

Characteristics of domestic predictors of persistent bronchial asthma in adolescents and allergic rhinitis in children with a distal occlusion

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Purpose. Determination of domestic predictors of bronchial asthma in adolescents and allergic rhinitis in children with distal occlusion who have a persistent clinical course of the disease.

Materials and methods. A clinical, anamnestic and allergic examination of 87 adolescents aged 13 to 17 years has been conducted. Of them, 34 adolescents with persistent bronchial asthma were considered as the first monitoring group (I); the group II included 28 children with persistent allergic rhinitis and distal occlusion, thereby they additionally received orthodontic treatment for faciomaxillary pathology. The control group (III) consisted of 25 healthy children. The ratio of boys to girls in the observation and control groups was the same ($P > 0.05$). Questionnaire method was used for the anamnestic data on living, social and hygienic conditions study: current household pet-keeping practice, frequency and specifications of certain cleaning agents and cosmetic products use in children. Also the clinical course of diseases and the subsequent dispensary observation in the remission period of children with persistent bronchial asthma and allergic rhinitis have been analyzed; an allergic study has been conducted in the absence of contraindications for in vivo testing with allergens by the use of skin prick tests with household and epidermal allergens produced by the Limited Liability Company "Immunologist" (Vinnytsia). When comparing statistical aggregates the non-parametric statistical method 2×2 Table, the Chi-square test ($df = 1$) were used and the odds ratio (OR) was calculated using the four-fold table with diagnostic interval (DI) calculation using the Woolf method. By the nonparametric gamma correlation method, recommended for use when there are many matching values in the data, the relationship between hypersensitivity indicators to allergens has been analyzed. A P-value of less than 0.05 was considered statistically significant.

Results. Persistent course of chronic moderate allergic respiratory syndrome trended significantly higher in children with allergic rhinitis and distal occlusion (75.00%) than in adolescents with bronchial asthma (32.35 %). Household predictors of allergic diseases development in surveyed children were living in homes which were not renovated for over 10 years and keeping animals (for adolescents with asthma OR = 3.56, DI [1.08, 11.68] and OR = 6.27, DI [1.26; 31.29]; for children with allergic rhinitis and distal occlusion OR = 4.62, DI [1.35; 15.78] and OR = 6.39, DI [1.24; 32.89]. Hypersensitivity to domestic dust allergens (35.29 %), Dermatophagoides pteronyssinus (29.41 %) house dust mites, epidermis of cats (23.53 %) has been diagnosed in adolescents with bronchial asthma and to house dusts Dermatophagoides pteronyssinus (50.00 %) and Dermatophagoides farinae (42.86 %), house dust mites (42.86 %), cat (42.86 %) and rabbit (17.86 %) epidermis has been revealed in children with allergic rhinitis and distal occlusion. Cosmetics, shampoos, bathing soaps containing formaldehyde, parabens, triclosan, sodium lauryl sulfate and surface-active agents for dishwashing were significantly more often used in the families of children with allergic diseases than in healthy families.

Conclusions. Prevention of bronchial asthma in adolescents and allergic rhinitis and distal occlusion in children included the elimination treatment, prescription of allergen-specific immunotherapy according to positive results of allergy testing, living conditions improvement with timely repairs in their homes, use of hypoallergenic cosmetics, shampoos, soaps, gels, detergents for dishwashing without surface-active agents or careful rinsing under running water.

Key words:

allergic rhinitis, asthma, adolescents, children, malocclusion.

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Характеристика побутових предикторів персистуючого перебігу бронхіальної астми у дітей-підлітків та алергічного риніту у дітей із дистальним прикусом

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Мета роботи – визначення побутових предикторів розвитку бронхіальної астми в дітей-підлітків та алергічного риніту в дітей із дистальним прикусом, що мали персистуючий клінічний перебіг захворювання.

Матеріали та методи. Здійснили клініко-анамнестичне та алергологічне дослідження 87 дітей підліткового віку (від 13 до 17 років). У I групу спостереження ввійшли 34 підлітки із персистуючим перебігом бронхіальної астми, II групу – 28 дітей із персистуючим алергічним ринітом і дистальним прикусом, які додатково лікували супутню зубощелепо-лицьову патологію в лікаря-ортодонта. Контрольна група спостереження (III) – 25 здорових дітей. Співвідношення хлопчиків і дівчаток у групах спостереження та контролю було однаковим ($p > 0,05$). За анкетуванням вивчили анамнестичні дані щодо побутових умов проживання, соціально-гігієнічний стан житла: наявність домашніх тварин, частоту та особливості використання певних хімічних мийних і косметичних засобів у дітей. Проаналізували клінічний перебіг захворювань. Під час диспансерного спостереження в періоді ремісії дітям із персистуючим перебігом бронхіальної астми та алергічного риніту за відсутності протипоказань до тестування in vivo з алергенами виконали алергологічне дослідження шляхом постановки шкірних прик-тестів із побутовими й епідермальними алергенами виробництва ТОВ «Імунолог» (м. Вінниця). Порівнюючи статистичні сукупності, використовували непараметричний статистичний метод « 2×2 Table», the Chi-square ($df = 1$) та розраховували відношення шансів (ВШ) з використанням чотирьохпільної таблиці з розрахунком довірчого інтервалу (ДІ) за методом Woolf. З використанням непараметричного методу gamma correlation (рекомендується використовувати, коли в даних є багато значень, котрі збігаються) виконали аналіз зв'язку між показниками гіперчутливості до алергенів. Розбіжності $p < 0,05$ при порівнянні показників у групах спостереження та контрольній вважали статистично вірогідними.

Результати. Персистуючий перебіг хронічного алергічного респіраторного синдрому середнього ступеня тяжкості вірогідно частіше реєстрували в дітей з алергічним ринітом і дистальним прикусом (75,00 %), ніж у підлітків із бронхіальною астмою

Ключові слова:

алергічний риніт, бронхіальна астма, персистуючий перебіг, підлітки, діти, дистальний прикус.

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(32,35 %). Побутовими предикторами розвитку алергічних захворювань в обстежених дітей були проживання в помешканнях, в яких більше ніж 10 років не було ремонту, та утримання в помешканнях домашніх тварин (для підлітків із бронхіальною астмою ВШ = 3,56, ДІ [1,08; 11,68] та ВШ = 6,27, ДІ [1,26; 31,29]; для дітей з алергічним ринітом і дистальним прикусом ВШ = 4,62, ДІ [1,35; 15,78] та ВШ = 6,39, ДІ [1,24; 32,89]. Встановили гіперчутливість підлітків з бронхіальною астмою до алергенів домашнього пилу (35,29 %), кліща побутового пилу *Dermatofagoides pteronissinus* (29,41 %), епідермісу kota (23,53 %), а дітей з алергічним ринітом і дистальним прикусом – до кліщів побутового пилу *Dermatofagoides pteronissinus* (50,00 %) і *Dermatofagoides farinae* (42,86 %), домашнього пилу (42,86 %), епідермальних алергенів kota (42,86 %) та кроля (17,86 %). У сім'ях дітей з алергічними захворюваннями вірогідно частіше використовували косметику, шампуні, мило для купання, що містили формальдегід, парабени, триклозан, лаурилсульфат натрію, а для миття посуду – засоби, що містили поверхнево-активні речовини, ніж у родинах здорових.

Висновки. Профілактика бронхіальної астми в підлітків та алергічного риніту та дистального прикусу в дітей включала елімінаційні заходи та призначення алерген-специфічної імунотерапії щодо позитивно значущих алергенів за результатами алерготестування, поліпшення побутових умов проживання зі своєчасним ремонтом в оселях, застосуванням гіпоалергенних косметичних засобів, шампунів, мила, гелів, використанням для миття посуду засобів без поверхнево-активних речовин або ретельне його ополіскування проточною водою.

Ключевые слова:

аллергический ринит, бронхиальная астма, персистирующее течение, подростки, дети, дистальный прикус.

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Характеристика бытовых предикторов персистирующего течения бронхиальной астмы у детей-подростков и аллергического ринита у детей с дистальным прикусом

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Цель работы – определение бытовых предикторов развития бронхиальной астмы у детей-подростков и аллергического ринита у детей с дистальным прикусом, имеющих персистирующее клиническое течение заболевания.

Материалы и методы. Проведено клинико-anamnestическое и аллергологическое обследование 87 детей подросткового возраста (от 13 до 17 лет). I группу наблюдения составили 34 подростка с персистирующим течением бронхиальной астмы, II группу – 28 детей с персистирующим аллергическим ринитом и дистальным прикусом, в связи с чем дополнительно лечились у врача-ортодонта. Контрольную группу наблюдения (III) составили 25 здоровых детей. Соотношение мальчиков и девочек в группах наблюдения и контрольной группе не имело достоверных различий ($p > 0,05$). Методом анкетирования изучены анамнестические данные, характеризующие бытовые условия проживания, социально-гигиеническое состояние жилья: наличие домашних животных, частота и особенности использования химических моющих и косметических средств у детей. Проведен анализ клинического течения заболеваний. При диспансерном наблюдении в периоде ремиссии детям с персистирующим течением бронхиальной астмы и аллергического ринита при отсутствии противопоказаний к тестированию *in vivo* с аллергенами проведено аллергологическое обследование путем постановки кожных прик-тестов с бытовыми и эпидермальными аллергенами производства ООО «Иммунолог» (г. Винница). При сравнении статистических совокупностей использовали непараметрический статистический метод « 2×2 Table», the Chi-square ($df = 1$) и рассчитывали отношение шансов (ОШ) с использованием четырехпольной таблицы и доверительный интервал (ДИ) методом Woolf. Непараметрическим методом gamma correlation (рекомендуется использовать, если есть много совпадающих значений) проведен анализ корреляционной связи между показателями гиперчувствительности к аллергенам. Различия $p < 0,05$ при сравнении показателей в группах наблюдения и контрольной группе считали статистически достоверными.

Результаты. Персистирующее течение хронического аллергического респираторного синдрома средней степени тяжести достоверно чаще регистрировали у детей с аллергическим ринитом и дистальным прикусом (75,00 %), чем у подростков с бронхиальной астмой (32,35 %). Бытовыми предикторами развития аллергических заболеваний у обследованных детей были проживание в помещениях, в которых больше чем 10 лет не было ремонта, и содержание в квартирах домашних животных (для подростков с бронхиальной астмой ОШ = 3,56, ДИ [1,08; 11,68] и ОШ = 6,27, ДИ [1,26; 31,29]; для детей с аллергическим ринитом и дистальным прикусом ОШ = 4,62, ДИ [1,35; 15,78] и ОШ = 6,39, ДИ [1,24; 32,89]). Диагностирована гиперчувствительность подростков с бронхиальной астмой к аллергенам домашней пыли (35,29 %), клеща бытовой пыли *Dermatofagoides pteronissinus* (29,41 %), эпидермальным аллергенам kota (42,86 %) и кролика (17,86 %). В семьях детей с аллергическими заболеваниями достоверно чаще использовали косметику, шампуні, мыло для купания, которые содержали формальдегід, парабени, триклозан, лаурилсульфат натрия, а для мытья посуды – средства, содержащие поверхностно-активные вещества, чем в семьях здоровых детей.

Выводы. Профилактика бронхиальной астмы у подростков и аллергического ринита и дистального прикуса у детей включала элиминационные мероприятия, назначение аллерген-специфической иммунотерапии с причинно-значимыми аллергенами, улучшение бытовых условий проживания со своевременным проведением ремонта, использование гипоаллергенных косметических средств, шампуней, мыла, гелей и средств для мытья посуды без поверхностно-активных веществ или тщательное ополаскивание ее проточной водой.

Introduction

At the present stage, the frequency of allergic diseases is steadily increasing throughout the world. Respiratory manifestations of allergy, – allergic rhinitis and bronchial asthma, reduce living standards and are injurious to children's somatic health. Allergic rhinitis today affects about 10–25 % of adult and up to 15 % of child population [1,2].

Household allergens are constantly present in the child's atmosphere, namely house dust mites, epidermal allergens (animal fur, feathers) and cause perennial and persistent rhinitis development when the symptoms of disease last longer than 4 days a week or more than 4 weeks a year [3]. Persistent allergic rhinitis beginning in childhood causes the nasal breathing permanent violation and is one of the leading etiological factors of the distal occlusion

formation, which is one of the most common dentoalveolar abnormalities. The frequency of distal occlusion ranges from 3.6 % to 65 % among various types of pathological occlusions and further worsens nasal breathing and affects chewing, swallowing, sound pronunciation, smile and face aesthetics [4].

In addition, allergic rhinitis is also the premonitory symptom of bronchial asthma in 90% of ill children [5]. It should be noted that over the past years there has been an increasing in the bronchial asthma incidence, and today 32 % of children suffer from bronchial asthma attacks [6]. Persistent bronchial asthma always requires careful selection of controlled therapy and constant dispensary follow-up of patients, especially in adolescence [7,8].

Most often chronic allergic respiratory syndrome, which includes such respiratory forms of allergic diseases in children as bronchial asthma and allergic rhinitis, is formed on the background of genetic predisposition to atopy through the "allergic march" when there is a chronological stage of sensibilization development and clinical manifestations of allergy transformation depending on the child's age. Together with the average time from the first symptoms of allergy appearance to the allergic rhinitis or bronchial asthma final diagnosis is 5–8 years [9,10].

Food allergens are the first for children after their birth, while others are definitely household reasons which often are etiological factors of persistent respiratory forms of allergic diseases development in children, so the increase in the frequency of persistent allergic rhinitis and bronchial asthma in children may be related to two factors: they have less advanced protective mechanisms and changes in living and upbringing conditions, and which emerge in the years ahead. This may be an increase in the level of allergens, a change in the nature of nutrition, increase in medication and chemical load, including increased use of household chemistry, a variety of cosmetic products, which leads to changes in the immune system and contributes to allergies development as early as in childhood. Consequently, there is a hygienic hypothesis that explains allergies development and the increase in its prevalence. According to this hypothesis, the reason for an increase in the incidence of allergic conditions is the reduction of the microbial antigen load on the child's body due to family size reduction and the living conditions improvement in everyday life [11].

Therefore, the allergenic action of chemical additives, which are widely used in everyday life (detergents, shampoos, gels for bathing, soaps, creams and so on) should be considered separately. Although many of them do not cause concern in terms of toxicity, they are strong allergenic haptens which cause the symptoms of allergy development in children. Complications caused by these additives are quite often observed in our time, because phosphates, surface-active substances, formaldehyde, parabens, dyes, preservatives, emulsifiers, every day enter the human body with different agents. Thus, everyone consumes chemical additives, but allergic reactions to them are recorded on the average in 23 % of patients [12]. Allergen-haptens of chemical solutions have been found to be one of allergic diseases risk factors in children from Zaporizhzhia according to preliminary studies: a foam generating agent used as a basis for detergents production (Zoharconctex 47) – in

32.43 % of cases; a foam generating agent used as a basis for shampoos and shower gels production (sodium lauryl sulphate 92 %) – 40.54 %; antioxidant-plasticizer for soap – in 45.95 % of children [13].

Since the persistent allergic respiratory pathology is the most frequent form due to hypersensitivity to household allergens which accumulate mostly in children's living places, we have also decided to study the living conditions of children.

Purpose

Determination of domestic predictors of bronchial asthma in adolescents and allergic rhinitis in children with distal occlusion who have a persistent clinical course of the disease.

Materials and methods

A clinical, anamnestic and allergic examination of 87 adolescents aged 13 to 17 years has been conducted. Of them, 34 adolescents with persistent bronchial asthma were considered as the first monitoring group (I); the group II included 28 children with persistent allergic rhinitis and distal occlusion, thereby they additionally received orthodontic treatment for faciomaxillary pathology. The control group (III) consisted of 25 healthy children. The ratio of boys to girls in the observation and control groups was the same ($P > 0.05$).

Questionnaire method was used for the anamnestic data on living, social and hygienic conditions study: current household pet-keeping practice, frequency and specifications of certain cleaning agents and cosmetic products use in children. Also the clinical course of diseases and the subsequent dispensary observation in the remission period of children with persistent bronchial asthma and allergic rhinitis have been analyzed; an allergic study has been conducted in the absence of contraindications for in vivo testing with allergens by the use of skin prick tests with household and epidermal allergens produced by the Limited Liability Company "Immunologist" (Vinnytsia). Formulation and evaluation of skin tests were carried out in a specially equipped cabinet of the Allergic Center and Allergology Department of the Municipal Institution "City Multi-Specialty Children's Hospital no. 5" in accordance with the Instructions on the use of allergens. The results of skin tests obtaining and evaluation were performed in accordance with the requirements of the Order of the Ministry of Healthcare of Ukraine and the Academy of Medical Sciences of Ukraine No. 127/18 dated 02.04.02 "Instructions on the Procedure for the Specific Diagnostics and Immunotherapy of Allergic Diseases".

When comparing statistical aggregates the non-parametric statistical method "2 × 2 Table", the Chi-square test ($df = 1$) were used and the odds ratio (OR) was calculated using the four-fold table with diagnostic interval (DI) calculation using the Woolf method. By the nonparametric gamma correlation method, recommended for use when there are many matching values in the data, the relationship between hypersensitivity indicators to allergens has been analyzed. The difference between indicators of the study and control groups $P < 0.05$ was considered statistically significant [14].

Results and discussion

According to the study results it has been found that children in the period of bronchial asthma or allergic rhinitis exacerbation had consulted an allergist more often. Thus, in the exacerbation period 73.53 % (25/34) of children with bronchial asthma and 64.29 % (18/28) with allergic rhinitis were examined. And only 26.47 % (9/34) of children with bronchial asthma and 35.71 % (10/28) with allergic rhinitis independently visited an allergist during the remission period for preventive measures to avoid further exacerbation periods. The clinical course of allergic diseases in children is presented in *Table 1*.

Among the examined children with persistent respiratory forms of allergic diseases the average severity was recorded almost twice as often in children with allergic rhinitis as with bronchial asthma (75.00 % versus 32.35 %, $\chi^2 = 11.18$, $P = 0.0008$). The intermittent bronchial asthma (the I degree) in adolescents of this group was not observed, mild persistent bronchial asthma (the II degree) was diagnosed in 61.76 % of cases, moderate persistent bronchial asthma (the III degree) was recorded in 32.35 % of children and only 5.88 % of adolescents had a severe persistent bronchial asthma (the IV degree).

It should be noted that persistent allergic rhinitis in children from the second study group was combined with such orthodontic pathology as a distal occlusion that affected appearance and aesthetic look of the face, led to a diction violation, nasosnement, psychological disorders and need for further treatment and dispensary observation by both pediatric allergist and pediatric orthodontist. In addition, complications such as sinusitis (21.43 %) and otitis (10.71 %) were diagnosed in children with moderate to severe persistent allergic rhinitis and distal occlusion.

We also decided to characterize the living conditions of children through questionnaires, analyzing the answers to questions that characterize family living conditions, feather pillows use, presence of carpets, houseplants, pets, birds and information on the use of shampoos, soaps and detergents types which despite phosphates, bronopol, sodium lauryl sulfate or triclosan content are still widely used in everyday life.

Consequently, an analysis of the answers to the questionnaire describing the living conditions of examined

children has showed that almost all the children lived in apartments and very few of them in a private house. Thus, 91.18 % of children with bronchial asthma and 96.43 % of children with allergic rhinitis and all 100 % of healthy children lived in the apartments. All of these children had central heating in the apartments in the winter. Only 3 children (8.82 %) with bronchial asthma lived in the private houses (in two cases there were gas heating and one with the household stove in winter) and one child (3.57 %) with allergic rhinitis lived in a house with household stove heating in winter. Also, all the dwellings were built more than 10 years ago. Between the time passed from the last repair works made to improve living conditions there was a significant difference, that healthy children lived more often in rooms with repairs done five to ten years ago (80 %) than children with bronchial asthma (52.94 %) or allergic rhinitis (46.43 %). The 47.06 % of children with bronchial asthma ($\chi^2 = 4.60$, $P = 0.0320$) with OR (odds ratio) = 3.56, DI [1.08; 11.68] and 53.57 % of children with allergic rhinitis ($\chi^2 = 6.34$, $P = 0.0118$) with OR = 4.62, DI [1.35; 15.78] when compared with 20 % of healthy children had no repair works at their homes.

29.41 % of children in the group I, 28.57 % of children in the group II and 16 % of healthy children indicated the increased dampness and mold on the walls in the dwellings, but there was no significant difference between these data.

Almost every family had carpets at home: in adolescents with bronchial asthma (91.18 %), in children with allergic rhinitis and comorbid orthodontic pathology (92.86 %) and in the control group (92.00 %). Feather pillows were used in 38.24 % of the group I examined children, in 32.14 % – from the group II and in 16 % of the examined children of the group III. Although the sick children had feather pillows almost twice as often, there were no statistically significant differences between these indicators.

There were ornamental indoor plants significantly more often in healthy children's (92.00 %) rooms and rooms of children with persistent allergic rhinitis and distal occlusion (89.29 %) than in adolescents with persistent bronchial asthma (8.82 %), respectively $\chi^2 = 40.44$, $P = 0.0001$ and $\chi^2 = 40.14$, $P = 0.0001$.

However, this was due to the fact that in the homes of adolescents with bronchial asthma the elimination measures were earlier and more closely followed.

Most of the children living in apartments had aquarium with fish or domestic animals and birds. Thus, dry fish food and daphnia for aquarium fish were present in rooms of the I children group (20.59 %), in 25.00 % of the II group and in 16.00 % of the III group.

Almost with the same frequency children from the I and II groups had birds such as parrots (8.82 % and 7.14 %), while healthy children did not keep birds. Animals such as cats, dogs and rodents were kept by 35.29 % of adolescents with bronchial asthma (OR = 6.27, DI [1.26; 31.29]) and by 35.71 % of children with allergic rhinitis and comorbid orthodontic pathology (OR = 6.39, DI [1.24; 32.89]), compared with 8 % in the healthy group, respectively $\chi^2 = 5.93$, $P = 0.0149$ and $\chi^2 = 5.79$, $P = 0.0161$ (*Table 2*). Characterization of animal species kept in dwellings has showed that exposure to cats were more often among children from the I group than among healthy children, and exposure to rodents (rabbits and rats) and products for their feeding and

Table 1. Characteristics of the allergic diseases severity (abs./%)

	n	Severity level		
		Mild (I)	Moderate (II)	Severe (III)
BA	34	21/61.76 ^{*II,III}	11/32.35 ^{*I,III}	2/5.88 ^{*I,II}
AR	28	6/21.43 ^{*I,III}	21/75.00 ^{*I,III}	1/3.57 ^{*I,II}
P (BA–AR)		< 0.05	< 0.05	> 0.05

P (BA–AR) means the significance of differences between the children groups; ***I, II, III** means the significance of differences between the children groups with I, II, III severity levels ($P < 0.05$).

Table 2. The animals kept in dwellings (abs./%)

Groups	n	Keeping pets	The pets		
			Cats	Dogs	Rodents
I	34	12/35.29 ^{*III}	8/23.53 ^{*III}	3/8.82	1/2.94
II	28	10/35.71 ^{*III}	4/14.29	1/3.57	5/17.86 ^{*III}
III	25	2/8 ^{*I,II}	1/4 ^{*I}	1/4	0 ^{*II}

^{*I, II, III}: significance of differences between the corresponding groups of children ($P < 0.05$).

keeping (feedstuff, animal litters, etc.) were common among children from the group II.

Therefore, in the studying process we decided, based on the skin tests results, to define the etiological factors of the persistent course of bronchial asthma and allergic rhinitis due to hypersensitivity to the main household and epidermal allergens, the manifestation of which, of course, is the result of genetic factors interaction with environmental factors as well as with living conditions.

Among household allergens the most important are domestic dust (household dust) allergens, domestic dust mites *Dermatophagoides pteronyssinus* (*D. pteron*) and *Dermatophagoides farinae* (*D. farinae*) allergens, fur and feather allergens, allergens of sheep wool and allergens of cat, dog and rabbit epidermis among the epidermal allergens. The frequency of positive skin tests to household and epidermal allergens in children is presented in Fig. 1.

Upon the results of hypersensitivity test to household allergens it should be noted that almost one third of adolescents with persistent bronchial asthma experienced sensitization to domestic dust (35.29 %) and *Dermatophagoides pteronyssinus* (29.41 %) household dust mites. Children with persistent allergic rhinitis and distal occlusion in almost half of the cases were sensitized to *Dermatophagoides pteronyssinus* (50.00 %), *Dermatophagoides farinae* (42.86 %) domestic mites and domestic dust (42.86 %). Hypersensitivity to *Dermatophagoides farinae* household dust mites was significantly more often registered in sick children of the group II than in the study group I ($\chi^2 = 7.75$, $P = 0.0054$).

Children with allergic rhinitis among the epidermal allergens most often had sensitization to cat (42.86 %) and rabbit (17.86 %) epidermis, and among children with bronchial asthma sensitization to cat epidermis was recorded in 23.53 % of cases. By expressiveness of sensitization taking into account the papule size when the results of skin prick test evaluation using a nonparametric gamma correlation method in children with bronchial asthma, a direct moderate correlation between hypersensitivity to the epidermal allergens of home dust and to allergens of domestic dust mites *Dermatophagoides pteronyssinus* (gamma correlation 0.59, $P < 0.05$) was traced. In children with allergic rhinitis there was a direct moderate correlation between hypersensitivity to epidermal cat allergens and to domestic dust allergens (gamma correlation 0.34, $P < 0.05$), to allergens of domestic dust mites *Dermatophagoides pteronyssinus* (gamma correlation 0.40, $P < 0.05$), *Dermatophagoides farinae* (gamma correlation 0.36, $P < 0.05$). Between hypersensitivity to the epidermal allergens of home dust a direct strong correlation with *Dermatophagoides pteronyssinus* domestic dust mites (gamma correlation 0.75, $P < 0.05$) and moderate one to *Dermatophagoides farinae* domestic dust mites was detected (gamma correlation 0.59, $P < 0.05$).

Subsequently, the results of allergy testing were taken into account for adoption of elimination measures to avoid the causative allergens influence, the individualized allergen-specific immunotherapy with causative allergens prescription and preventive measures implementation.

Sometimes various detergents are overused for housecleaning and children themselves, especially adolescence as it is illustrative of their age, use skin care products and cosmetics ignoring skin type and age. Therefore we con-

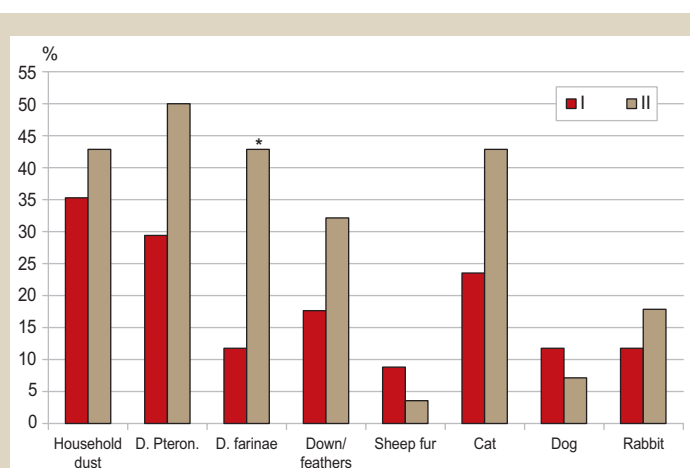


Fig. 1. Results of sick children skin testing with household and epidermal allergens.

*: $P < 0.05$ in comparison with the corresponding group of children.

Table 3. Use of cosmetic creams (abs./%)

Groups	n	None	Children cream	Adult cream	Marketing cream
I	34	6/17.65	2/5.88	21/61.76	5/14.71
II	28	7/25	3/10.71	14/50	4/14.29
P I-II		>0.05	> 0.05	> 0.05	> 0.05
III	25	8/32	10/40	1/4	6/24
P I-III		>0.05	<0.05	<0.05	> 0.05
P II-III		>0.05	<0.05	<0.05	> 0.05

P: significance of differences between the corresponding groups of children.

Table 4. Use of shampoos (abs./%)

Groups	n	Children shampoo	Adult shampoo	Marketing shampoo
I	34	11/32.35	21/61.76	2/5.88
II	28	6/21.43	19/67.86	3/10.7
P I-II		>0.05	>0.05	>0.05
III	25	20/80	4/16	1/4
P I-III		<0.05	<0.05	>0.05
P II-III		<0.05	<0.05	>0.05

P: significance of differences between the corresponding groups of children.

Table 5. Use of soap (abs./%)

Groups	n	Children soap	Adult soap	Marketing soap
I	34	11/32,35	23/67,65	0
II	28	7/25	18/64.29	3/10.71
P I-II		>0,05	>0,05	>0,05
III	25	18/72	6/24	1/4
P I-III		<0,05	<0,05	>0,05
P II-III		<0,05	<0,05	>0,05

P: significance of differences between the corresponding groups of children.

tinued patients and healthy children questioning by adding questions to questionnaires regarding cosmetic creams, hygiene products (shampoos, soaps) and household chemicals for laundry and dishwashing use.

So, according to presented in Tables 3, 4, 5 results of the questionnaire it has been found that healthy children had used more often for the health care cosmetics, shampoos, bathing foam intended for children with no bronchopul-

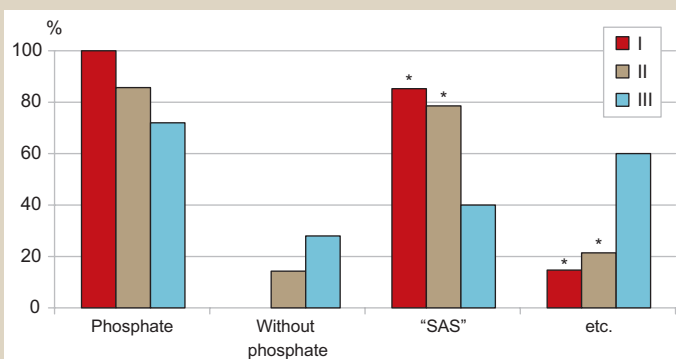


Fig. 2. Characteristics of detergents used by a child at home.

*: $P < 0.05$ compared to the third group.

(formaldehyde), parabens, triclosan and with sodium lauryl sulfate (SLS) concentration in soap not exceeding 1 %.

Characteristics of detergent used in everyday life of children are presented in Figure 2. Detergents for laundry, regardless of its manufacturer, were all with phosphate content and all used with almost the same frequency both in the families of patients and healthy children. In everyday life families of children who have allergies, significantly more often used dishwashing detergent containing surface active substances ("SAS") than in healthy families, which used different detergents. Considering the large range of cosmetics, washing and other chemicals in Ukraine, delayed-type hypersensitivity to chemical allergens in the sensitization of population structure is gradually growing, but it is currently impossible to perform the patch testing with standardized hapten-allergen chemicals, because their production is suspended nowadays.

The results of our study were compared with the data of other scientists from different countries. Thus, in Italy 24 patients (23.08 %) of 104 examined children with allergic rhinitis had a mild persistent course; this fact is consistent with our data [15]. In Spain, the moderate course of allergic rhinitis had 63% of the examined children, which is 12% less than our data, but the hypersensitivity to domestic dust mites was registered with a higher frequency and was equal to 61.9 % [16]. Silvia de Magalhaes Simoes and co-authors showed that 143 (36 %) children of 397 children with bronchial asthma had intermittent course; 160 (40 %) – mild persistent course; 51 (12.8 %) – persistent moderate course and 43 (10.8%) – persistent severe course of the disease [17]. In the same way as in our study the prevalence of allergic rhinitis in children living in Korea or in the Southern Mediterranean region was associated with their place of residence and *Dermatophagoides pteronyssinus* was the dominant in allergen-induced bronchial asthma [18,19]. The incidence of bronchial asthma and hypersensitivity to domestic allergens was recorded at 12 % vs. 3 % and 56 % vs. 38 % in Lima as compared with Tumbes, and the risk factor for allergic rhinitis development was also the sensitization to domestic allergens [20]. However, in adolescents with bronchial asthma who were treated in the Pulmonary Department of the Regional Clinical Hospital in Chernivtsi, the intermittent course of bronchial asthma was recorded in 14.6 % of children, the persistent course –

in 10.7 %, the moderate course – in 38.8 % and the severe course – in 35.9 % of cases; disease severity correlated with the results of prick tests with domestic dust allergen ($r < 0.4$; $P < 0.05$) and the positive results of prick tests with epidermal allergens of animals (cats, dogs) correlated with keeping pets in apartments ($r < 0.5$; $P < 0.05$) [21]. Ukrainian scientists, O. M. Okhotnikova with co-authors state that persistent allergic rhinitis development is associated with sensibilization to domestic aeroallergens, primarily to the allergens of domestic dust mites – *Dermatophagoides farinae* and *Dermatophagoides pteronyssinus* (55 %) and to the allergens of pets. Moreover, the development of allergic rhinitis was predominantly caused by the contact with cat and dog epidermis, hair, saliva and urine, which have significant allergenic activity [22]. Thus, in Kyiv and Kyiv region hypersensitivity to cat epidermal allergens was recorded in 31 % of children with bronchial asthma and in 24 % of patients with bronchial asthma and allergic rhinitis [23]. It was also found in Dnipro that one of the risk factors for bronchial asthma development in children was poor living conditions and in 26.5 % of cases – presence of pets in the room where the child lived. The following allergens showed the largest proportion among others: domestic dust allergens – 48.2 % of patients, epidermal allergens – 36.1 %, domestic allergens – 31.3 % of patients [24]. At the same time, in Vinnytsia region hypersensitivity to the mites, as the main etiological factors of perennial allergic rhinitis, amounted to 78.2 % of cases and regardless of bronchial asthma severity, the domestic allergy also prevailed and was diagnosed in 88.2 % of patients with mild course, in 90.2 % with moderate course and in 84.2 % with severe course of the disease; but these data exceed the indices of our study [25]. Our studies are also associated with the data of works in which it was proved that various toiletries, including lipsticks, cosmetic creams and powders, shaving creams, shampoos and soaps, could be allergens, and it was found that the frequency of allergy to perfumery in children was observed in 2.5–3.4 % of cases [26].

Consequently, the results of our work are broadly consistent with the data of literature sources and emphasize the relevance of this issue. However, in our opinion a certain difference between the results of our study and the data of other scientists' works can be explained by the main regional domestic differences in living conditions of patients.

The study of living conditions and hypersensitivity of children to domestic and epidermal allergens has showed that the sensitization of children was formed, obviously, under the influence of certain conditions and everyday life of children peculiarities. Knowledge of these factors allows improving the etiologic diagnostics of allergic diseases in children, appropriate treatment and prevention of allergic diseases and states related to poor conditions.

Conclusions

1. Persistent course of chronic moderate allergic respiratory syndrome trended significantly higher in children with allergic rhinitis and distal occlusion (75.00 %) than in adolescents with bronchial asthma (32.35 %).

2. Household predictors of allergic diseases development in surveyed children were living in homes which were not renovated for over 10 years and keeping animals

(for adolescents with asthma OR = 3.56, DI [1.08, 11.68] and OR = 6.27, DI [1.26; 31.29]; for children with allergic rhinitis and distal occlusion OR = 4.62, DI [1.35; 15.78] and OR = 6.39, DI [1.24; 32.89].

3. The persistent respiratory forms of allergic diseases were due to the hypersensitivity of adolescents with bronchial asthma to domestic dust allergens (35.29 %), *Dermatophagoides pteronyssinus* (29.41 %) household dust mites, cat epidermis (23.53 %), and children with allergic rhinitis and distal occlusion – to household dusts *Dermatophagoides pteronyssinus* (50.00 %) and *Dermatophagoides farinae* (42.86 %), domestic dust mites (42.86 %), cat (42.86 %) and rabbit (17.86 %) epidermis.

4. It has been found that cosmetics, shampoos, bathing soaps containing formaldehyde, parabens, triclosan, sodium lauryl sulfate and surface-active agents for dishwashing were significantly more often used in the families of children with allergic diseases than in healthy families.

5. Prevention of bronchial asthma in adolescents and allergic rhinitis and distal occlusion in children included the elimination treatment, prescription of allergen-specific immunotherapy according to positive results of allergy testing, living conditions improvement with timely repairs in their homes, use of hypoallergenic cosmetics, shampoos, soaps, gels, detergents for dishwashing without surface-active agents or careful rinsing under running water.

Prospects for further researches. In the future we plan to study genetic predictors of respiratory forms of allergic diseases in children. The next work will be devoted to study the relationship between interleukin-4 gene polymorphisms (IL-4, C-589T (rs2243250)), collagen 1A1 gene polymorphisms (COL1A1 (rs1107946)) and bronchial asthma, allergic rhinitis, allergic rhinitis with distal occlusion in children and adolescents.

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