Urban-rural differences in the prevalence of atopic diseases in the general population in Lodz Province (Poland)

Różnice między miastem a wsią w częstości występowania chorób atopowych w populacji ogólnej na terenie województwa łódzkiego (Polska)

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Abstract

Introduction: A dramatic increase in the prevalence of atopic diseases can be observed. The reasons for this phenomenon remain unclear.
Aim: To compare the prevalence of atopic diseases in subjects living in the city centre and a rural area.
Material and methods: The study was done on a randomly chosen group of inhabitants of Lodz province, aged 3 to 80 years, living in two different areas: the city centre and a rural area. Demographic data and the anamnesis were collected on the basis of standardised questionnaires. Additionally, skin prick tests and screening spirometries were performed.
Results: The complete data from 482 subjects living in the city centre and 469 in the rural area were included in the analysis. Asthma prevalence in the city centre was estimated at 13.2% in adults and 18.4% in children compared to 4.2 and 6.0% respectively in the rural area. The prevalence of seasonal allergic rhinitis in the city centre was 13.2% in adults and 16.1% in children, in comparison to 10.1 and 6.7% in the rural area. Atopic dermatitis was diagnosed in 2.3% of adults and in 10.3% of children living in the city centre, compared to 0.3 and 11.9% in the rural area. The higher prevalence of asthma both in adults and children and seasonal allergic rhinitis in children, observed in the city centre, was statistically significant ($p < 0.0001$). The difference in atopic dermatitis reached statistical significance only in the group of adults, while the prevalence in the group of children did not differ between study regions.
Conclusions: The study revealed a difference in the prevalence of atopic diseases between city and rural areas. The high prevalence of atopic dermatitis in the rural area may be a portent of an increase in other atopic diseases and the disappearance of the differences between city and rural areas.

Key words: asthma, allergic rhinitis, atopic dermatitis, epidemiology, urban-rural differences.

Streszczenie

Wprowadzenie: W ostatnich latach obserwuje się gwałtowne zwiększenie zapadalności na choroby atopowe. Przyczyny tego zjawiska nie są w pełni poznane.
Cel: Porównanie częstości występowania chorób atopowych w populacji mieszkańców centrum miasta i terenów rolniczych.
Materiał i metody: Badanie przeprowadzono na losowo wybranej grupie mieszkańców województwa łódzkiego w wieku 3–80 lat, mieszkających w dwóch różnych rejonach – centrum miasta i na wsi. Dane demograficzne i wywiad chorobowy zbierano na podstawie standaryzowanych kwestionariuszy. Dodatkowo u respondentów wykonywano punktowe testy skórne i przesiewową spirometrię.
Wyniki: Analizie poddano kompletne dane zebrane od 482 mieszkańców centrum miasta i 469 mieszkańców wsi. Częstość astmy u dorosłych mieszkających w centrum miasta oszacowano na poziomie 13,2%, u dzieci 18,4%, podczas gdy w populacji mieszkającej na wsi odpowiednio u dorosłych 4,2% i u dzieci 6,0%. Częstość występowania sezonowego alergicznego nieżytu nosa wyniosła odpowiednio w centrum miasta u dorosłych 13,2% i u dzieci 16,1% w porównaniu z terenami wiejskimi, gdzie wynosiła u dorosłych 10,1% i u dzieci 6,7%. Atopowe zapalenie skóry dia-

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gnozowano u 2,35% dorosłych osób mieszkających w centrum miasta i u 10,3% dzieci, natomiast na terenach wiejskich u 0,3% dorosłych i 11,9% dzieci. Częstość występowania astmy u dorosłych i dzieci oraz sezonowego nieżytu nosa u dzieci na obszarach miejskich była istotnie większa niż na obszarach wiejskich ($p < 0,0001$). W przypadku atopowego zapalenia skóry różnica w chorobowości była istotna tylko w grupie osób dorosłych, podczas gdy u dzieci nie obserwowano istotnych statystycznie różnic.

Wnioski: W badaniu wykazano istnienie różnic w częstości występowania chorób atopowych między miastem a wsią. Dużą częstość pojawiania się atopowego zapalenia skóry na terenach wiejskich może być zapowiedzią zwiększenia zapadalności na inne choroby atopowe w tym rejonie i zanikania różnicy między miastem a wsią.

Słowa kluczowe: astma, alergiczny nieżyt nosa, atopowe zapalenie skóry, epidemiologia, różnica miasto–wieś.

Introduction

During the last 30 years, a dramatic increase in the prevalence of atopic diseases has been observed [1, 2]. Although lots of intensive studies have already been performed on the epidemiology of atopic diseases, the reasons for such an intensive increase of their prevalence over the last years remain unclear. It seems that a complex interaction between genes and such factors as air pollution, urbanization, industrialization, changes in living style including feeding habits and increase in personal hygiene, as well as the medical progress in the treatment and prophylaxis of infectious diseases may be of great importance [3].

In 1998-2000 an epidemiological multi-centre study on the prevalence of allergic diseases was performed in the whole of Poland. Lodz was one of 11 clinical centres conducting this study [4].

Aim

The aim of the current analysis is to compare the epidemiology of atopic diseases in the general population of Lodz province's citizens living in the city centre and a rural area.

Material and methods

Study population

At the end of 1998 the area of Lodz province was 1520 km^2, the province had 1 105 400 inhabitants and over 90% of it was urbanized. The study was performed on a randomly chosen group of Lodz province inhabitants of both sexes, aged from 3 to 80 years. The analyzed subgroup lived in two regions differentiated by the degree of urbanization, industrialization and air pollution as well as living conditions. The first subgroup came from the centre of Lodz – a city with eight hundred thousand inhabitants, with textile and chemical industry, with transport arteries connecting south to north and east to west. The year averages of dust level and sulphur dioxide in 1999 were the highest in the province and respectively came to 38 and 18 $\mu g/m^3$. Commune Brójce is an agricultural territory 30 km from Lodz city. Brójce was inhabited by 2000 persons. The average dust level in 1999 was lower than in the city centre and came to 21.6 $\mu g/m^3$ and SO_2 was 11.8 $\mu g/m^3$.

The Provincial Statistical Office drew 200 apartments in both areas: the city centre and the rural region. The list of persons living in matched addressees was prepared by the Provincial Bank of Personal Data.

Interview

The interviews were performed at subjects' houses, face-to-face by trained personnel – medical students and nurses – in pre-arranged appointments. Announcements about the planned epidemiological study were published in regional newspapers and each of the selected individuals received a letter with an invitation for participation in the study. Then the interviewer made an appointment with the selected individuals. Three attempts of appointments were undertaken.

Questionnaires

Demographic data, living conditions, habits and the anamnesis were collected on the basis of original standardised questionnaires. Five questionnaires were prepared: one describing living conditions, a screening one for adults (always completed), a detailed one for adults (completed only in subjects with at least one positive answer in the screening test), one for children and one for unexamined. The questions concerning asthma, rhinitis and atopic dermatitis were patterned on the International Study of Asthma and Allergies in Childhood (ISAAC) and the European Community Respiratory Health Survey (ECRHS) questionnaires and included asthma, rhinitis and dermatitis symptoms, smoking habits, cardiological disorders, potential risk factors, information about previous diagnoses, elements of differential diagnosis and the kind of previous treatment.

Skin prick tests

All responders had performed skin prick tests with 10 common inhaled allergens: *Dermatophagoides farinae*, *Dermatophagoides pteronyssinus*, mixed grass pollens, *Artemisia*, rye, *Betula, Hazel*, cat allergens, *Alternaria*, *Cladosporium* (Allergopharma). The pricks were applied

on the inner side of the forearm using disposable lancets (Allergopharma). The results were read after 10 min for controls (histamine and diluent) and after 15 min for allergens and recorded as the diameter of the wheal. The washout periods for antihistamines drugs were respected. The test was considered as positive if the diameter of the wheal was 4 mm greater than a negative control.

Screening spirometry

During the same visit all adults had performed screening spirometry using a microspirometer (MicroMedical Ltd Rochester) according to the recommendations from the ATS [5]. The spirometry was performed in the sitting position using a nose clip. At least three forced expirations were performed; if the results were not repeatable, eight manoeuvres were done. Four parameters were recorded: FEV1, FVC, FEV1/FVC and PEF. Values below 80% of the norms (ECSC) for FEV1 and FVC and 70% for FEV1/FVC were considered as pathological.

Epidemiological diagnosis and verification process

On the basis of information with questionnaires, SPT results and spirometry, as well as the patients' documentation, one expert on-site made the diagnosis in accordance with the diagnostic criteria suggested by the ATS [6] for asthma, criteria of the International Rhinitis Management Working Group for allergic rhinitis and Hanifin-Rajka's criteria for atopic dermatitis. In doubtful cases additional tests were performed in the Out-Patient Clinic, e.g. reversibility test, histamine provocation tests, exercise provocation test, total IgE and specific IgE, and then after verification the final diagnosis was established.

Statistical analysis

Descriptive statistics were used for characterization of the study population. Prevalence rates of atopic diseases with 95% confidence intervals were calculated separately for children and adults. The comparisons of some indices and other variables in the selected sub-groups were carried out by χ^2 test, or Fisher's test.

Results

Demographic characteristics

Six hundred subjects were randomly selected out of the population living in the city centre and 518 from Brojce area. Respectively 482 and 469 subjects living in the city centre and the rural area were examined and included in the statistical analysis. The response rate was above 85% in the whole study group and no less than 80% in analyzed subgroups.

The mean age of adults (17-80 years) living in the city centre was over 7 years higher than subjects living in the rural area and amounted respectively to 49.02 and 41.93 years. The mean age of children (3-16 years) did not differ statistically significantly between the study groups and amounted to 8.43 years for children living in the city centre and 9.27 years for subjects living in the rural area. No difference was observed in respect of sex distribution in the children group between city and village, but a significant majority of women from the city centre were examined. The structure of the study group reflects the demographic situation in Lodz province. From a sociological point of view, the factor of education level of heads of families was compared in both regions. In the city centre, in 20.7% of families the head had university education, 47.5% secondary and 31.8% primary, in the rural area only 6.3% of the family heads had university education, 35.2% secondary and 58.5% primary. The differences observed in education level were statistically significant.

Results of questionnaires

Living conditions

The data from 359 households were analyzed: 217 from the city centre and 142 from the rural area. 96.8% of households from the city centre lived in apartment houses; in contrast 93.7% of subjects from the rural area lived in one-family detached houses. The average number of persons in one house was 2.54 in the city centre and 3.71 in the rural area. Pets were present in 53.9% of the houses in the city centre and in 34.5% of houses in the rural area. The above-mentioned differences between studied areas were statistically significant.

Questionnaires for adults

Subjects living in the city centre more often complained of wheezing (24.3%) compared to people from the rural area (15.2%). 14.9% of adults from the city centre have had symptoms during the last 12 months compared to 9.9% of subjects from the rural area. 17.5% of responders from the city centre in comparison with 10.1% from the rural area had wheezes independently of infection. 11.1% of individuals living in the city centre have suffered from night dyspnoea but only 6.3% of those living in the rural area. Respectively 6.8 vs. 5.1% of subjects have had symptoms during the last 12 months. Night cough was reported by 22% of subjects living in the city and by 16.4% in the country. Anti-asthmatic treatment has been received by 7.1% of subjects living in the city centre and 3% in the rural area. None of these differences were statistically significant.

14.7% of the city centre inhabitants reported rhinitis and conjunctivitis, 11.4% of them have had seasonal rhinitis and 10.9% perennial rhinitis. In the rural area 8.1% of subjects have suffered from rhino-conjunctivitis, 4.8% of them have had seasonal and 6.3% perennial rhinitis. All the differences between study groups were statistically significant.

15.7% of responders from the city centre complained of skin itching and 12.4% have had additionally skin exanthema. Itching was reported by 11.7% of subjects of the rural area and skin exanthema by 9.9%. None of these differences were statistically significant (Table 1).

Questionnaires for children

In the group of children 19.5% of them living in the city centre have had wheezing and similarly 18.7% in the country (the difference was not statistically significant). 9.2% of children from the city and only 3% from the village have had exercise wheezes in the last year. Wheezes independently of infection were observed in 9.2% of children in the city centre and only in 3% in the rural area. These differences were not statistically significant, though the trend was strong. Dyspnoea with wheezing has appeared in 11.5% of children living in the city and in 11.2% living in the village. Wheezes provoked by exercise were reported in 5.7% of children from the city and in 3% from the rural area. Attacks of dry night cough have appeared in 10.3% of children from the city and 12.7% from the rural area. 13.8% of children living in the city centre and 9% in the rural area have been treated for spastic bronchitis. These differences did not reach statistical significance.

Rhinitis, sneezing and nasal obstruction without infection were observed in 21.8% of children living in the city centre and in 11.9% from the rural area. Almost all have had symptoms during the last year. The difference between regions was statistically significant. The symptoms of conjunctivitis have been present in 10.3% of subjects from the city centre and in 11.2% of those living in the rural area; the difference was not statistically significant.

Long-term itching exanthema lasting over 6 months has been present in 12.6% of children living in the city centre and in 7.5% from the rural area. During the last 12 months an itching rash was observed in 5.7% of children from the city centre and in 5.2% from the rural area. The differences between study regions were not statistically significant (Table 2).

The results of skin prick tests

At least one positive reaction to tested aeroallergen was observed in 25.1% of subjects living in the city centre and 28.6% living in the village. The most common sensitizing allergens in both study groups were house dust mites. The prevalence of positive SPT for *Dermatophagoides farinae* was 18.3% in the city and 19.9% in the village, while for *Dermatophagoides pteronyssinus* the prevalence was respectively 16.3% and 19.9% without statistically significant differences between studied regions. Some differences were observed in the prevalence of positive reaction to pollen and animal allergens. Positive reactions for grass (15.3%), and cat dander (9.3%) were statistically more frequent in the city centre than in the rural area (9.2 and 5.4% respectively),

Table 1. Demographic data and living conditions

Data	City centre	Rural area	*p*-Value
Selected subjects	600	518	
Analyzed subjects	482	469	
Number of children: • boys • girls	87 44 (50.6%) 43 (49.4%)	134 59 (44%) 75 (56%)	 0.34
Mean age of children [years]	8.43	9.27	0.27
Number of adults: • men • women	395 151 (38.2%) 244 (61.8%)	335 155 (46.3%) 150 (53.7%)	 < 0.001
Mean age of adults [years]	49.02	41.93	< 0.0001
Households: • apartment houses • detached houses	217 210 (96.8%) 7 (3.2%)	142 9 (6.3%) 133 (93.7%)	 < 0.0001
Average no. of persons in one household	2.54	3.71	
Education in family: • university • secondary • primary	217 45 (20.7%) 103 (47.5%) 69 (31.8%)	142 9 (6.3%) 50 (35.2%) 83 (58.5%)	 < 0.05
Pets in house (present or previous)	117 (53.9%)	49 (34.5%)	< 0.005

whereas in the rural area positive reaction to *Artemisia* was more prevalent (12.5%) compared to the city centre (7.4%).

The results of spirometry

Spirometry was performed and assessed in 328 adults living in the city centre and in 318 living in the rural area. Disturbances in airflow were observed in 18.9% of subjects living in the city centre and only in 5.7% of subjects from the rural area ($p < 0.0001$).

Diagnosis of atopic diseases

Asthma prevalence in adults was estimated at the level of 13.2% (95% CI 9.8-16.5) in the city centre compared to 4.2% (95% CI 2.0-6.3) in the rural area. In children asthma was assessed at 18.4% (95% CI 10.3-26.5) in the city centre and at 6.0% (95% CI 2.0-10.0) in the rural area. The differences were statistically significant.

The prevalence of seasonal allergic rhinitis among adults was 13.2% (95% CI 9.8-16.5) in the city centre compared to 10.1% (95% CI 6.9-13.4) in the rural area. The prevalence in children groups were respectively 16.1% (95% CI 8.4-23.8) in the city centre and 6.7% (95% CI 2.5-11.0) in the rural area. The difference in children groups achieved statistical significance. In adults although the difference did not achieve statistical significance the tendency was marked.

Atopic dermatitis was diagnosed in 2.3% (95% CI 0.8-3.8) of adults and in 10.3% (95% CI 3.9-16.7) of children living in the city centre compared to 0.3% (95% CI 0.0-0.9)

Table 2. Data from interview

Data	Prevalence [%]		*p*-Value
	city centre	rural area	
Adults			
Wheezing	24.3	15.2	< 0.005
Wheezing during last 12 months	14.9	9.9	< 0.001
Wheezing independently of infection	17.5	10.1	< 0.005
Night dyspnoea	11.1	6.3	< 0.05
Night dyspnoea during last 12 months	6.8	5.1	0.32
Night cough	22	16.4	0.056
Anti-asthmatic treatment	7.1	3	< 0.05
Rhino-conjunctivitis	14.4	8.1	< 0.01
Seasonal rhinitis	11.4	4.8	< 0.005
Perennial rhinitis	10.9	6.3	< 0.05
Skin itching	15.7	11.7	0.12
Skin exanthema	12.4	9.9	0.28
Children			
Wheezing	19.5	18.7	0.87
Wheezing after exercise	9.2	3	0.09
Wheezing independently of infection	9.2	3	0.09
Dyspnoea with wheezing	11.5	11.2	0.95
Dyspnoea provoked by exercise	5.7	3	0.51
Night cough	10.3	12.7	0.60
History of spastic bronchitis	13.8	9	0.26
Rhinitis without infection	21.8	11.9	0.049
Conjunctivitis	10.3	11.2	0.84
Itching skin exanthema lasting 6 months	12.6	7.5	0.20
Skin exanthema during last 12 months	5.7	5.2	0.89

of adults and 11.9% (95% CI 6.4-17.4) of children living in the rural area. A statistically significant difference was only observed in the group of adults while in the children it did not reach this level (Figure 1).

Discussion

Atopic diseases are nowadays among the most frequent chronic diseases and their prevalence is still increasing [1]. However, international comparisons of the prevalence of allergic disorders have shown large geographical differences. So far two huge international epidemiological programmes on the prevalence of atopic diseases have been conducted: one in children and one in adults.

The first stage of the International Study of Asthma and Allergies in Childhood (ISAAC) was performed in two age groups: among 6-7 year olds in 91 centres from 38 countries and among 13-14 year olds in 155 centres from 56 countries. It revealed 20-fold to 60-fold differences between centres in the prevalence of atopic disease symptoms [7]. The lowest prevalence of asthma in children 6-7 and 13-14 year old was recorded in Indonesia and was 4.1 and 2.1% respectively, while the highest prevalence was in Costa Rica (32.1% for 6-7 year olds) and in the United Kingdom (32.2% in the group of 13-14 year olds). The analysis showed the existence of consistently more variation between countries than within countries [8]. However, the majority of study centres were located in main big cities, which prevented the assessment of local differences.

The European Community Respiratory Health Survey (ECRHS) was an earlier study designed for assessment of asthma and nasal allergy symptoms prevalence in adults. ECRHS was conducted in 20-44 year old subjects in 48 centres in 22 countries. It first revealed large geographical variation of the prevalence of atopic diseases in adults [9].

Comparison of these two studies shows the characteristic international pattern in the prevalence of atopic diseases [10] with higher prevalence of atopic diseases in the developed countries with so-called Western life-style and lower in the developing countries. However, these two studies do not include information about local conditions which may influence the prevalence of atopic diseases.

The aim of our study was to look for differences in atopic disease prevalence within a small geographical area, limited to one province. The study was performed on a random sample of Lodz province citizens living in two different, in respect of urbanization, industrialization and culture, regions: in the city centre and a rural area. The study revealed wide variation in the prevalence of atopic diseases, with a higher value in the city centre. The inhabitants of the city centre suffered from asthma over three times more often than subjects living in the rural area: asthma prevalence in Lodz centre was 13.2% for adults and 18.4% for children compared with 4.2% and 6% respectively in the rural area. Smaller differences were observed for seasonal rhinitis. A statistically significant difference was recorded in the children's population in which the prevalence of seasonal rhinitis in the city centre was over two times higher than in the rural area (16.1% compared to 6.7%). Although in adults the difference did not achieve statistical significance, the tendency was marked: 13.2% prevalence of allergic rhinitis in the city and 10.1% in Brojce. Atopic dermatitis was the third disease from the atopic triad evaluated in the study. A significant difference in the prevalence of atopic dermatitis between subjects living in the city centre and the rural area was only found in adults though the prevalence itself was low in this

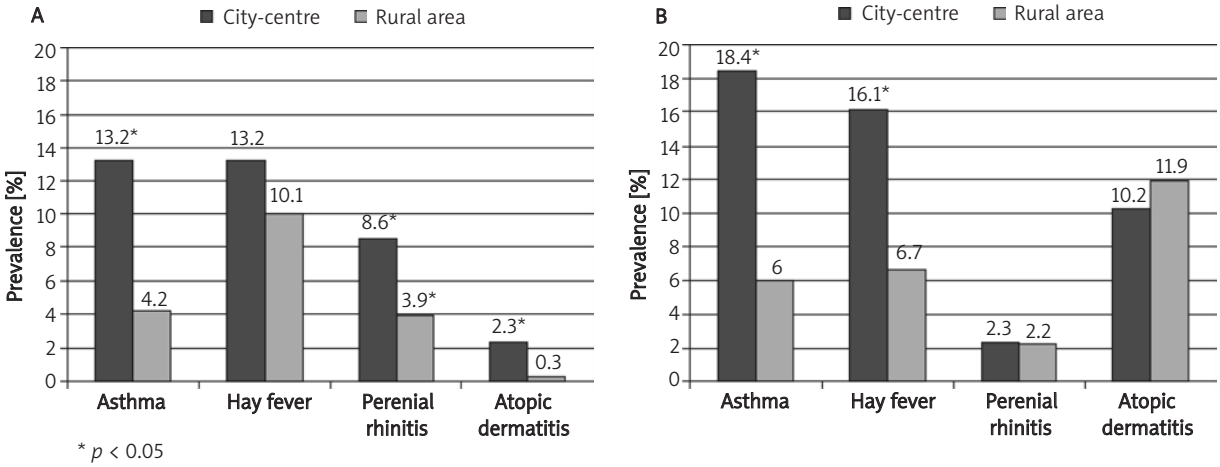

Figure 1. Prevalence of atopic diseases in the city centre and rural area of Lodz province: A) adult, B) children

population (2.3% compared to 0.3%). In the group of children the prevalence of atopic dermatitis was significantly higher than in adults but no difference was observed between city and rural areas.

There are a few published articles revealing the existence of urban-rural difference in the prevalence of atopic diseases. Most of them come from developing countries, for example: Ethiopia [11], South Africa [12], Gambia [13], Turkey [14], and Slovakia [15]. Only a few studies published lately come from developed countries: Israel [16], Switzerland [17] and Japan [18].

Among potential "urban factors" responsible for an increase of atopic diseases in modern cities, air pollution from industry and especially traffic emissions are mentioned most often. In several studies from Europe and the US a relationship between high levels of PM and SO_2 was noticed. Also the impact of PM and ozone on lung function was reported. But besides the direct harmful effect of air pollution on airways some pollution may favour IgE sensitization and the development of allergic diseases. Many valuable observations come from studies performed in Germany after reunification. This ethnically homogeneous population was exposed to different types of atmospheric pollution. In East Germany in the 1970s and 1980s industrial pollution with high levels of SO_2 dominated, while in West Germany ozone and nitric oxides were the major problem. In the study by Mutius [19] sensitization to aeroallergens as well as asthma and hay fever are strikingly more frequent in West Germany than in East Germany. Similar results were obtained by Ring and his group [20].

Lodz used to be the capital of the textile and chemical industries. In the last years, due to legal regulations but also due to the industrial recession, the pollution level, mainly dust and SO_2, has decreased, but the level of NO_2 has been increasing. There are very high differences in air pollution between regions in the same province, even within the small geographic area. In Lodz province, Brójce region is among the purest areas and Lodz centre is the most polluted [21].

The relation between car traffic and allergy was observed by Ishizaki *et al*. [22]. They noticed that the incidence of allergic rhinitis is much higher in subjects living close to main roads with heavy traffic than those living in cedar forest, despite the similar cedar pollen counts in both area.

Kramer *et al*. [23] found that hay fever, symptoms of allergic rhinitis, wheezing, sensitization against pollen, house dust mites or cats, and milk or eggs were associated with outdoor NO_2 as a marker of automobile exhaust fumes. The results indicate that traffic-related air pollution leads to increased prevalence of atopic sensitization, allergic symptoms, and diseases.

Lodz is situated on the North-South and East-West traffic routes and unfortunately still lacks a ring road; therefore all transit traffic goes through the city centre. Moreover, the number of cars registered in Lodz is rapidly increasing. This may be one reason for the urban-rural difference.

A very interesting phenomenon observed in the study was equalization of atopic dermatitis prevalence in the child populations living in the city centre and the rural area. As atopic dermatitis appears first in the allergic march [24], it may be the portent of an increase in the prevalence of other atopic diseases as a consequence of the first step and the disappearance of the differences between city and rural areas. A similar observation was made in Ireland by Taylor and his group. They examined children from 4 to 19 years old and found that hay fever was more common in the urban than the rural children, but there was no town/country difference for eczema [25]. Looking for the causes of this phenomenon one should take into consideration the changes of living conditions in the rural area due to interference in the natural environment by mechanization, artificial fertilizers, chemical agents protecting plants, development of motorization but also because of the changes in household habits, feeding and hygiene.

How changes in agriculture may influence the prevalence of atopic diseases is shown in the example of Israel. This is a country originally with a desert climate, but extensive agriculture during the last 40 years due to artificial irrigation has developed rich vegetation and intensive agriculture. At the same time hay fever prevalence has risen over 20-fold with dominance in the rural areas [26]. Another factor which may influence the atopic disease prevalence profile in rural areas is exposure to the farming environment and rural lifestyle. As the specialization in agricultural production proceeds and small farms unite to form big plantations, the lifestyle in villages changes. More often village residents work as hirelings outside agriculture and resign from their own farming. A few studies show that not living in a rural area, but exposure to the farming environment gives protection against atopy in children. In the SCARPOL study performed in Switzerland Braun-Fahrlander *et al*. [27] show that factors directly or indirectly related to farming such as parental occupation reduce the risk of children becoming atopic and developing symptoms of allergic rhinitis. Similar results were obtained in Finnish [28], Australian [29] and German (MONICA/KORA) [30] studies, though in the last one the difference between farmers and non-farmers did not reach statistical significance. In the Finnish study Kilpelainen *et al*. [28] not only showed a difference between farm and non-farm environments, but also similarity between urban and rural non-farm exposure in childhood on the prevalence of atopic diseases in adults. No difference between urban and rural areas was observed in developed countries, where the difference between urban and rural areas is limited, like in France [31].

Conclusions

The study revealed a difference in the prevalence of atopic diseases between city and rural area inhabitants. However, it also revealed changes in atopic disease prevalence in the rural area. As atopic dermatitis appears first in the allergic march, its increase may be the portent of an increase of other atopic diseases and disappearance of the differences between city and rural areas. This hypothesis needs further epidemiological studies.

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