
Salsola pollen as a predominant cause of respiratory allergies in Kuwait

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Background: Respiratory allergies are common in Kuwait, and the role of certain allergens has been previously documented.

Objective: To evaluate the results of skin prick tests to a range of allergens that were considered relevant to the vegetation surveys and aerobiological studies performed in Kuwait.

Method: New patients attending our center during August 2002 to February 2003 with asthma or allergic rhinitis underwent skin prick tests to a battery of allergens.

Results: A total of 451 patients aged 5 to 60 years (mean age, 29.5 years) were tested. Of these patients, 403 (89.4%) had a positive test result to at least one allergen and were considered allergic. A total of 76.7% of the allergic patients had a positive reaction to *Salsola* pollen, with a mean wheal diameter of 8.25 mm (median, 8 mm). *Chenopodium album* was positive in 57.6% and Bermuda grass was positive in 38.2% of the allergic cases. Indoor allergens seemed to play a lesser role than pollens: *Dermatophagoides pteronyssinus* was positive in only 37.5%, and American and German cockroaches were positive in 33.2% and 22.3%, respectively. All the allergens other than *Salsola* elicited a mean wheal diameter of less than 6.25 mm (median, ≤ 6 mm).

Conclusions: Indoor allergens seem to play a lesser role in respiratory allergies in Kuwait. Most allergic patients become sensitized to pollens; the strongest and most frequent reaction is from *Salsola* pollen. *Salsola imbricata* is found growing extensively in most areas of the country, flowering mainly in autumn, when the most common pollen is of the Chenopod-Amaranth type and when most patients with seasonal allergic rhinitis become symptomatic.

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INTRODUCTION

The prevalence of asthma and allergic rhinitis in Kuwait has been increasing during the past few decades. Previously thought to be fairly rare, respiratory allergies now have a high prevalence, as shown by the recent International Study of Asthma and Allergies in Childhood (ISAAC).^{1,2} The prevalence rates for wheeze ever, current wheeze, and physician-diagnosed asthma were 25.9%, 16.1%, and 16.8%, respectively. The prevalence rates for symptoms of allergic rhinitis ever, current symptoms of allergic rhinitis, and physician-diagnosed allergic rhinitis were 43.9%, 30.7%, and 17.1%, respectively.

Patients have often expressed that their asthma started after or was made worse by the extensive oil well fires that followed the invasion and liberation of Kuwait in 1991. However, a study in Kuwait failed to show that hospital admissions for asthma or asthma-related deaths underwent any change after the liberation.³

Kuwait is a small country of approximately 18,000 km² situated in the northwestern part of the Arabian Gulf and has a desert climate, with temperatures reaching up to more than 45°C in summer. In winter, the air temperature is cool, dropping to approximately 8°C or lower. Relative humidity

is low during summer, with a monthly average of 27% to 31%; it is higher during winter, when the monthly average reaches 65% to 75%. Rainfall is scanty, normally confined to the cooler months of October to May. However, the amount of rainfall is irregular from year to year, which influences the type and amount of vegetation in the desert. Much of the soil has a high salt content, which determines the type of vegetation encountered, favoring the growth of salt-tolerant species.⁴

Furthermore, there is an ever-increasing process of cultivating various trees and plants everywhere in the country, in both private gardens and public places. Thus, lawns are created and numerous trees are planted in parks, in private gardens, and along streets. The date palm (*Phoenix dactylifera*) is, of course, common, and the *Prosopis* tree (*Prosopis juliflora* and *Prosopis spicigera*) is a frequent sight along streets. However, a number of *Prosopis* trees have been cut down in the past as a measure to decrease the allergenic risk to the population. For approximately a decade, another species, *Conocarpus* (*Conocarpus lancifolius* and *Conocarpus erectus*), has been extensively planted as hedges and fully grown trees, and it seems to be adapting extremely well to the harsh climate. Various other trees are encountered, including *Eucalyptus*, *Casuarina*, *Ziziphus*, and *Acacia*.

The lifestyle in this oil-rich country has been changing considerably for the past several decades, with the population spending more time in their air-conditioned houses or offices. Indoor allergens, however, have been shown not to be the predominant cause of respiratory allergies.^{5–7} In particular,

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relatively few patients are found to be sensitive to house dust mites and cockroaches. Cats are rarely kept in the houses, although stray cats are a fairly common occurrence. There are very few dogs kept as pets, and stray dogs are rarely ever seen.

The composition of the population is typical of the oil-rich gulf countries. Besides the local population, a large number of foreigners work and live in the country, most of them from south Asian countries and nearby Arab states.

Earlier studies of skin sensitivity to inhalant allergens in Kuwait, as well as surveys of specific IgE directed against inhalant allergens, have been published. However, the availability of a wider range of commercial allergens for skin prick testing led us to readjust our battery. We also based our study on pollen studies performed in Kuwait and on more recent surveys of the local vegetation.

Herein, we report the results of skin prick tests to an array of allergens performed during August 2002 to February 2003 at the Al-Rashid Allergy Centre, Sulaibikhat, Kuwait. This unit has been set up as a facility to investigate and treat allergies in Kuwait.

METHODS

The new patients attending our center during August 2002 to February 2003 and who were diagnosed as having either asthma or allergic rhinitis were selected to undergo skin prick tests to a battery of inhalant allergens. The standard battery included house dust mites, cat, cockroaches, molds, relevant tree pollens, and grass and weed pollens. The tests were performed by trained personnel under the supervision of a physician. Patients had to abstain from using antihistamines for at least 5 days before the test; histamine hydrochloride

solution (10 mg/mL) and isotonic sodium chloride solution were used as positive and negative controls, respectively. The reagents were obtained from Stallergenes (Antony, France). The list of allergens in our battery of tests is shown in Figure 1. The name of each allergen is as indicated. The 5 grass pollen mixture includes *Dactylis*, *Festuca*, *Lolium*, *Anthoxanthum*, and *Phleum*. Each mold reagent consists of a mixture of several species of the same genus: *Alternaria* (*Alternaria alternata* and *Alternaria longipes*), *Aspergillus* (*Aspergillus fumigatus*, *Aspergillus nidulans*, and *Aspergillus niger*), *Cladosporium* (*Cladosporium cladosporoides* and *Cladosporium herbarum*), and *Penicillium* (*Penicillium digitatum*, *Penicillium expansum*, and *Penicillium notatum*). Reading was performed by a physician after 15 minutes, and the size of the wheal was measured. A wheal with a diameter equal or larger than 3 mm was considered to be a positive reaction.

RESULTS

A total of 451 patients were tested (259 males and 192 females, male-female ratio of 1.35). Their age ranged from 5 to 60 years, with a mean of 29.5 years. A total of 200 had isolated allergic rhinitis, 212 had both allergic rhinitis and asthma, and 39 had only asthma. A total of 350 were Kuwaiti nationals, 78 were non-Kuwaiti Arabs, 21 were non-Kuwaiti Asians, and 2 were from other nationalities. A total of 403 patients (89.4%) had at least 1 positive skin prick test result and were considered allergic cases. Forty-eight patients (10.6%) had negative results of all tests and were considered nonallergic. The percentage of positive results is expressed as the percentage of allergic patients who had a wheal response equal to or greater than 3 mm in diameter to the allergen tested. The range of allergens tested and the percentage of

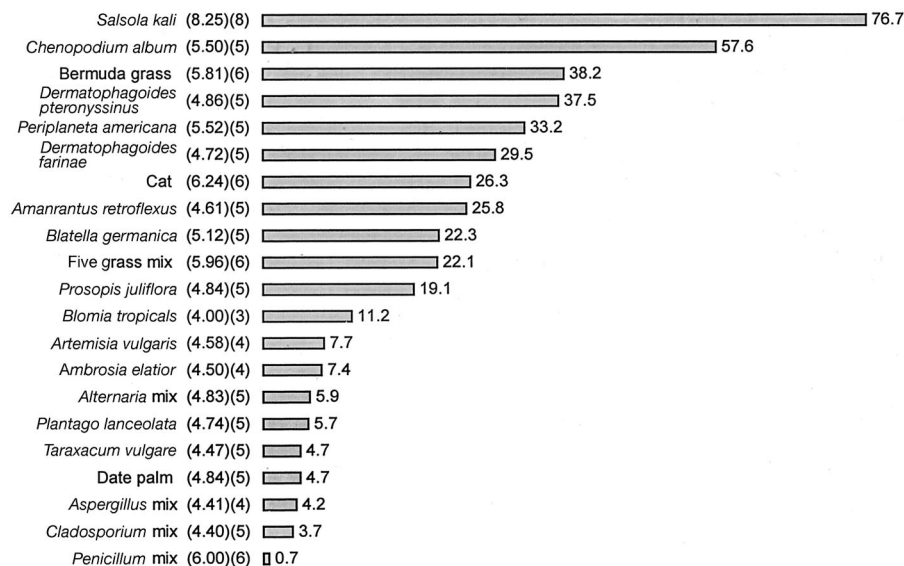


Figure 1. Results of skin prick test to the various inhalant allergens. The first number in parentheses is the mean diameter of the wheal in millimeters; the second number in parentheses is the median diameter of the wheal in millimeters. The results are expressed as a percentage of allergic patients with positive test results.

allergic patients who had a positive response are shown in Figure 1. We have also included in the results the mean diameter of the wheal and the median value. Histamine wheal had a mean diameter of 7.62 mm, and the median value was 8 mm.

Most patients were males, so the sex difference in the recruited patients was further studied; results are shown in Table 1. The results show a predominance of male children, and this progressively decreases until the sex ratio is 1 in adults older than 39 years. The ISAAC results of prevalence of asthma and allergic rhinitis in Kuwait had similarly shown a predominance of boys in the 13- to 14-year age group, with a male-female ratio of 1.6 to 1.7.²

DISCUSSION

Our study revealed the striking importance of pollens as a cause of respiratory allergies and the fact that indoor allergens seemed to be of lesser importance. This has been shown earlier in a study of skin tests in asthmatic patients.⁸ *Prosopis* was a leading cause, with 74% of patients sensitive to it, *Chenopodium album* was responsible in 62% of cases, and Bermuda grass in 54% of cases. *Dermatophgoides* sensitivity was seen in only 1.5%. Animal dander sensitivity was seen in 6%.⁸

Studies of specific IgE have also demonstrated that *Chenopodium*, Bermuda grass, and *Prosopis* tree pollens play important roles in the pathogenesis of respiratory allergies in Kuwait. In a group of patients with extrinsic asthma, Ezeamuzie et al⁶ showed that 70.7% were sensitive to *Chenopodium*, 62.9% to Bermuda grass, and 62.7% to *Prosopis* tree pollen. A similar study in a group of patients with allergic rhinitis showed sensitivity to *Chenopodium* in 64.3% of cases, Bermuda grass in 55.0%, and *Prosopis* tree pollen in 50.3%.⁵

In all the studies, indoor allergens such as house dust mites and cockroaches were of lesser importance. One previous study⁷ investigated the levels of indoor allergens by measuring major allergens in dust collected from homes and public buildings in Kuwait. House dust mite allergen Der p 1 was found only in one of their samples; Der f 1 was not detectable in any sample. Low levels of cockroach allergens were also detected in their samples, but significant amounts of cat allergen Fel d 1 were found in some public buildings, although less so in homes. The hot and dry climate may be unsuitable for house dust mites to thrive, thus the allergen levels remain low.

Our study showed that only approximately a third of our allergic patients were sensitive to *Dermatophagoides ptero-*

nyssinus. A lesser proportion was sensitive to *Dermatophagoides farinae*. We also included *Blomia tropicalis* in our panel and found that 11.2% of our allergic patients reacted to it. House dust mites are presumably not abundant in Kuwait, but the predominant species present is not documented. We hypothesize that *D pteronyssinus* is the likely predominant species, since it is ubiquitous and its extract gives the most frequently positive response. Positive reactions to various dust mites may be due only to cross-reaction in *D pteronyssinus*-sensitive patients. Indeed, 94% of our patients sensitive to *D farinae* are also sensitive to *D pteronyssinus*. Similarly, 92.1% of patients sensitive to *Blomia* are also sensitive to *D pteronyssinus*.^{9,10}

Cockroaches are common in many houses and other places in Kuwait. *Blatella germanica* is a frequent pest of kitchens, and *Periplaneta americana* is found more often in drains. *Periplaneta* sensitivity is found in one third of our allergic patients and *Blatella* in 22.3%.

Cat allergen elicited a positive response in 26.3% of the allergic patients, and this occurred in most cases without the presence of a cat in the house. Cat allergen is known to be airborne and is encountered in Kuwait mostly in public places, such as cinemas and mosques.⁷ However, although mosques are attended mostly by males, the prevalence of sensitization was similar in both male and female Kuwaitis (25.9% and 26.7%, respectively).

The difference in the pattern of positive test results among patients of different nationalities was most evident for domestic allergens. There was a significantly larger proportion of non-Kuwaiti Asians who were sensitive to house dust mites and cockroaches (Fig 2). However, the number of these patients is comparatively small and does not necessarily reflect their original populations.

The vegetation of Kuwait is undergoing change not only because of the planting of new species but also because of various other human activities. Large areas of the desert are used as camping grounds in early spring, thus altering the ground vegetation. Many of the sheep, goats, and camel bred or imported in Kuwait are kept in the desert areas, grazing much of the scanty vegetation. Some original native plants are becoming rare and are being replaced by hardier ones. Larger areas of land are being cultivated, giving increased opportunity for weeds to grow.⁴

The number of patients who attend medical centers in Kuwait for respiratory allergies increases during April to May and even more so during September to October.⁸ These periods correspond to the pollen seasons: grass pollens predominate in spring and Chenopods have peaks both in spring and especially in autumn.

In our series, sensitivity to *Chenopodium* pollen also remains a dominant cause of respiratory allergy, but skin prick test results to *Salsola* pollen were more often positive. Furthermore, the response to *Salsola* pollen was almost always markedly greater than that of all other allergens used. Chenopods of various types are common in the desert and wastelands and along the roadsides. *C album* exists, but *Chenop-*

Table 1. Variation of Sex Ratio According to Nationality and Age Group

Group of patients	Male, %	Female, %
All nationalities, age <15 years	67.6	32.4
Kuwaiti, age <15 years	66.7	33.3
All nationalities, age >39 years	53.5	46.5
Kuwaiti, age >39 years	50	50

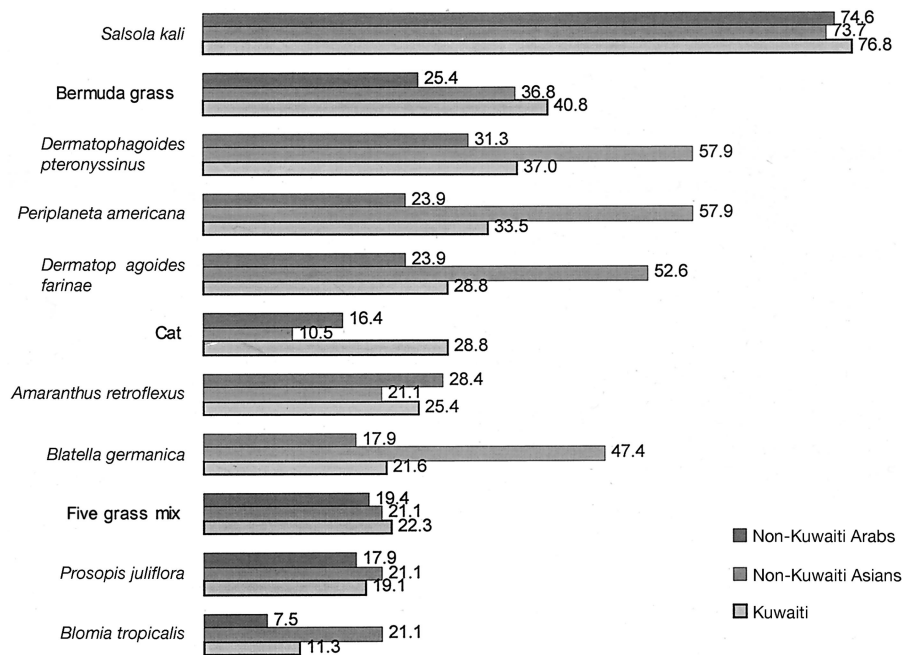


Figure 2. Comparison of the percentage of positive test results to the major allergens in different groups of patients.

odium murale is especially common and flowers in spring. *Salsola imbricata* (synonym *Salsola baryosma*) is a common perennial weed; it is often the first plant to colonize disturbed ground and in many places becomes the predominant plant in late summer; it flowers mostly in autumn. Various other Chenopods thrive in the country, in particular *Haloxylon salicornium*, which forms communities in several areas.⁴ Some *Amaranthus* species are also found in the country, adding to the counts of Amaranth-Chenopod pollens, which share similar morphologic characters. Chenopodiaceae pollens are the most common pollens in the aerobiological surveys in Kuwait, with a peak during September and October.¹¹ This also corresponds to the peak in number of patients attending our center. A survey in Riyadh, in neighboring Saudi Arabia, also found a predominance of Chenopod pollens.¹²

Many species of grass exist in Kuwait, often in communities that vary from area to area, making them the most common plant family. Grass pollens are second only to Chenopod pollens in aerobiological surveys. Bermuda grass is common and found mostly in the residential and cultivated areas and along roadsides. It is often grown as lawns but grows abundantly on its own. Bermuda grass pollen allergens differ from those of other grasses and are thus tested separately. The frequency of Bermuda grass pollen sensitivity is 38.2% of the allergic subjects and is next only to *Salsola* and *Chenopodium* in our study, as was previously described.^{5,6,8} It appears that the frequency of Bermuda grass pollen sensitivity is slightly more important in the Kuwaiti patients. Our series also showed that 22.1% of the allergic subjects were sensitive to grass pollen mixture.

Prosopis pollen test results were positive in 19.1% of the allergic patients, which is appreciably lower than previously recorded. Its allergenicity has been reported in several countries, including the United States, India, and Saudi Arabia.¹³ In Kuwait, the tree is common, but another species, namely *Conocarpus*, is being planted in all the newer areas of the city. Evidence of *Conocarpus* pollen allergy could not be obtained from a MEDLINE search, and its possible role in respiratory allergies seems unknown.

Date palm pollen was found to give positive test results in only 4.7% of the allergic patients. This seems a low prevalence in a place where date palms are native and widely grown, in both private gardens and public places. The finding could be due to the fact that airborne date palm pollen is encountered mostly in proximity of the trees.¹⁴

Artemisia pollen has been identified in aerobiological studies, although the genus is only represented by 2 species seldom encountered (*Artemisia scoparia* and *Artemisia herba-alba*).^{11,15} A positive skin test result to *Artemisia* pollen was seen in 7.7% of our allergic patients. The genus *Ambrosia* does not figure on the flora checklist of Kuwait.¹⁵ However, its pollen has been identified in aerobiological studies in Riyadh.¹² Since it is an important and aggressive allergen in various countries, it was included in our battery. A total of 7.4% of our allergic patients were sensitive to it.

Plantago is fairly common in Kuwait. It is represented by 8 different species, including *Plantago lanceolata*, *Plantago boissieri*, and *Plantago ciliata*. The plants are common in spring both in the desert and along roadsides; they flower in spring. *Plantago* pollen is trapped during this season.¹¹ Only

5.7% of the allergic patients had a positive test result, thus showing that it probably has a limited role.

Casuarina pollen has also been described in aerobiological studies performed in Kuwait, and allergy to it is occasionally reported.¹⁶ It was only occasionally tested in our patients, and no positive test result was recorded. Few Myrtaceae pollens are trapped and are mostly represented by *Eucalyptus* species.

Mold allergy has been described in Kuwait. Only 0.8% of a group of asthmatic patients had a positive skin test result in an earlier study.⁸ In another study, Ezeamuzie et al¹⁷ showed that 20.9% of patients with a respiratory allergic disorder had a significant level of IgE antibody against at least 1 mold. We included 4 common molds in our panel (*Alternaria*, *Aspergillus*, *Cladosporium*, and *Penicillium*). The positivity was highest to *Alternaria* and least to *Penicillium*. Spores of all these fungi have been shown to be present in the atmosphere of Kuwait.^{18,19}

CONCLUSION

Our study reconfirms the frequent sensitization of patients with asthma or allergic rhinitis to *Chenopodium* pollen. We found that the patients react most frequently and most strongly to *Salsola* pollen. Cross-reactivity between different members of the Chenopodiaceae and Amaranthaceae groups is known.^{20–23} In specific immunotherapy for Chenopodiaceae-Amaranthaceae allergy, a single agent is considered sufficient.²⁴ It would be preferable to use the allergen to which the patient has the strongest reaction. Currently, the most common pollen extract used for hyposensitization in our center is *Chenopodium*, often mixed with Bermuda grass. A recent study in our center of patients with poorly controlled allergic rhinitis (with or without asthma) showed that of the patients who completed a 3-year course of vaccine with either *Chenopodium* extract or *Chenopodium* plus Bermuda grass extract, 7% stopped use of their medications and 88% significantly decreased use. Adverse effects were rare; the worst complication was an attack of asthma, occurring within 2 hours, in 4 of 181 patients.²⁵ However, we suggest that *Salsola* should figure in the battery of inhalant allergens in Kuwait. Further studies of *Salsola* allergen challenge would help to confirm its clinical importance. We also suggest that hyposensitization with *Salsola* pollen extract in *Salsola*-sensitive patients with late summer and autumn seasonal respiratory allergies in Kuwait be tried.

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