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The epidemiology of atopic dermatitis in the general population of the Łódź province's citizens

Abstract

Introduction: It is estimated that 12–26% of the European population is suffering from atopic dermatitis. The aim of the study was to determine the prevalence of atopic dermatitis in the general population of the Łódź province in Poland and to attempt to identify the risk factors for this disease.

Material and methods: We investigated a randomly selected group of 1522 inhabitants of the Łódź province aged between 3 and 80 years. The demographic and anamnestic data were collected by means of standardised questionnaires. Skin prick testing was performed with 10 aeroallergens commonly occurring in Poland.

Results: We analysed complete data sets from 1340 (283 children and 1057 adults). The prevalence of atopic dermatitis was estimated at 9.2% in children and 0.9% in adults. Family history of atopy and exposure to tobacco smoke were found to be strong risk factors of atopic dermatitis (OR 3.69 and 3.40, respectively). The difference in the prevalence of atopic dermatitis between inhabitants of the city centre and inhabitants of rural areas was observed only in adults, while children inhabiting both types of area were characterised by the same high prevalence rate. We found that 38% of the children and 10% of the adults had not been correctly diagnosed with atopic dermatitis prior to this epidemiological study.

Conclusions: The results of our epidemiological study show that atopic dermatitis has become a significant health, social and economic problem. The equalisation of the prevalence rates of atopic dermatitis in inhabitants of rural and urban areas may reflect an increase in the prevalence of other atopic diseases in this population and the disappearance of differences between rural and urban areas.

Key words: atopic dermatitis, epidemiology, prevalence, risk factors

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Introduction

Atopic dermatitis is known by many names in the medical literature: from intrinsic atopic eczema to prurigo. It is characterised by persistent pruritus and inflammatory skin changes of typical morphology and location depending on age. Of the classical triad of atopic diseases, atopic dermatitis manifests earliest in the patient's life and its presence increases the risk of developing other atopic disorders. Atopic dermatitis affects mainly children with 57% of patients having been diagnosed by 1 and 87% by 6 years of age. After puberty 60–90% of the patients go into remission [1–3] with

as much as 40–60% developing allergic respiratory diseases in later lives [2]. The most recent epidemiological reports from Europe estimate the prevalence rate in children at 12–26% [4].

The aim of the study was to determine the prevalence of atopic dermatitis in the general population of the Łódź province, Poland, and to attempt to identify the risk factors for this disease entity.

Material and methods

The study was conducted in 1998–1999 in three randomly selected regions of the Łódź province, Poland, differing in the degree of urbanisa-

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tion and the level of environmental pollution, namely Łódź–Śródmieście (Region 1, the central district of Łódź), Konstaktyńów (Region 2) and the community [gmina] of Brójce (Region 3). The city district of Łódź–Śródmieście is the centre of a city with the population of 800 thousand inhabitants, the highest degree of urbanisation and the highest mean annual levels of air pollution with suspended dust ($38 \mu\text{g}/\text{m}^2$) and SO_2 ($18 \mu\text{g}/\text{m}^3$) (data recorded in the study period). The main lines of road transportation joining northern with southern and eastern with western Poland run through this district. Konstaktyńów is a town of 20 thousand population bordering with Łódź. The level of air pollution with dust and SO_2 is $24.1 \mu\text{g}/\text{m}^2$ and $15.5 \mu\text{g}/\text{m}^3$, respectively. The community of Brójce consists of mainly rural areas 18 km away from Łódź inhabited by about 2000 people. The mean annual level of air pollution with dust and SO_2 was $21.6 \mu\text{g}/\text{m}^2$ and $11.8 \mu\text{g}/\text{m}^3$, respectively. The study population consisted of people aged between 3 and 80 years. The draw was conducted in two stages. The first stage, based on the table of random numbers, involved the selection of regions whose area covered the addresses of district health centres within areas of different degrees of air pollution determined on the basis of data received from sanitary and epidemiological units. The second stage involved a random draw of addresses of flats or houses from the list of all addresses within the range of operation of selected district health centres. The draw was performed by the Provincial Statistical Office using a random number generator according to the approach of simple random sampling without replacement. The list of persons registered as residents at the drawn addresses was made available by the Field Databank. All the patients were requested to provide demographic and clinical data in questionnaires developed by the Polish Society of Allergologists based on ISAAC and ECRHC questionnaires, the study by Sawicki, Quak and the ALA report (living conditions questionnaire, screening questionnaire for adults [over 16 years of age], detailed questionnaire for adults, questionnaire for children [up to 16 years of age], questionnaire for unexamined subjects). In addition, in order to evaluate the prevalence of atopy all the surveyed subjects received skin prick tests using a set of 10 commonly occurring aeroallergens: *Dermatophagoides pteronyssinus*, *Dermatophagoides farinae*, grass pollen mix, *Artemisia* pollen, rye pollen, hazel pollen, birch pollen, cat dandruff, *Alternaria* and *Cladosporium* spores (Allergopharma). Positive results were defined as wheal diameters of at least 3 mm versus negative

control. Appropriate washout periods before performing the skin tests were employed. If the performance of the tests during completion of the questionnaire was not possible, another visit was scheduled.

The diagnosis was made by the study coordinator at the study site (Norbert Barlicki Memorial University Teaching Hospital No. 1 in Łódź, Medical University in Łódź, Poland) based on the answers to questions in the questionnaires, test results, medical expertise in accordance with the criteria published by Hanifin and Rajka and in line with the applicable guidelines for the diagnosis of atopic dermatitis.

All the statistical analyses were performed separately for children and adults. The study group characteristics were summarised by descriptive statistics (mean, standard deviation, median, range and percentage).

The prevalence of allergic diseases in the study group was evaluated by fraction estimation with the probability of 0.95. Quantitative data were analysed by means of ANOVA and non-parametric tests (chi-square and Fisher's exact tests) were used to analyse qualitative variables. Results were considered statistically significant at the P value of less than 0.05.

The relative risk of an allergic disease as a result of exposure to the putative aetiological factor was estimated by means of the odds ratio. Odds ratios exceeding 1 whose left-sided limit of the confidence interval exceeded 1.00 ($P < 0.05$).

The statistical analysis was performed using the following statistical software packages: Statistica (Microsoft) and Epi Info (WHO, World Health Organisation).

Results

We examined 1351 of the 1522 randomly sampled patients, 1340 of whom (283 children and 1057 adults) were subsequently included in further analysis. The study group was representative for the population of the Łódź province in terms of age and sex. Very high probability values were obtained for both variables in the study group in relation to the general population: 97.6% for sex and 90.8% for age.

Persistent pruritus was reported by 10.3% of adults with 6.6% patients reporting its presence over the 12 months preceding the study and 8.5% reporting it being accompanied by skin changes. These symptoms were significantly more common in women living in the city centre ($P = 0.0015$ and $P = 0.003$ for pruritus and skin changes, respecti-

Table 1. The prevalence of dermal signs and symptoms in the general population depending on sex in adults and children

	All	Adults		Comparison (W/M)
		Women	Men	
Number of responders	1057 (100%)	606	451	p
— whenever itching	109 (10.3%)	78 (12.9%)	31 (6.9%)	0.0015
— whenever itching and lesions different than after scratching	70 (6.6%)	52 (8.6%)	18 (4.0%)	0.003
	All	Children		Comparison (W/M)
		Girls	Boys	
Number of responders	283 (100%)	132	151	p
— whenever itching exanthema during 6 months	24 (8.5%)	8 (6.1%)	16 (10.6%)	0.087
— itching exanthema within last 12 months	12 (4.2%)	4 (3.0%)	8 (5.3%)	0.391

Table 2. The prevalence of dermal signs and symptoms in the general population depending on the living area in adults and children

	All	Adults			Comparison
		Region I	Region II	Region III	
Number of responders	1057	395	327	335	p
— whenever itching	109 (10.3%)	62 (15.7%)	8 (2.4%)	39 (11.7%)	< 0.0001
— itching within last 12 months	70 (6.6%)	38 (9.6%)	6 (1.8%)	26 (7.8%)	0.002
— whenever itching and lesions different than after scratching	90 (8.5%)	49 (12.4%)	8 (2.4%)	33 (9.9%)	0.0002
	All	Children			Comparison
		Region I	Region II	Region III	
Number of responders	283	87	62	134	p
— whenever itching during 6 months	24 (8.5%)	11 (12.6%)	3 (4.8%)	10 (7.5%)	0.199
— itching within last 12 months	12 (4.2%)	5 (5.7%)	0	7 (5.2%)	1.0

vely, in women and $P < 0.0001$ and $P = 0.0002$ for pruritus and skin changes depending on the region of residence) (Tables 1 and 2).

Pruritic rashes persisting for at least 6 months were reported by parents in 8.5% of the children with the skin changes having been present in the previous 12 months in 4.2%. No statistically significant differences were observed in terms of these symptoms between girls and boys (Table 1).

In adults, atopic dermatitis was diagnosed in 0.9% of the cases. No statistically significant differences were observed between men and women in terms of its development (Table 3). We did, however, demonstrate a statistically significantly more common development of atopic dermatitis among the inhabitants of the centre of Łódź (Table 4): inhabiting the city centre increased the risk of atopic dermatitis in adults by 2.3-fold (95% CI 1.16–4.75) (Table 5).

In the group of children the diagnosis of atopic dermatitis was established in 9.2% of the surveyed patients. We showed no statistically significant differences in the prevalence of atopic dermatitis between girls and boys (Table 3) or in the prevalence of this disease between inhabitants of rural and urban areas (Table 4).

One of the risk factors we analysed was the effect of family history of atopic diseases on the development of atopic dermatitis in children. We found that a positive family history of atopic diseases increased the risk of atopic dermatitis in children by 3.69-fold (95% CI 1.40–10.04) and the diagnosis of an atopic disease in siblings increased the risk of atopic dermatitis by as much as 3.55-fold (95% CI 1.41–8.89) (Table 5).

We also observed that exposing children to tobacco smoke at their places of residence increased the risk of developing the disease by 3.4-fold (95% CI 1.19–11.86).

Table 3. The prevalence of atopic dermatitis in adults and children depending on sex

Prevalence of AD in adults									
Adults			Woman			Men			p
n	%	95% CI	n	%	95% CI	n	%	95% CI	
10	0.9%	0.4–1.5	8	1.3%	0.4–2.2	2	0.4%	0–1.1	0.256

Prevalence of AD in children									
Children			Girls			Boys			p
n	%	95% CI	n	%	95% CI	n	%	95% CI	
26	9.2%	5.8–12.6	12	7.9%	3.6–12.3	14	10.6%	5.4–15.9	0.440

Table 4. The prevalence of atopic dermatitis in adults and children depending on the living area

Prevalence of AD in adults									
Region I			Region II			Region III			p
n	%	95% CI	n	%	95% CI	n	%	95% CI	
9	2.3%	0.8–3.8	0	0		1	0.3%	0–0.9	0.034

Prevalence of AD in children									
n	%	95% CI	n	%	95% CI	n	%	95% CI	p
9	10.3%	3.9–16.7	1	1.6%	0–4.7	16	11.9%	6.4–17.4	0.715

Table 5. The risk factors of AD in children

Variable	Risk of AD in children	
	OR	95% CI
Sex		
Female	1	
Male	1.37	0.57–3.32
Family history		
atopic diseases	3.69	1.40–10.04
siblings	3.55	1.41–8.89
parents	1.37	0.52–3.53
grandparents	3.11	1.24–7.74
Animals in the house	1.25	0.52–3.01
Smoking exposition	3.40	1.19–11.86
Living area		
III rural area	1	
city centrum	0.85	0.33–2.17

We did not perform a similar analysis of the risk factors in adults due to the low incidence of atopic dermatitis in this group.

We concluded our analyses by comparing the frequency of epidemiological diagnoses of atopic dermatitis with the frequency of diagnoses established earlier by general practitioners or dermatologists. The degree of underdiagnosis was calculated as the absolute difference between the epidemiolo-

gical diagnosis and patient-reported diagnosis divided by the number of epidemiological diagnoses.

Sixteen out of 26 children (62%) with signs and symptoms of atopic dermatitis had been correctly diagnosed by their GPs or dermatologists, while 9 out of 10 adults were aware of the nature of their disease. No cases of overdiagnosis were noted.

Discussion

Prospective epidemiological studies show that the incidence of atopic dermatitis is growing and that the increase has been especially dramatic in the past 20–30 years. Data from the Łódź province confirm the growing problem of increasing prevalence of atopic dermatitis in the past few years [5]. The disease is estimated to affect about 12% of the general European population and the incidence depends on the age group and place of residence [4]. Atopic dermatitis is a chronic and recurrent illness. The persistent pruritus that accompanies atopic dermatitis and the skin lesions that are disfiguring and embarrassing in some patients considerably reduce the quality of life. In effect, the disease is increasingly perceived as a serious health, social and economic problem. No data on the prevalence of atopic dermatitis in the general Polish

population have so far been available. Our study is part of the national research programme investigating the prevalence of allergic diseases conducted under the patronage of the Polish Society of Allergology in 11 sites in Poland between 1998 and 1999 [6]. The study was carried out in a randomly selected population of the inhabitants of the Łódź province.

In the study the prevalence of atopic dermatitis among the inhabitants of Łódź was estimated at 5.8–12.6% (mean 9.2%) in children and 0.4–1.5% (mean 0.9%) in adults. The diagnosis according to the guidelines for the diagnosis of atopic dermatitis was established by the site coordinator based on the medical history taken from the respondents completing the questionnaires that contained questions about the characteristic clinical manifestations of the disease which were developed on the basis of the diagnostic criteria of Hanifin and Rajka [7]. The differences between the incidence of pruritus and skin lesions in the questionnaires and the established diagnoses result from the lack of typical clinical manifestations in atopic diseases. Both pruritus and inflammatory skin changes of similar morphology and location may occur in other dermatoses (such as contact dermatitis) or be a manifestation of systemic problems (such as lymphoma). In equivocal cases the diagnosis was determined on the basis of clinical examination.

Most epidemiological studies are solely founded on disease questionnaires, such as the ISAAC questionnaire [8]. Diagnostic investigations, such as skin prick tests, and the clinical verification of diagnoses conducted in our study considerably increased the sensitivity and specificity of the method.

Due to the differences in the terminology, diagnostic criteria and research tools, comparisons of the prevalence of atopic dermatitis may be difficult and the results of epidemiological studies may vary significantly. The national programme mentioned above, all the 11 sites employed the same research methods, which made it possible to assess the prevalence of atopic dermatitis against the other provinces of Poland [5]. The prevalence of atopic dermatitis among adults in the Łódź province is lower than the national average (0.9% vs 1.4%) and twice as high as the national average in the case of children (9.81% vs 4.7%). Given the fact that the diagnostic criteria for atopic dermatitis in all the 11 sites were the same, the high prevalence rate in children should be treated as a harbinger of a general increase in the prevalence of this disease in the Łódź province as well as an increase in the prevalence of the other atopic diseases, as atopic dermatitis is a strong predictor of the development of inhalation allergies.

Comparing our results with data from other European countries we can observe that the prevalence of atopic dermatitis in the Łódź province is lower than that in Western Europe and higher than that in Eastern Europe.

In the majority of published epidemiological studies atopic dermatitis was more commonly diagnosed in girls than in boys [9]. This tendency has not been confirmed to be true for the Łódź province or the nationwide study, where the sex ratio was inverse [5].

Positive personal and family history of atopy are the earliest risk factors of allergic diseases to have been identified. The role of IgE in the development of allergic reactions was discovered several decades ago. There are currently no epidemiological studies that would not investigate the effect of atopy on the development of allergic diseases. As already mentioned in the introduction, positive family history increases the risk of atopic dermatitis by 1.5–3.5-fold [9, 10]. In our study, positive family history of atopic diseases increased the risk of atopic dermatitis in children by about 3.5-fold.

Other factors affecting the expression of the disease include: eating habits, allergy to aeroallergens [10], infection [11, 12] and psychogenic factors [13]. A certain role is attributed to the socio-economic status of the child's family [14] and exposure to tobacco smoke [15]. According to Schafer and Ring, the prevalence of atopic dermatitis 18.1% in children of non-smoking mothers and as much as 33.8% in children of mothers who smoked during pregnancy or breastfeeding (OR 2.3) [14].

An interesting finding was the equalisation of the prevalence of atopic dermatitis in children inhabiting urban and rural areas. Similar findings have been reported by Taylor et al. in Ireland [16]. They studied children between 4 and 19 years of age and found that pollenosis was more common in children from urban than in those inhabiting rural areas, while no such difference was found in the case of atopic dermatitis. Atopic dermatitis develops as the first illness of the triad of allergic diseases. The increased prevalence of this disease entity may be a harbinger of the other allergic diseases in a given geographic area. If we were to look for the reasons, we should take into consideration changes in living conditions, including the rural areas, changes in the natural environment caused by the introduction of chemical pesticides in agriculture, changes in eating habits and hygiene and the increasing car traffic. The Israeli example [17] shows just how much the changes in agriculture can affect the development of allergy. This originally desert country has undergone considerable changes in the past 40 years: intensive watering has led

to the creation of areas of blooming vegetation and Israel is now well-known for its modern and efficient agriculture. At the same time the prevalence of allergic rhinitis increased by 20-fold and the disease is currently more common in rural areas. A similar phenomenon has been observed in Switzerland, where the differences in the prevalence of hay fever between urban and rural areas have been decreasing since the 1920s due to the growing degree of motorisation [18]. The same is the case in France [19] and Japan [20]. A high prevalence of atopic dermatitis is currently observed in East Germany, although it was low before the unification [21].

It has recently been demonstrated that protection from allergic diseases is provided by the exposure to rural environment and agricultural production rather than the mere inhabitation in rural areas [22–24]. According to the Finnish study by Kilpelainen et al. [24], there is a difference in the prevalence of allergic diseases in the rural areas between families dealing with agricultural production (lower prevalence) and families without farms. The study showed no differences in the prevalence of allergic diseases between individuals raised in non-farm families in the country and individuals living in the city.

Another factor potentially increasing the prevalence of atopic dermatitis in rural areas is the increased degree of motorisation. The number of cars owned by inhabitants of rural areas has increased in Poland in the recent years. Unfortunately, these vehicles are usually very old, hence emitting considerable amounts of pollutants to the atmosphere. Furthermore, rural areas are crossed by expressways. Morgenstern et al. have demonstrated that air pollution with car fumes is a potent risk factor for allergic diseases, including atopic dermatitis [25]. A Japanese study has also shown a relationship between the prevalence of allergic diseases and exposure to car exhaust fumes [26].

In the developing countries, such as Ethiopia, where civilisation-related changes in the rural environment are delayed in relation to urban areas, the differences in the prevalence of atopic dermatitis between rural and urban areas still hold [27].

Conclusions

The results of our study show that atopic dermatitis is a growing health problem in the Łódź province. They also reveal a phenomenon of equalisation of the differences between rural and urban areas in the prevalence of atopic dermatitis in children, which may be a harbinger of increasing prevalence of the other atopic diseases in this population. These findings require prospective studies.

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