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Common Inhalant Pollen and Grassesallergens Profile in Patients with Atopic Dermatitis

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Abstract

Atopic dermatitis is a chronic inflammatory skin reaction related to immediate-type hypersensitivity reactions and characterized by eczematous skin lesions. Pollen, of different sources, has been considered as an important causative agent of allergy worldwide. The present study aimed to investigate the sensitivity of atopic dermatitis patients towards different inhalant pollen allergens of grasses and trees. (100) persons of different ages and sexes and suffering from skin symptoms were included and subjected to skin prick testing using standard allergens solutions. The results revealed that (60%) of the tested group have allergic skin reactivity towards allergens used in the current study. Also, sensitization percent was significantly higher in females than in males and all age groups of the study population suggesting a role of the sex hormone. The highest skin reactivity was found against the Salicaceae, of the tree pollens, and five grasses mixture of the grasses pollen. Tree pollens were the main cause of atopic reaction in the studied group. The study concluded that aging and female sex may be major risk factors for developing allergic skin reactions after exposure to tree and grasses pollen. Tree pollens were significantly related to the occurrence of atopic dermatitis in the analyzed patients.

Key words: atopic dermatitis, inhalant tree pollen, grasses pollen, gender, age.

Introduction

Atopic dermatitis (AD) is a persistent inflammatory skin condition worldwide, identified by frequent itching attacks and eczematous lesions of the skin. Some allergic disorders such as rhinitis, asthma, allergic conjunctivitis can be followed by AD (1). AD was found to affect about (20% and 3%) of children and adults respectively globally (2). AD is associated with multiple

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comorbidities, including asthma, allergic rhinitis,2 cardiovascular risks, systemic immune deviation, and malignancy. AD pathogenesis is highly heterogeneous and is influenced by a complex interaction of genes and the environment. A defect in the epidermal barrier and a dysregulation of the immune system are the two primary dysfunctions responsible for the symptoms (3). Besides basophils, eosinophils, and cells of the mononuclear phagocyte lineage, skin lesions mainly contain CD4+ T lymphocytes. Elevated IgE is only found in 60% to 80% of all patients with AD and is therefore not a prerequisite for AD (4). The atopic disorders group includes allergic rhinitis, conjunctivitis, asthma, AD, and food allergies, all of which are distinguished by an increase in susceptibility to the development of sensitivities and allergies to natural antigen arising from domestic dust mites, pollen, pets, or food. Although the causal link between allergic rhinitis and asthma sensitizations against inhalant allergens is evident, sensitivity to these natural environmental antigens is considered less relevant when referring to the induction of AD relapses (5).

Pollens play a major role in the onset of allergies (6). It is approximated that about 40% of allergic patients have been affected by pollens (7). On the other hand, global climate change occurs around the world, including the Middle East. Several studies have shown a significant impact of climate fluctuation on the status of plants of each area and also on aeroallergens and their public and clinical health (8). This reality urges the need for an update, frequency, and distribution of allergenic tree pollens in each region.

Even though AD is associated significantly with food-related allergens, chronic or annual exposure to inhalant allergens like tree pollens and grasses are recently found to cause AD. Due to various extensive experimental work over the last 2 decades, it is now clear that skin-infiltrating inhalant allergen-specific T cells express a TH2-like cytokine pattern in acute skin lesions but can also secrete IFN-γ in chronic lesions (9). Skin barrier deficiencies allow the penetration and sensitization of food or airborne allergens, as well as Staphylococcus aureus, herpes simplex, or other microbial infections. Animal studies indicate that an antigen-presenting cell in the superficial epidermis may make contact with the immune system with environmental allergens, such as mites and food proteins, resulting in sensitization, which may intensify established AD and may also be an important cause of food and respiratory allergies (10).

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In line with the aforementioned studies, by using skin prick testing, the current study aimed to estimate the skin reactivity of patients with AD to tree and grasses allergens and their relationship to age and sex differences in Iraq.

Materials and methods

Study patients:

One hundred patients (50 female and 50 male) aging between (9-50 years old) suspected to have atopic dermatitis and suspected to have allergic reactions towards trees and grasses were included in the present study. Patients with antihistamine drugs or long-term steroid medications, as well as pregnant women were excluded. Also, patients with severe symptoms were avoided in the current study.

Methodology:

Patients were subjected to skin prick testing by using standard tree pollen and grasses allergen solutions manufactured by (ALK co. DK-2970 Hørsholm, Denmark). The standard tree pollen allergen solutions subjected in this study are Saliceae (Poplar and Willow), Betulaceae (Birch, Alder, Hornbeam, and Hazel), three trees mix (Alnus, Betula, and Corylus), *Fraxinus excelsior* (Ash), *Artimasia vulgaris* (Mugwort), Salsola kali (Saltwalt), and Urtica dioica (Nettle). The grasses allergens are different mixtures of grasses including six grasses mix (Dactylis, Festuca, Lolium, Phleum, Poa, and Avena), five grasses mix (Cocksfoot, Sweet, Verna grass, Rye grasses, and meadow), 12 grasses mix (Bentgrass, Bermuda grass, Bromus, Cocksfoot, Yorkshine fog, *Meadow fescue*, Meadow grasses, Rye grasses, Timothy, Sweet vernal grasses, wild oat, and *Olive europaea*), and four cereals (Oat, Wheat, Barley, Maize). Besides, histamine and normal saline solutions were applied as a positive and negative control respectively.

Skin Prick Testing:

All of the tests were carried out by the same person, who had a lot of experience in this area. Both forearms were put to the test. Skin prick tests were conducted according to The European Academy of Allergy and Clinical Immunology guidelines, and Lancets (Allergopharma) were used to puncture the skin (11).

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Statistical Analysis:

Qi square and percentage tests were used to analyze the results and demonstration the different relationships between responses to all allergens used in the study with differences of ages and gender of the patients.

Results:

We found that 60 (60%) of the study population demonstrated sensitivity to at least one of the allergens used in this study, figure (1). Overall, positive skin tests were found more frequently in females (44 %) than in male patients (p = 0.001).

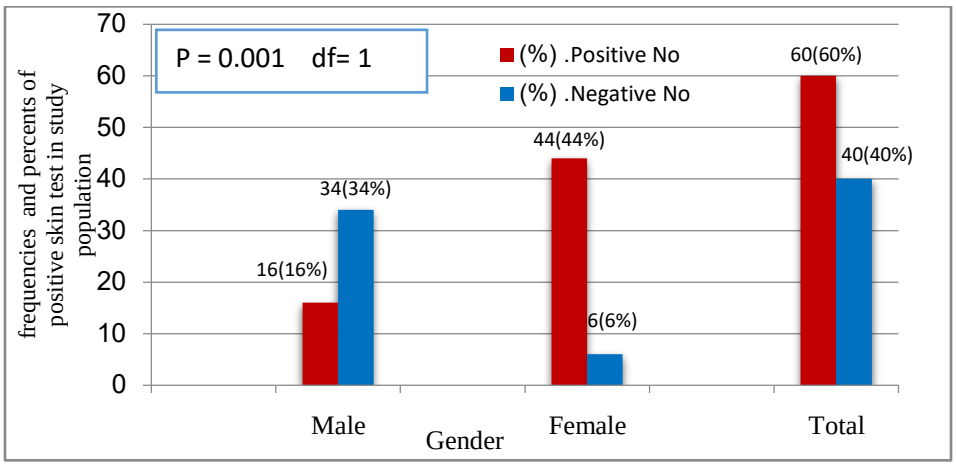

Figure 1: Frequencies and sex differences of patients with atopic dermatitis

The percentage of participants with positive skin, as seen in the table (1), tests increased with aga the analyzed groups, from 9% in the group of (9–20-year-old children) to 18 % in individuals aging between (21-30-year-old), then decreased to 12 % in the population of (31-40-year-old adults), then after, reached to its highest level (21%) in adult patients from the age group (41-50 years old) (p = 0.8). However, the increase in the frequency of sensitization with increasing age was shown to be independent (P = 0.353) of sex to all of the age groups of the study patients as seen in the table (2).

Table 1: Age differences among atopic dermatitis patients

Age Years old	Positive No. (% of total)	Negative No. (% of total)	Total
9-20	9 (9%)	9 (9%)	18(18%)

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21-30	18 (18%)	11 (11%)	29(29%)
31-40	12 (12%)	8 (8%)	20 (%)
41-50	21 (21%)	12 (12%)	33(33%)
Total	60 (60%)	40 (40%)	100(100%)
	Chi-Square=0.98	Df=3	P =0.8

Table 2: Interaction of age and sex in atopic dermatitis patients

Age Years	Gender	
	Male	Female
9_20	4(6.70%)	5(8.30%)
21-30	6(10.00 %)	12(20.00%)
31-40	3(5.00%)	9(15.00%)
41-50	3(5.00%)	18(30.00%)
Total	16(26.70%)	44(73.30%)
	60 (100%)	
Chi-SquareValue =3.53 P =0 .317		Df=3

The Tree pollen allergens associated with atopic dermatitis and their frequencies in the study group are illustrated in figure (2). Salicaceae was the most frequent tree pollen allergen associated with atopic dermatitis with a percent of (21.2%) followed by Betulaceae (16.8%), Mix of three trees and Salsola (15.1%), Artimasia (12.3%), *Fraxinus excelsior* (11.2%) and finally the *Urtica dioica* with the lowest percent of (8.4%).

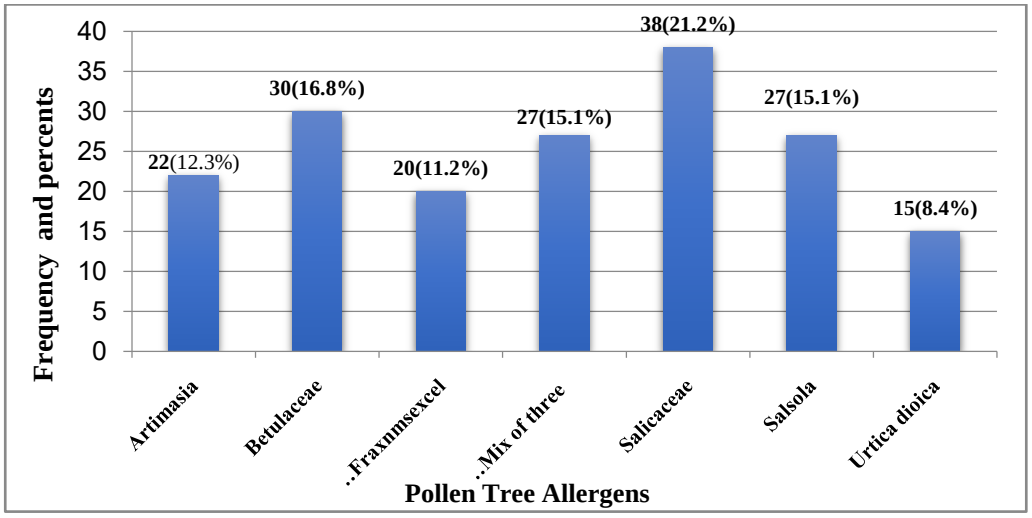

Figure 2: Frequencies and percent of pollen tree allergens associated with atopic dermatitis

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Sensitization to pollen tree allergens in AD patients was found to be different with the differences in the gender of patients, as, the results of the skin prick test seen in figure (3) showing that males with AD are less sensitized than females upon exposure to pollen tree allergens associated with AD (P = 0.01). In females, the percentage of allergen profile in descending order is Salicaceae (15.60%), Betulaceae (13.40%), the mix of three trees (11.20%), Salsola (10.60%), Artemasia (9.50%), Fraxnms excelisoit (8.90%), and Urtica dioica (5.60%). While in the female the descending ordering started also with Salicaceae (5.60%), then Salsola (4.50%) followed by a mix of three trees (3.90%), Betulaceae (3.40%), Artimasia and Urtica dioica (2.80%), and ended with Fraxnm excelisoit (2.20%).

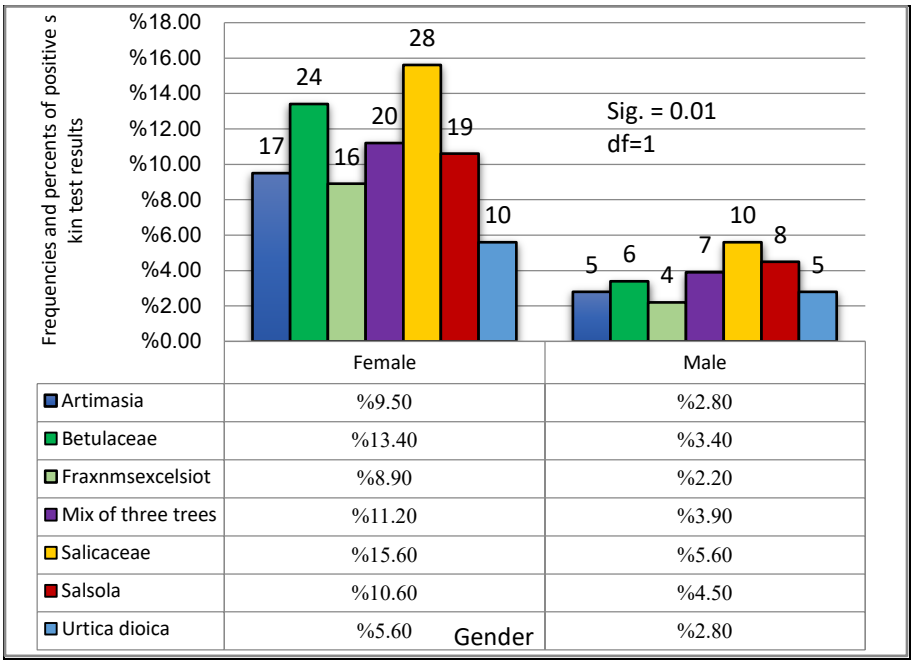

Figure 3: sensitization to tree pollen allergens according to the gender

Concerning grasses allergens associated with AD, figure (4) illustrates that the 5 grasses mixture represents the most frequent allergens causing AD in the studied group with a percent of (31.00%). Also, 12 grasses mixture represented the second-highest grasses allergens responsible for causing AD followed by 4 cereals mixture and 6 grasses mixture with percentages of (26.40%, 24.10%, and 18.40%) respectively.

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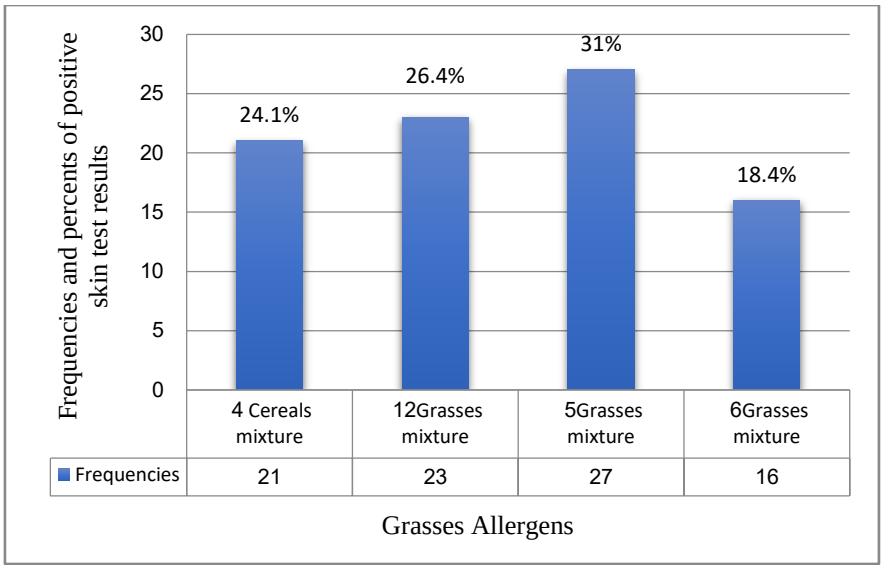

Figure 4: Frequencies and percent of grasses allergens associated with atopic dermatitis.

According to the age, the current results appear to be opposite to the results of tree pollen sensitization. As we found that sensitivity to all grass allergens used in the current study seemed to be significantly higher in the female sex compared to males (P =0.002) as shown in table (3).

Table 3: Sensitization to grasses allergens according to the sex of patients.

Grasses Allergens	Gender	
	Male	Female
4 Cereals mixture	5(5.70%)	16(18.40%)
12 Grasses mixture	5(5.70%)	18(20.70%)
5 Grasses mixture	6(6.90%)	21(24.10%)
6 Grasses mixture	5(5.70%)	11(12.60%)
Total	21(24.10%)	66(75.90%)
P=0.002 df= 1		

Moreover, sensitivity to grasses allergens appears to vary widely among analyzed patients according to their ages figure (5). Patient aged between (41–50-year-old) represents the first one sensitized group to grasses allergens, while patients from the age group of (21-30- years old) are the second one followed by patients from the age groups (31-40, and 9-20-years-old), see figure (5).

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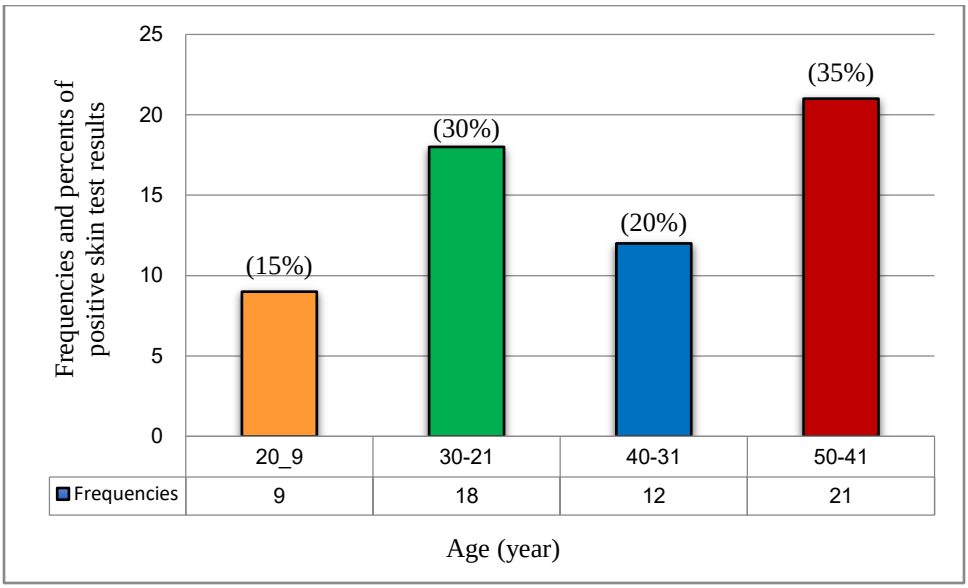

Figure 5: Sensitivity to grasses allergens according to the age.

In comparison between the two groups of allergens subjected in the present study, the results of the Chi-square test demonstrated that sensitization to tree pollen allergens is significantly associated with the occurrence of AD (P=0.002) as illustrated in figure (6).

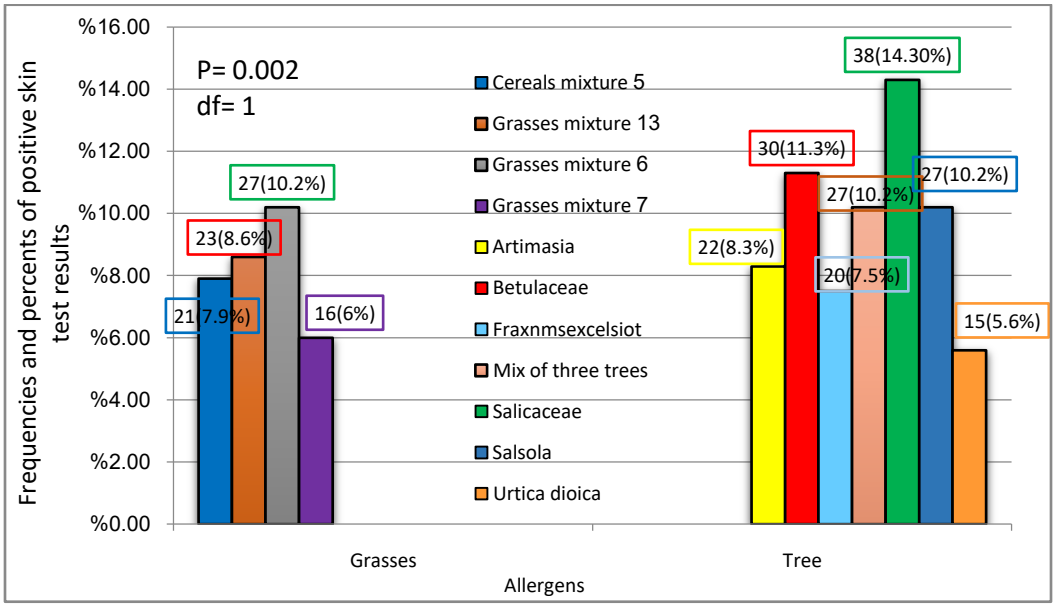

Figure 6: Comparison between trees and grasses sensitivity among atopic dermatitis patients

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In the same context, sex comparison results showed that females with AD are significantly influenced by the sensitivity to both grasses and tree pollens (P= 0.001) as seen in figure (7).

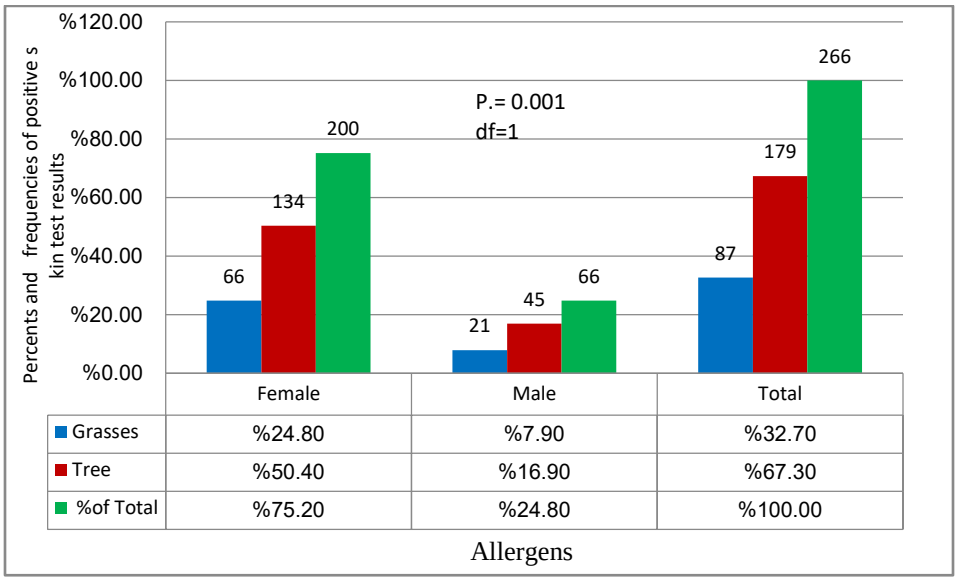

Figure 7: Sensitivity to pollens and grasses according to the sex.

Discussion

From the above results (figure 1), this study found that (60%) of the study populations were suffering from atopic dermatitis and were sensitive to at least one of the subjected trees and grasses allergens. Although atopic dermatitis is increasing and reached elevated levels in the Iraqi population, these results do not represent the accurate epidemiology of the disease in the country due to limitations including the small number of participants, the study area, and other factors. However, the epidemiology of AD seemed to be highly variable depending on study populations, geographic factors, and the interaction between genetic background and environmental factors (12-14).

This study found that females were more likely to suffer from allergic skin reactions upon exposure to the grasses and trees pollen allergens used in the skin test. Studies have agreed with this result (12,13). The effect of estrogens on the humoral response, immediate-type hypersensitivity reactions, and delayed-type hypersensitivity reactions is the theoretical explanation for the effects of sex on the sensitization process and the incidence of allergies (15). Recent research suggests that estrogens enhance the effector process of IgE-mediated allergic

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reactions by increasing mast cell activation and, as a result, inflammatory mediator secretion by mast cells and other effector cells (16). This effect may also be indicative of the presence of estrogen receptors, such as estrogen receptor a, on most immune cells, including those involved in the immediate response. Giving support to the role of sex hormones in the process of sensitization, clinical data revealed that women have higher rates of urticaria, anaphylaxis, food allergies, and asthma than men. (16,17).

In each age group, we discovered a growing proportion of people with allergies (Table 1). Only females were found to have a higher percentage of sensitized participants as they got older (table 2). Again, this result may indicate a role of the estrogen hormone and may suggest that high estrogen levels in the mature age group could be a factor affecting clinical expression and medically demonstrated sensitization symptoms. Moreover, estrogen can have a biphasic effect. Low estrogen levels may be a limiting factor in the clinical manifestation of allergy in sensitized females, while high estrogen levels may predispose individuals to clinically manifested sensitization symptoms. Liebhart et al (18) have drawn similar conclusions from the results of a big epidemiological study. It has been documented that AD affects males more frequently during the first two years of life (19,20), but that females have a higher prevalence during pubertal age and adulthood (21), with no major differences reported during school age. Furthermore, during the first 18 years of life, Ziyab and colleagues (22) conducted a longitudinal study to see if there was a connection between variations in AD prevalence, gender, and allergic sensitization. Puberty appears to be a critical time during which disease prevalence changes.

The results found that pollens of Salicaceae plants (Poplar and Widow), figure (2), were the most frequent allergens responsible for the occurring of AD in the analyzed group. However, there is a fluctuating response to other tree pollens, together all tree pollens are responsible for (67.30%) of atopic dermatitis ($P = 0.002$) cases in the current study, figure (6). There are significant differences ($P = 0.001$) in the sensitization to tree pollens according to gender, the female was highly sensitized than males at all as illustrated in figure (7). The abundant distribution of trees in the Iraqi cities may be a logical cause. Locally, in a previous study, we found that house dust mites allergens (HDM) caused several allergic reactions, of which (27%) was AD (25). In another study conducted in Erbil city, northeast of Iraq, the most frequent inhalant allergens associated with allergies in the male gender were Cultivated rye and Meadow

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foxtail (6.57%), Cultivated oat (5.26%), Boxelder, Sweet vernal grass, and Cockroach, German (3.94%) respectively. On the other hand, Orchardgrass (3.19%) followed by Sweet vernal grass, cultivated rye, honey bee venom, Cockroach, German, House dust, and *Dermatophagoides farina* (2.12%) were identified as the most common inhaled allergens in females respectively (26). Regionally, Sensitization to pollens may also be associated with the global climate change that occurs around the world, including the Middle East. Some studies have shown a significant impact of climate fluctuation on the status of plants of each area and also on aeroallergens and their public and clinical health. This reality urges the need for an up-to-date, frequency, and distribution of allergenic tree pollens in each region (27,28). As a result, in June and July, birch (Betula) pollen grains have been recorded as the most allergenic tree pollen grains in Central, North, West, and Eastern Europe. Pollen grains of Alnus Viridis are abundant in central Alpine regions during May and June (29). The Mid East is an intercontinental region centered on Western Asia and Northeast Africa, with a dry summer climate and mild winters. This has resulted in unique vegetation with various types of allergenic pollen that differ from those found in Europe (30).The Middle East's climate is generally dry, though the winters are mild and rainy. Moreover, the coverage of domestic trees varies in each area of the Middle East while palm and mesquite trees are common in countries located in the Persian Gulf area, olive is common in Palestine, Israel, and Turkey, and sycamore in Iran. The diversity of reported allergenic pollens in different areas of some countries should be taken into consideration and creating a panel of allergen extracts for the skin prick test that is a decision based according to locally reported allergic pollens can be more effective in the treatment of type I allergies. Furthermore, it is particularly notable that with an increasingly common practice of planting imported ornamental trees in public parks, highways, and streets, special attention should be paid to these new sources of pollens. Globally, Ricci et al (31) found that adolescents with AD frequently show sensitization to inhalant allergens like grass and birch pollens (44.4 %t and 55.6 %, respectively) and oral allergy syndrome (22 %) against plant foods.

In addition to tree pollens, grasses pollens were also responsible for occurring more than 30% of AD, though it is significantly lower than tree pollens figures (4 and 7). The most frequent grasses pollens allergens recorded in this study is five grasses mixture (31%). There are also differences in the sensitization according to the age and sex table (2) and figure (5). Generally, pollen concentrations in the air from grasses are highly dependent on flowering time and length,

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as well as short- and long-range atmospheric transport and weather conditions (32). Agricultural management affects grass since hay cutting or, more recently, silage cutting can occur before most grass species reach flowering, resulting in significantly reduced pollen release. Many plant species in the temperate and boreal zones advance their spring phenology as a result of anthropogenic-induced climate change, and grass species have shown a trend toward earlier flowering in recent decades (33-39).

Conclusion

The present study recorded a high percentage of atopic dermatitis, also, female sex was highly affected than male to develop allergic skin reaction upon exposure to trees and grasses pollens. Aging is an important risk factor to develop allergic reactions especially among women suggesting a role of estrogen hormone. At all, tree pollens especially those derived from Salicaceae together with other plant pollens caused the majority of atopic dermatitis in the studied group. Five mixture grasses appear to be the most frequent grasses pollen related to atopic dermatitis. Our results are important and support the suggestion of creating an Iraqi special pollen panel to be considered during the diagnosis and immune therapy of allergic reactions.

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