

Air Pollution and Prevalence of Allergic Diseases in Georgian Adolescent Population

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SUMMARY

During the last decades special attention of scientists has been focused on environmental pollution intensity and a great number of the so-called outdoor allergens (SO₂, NO₂, phenol, combustion gases, etc.) as well as on their increasing effect of formation of allergic diseases. Children's population is most sensitive to the influence of unfavorable environmental factors. This is associated with a number of physiological peculiarities of a children's organism.

In the present work the relationship between the frequency of allergic diseases in young population and the air pollution intensity has been studied. With this purpose in Tbilisi (Georgia) National Environmental Monitoring Center data on the laboratory control of air samples from seven districts of Tbilisi have been collected.

The prevalence and structure of allergic diseases (bronchial asthma, polynosis, atopic dermatitis, urticaria and Quincke's edema) have been investigated by examining an occasional representative group of adolescents (11073 adolescents aged 12-19 years) according to specially developed unified methods including a screening-questionnaire, a detailed map of epidemiological-biological analysis and unitary diagnostic criteria of allergic diseases in children.

The analysis of the data obtained has shown the relationship between the increasing prevalence rate of allergic diseases in children and the chemical air pollution intensity ($p < 0,001$). In the districts with high

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air pollution intensity the earlier onset, heavier development of allergic diseases in children and the increase of the polyvalent sensitization frequency ($p < 0,05$) have been recorded.

Thus, the obtained results indicate a significant influence of the air composition on the prevalence of allergic diseases and its growth with the pollution intensity in the dwelling district.

Problem Statement

Georgian Armed Forces is been forming now. One of the most important problem of nowadays military medicine very high morbidity of military personnel. Despite the fact that the scale and quality of conscripts' medical investigation, that is being done at the moment of recruiting, is far from required standards, - above mentioned morbidity level is a little bit unexpected.

We have done randomized investigation of patients' histories in Central Military Hospital (Tbilisi) and Military Outpatient Clinic (Tbilisi) for the last 5 years period: 1998-2003. Among the frequently revealed diseases, are allergic disorders: urticaria, Quinke's oedema, chronicle rhinitis, conjunctivitis and bronchial asthma. Above mentioned diseases often became the causes of soldiers' retention from the army. Their frequency are as well high in the civil population of similar age group.

In conditions of a substantial increase in bronchial asthma incidence rate epidemiological investigations become very important. It should be mentioned that none of the official documents of WHO and European international societies gives information on epidemiological investigations carried out in the former USSR. This can be explained, in official data such as low level of the bronchial asthma incidence rate is given that this figures are regarded as rather doubtful. In order to obtain impartial information on bronchial asthma in adolescent and young population in Tbilisi a prospective epidemiological investigation has been carried out.

During the last decades special attention of scientists has been focused on environmental pollution intensity and a great number of the so-called outdoor allergens (SO₂, NO₂, phenol, combustion gases, etc.) as well as on their increasing effect of formation of allergic diseases (1,2). Adolescents' population is most sensitive to the influence of unfavorable environmental factors. This is associated with a number of physiological peculiarities of a children's organism (3,4).

For this viewpoint the study of the role of ecological situation in formation of allergic diseases in Tbilisi becomes very important. The economical and geographical location of Tbilisi and expansion of urban building leads to widening of external and internal urban communications network and decreases the traffic capacity. High motor transport intensity and low traffic capacity increase the increase amount of combustion gases and exert the negative influence on the ecological situation in the city. Intensive urbanization processes all over the world will continue to affect adversely on prevalence of allergic diseases even if all city industrial enterprises are closed down. Motor Transport and fuel combustion are inevitable associated with an exhaust of a carbonic acid gas, carbon monoxide, nitrogen oxides, polycyclic hydrocarbons and other allergy inducers. It has been established that xenobiotics absorption on pollen and other allergens increases their immunogenicity a hundred times, most active are formaldehyde, thiocyanates, nitrogen, and sulfur oxides and toxic radicals (5, 6, 7).

Materials and methods

In the present work the relationship between the frequency of allergic diseases in children and the air pollution intensity has been studied. With this purpose in Tbilissi National Environmental Monitoring

Centre data on the laboratory control of air samples from seven air pollution observation zones in seven districts of Tbilissi have been collected.

The epidemiological investigation was performed by stages:

1. First stage – initial screening-questionnaire according to the specially developed program. Using the extended questionnaire (240 questions) a seasonal character, course of the disease, reasons for onset and recurrence, premorbid background, associated diseases duration of the disease etc. were revealed. At this stage 178 bronchial asthma patients were selected and then examined in special day hospital;
2. Second stage – questioning of the subjects selected at the first stage was carried out according to the extended map of epidemiological investigation;
3. Third stage – examination of some patients using special diagnostic methods: such as skin tests, determination of a general IgE level and specific IgE antibodies in blood serum by the ELISA method, investigation of the external respiratory functions; general medical examination methods were also used.

The epidemiological investigation data were processed using the program package SPSS.

The prevalence and structure of allergic diseases (bronchial asthma, polynosis, atopic dermatitis, urticaria and Quinke's oedema) have been investigated by examining an occasional representative group of adolescents (----- children aged year) according to specially developed unified methods including a screening-questionnaire, a detailed map of epidemiological analysis.

11073 adolescent and young population of 12 to 20 years of age living in Tbilisi were investigated. Among them were 200 cadets from United Military Academy aged 15-18 years and 200 military men aged 18-20 years.

The difference of allergic diseases incidence rates between population depend not only on different approaches of its revealing, but also on different exposition factors which can provoke these diseases. In this connection in the work the frequency of possible combination of medical and biological as well as social and hygienic risk factors and their qualitative distribution in young population. were studied.

Results:

In Tbilisi the prevalence of allergic diseases in children was 18.8%. Atopic dermatitis has the highest incidence rate – 7.7%, urticaria and Quinke's oedema are recorded in 4.4 % of cases, polynosis amounts to 3.1% of cases.

The initial screening questionnaire of the representative group of population by yard-to-yard round revealed 343 children with bronchial asthma, which forms 3.1. Among them 147 are female, 196 – males.

Bronchial asthma was prevalent in the groups of 12-15 years old adolescent and more rarely was observed in the older group.

More often genetic burden was observed from maternal (52.8) and more rarely from fraternal (21.6) line. Inheritance was burdened by allergic diseases both from maternal and fraternal line (21.6). Parents (and close relatives) of these patients suffered from various allergic diseases.

Among patients from bronchial asthma the presence of one risk factor was observed only in 2% of cases and in the rest cases – a combination of several (3,4,5) factors was noted.

At the third stage selected patients were examined in special day hospital. In 101 case atopic bronchial asthma was revealed, and in 77 cases – infection-depended asthma was noted. In all the cases of atopic bronchial asthma an increase in the general IgE level was observed, but at the infectious-depended asthma cases the general IgE level was normal. Disorders in the external respiratory functions were more significant in at the infectious-depended asthma.

In 78 cases of atopic BA the aetiologic structure was established by determining specific IgE antibodies in blood serum. In 23 cases Skin tests were performed. The casual factor of infectious-allergic asthma (77 cases) was also revealed by skin tests.

The Investigation of bronchial asthma in young population of Tbilisi showed an intensive increase in bronchial asthma incidence rate for the last two decades, namely by a factor 14. Sex dependence of the disease was noted and age groups susceptible to bronchial asthma were distinguished. Some regularities in the study of the risk factor structure were found. Frequency and peculiarities of distribution of separate factors and variants of their possible combination in bronchial asthma and healthy population were established. Casual factors of BA seemed to be first of all food and social allergens and then pollen, epidermal and bacterial sensibilization.

The analysis of the air pollution intensity in the studied districts has shown a different quantitative and qualitative air composition. See map# 1. The composition of the air pollution data with maximum allowable concentrations (MAL) in separate chemical components revealed different Contamination levels in the investigated zones. In the first MAC was exceeded in 3 components (dust – by a factor of 3.8; carbon monoxide – by a factor of 1.5, phenol – by a factor of 2, formaldehyde – by a factor 4.2). In the second zone MAC was exceeded in 3 substances (dust – by a factor of 4.3; phenol – by a factor of 1.6, formaldehyde – by a factor 5.6). In the third zone the excess of MAL was observed in 2 components (dust – by a factor of 4.3; phenol – by a factor of 1.6, formaldehyde – by a factor 5.4). In the fourth zone MAL was exceeded of in 4 components (dust – by a factor of 1.6, carbon monoxide – by a factor of 1.2, phenol – by a factor of 2, formaldehyde – by a factor of 5.4). In the fifth zone – in two components: (dust – by a factor of 2.4, formaldehyde – by a factor 4.2), In the sixth zone – in three components: dust – by a factor of 2.4, carbon monoxide – by a factor of 1.4, phenol – by a factor of 1.7) and in the seventh zone no mark able excess of MAC in two substances was found (dust – by a factor of 1.4; phenol – by a factor 1.2). Thus in all the investigated zones the excess of substances of the second and third class of danger was revealed.

Prevalence of allergic diseases in children
population of Tbilisi depending
on the air pollution intensity

Tbilisi

The prevalence rate of allergic diseases
in children (according to nosologies)

Legend for Nosologies:

- Bronchial asthma
- Polynosis
- Atopic dermatitis
- Urticaria, Quincke's edema

Legend for Pollution Zones and Boundaries:

- Boundaries of administrative units
- Boundaries of pollution zones
- 1. High pollution intensity zone ($K > 0.6$)
- 2. Medium pollution intensity zone ($K > 0.3$)
- 3. Low pollution intensity zone ($K > 0.2$)

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Table 1: Relationship Between the Prevalence Rate of Allergic Diseases in Young Population and the Air Pollution Intensity

District	Number of examined patients		Prevalence of allergic disease		Bronchial Asthma		Polynosis		Atopic dermatitis		Urticaria and Quinke's edema		Net index of air pollution (T)
	abs.	%	abs	%	abs	%	abs.	%	abs.	%	abs.	%	
Nadzaladevi*	2354	21.3	30	1.3	8	0.3	6	0.2	13	0.6	3	0.1	3.94
Vake	667	6	255	38.3	30	4.5	69	10.3	83	12.6	72	8.5	
Chugureti*	1371	12.4	492	35.1	80	5.8	46	3.3	223	16.3	132	9.7	16.3
Krtsanisi	1849	16.7	92	5	12	0.7	3	0.2	44	2.4	33	1.8	
Samgori**	596	4.9	121	22	8	1.5	89	16.3	17	3.1	7	1.2	6.63
Isani**	733	6.6	133	18.2	19	2.5	69	9.3	27	3.7	14	2.7	7.72
Saburtalo***	951	8.7	278	29.2	33	3.5	57	6.0	110	11.6	78	8.2	10.78
Mtatsminda	521	4.7	215	41.2	36	6.8	53	10.1	76	14.7	50	9.6	
Didube***	1451	13.1	253	17.3	75	5.1	11	0.8	111	7.6	54	3.8	10.29
Gldani***	631	5.7	242	38.4	42	6.7	22	3.5	122	19.3	61	8.9	14.55
Total	11073	100.0	2035	18.8	343	3.1	425	3.8	828	7.5	489	4.4	

The analysis of the data obtained has shown the relationship between the increasing prevalence rate of allergic diseases in adolescents and the chemical air pollution intensity ($p < 0.001$). So, in the pure district it was 1.3%. In the contaminated zones the allergic disease prevalence was high: 7.3% - 38.4%.

In the districts with high air pollution intensity the earlier onset, heavier development of allergic diseases in adolescent and young population and the increase of the polyvalent sensitization frequency ($p < 0.05$) have been recorded.

Thus, the obtained results indicate a significant influence of the air composition on the prevalence of allergic diseases and its growth with the pollution intensity in the dwelling districts.

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