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SENSITIVITY OF BRONCHIAL RECEPTORS UNDER THE EFFECT OF TOBACCO SMOKE IN THE CONDITIONS OF VARIOUS ACTIVITY OF THE THYROID GLAND IN CHILDREN

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Ключові слова: *тютюновий дим, діти, щитоподібна залоза, бронхіальна гіперчутливість*
Ключевые слова: *табачный дым, дети, щитовидная железа, бронхиальная гиперчувствительность*

Abstract. Sensitivity of bronchial receptors under the effect of tobacco smoke in the conditions of various activity of the thyroid gland in children. Bashkirova N.S., Vysochina I.L. *The role of the initial hormonal profile disorders of the system "pituitary – thyroid" in the emergence of a bronchospasm in response to exogenic stimuli has not been finally determined. The aim of our research was to investigate the character and degree of the relationship between bronchial hypersensitivity in children exposed to smoking and the functional activity of the thyroid gland. The research involved 74 patients aged 10 to 17 years. Sixteen children were not exposed to tobacco smoke, 50 children were passive smokers, and 8 of the children surveyed smoked actively. To investigate the level of bronchial sensitivity, a bronchial provocation test with a non-specific stimulus – bronchoconstrictor acetylcholine was carried out. We assayed the functional state of the thyroid gland by the level of free triiodothyronine (FT_3), free thyroxin 4 (FT_4) and thyroid stimulating hormone (TSH), identified by Enzyme-linked Immunosorbent Assay (ELISA) (Alkor Bio, Russia). Indicators of hormones of a thyroid gland in most of the examined children did not differ from standard values for healthy children. Analysis of the results of the inhaled bronchial provocation test with acetylcholin showed that the state of non-specific bronchial hypersensitivity was observed in 2 active smokers and in none of the passive smokers and non-smokers ($\chi^2=15,4>\chi^2_{01}=9,21$ або $p<0,01$). According to our data, in children with hypothyroidism, under the effect of tobacco smoke, changes in the functional state of sensitive bronchial receptors do not occur. Among 2 children who had an increased activity of the thyroid gland (hyperthyroidism), one child from the group of smokers had an increased bronchial sensitivity by the results of the acetylcholine test ($p>0.05$). According to our data, changes in the functional status of sensitive bronchial receptors (cholinergic receptors) resulting from exposure to tobacco smoke in children exposed to tobacco smoke, active or passive, do not depend on the functional state of the thyroid gland ($P\chi^2>0,05$).*

Реферат. Чутливість бронхіальних рецепторів під впливом тютюнового диму в умовах різної активності щитоподібної залози в дітей. Башкірова Н.С., Височина І.Л. *Остаточно не визначена роль вихідних порушень гормонального профілю системи «гіпофіз - щитоподібна залоза» у виникненні бронхоспазму у відповідь на екзогенні стимули. Метою нашого дослідження було вивчення характеру і вираженості взаємозв'язку між бронхіальною гіперчутливістю в дітей, які зазнають впливу куріння, і функціональною активністю щитоподібної залози. У дослідженні взяли участь 74 дитини у віці від 10 до 17 років. Серед обстежених дітей було 16 дітей, які не зазнавали впливу тютюнового диму, 50 дітей були пасивними курцями, і 8 обстежених дітей активно курили. Для дослідження рівня бронхіальної чутливості проводилися інгаляційні бронхопровокаційні тести з неспецифічним подразником – бронхоконстрикторами з ацетилхоліном. Функціональний стан щитоподібної залози оцінювали за рівнем у сироватці крові тиреотропного гормона (ТТГ), тироксину (Т4) і трийодтироніну (Т3). Для більшості обстежених дітей типовими були показники гормонів щитоподібної залози, які не відрізняються від нормативних показників для здорових дітей. Аналіз результатів інгаляційного бронхопровокаційного тесту з ацетилхоліном показав, що стан неспецифічної бронхіальної гіперчутливості мав місце в 2 активних курців, в одного пасивного курця і в одного, який не палить ($\chi2=15,4>\chi201=9,21$ або $p<0,01$) у групі дітей з еутиреоїдним станом. У дітей з гіпотиреоїдизмом під впливом тютюнового диму змін у функціональному стані чутливих рецепторів бронхів не відбувається. Серед 2 дітей, які мали підвищену активність щитоподібної залози (гіпертиреоїдизм), одна дитина з групи курців мала*

підвищену бронхіальну чутливість за результатами тесту з ацетилхоліном (p>0,05). Згідно з нашими даними, зміни у функціональному стані чутливих рецепторів бронхів (холінорецепторов) у дітей, які зазнають впливу тютюнового диму, активно або пасивно, не залежать від функціонального стану щитоподібної залози (Pχ2>0,05).

Tobacco smoking remains the most common harmful habit of humanity. Smoking is comparable with epidemic, as according to data of the World Health Organization (WHO) 87% of annually deaths from lung cancer are associated with smoking, 82% of deaths – from chronic pulmonary obstruction (bronchitis, emphysema), and 21% of deaths – from cardiovascular diseases [2].

In literature there are many data that not only active smoking, but also air pollution of rooms with tobacco smoke is a risk factor for development of various diseases [8, 9, 11, 12]. Especially tobacco smoke has negative effect on children and teenagers [1]. In childhood passive smoking causes respiratory tract infections, asthma attacks in babies and children, increases the risk of developing asthma and chronic obstructive lung disease, bronchitis and other diseases of respiratory system in adults [3]. The risk of the development of acute respiratory infections increases by 42% in smoking households as compared with non-smoking [10].

In our previous work it was shown that in childhood, tobacco smoke impairs the functional condition of cholinergic receptors, which play the main role in regulating the patency of the airway tree, increasing bronchial hypersensitivity [7].

Today it is known that bronchial hypersensitivity is the main component of the pathogenetic mechanism of bronchial asthma development. Tobacco smoke, combined with an increase in bronchial hypersensitivity is a stress factor that induces the development of a complex of metabolic changes in the body, including the hypothalamic-pituitary-thyroid system [5]. Taking this into accountit it is possible to suppose existence of functional changes of the thyroid status in the presence of bronchial hypersensitivity under the effect of tobacco smoke. Scientific publications about a thyroid function condition in the effect of a stressful factor of smoking in children are limited. The role of the initial hormonal profile disorders of the system “pituitary – thyroid” in the emergence of a bronchospasm in response to exogenic stimuli has not been finally determined.

The aim of our research was to investigate the character and degree of the relationship between bronchial hypersensitivity in children exposed to smoking and the functional activity of the thyroid gland.

MATERIALS AND METHODS OF RESEARCH

The research involved 74 patients aged 10 to 17 years, including 32 boys and 42 girls. Sixteen children were not exposed to tobacco smoke, 50 children were passive smokers, and 8 of the children surveyed smoked actively. In carrying out functional methods of a research children did not have anamnestic and clinical manifestations of acute, recurrent or chronic diseases of a respiratory system, it made possibile to determine basal levels of bronchial sensitivity.

To investigate the level of bronchial sensitivity, a bronchial provocation test with a non-specific stimulus – bronchoconstrictor acetylcholine was carried out. For the test such solutions were used: 0.004%, 0.012%, 0.036%, 0.11%, 0.33%, 1%, 3%, 9% starting from the lowest concentration. Measurement procedure provided control of condition of patency of airways under the effect of increasing concentrations of the irritant.

Respirable concentration of acetylcholine after which levels of FVC, FEV1, FEV1/FVC decreased by 20% was considered as a threshold of the increased nonspecific bronchial sensitivity (threshold concentration – PK20).

If, after inhalation of a 1% acetylcholine solution, the patency of airways was not reduced by a specified percentage, the nonspecific sensitivity of the bronchi was considered as low [4, 6].

We assayed the functional state of the thyroid gland by the level of the free triiodothyronine (FT_3), free thyroxin 4 (FT_4) and thyroid stimulating hormone (TSH), identified by Enzyme-linked Immunosorbent Assay (ELISA) (Alkor Bio, Russia). The obtained data were compared to standard indicators depending on the child`s age.

The study was carried out in accordance with the principles of bioethics.

The analysis of data was carried out using the following statistical methods of the chi-square test to compare qualitative variables between groups; unpaired t-tests – to compare two groups.

RESULTS AND DISCUSSION

Findings of thyroid gland hormones in most of the examined children did not differ from standard values for healthy children.

At the same time thyroxine findings (T4) lower than norm in normal findings of triiodothyronine (T3), thyroid-stimulating hormone(TSH) were registered in 40% of children.

The average values of the content of the main thyroid hormones in the blood serum in the examined children did not differ from the standard values (Table).

Average findings of thyroid hormones in blood serum in children depending on the status of the smoker

Indexes	TSH uIU/mL	FT4 nmol/l	FT3 nmol/l
Non-smokers	1,24±0,5	90,43±46,3	2,067±0,7
Passive smokers	1,13±0,6	67,32±43,5	2,46±1,4
Active smokers	1,24±0,5	86,69±88,9	1,72±0,7

Note: There was no significant difference in TSH, FT, FT between patient groups and normative indices (p>0.05).

In children smokers there was no significant difference between the indices of the content of individual hormones in the blood depending on the sex (Fig. 1).

None of the children had sufficient clinical and laboratory criteria that correspond to the level of diagnosis of hypothyroidism or hyperthyroidism, or a subclinical state. However, in some children deviations of thyroid parameters from the norm give possibility to suppose the beginning of the development of the pathological condition.

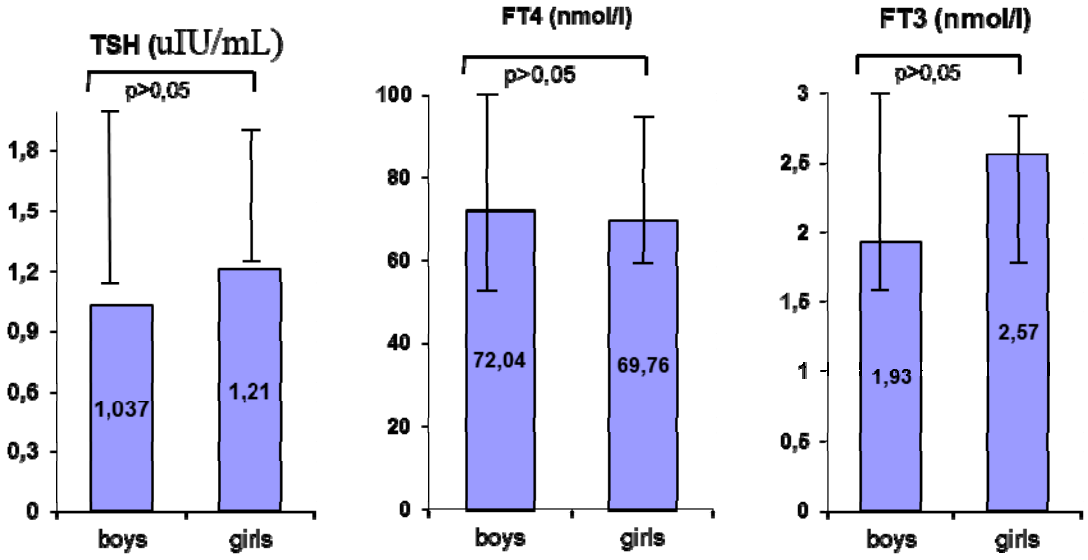
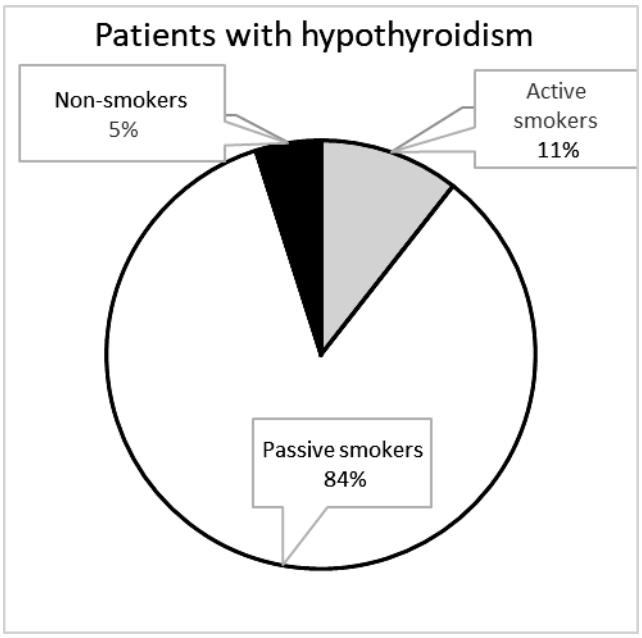


Fig. 1. Findings of thyroid hormone levels in blood, depending on sex in children who smoke

Given this, to achieve the aim – to determine the change in the functional state of sensitive bronchial receptors under the effect of tobacco smoke in the context of different functional activity of the thyroid gland, the statistical analysis was performed in groups with different endocrine profile.

The results of the distribution of children into groups depending on the status of the smoker and endocrine profile are shown in figures 2, 3.

In the group of children with euthyroid status, 29 children were smokers (5 active and 24 passive), 13 children were not exposed to tobacco smoke. Analysis of the results of the inhaled bronchial provocation test with acetylcholin showed that the state of non-specific bronchial hypersensitivity was observed in 2 active smokers and in none of the passive smokers and non-smokers (χ^2=15,4>χ^2_{01}=9,21 або p<0,01). Thus, the obtained data show that in children who are in the euthyroid state of the thyroid gland under the effect of tobacco smoke, the functional state of bronchial cholinergic receptors worsens, as evidenced by an increase in bronchial sensitivity to acetylcholine in active smokers.



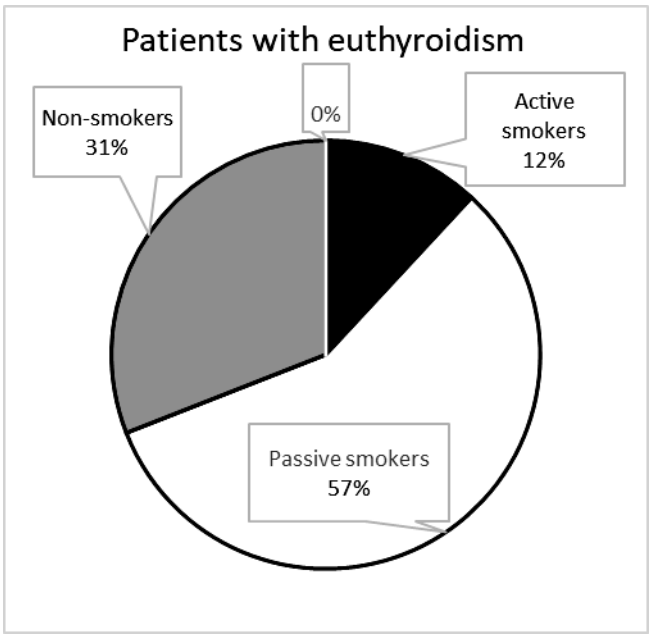


Fig. 2, 3 Distribution of children by functional activity of the thyroid gland and the status of a smoker

According to our data, in children with hypothyroidism under the effect of tobacco smoke, changes in the functional state of sensitive bronchial receptors do not occur. Thus, the analysis of the results of the bronchial provocation test with acetylcholine showed that out of 30 children who form a group of children with hypothyroidism, cases of nonspecific bronchial hypersensitivity were observed in 2 out of 24 passive smokers and none of the 3 active smokers and non-smokers (χ^2=0,53<χ^2_{05}=5,99 або p>0,05).

Among 2 children with an increased activity of the thyroid gland (hyperthyroidism), one child from the group of smokers had an increased bronchial sensitivity according to the results of the acetylcholine test (p> 0.05).

An attempt to compare the average levels of thyroxine, triiodothyronine, thyroid-stimulating hormone in the blood serum of children smokers between groups with different levels of bronchial sensitivity to acetylcholine showed that there is no direct correlation between these indicators.

Therefore, the presented results of the study showed that in children exposed to tobacco smoke, actively or passively, changes in the functional state of the bronchial receptors of cholinergic receptors do not depend on the functional activity of the thyroid gland. The difference between the formation of impairments of the bronchial receptor apparatus that occurs under the effect of tobacco smoke in children with different levels of tyretropic hormone, thyroxine, triiodothyronine in serum was not detected (p>0.05).

Ambiguity of the obtained data requires further research and dynamic monitoring as well.

CONCLUSION

According to our data, changes in the functional status of sensitive bronchial receptors (cholinergic receptors) resulting from exposure to tobacco smoke in children exposed to tobacco smoke, active or passive, do not depend on the functional state of the thyroid gland (Pχ^2>0,05).

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