

# Multicenter Study on the Prevalence of Perennial Allergic Rhinitis and Allergy-Associated Disorders

This study was aimed to determine the prevalence of perennial allergic rhinitis (PAR) using the skin test, radioallergosorbent test (RAST), or multiple allergosorbent test (MAST) and to clarify the clinical aspects of the patients diagnosed as having PAR by the questionnaire survey and rhinologic examination. The 71,120 subjects who had visited the 23 otolaryngology clinics at the randomly selected tertiary referral hospitals in Korea between November 1, 1999 and April 30, 2000 were studied. PAR was diagnosed when subjects complained of two or more associated symptoms and the skin test, RAST, or MAST using perennial inhalant allergens was positive. The questionnaire survey and rhinologic examination were performed in subjects with PAR. The prevalence of PAR was 3.93%. We could find no significant difference in the prevalence of PAR between the two sexes. However, there was a significant difference in the prevalence of PAR between the child and adult groups. The chief complaints were, in order of decreasing frequency, nasal obstruction, watery rhinorrhea, and sneezing. There was a family history of PAR in 40.2% of the subjects. The 39.6% of the subjects had associated allergic diseases, being atopic dermatitis most common. In conclusion, the prevalence of PAR in tertiary referral hospitals in Korea is 3.93%. Many subjects with PAR have family history and appear to be associated with other allergic diseases.

Key Words : Prevalence; Rhinitis, Allergic, Perennial; Family History; Dermatitis, Atopic

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## INTRODUCTION

Allergic rhinitis is one of the most prevalent allergic diseases. A number of studies have shown that there has been an increase in the prevalence of allergic rhinitis all over the world in recent years (1, 2). In numerous reports on the prevalence of allergic rhinitis in many countries, the figures were so confusing and did not always coincide with one another, probably due to differences in the populations studied and the diagnostic criteria employed in each study.

Little is known about the incidence and the prevalence of perennial allergic rhinitis (PAR) in Korea. Min et al. reported that the overall prevalence of PAR in Korea in 1991 was 1.14% (3). In U.S.A., 23-yr cumulative incidence of perennial allergic rhinitis in selected college graduates was reported to be 14.0% by Hagi et al. (4, 5).

Unlike the ambiguity of research concerning the prevalence of PAR, its strong familial tendency and its association with other allergic diseases, such as atopic dermatitis, asthma and/or conjunctivitis are relatively well documented (6, 7).

We aimed to determine the current prevalence of PAR and to investigate its symptoms, hereditary tendency, and its asso-

ciation with other allergic diseases by the questionnaire survey and rhinologic examination. This study also revealed many clinical aspects and physical findings regarding PAR.

## MATERIALS AND METHODS

The study population was the subjects who had visited the otolaryngology outpatient clinics at 23 randomly selected tertiary referral hospital out of 43 tertiary referral hospitals in Korea between November 1999 and April 2000. The total number of subjects targeted was 71,120. The male subjects (41,672) ranged in age from 5 to 67 yr (median, 45 yr). The female subjects (29,448) ranged in age from 4 to 71 yr (median, 48 yr) (Table 1).

PAR was diagnosed using the history taking, skin test, radioallergosorbent test (RAST), and multiple allergosorbent test (MAST). Subjects were asked whether they were troubled by sneezing, runny nose, nasal obstruction, and/or itchy nose all through the year recently. When subjects complained of two or more of these symptoms recently, the skin test, RAST or MAST, and rhinologic examination were performed. Sub-

jects with flu were excluded. Flu was diagnosed when subjects had symptoms such as fever, sore throat, or malaise.

The skin test, RAST, or MAST was performed in 4,660 of 71,120 subjects. PAR was confirmed when the skin test, RAST, or MAST showed positive reactions.

The skin test was interpreted as positive when the wheal caused by one of the allergens was the same size or larger than half of that caused by the histamine control.

The result of RAST was taken as positive when the RAST value to one of the allergens exceeded 2.0. The result of MAST was taken as positive when the MAST value to one of the allergens was more than class 2. The skin test, RAST, or MAST was performed using common perennial allergens in Korea: *Dermatophagoides pteronyssinus*, *Dermatophagoides farinae*, cockroach, *Aspergillus*, *Cladosporium*, *Alternaria*, dog fur, and cat fur (8).

Physical examination was done using nasal endoscopes in subjects diagnosed as having PAR. Questionnaire survey was performed in the subjects, regarding symptoms the family history, and the presence of other associated allergic diseases.

## RESULTS

The prevalence of PAR at the tertiary referral hospital was 3.93% (Table 1).

The prevalence in males (4.00%) was slightly higher than that in females (3.82%), but there was no statistically significant difference in prevalence between the sexes.

The 2,796 subjects were divided into 5 age groups by ten year intervals. The 10- to 19-yr-old group had the highest prevalence (6.02%) (Table 1).

**Table 1.** Prevalence of perennial allergic rhinitis according to age and sex

Age (yr)		Number of study population	Perennial allergic rhinitis	
			n	Prevalence, %
-9	male	6,250	185	2.96
	female	5,006	114	2.27
	subtotal	11,256	299	2.65
10-19	male	8,751	628	7.17
	female	6,773	308	4.54
	subtotal	15,524	936	6.02
20-29	male	8,334	406	4.87
	female	6,184	336	5.43
	subtotal	14,518	688	4.73
30-39	male	9,584	247	2.57
	female	5,889	172	2.92
	subtotal	15,473	419	2.70
40-	male	8,753	205	2.34
	female	5,596	95	1.69
	subtotal	14,349	300	2.09
Total	male	41,672	1,671	4.00
	female	29,448	1,125	3.82
	Total	71,120	2,796	3.93

The subjects were divided into two groups: the child group (15 yr or younger) and the adult group (older than 16 yr) (Table 2). The adult group showed higher prevalence (4.11%) than the child group (3.43%) and the difference was statistically significant ( $\chi^2=23.97$ ,  $p<.005$ ). In the child group, the prevalence in males was slightly higher than that in females and the difference was statistically significant ( $\chi^2=14.09$ ,  $p<.005$ ). However, there was no statistically significant difference in prevalence between the sexes in the adult group.

The positivity rate of the skin test, RAST, or MAST in subjects with allergic nasal symptoms was 60.0% (2,796 of 4,660 subjects). The subjects who were diagnosed as having PAR revealed positive reactions to *Dermatophagoides pteronyssinus* in 89.3% and *Dermatophagoides farinae* in 83.3%. Only 1.0% of subjects revealed positive reaction to the *Cladosporium* (Table 3).

The potential environmental factors such as urban residence, high educational attainments and the potential host factors, such as history of breast feeding or single state were frequently detected in subjects with PAR but no statistical meaning could be achieved because we had no information about control groups. The aggravating factors were, in order of decreasing frequency, temperature change (22.9%), dust in the house (21.4%), and windy weather (10.5%) (Table 4). The 25.8% of the subjects with PAR had radiographically proven sinus infection (Table 5).

According to the questionnaire, the most frequent symp-

**Table 2.** Prevalence of PAR according to sexes and child and adult groups

Age (yr)		Number of study population	Perennial allergic rhinitis	
			n	Prevalence, %
-15 (Child group)	male	10,591	413	3.90
	female	8,446	240	2.84
	subtotal	19,037	653	3.43*
16- (Adult group)	male	31,081	1,258	4.04
	female	21,002	885	4.21
	subtotal	52,083	2,143	4.11*

\* $p<.005$  by chi-square test

**Table 3.** The results of skin test, RAST, and MAST (N=2,796)

Allergen	Number of (+) reaction to each allergen	Positivity rate of each allergen
<i>Dermatophagoides pteronyssinus</i>	2,496	89.3%
<i>Dermatophagoides farinae</i>	2,468	88.3%
Cockroach	187	6.7%
<i>Aspergillus</i>	75	2.7%
<i>Alternaria</i>	42	1.5%
<i>Cladosporium</i>	28	1.0%
Cat fur	218	7.8%
Dog fur	70	2.5%

**Table 4.** Potential environmental risk factors in PAR (N=2,796)

Potential risk factors		n (%)
Residency	Urban	2,415 (86.4)
	Rural	381 (14.6)
Marital status	Single	2,025 (72.4)
	Married	771 (27.6)
Educational attainment	Elementary	291 (10.4)
	Junior high	378 (13.5)
	Senior high	1,103 (39.4)
	College	1,024 (36.7)
Aggravating factors	Temperature change	640 (22.9)
	Dust in home	598 (21.4)
	Windy weather	293 (10.5)
	Smoking	363 (13.0)
	Others	892 (32.0)

**Table 5.** Potential host risk factors in PAR (N=2,796)

Potential risk factors		n (%)
History of breast feeding	Yes	2,025 (72.4)
	No	771 (27.6)
Nasal operation history	Yes	546 (19.5)
	No	2,250 (80.5)
Sinusitis in X-ray	Yes	654 (25.8)
	No	2,142 (74.2)

tom was nasal obstruction, followed by watery rhinorrhea and sneezing (Table 6).

Allergic nasal symptoms occurred most frequently in the morning (53.1%), followed by in the evening (27.0%) and throughout the day (18.0%). The 39.2% of subjects complained of sneezings six times or more per day (Table 6). According to the rhinologic examination, variable findings were observed. The most frequent nasal mucosal finding was pale mucosa (57.5%). Edematous mucosa and boggy mucosa were also found in 26.9% and 4.09% of subjects, respectively (Table 6).

In most of the subjects (78.7%), PAR disturbed their everyday lives to a mild degree or less. Only 10.7% of the subjects complained that their everyday lives were seriously disturbed by PAR.

There was a family history of PAR in 40.2% of subjects. The siblings had more chance of having PAR than did parent or grandparent (Table 7).

Of subjects with PAR, 39.4% had other associated allergic diseases, such as atopic dermatitis, asthma, and/or allergic conjunctivitis, being atopic dermatitis (20.9%) most common (Table 8).

## DISCUSSION

A prevalence of 3.93% of PAR was found in this study. This value is almost 2 times greater than the value of 1.14% which was reported previously as the prevalence of perennial

**Table 6.** Various clinical aspects in PAR (N=2,796)

Clinical aspects		n (%)
Main symptom	Nasal obstruction	884 (31.6)
	Watery rhinorrhea	686 (24.5)
	Sneezing	442 (15.8)
	Itching	68 (2.4)
	Others	716 (25.6)
Daily symptomatic attack	Morning	1,504 (53.7)
	Evening	752 (26.9)
	All through the day	504 (18.0)
Frequency of sneezing	Afternoon	36 (1.3)
	More than 11 times	398 (14.2)
	6-10 times	700 (25.0)
	1-5 times	1,300 (46.4)
	No sneezing	398 (14.3)
Nasal mucosal findings	Pale mucosa	1,602 (57.5)
	Swollen mucosa	724 (26.9)
	Boggy mucosa	114 (4.0)
	Bluish mucosa	88 (3.1)
	Others	232 (8.4)

**Table 7.** Family history in subjects with PAR

Family member with PAR	No. of subjects with family history (%)	
Parent only	Father	168 (6.0)
	Mother	150 (5.3)
	Both father and mother	34 (1.2)
	<i>Subtotal</i>	352 (12.5)
Siblings only	378 (13.5)	
Both parents and siblings	250 (8.9)	
Grandparents or grandchildren	56 (2.0)	
Children	38 (1.3)	
Cousin only	19 (0.6)	
Total	1,123/2,796= 40.2 % of total PAR subjects	

**Table 8.** Associated other allergic diseases in subjects with PAR (N=2,796)

Associated allergic diseases	n (%)
Atopic dermatitis	584 (20.9)
Asthma	282 (10.1)
Conjunctivitis	236 (8.4)
Total	1102 (39.4)

allergic rhinitis in 1991 by Min et al. (3). The several explanations for the difference may be as follows. One explanation is actual increase of allergic rhinitis patients. PAR is one of the most prevalent allergic diseases and the number of cases has increased all over the world along with asthma. In U.S.A., 23-yr cumulative incidence of perennial allergic rhinitis in selected college graduates was reported to be 14.0% by Hagy et al. (4, 5). The prevalence of PAR in Swedish 18-yr-old boys preparing for military service almost doubled from 4.4% in 1971 to 8.4% in 1981 (9). The prevalence of PAR in 15-yr-old boys in Geneva increased from 4.4% in 1968 to 6.1%

in 1981 (10).

Although the prevalence of PAR has varied from region to region due to the various diagnostic criteria and different study populations, most reports indicate increasing trends in its prevalence. The factors that might contribute to the increased prevalence of allergic diseases include the exposure to indoor allergens, air pollution, house pets, decreased consumption of fruits, vegetables, and fish, and change of life style, specifically a more sedentary life style than ever before (11). Decreased early viral infection, which has been suggested to protect allergy sensitization, is also considered to be one of the plausible causes of recent increase in PAR (12).

Another explanation is that our study population was drawn from the otolaryngology outpatient clinic visitors who were expected to have higher prevalence than the general population. The other explanation is that Min *et al.* included the pale mucosal findings in the inclusion criteria (3). In this study, the pale mucosa was found in only half of the patients, permitting the possibility of underestimating prevalence at that time.

In this study, no significant difference in the prevalence of PAR was found between the sexes. The age group of 10 to 19 yr accounts for the largest portion (31.7%) of PAR subjects with the highest prevalence (Table 1). Viner and Jackman (13) reported that allergic rhinitis could start at any age and that 30% of their subjects presented with allergic symptoms before the age of 10 yr. The average duration of symptoms of PAR in this study was 76.7 months (6.4 yr) and more than one third of subjects with PAR belonged to the age groups of 0 to 9 yr and 10 to 19 yr. It is thus inferrable in this study that symptoms of PAR can start before the age of 15 yr in one third of subjects. This result is not quite different from that of Viner and Jackman's report.

In this study, the adult group significantly exhibited a higher prevalence than the child group. In addition, this study showed a high prevalence of PAR in both the age groups of 10 to 19 yr and 20 to 29 yr and a relatively low prevalence in the age group of 0 to 9 yr.

In the child group, the prevalence in males was significantly higher than that in females. However, there was no statistically significant difference between the sexes in the adult group although the prevalence in females was slightly higher than that in males. These results coincide with those of other articles. It has been reported that in adolescents, the prevalence of PAR in males is slightly higher than that in females but that with age, the tendency reverses and there is no difference in prevalence of PAR between the sexes overall (14, 15).

In this study, subjects who had allergic symptoms were given the skin test for the common perennial allergens including *D. pteromyssinus*, *D. farinae*, cockroach, *Aspergillus*, *Alternaria*, *Cladosporium*, cat fur, and dog fur and regarded as PAR patients when skin test, RAST, or MAST was positive. The 60% of subjects with allergic symptoms showed posi-

tive reactions to the perennial allergens. The remaining 40% of subjects may be considered as false negative PAR patients, seasonal allergic rhinitis patients, and/or nonallergic rhinitis patients.

This study found that symptoms that bothered the subjects most seriously in decreasing order were nasal obstruction, watery rhinorrhea, and sneezing. It has been reported that among the Korean subjects with allergic rhinitis, nasal obstruction was the most common symptom (16, 17). According to a Southeast London report on perennial allergic rhinitis, nasal obstruction was also the most common and bothersome symptom. However, in patients with seasonal allergic rhinitis, sneezing and itching are more common than nasal obstruction (17).

Hereditary factor and family history are known to play important roles in PAR (11, 17). According to some reports, a subject with family history of allergic rhinitis has a fivefold to sixfold risk of developing the condition (18). Lans' study also reported that, in children without a family history of allergic diseases, the prevalence was 10% or less. However, when both parents are allergic patients, up to 75% of children have allergic diseases (19). In this study, 40.2% of PAR subjects had family history of the same disease. The siblings occupied the larger portion of the family member with the same disease than parents or grandparents (Table 7). It is well known that life-style also contribute to the development of allergic conditions. In this study, the urban residents, single unmarried subjects, and subjects with host factors such as history of being breast-fed and high educational attainment were predominant among subjects diagnosed as having PAR but no statistical meaning could be achieved because this study had no control group.

Urban inhabitants can be considered to be much more exposed to indoor house dust mite and air pollutants, which are known to contribute to sensitization to allergic rhinitis than rural inhabitants. The life in well-developed cities deprives children of many chances of early viral infection, which has been suggested to protect against the subsequent development of allergic diseases (12). High educational attainment and higher affluence can be considered to expose subjects to a more westernized city-life, which may contribute to sensitization to allergic rhinitis. Correlations have been noted between the prevalence of the disease and higher affluence and lower number of siblings (12, 20).

The significant determinants of indoor air quality favoring the development of PAR are house dampness and high indoor humidity, and unmarried subjects have more chances of being exposed to these situations than married ones. In this study, breast-fed subjects occupied 72.4% of subjects with PAR. This may be related to the fact that allergen exposure in early life is important to later development of specific allergic conditions, probably due to the increased immunological vulnerability during the first year of life (21).

Inhalent allergens floating in the air are the most frequent

inducers of asthma, atopic dermatitis, and allergic conjunctivitis, as well as allergic rhinitis. It is inferable that PAR subjects may have other associated allergic diseases. According to this study, 39.4% of subjects having PAR also had other allergic diseases, being atopic dermatitis most common.

As for the nasal mucosal findings of allergic rhinitis subjects, pale and swollen mucosa and watery rhinorrhea are the characteristic features. In this study, the most frequent nasal mucosal finding was pale mucosa (57.5%). Swollen mucosa and boggy mucosa were found in 26.0% and 4.09% of the subjects, respectively. In the nasal cavity, 57.5% of the subjects had watery nasal discharge and 19.7% of the subjects had mucoid nasal discharge.

It would be relatively hard to diagnose a patient as having allergic rhinitis only by nasal mucosal findings because swelling in nasal mucosa was variable.

In conclusion, the prevalence of PAR at the otolaryngology outpatient clinics of tertiary referral hospitals in Korea is 3.93% (4.00% in males and 3.82% in females). The age group of 10 to 19 yr showed the highest prevalence of PAR. About 40% of subjects with PAR have family history and are associated with other allergic diseases such as atopic dermatitis and bronchial asthma.

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