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# Bronchial asthma and obesity: the issue of comorbidity

**Key words:** *bronchial asthma, obesity, comorbidity.*

Treatment of comorbid conditions is one of important and difficult tasks in medical practice. Population aging, bad habits, hypodynamia, an irrational diet, worsening of an ecological situation create conditions with constant pressure of adaptable and biochemical mechanisms for the organism of a modern person and as result the formation of several diseases simultaneously. Prevalence of comorbid pathologies among patients makes, on the average, 78,6 %, and, the given condition in women is 82 % of cases, and in men is 72 % of cases [2, 5]. The number of comorbid diseases in one patient essentially raises with aging. So, it is noticed by researchers that multimorbidity increases from 10 % at the age not more than 19, to 80 % – in people of 80 and older [56]. Presence of several diseases simultaneously influences each of them, making their course more severe, promotes earlier formation of complications and creates difficulties for therapy. The risk of death in the presence of two accompanying diseases makes 5–10 %, and at increase of their quantity to five – increases to 70–80 % [62]. The special attention is paid to the combination of diseases which have common or close etiological and pathogenetic factors.

One of the most spread kinds of comorbidity is the combination a bronchial asthma (BA) and obesity. Prevalence of both diseases has considerably increased in recent years [33]. According to the data of the WHO and GINA (2012) about 300 million people all over the world suffer from asthma nowadays. Prevalence of bronchial asthma averages from 7 to 15 % of the population in various countries, and this number progressively grows. Death rate from this disease all over the world has also increased to 250000 cases annually. More than 30 % of the population all over the world suffer from obesity, and experts of the WHO predict its further growth. So, by 2015 it is expected that 2,3 billion population of the whole world will have superfluous weight, and 700 million people will have obesity.

Thus, for today it is possible to note parallel increase in prevalence both obesity and asthma all over the world.

According to M. Vortmann (2008) [71], 28–44 % of patients with bronchial asthma have obesity of various degrees. Modern researches of bronchial asthma cases in patients with various level of increasing of the body mass index (BMI) have found out direct dependence of increasing in frequency of development BA in patients in process of increasing BMI [40]. At the same time it has been revealed, that in patients with bronchial asthma the occurrence of superfluous body weight and obesity twice above, than average occurrence among population [67].

The patients with comorbidity of asthma and obesity still have low enough indicator of achievement of asthma-control [16]. In GINA 2013, obesity along with genetic factors and sex of the patient is designated as one of primary risk factors of progressing of asthma and worsening of control of the disease. Combination of asthma and obesity can promote mutual burdening and formation of a «vicious» circle which other pathogenetic mechanisms join, worsening the course of asthma [34]. On one hand, obesity even in the absence of

asthma leads to physiological changes of pulmonary function [41]. It is noticed that people with obesity spend most of their time within a premise, thereby increasing chances of bronchial asthma progressing because of the raised content of room allergens, tobacco. And on the other hand, presence of bronchial asthma reduces patient's physical activity that at increased appetite on the background of taking glucocorticoids leads to increasing of patient's weight. Besides, frequency of hospitalisation of the patients with obesity, in connection with aggravation course of asthma throughout a year in 2–4 times is more in comparison with the patients with normal weight and the same severe level of asthma, also depends on degree of expressiveness of obesity. Requirement in system corticosteroid therapies in patients with combination of bronchial asthma and obesity almost twice higher[50]. One of essential features of asthma course against a background of obesity is less expressed efficiency of provided basic therapy with usage of inhalation glucocorticoid that is often accompanied by increasing of a daily dose of the given preparations and reduces quality of asthma control [37].

Early studies of interaction asthma and obesity have been shown in works on mice and have begun the studying of pathogenesis and interrelations of the given diseases [64]. So, it has been noticed by researchers that reactance of respiratory tract increased in the mice, suffering from obesity, even those without problems of respiratory organs. It has attracted researchers' special attention to features of course of asthma against a background of body overweight and obesity [34, 40, 42, 55], however, pathogenetic features of combined courses of these diseases up are not found out to the end.

Excess weight influences on function of respiratory organs is made simultaneously through some mechanisms, changes of mechanics of breath, immunological and hormonal infringements are among them [66].

Mechanical influence of overweight even in healthy people is shown by influence on physiology of breath at the expense of excessive deposition of adipose tissue on a diaphragm, on an internal surface of a thorax and around ribs, and also – decrease extensibility of thoraxwalls. It leads to difficulty in increasing of thorax volume at breathing. Excessive deposition of adipose tissue in mediastinum limits mobility of lungs in an abdominal cavity it promotes development of dysfunction of a diaphragm that limits its excursion [34, 61]. Changes of mechanical properties of respiratory system were shown in infringement of respiratory function. According to the data of spirometry at high BMI, decreasing in volume of the forced expiratory volume ($FEV_1$), the forced vital capacity (FVC), and vital capacity (VC) is noted. The reason of lower respiratory volumes was decreasing of function of respiratory muscles, presence of smaller diameter of distal departments of respiratory tracr in comparison with the people with normal body weight [42].

Formation of decreasing in elasticity of a pulmonary tissues and increasing of resistance of respiratory tract that is shown in infringement of respiratory function on the mixed type, is simultaneously noticed. So, because of decreasing of pulmonary volumes, a restrictive component of infringement in respiratory function is formed, and obstructive component is formed at the expense of narrowing of distal departments of respiratory tract [21, 61]. In people with bronchial asthma and obesity more significant decreasing of $FEV_1$ and other respiratory volumes is noted and decreasing in body weight in patients with asthma and obesity leads to improvement of indices of respiratory function and reducing of severity of asthma symptoms [41, 45, 66]. So, at weight reducing on each 10 % of the initial there was increasing of FVC by 92 ml, and increasing of $FEV_1$ by 73 ml [45].

At body overweight asthma proceeds more severely, it is supervised more difficult and by results of researches it is accompanied in 4, 6 times by higher risk of hospitalisation in comparison with patients having bronchial asthma without obesity. It is considered that the clinical and biological answer to therapy with glucocorticoids changes owing to the system inflammation supported by active substances, produced by a adipose tissue. One of the reasons of the lowered answer to therapy with glucocorticoids in such patients is prevalence of neutrophils, instead of eosinophils inflammation in bronchus [11, 13]. The combination of these factors explains the possible reasons of the fact that asthma in such patients is supervised more difficult.

In patients with obesity and body overweight gastroesophageal reflux disease is registered more often, the frequency increases with increasing of BMI. On one hand, gastroesophageal reflux disease raises the frequency of occurrence of respiratory obstruction in patients with asthma by activation with gastric contents of a esophagus -gastric reflux and stimulation of a wandering nerve, and also – by direct microaspiration of the stomach content, leading to exudative inflammation of a mucous membrane of bronchi and hyperreactance of bronchi. On the other hand, the presence of asthma leads to development and maintenance of gastroesophageal reflux because of increasing of pressure gradient between a thorax and a belly cavity.

A lot of pathophysiological interrelations are found between asthma and a syndrome of obstructive sleep apnea. So, the increased tone of a wandering nerve promotes strengthening bronchoconstriction, and the inflammation of upper respiratory tract supports the inflammation of distal bronchial tubes, and, as consequence, there are frustrations of central regulation of breathing and a tone of bronchial tubes [34].

According to modern views asthma is a chronic inflammatory process in respiratory tract with involving of immune and not immune mechanisms [20]. In a basis of pathogenesis of BA disbalance T-lymphocyte helpers (Th) with activation of Th of 2nd type lie, which consequence is development of chronic local inflammation. The disbalance of subpopulation structures of T-lymphocyte at bronchial asthma is accompanied by stimulation of B-lymphocyte, dysimmunoglobulinemia [3]. The immune inflammatory answer is shown by development of cellular and humoral reactions, however, their division on cellular and humoral relative enough as the immune answer is a single process including various cellular elements depending on a kind of an antigene, with obligatory participation of specific antibodies and others humoral factors (mediators, cytokines, the antibodies, circulating immune complexes, etc.) which can change at various pathological conditions [17, 27, 68].

The specified infringements of immune balance allow to consider them as the secondary immunodeficiency state [4].

As acknowledgement of it there is the decrease in general population of T-lymphocytes revealed in blood of patients with asthma and disbalance of a cellular link of immunity. Expressiveness of immune disbalance directly correlates with disease severity level, patient's age and the time of disease beginning, features of therapy, presence of comorbidity pathologies.

Presence of comorbidity visceral obesity, on one hand, strengthens immune infringements in patients with asthma [26] that leads to inefficiency of standard basic treatment and creates conditions for application of additional medical preporations, for example, kvercitin [25]. On the other hand, strengthening of the immune reactions mediated Th2 under the influence of constant superfluous synthesis IL-6 [31] in patients with obesity comes to light.

Apparently, the data about condition of the basic indices of immune system in patients with asthma, associated with obesity, create preconditions for profound studying of immune infringements at such comorbidity for more effective treatment.

The products of activated immunocompetent cells are cytokines. At asthma the most studied are pro- and anti-inflammatory cytokines – interleukin (IL)-1 β, IL-4, IL-6, IL-8, IL-10, TNF-α. They take part in regulation of degree and duration of inflammatory and immune answers, markers of efficiency of provided therapy of bronchial asthma [32].

Adipose tissue is considered now not as a passive place of energy, but as important endocrine organ with a number of effects, including one on immune system and cytokines profile [44]. In particular, adipose tissue is a source of secretion of some proinflammatory mediators – adipokins, cytokines, such as TNF-α, IL-4, IL-5, IL-6, IL-13, vascular endothelial growth factor. At the same time at obesity synthesis of anti-inflammatory cytokine adiponectin and IL-10 [26] is oppressed. In patients with obesity a great attention is paid to IL-6 which is one of key mediators of inflammation at obesity. It is known that about 30 % of all circulating in blood IL-6 is for synthesised in adipose tissue. At obesitysity the level of IL-6 increases under the influence of TNF-α and IL-1.

Increasing of concentration of proinflammatory IL-1 β, IL-6 and decreasing of anti-inflammatory IL-4 at comorbidity obesity has been noted in patients with deforming osteoarthritis [19] and not alcoholic steatohepatitis, combined with chronic bronchitis [15]. At the same time IL-4 is key proinflammatory cytokine at asthma. Obesity in patients with bronchial asthma was accompanied by decreasing of IL-10 content [26].

In view of the aforesaid, the content and features of interaction of the cytokines in blood at combination of bronchial asthma and obesity represent research interest as production disbalance of cytokines towards the proinflammatory can be the factor of maintenance of system inflammation.

In pathogenesis of obesity infringements of exchange of leptin as one of hormones, secreting by adipose tissue has a great value. Leptin is protein coded in adipose cells by a gene, causing obesity. Leptin participates in processes of regulation of weight of a body. Level of leptin increases with weight increasing both men, and women. Researches on correlation studying between concentration of leptin in serum and obesity degree have shown that concentration of leptin is increased in the patients, suffering from obesity. Body weight reduction by 10 % leads to 53 % decreasing in concentrationof leptin. On the contrary, 10 % set of weight increases the level of serum leptin by 300 %. Signal giving about saturation concerns effects of leptin, appetite is thus oppressed, the power expense and participation in regulation of breath [14] raises. Also leptin influences on the T-cellular immunity, the change of which is shown in synthesis of proinflammatory endothelium at the expense of stimulation of T-helpers [49]. Leptin stimulates hypersympathicotonus, promotes level increase of adenocorticotropic hormone, cortisol and aldosterone [51]. Recent researches in vitro have shown that leptin also is capable to stimulate activity of the growth factor of vascular endothelium with cells of the respiratory tract [69], increasing of which can lead to stimulation of subepithelial neovascularity and to increasing of vascular permeability, formation of endothelium dysfunction. As the additional factor of development of last one also serves disbalance of cytokines [1].

One of the effects of leptin is influence on an inflammation through strengthening of synthesis and releasing of leukotrienes from alveolar macrophages and lymphocytes [52]. These conclusions have found acknowledgement in researches which have shown regulator influence of leptin on system IL. So, increasing of production IL-3, IL-6 and TNF-a [53], an expression of molecules of adhesion on endothelial cells [46] under the action of leptin has been noted. Because of ability of leptin to induce the T-immune answer and production of cytokines in vivo and in vitro, it is possible to consider it as the intermediary between adipose tissue and inflammatory process.

However, there are few researches which characterize infringements of content of various cytokines and in particular, of leptin, resistin at combination of asthma and obesity, and also a way of their correction. Besides, in a number of researches [38, 39] at studying of interrelation of increasedsed level of serum leptin and risk of development of asthma, dependence between investigated parametres has not been found. On the contrary, in others higher concentration of serum leptina in patients with asthma [26, 65] has been shown. All aforesaid for understanding pathogenesis and workings out of more effective treatment of such comorbidity, stimulates the interest to studying of leptin content and its interrelations with other pathogenetic mechanisms in patients with bronchial asthma, combined with obesity.

The search of the most informative markers of activity of inflammatory process in patients with asthma of various severity level and also asthma, combined with obesity, has shown a great value of defining of level fraktalkin [28].

An important link of pathogenesis as asthma, and obesity, is oxidative stress [6, 22]. Developing at aggravations of bronchial asthma oxidative stress which is accompanied by raised production of active forms of oxygen causes increase of activity of processes of lipid peroxidation and activity decrease of antioxidant protection [10]. Oxidative stress stimulates formation of number of proteolitic enzymes, such as matrix metalloproteinases, hematogenically serine proteinase, cathepsinG which have damaging effect on vessel endotheli-

um of a small circle of blood circulation and interstitium of pulmonary tissue, stimulate angiotensin II formation and increase of sensitivity of vessels to it [12].

In patients with BA decreasing in activity of antioxidant protection enzymes which also remains during remission with accumulation of free-radical metabolites (hydroperoxides, diene conjugate, malonic dialdehyde) is noted. Such changes have been noted in various biological liquids – blood plasma, a secret of bronchi and a condensate of exhaled air. One of the basic sources of production of a significant amount of superoxide anion, the basic predecessor of free radical connections in the organism of patients with asthma, eosinophilic granulocytes are [63]. Direct participation of lipid peroxidation in formation of bronchial obstruction [22] is proved. It has been noticed that processes of lipid peroxidation irrespective of etiological variant of asthma are able to change in phase: The syndrome of hyperlipoperoxidemia (increasing of the level of diene conjugated) developed in winter and spring periods against a background of relative antioxidant insufficiency (decreasing in the activity of superoxide dismutase) [36] that could create conditions for the disease aggravation. The intensification of processes of lipid peroxidation also increased with severity level of the disease [8].

Obesity development also is accompanied by occurrence of oxidative stress in the organism [43]. The given condition acts in a role of one of the major pathogenetic links of formation of metabolic infringements at development of obesity and is connected with capacity restriction of antioxidant systems in the organism. In fat patients the level of antioxidant protection is lower, than in patients with normal body weight, and its level back correlates with degree of expressiveness of the central obesity. It is supposed that sources of oxidative stress obesity are hyperglycemia, hyperleptinemia, hyperlipidemia, the raised speed of formation of free radicals and presence of chronic inflammation [70] that is accompanied by inadequate level of antioxidant protection. One of the factors promoting a low level of antioxidant protection at obesity, possibly, is the feature of a diet of fat people with insufficient consumption of the products containing antioxidants: fruit, vegetables and beans, and also insufficient physical activity [59]. The incidental bronchial obstruction at asthma, combined with constant infringement of function of the external breath, caused by obesity, promotes aggravation hypoxia and increasing of oxidative stress. Working out of actions for rational correction of system of lipid peroxidation – antioxidant protection in patients with bronchial asthma, comorbid with obesity, is an important direction of pathogenetic therapy of such combination.

Obesity is characterised by increased content not only active forms of oxygen , but also active forms of nitrogen. Production infringement of nitrogen oxide (NO) is an important link of pathogenesis of BA and obesity in conditions of oxidative stress Molecule NO possesses high biological activity, is capable to get quickly through cellular membranes and to realise the function on metabolic processes both in synthesis cells, and in located nearby. NO in a healthy person causes vasodilatation, regulates processes of an inflammation and immune protection, possesses antioxidant, anti-inflammatory properties, regulates a tone of smooth muscles of internal organs and strengthens activity ciliated epithelium and mucociliary transport of respiratory tract, is also a mediator of bronhodilatace. At asthma secretion NO much increases, and in this situation molecules of NO, co-operating with active forms of oxygen , turn in active forms of nitrogen. So, interaction of NO with superoxide radical results in formation of highly reactive oxidizer – peroxynitrite ($ONOO^-$) which is capable to come in chemical reaction with many biomolecules and has a toxic effect on tissue and cells. Activity of alveolar macrophages is changed under the influence of high concentration of metabolites NO ($NO_x$) in the inflammation centre, there is an activation stimulation of cyclooxygenase and lipoxygenase and production of leukotriene [22], that promotes strengthening of features of inflammation, and clinically leads to longer and more severe attack of asthma.

On the contrary, in patients with obesity levels of metabolites NOx decrease – blood nitrites and nitrates, has been revealed – and it is noticed their negative correlation interrelation with glycemia, level of blood lipids and absence of dependence on patients' age and sex [29] that serves the precondition of necessity of the further studying of features of oxidative and nitrozive stress interaction at progressing of bronchial asthma, combined with obesity

Powerful source of NO in a human body is endothelium. The important role of dysfunction of endothelium has been shown in development of chronic pulmonary heart at chronic obstructive lung disease [23]. The multidirectional content of metabolites of NO at each of diseases forms the interest for their studying at comorbid of asthma and obesity.

One of protective factors for vessels endothelium and myocardium from the damage induced by oxidative stress at obesity is adiponectin [47, 72]. Recent researches have shown that adiponectin is synthesised by adipocytes of white adipose tissue and possesses anti-inflammatory and anti-atherogenic properties, positively influences on lipids and carbohydrate exchanges. Unlike others adipocytokine (TNF- α, IL-6, resistin) which levels raise proportionally to weight of adipose tissue, adiponectin at obesity is defined in lower concentration, than in people with a normal body mass index. In a number of researches it is shown that the level of adiponectin decreases in process of increasing in degree of obesity, that is weight accumulation of visceral fat [62]. Reduction of body weight is one of effective strategy of increasing of concentration of adiponectin in plasma. The level of this hormone considerably raises at starvation and decreases in weight against a background of hypohigh-calorie diet in patients with obesity [35, 57, 72]. At conditions of oxidative stress at adiposity reactive oxygen species are capable to suppress production of adiponectin in adiposities.

Adiponectin promotes stimulation of synthesis of NO in vessel endothelium, oppression production of TNF, can induce adhesion of monocytes and inhibit an expression of adhesion molecules [48, 72]. In researches Salmenniemi et al. (2004) it is proved that low level of adiponectin at adiposity is responsible for damage of endothelium and development of a system chronic inflammation. At the same time such adiponectin as leptin and resistin lead to function of endothelium infringement [34]. Dysfunction of endothelium has essential

pathogenetic value at formation of microvascular complications which make a basis for changes in the macrovascular status, in particular, for formation of chronic pulmonary heart at chronic bronchobstruction [23]. Oxidative stress in combination with nitrozive stress, increasing of production of proinflammatory cytokine which are important links in pathogenesis of bronchial asthma, can be developing factors of endothelial dysfunctions at its combination with obesity. Taking into account set of the factors changing function of endothelium, both at asthma and at obesity, features of formation, clinical displays of endothelium dysfunction and its value in developing of complications at such comorbid, demand studying for working out pathogenetic well-founded correction.

However, the question devoted to dynamics research of adipokins, and also their link with dysfunction formation of endothelium in patients with bronchial asthma, combined with obesity, remains insufficiently studied.

In patients with bronchial asthma participation of one kind of eicosanoids – leukotrienes (LT) in formation and inflammation maintenance has been proved. Their activation causes bronchial obstruction owing to a spasm of respiratory muscles, development of hypostasis of a mucous membrane of bronchial tubes because of an exit of a liquid and fiber from vessels, and also increasing of sputum secretion. The greatest attention of researchers has been turned on changes of cysteinyl LT $4^{th}$ and $5^{th}$ series (C, D, E, etc.). So, at studying of spectrum of LT in children it has been noticed that in leukocytes of conditionally healthy children LT $5^{th}$ series – metabolites of polynonsaturated fat acids ω-3 prevail. In children with BA increasing in synthesis of proinflammatory sulfidopeptide, LT $4^{th}$ series (derivatives ω-6 polynonsaturated fat acids), LTC4 and LTE4 was registered, and in the presence of obesity increasing in level of LTD4, parity change between leukotrienes of $4^{th}$ and $5^{th}$ series, and also between separate kindsof sulfidopeptide (C, D,) and nesulfidopeptide () leukotrienes which are synthesised by neutrophil leukocyte,s has been noted. Formation of severe asthma nowadays is connected with prevalence of neutrophil inflammatios in tracheobronchial tree [11].

Application of inhibitors of sulphidity leukotrienes (montelukast) promotes decrease in levels of leukotrienes C4, E4, D4. However, these preparations do not influence the level LTB4 that causes thebsearch of ways of leukotrienes correction. The interest is caused by the research which has revealed decreasing in its level in children with obesity, in comparison with healthy children, that, obviously, has been connected with the raised expense of general predecessor of LTB4 and cisteinyl LTD4 and LTE4 – LTA4 – on formation LTB4 and LTE4 [7, 13]. Thus it is not revealed any patient with obesity with LTD5 prevailing kind of LT in healthy children that, according to authors, it is probably connected with insufficient receipt of polynonsaturated fat acids, in particular ω-3 class, in structure of their diet that specifies in positive prospect of application of preparations ω-3 for correction of production of LTB4 in patients having asthma with obesity.

Thus, as the results of researches show, both asthma, and obesity are diseases forming steady inflammatory process in the organism. In the first case it is more local, concentrated mainly in respiratory tract, in the second case it is extended, influencing lots of organs and systems. Now many mechanisms of influence of obesity on asthma are described and formulated, but approaches to treatment of the given comorbid state are developed only taking into account some links of pathogenesis. Many components of pathogenesis of the given state remain not studied, and possible ways of their correction are not investigated. It also should define directions of scientific researches for increasing treatment efficiency of patients with such extended comorbid, and also, probably, for decreasing frequency of its displays.

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## ЩОДО ПИТАННЯ ПРО КОМОРБІДНУ ПАТОЛОГІЮ: БРОНХІАЛЬНА АСТМА ТА ОЖИРІННЯ

*Г. П. Победьонна, С. В. Ярцева*

**Резюме.** *Поширеність супутніх захворювань серед пацієнтів різного віку – досить висока і має тенденцію до збільшення. Наявність кількох захворювань у одного пацієнта одночасно впливає на тяжкість кожного з них, сприяє розвитку ускладнень і створює труднощі для терапії. На особливу увагу заслуговує поєднання захворювань, які мають спільні або подібні етіологічні та патогенетичні фактори. Одним із найбільш поширених типів коморбідних захворювань є поєднання бронхіальної астми (БА) та ожиріння.*

*Сучасні дослідження показали прямий зв'язок між збільшенням захворюваності на БА та збільшення індексу маси тіла (ІМТ). Перебіг БА у пацієнтів з надмірною масою тіла тяжчий та її важче контролювати. Надмірна маса тіла чинить негативний вплив на функцію дихальної системи.*

*При аналізі основного патогенетичного зв'язку цих коморбідних захворювань виявлено порушення з боку імунної системи, дисбаланс продукції про- та протизапальних цитокінів – інтерлейкінів, розвиток окисного стресу, порушення продукції оксиду азоту і активації одного з типів ейкозаноїдів – лейкотрієнів.*

*Таким чином, згідно з результатами досліджень астма і ожиріння є захворюваннями, що сприяють формуванню в організмі стійкого запалення. Нині описано і сформульовано багато механізмів, за допомогою яких ожиріння впливає на перебіг БА, але підходи до лікування цих поєднаних захворювань розроблено з урахуванням лише деяких ланок патогенезу. Багато компонентів патогенезу цього коморбідного стану залишаються недослідженими, і можливості їх корекції потребують подальшого вивчення.*

**Ключові слова:** *бронхіальна астма, ожиріння, коморбідна патологія.*

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## TO THE QUESTION OF COMORBIDITY: ASTHMA AND OBESITY

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**Absract.** *The prevalence of comorbidity disease among patients of different ages is quite high and tends to increase . The presence of several diseases in the one patient at the same time affects each of them for their weights, promotes earlier formation creates complications and difficulties for the therapy. Particularly noteworthy is the combination of diseases that share common or similar etiological and pathogenetic factors. One of the most common types of comorbidity is a combination of asthma and obesity.*

*Modern research has found a direct link between the increase in the incidence of asthma with increasing body mass index, and in patients with bronchial asthma incidence of overweight and obesity is twice higher than in the average. The current of asthma in overweight patients is more severe and it is difficult to control. Excess weight has a negative effect on the function of the respiratory system.*

*In the analysis of the basic pathogenetic link of these comorbidities identified violations of immune system, there is an imbalance of production of proinflammatory and antiinflammatory cytokines – interleukins, recorded development of oxidative stress, there is disruption of nitric oxide production and activation of one of the types of eicosanoids – leukotrienes .*

*Thus, as shown by the results of studies, asthma and obesity, are diseases in the body – forming sustained inflammation. Currently described and formulated many mechanisms by which obesity on asthma, but the approaches to the treatment of this comorbidity condition developed only taking into account some of the pathogenesis. Many components of the pathogenesis of this combined states remain unexplored and possible correction – unexplored.*

**Key words:** *asthma, obesity, comorbidity.*

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