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Original article

Chenopodium album is a remarkable allergen pointing to allergic rhinoconjunctivitis in children

Chenopodium album est un allergène remarquable de rhinoconjunctivite allergique chez les enfants

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ABSTRACT

Allergic rhinitis and asthma are highly related to indoor and outdoor allergens. A common weed, *Chenopodium album* is one of these outdoor aero-allergens. In the literature, data about specific characteristics of children with *C. Album* sensitization is limited. In this study, we aimed to evaluate demographic and clinical characteristics of patients with *Chenopodium album* sensitization in a cross-sectional study. The patients and two control groups included in the study were found to be sensitized to *Chenopodium album* following skin prick tests in an allergy clinic over a period of one year. The patients and control groups completed a questionnaire consisting of items regarding demographics and clinical characteristics. The frequency of *Chenopodium album* sensitization was 9.4% (47/502). The distribution of these patients diagnoses was: 48.9% allergic rhinoconjunctivitis (ARC), 19.1% allergic rhinitis (AR), 12.8% ARC + asthma, 8.5% asthma, 4.3% asthma + AR. Allergic rhinoconjunctivitis was statistically higher than in the control groups ($P: 0.008$, $P: 0.001$). Allergic rhinitis symptoms and ocular symptoms occurred together in 51% during the pollination period of *Chenopodium album*, whereas 17% of the patients were asymptomatic between August-September. Forty percent of the patients had accompanying sensitization to animal dander (cat and/or dog dander), which was statistically high compared to control group 1 ($P: 0.001$). In conclusion, *Chenopodium album* sensitization is highly related to rhinoconjunctivitis. Children with ocular symptoms must be evaluated for *Chenopodium album* sensitization. These children can also be expected to have a high animal dander sensitization rate.

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R É S U M É

La rhinite allergique et l'asthme sont étroitement liées aux allergènes intérieurs et extérieurs. Une mauvaise herbe commune, *Chenopodium album* est l'un des aéroallergènes d'extérieur. Dans la littérature, les données sur les caractéristiques spécifiques des enfants sensibilisés à *C. album* sont limitées. Dans cette étude, nous avons cherché à évaluer les caractéristiques démographiques et cliniques des patients présentant une sensibilisation à *Chenopodium album*. Il s'agit d'une étude transversale. Les patients et deux groupes témoins qui ont été trouvés sensibilisés à *Chenopodium album* lors de tests cutanés en clinique d'allergie au cours d'un an ont été inclus dans l'étude. Les patients des groupes d'étude et de contrôle ont rempli un formulaire de questionnaire comprenant des items sur les caractéristiques démographiques et cliniques. La fréquence de la sensibilisation à *Chenopodium album* était de 9,4 % (47/502). La distribution de ces patients diagnostiqués positifs était : 48,9 % de rhinoconjunctivite allergique (ARC), 19,1 % de rhinite allergique (AR), 12,8 % d'ARC + asthme, 8,5 % d'asthme, 4,3 % d'asthme + AR. La rhinoconjunctivite allergique était statistiquement plus élevée que dans les groupes témoins ($p : 0,008$, $p : 0,001$). La

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conjonction des symptômes de la rhinite allergique et des symptômes oculaires était de 51% pendant la période de pollinisation de *Chenopodium album* alors que 17% des patients étaient asymptomatiques entre août et septembre. Quarante pour cent des patients avaient une sensibilisation associée aux squames animales (squames de chat et/ou de chien), qui était statistiquement plus élevée que dans le groupe témoin 1 ($p : 0,001$). En conclusion, la sensibilisation à *Chenopodium album* est fortement liée à la rhinoconjonctivite. Les enfants présentant des symptômes oculaires doivent être évalués à la recherche d'une sensibilisation à *Chenopodium album*. L'association à un taux élevé de sensibilisation aux squames animales chez ces enfants est également remarquable.

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1. Introduction

Allergic diseases are considered an important public health problem with increasing prevalence. Allergic rhinitis and asthma are related to indoor and outdoor allergens. Weeds are common aeroallergens. One common weed, *Chenopodium album* (*C. album*), is a member of the *Amaranthaceae* family [1]. It is also known as lamb's quarter or goosefoot [2,3]. It can be seen in the temperate areas of southern Europe, western United States and also Saudi Arabia, Kuwait, Iran and the Mediterranean area [1–6]. *C. album* is a perennial plant which flowers between June and October [2]. In some areas, it can begin in May and persist into November [3]. In Ankara, Turkey *Amaranthaceae* pollen can be seen in the atmosphere all year round, but the maximum pollen volume occurs in August and September [7]. *C. album* sensitization in patients with allergic rhinitis is as high as 64% in Kuwait, 31% in hay fever patients in Spain and 23% in asthmatic patients in Saudi Arabia [4,6,8]. In the Trakya region of Turkey, the frequency of sensitization to *C. album* was found to be 4.8% in children [9].

The allergens of *C. album* are Che a1 (an ole e1-like protein), Che a2 (profilin) and Che a3 (polcalcin). Che a1 was found in 77% of the allergic patients [10]. Che a1 showed about 30% identity with Ole e1 because of this IgE cross-reactivity between Che a1 and Ole e1 allergens was limited [2,11].

In the literature, data about specific characteristics of children with *C. album* sensitivity is limited. In this study, we aimed to evaluate the demographic and clinical characteristics of patients with *C. album* sensitization.

2. Materials and Methods

Patients who were found to be sensitized to *C. album* ($n: 47$) in skin prick tests in the allergy clinic between January and December of 2019 were included in the study. Two control groups were also selected randomly from patients on whom skin prick tests had been performed in our clinic during the same period. The first control group ($n: 50$) included patients who had at least one other aeroallergen sensitization other than *C. album*, while the second control group ($n: 44$) included patients who had sensitization to grasses with or without other allergens but not to *C. album*. Patients who did not want to participate in the study or whose laboratory test results were unavailable were excluded.

Skin prick tests were performed with a standard panel consisting of 16 allergen extracts: grass mix, cereal mix, tree mix, *Dermatophagoides pteronyssinus*, *Dermatophagoides farinea*, *Alternaria alternata*, *Cladosporium herbarum*, *Cupressus sempervirens*, *Betula verrucosa*, *Chenopodium album*, *Artemisia vulgaris*, *Ambrosia artemisiifolia*, *Paritaria judaica*, *Felis domesticus*, *Canis familiaris*, *Blattella germanica*, and histamine (10 mg/ml of histamine phosphate) as positive and 0.9% sterile saline as negative controls. Skin prick tests were evaluated 15–20 min after application and were considered positive if the mean wheal diameter was ≥ 3 mm.

Those patients with a positive skin prick test were considered sensitized to that allergen.

Patients in the study and control groups completed a questionnaire form including questions about demographic and clinical characteristics. Serum total IgE (tIgE) and eosinophil values were obtained from hospital records. Levels $\geq 4\%$ were accepted as eosinophilia.

The study was approved by the local ethics committee. Data analyses were performed using Statistical Package for Social Sciences version 22.0. All data were presented as percentages or mean $\pm$ standard deviation (SD). Comparisons between groups were analyzed using Pearson's χ^2 test. $P < 0.05$ was taken as the criterion for statistically significant differences.

3. Results

Forty-seven patients (63.8%, $n: 30$ male) who were found to be sensitized to *Chenopodium album* in skin prick tests between January and December 2019 were included in this study. The average age and the age when symptoms began were 133 ± 48 months and 90 ± 49 months respectively. The frequency of *C. album* sensitivity was 9.4% (47/502). The consanguinity rate was 17.5%, 93% lived in the city and 90% lived in an apartment. Passive smoking was 24.3%. Family atopy was seen in 58.1% of the patients. This was statistically higher than control group 1 ($P: 0.048$) but not control group 2 ($P: 0.069$).

The distribution of these patients' diagnoses were: 48.9% allergic rhinoconjunctivitis (ARC), 19.1% allergic rhinitis (AR), 12.8% ARC + asthma, 8.5% asthma, 4.3% asthma + AR. Allergic rhinoconjunctivitis was statistically higher than in the control groups ($P: 0.008$, $P: 0.001$). A combination of allergic rhinitis symptoms and ocular symptoms was seen in 51% during the pollination period of *C. album*, whereas 17% of the patients were asymptomatic between August and September. Seventeen percent ($n: 8$) of the patients had perennial symptoms and 6 (12%) of these patients did not have any sensitization to a perennial allergen in the skin prick test. In the second control group, which included patients with grass pollen sensitivity, there were only 6 patients who had symptoms in this period ($P: 0.001$). Sensitization to multiple aeroallergens was seen in 97.8% (shown in Fig. 1). Forty percent of the patients had accompanying sensitivity to animal dander (cat and/or dog), which was statistically higher than control group 1 ($P: 0.001$). In the study group, the average tIgE level was 491 ± 241 and the eosinophil percentage was $3.9 \pm 2.8\%$. There was no significant difference in the control groups.

4. Discussion

C. album, one of the main species of the *Amaranthaceae* family, is a cause of allergic symptoms [12]. In this study, we evaluated 47 children with *C. album* sensitization. The frequency of *C. album* sensitization was 9.4%. This was only the frequency of patients

Sensitivity with other allergens

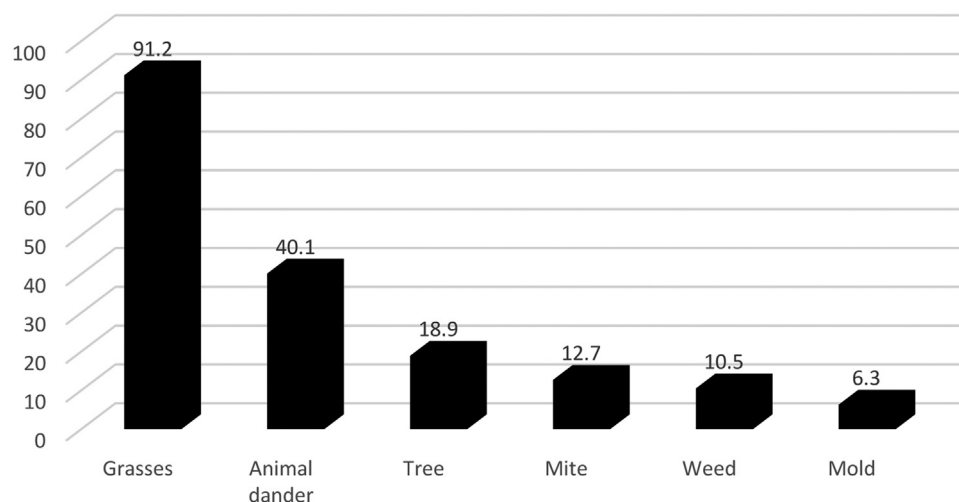


Fig. 1. Distribution of other allergen sensitivities in the study group.

attending our clinic and does not represent the population. In 2003, Ayvaz et al. evaluated 756 children who had undergone skin prick tests in their clinic and only 13 (1.7%) had *C. album* sensitivity in the East Black Sea region of Turkey [13]. With the increase of allergic diseases in recent years, *C. album* has also been drawing attention as a more common allergen.

The most common diagnosis in these children was allergic rhinoconjunctivitis (48.9%+12.8%) and this was statistically significant from the control groups. In Ankara, the maximum pollen volume of the *Amaranthaceae* family is seen in August and September [7]. In these months, 17% of the patients were asymptomatic, and all of them also had grass pollen sensitivity. Cross-reactivity was possible in the patients who had symptoms in spring. Eighty three percent of the patients were symptomatic in August and September and 51% had both allergic rhinitis symptoms and ocular symptoms, which was remarkable. In the second control group, which included patients with grass pollen sensitization, there were only 6 patients who had symptoms in this period ($P: 0.001$). Eight (17%) patients had perennial symptoms and 6 (12%) of these patients had no sensitization to a perennial allergen, which could explain their symptoms. In Ankara, pollens of the *Amaranthaceae* family can be seen in the atmosphere all year round [7]. Some studies with birch and grass pollen, have suggested this persistence of allergenic particles in the environment in order to explain the existence of symptoms outside the pollen season [14,15]. The children with perennial symptoms support these studies. But there is not any study of *C. album* and perennial symptoms. Nearly half of the patients (40.1%) had accompanying sensitization to animal dander (cat and/or dog), which was statistically higher than the control groups. This is also remarkable and there is no information in the literature regarding the frequency of *C. album* and animal dander sensitizations occurring together.

This study has some limitations. Firstly, we didnot perform component resolved diagnosis for these patients so we could not present the Che a1, Che a2 and Che a3 levels of these patients. Secondly, we did not perform a provocation test on these children. Thirdly, the period in which the symptoms occurred was determined according to the patients' discourse and no pollen measurement was performed within the scope of the study for correlation of symptoms and pollen density. The main strength of this study is that, to the best of the authors' knowledge, this is the first study evaluating *C. album* sensitized childrens demographic and clinical characteristics.

In conclusion, *C. album* sensitization is highly related to rhinoconjunctivitis. Children, especially those with ocular symptoms, must be evaluated for *C. album* sensitization. Some patients with *C. album* sensitization may be symptomatic due to the presence of pollen in the atmosphere outside the pollen season. Accompanying high animal dander sensitization rate in these children is also notable.

Context of the study

The work was performed at "University of Health Sciences, Dr. Sami Ulus Maternity and Children Training and Research Hospital".

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Disclosure of interest

The authors declare that they have no competing interest.

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