

## CLINICAL REPORT

# Prevalence of Atopic Dermatitis in Korea

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**This study was designed to estimate the prevalence and personal or family history of atopic dermatitis in school children in 3 areas of Korea: urban (Seoul), industrial (Ulsan) and rural (Chuncheon). On the basis of dermatologists' physical examinations and the questionnaires completed by parents or guardians, the prevalence of atopic dermatitis was estimated to be 3.3% in the industrial area, 6.6% in the rural area and 7.8% in the urban area. The frequency of atopic dermatitis decreased with age and was significantly lower in the industrial area than in the rural and urban areas. Key words: atopic dermatitis; prevalence; urban; industrial; rural.**

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Studies on the frequencies of atopic dermatitis (AD) have produced widely varying figures, ranging from 0.3% (1) to 33% (2), which may be due to several factors such as the age of the subjects, the investigative methodology and an environmentally different definition for diagnosis (3). Furthermore, few studies have been performed using dermatologists' physical examinations owing to the time and cost involved.

This study was performed in order to estimate the prevalence and personal or family history of AD in 3 different areas of Korea: Seoul (urban), Ulsan (industrial) and Chuncheon (rural).

## MATERIAL AND METHODS

### Subjects

The study was performed from April 1994 to June 1995 and all clinical examinations were carried out by the same dermatologists. The study subjects were students who were randomly selected and lived in 3 different areas (Seoul, Ulsan and Chuncheon) in Korea. Seoul is relatively urbanized, Ulsan industrialized and Chuncheon rural. The average temperature and relative humidity are 11.8°C and 68% in Seoul, 13.5°C and 70% in Ulsan, and 10.6°C and 72% in Chuncheon, respectively. The subjects were correlated according to their gender and age, and 3 different age groups were chosen for this study (6–8-year-old, 10–12-year-old and 16–18-year-old students). Because of missing data on the questionnaires, 26.1% of the students (2,142/8,212) were excluded from the study. A total of 6,070 students took part in the study.

### Diagnosis of atopic dermatitis

AD was diagnosed using the abbreviated diagnostic criteria of Hanifin (4). The students were diagnosed with AD if they possessed at

least 4 out of the following 5 criteria: pruritus, early age of onset, typical morphology and distribution, chronic or chronically relapsing dermatitis, and personal or family history of atopy (AD, allergic rhinitis and asthma).

### Questionnaire

In addition to the physical examinations by dermatologists, further information was obtained from questionnaires. The questionnaires, covering previous symptoms, age at onset of AD, personal or family history of atopy, were sent home from school with the students to be completed by parents or guardians, and then collected by the teachers. All ambiguous replies were evaluated by the dermatologists.

### Classification of subjects

According to the dermatologists' physical examinations and the questionnaires, the 6,070 students participating in this study were classified into 3 different groups:

1. group I: subjects in whom AD was noted by the dermatologists' physical examinations and the questionnaires at the time of the study;
2. group II: subjects in whom AD was not found to be present at the time of the study but was found, through the questionnaires, to have occurred previously;
3. group III: subjects without AD.

The prevalence is defined as the proportion of a population with AD at the time of the study (group I).

### Statistics

Statistical analyses were performed using the statistical package SAS (Statistical Analysis System). The asymptotic *t*-test for proportions and Duncan's multiple range test were used for data evaluation. A *p*-value of <0.05 was considered significant.

## RESULTS

### Distribution of total subjects by age and gender

A group of 6,070 subjects (50.2% males and 49.8% females) completed the dermatologists' physical examinations and the questionnaires. See Table I for age and gender profiles.

### Prevalence of atopic dermatitis

Based on the dermatologists' physical examinations and the questionnaires, an attempt was made to estimate the differences of the prevalence of AD in 3 areas with different living conditions: Seoul, Ulsan and Chuncheon (Fig. 1). The prevalence of AD was  $6.0 \pm 0.6\%$  in total, and was observed to be age-differentiated, with  $10.0 \pm 1.3\%$  in first-grade primary school students,  $5.4 \pm 0.9\%$  in

Table I. Age and gender profile of the subjects (n= 6,070)

Gender	Age (years)	Seoul	Ulsan	Chunchon	Total
Male	6-8	337	432	252	1,021
	10-12	457	424	272	1,153
	16-18	414	279	179	872
	Total	1,208	1,135	703	3,046
Female	6-8	309	348	248	905
	10-12	425	485	299	1,209
	16-18	543	127	240	910
	Total	1,277	960	787	3,024

fifth-grade primary school students and  $2.5 \pm 0.7\%$  in second-grade high school students. There was a significant reduction in the prevalence with age, and no significant difference in the prevalence of AD was observed between males and females. Of the total subjects, the prevalence of AD was  $7.8 \pm 1.1\%$  in Seoul,  $3.3 \pm 0.8\%$  in Ulsan and  $6.6 \pm 1.3\%$  in Chunchon. There was no significant difference in the prevalence of AD between Seoul and Chunchon, and the prevalence of AD in both Seoul and Chunchon was significantly higher than that in Ulsan ( $p < 0.05$ , Fig. 1). Of the first-grade primary school students, the prevalence of AD was  $17.5 \pm 2.9\%$  in Seoul,  $4.0 \pm 1.4\%$  in Ulsan and  $9.6 \pm 2.6\%$  in Chunchon. The prevalence of AD in Seoul was significantly higher than that in Chunchon, which was also significantly higher than in Ulsan ( $p < 0.05$ , Fig. 1). Of the fifth-grade primary school students, the prevalence of AD was  $6.5 \pm 1.6\%$  in Seoul,  $3.5 \pm 1.2\%$  in Ulsan and  $6.7 \pm 2.0\%$  in Chunchon. The prevalence of AD in Chunchon was not significantly different from that in Seoul, and both were significantly higher than that in Ulsan ( $p < 0.05$ , Fig. 1). Of the second-grade high school students, the prevalence of AD was  $2.6 \pm 1.0\%$  in Seoul,  $1.5 \pm 1.2\%$  in Ulsan and  $3.1 \pm 1.7\%$  in Chunchon. There was no significant difference in the prevalence of AD among the 3 areas in this age group (Fig. 1).

#### Personal or family history of atopic diseases in the population with atopic dermatitis (group I)

Among the total subject group, the frequency of a personal or family history of atopic diseases (AD, allergic rhinitis and asthma) in group I was  $64.7 \pm 5.5\%$ . This frequency of a history of atopic diseases in group I was  $66.7 \pm 7.4\%$  in Seoul,

$70.2 \pm 11.9\%$  in Ulsan and  $56.2 \pm 11.4\%$  in Chunchon. Among the 3 areas, there was no significant difference in the frequency of a personal or family history of atopic diseases.

#### DISCUSSION

AD is a chronic relapsing inflammatory skin disease of unknown pathogenesis, which arises most commonly during early infancy and childhood. It has generally been accepted that the onset of AD occurs before 7 years of age in 80–90% of the cases, and consequently the epidemiology of AD has been studied mostly in children on admission to the first grade of primary school (5). It is, however, problematic that the signs and symptoms of AD at this age would have disappeared from many of those who had exhibited AD in early infancy (5). Therefore, first-grade primary school students aged 6–8 years were included in this study to evaluate the prevalence of AD based on dermatologists' physical examinations and questionnaires.

AD may be classified into 3 phases according to age: infantile (from birth to 2 years), childhood (from 3 to 11 years) and adolescent (from 12 to 20 years)/adult (after the age of 20 years) (6). Although the natural course of AD is highly variable and there is a general tendency towards resolution with age (7), in the present authors' experience it seems that the numbers of patients whose symptoms do not improve with age has recently been increasing. Therefore, the prevalence of AD was also investigated in fifth-grade primary school students aged 10–12 years, as a boundary between childhood and adolescence, and in second-grade high school students aged 16–18 years, representative of adolescence.

In first-grade primary school students aged 6–8 years, the prevalence of AD was 10.0%, which lies between the 8.3% observed in 7-year-old Swedish students in 1975 (8) and 17.3% in 8-year-old German students in the 1990s (9). Studies from 1994 to 1996 have reported a prevalence of AD of 19% in 7–9-year-old Japanese students (10), 2.8% in 6–7-year-old students in Beijing, China (11), 2.0% in 6–7-year-old students in Urumqi, China (11), and 4.2% in 6–7-year-old students in Hong Kong (12). In addition, the prevalence of AD in Thailand was 12.9% in Chiang Mai and 16% in Bangkok (13, 14).

Taylor et al. (15) demonstrated that the overall rates of AD

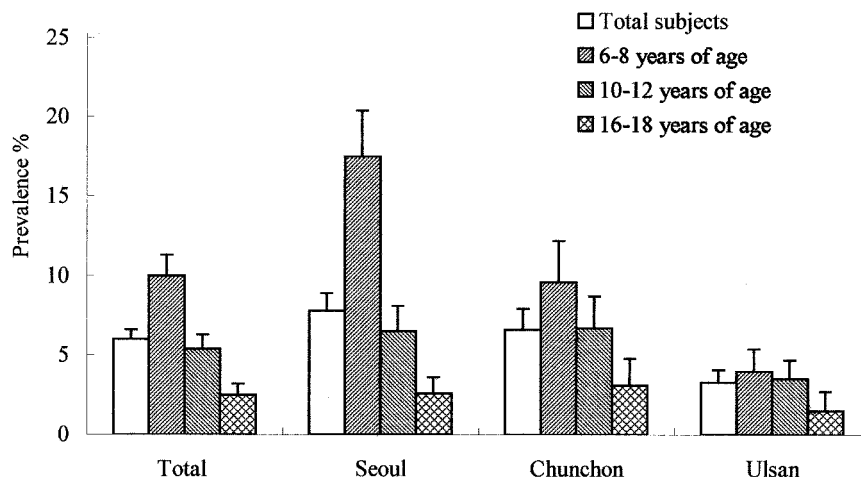


Fig. 1. Prevalence of atopic dermatitis (n= 6,070).

in Great Britain rose from 5.1% in children born in 1946 (assessed at 6 years) to 7.3% in children born in 1958 (at 7 years), and to 12.2% in the 1970 cohort (at 5 years).

The prevalence of AD in fifth-grade primary school students, aged 10–12 years, was 5.4%, which is lower than the 21.4% seen in 9–11-year-old English students in the 1990s (16), 20.1% in 11–13-year-old Hong Kong students in the 1990s (17) and 15% in 10–12-year-old Japanese students in 1994 and 1995 (10). However, it is similar to the 6.1% rate observed in 12-year-old Swedish students in 1975–1976 (18), 7.2% in students in San Bu, China, and 7.6% in students in Kota Kinabalu, Malaysia (18).

In second-grade high school students aged 16–18 years, the prevalence of AD was 2.5%, which lies between the 2.0% rate reported in 16-year-old Swedish students in 1975–1976 (16) and 9.7% in 15–16-year-old Finish students in 1989–1990 (19). The prevalence of AD in 16–18-year-old Japanese students in 1994 and 1995 was 11% (10). It was 11.6% in Australian students (20).

Currently, many researchers are using the protocol of the International Study of Asthma and Allergies in Childhood (ISAAC), which was designed to standardize methodology, and to employ a similar study design in all participating centres (21–23). In a study comparing the difference in the prevalence of AD between the former West and East Germany, using the ISAAC protocol, Duhme et al. (21) reported that the prevalence of AD in 5–8-year-old and 12–15-year-old students was 7.1% and 7.3% in Münster, West Germany, and 7.0% and 6.7% in Greifswald, East Germany, respectively. These data suggest that there were no significant differences in AD prevalence between the 2 areas in either age group (21). In a world-wide study including data from 56 countries, using the ISAAC protocol, the prevalence range for symptoms of atopic eczema in 6–7 year olds ranged from 1.1% in Ilan to 18.4% in Sweden (22). In 13–14 year olds, the prevalence of these symptoms ranged from 0.8% in Albania to 17.7% in Nigeria (22). The highest prevalence values (above 15%) for both age groups were found in urban Africa, the Baltics, Australia, and northern and western Europe (22). The lowest prevalence values (under 5%) were found in China, eastern Europe and central Asia (22). The results of that study suggested that atopic eczema was a major public health concern world-wide, affecting approximately 5–20% of all children aged 6–7 and 13–14 years (22).

From the viewpoint of regional disparity, the prevalence of AD was 17.5% in Seoul, 9.6% in Chunchon and 4.0% in Ulsan in first-grade primary school students aged 6–8 years. Pöysä et al. (24) reported that atopic diseases were less common in an agrarian region than in an urbanized one. Dotterud et al. (25) suggested that the high frequency of AD might be explained by both a subarctic climate and industrial pollution. In a recent study of the prevalence of atopic disease in Scandinavia and eastern Europe, the prevalence was higher in Scandinavia than in Estonia, Latvia and Poland (23). These countries, in turn, had a higher prevalence of atopic disease than 5 other countries of eastern Europe (Albania, Rumania, Russia, Georgia and Uzbekistan), which have cultures less similar to those of western Europe countries (23). This suggests the hypothesis that a “western life style” may be associated with a high prevalence of childhood allergy (23). However, in this study, the prevalence of AD in first-grade primary school students was lower in Ulsan (the recently

industrialized area) than in Chunchon (the rural one), although it was highest in Seoul (the most urbanized area in Korea). Even if the discrepancy cannot be elucidated at this moment and further studies are required, one feasible explanation is that the precise distinction among the 3 areas may be unclear because Chunchon is only recently being gradually urbanized and Ulsan is a recently industrialized area. Besides both indoor and outdoor pollution, increased exposure to allergens through changes in the way of living can be an important cofactor responsible for the increased incidence of atopic diseases (26), and other factors such as psychological influences may contribute to the development of AD.

The frequency of a personal or family history of atopic diseases was calculated to be 58% in a group of 428 German AD patients, of whom 46% suffered from concomitant respiratory allergies (27). In a recent study, 52% of 492 AD patients in Singapore had “pure” AD without concomitant respiratory allergies and 48% suffered from the “mixed” type of AD (28). Of these patients, 23% had allergic rhinitis, 12% had asthma and 13% had both asthma and allergic rhinitis (28). In addition, Wüthrich (29) reported that 48% of their AD patients had pure AD and 52% had the mixed type. Of their patients, 6% had allergic rhinitis, 19% had asthma and 27% suffered from both asthma and allergic rhinitis (29). Of 188 Caucasian AD patients, 48% suffered from respiratory atopy, and atopic diseases existed more frequently in the families of patients suffering from AD accompanying respiratory atopy (83% of the families had atopic numbers) than in the families of patients with AD only (61% of the families had atopic numbers) (30). Tay et al. (28) reported that 47% of the 492 AD patients from Singapore mentioned above had at least 1 first-degree family member with atopic disease: 17% with AD, 15% with asthma and 15% with allergic rhinitis. Although a direct comparison with previous studies which have used different methods is difficult, the present frequency of personal or family history of atopy in 64.7% of AD patients is similar to the results of previous studies (27, 30).

Taken together, the prevalence of AD was as follows: 17.5% in Seoul, 9.6% in Chunchon and 4.0% in Ulsan in first-grade primary school students aged 6–8 years; 6.7% in Chunchon, 6.5% in Seoul and 3.5% in Ulsan in fifth-grade primary school students aged 10–12 years; and 3.1% in Chunchon, 2.6% in Seoul and 1.5% in Ulsan in second-grade high school students aged 16–18 years. In general, the frequency of AD decreased with age and was lower in Ulsan (the recently industrialized area) than in Chunchon (the rural area) or in Seoul (the most urbanized area in Korea). Further evaluation will be required to explain the role of regional background and different living conditions on the development of AD, and more precise information on the frequency of AD may be obtained by conducting a re-examination under the same conditions in 10 years.

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