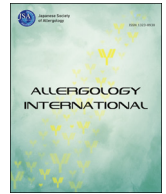




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Original article

## Epidemiology of pediatric allergic diseases in the Ogasawara Islands

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BA, bronchial asthma; AD, atopic dermatitis;

AR, allergic rhinitis; FA, food allergy;

ISAAC, International Study of Asthma and

Allergies in Childhood; ppb, parts per billion

## ABSTRACT

**Background:** The Ogasawara Islands, away from mainland Japan, belong to a subtropical area. Although the daily eating habits and food are relatively similar to that on the mainland, the living environment is quite different. The prevalence of allergic diseases in the Ogasawara Islands is unknown. This study aimed to identify the prevalence of allergic diseases in the Ogasawara Islands.

**Methods:** A survey was conducted among all children belonging to preschool, elementary school, and junior high school in the Ogasawara Islands. A questionnaire was prepared in accordance with the International Study of Asthma and Allergies in Childhood (ISAAC) core written questionnaire in bronchial asthma (BA) and the West Japan Study of Asthma and Allergies in Childhood core written questionnaire for atopic dermatitis (AD), allergic rhinitis (AR), and food allergy (FA). At the same time, height, weight, duration of dwelling on the island, home environment, lifestyle, and exercise habits were also asked.

**Results:** The target population comprised 352 children, of whom 284 (80.6%) completed the questionnaires. The current prevalence was 9.3% for BA, 4.3% for AD, 17.8% for AR, and 3.0% for FA. Significantly lower rates of current BA and AD were observed compared to previous reports from Japan. The percentage of children belonging to sports clubs, and exercising more than 3 times per week at the Ogasawara Islands is higher compared with the national average.

**Conclusions:** The lower prevalence of BA and AD in the Ogasawara Islands implies the influence of differences in the living environment and exercise habits.

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## Introduction

The Ogasawara Islands, consisting of many uninhabited islands and two manned islands named Chichijima and Hahajima, are located 1000 km south of mainland Japan (Fig. 1). The total area of the Ogasawara Islands is approximately 100 km<sup>2</sup>, with an annual mean temperature of 23.2 °C, an annual mean humidity of 77%, and an annual amount of precipitation of approximately 1292 mm. Approximately 2500 people live in the Ogasawara Islands and the percentage of the population younger than 15 years is 18.8%. The major industries are tourism, agriculture, and fishery, and there are hardly any secondary industries in the Ogasawara village. The Ogasawara Islands, in contrast to mainland Japan, belong to a

subtropical area and the living environment is significantly different. Various natives live in Ogasawara Islands, and it's called "the Oriental Galapagos Islands." The means of transportation to the Ogasawara Islands is solely by a weekly ship. Because of the subtropical climate, cedars do not exist in the Ogasawara Islands. However, the daily eating habits and foods are relatively similar to that of the mainland because essential food items are transported from the mainland to the island by ship. The first author of this article worked as a physician in the Ogasawara Islands from 2010 to 2012. Although an increasing prevalence of allergic diseases among Japanese children has been recently reported,<sup>1</sup> this author was under the impression that the number of patients with allergic disorders was small in the islands at that time. The prevalence of allergic disease in the Ogasawara Islands is unknown. Moreover, the author believed that these islands might be suitable for the identification of environmental or lifestyle factors contributing to the development of allergic diseases as they comprise the same races with relatively similar eating habits as people on the mainland. This study aimed to identify the prevalence and highly

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**Fig. 1.** Location of the Ogasawara Islands. The Ogasawara Islands are located at a distance 1000 km south of mainland Japan. They extend from latitude 20° 25 min north to 27° 40 min north and from longitude 136° 04 min east to 153° 59 min east. The star marks the Chichijima, the biggest island in Ogasawara.

correlated factors of pediatric allergic diseases in the Ogasawara Islands, with a specific focus on the environment and lifestyles.

## Methods

### Subjects

The survey was conducted among all children in preschool, elementary school, and junior high school in the Chichijima and Hahajima islands. The distribution, response, and collection of survey questionnaires were done in December 2012 through the schools.

### Questionnaire

The questionnaire was prepared in accordance with the International Study of Asthma and Allergies in Childhood (ISAAC)<sup>2</sup> core written questionnaire Japanese version in bronchial asthma (BA) and West Japan Study of Asthma and Allergies in Childhood (WJSAAC)<sup>3</sup> core written questionnaire in atopic dermatitis (AD), allergic rhinitis (AR), and food allergy (FA) (Fig. 2). Height, weight, duration on the island, home environment, smoking habits in the family, lifestyle, and exercise habits were also asked at the same time. The obesity rate was calculated with the method of the Ministry of Education, Culture, Sports, Science and Technology in Japan,<sup>1</sup> and the obesity trend was defined as  $\geq 20\%$ .

### Ethical considerations

A study plan was created in accordance with the guidelines of ethics of an epidemiology investigation made by Ministry of Health, Labour and Welfare, and Ministry of Education, Culture, Sports, Science and Technology. The ethics committee of Ogasawara village, Tokyo approved the study protocol. The questionnaire was carried out using an unsigned method to maintain anonymity of the participants. Prior to filling out the questionnaire, all participants in the study provided informed consent. The children in the

older age group completed the questionnaire on their own, while the children in the younger age group completed it by taking help from their parents.

### Statistical analysis

The background and each item in the questionnaire were analyzed using frequency distribution and percentages for categorical variables, and the mean and standard deviation for the continuous variables. Chi-square tests were used for associations between categorical variables. A two-sided significance level was set at 0.05. All statistical analyses were performed with the IBM SPSS version 22.0.0 (IBM Corp. Armonk, NY).

## Results

Of the two preschools, two elementary schools, and two junior high schools on the Chichijima and Hahajima islands approached for study participation, all institutions decided to participate. Target population comprised 352 children, and 284 children (80.6%) completed questionnaires. Of the 284 children that we were able to analyze, 152 (53.5%) were boys, and 130 (45.8%) were girls. The gender could not be determined in two children. Of the 284 children, 99 children (35%) were in preschool, 142 children (54%) were in elementary school, and 43 children (15%) were in junior high school. Of the 284 children, 212 children (75%) lived on the Chichijima island, and 72 children (25%) lived on the Hahajima island (Table 1).

### Bronchial asthma

The estimated lifetime BA prevalence was 20.0% and the current BA prevalence was 9.3%, of which 12.2% of patients were in preschool, 7.8% were in elementary school, and 7.0% were in junior high school (Fig. 3A). Of 26 current BA children, 16 (61%) were boys. The prevalence tended to be lower in older children. The percentage of severe asthma, frequent wheezing, and sleep disturbance showed a

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