova*

The studies published in the last decades on the official platforms of the WHO and EUROSTAT demonstrate that, both among children and adults, the incidence of obesity has tripled. Obesity is a multifactorial condition that affects all vital organ systems of the body and significantly affects health and quality of life. Researchers in the field report that approximately 30% of children and 50% - 70% of adults with obesity associate at least one cardiovascular risk factor, diabetes co morbidity is present in 1% - 8% of obese children and approximately 45% of obese adults and approximately 25-30% of obese children may develop metabolic syndrome. Obesity also directly affects the musculoskeletal system, causing a number of problems related to posture and bone and joint health. At the same time, it is well known that from 40% to 80% of obese children remain obese in adulthood. Thus, obesity remains a major public health problem, being associated with long-term complications, such as cardiovascular, respiratory, endocrine, osteoarticular diseases.

**Keywords:** *obesity, incidence, complications, health risk, child, adult.*

### OBEZITATEA – COMPLICATII ASUPRA CORPULUI LA COPII ȘI ADULȚI

Studiile publicate în ultimele decenii pe platformele oficiale ale OMS și EUROSTAT demonstrează că, atât în rândul copiilor cât și a adulților, incidența obezității s-a triplat. Obezitatea este o afecțiune multifactorială care vizează toate sistemele de organe vitale ale organismului și afectează semnificativ sănătatea și calitatea vieții. Cercetătorii din domeniul raportează că aproximativ 30% copii și 50% - 70% dintre adulți cu obezitate asociază cel puțin un factor de risc cardiovascular, comorbiditatea diabetului zaharat este prezentă la 1% - 8% copii obezi și aproximativ 45% la adulți obezi și aproximativ 25-30% dintre copii obezi pot dezvolta sindromul metabolic. Obezitatea de asemenea afectează în mod direct sistemul musculo-scheletic, cauzând o serie de probleme legate de postura și sănătatea oaselor și articulațiilor. Totodată este bine cunoscut faptul că de la 40% până la 80% dintre copiii obezi rămân obezi la maturitate. Astfel, obezitatea rămâne a fi o problemă majoră de sănătate publică, fiind asociată cu complicații pe termen lung, cum ar fi bolile cardiovasculare, respiratorii, endocrine, osteoarticulare.

**Cuvinte-cheie:** *obezitate, incidență, complicații, risc pentru sănătate, copil, adult.*

### Introduction

In the last three decades, the prevalence of overweight and obesity among both children and adults has increased rapidly. Globally, in 1990, approximately 4% of children between the ages of 5 and 19 were diagnosed as obese. Between 2000 and 2016, the WHO reports that the incidence of children suffering from obesity increased from 10% to 18% (of which 6% were boys and 8% were girls) [11]. And according to the most recent studies, carried out between 2007 and 2019, through the COSI (Childhood Obesity Surveillance Initiative) initiative monitored by the WHO, it demonstrates that the prevalence of pediatric obesity in the European region has grown alarmingly and that one in 3 children (29% of boys and 27% of girls) aged between 7 and 9 live with overweight or obesity [15].

And the studies carried out between 1990 and 2023 confirm that the general obesity rate among adults in Eastern Europe has tripled, increasing from 15% to 50%, depending on the region [5, 8, 12]. According to data from the 2021 STEPS (WHO) study, more than six in 10 adults (63.9%) were overweight (BMI  $\geq$  25 kg/m<sup>2</sup>), with a significantly higher proportion of men (70.8%) than women (57.0%) [14]. Statistics published in 2019 by EUROSTAT show that the highest proportions of women considered obese were recorded in Estonia (23.6%) Latvia (25.7%), Ireland (26.0%) and Malta (26.7%) , while for obese men the highest proportions were found in Croatia (23.7 %), Ireland (25.7 %), Hungary (25.8 %) and Malta (30.6 %) [12] .

In the Republic of Moldova, the situation follows a similar pattern and according to official statistics, 56% of adults (18 years +) are overweight, including 23% who are obese [21].

Currently, obesity is considered the most widespread chronic disease that associates multiple comorbidities (hypertension, ischemic disease, type 2 diabetes, hormonal disorders, bronchial asthma, obstructive sleep apnea, degenerative diseases of the locomotor system, etc.) that seriously affect the state of health and quality of life, becoming the most serious public health problem of the 21st century [2, 4, 9, 22].

**The aim of the respective study** was to analyze the incidence of obesity among children, adolescents and adults in the European region. We also studied the impact of obesity as well as short and long-term complications as a risk factor on the health of children and adults.

### Materials and methods

Study of the WHO (Global Health Statistics WHO) database and scientific articles published in electronic databases (Pubmed, Epub, Google Scholar) regarding the spread of obesity morbidity in the European Union. The prevalence of obesity and the complications occurring in both children and adults, officially registered in the statistical forms in the period 2010 - 2023, were studied and evaluated.

Obesity is a global phenomenon, which has reached the scale of an “epidemic” due to the increased incidence, which affects all socio-economic groups, regardless of age, sex or ethnicity.

Several researchers such as Llewellyn A et al. (2016), Geserick M. et al. (2018) in a systematic review and meta-analysis found that obese children have a higher risk of becoming obese adults. This depends on the age at which obesity was established, such as: approximately 25% of obese children between the ages of 2 and 5 will remain obese in adulthood, in obese 10-year-old children the risk increases to approximately 50%, and adolescents between 12 and 19 the risk increases exponentially to 80% for them to become obese adults. And obesity in both children and adults is associated with an increased risk of morbidity [7, 8].

Many comorbid conditions such as metabolic, cardiovascular, psychological, orthopedic, neurological, hepatic, pulmonary and renal disorders are observed in association with obesity and can develop in the child's body and cause long-term complications with age.

A holistic approach to the association of obesity with various conditions involves treating obesity not only as a problem of excess weight, but as a determining factor for numerous other health problems. This involves a comprehensive understanding of the interaction between different organ systems as well as determining the complex factors that contribute to the development and association of these conditions.

The most common conditions reported to be associated with obesity are [1, 2, 3, 10, 19]:

- Cardiovascular diseases: High blood pressure, heart failure, atherosclerosis and coronary heart disease are often linked to obesity.
- Type 2 diabetes: Excess weight and abdominal fat increase the risk of insulin resistance, contributing to the development of diabetes.
- Metabolic disorders: Metabolic syndrome, dyslipidemia (high cholesterol)
- Respiratory disorders: Obstructive sleep apnea and obese hypoventilation syndrome are frequently associated with obesity.
- Musculoskeletal conditions: Obesity leads to joint problems such as osteoarthritis, especially in the knees and hips.
- Gastrointestinal problems: Gastroesophageal reflux disease (GERD) and non-alcoholic fatty liver disease are more common seen among the group of obese people.
- Chronic inflammation.

Currently, there are few studies that have examined the long-term effects of childhood obesity as a predisposing factor on later disease development among adults. However, existing studies show that suffering from obesity in childhood or adolescence appears to increase the likelihood of morbidity and mortality when the subjects reach the adult age.

Multiple studies conducted by Falkner B., Simmonds M. et al., Templin T. et al. demonstrated that childhood obesity is the most consistent predictor of heart disease at reaching adult age. This fact has been well documented in the last decades and it has been proven that arterial hypertension is the most common

cardiac comorbidity of obesity both among children and adolescents as well as adults. Cardiovascular risk increases with exceeding the normal BMI around the 85th percentile of body weight, implicitly with a decrease in the level of high-density lipoprotein cholesterol (HDL-C) and a higher level of triglycerides, and as a consequence it generates other changes in the body that become a risk factor for the association of other ailments [5, 7, 20].

According to Tong J. et al. excess weight affects several systems in the body. First of all, in obese people, blood volume and cardiac output increase to ensure the nutrition of additional adipose tissue, so the heart has to work more intensively to maintain blood circulation and as a result blood pressure increases. Also, obese people are prone to develop insulin resistance, which can lead to type 2 diabetes and metabolic syndrome. And metabolic syndrome is a group of conditions that includes elevated blood sugar, increased waist circumference, and abnormal levels of LDL cholesterol (low-density lipoprotein) and triglycerides. These conditions contribute to the development of atherosclerosis and increased blood pressure with serious consequences such as myocardial infarction and stroke. Obesity is also associated with a state of chronic inflammation in the body. This occurs with the excess accumulation of adipose tissue which becomes a metabolically active organ and produces a series of inflammatory molecules such as: pro-inflammatory cytokines, adipokines (with varied roles in inflammation and regulation of metabolism) [21].

The research carried out by Esanu V. et al. (2018), reveals that the increase in the prevalence of hypertension in childhood is largely a consequence of obesity. Thus, childhood obesity promotes atherosclerotic disease in vascular structures such as the aorta and coronary arteries. Also, overweight in childhood and adolescence has a strong influence on the structure and function of the heart, with a preponderance of the left ventricle [6].

The results obtained in another similar study carried out by the Moldovan researchers Romaniuc L. and Revenco N. (2023) showed that about 3.5% of obese adolescents 23% - 30% were diagnosed with hypertension [17].

The study conducted by Posohova NV revealed that overweight/obesity in the first years of life was present in 30% of the children included in the study, of which 50% were between 7-8 years old, and 20% were between 11- 12 years. And the most common symptoms reported by children with obesity degree II-III were: headache (50%), chest pain and shortness of breath during physical activity (40% of children), and palpitations at rest were reported of 20% of boys and 30% of girls. Also, high blood pressure was detected in these children, up to  $150 \pm 20$  mmHg for systolic and  $90 \pm 10$  mmHg for diastolic [13].

According to Raj M. (2012) the likely mechanisms of obesity-related hypertension include insulin resistance, sodium retention, increased activity of the sympathetic nervous system, activation of the renin-angiotensin-aldosterone system, and altered vascular function [14].

Multiple studies indicate that childhood obesity is a major risk factor for the development of type 2 diabetes, due to increased insulin resistance and associated metabolic dysfunctions. Previously, type 2 diabetes (T2D) was considered a disease of adults, and currently it has become frequently diagnosed among obese children aged between 7 and 18 [1, 9, 18].

According to WHO data, more than 50% of hypertensive patients have additional cardiovascular risk factors, namely: type 2 diabetes (15-20%), elevated LDL-cholesterol and triglycerides (30%), overweight/obesity (40%), hyperuricemia (25%) and metabolic syndrome (40%) [11].

In this context, the results obtained in the study by Abbasi A. et al. demonstrate that the increase in the prevalence of obesity among children and adults has contributed to the increase in the incidence of type 2 diabetes (T2D), but not type 1 diabetes (T1) [1].

Another study finds that insulin resistance is a well-known cardiovascular risk factor in adulthood and has a strong association with childhood obesity. The rate of insulin resistance was 37% of boys and 27.8% of girls during the prepubertal period, while during puberty the rates increased to 61.7% for boys and 66.7% for girls [19].

We believe that the likely reasons why insulin resistance and/or hyperinsulinemia may increase blood pressure include the antinatriuretic effect of insulin, increased activity of the sympathetic nervous system, increased responses to endogenous vasoconstrictors, altered cation transport across the vascular membrane, impaired endothelium-dependent vasodilation, and stimulation the endothelium.

Llewellyn A. et al. conducted a systematic review and meta-analysis study investigating childhood obesity as a predictor of morbidity in adulthood. The obtained results confirmed that 31% of diabetes cases and 22% of hypertension cases in adults were preceded by coronary disease diagnosed among the children that have been diagnosed as overweight or obese, aged after 12 years [8].

In the specialized literature, the association of pediatric obesity and the metabolic syndrome (MS), also known as „insulin resistance syndrome”, is frequently described. MS is defined as a clustering of at least 3 of 5 medical conditions: abdominal obesity, hypertension, elevated blood glucose, elevated serum triglycerides, and low serum high-density lipoprotein (HDL). It is also well established that adults who meet the criteria of this syndrome are under increased risk of developing type 2 diabetes and cardiovascular disease. Most studies show that one of the most important risk factors in the development of MS among adults and children, is the excess of adipose tissue in the abdominal region.

Thus, the metabolic syndrome becomes a common condition among both adults and overweight children. Data obtained by Ferranti et al., using a definition adapted for children, identify a 9.2% prevalence of MS among them. In the same context, according to the official data presented in the specialized literature, the prevalence of MS among overweight adults diagnosed with hypertension varies from 25% to 40%, depending on the region, race and ethnicity [16, 18]

Also, there are multiple studies that demonstrate the association of obesity with musculoskeletal disorders.

Nowicki P. et al. studied the effects of childhood obesity on the growing skeleton. The study demonstrates that obesity plays an important role in altering bone mass accumulation, particularly through the metabolic syndrome that is associated with abdominal obesity. Despite the mechanical load that might encourage bone strength, the endocrine changes and nutritional deficiencies that result from obesity actually lead to a lower ratio of total bone mass. Thus, MS deregulates the endocrine system in several ways, including insulin resistance, increased inflammatory cytokine production, altered leptin production, and vitamin D deficiency. It is also now well accepted that factors influencing childhood bone mass are determinants important risk factors for osteoporosis in adulthood [10].

The increased fracture risk identified among obese children has led to focus on the relationship between excess adipose tissue, bone density and the impact of obesity on the process of skeletal development. Currently, advances in skeletal imaging have shifted the focus from bone quantity among obese children to assessing changes in bone microarchitecture. Accordingly, the findings of these studies suggest that bone strength in the appendicular skeleton does not adapt to increased body size, resulting in a mismatch between bone strength and the forces exerted during falls.

Fewer studies have quantified the prevalence of weight-related orthopedic conditions in overweight compared to normal weight children.

These studies show that overweight children report more frequent musculoskeletal problems in the spine, ankle and feet in daily life than children with normal weight. It was also found that overweight adolescents over the age of 12 sought medical help more frequently for lower extremity problems than their normal-weight peers. Orthopedic conditions associated with childhood obesity include: extremity fractures, slippage of the femoral capillary epiphysis, tibia varus, and misalignment of the lower extremities in both valgus and varus. [10, 22].

The relevant studies that focused on the effects of childhood obesity as a predictor of musculoskeletal disorders among adults, demonstrated that the functional and structural limitations imposed by obesity can lead to aberrant mechanics of the lower limbs and increase the risk of chronic musculoskeletal injuries [7].

There are multiple studies that demonstrate that obesity, regardless of age, involves disturbances in lung function. In this context, researchers who have studied this topic indicate that the most common respiratory disorder associated with obesity is obstructive sleep apnea syndrome (OSAS). Another lung condition commonly reported to be associated with obesity is asthma. In his study di Palmo E. et al. states that in children asthma and obesity can occur simultaneously. And researchers Beuther DA and Sutherland ER believe that asthma can predispose to obesity. According to the obtained results, it was proven that the risk of developing obesity is almost twice as high among the children aged eight [12, 18].



## Conclusions

1. In recent decades, the incidence of obesity has tripled, taking on the scale of an “epidemic”, which affects the health status of both the pediatric population and adults.
2. Current evidence linking childhood obesity to deterioration of cardiorespiratory health, both in the short and long term, is compelling. The contribution of this pathological condition during childhood period to cardiovascular morbidity and mortality in adulthood is significant.
3. Obesity is a multifactorial metabolic condition that affects most body systems, with short-term or lifelong consequences. Often, obesity is associated with conditions not only of the cardio-respiratory system, but also with musculoskeletal conditions, located especially at the level of the spine and lower limbs. These conditions are established in childhood and progress during adulthood, negatively influencing health and quality of life.

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#### Data about the authors:

**Mariana CORMAN**, PhD, university lecturer, Faculty of Physical Therapy, Institute of Physical Education and Sport, State University of Moldova.

**ORCID:** 0009-0009-1166-7197

**E-mail:** kineto7@mail.ru

**Ala POGORLETCI**, PhD, university associate professor, Faculty of Physical Therapy, Institute of Physical Education and Sport, State University of Moldova.

**ORCID:** 0000-0002-2160-7114

**E-mail:** vallarann@mail.ru

**Natalia MIHAILOV**, PhD student, university assistant, Faculty of Physical Therapy, Institute of Physical Education and Sport, State University of Moldova.

**ORCID:** 0009-0009-3660-0503

**E-mail:** nataliazapanovici@mail.ru

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