International Journal of Pediatric Otorhinolaryngology 89 (2016) 33–37

Contents lists available at ScienceDirect

International Journal of Pediatric Otorhinolaryngology

journal homepage: http://www.ijporlonline.com/

Allergic sensitization prevalence in a children and adolescent population of northeastern Greece region

Michael Katotomichelakis [a, *], Gerasimos Danielides [a], Theodoros Iliou [b], George Anastassopoulos [b], Christos Nikolaidis [c], Efthimios Kirodymos [a], Evangelos Giotakis [d], Theodoros C. Constantinidis [c]

[a] Department of Otorhinolaryngology, Medical School, Democritus University of Thrace, Alexandroupolis, Evros, Greece
[b] Laboratory of Informatics, Medical School, Democritus University of Thrace, Alexandroupolis, Evros, Greece
[c] Laboratory of Hygiene and Environmental Protection, Medical School, Democritus University of Thrace, Alexandroupolis, Evros, Greece
[d] Department of Otorhinolaryngology, Facial Plastic and Reconstructive Surgery, Städtisches Klinikum Karlsruhe, Karlsruhe, Germany

ARTICLE INFO

Article history:
Received 14 May 2016
Received in revised form
20 July 2016
Accepted 21 July 2016
Available online 25 July 2016

Keywords:
Allergic rhinitis
Childhood
Adolescent
Co-sensitivities
Prevalence
Skin prick test

ABSTRACT

Objectives: To evaluate the prevalence of allergic sensitization in a childhood and adolescent population, to explore age- and gender-specific variations and finally to discover co-sensitivities among allergens.
Methods: A two-stage cross-sectional survey among school-aged children. The two stages of the study involved enrollment of schools and then skin prick testing (SPT) within schools. A total of 675 school children were included in the study. Of those, 231 were diagnosed with allergic rhinitis (AR), according to the medical history as provided by parental-completed questionnaires and positive SPT results. The antigen panel consisted of common allergens and more specifically *house dust mites-HDM* (*Dermatophagoides farinae and Dermatophagoides pteronyssinus*), *grass mix*, *trees* (*olive*, *cypress and pine*), *weeds* (*Parietaria* spp.), *cat* and *dog* epithelium and *moulds* (*Alternaria* spp., *Cladosporium* spp.). The SPT sensitivity was graded according to SPT-USA Standards.
Results: The overall prevalence rate of AR was 34.22%. In total, 93 school children (40.3%) were mono- and 138 (59.7%) were poly-sensitized. Overall, the most prevalent sensitizations in decreasing order were to *HDM* (59.74%), to *grasses* (48.9%), to *Alternaria* (34.6%) and to *olive* (14.71%). There were no age- and sex-specific differences, except for *Alternaria* mould that showed a significant prevalence among primary school-aged children and predominance in the female gender, by contrast to *grass* pollen allergy that was predominant to males. A 32% of SPT-positive individuals were not aware of their allergy, with no statistically significant differences between ages. Co-sensitivities were detected for *grass* pollens and *pine* and *olive* trees, for *Alternaria* and *Cladosporium* moulds, for *cypress* and *pine* trees, and finally for *dog* and *cat* danders.
Conclusions: Given data among school-aged children should be a baseline from which to monitor disease trends and is considered important for the optimal management of AR patients.

1. Introduction

Allergic rhinitis (AR) represents a common problem in both childhood and adolescence [1], with a negative impact on patients' quality of life (QoL) [2] and furthermore a considerable socioeconomic burden [3,4]. It has been described as one of the three most important public health problems worldwide [5]. Typically, patients can be diagnosed as having AR on the basis of rhinitis symptoms in the presence of sensitization [6]. The allergens mostly involved are *house dust mites (HDM)*, *grass*, *tree* and *weed* pollens, *cat* and *dog* epithelia and finally *moulds* [7]. There is a wide variability described in the literature, concerning the sensitivity rates among populations not just between different regions and countries but also between geographic regions in the same country [5,8]. This can be mainly attributed to environmental factors (economic development, dietary habits, climate, and pollens) that possibly cause these variations [1]. Based on the finding that prevalence in

* Corresponding author. Alexandroupolis University Hospital, Alexandroupolis, 68100, Greece.
E-mail address: katotomihelakism@yahoo.gr (M. Katotomichelakis).

http://dx.doi.org/10.1016/j.ijporl.2016.07.027
0165-5876/

children is much higher than in adults [9], early diagnosis and screening are clinically significant, especially in sight of future co-morbidity prevention (e.g. asthma, chronic rhinosinusitis, nasal polyps etc.). Epidemiologic studies are, thus, of great importance, since they can help monitor disease trends and optimize patient management.

Despite this realization however, there is very limited data concerning the epidemiology of allergic disorders in Greece [10–13]. Furthermore, there are no recent epidemiological studies performed at primary and secondary school-aged children. Especially for the large area of Eastern Macedonia and Thrace (NE Greece), this is the first study ever to be presented.

The aims of this study were: i) to evaluate the prevalence of allergic sensitizations to common allergens, based on Skin Prick Test (SPT) results, from a cohort of children living in this area of Greece, ii) to explore variations of prevalence by age and gender, iii) to detect SPT's sensitivity scores to allergens, and finally iv) to discover co-sensitivities among allergens.

2. Materials & methods

2.1. Study area

This work is the first part of a two-stage, cross-sectional study in school-aged children, living in a region of NE Greece. It was carried out by the Rhinology team of the Tertiary University Hospital of Evros. The study area is situated in the Evros region, in the Eastern Macedonia and Thrace Evros regional unit (NE Greece). The climate in the region is typical Mediterranean with an average daily temperature of 17 °C, a relative humidity of 57% and mostly southern winds. Its ecology includes forests and shrubs that dominate most parts of the surrounding environment.

2.2. Study group and sampling technique

In total, 843 children were invited to participate. The response rate was 82.1% (151 refused to participate) and 17 children were excluded from the study. Among the 675 children who participated, 231 (34.2%) were diagnosed with AR. The diagnosis was based on medical history as provided by their parents and confirmed by the positive SPT results. All children lived in the same area for a long time period. Criteria for exclusion were history of anaphylaxis or angioedema and dermographism and recent use of oral or nasal corticosteroids for 4 weeks prior to inclusion and oral antihistamines for 1 week prior to SPT. All patients fulfilled the criteria of AR according to the 2008 ARIA guidelines [6].

The sampling technique that was used is stratified random sampling. Our study of the public schools in the geographic region involved two stages. The first stage of the study included the registration of schools. For this reason, a list of all public schools in the study area was obtained from the General Directorate of Education of Evros region. After registration, all schools were invited to participate with a letter of explanation to the head teachers outlining the aims of the study and the following procedures. Additionally at the same time, the parents of the children received via the school, a letter explaining clearly the significance of the study and the following procedures, a consent form and a questionnaire, which they were invited to complete and return to the class teacher. The parental-completed questionnaires involved questions concerning childhood disease and family history, as well as demographic characteristics of the study group (age, gender, place of residence, concomitant diseases etc.). Permission to perform this study was obtained from the local educational authorities and from the respective school head teachers. The study protocol was also approved by the local Institutional Review Board. All parents were asked to give their signed informed consent, too.

After the enrollment of schools participating in the study, we went further to the second stage that included SPT conducted by doctors within randomly selected schools. SPTs were evaluated as described by the European Academy of Allergy and Clinical Immunology [14]. The antigen panel consisted of common allergens, according to the environmental characteristics of the area [10,11] and more specifically *HDM (Dermatophagoides farinae and D. pteronyssinus)*, *grass mix*, *trees (olive*, *cypress and pine)*, *weeds (Parietaria* spp.*)*, *cat and dog epithelium* and *moulds (Alternaria* and *Cladosporium* spp.*)*. The SPT sensitivity was graded as provided by Demoly et al. [15] according to the SPT-USA Standards (SPT: neg = 0 reaction, 1+ = 1 mm wheal above saline control; 2 + = 1–3 mm wheal above saline control; 3 + (the first point we consider a positive reaction) = 3–5 mm wheal above saline control plus an accompanying flare; and 4 + = > 5 mm wheal above saline control, plus an accompanying flare).

2.3. Statistical analysis

Statistical analysis of the data was performed using the Statistical Package for the Social Sciences (SPSS), version 22.0 (IBM). Descriptive statistics were used to describe the main features of our study group. Co-relations among allergens were detected by bivariate correlation analysis using the Spearman's rank correlation coefficient. Finally, a cross tabulation analysis (contingency table analysis) was used to display the frequency distribution of age and gender for each allergen, discovering interrelations and any interaction between the sensitivities to allergens and age and gender of the study group.

3. Results

3.1. Study group characteristics

The total study group included 675 children. Among them a total of 231 showed sensitization (34.2%). Of those, 117 (50.6%) were males and 114 (49.4%) were females. According to age, 166 (71.9%) were primary school children (6–11 years old), whereas 65 (28.1%) were secondary school children (12–17 years old). A 37.7% of SPT-positive individuals reported a family history of allergies. In total, 32% of SPT-positive individuals were not aware of their allergy, with no statistically significant differences between ages (32.5% in primary school children vs 30.8% in secondary school children). The characteristics of the study group are presented in Table 1.

3.2. Sensitizations

According to SPT results, 93 children (40.3%) were mono-

Table 1
Demographic characteristics of AR children group.

	AR Patients (n = 231)
Sex, [(%)]	
Male	117 (50.6%)
Female	114 (49.4%)
Age	
6–11 years old	166 (71.9%)
12–17 years old	65 (28.1%)
Sensitizations	
Monosensitization	93 (40.3%)
Polysensitization	138 (59.7%)
Family history	87 (37.7%)
Aware of allergic disease	74 (32%)
Asthma presence [(%)]	37 (16%)