**PREVALENCE AND RISK FACTORS FOR OVERWEIGHT AND OBESITY IN CHILDREN AND ADOLESCENTS**

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**Introduction**

Obesity in children is one of the main problems of contemporary health care due to its high prevalence, complex adverse health effects, the risk of complications and low effectiveness of existing treatments.

It is important to note that childhood obesity often leads to overweight in adults and entails not only health problems but also economic consequences, both for the individual and for society as a whole. This is due to the disability of patients of working age and the reduction in overall life expectancy, which is a consequence of severe comorbidities and disorders.

Obesity is a multifactorial disease. In most cases (90%) in childhood and adolescence diagnose exogenous-constitutional obesity. Other forms of this pathology are quite rare and usually differ in morbid course and the presence of specific symptoms.

Being overweight in childhood and adolescence causes both short-term and long-term adverse effects on physical and psychosocial health. Systemic hormonal and clinical disorders associated with childhood obesity are combined into a metabolic syndrome. Manifestations of this syndrome are insulin resistance and the manifestation of type 2 diabetes, dyslipidemia, hypertension and ovarian hyperandrogenism. In addition, obesity causes digestive, endocrine, orthopedic and other disorders, sleep apnea, reduces resistance to colds and infectious diseases and dramatically increases the risk of complications from surgery and trauma. Psychological aspects of overweight and obesity in childhood are also very important. They are associated with low self-esteem, dissatisfaction with own body, depression, up to suicidal thoughts. Such adolescents are stigmatized by peers and have fewer friends than children with normal body weight. This, in turn, can affect school performance. In the future, obese young people are more prone to social exclusion, early school leaving, exacerbation of existing eating disorders, alcoholism and drug addiction, and have lower marriages and overall life satisfaction. Thus, the problem of obesity is at the intersection of different branches of medicine – pediatrics, health care, therapy, endocrinology, gastroenterology, nutrition, gynecology, andrology, neurology and psychiatry.

**1. General trends in the epidemiology of overweight and obesity among children in the world and in Ukraine.**

In 2016, the WHO, together with experts from Imperial College London, conducted a study of the prevalence of overweight and obesity in the world. This study is the most comprehensive in the last 40 years. According to the results, it was found that more than 1,9 billion adults over the age of 18 were overweight and obese. Thus, the number of adults suffering from obesity increased from 100 million in 1975 to 671 million in 2016. It is noted that the country with the largest number of overweight people is the United States (38,2%), and the smallest – Japan (3,7%). At the same time, WHO experts predict a further significant increase in the number of obese people by 2025.

The most worrying situation is the growing number of overweight and obese children and the shift in the peak of childhood obesity in early age compared to previous years. According to a 2016 study, the total number of overweight and obese children was about 41 million children under the age of 5 and 340 million between the ages of 5 and 19. Thus, the prevalence of overweight and obesity among children aged 5 to 19 years increased sharply from 4% in 1975 to 18% in 2016. In 1975, slightly less than 1% of children and adolescents aged 5 to 19 years were obese and in 2016 their number reached 124 million (6% of girls and 8% of boys). This trend exacerbates the obesity epidemic in adults and poses a growing threat to the health of the next generation.

Until recently, there were almost no large-scale epidemiological studies of obesity among children and adolescents in Ukraine. Despite the fact that in recent years in some regions significant progress has been made in studying the epidemiology of food-dependent diseases, including obesity among children and adolescents, the diagnostic process for this type of pathology is ineffective. Thus, the prevalence of obesity in Ukraine in 2016 was 13,50 per 1 thousand children aged 0–17 years inclusive (or 1,3%), with a negative trend over the past 2 years. This number is much lower than in most European countries, where the incidence of obesity among children ranges from 10–15%, and among adolescents even more. In the Kharkiv region, the corresponding prevalence of obesity was 15,1 ‰.

Insufficient registration of obesity in Ukraine is due to the imperfection of the existing system of prevention of food-dependent diseases and informational and communicational of its support, lack of unified and standardized programs for early detection of overweight in children and related health disorders, accounting such children and medical supervision of them. This is the reason why the awareness and vigilance of the population of our country on this problem is low. In many families, obesity is not considered a disease, but on the contrary, is considered a sign of health of children, especially boys. Therefore, children and adolescents often have complications on the background of premorbid conditions associated with obesity and the reason to see a doctor is not overweight, but complaints associated with the development of obesity complications: headache, shortness of breath, dizziness, thirst, pain in legs, sexual dysfunction.

The International Consensus on Childhood Obesity states that early intervention, including diet therapy, dietary change, and physical activity, is recommended to prevent the development of complications. So, of particular relevance is the development and implementation at the primary level of medical care for children of early detection of overweight children, their accounting and monitoring of health, taking into account the risks of disease, starting from the antenatal period. This monograph describes the main results of the study of the prevalence and risk factors of overweight and obesity among children and adolescents aged 6–17 years in Kharkov.

**2. Analysis of the results of the prevalence and main risk factors for overweight and obesity in children and adolescents in Kharkiv.**

The prevalence of obesity and overweight in children and adolescents in Kharkiv was studied by a single continuous method. For this purpose, we copied anthropometric data from the history of the child's development (f.112/a) of the statistically representative sample of 4789 children and adolescents aged 6–17 years. Of these, 2406 girls and 2383 boys, 50,3±0,8% and 49,7±0,8%, respectively. Processing of the obtained results included assessment of body mass index according to age and sex according to the recommendations of WHO experts (Development of a WHO growth reference for school-aged children and adolescents. Bull. World Health Organ. 2007), which was calculated by dividing body weight (kg) per square of height (m). This technique belongs to parametric or sigma methods. The parametric rating scale includes the arithmetic mean and standard deviations (SD score). If the BMI value is in the range (±SD), body weight is considered normal; in the range from (+1SD to +2SD) – excess body weight; more (+2SD) – obesity; less (-2SD) – body weight deficit.

Thus, all studied were divided into four groups: I experimental group – obese children, II experimental group – overweight children, III group – children with normal body weight, IV – children with underweight.

Obesity (I research group) was found in 280 (58,4±3,4‰) children, including 105 (43,6±4,2‰) girls and 175 (73,4±5,3‰) boys. Overweight (research group II) was found in 440 (91,9±4,2‰) children, of which 223 (92,7±6,0‰) girls and 217 (91,0±5,9‰) boys. 3925 (819,6±5,6‰) children, 1989 (826,7±7,7‰) girls and 1936 (812,4±8,0‰) boys had normal body weight (research group III). Insufficient body weight (IV research group) was found in 144 (30,1±2,5‰) studied, including 89 (36,9±3,8‰) girls and 55 (23,1±3,1‰) boys (Tab 2.1).

**Table 2.1**

**Prevalence of obesity, overweight,**

**normal and insufficient body weight among children and adolescents in Kharkiv**

**depending on gender, (‰)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Research groups** | **Boys** | **Girls** | **Total** |
| **Obesity (I group)** | 73,4±5,3 | 43,6±4,2 | 58,4±3,4 |
| **Overweight (II group )** | 91,0±5,9 | 92,7±6,0 | 91,9±4,2 |
| **Normal body weight ( III group)**  | 812,4±8,0 | 826,7±7,7 | 819,6±5,6 |
| **Insufficient body weight (IV group)**  | 23,1±3,1 | 36,9±3,8 | 30,1±2,5 |

The next stage of our work was the distribution of the total number of children and adolescents in the research groups depending on the age group. In total, three age groups were distinguished: from 6 to 9; from 10 to 13 and from 14 to 17. The largest number – 1894 (39,5±0,7%) persons were observed in the age group of 10–13. The next group was 6–9, with 1680 (35,1±0,7%) persons, and the last was the age group of 14–17 with 1215 (25,4±0,63%) persons.

It was found that obesity (research group I), overweight (research group II) and insufficient body weight (research group IV) were most common in the age group 6–9 – 78,5±6,6‰, 111,3±7,7‰ and 39,2±4,7‰, respectively. The lowest prevalence of obesity (research group I) and insufficient body weight (research group IV) was found in the age group 14–17 – 27,1±4,6‰ and 23,9±4,4‰, respectively, and overweight body (II research group) in the age group 10–13 (80,7±6,3‰), but this indicator was only slightly lower than the corresponding indicator in the last age group – 82,3±7,9‰, respectively (Tab 2.2).

**Table 2.2**

**Prevalence of obesity, overweight,**

**normal and insufficient body weight among children and adolescents in Kharkiv**

**depending on age, (‰)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Age** | **Obesity (I group)** | **Overweight** **(II group)** | **Normal body weight ( III group)**  | **Insufficient body weight****(IV group)** |
| **6-9 years** | 78,5±6,6 | 111,3±7,7 | 770,8±10,3 | 39,2±4,7 |
| **10-13 years** | 60,7±5,5 | 80,7±6,3 | 832,6±8,6 | 25,9±3,7 |
| **14-17 years** | 27,1±4,6 | 82,3±7,9 | 866,7±9,7 | 23,9±4,4 |
| **Total** | 58,4±3,4 | 91,9±4,2 | 819,6±5,6 | 30,1±2,5 |

According to the study of the prevalence of overweight and obesity among children aged 6–17, it was determined that overweight and obesity were diagnosed in 720 (150,3±5,2‰) children and adolescents – in 328 (136,3±7‰) girls and 392 (164,5±7,6‰) boys and much more often studied pathology occurred in the age group 6–9 (189,9±9,6‰) than in the group 14–17 (109,5±9,0‰).

Thus, every seventh child has this pathology and this level of prevalence, in turn, corresponds to the global trend.

The reason for the growing prevalence of this pathology among children is that today many children grow up in an environment that contributes to obesity. In the context of globalization and urbanization, the influence of this environment is growing in all social and economic groups, both in countries with high and low and medium levels of wealth.

Therefore, at the next stage, the analysis of the probable risk factors for the development of overweight among children and adolescents was performed.

The main sources of information in the study of risk factors for overweight were the responses of children aged 9 to 17 years and their parents, who were the main (413 people) and control group (396 people) and data from the history of the child's development (f.112/a).

Identification of risk factors for the development of the disease was carried out using analysis of variance, which makes it possible to install significant differences in factors in the main and control groups. The study of the proved factors was carried out by calculating the indicators of the strength of the influence of factors (η–%) and the ratio of chances (OR).

During the processing of the obtained results it was found that 22 factors had a significant impact on the development of excess body weight. All factors were divided into 4 groups: medical and biological, social and hygienic, social and economic and psychological (Pic 2.1).



**Picture 2.1. Risk factors of formation and development of overweight and obesity among children and adolescents**

Obesity is a chronic non-specific disease, and hereditary factors play an important role in the occurrence and development of this pathology. It is known that the probability of developing the studied condition in a child increases in the presence of excess body weight, obesity or other chronic diseases, especially the endocrine system, in relatives. The results of the study indicate that on the development of excess weight in children and adolescents, biological factors had a significant impact. It was found that patients in the main group were much more likely to be overweight in one or two parents compared with the control group – 64,4±2,4% and 34,3±2,4%, respectively (η–9%; p<0,001; OR=3,5; СI=2,6–4,6). Thus, overweight of both family members was observed in 22,5 (35,0%)±2,1% of cases in the main group against 15,0 (43,4%)±1,8% of cases in the control group. Overweight in one parent was observed in 41,9 (65,0%)±2,4% of families in the main group and in 19,4 (56,6%)±2% of families in the control group. In both the main and control groups, overweight was more common among mothers than among fathers – 46,7 (53,8%)±2,4%; 40,1 (46,2%)±2,3% and 25,3 (51,5%)±1,9%; 24,0 (48,5%)±1,9%, respectively.

Aggravated heredity of hypertension, diabetes mellitus and other endocrine pathology was found in 59,3±2,4% of relatives of patients in the main group and only in 34,3±2,4% of relatives of patients in the control group (η–6%; p<0,001; OR=2,8; СI=2,1–3,7).

According to experts, it is important to pay attention to the general obstetric problems of pregnancy, including overweight, anemia, preeclampsia, and the pathology of childbirth (premature, late or rapid birth, weakness of labor), as such conditions can cause inadequate weight gain in children and adolescents in the postnatal period. The obtained results confirm the significant influence of perinatal factors on the development of excess body weight. Thus, in the analysis of pregnancy it was noted that preeclampsia, threats of abortion, extragenital pathology and overweight during pregnancy were observed in 41,2±2,4% of mothers of obese children and overweight and in 24,7±2,2% of mothers of children with normal body weight (η–3%; p<0,001; OR=2,1; СI=1,6–2,9). According to the obstetric anamnesis, the frequency of complications in childbirth in mothers of obese patients and overweight was 26,2±2,2%, and in mothers of children with normal body weight – 14,1±1,7%, which also indicates a probable difference of indicators (η–2%; p<0,001; OR=2,2; СI=1,5–3,1).

Careful study of postnatal development of the child, namely: the dynamics of weight gain and the nature of breastfeeding in the first year of life is a necessary task in studying the development of many conditions, including childhood obesity. Thus, together with the assessment of prenatal and birth history, a study of the dynamics of postnatal development of children in the control and main groups was conducted. When evaluating anthropometric data at birth and the dynamics of weight gain of children during the first year of life, it was found that 39,5±2,4% of children in the main group had a birth weight of more than 3500 g. and/or there was excessive weight gain at the first year of life. In the control group, the corresponding indicator was significantly lower and amounted to 22,5±2,1% (η–3%; p<0,001; OR=2,2; СI=1,7–3,1). We analyzed data that reflect the characteristics of children's nutrition during the first year of life. It was found that 33,7±2,3% of children in the main group were on artificial, mixed feeding and/or there was an early introduction of complementary foods and a predominance in the structure of the diet of semolina and cow's milk. In the control group of children, the value of the corresponding indicator was 17,7±1,9% (η–3%; p<0,001; OR=2,4; СI=1,7–3,3) respectively.

Today, scientific and technological progress is the basis of modern society and civilization. However, its consequences are changes in diet and physical activity, which, in turn, lead to weight gain among both adults and children. This fact explains that the largest number of factors that according to the results of this study had a significant impact on the development of the studied pathology, belonged to the group of social and hygienic. It should be noted that the strength of the influence of two factors, namely, the consumption of high-calorie foods and non-compliance with the diet – significantly exceeded the strength of the influence of other factors in this group. According to a sociological survey of adolescents and their parents in the main group, it was found that 55,2±2,5% of children almost daily in the diet was dominated by foods high in fat in the form of sausages, cheeses or offal and easily digestible carbohydrates in the form of bakery products and sweet desserts, as well as insufficient consumption of fish dishes, seafood, cereals, vegetables and fruits. Against this background, it was found that in the vast majority of cases, these children and adolescents preferred to quench their thirst with sweet carbonated drinks instead of ordinary water, juices and compotes (63,9±2,4%). In the control group, the indicator characterizing the diet was significantly lower – 29,3±2,3%, respectively (η–7%; p<0,001; OR=3,0; СI=2,2–4,0). In comparison with the quality, the amount of food consumed also had an impact on the development of the studied condition, but not so significant – 45,3±2,5% in the main group against 23,7±2,1% in the control group, (η–5%; p<0,001; OR=2,7; СI=2,0–3,6) respectively. When evaluating the diet, it was found that 58,4±2,4% of children in the main group ate less than three times a day or did not have a certain time and frequency of meals during the day and often missed breakfast and/or ate just before bedtime. In the control group, these dietary features were observed only in 32,3±2,3% of children (η–7%; p<0,001; OR=2,9; СI=2,2–3,9). At the same time, it should be noted that children with obesity and overweight significantly more often than children with normal body weight visit fast food enterprises – 33,4±2,3% and 17,2±1,9%, respectively (η–3%; p<0,001; OR=2,4; СI=1,7–3,4). The study found that a sedentary lifestyle was an important factor. It was found that 51,3±2,5% of children with obesity and overweight had reduced physical activity on weekends and/or they did not attend sports sections, physical education classes at school. In addition, it was noted that a significant proportion of patients in the main group do not perform morning exercise (60,8±2,4%), rarely walk (47,9±2,5%), climbs stairs (56,7±2,4%) and more often (67,3±2,3%) prefer inactive leisure activities (reading, computer games, etc.). Lack of physical activity was observed only in 28,5±2,3% of children with normal body weight (η–5%; p<0,001; OR=2,6; СI=2,0–3,5). Sedentary lifestyle, in turn, was complicated by two other factors in this group. This is a long time spent on electronic devices and a significant mental load. Thus, 50,8±2,5% of children in the main group against 32,1±2,3% of children in the control group noted that on average they spend more than 3 hours a day on electronic devices (η–4%; p<0,001; OR=2,2; СI=1,6–2,9). Intensive mental load, namely: training in gymnasiums, lyceums, additional classes – was found in 24,5±2,1% of children in the main and in 16,2±1,8% of children in the control group (η–1%; p<0,01; OR=1,7; СI=1,2–2,4). When assessing other factors, it should be noted that 31,2±2,3% of respondents in the main group prefer to eat in front of the TV, computer or desk, while in the control group this trend was observed in 18,2±1,9% of respondents (η–2%; p<0,001; OR=2,0; СI=1,5–2,8). According to the study, some reliable factors indicate a role for parents in the development of overweight in children. It was found that 21,3±2% of parents of children in the main group do not prohibit the consumption of high-calorie foods, and 36,8±2,4% of parents in this group said that they often encourage their children with delicious food for good behavior or academic marks. In the control group, only 9,8±1,5% of parents do not forbid their children to eat high-calorie foods (η–2%; p<0,001; OR=2,5; СI=1,7–3,7) and 24,7±2,2% often encouraged children to eat tasty food, respectively (η–2%; p<0,001; OR=1,8; СI=1,3–2,4). In 16,2±1,8% of parents of children in the main group against 10,4±1,5% of parents in the control group there was insufficient awareness of nutrition issues, and they could not give a realistic estimate of calorie and fat intake with food (η–1%; p<0,05; OR=1,7; СI=1,1–2,5). In addition, the majority of respondents in the main group (54,2±2,5%) did not consider it necessary to have scientifically proven information on nutrition and, as a rule, received information from the media, friends, acquaintances, books and magazines (79,2±2,0%), and when choosing food were more often guided by taste and price, rather than health benefits (80,4±2,0%). In addition, it was found that 15,3±1,8% of parents in the main group can not fully control the nutrition of children during the day, and in the control – only 8,3±1,4%, respectively (η–1%; p<0,01; OR=2,0; СI=1,3–3,1).

The identified features must be taken into account when conducting hygienic training of the population at the primary level of health care.

The choice of food and food intake is to some extent influenced by social and economic factors (level of education, income and marital status). Therefore, the study involved determining the general social and economic status of families. It was determined that 52,8±2,5% and 57,1±2,5% of children in the main and control groups, respectively, in complete families were brought up. Material support of most families of the studied groups was lower or higher than the average level – 40,9±2,5% and 37,3±2,4% in the main and 41,2±2,5% and 40,4±2,5% in the control group, respectively. About 70,0±1,6% of families spend half or more of their budget on food and less than half on rehabilitation and live in good or satisfactory living conditions. Bad habits such as smoking and alcohol abuse among family members were also absent in most cases. Thus, the results of the analysis did not reveal a significant difference between these indicators, and the development of the disease was significantly influenced by such social and economic factors as the number of children in the family and the level of education of parents. It was determined that 43,1±2,4% of families in the main group have one child, and in the control group – 32,1±2,3%, respectively (η–1%; p<0,001; OR=1,6; СI=1,2–2,1). 33,7±2,3% of parents of the main group against 23,2±2,1% of parents of the control group had secondary education (η–1%; p<0,001; OR=1,7; СI=1,2–2,3).

It is known that the presence of psychological problems in a child, such as chronic anxiety or depression, can lead to an increase in food intake and reduced physical activity, which, in turn, will contribute to the formation of excess body weight. Thus, the study of psychological factors was a prerequisite for the study.

The assessment of these factors confirmed the influence of the child's psychological state on the development of the disease. According to the results, 43,1±2,4% of children and adolescents in the main group ate food in stressful situations and in a bad mood. In the control group, the corresponding indicator was probably lower – 32,1±2,3% (η–2%; p<0,001; OR=1,8; СI=1,3–2,3). Presence of stressful situations and psychological traumas in the family (divorce of parents, conflicts between family members, death of relatives), at school (conflict situations with teachers, classmates), in communication with peers (unrequited love, etc.) were found in 15,3±1,8% of children with obesity and overweight against 6,8±1,3% of children with normal body weight (η–2%; p<0,001; OR=2,5; СI=1,5–4,0). In addition, it should be noted that a rather small probable difference in the indicators of psychological factors may be due to the peculiarities of the childhood of the examined patients.

In order to identify the main and secondary factors that contributed to the pathology under study, a ranking of groups of risk factors was performed. The main risk factors were those with an impact force ≥ 3%.

It was determined that the main risk factors for overweight in children and adolescents were all biological and some social and hygienic factors, namely overweight in family members (η–9%), daily consumption of high-calorie foods (η–7%), non-compliance with the diet (η–7%), burdened heredity (η–6%), eating a significant amount of food (η–5%), sedentary lifestyle (η–5%), daily stay on electronic devices more than 3 hours a day (η–4%), pathological course of pregnancy (η–3%), overweight of a child under one year (η–3%), visits to fast food enterprises more than twice a week (η–3%), features of nutrition in the first year of life (η–3%). Social and economic and psychological factors belonged to the group of additional factors.

Thus, the combination of biological determinants and adverse environmental factors significantly increases the risk of developing excess body in children and adolescents. Therefore, first of all it is necessary to influence the environmental factors that contribute to the development of obesity in combination with an approach that takes into account the key stages of the life cycle of children: antenatal, mammary, early and late childhood and adolescence. This will prevent the action of both specific and external factors on the development of pathology.

**3. Determining the main measures for the problem of overweight and obesity in children and adolescents according to the results of the study.**

Based on the results of the medical and social study, it was determined that the priority measures to reduce the prevalence of obesity and its consequences should be aimed at modifying risk factors, namely: changing stereotypes and habitats that contribute to pathology, and improving the quality of care, including at the primary level.

Thus, the problem of obesity among children and adolescents requires decision-making at the regional level and the application of an integrated approach involving all stakeholders and the main strategies are: conducting medical and hygienic education of the population through the media, forming motivation and awareness of healthy lifestyle, forming stereotypes of the health care system and society regarding the proper attitude to obese people, implementing standards and improving the quality of health care, prevention of noncommunicable diseases, creating an environment that will promote a healthy lifestyle, namely opportunities for physical activity, availability of healthy food for the whole population (development of recommendations for all structures and organizations related to nutrition, trade, planning and arrangement of areas adjacent to children's institutions), control of marketing activities ( food and non-alcoholic beverages, the introduction of a standardized system of food labeling with information about the energy value on the label).

**The main areas of improving the quality of medical care for obese children include:**

1. Mandatory monitoring of body mass index among children from 3 years of age and assessment of the harmony of physical development;

2. Introduction of an information system for accounting, monitoring of obesity and overweight and the main risk factors (electronic medical record of the patient);

3. Introduction of patient registers at the territorial and regional level;

4. Preferential supervision by the family doctor, involvement of all experts, including the psychologist (carrying out psychological correction);

5. Raising public awareness at the group, individual level;

6. Timely identification of risk factors, formation of risk groups, organization of dynamic monitoring, creation of differentiated prevention programs and study of public awareness of the main risks of overweight;

7. Advanced training of doctors, conducting training seminars and trainings on nutrition.

The combination of efforts of different parties related to the problem of childhood obesity and the implementation of comprehensive measures will improve the prevalence, modify risk factors and will facilitate the adaptation of children with this pathology in society.

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