

Prevalence of Japanese Cedar Pollinosis among Schoolchildren in Japan

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Key Words

Allergy · Epidemiology · Prevalence · Japanese cedar · Hay fever · Pollinosis · IgE · Children

Abstract

Background: Japanese cedar pollinosis is an important allergic rhinoconjunctivitis in Japan in spring. We investigated the relationship between the amount of pollen in the air and the prevalence of the disease and sensitization to Japanese cedar pollen in this ecological study. **Methods:** The IgE antibody to Japanese cedar pollen (JCP-IgE) was determined in human serum and rhinoconjunctival symptoms were surveyed in 407–510 children in May or June every year from 1995 to 2001. Japanese cedar pollinosis was defined as being JCP-IgE ≥ 1.5 IU/ml and having any rhinoconjunctival symptom lasting 3 weeks or longer in March or April. **Results:** Prevalence rates of Japanese cedar pollinosis were 13.8–22.9%. Prevalence rates of being JCP-IgE ≥ 1.5 IU/ml were 39.0–50.1%, and those of being JCP-IgE ≥ 15.01 IU/ml were 11.4–23.2%. All prevalence rates were significantly related to the amount of pollen in the air. The proportion of subjects with rhinoconjunctival symptoms was relatively constant in each stratum of low JCP-IgE levels (<0.35 , 1.50–2.99, 3.0–14.9 IU/ml). **Conclusion:**

High exposure to Japanese cedar pollen was associated with higher levels of JCP-IgE antibody and a high prevalence of Japanese cedar pollinosis. The relationship between the level of JCP-IgE and the proportion of subjects with symptoms was relatively constant.

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Introduction

Japanese cedar pollinosis is a common allergic rhinoconjunctivitis in Japan in spring. Due to climate variation, the production of Japanese cedar pollen (JCP) and pollen in the air varies widely from year to year, as does the prevalence of disease. This ecological study was conducted to evaluate the relationship between the amount of pollen in the air and the prevalence of Japanese cedar pollinosis, the level of serum antigen-specific IgE antibody and rhinoconjunctival symptoms.

Subjects and Methods

The study base included children from primary and junior high schools in a rural town in southern Kyoto Prefecture, Japan. Most children in the town attended those schools. Study samples were made up of 407–510 children (80.5–87.0% of the study base) who

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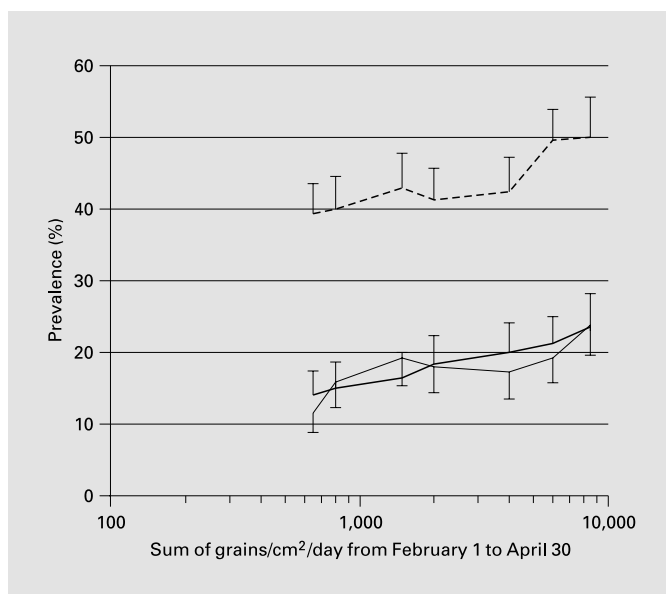


Fig. 1. Prevalence of Japanese cedar pollinosis (—) and sensitization to Japanese cedar pollen. The x-axis shows the sum of the numbers of pollen grains per square centimeter on the glass slide that was set outside for 24 h using a Durham sampler (from February 1 to April 30). The counts were 5,941, 663, 2,007, 799, 4,129, 1,488 and 8,369 for 1995 to 2001, correspondingly. --- = Prevalence rate of being JCP-IgE ≥ 1.5 IU/ml; — = subset of JCP-IgE ≥ 15.0 IU/ml (highly sensitized). The ranges show 95% confidence intervals (one side is shown to avoid confusion).

participated in a serum examination and a questionnaire survey during 1995–2001. JCP-specific IgE antibody (JCP-IgE) was measured in May or June every year using the Pharmacia CAP System at SRL, Japan. In the questionnaire, the subjects were asked: ‘Did you have any of the following symptoms this March or April’, the following symptoms being sneezing, nasal discharge, nasal obstruction, itching of nasal mucosa, itching of conjunctiva, watering eyes and eye irritation. They were also asked whether it lasted 3 weeks or longer. ‘Symptoms of Japanese cedar pollinosis (JCPS symptoms)’ had to satisfy the condition that any of the above symptoms lasted 3 weeks or longer in March or April in the study year. A subject who was positive to the JCP-IgE test (≥ 1.5 IU/ml) and had JCPS symptoms was diagnosed as having Japanese cedar pollinosis.

Pollen in the air were counted in the town using Durham’s method. A vaseline-coated glass slide was set outside for 24 h using a Durham sampler and the number of naturally fallen pollen grains collected on the slide was counted. The measurement was presented as the number of pollen grains per square centimeter on the slide [1, 2]. The amount of Japanese cedar pollen in the study year was shown as the sum of the numbers from February 1 to April 30. The counts were 5,941, 663, 2,007, 799, 4,129, 1,488 and 8,369 from 1995 to 2001, correspondingly. The amounts in 1995 and 2001 were thought to be the largest ever observed in Japan. Regarding exposure, the Cochran-Armitage test was used to assess statistically significant trends.

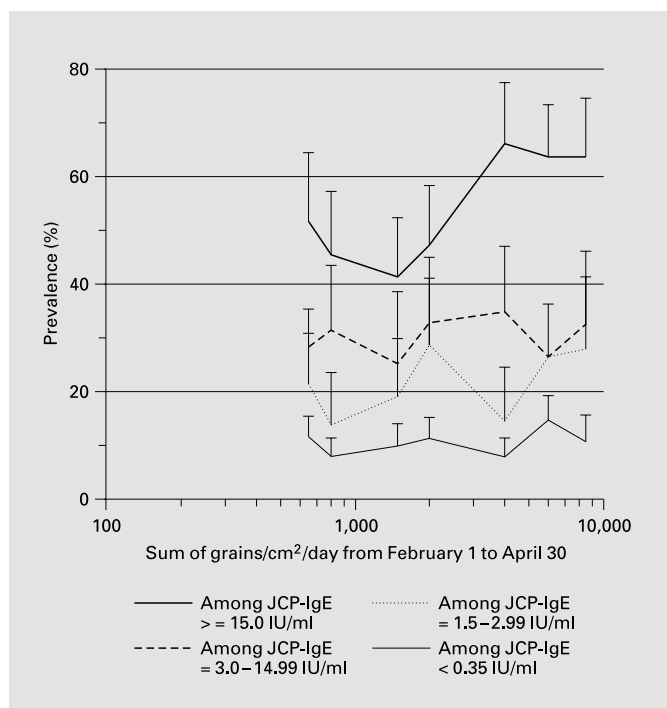


Fig. 2. Prevalence of JCPS symptoms stratified by the specific IgE level to Japanese cedar pollen. JCPS symptoms were defined as having any of the rhinoconjunctival symptoms lasting 3 weeks or longer in March or April in the study year. The lines show the prevalence of having JCPS symptoms among the subjects at specific levels of JCP-IgE antibody. The ranges show 95% confidence intervals (one side is shown to avoid confusion).

Results

Prevalence rates of Japanese cedar pollinosis were 13.8–22.9% during the observation period (fig. 1). Prevalence rates for being JCP-IgE ≥ 1.5 IU/ml were 39.0–50.1%, and those for the subset of JCP-IgE ≥ 15.0 IU/ml (highly sensitized) were 11.4–23.2%. All of these rates were significantly related to the amount of JCP in the air ($p < 0.0001$).

Figure 2 shows the prevalence of having JCPS symptoms at a specific level of JCP-IgE antibody. Around 10% of the subjects without JCP-IgE antibody (< 0.35 IU/ml) had JCPS symptoms. Similarly, around 20% of the subjects with JCP-IgE = 1.5–2.99, and 30% for JCP-IgE = 3.0–14.9 had JCPS symptoms. The rates were not related to the amount of pollen in those three strata ($p = 0.48$, 0.25 and 0.88, respectively). However, the proportion was related to the amount of pollen among highly sensitized subjects (JCP-IgE ≥ 15.0 IU/ml; $p = 0.0006$).

Discussion

The prevalence rate of Japanese cedar pollinosis has been estimated from 5 to 20% in various target populations in Japan [3]. However, only a small number of studies has been conducted using serum IgE examinations of schoolchildren in a general population. Among recent studies, Mori [4] for example reported that the positive rate of JCP-IgE (≥ 1.5 IU/ml) was 40–50% in schoolchildren aged 7–17 in 1992. Kato et al. [5] also reported that the positive rate of JCP-IgE (≥ 1.5 IU/ml) was 40.4% and the prevalence rate of Japanese cedar pollinosis was 17.1% among junior high school students in 1992–1994.

The prevalence rate of Japanese cedar pollinosis depends on the diagnostic criteria of rhinoconjunctival symptoms. Most questionnaires in previous reports [3–5] assessed the average condition over several years. This means that they cannot identify subjects with symptoms in a specific study year, while our questionnaire has the advantage of identifying them. The prevalence rate we found was consistent with the previous reports.

The Durham sampler is still usually applied for evaluating the amount of pollen in the air in Japan. The measuring method is semiquantitative. Takeuchi et al. [6] reported in a local Japanese journal that the correlation coefficient between the amounts of Japanese cedar pollen in the air measured by the Durham's method and that by

the Burkard sampler was 0.72 during January to May in 1994, and 0.64 during the same period in 1995 [6]. Therefore, the method in this study is thought to evaluate the amount of pollen in the air adequately.

A higher proportion of subjects with elevated JCP-IgE antibody was observed in years with greater pollen levels in this study. In a longitudinal study of the same individuals, a fluctuation in JCP-IgE antibody levels according to the amount of pollen in the air was observed [7]. The prevalence rate of Japanese cedar pollinosis was also related to the amount of pollen in the air. However, the proportion of subjects with JCPS symptoms was relatively constant in each stratum of lower JCP-IgE antibody levels (<15.0 IU/ml), although the amount of pollen varied (fig. 2). The relationship at the level of JCP-IgE ≥ 15.0 IU/ml may be caused by an undefined upper limit. In conclusion, a high exposure to JCP was associated with high JCP-IgE antibody levels, and the high prevalence of Japanese cedar pollinosis is thought to directly reflect the high prevalence of elevated JCP-IgE antibody levels in years with large amounts of pollen in the air.

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