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The role of controlled dosage physical exercise in the treatment of overweight children with asthma

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Abstract. The study includes 115 children aged 6 to 11 years with exogenous asthma of varying severity, with different levels of control. Children with asthma were divided into two groups according to the level of physical development: I group (60 children) with harmonic physical development and II group (55 children) overweight. It was found that overweight children who have overweight greater than $(4,2 \pm 0,3)$ there are patients with severe bronchial asthma and higher than $(2,5 \pm 0,2)$ there are children with the uncontrolled progress of the disease in comparison with a group of patients with a harmonious physical development. There were recommendations on physical exercise for overweight children of 6-11 years with moderate asthma depending on the degree of control of asthma during the major periods of rehabilitation. It is shown that the efficacy of integrated application of dosed physical exercise and lipid-lowering diet with exception of carbohydrate is 1.7 times better in comparison with using only a standard diet in addition to the basic treatment of asthma.

Key words: asthma, children, overweight, physical exercise.

Introduction. Asthma has one of the first places on the prevalence, severity, difficulty in diagnosis, treatment and rehabilitation [4, 7]. Studying of efficiency of standard schemes of anti-inflammatory therapy showed absence of stable positive dynamics, both clinical and functional, in almost 30% of patients with A. One of the reasons for such resistance to anti-inflammatory therapy may

be the presence of accompanying diseases, which aggravate A, reduce the efficacy of treatment and worsen the prognosis. Among all accompanying diseases in children with A the prominent position is occupied by overweight and obesity (16-38%) [1, 6, 8]. In prospective epidemiological studies of recent years, it was demonstrated that overweight associates with BA in both children and adults, and increased body weight is a risk factor for A development [5, 9, 10].

There is a erroneous opinion, that patients with A should limit physical activity (PA), thereby preventing deterioration of the disease. As a result, the decreasing of the level of PA negatively affects harmonious physical development of children. Low PA leads to a reduction of energy costs of the child and, consequently, to overweight and overweight in turn aggravates A, leads to decreasing of PA, thus closing the "vicious circle". [3] Therefore, there is need to develop recommendations on physical activity for children with A, particularly of overweight to prevent children obesity and deterioration of asthma control in the future.

Goal: To assess the level of physical activity of overweight children with asthma on a background of overweight and develop physical activity complexes depending on the degree of asthma control for these patients.

Materials and methods. In the study included 115 children aged 6 to 11 years, patients with BA of exogenous character and different degree of severity and with different levels of control (code ICD-10 - J 45-J 46). Children with asthma were divided into two groups according to the level of physical development: I group (60 children) with HarPD and II group (55 children) with overweight patients. To comparison group were included 26 children with overweight. The control group was formed of 24 healthy children of the same age with HarPD. Among the examined children were 54 (47%) girls and 61 (53%) boys.

As of the design of study, selection of patients for the use of physical exercise was performed in accordance with the criteria of "inclusion/exclusion". Inclusion criteria: age 6 to 11 years, the presence of verified, exogenous, persistent A with medium severity, partiality controlled and overweight. Exclusion criteria: acute infection, chronic decompensates accompanying pathology metabolic syndrome, obesity, age under 6 and older than 11 years with BA or other types of BA or diseases that imitate it.

Providing medical care for children with BA was carried out in accordance with the Order of the Ministry of Health of Ukraine (№ 868 dated 08.10.2013) and the program "Global strategy for the prevention and treatment of bronchial asthma» (GINA) 2006-2013. According to these documents it the determined the severity of BA and volume of treatment was determined and which will be referred as "base" in future.

Physical indexes were evaluated which were obtained by anthropometry, which were compared with the standards of physical development, currently in

force in Ukraine. In addition to conventional parameters (height, weight, BMI) circumference neck (CN) was measured using measuring tape for a correct assessment of physical development [2]. To determine the proportion of fat and lean mass bioelectrical impedance method was used (K. Willett et al., 2006). The level of physical activity was assessed by subjective questionnaires and objectively using of a pedometer (Omron HJ-320-E). We determined the parameters of lipid panel – level of total cholesterol, triglycerides, high-density lipoproteins, and low-density lipoproteins.

For an objective assessment of the level of BA control in the last 4 weeks a questionnaire ACT (Asthma Control Test, Quality Metric Incorporated, 2002) for children was used. For an objective assessment of respiratory function (RG) it was done spirometry (Spirobank MIR, SN A23) and daily peak flow (AirZone OI20).

Methods of statistical research. Basic sample statistics were calculated: mean, standard deviation, standard error, median, lower and upper quartile. Compliance of empirical distributions to normal law was examined using criteria of Kolmogorov – Smirnov, Shapiro - Wilk and Lilliefors. To reduce the dimensionality of data and building of accumulating variable was used factor analysis. We followed conventional levels of statistical significance ($p < 0,05$). Additionally relative risk (RR), relative risk reduction (RRR), the number of patients to whom complex rehabilitation must be applied for getting one case of positive result (NNT) were calculated.

Results and their discussion. Among examined children with A on with HarPD the majority boys - 71.7% (43 of 60 children) and with A in overweight patients - girls - 63.6% (35 of 55 children). Characteristics of the physical development of examined children at the stage of formation of cohort groups are reflected in the Table. 1.

Table 1

Characteristic of groups of examined children according to the indexes of physical development ($M \pm \sigma$)

Index	HarPD		Overweight	
	Control group, n=24	I group, n=60	Comparative group, n=26	II group, n=55
IMT, kg/m ²	16,80±1,00	16,50±0,80	19,70±1,30	19,90±1,80*
Fat content, %	21,80±0,80	20,69±1,20	29,40±2,42	30,56±2,60*
CN, cm	26,97±0,18	26,91±0,14	27,48±0,24	27,76±0,53*

Note. * - $P < 0.05$ compared with the control group.

The average age of the children of I group and at the time of asthma onset was $(7,6 \pm 0,8)$ years, and in II group - $(4,3 \pm 1,1)$ years. Thus, in overweight children A development occurred about $(2,0 \pm 0,6)$ years earlier than in children with of HarPD. The average duration of disease in group I reached $(2,8 \pm 1,1)$ year in group II - $(4,1 \pm 0,8)$ years ($p < 0,05$).

Data analysis showed that the presence of overweight affected the degree of BA severity, frequency and duration of exacerbations. In the group of overweight children the number of cases of severe A was $(4,2 \pm 0,3)$ times greater to a group of children with HarPD: $(11,8 \pm 5,0)\%$ versus $(2,8 \pm 1,1)\%$ ($p < 0,05$). In group I BA occurred almost three times more than in group II - $(43,3 \pm 2,1)\%$ to $(14,5 \pm 3,1)\%$ ($p < 0,05$).

Analysis of the test results of asthma control (ACT) showed that $(36,0 \pm 5,2)\%$ of both examined groups do not have enough controlled A. Among them $(70,7 \pm 7,4)\%$ of children in group I were overweight, which is is 2.5 times more than in II group.

Exacerbation of Astma often $(2,3 \pm 0,8)$ times a year observed in children with overweight than in the group of children with HarPD ($p < 0,05$). The duration of exacerbations was also longer in overweight children - $(10,1 \pm 1,4)$ days vs $(5,8 \pm 2,4)$ days ($p < 0,05$).

According to the questionnaires, the level of PA in children of II group largely was the lowest (78.3%), high levels of PA never determined. In I group the level of PA was low (55.6%), and high - only in 7 children 6-8 years (6.1%) (Fig. 4.1).

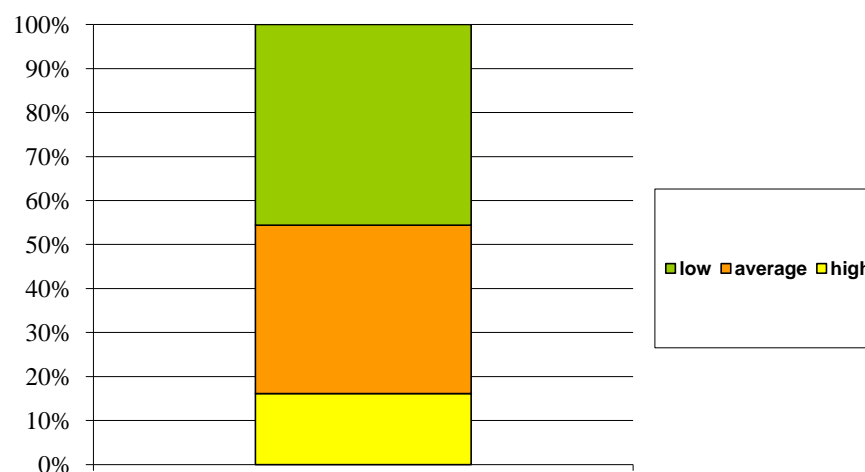


Fig. 1. Level of physical activity of children with bronchial asthma on a background of overweight (based on questionnaires)

According to the pedometer the PA in overweight children with A does not exceed 7 000 steps per day in all age groups, those are significantly lower indexes than those recommended by the standards of WHO (Fig. 4.2).

Based on these data, taking into account known pathogenetic mechanisms and features of A and overweight in examined children a complex of rehabilitation was developed with use of activities of non-specific correction. Non-specific correction included: recommendations concerning organization of rational regime of the day according to the age of child, hypolipidemic diet with the exception of foods with high level of fat and carbohydrate (except recommendations with lipid-lowering diet taking into account individual allergic test) and regular dosed physical exercises.

In opinion of the most scientists, the adapted controlled physical exercise is an essential part of everyday life in patients with BA that can solve their social integration. Therefore, in the course of the work recommendations were developed concerning physical exercise for overweight children (Table 4.1.).

It should be noted that before the appointment of an increase of physical bronchial hyperactivity exercise was determined by the provocative test introduction with physical exercise. According to the results of the test the exclusion group consisted of children whose FEV₁, decreased more than 10%.

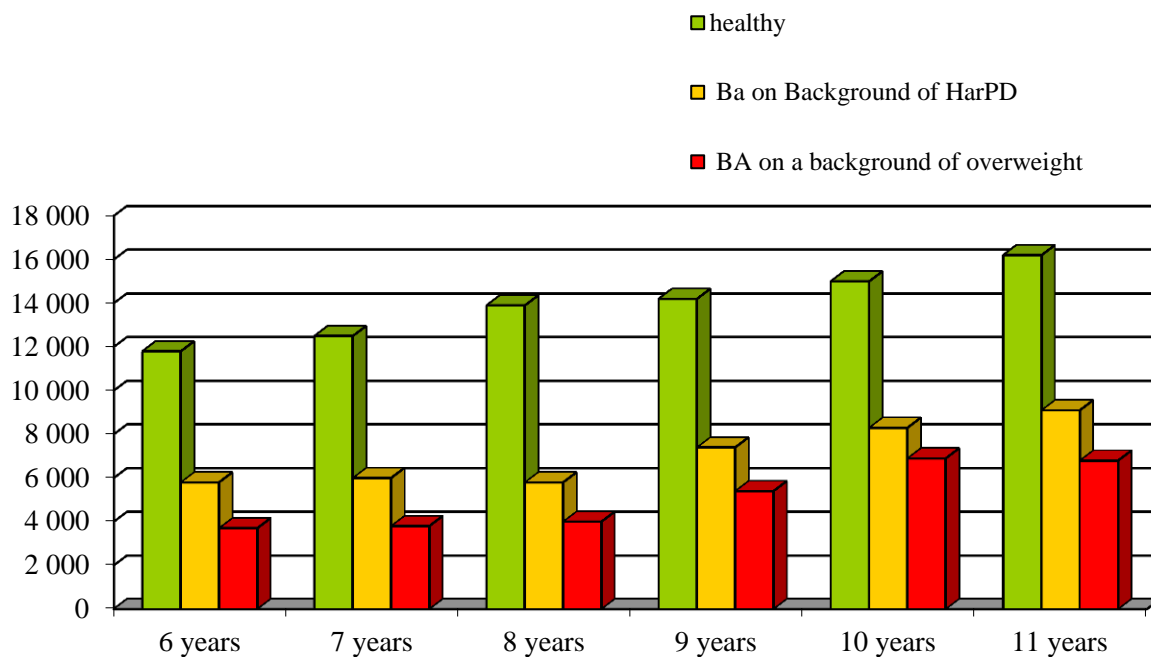


Fig. 2. The level of physical activity of overweight children with bronchial asthma (according to pedometer)

Taking into account the fact that post-loading bronchospasm is characteristic of the majority of children with A, especially with not enough control of the disease it was recommended they keep a diary. The diary kept track of exercise, well-being during and after exercises, indications of peak flow, frequency of using of inhaler during exercise. This measurement allowed for developing an individual training program and achieving good results.

Evaluating the efficacy of regenerative therapy "basic + diet + exercise" in overweight children with A it is necessary to mention the fact that most children ($84,4 \pm 3,6\%$), who used a pedometer for control gladly reached daily rates of required distance, only a small number of children refused to increase physical activity. In addition, it was easy to monitor individual increase of physical activity using a pedometer in the research group. It should be noted that during a month the patients could objectively increase physical activity to the recommended standards of steps, in most of the children - ($68,7 \pm 4,3\%$).

Table 2

Recommendations for physical exercise for overweight children of 6-11 years with depending on the degree of control of asthma in major rehabilitation period

	Partially controlled	Controlled
Period of rehabilitation	Average (in postaccessual period of BA)	Late (sustaining)
Stage	Inpatient Outpatient	Outpatient
Type of PA	Functional	Training
Form	Breathing exercise. Physiotherapy: - Breathing exercise with extended exhalation, - Exercise to relax the muscles of the upper limbs and waist to strengthen the abdominal muscles; - Diaphragmatic breathing, etc. Walking with moderate steps (5 - 6 thousand steps per day to 8-10 thousand).	Hygienic morning gymnastics. Physiotherapy. Extended walk (from 8-10 thousand steps per day to 12-13 thousand). Additional dosage exercises: swimming, dam, skiing, skating, volleyball, basketball, dancing.
Duration, frequency	Breathing exercise: 5-10 minutes daily. Physiotherapy: 20-30 minutes daily; The dosage walking from 30 to 60 minutes daily	Hygienic morning gymnastics: 20 minutes a day. Physiotherapy: 20-30 minutes daily. Walking dosage: from 60 to 120 minutes daily. Advanced training in sports sections 2-3 times a week.
Tempo	Moderate Average	Average, Extended
Starting position for exercises	Sitting, standing leaning on a chair, standing	Standing

Our study shows that recommended physical activity in overweight children with A sustains lowering of BMI (Fig. 5.1) and is an effective method of weight loss (RR = 0,41; RRR = 0,47; NNT = 3,6; 95% CI 3,2-4,3).

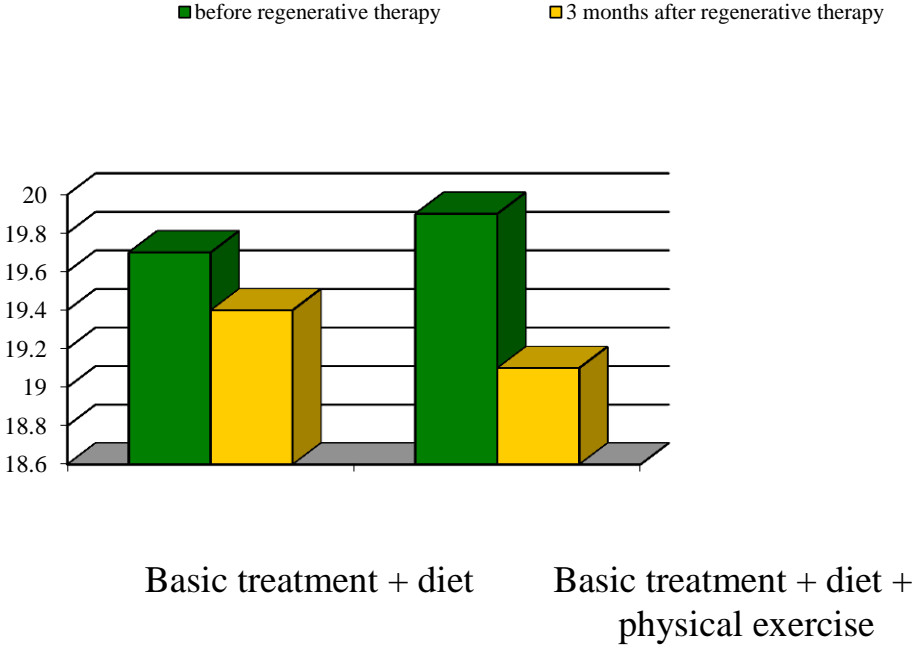


Fig. 3. Dynamics of body mass index in children with bronchial asthma on the background of overweight by increasing physical activity

According to Figures on Figure 5.1 children, who in addition to standard treatment and the proposed diets received dosed controlled physical exercise could reduce body weight and BMI respectively within 3 months of stable physical activity ($p < 0,05$). In the group of children, who in addition to the basic treatment adhered only to lipid-lowering diet, the significant reduction in BMI did not happen, mainly because of lack of motivation and because of occasional physical activity.

Moreover, weight loss was accompanied by improvement of A control more significantly in the group of children with physical exercise ($56,6 \pm 1,5\%$) than in the group without exercise ($47,3 \pm 3,2\%$) compared with the share of asthma control to restorative treatment ($42,4 \pm 2,1\%$) (Fig. 5.2). The efficacy of the method is high (RR = 0,36; RRR = 0,44; NNT = 4,1; 95% CI 3,8-4,4).

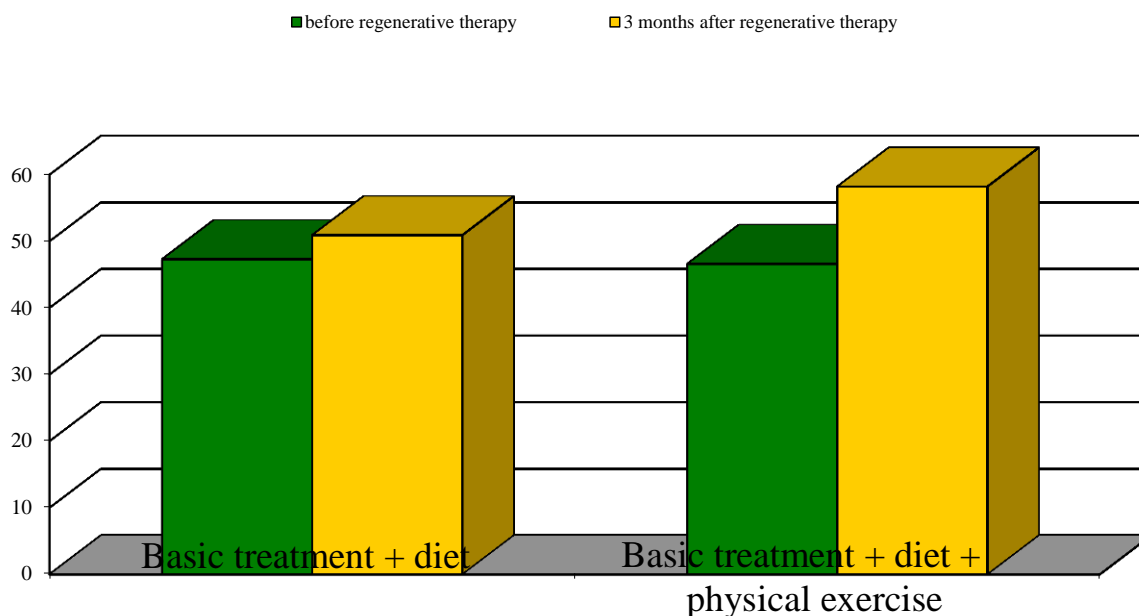


Fig. 4. The proportion of overweight children with asthma control before and after the restorative treatment

Thus, the efficacy of schemes for regenerative therapy by A using controlled diet and dosed physical exercise in middle and late period of rehabilitation of A is confirmed by direct results of clinical observation of overweight children with A.

Conclusions.

1. In the group of overweight children ($4,2 \pm 0,3$) the proportion of patients with severe asthma is higher and ($2,5 \pm 0,2$) children with the uncontrolled disease in comparison with a group of patients with a harmonious physical development also is higher. Among overweight children with we can see 2,5 times more poorly controlled bronchial asthma.

2. The results of the efficacy of the proposed complex of exercise in comparison with using of only base treatment and diet got 3 months are: lowering of BMI (RR = 0,41; RRR = 0,47; NNT = 3,6; 95% CI 3, 2-4,3), achieving of asthma control (RR = 0,36; RRR = 0,44; NNT = 4,1; 95% CI 3,8-4,4).

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