METHOD FOR CORRECTING METABOLIC AND IMMUNOPATOLOGICAL DISORDERS IN CHILDREN WITH EXOGENOUS CONSTITUTIONAL OBESITY

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Abstract. *The results of our own study of weight correction, metabolic and immunopathological disorders in overweight and obese adolescent children are presented.*

Aim: Development of a treatment and preventive program for weight correction, metabolic and immunopathological disorders in overweight and obese children.

Materials and methods: 60 adolescents were examined: 40 with exogenous constitutional obesity of the first degree, 20 with overweight. Studies were carried out on the levels of adiponectin, highly sensitive C-reactive protein, lipid spectrum in the blood plasma, as well as bacteriological examination of feces. The developed treatment and preventive program was applied to 50 children, divided into 4 groups: the main ones - 20 obese children (1) and 10 overweight children (2), who received a course of probiotic medication as part of the developed treatment and preventive program. The control groups included 20 obese children (3) and 10 overweight children (4), who, for a number of reasons (parental abandonment, child abandonment, financial situation in the family), did not receive a probiotic drug as part of the weight correction program. The results were assessed after 6 and 12 months, with repeated paraclinical studies.

Results: Assessment of the level of CRP-hs after 12 months of application of the developed treatment and prophylactic program demonstrated a decrease in the activity of CRP-hs and an increase in the level of adiponectin (from 4.06 ± 0.06 to 2.4 ± 0.03 and from 5.0 ± 0 .13 to 12.23±0.08 mg/ml, respectively), a significant ($p < 0.05$) decrease in total cholesterol levels (from 6.09±1.07 to 4.85±0.93 mmol/l) and triglycerides (from 2.05±0.17 to 1.12±0.29 mmol/l), as well as normalization of the quantitative and qualitative composition of the intestinal microbiota, the degree of dysbiotic disorders and the disappearance of signs of bacterial contamination in the main groups of children, compared with the control in groups. Stabilization of body weight, disappearance of signs of metabolic and immunopathological disorders after 12 months of use of the developed treatment and preventive program in the complex treatment of obesity allow us to recommend its use in both group and individual treatment.

Keywords: *obesity, children, metabolic and immunopathological disorders, correction.*

Recently, obesity has been considered a new non-infectious epidemic of the 21st century, which has become significantly younger over the past decade and represents a huge problem that has not only medical but also social significance, as it leads to the development of a number of diseases that limit the ability to work and cause disability in patients.

The prevalence of obesity throughout the world has been steadily increasing over the past decades, not only among adults, but also among children. According to the latest WHO data, around the world, about 41 million children under the age of 5 years are overweight or obese, and

340 million children and adolescents aged 5 to 19 years are overweight or obese [21]. However, according to a number of studies, official information does not reflect the complete picture of real morbidity rates, which is due to insufficient attention of medical personnel and parents to the problem of childhood obesity, as well as the lack of unitary approaches to the observation and treatment of overweight and obese children [1, 2,4,19].

Numerous studies have demonstrated that adipose tissue is an active endocrine and paracrine organ, secreting a variety of mediators called adipocytokines [16,22]. Currently, several groups of adipocytokines have been identified: hormones, proinflammatory cytokines and other proteins, the mechanism of action of which is being actively studied. It has now been proven that in obesity, the functioning of fat cells is disrupted; the result of this dysfunction is the overproduction of pro-inflammatory and decreased production of anti-inflammatory cytokines [1]. Also, the results of the studies demonstrated the ability of various adipocytokines to cause the development of structural and functional remodeling of the myocardium, regulate vascular tone, participate in the formation of insulin resistance and lipid metabolism disorders, and also initiate the occurrence of atherosclerotic vascular damage. The data obtained as a result of scientific research have proven the presence of protective properties of such adipocytokine as adiponectin. Unlike most other adipocytokines, serum levels of adiponectin decrease in obesity [6,11]. Plasma concentrations of adiponectin negatively correlate with BMI. Prospective animal studies have shown that adiponectin levels progressively decrease as obesity progresses and, conversely, circulating adiponectin levels increase with weight loss. Serum adiponectin is more associated with abdominal redistribution of adipose tissue [5].

Overweight and obesity in 70-90% of cases are combined with a disturbance in the composition of the resident microflora of the digestive tract - dysbacteriosis [4]. Recently, more and more studies have appeared that show a connection between changes in the microbiome of the digestive system and the development of obesity. Numerous scientific studies have confirmed that the intestinal microbiota plays a critical role in the pathogenesis of obesity [8]. At the same time, disruption of the normal intestinal microflora can indirectly contribute to the emergence and development of metabolic syndrome and coronary heart disease. A number of researchers claim that intestinal dysbiosis is a trigger in the genesis of aseptic inflammation of adipose tissue in obesity, type 2 diabetes mellitus and metabolic syndrome [2,3]. It has been shown that some microorganisms that are part of the normal intestinal microflora have anti-inflammatory properties and take part in the regulation of immune processes. In particular, intestinal microflora influences the differentiation of T lymphocytes in Peyer's patches. Thus, normal intestinal microbiota induces the synthesis of the Th4 subpopulation, which in turn produces anti-inflammatory cytokines - tumor necrosis factor β and interleukin 10 (IL-10) [14].

Scientific achievements of the last two decades have allowed us to reach a qualitatively new level of understanding of the relationship between intestinal microflora and a wide range of chronic diseases, such as obesity, fatty liver disease, type 2 diabetes mellitus, oncology, osteoporosis and diseases of the cardiovascular system [17]. The attitude towards microorganisms - “commensals” (from the medieval Latin commensalis - meal companion) that inhabit the human body, most of which are located in the intestines, was rethought. “Commensals” are an ecosystem containing one hundred trillion microorganisms that perform various functions, including the synthesis of vitamin K and the biochemical transformations of some nutrients. The intestinal microflora also makes it possible to extract energy from indigestible food elements (fiber). There is an opinion that the intestinal microbiota contributes to the development of obesity, due to its

active participation in the accumulation of food energy and the biocontrol of energy balance. Microbial “commensals,” in addition to satisfying their own needs, help obtain calories from consumed foods and accumulate this energy in fat depots, i.e. form adipose tissue Experiments conducted in England in 2015 showed that obesity is not the root cause, but a consequence of dysbiosis of the digestive tract. The intestines of germ-free mice were seeded with the microflora of obese mice, and the animals gained weight faster than if they were seeded with bacteria from normal-weight mice.

It has been repeatedly found that obesity is accompanied by an increase in the number of pathogenic bacteria of the Firmicutes type and the Enterobacteriaceae (Esherichiacoli) family, with a simultaneous decrease in representatives of the normal intestinal microflora Bacteroidetes (Bacteroides, Prevotella), Bifidobacterium and Lactobacillus. It has also been found that eating foods saturated with fat leads to inflammatory changes in the intestinal mucosa and an indirect reduction in the number of lactobacilli, which leads to the development of obesity and type 2 diabetes. A high-fat diet creates conditions for the growth of bacterial strains in Peyer's patches that produce pro-inflammatory cytokines and inhibits the growth of Lactobacillus reuteri strains that synthesize anti-inflammatory substances [7,9,12]. The biomechanisms of the involvement of intestinal microflora in the development and progression of atherogenic dyslipidemia are realized in two ways. With the rapid transport of metabolites of intestinal bacteria into the blood, a chemical interaction of low-density lipoproteins occurs with the main component of the bacterial cell wall, lipopolysaccharide, which leads to a change in lipoprotein metabolism. Lipopolysaccharide damages endothelial cells, activates the synthesis and release of superoxide anion, oxidation of low-density lipoproteins, which promote the release of proinflammatory cytokines (IL-1.6, TNF-α) from macrophages. The latter are transformed into foam cells, accumulate in the intima of blood vessels and then form into an atherosclerotic plaque. The second mechanism is the production of trimethylamine-N-oxide during the metabolism of phosphatidylcholine supplied with food (meat, eggs, offal).

In the intestine, trimethylamine N-oxide is transformed into a variety of metabolites such as phosphocholine, choline and glycerophosphocholine, which increase the ability of macrophages to accumulate cholesterol and form foam cells, i.e. provoke changes associated with atherosclerosis [15,18]. In addition, it was discovered that lacto- and bifidobacteria are capable of secreting deconjugases, which, with bile salts, transform taurine- and glycine-containing bile acid amides into sparingly soluble precipitates. The latter bind to colon cholesterol and remove it with feces, reduce the excretion of cholesterol from liver cells and affect the number of bioreceptors in blood cells for low-density lipoproteins [10]. From the above it follows that the development and progression of dyslipidemia, as a trigger for the development of cardiovascular disorders, must be considered in direct connection with the intestinal microbiota.

Purpose of the study

Development of a treatment and preventive program for weight correction, metabolic and immunopathological disorders in overweight and obese children.

Materials and methods

At the adolescent clinic in Tashkent, we examined 60 adolescents aged 13-17 years, of which 40 were adolescents with exogenous constitutional obesity (ECO) degree I, 20 were overweight. Determination of standard deviations of body mass index (SD BMI) was used as a diagnostic criterion for overweight and obesity in children. Taking into account WHO

recommendations, obesity in adolescents was defined as a BMI equal to or more than +2.0 SD BMI, and overweight from +1.0 to +2.0 SD BMI. Normal body weight was diagnosed with BMI values within the range of +1.0-0- -1.0 BMI SD. All children selected for this study underwent studies of the levels of adiponectin, high-sensitivity C-reactive protein, lipid spectrum in the blood plasma, as well as a bacteriological study of feces with analysis of the qualitative and quantitative composition of the intestinal microflora. The severity of dysbiotic disorders in the intestines in the examined children was determined in accordance with industry standard 91500.11.0004-2003 “Protocol for the management of patients. Intestinal dysbiosis."

In our study, the level of highly sensitive C-reactive protein (CRP-hs) was determined in blood serum using reagent kits from Siemens (Germany) on an Immulite 2000 device, Germany. The reference level of CRP-hs is taken to be 0-3.0 mg/L.

The state of the lipid spectrum of blood serum was assessed using traditional results of the concentration of total cholesterol (mmol/l) and its forms: low-density lipoproteins - LDL, high-density lipoproteins - HDL, triglycerides (determined in blood serum on a biochemical analyzer "Minray BS-200" (China) using commercial kits "Human", Germany), and also determined the atherogenic coefficient - KA (KA = (cholesterol - HDL)/HDL, norm 2.3 conventional units).

The therapeutic and preventive weight correction program we developed included:

- recommendations for a healthy lifestyle (HLS) with printed information;

- a diet with reduced energy value, by reducing the content of fats and carbohydrates in the food consumed;

- increasing the volume of physical activity due to aerobic physical activity, physical exercises that develop and strengthen the muscular and skeletal systems according to the classification of physical activity (Rangul V, et al., 2008);

- monthly conversations on nutrition and increasing the intensity of physical activity; with anthropometry and keeping a food diary;

- a course of taking a multicomponent probiotic preparation in an age-specific dosage containing 2 types of lactic acid bacteria Lactobacillus acidophilus (LA-5) and Bifidobacterium animalis subsp. lactis (BB-12) for 14 days 4 times a year was used in 20 children with exogenous constitutional obesity of the first degree and 10 overweight children.

Using a targeted sampling method, children were divided into 4 groups: the main groups consisted of 20 obese children (1) and 10 overweight children (2), who received a course of probiotic medication as part of the developed treatment and preventive program. The control groups included 20 obese children (3) and 10 overweight children (4), who, for a number of reasons (parental abandonment, child abandonment, financial situation in the family), did not receive a probiotic drug as part of the weight correction program.

Criteria for inclusion in a clinical trial:

- children aged 13-17 years with an exogenous-constitutional form of obesity of the first degree, BMI = 30-34.9 kg/m², as well as overweight BMI = 25-29.9 kg/m².

Exclusion criteria from a clinical trial:

- patients with a secondary form of obesity: hypothalamic-pituitary (central) and associated with dysfunctions of other endocrine glands (peripheral) forms.

In all cases, the diagnosis of exogenous constitutional obesity was established by an endocrinologist at the adolescent clinic in Tashkent. Non-inclusion criteria were established based on clinical, anamnestic and laboratory data.

When making a diagnosis, the results of anamnestic, clinical, anthropometric, functional, and biochemical research methods were taken into account. General clinical examination of patients included a detailed analysis of the medical history. At the same time, attention was paid to the duration of the disease, previous and concomitant diseases. Data from a clinical examination, laboratory parameters, and results of instrumental studies were entered into a specially designed registration card. Statistical significance was determined using correlation analysis (Pearson's method); if $p<0.05$, the differences were considered statistically significant.

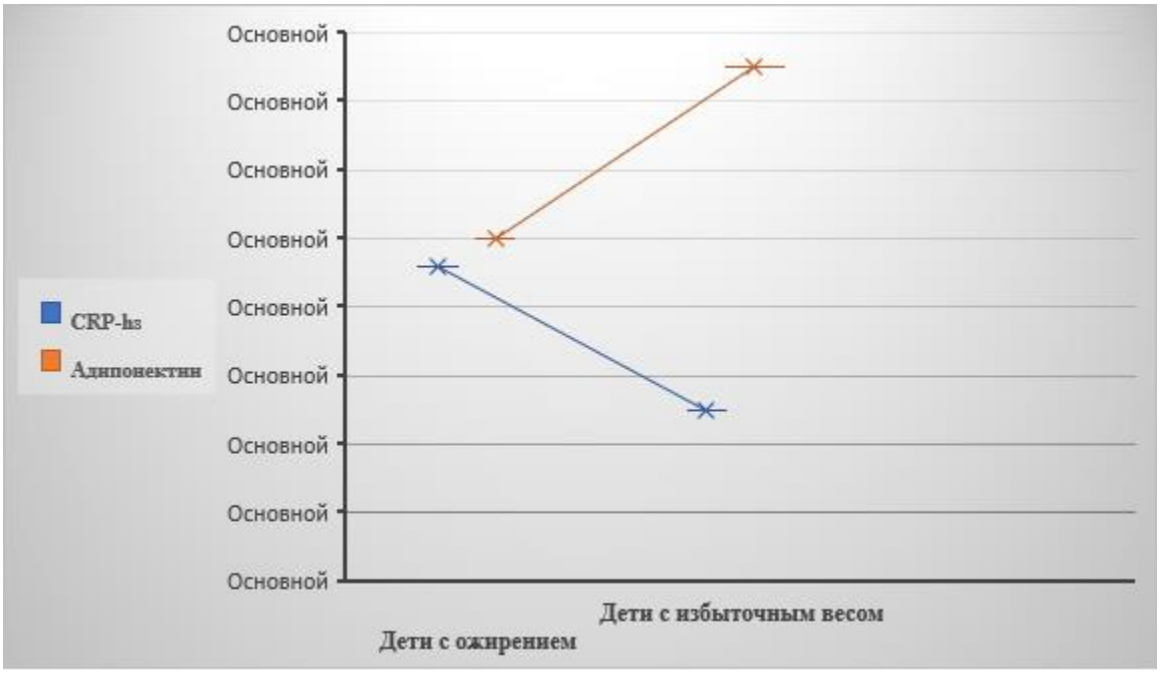
The results were assessed in 4 groups after 6 and 12 months, with repeated paraclinical studies.

Results and its discussion

When assessing the initial anthropometric indicators, the average BMI values in obese children (groups 1 and 3) were 31.74±0.73 kg/m2, in overweight children (groups 2 and 4) - 27.52±0.96 kg/m2.

Picture 1.

Initial indicators of CRP-hs and adiponectin levels in the examined groups of children.



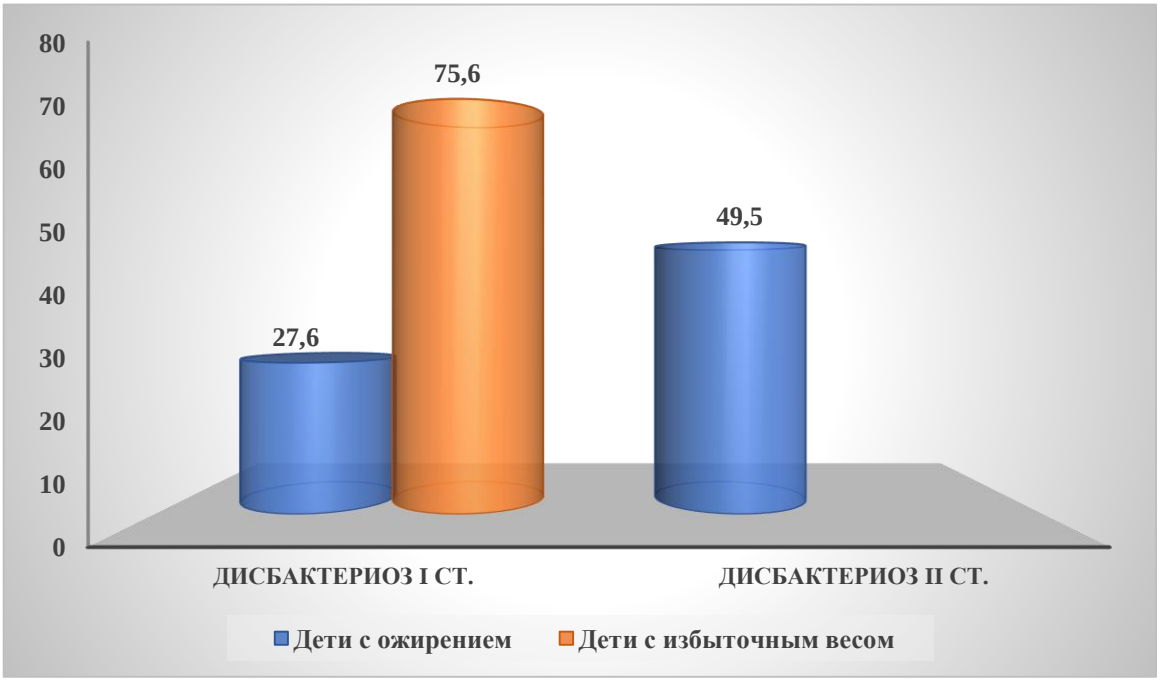
The level of CRP-hs in the groups of obese children was 4.6±0.06 mg/l, and in the groups of overweight children - 2.5±0.04 mg/l. The level of adiponectin in the blood plasma in obese children was 5.0±0.13 mcg/ml; in the group of overweight children - 7.5±0.08 μg/ml - Fig. 1.

The state of lipid metabolism in the examined children before treatment and preventive measures revealed dyslipidemia in the form of hypercholesterolemia (TC 6.09±1.07 mmol/l) and/or a tendency towards hypertriglyceridemia (TG 2.05±0.17 mmol/l) which was observed in 30 (75%) obese patients. Dyslipidemia was not detected in the group of overweight children. A bacteriological study of intestinal microbiocenosis showed that more than 80% of the examined children had deviations in its composition. However, the severity of dysbiosis in each group had its own characteristics: for example, in overweight children, disorders characteristic of the first degree of intestinal dysbiosis predominated, in the form of a deficiency of indigenous flora (bifidobacteria and normal E. coli). Deficiency of bifidobacteria and lactobacilli and a decrease in their population density were observed in 75.6% of overweight children and 27.6% of obese children (respectively, up to 7.1 ± 1.05 CFU/g (colony forming units per gram of feces) and 7.5 ±

1.02 CFU/g); deficiency of normal E. coli - in 21.8% of overweight children and in 21.6% of obese children. The second degree of intestinal dysbiosis was registered in 49.5% of obese children, in which, in addition to a decrease in the content of bifidobacteria to 9.0 ± 1.02 CFU/g, an increased content of opportunistic microorganisms was found to 4.8 ± 1.6 CFU /g and their associations.

Figure 2.

Distribution of the degree of dysbiosis of intestinal microflora in obese and overweight children



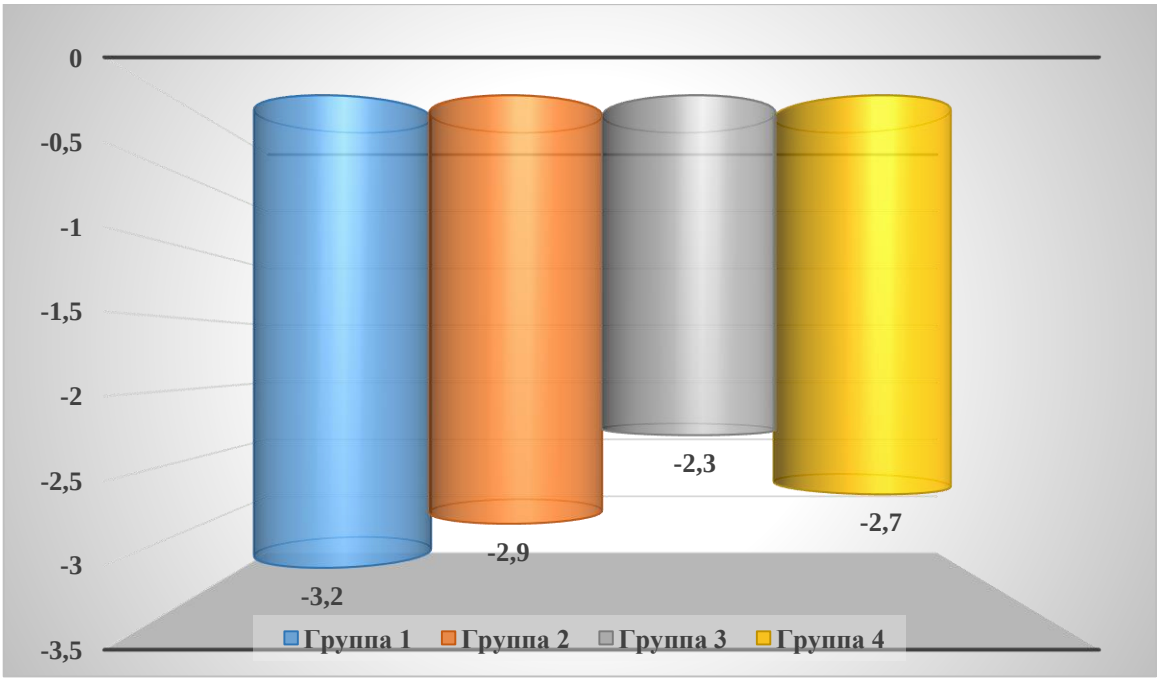
In the main and comparative groups, the following activities were developed and carried out for each child individually, taking into account BMI indicators, dietary preferences and physical fitness: a nutrition plan was drawn up - the number of servings per day with equivalent serving sizes; Based on the values of the target heart rate range (HR) for each child, the load intensity and energy consumption for the most common types of physical activity were calculated (light intensity - walking, 3–4 km/h, moderate intensity - walking, 4–6 km/h hour, brisk walking, >6 km/h, cycling, 16–19 km/h, intense – aerobics, cycling, 19–22 km/h; daily moderate to vigorous exercise, total at least 60 minutes). In the main groups, a course (4 times a year) of a multicomponent probiotic preparation containing Lactobacillus acidophilus (LA-5) and Bifidobacterium animalis subsp lactis (BB-12) was added to the complex of treatment and preventive measures described above, 1 capsule daily for 14 days 2 times a day 30 minutes before meals.

Monitoring of the implementation and implementation of the developed schemes of preventive measures was carried out by surveying and interviewing the children themselves and their parents, keeping a diary of nutrition and physical activity.

A control examination of 60 children after 6 months of treatment revealed a significant decrease in BMI: in group 1 this indicator decreased by 3.2±1.06 kg/m2, in group 2 by 2.9±0.94 kg/m2 m2, in the 3rd - by 2.3 ± 0.51 kg/m2, in the 4th - by 2.7 ± 0.51 kg/m2 - fig. 2

Figure 3.

Dynamics of BMI values in observed children receiving various treatment and preventive therapy regimens after 6 months



A significant decrease in the level of CRP-hs and an increase in the level of adiponectin after 6 months of treatment were observed only in groups of children who took a probiotic drug as part of a complex of therapeutic and preventive measures, which is consistent with the literature data [18] - Fig. 3.4.

Figure 4.

Dynamics of changes in the concentration of CRP-hs levels after 6 months of treatment.

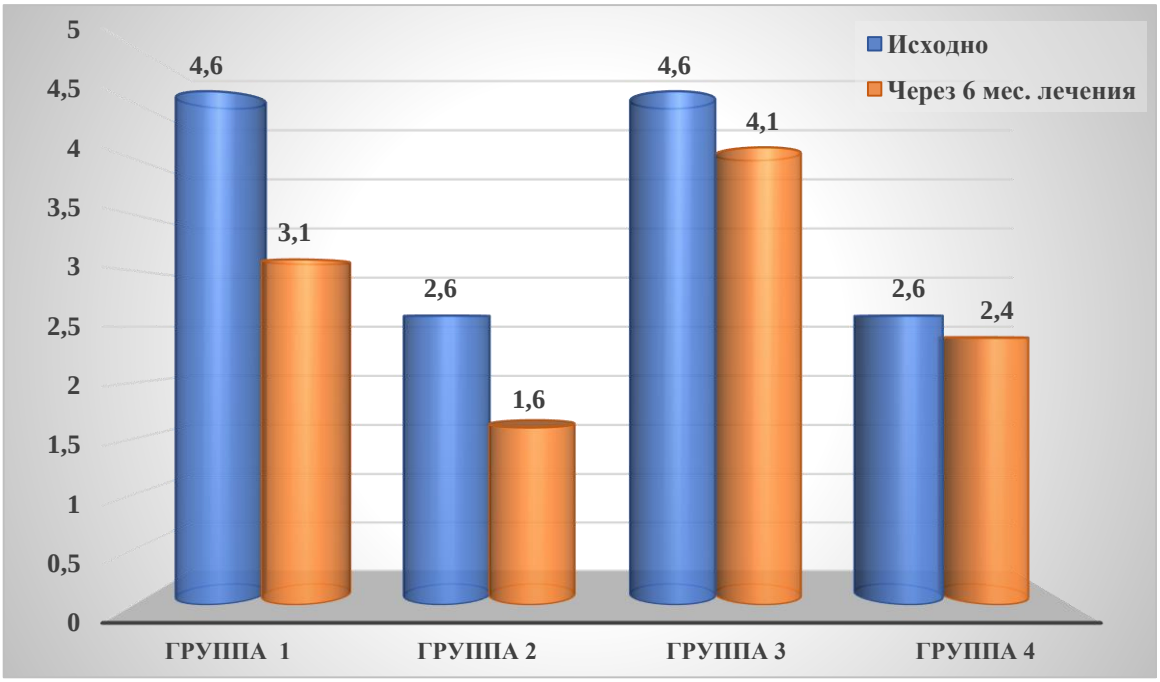
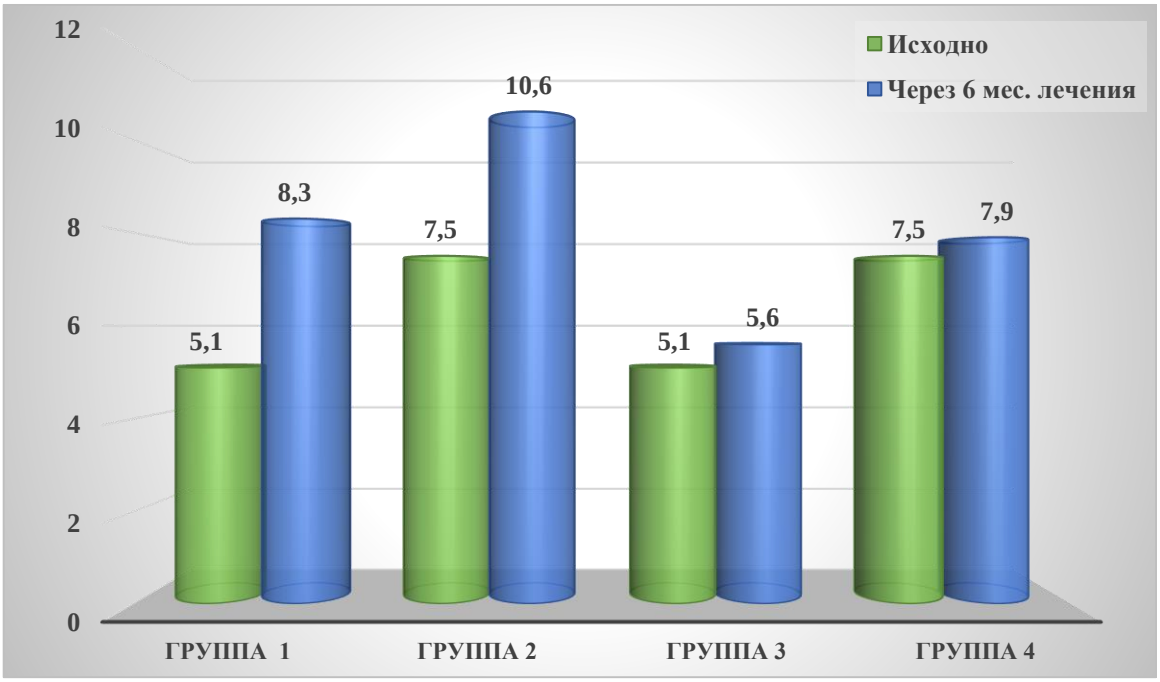


Figure 5.

Dynamics of changes in the concentration of adiponectin levels after 6 months of treatment.



As can be seen from Figures 4 and 5, as a result of treatment in children of groups 1 and 2 after 6 months of treatment, the level of serum CRP-hs significantly decreased to 3.1±0.06 and 1.6±0.08 mg/ml, respectively ($p < 0.05$), and the level of adiponectin increased to 8.3 ± 0.12 and 10.6 ± 0.03 μg/ml, respectively ($p < 0.05$). In groups 3 and 4, the levels of CRP-hs and adiponectin did not change significantly.

Also, the developed treatment and preventive program with the use of a probiotic drug after 6 months made it possible to eliminate atherogenic changes in the lipid profile in obese children. The level of total cholesterol significantly decreased from 6.09±1.07 to 4.85±0.9 mmol/l, and triglycerides from 2.05±0.17 to 1.84±0.57 mmol/l. In the group of obese children who did not receive a probiotic drug as part of the treatment, there was also a decrease in the levels of TC and TG, but without statistical significance - to 5.72±1.09 and 1.93±1.07, respectively. In addition, in children of groups 1 and 2 who received the probiotic drug, after 6 months of treatment, the colon microflora was restored. Thus, a decrease in the degree of dysbiosis was observed in 70% of children in group 1 and in 80% of children in group 2. There was also an increase in the number of bifidobacteria, lactobacilli and the total number of normal E. coli. In addition, there was a tendency towards a decrease in the number of opportunistic strains - table. 1.

Table 1.

Dynamics of microbiological parameters (lg CFU/g feces) in the feces of the examined groups of children before and after treatment

Indicators	1 group of patients(n=20)		2 group of patients (n=10)		3 group of patients (n=20)		4 group of patients (n=10)	
	before treatment	After treatment	before treatment	After treatment	before treatment	After treatment	before treatment	After treatment

	lgCFU/g feces (M±m)							
Bifidobacteria	7,1±1,05	10,5±1,8*	7,0±1,2	10,0±1,0*	7,1±1,05	6,81 ± 0,42*	7,0±1,2	6,8±0,7
Lactobacilli	7,5±1,02	10,4±0,6*	8,0±1,7	9,2±0,7	7,5±1,02	6,28± 0,98*	8,0±1,2	7,9±0,8
Typical	6,0±2,5	7,7±0,1	7,0±,09	7,7±2,9	6,0±2,2	6,8±2,9	7,0±0,8	7,4±2,3
intestinal	5,4±0,9	0,9±1,3*	4,8±1,6	0,6±1,2*	5,2±2,0	5,8±0,9	4,8±1,8	4,8±0,8

Note: * – p<0.05, compared with the level of indicators before treatment

At the same time, the developed treatment and preventive program without the use of a probiotic preparation did not reveal significant changes in the intestinal microflora, and in some cases there was a progression of previously existing dysbiotic changes. In the group of obese children, there was a tendency towards a decrease in the main representatives of the intestinal microflora (bifidobacteria and lactobacilli) from 7.1±1.05 lgCFU/g to 6.81±0.42 and from 7.5±1.02 to 6. 28 ± 0.98 lgCFU/g, respectively (p > 0.05), as well as an increase in the amount of opportunistic flora from 5.2 ± 2.0 lgCFU/g to 5.8 ± 0.9 lgCFU/g (p > 0.05).

Analysis of long-term results of examination of 60 children after 12 months showed that BMI stabilized and the downward trend remained, and in each of the four groups the number of children with abdominal obesity decreased. However, in the groups of children who used the probiotic drug in treatment, there was a more significant weight loss (Table 2, 3).

Table 2

Dynamics of anthropometric indicators in the study groups after 12 months

Indicators	1 group of patients(n=20)		2 group of patients (n=10)		3 group of patients (n=20)		4 group of patients (n=10)	
	before treatment	After treatment	before treatment	After treatment	before treatment	After treatment	before treatment	After treatment
BMI	31,74± 0,73	27,54± 0,73*	27,52± 0,96	23,76± 0,85*	31,74± 0,73	28,44± 0,52*	27,52± 0,83	24,55± 0,27*
OT/OB	0,92±1,92	0,89±± 0,12*	0,9 ± 0,09	0,86 ± 0,07*	0,92±1,92	0,90±1,85*	0,90 ± 0,09	0,88 ±0,11*

Note: * – p<0.05, compared with the level of indicators before treatment

Assessment of the level of high-sensitivity C-reactive protein after 12 months of using the developed treatment and preventive program also demonstrated a more significant decrease in CRP-hs activity and an increase in the level of adiponectin in groups of children taking the probiotic drug (from 4.06 ± 0.06 to 2.4 ± 0.03 and from 5.0±0.13 to 12.23±0.08, respectively), compared with control groups (Table 3).

The effect of the probiotic preparation on the correction of dyslipidemia for 12 months was also revealed: a significant effect (p <0.05) of the probiotic on reducing the level of total cholesterol and triglycerides in obese children was noted compared with control groups.

Table 3

Dynamics of biochemical parameters and composition of intestinal microflora in the study groups after 12 months

Indicators	1 group of patients(n=20)		2 group of patients (n=10)		3 group of patients (n=20)		4 group of patients (n=10)	
	before treatment	After treatment	before treatment	After treatment	до лечения	before treatment	After treatment	before treatment
CRP-hs, mg/ml	4,6±0,06	2,4±0,03	2,5±0,04	1,2±0,05	4,6±0,06	3,4±0,08	2,5±0,04	2,1±0,03
Adiponectin, µg/ml	5,0±0,13	12,23±0,08	7,5±0,08	13,60±0,13	5,0±0,13	7,3	7,5±0,08	9,5
Cholesterol, mmol/l	6,09±1,07	4,85±0,93*	4,67±0,95	4,01±0,68	6,09±1,07	5,94±1,1	4,67±0,95	4,09±0,84
Triglycerides, mmol/l	2,05±0,17	1,12±0,29*	1,84±0,34	1,06±0,36*	2,05±0,17	1,940,95	1,84±0,34	1,72±1,07
Bifidobacteria (lg CFU/g feces)	7,1±1,05	10,5±1,8*	7,0±1,2	10,0±1,0*	8,0±0,7	9,0±0,6	8,3±0,5	8,4±0,7
Lactobacilli	7,5±1,02	10,4±0,6*	8,0±1,7	9,2±0,7	7,3±1,2	7,4±1,3	8,0±1,2	8,8±0,8
Typical	6,0±2,5	7,7±0,1	7,0±,09	7,7±2,9	6,0±2,2	6,8±2,9	7,0±0,8	7,4±2,3
intestinal	4,4±1,0	5,6±0,7	4,8±1,5	4,5±0,9	4,5±1,3	4,9±0,8	4,9±0,6	5,0±0,1
sticks	3,9±1,7	1,8±1,5*	4,4±1,2	3,5±1,3	4,1±1,3	4,0±,08	3,6±1,2	3,7±1,5
Intestinal	5,0±1,0	6,0±0,6	4,5±2,9	6,0±0,8	5,1±1,2	6,0±0,5	4,4±2,8	6,0±0,7
sticks with	5,4±0,9	0,9±1,3*	4,8±1,6	0,6±1,2*	5,2±2,0	5,3±0,9	4,4±1,8	4,5±0,8

Note: * – p<0.05, compared with the level of indicators before treatment

Data analysis presented in table. 2, showed a significant (p <0.05) improvement in fecal microflora indicators - normalization of the quantitative and qualitative composition of the intestinal microbiota, as well as the degree of dysbiotic intestinal disorders and the disappearance of signs of bacterial contamination in children of the 1st and 3rd groups who took it as part of the treatment complex probiotic drug.

Thus, the results of the study showed that the use of a probiotic drug in the complex treatment of obesity is currently very advisable, as it contributes to the implementation of effective therapeutic and preventive measures. Stabilization of body weight after 12 months from the start of treatment allows us to recommend the use of this program both in group and individual treatment.

Conclusion

Globally, obesity has become an epidemic, with at least 2.8 million people dying each year as a result of being overweight or obese, according to WHO. Obesity, previously associated with high-income countries, is now also common in low- and middle-income countries. Obesity-associated diseases, primarily cardiovascular diseases, are the cause of death in children and adults. Late diagnosis and inadequate assessment of prognosis in children and adolescents with obesity underlie high morbidity and mortality in older age groups, and the success of preventive programs directly depends on their early implementation. The positive experience of countries with low mortality rates from non-infectious diseases shows that the success of combating this pathology is greatly influenced by its early detection, treatment and prevention in childhood. This dictates the need to develop effective preventive programs, including timely screening in risk groups and preventing the formation of resistant forms of the disease. The health of children and the future health of the nation rests on careful nutritional choices, especially from childhood, based on the best available evidence. Nutrition and physical activity recommendations need to be promoted and disseminated to health care providers, families, child care providers and schools to promote optimal health and prevent the development of chronic diseases such as obesity.

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