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RESEARCH ARTICLE

AEROALLERGEN SKIN PRICK TEST REACTIVITY LACKS SEASONAL VARIATION IN RIYADH REGION.

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Abstract

Background:- Exposure to aeroallergens varies in different seasons and correlates with increased frequency of sensitized individuals seeking medical aid.
Objectives:- Based on skin prick reactivity during each calendar month of the year the reactivity pattern of aeroallergens was assessed.
Methods:- This was a retrospective analysis of data of 238 patients (165 female and 73 male; mean age 26+11 years) with airway allergy undergoing skin prick testing between 2014 and 2016 at King Khalid University Hospital, Riyadh. A wheal diameter measuring 3 mm or more was considered as a positive reaction.
Results:- Among the individuals tested there were 98 (41.1%) patients with asthma, 115 (48.3%) had rhinitis and 25 (10.5%) were suffering from hay fever. The most frequently reacting indoor aeroallergen was cat in 120 (50.2%) patients followed by *Dermatophagodies farinae* in 78 (32.6%), *Dermatophagodies pteronyssinus* in 67 (28%) and Aspirgillus in 57 (23.8%). Among the outdoor aeroallergens *cynodon dactylo*n reactivity was observed in 90 (37.6%) patients followed by *salsola kali* in 86 (36.2%) and *lolium perenne* in 83 (34.7%). Reactivity against the cat allergen was consistently higher than the house dust mite allergens peaking in October until the month of March. Reactivity pattern of *salsola kali, cynodon dactylon* and *lolium perenne* was almost similar and remained higher than the other pollens between the months from September to May. Data for the months of July and August were not available.
Conclusion:- Skin prick test reactivity against aeroallergens was not only high in Riyadh region but was also devoid of seasonal variations.

Introduction:-

Aeroallergen exposure triggers a robust specific IgE antibody response among sensitized individuals resulting in increased serum level of specific IgE antibody and skin test reactivity (1).Higher pollen counts in the environment during specific pollen season are known for their ability to induce allergy symptoms among sensitized individual most likely due to increased production of specific IgE. Elevation of ragweed specific IgE antibodies among ragweed sensitized airway allergy patients during and following ragweed pollination season points to a direct relationship between the environmental allergen exposure and serum levels of specific IgE antibodies (2).Moreover among tree pollen sensitized individuals the skin test reactivity not only correlates with tree pollen counts but the

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size of the allergen induced wheal also increases during the pollen season (3). The reduction in nasal flow values observed among children with seasonal allergic rhinitis during the pollen season may possibly be related to ambient allergen load (4). Patients suffering from asthma are known to exhibit seasonal variation in hospital visits seeking medical aid for acute exacerbations of asthma related symptoms (5). These seasonal variations in hospital visits have been shown to exhibit a strong positive correlation with pollen counts (6). The concentration of house dust mite (HDM) allergen is traditionally believed to be prevalent throughout the year has also been reported to exhibit seasonal variations (7,8). HDM allergen concentration peaks during the fall in Korea and it is associated with concurrent elevation of HDM allergen specific IgE in the sera of sensitized individuals (9,10). It is therefore quite conceivable that exaggeration of clinical signs and symptoms of allergy in different seasons is consequent to increased production of specific IgE due to higher exposure to allergen (11). Riyadh region is a desert terrain, less humid and extended summer time with temperatures ranging between 40oC to 50oC offers a unique opportunity to investigate seasonal variations in aeroallergen exposure. This study was performed to assess the seasonal variations in skin prick test reactivity in Riyadh region.

Patients and methods:-

This retrospective study was performed to extract data for skin test reactivity of all patients with airway allergy between 2014 and 2016 at King Khalid University Hospital, Riyadh. The hospital is a tertiary care hospital catering for patients from Riyadh region. During the study period a total of 321 patients underwent skin prick testing with 238 (74.1%) yielding positive results reacting to either one or more allergens. This group of patients included 165 (69.3%) females and 73 (30.7%) male patients with the mean age of 26+11 years. There were 98 (41.1%) patients with asthma, 115 (48.3%) had rhinitis and 25 (10.5%) were suffering from hay fever. Patients were advised to discontinue treatment with oral antihistamines at least one week prior to being skin tested. Patients who could not stop antihistamine therapy because of the severity of the symptoms, those on long term steroid therapy and pregnant women were not offered skin prick test.Table 1 contains the list of indoor and outdoor aeroallergen panel used for skin prick test. A positive (histamine dihydrogen phosphate 1mg/ml) and a negative (normal saline) controls were also included for each assessment. Skin prick test was performed by placing a drop of each allergen including the controls on the skin of forearm and the underlying skin was nicked by a fine lancet. The excess amount of each allergen was removed by filter paper and the interpretation of results was performed after 15 minutes by measuring the diameter of the wheal. A skin prick test was considered positive if the wheal diameter was either equal to or more than 3 mm.

Statistical analysis:-

Data were recorded in Excel spreadsheet and were analyzed by SPSS computer software version Categorical data were summarized as numbers and percentages and numeric data were summarized as mean and standard deviation.

Results:-

Figure 1 shows data for the common indoor allergen sensitization based on skin prick test reactivity. Out of the total 120 (50.2%) patients were sensitized against cat allergen followed by 78 (32.6%) against *Dermatophagodies farina*e, 67 (28%) against *Dermatophagodies pteronyssinus*, 57 (23.8%) against *Aspirgillus* and 42 (17.5%) patients were sensitized against *Alternateria alternata*. Among the outdoor allergens the most frequently observed reactivity was against *Cynodon dactylon* among 90 (37.6%) patients followed by *Salsola kali* in 86 (36.2%), *Lolium perenne* in 83 (34.7%), *Amaranthus retroflexus* in 71 (23.8%), *Artimesia vulgaris* in 57 (23.8%) and dates in 48 (20%) patients (Fig. 2). Interpretation of the seasonal variation was performed by categorization of skin prick test reactivity on monthly basis for each allergen. Figure 3 shows data for number of positive skin prick tests for common indoor allergens in each month of the year. Cat allergen reactivity was consistently higher than house dust mite and peaking in the month of October through to the month of March. House dust mite reactivity was higher than the cat allergen reactivity in the month of June. Skin prick test reactivity against the pollens was frequently observed against Salsola kali, cynodondactylon, loliumperenne and amaranthusretroflexus (Fig. 4). Reactivity pattern ofSalsola kali, cynodondactylon andloliumperenne was almost similar and remained higher than other pollens between the months from September to May. Amaranthus skin reactivity peaked in the month of December and declined in May. Data for the aeroallergen reactivity were not available for the months of July and August.

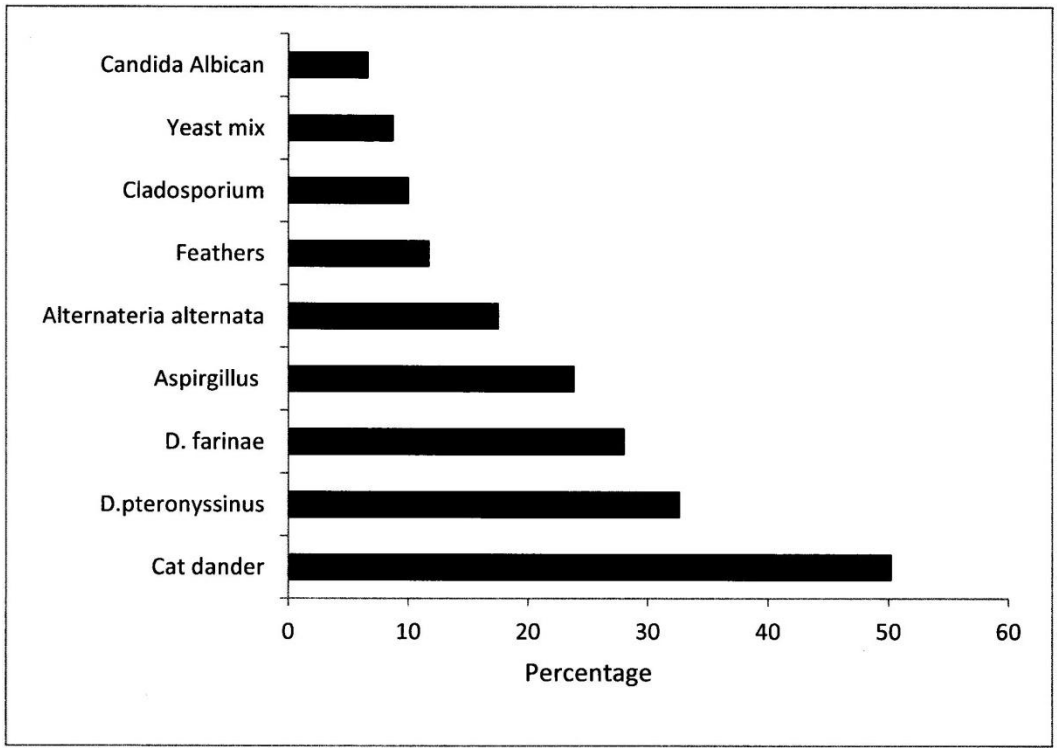
Candida Albican
Yeast mix
Cladosporium
Feathers
Alternateria alternata
Aspirgillus
D. farinae
D.pteronyssinus
Cat dander
0
10
20
30
40
50
60
Percentage

Fig.1:-

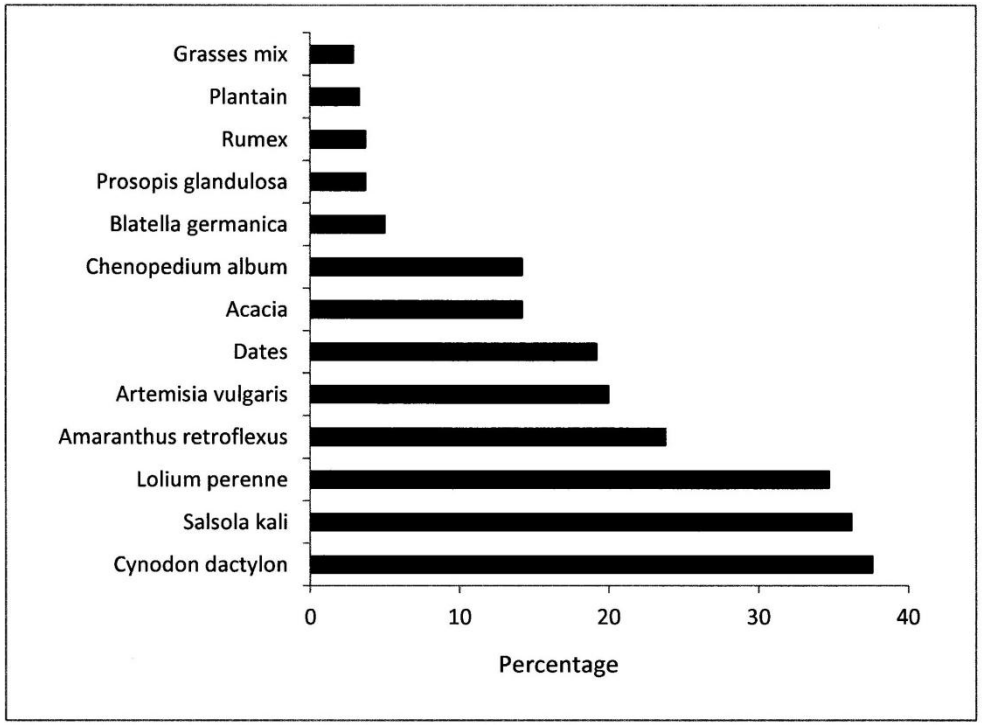
Grasses mix
Plantain
Rumex
Prosopis glandulosa
Blatella germanica
Chenopedium album
Acacia
Dates
Artemisia vulgaris
Amaranthus retroflexus
Lolium perenne
Salsola kali
Cynodon dactylon
0
10
20
30
40
Percentage

Fig. 2:-

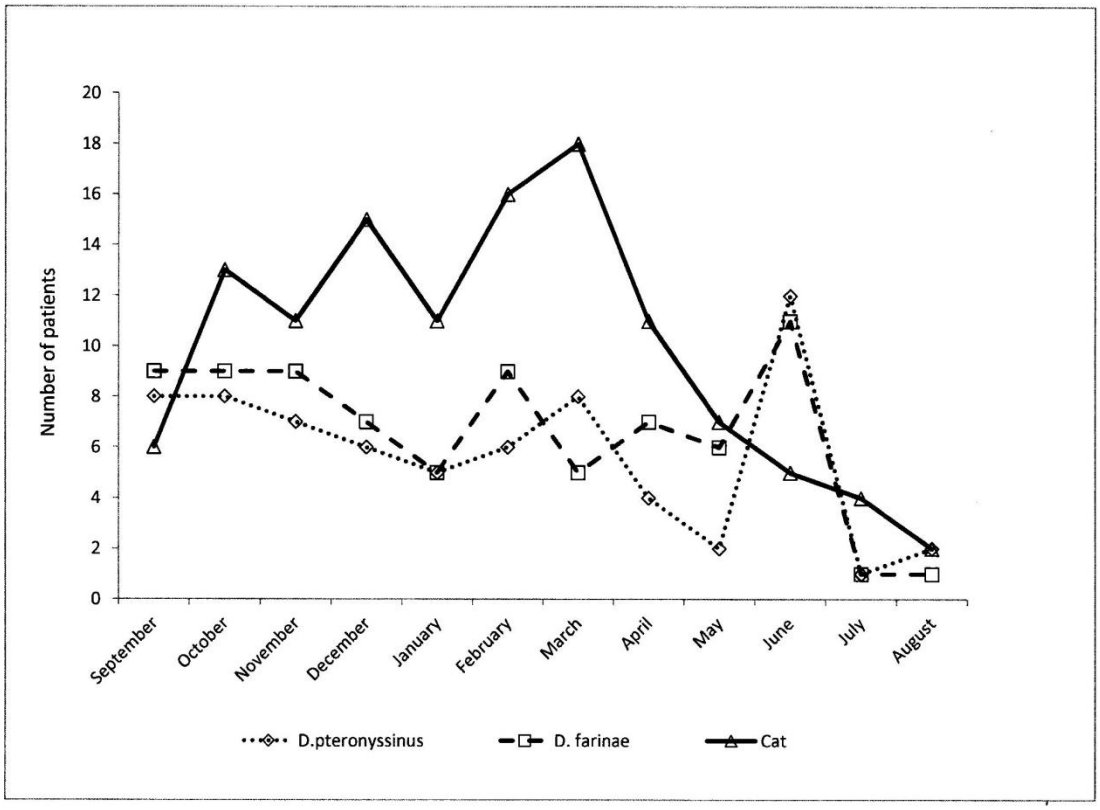
Number of patients
20
18
16
14
12
10
8
6
4
2
0
September
October
November
December
January
February
March
April
May
June
July
August
D.pteronyssinus
D. farinae
Cat

Fig 3:-

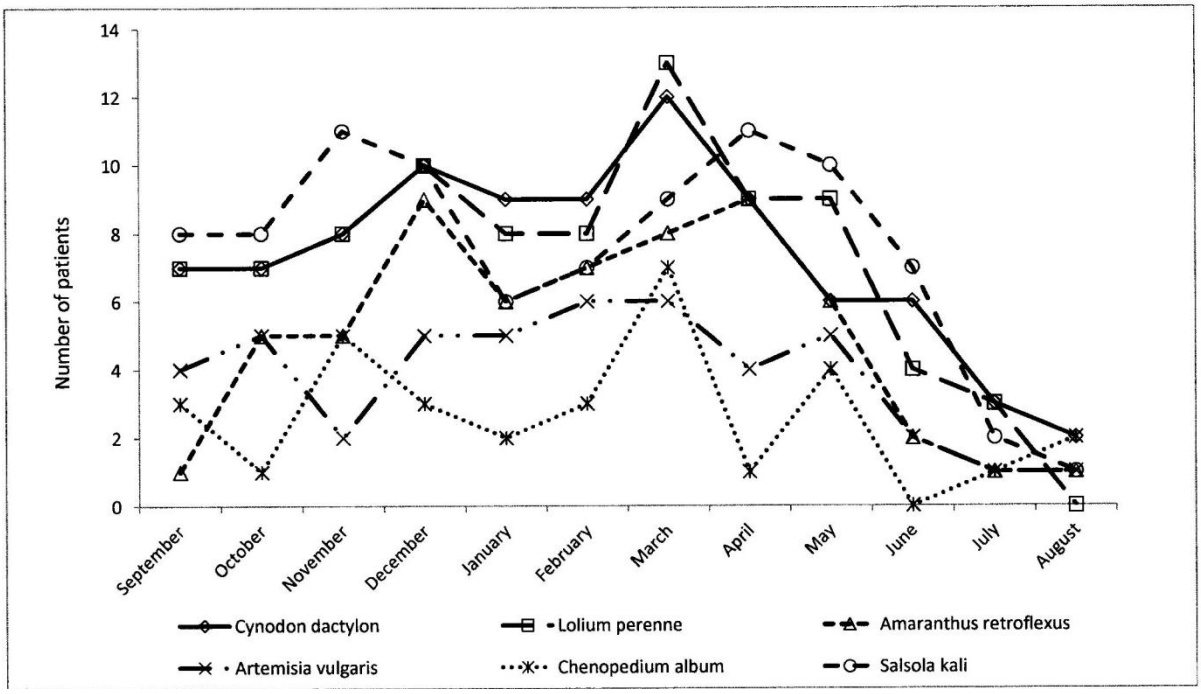
Number of patients
14
12
10
8
6
4
2
0
September
October
November
December
January
February
March
April
May
June
July
August
Cynodon dactylon
Lolium perenne
Amaranthus retroflexus
Artemisia vulgaris
Chenopedium album
Salsola kali

Fig 4:-

Allergen	Concentration
Mixed Grasses	1:20 w/v
Mixed Trees	1:20 w/v
Red Sorrel	1:20 w/v
Plantigo lanceolate	1:20 w/v
Mugwort common	1:20 w/v
Cynodon dactylon	1:10 w/v
Acacia	1:20 w/v
Lolium multiflorum	1:10 w/v
Chenopodium album	1:20 w/v
Alternaria	1:20 w/v
Dermatophagodies pteronyssinus	10,000 IU/ml
Dermatophagoides farinae	10,000 IU/ml
Cockroach	1:100 w/v
Cat	1:10 w/v
Horse Epithelia	1:10 w/v
Sheep Hair	1:10 w/v
Goat Hair	1:20 w/v
Camel Hair	1:20 w/v
Aspergillus mix	1:20 w/v
Cladosporium	1:20 w/v
Candida albicans	1:20 w/v
Penicillium notatum	1:20 w/v

Discussion:-

This study revealed that the skin reactivity toindoor allergens such as cat and house dust mite allergens and outdoor allergens including cynodondactylon, salsola kali and loliumperenne was not only common among the allergy patients but remained consistently high over a period of ten months. The HDMs: *Dermatophagodies farinae* and *Dermatophagodies pteronyssinus* are common sensitizing allergens (8) and have been implicated in the induction of airway hperresponsiveness (12). HDM skin prick reactivity has been shown to exhibit seasonal variation with highest incidence in winters compare to summer season (13). Whereas HDMs have been frequently reported as common allergens in airway allergy cat allergen reactivity was found to be higher than HDM allergen reactivity in the present study. Cat allergen exposure is believed to be involved in 29% of asthma cases in the United States of America where 17% of the population is estimated to be sensitized to cat allergens (14). Cat is a popular pet all over the Kingdom of Saudi Arabia and could possibly be related to over 50% cat allergen sensitization observed in the present study.Seasonal variation in skin test reactivity to cat allergen has been reported with less frequent occurrence during summer time (15). However, the reactivity to cat allergen remained high for almost ten months in the present study both in winters and in summers. The climate of the Kingdom of Saudi Arabia is predominantly hot and seasonal variations are infrequent that may explain persistently elevated skin prick reactivity to cat and HDM allergens observed in the present study.

Among the outdoor allergens *Salsola kali, Cynodon dactylon, Lolium perenne* and *Amaranthus retroflexus* were the most frequently reacting allergens and skin prick test reactivity was observed to be persistently high during the winter and summer seasons. Seasonal variations of pollens have been implicated in induction signs and symptoms of allergy during pollinating seasons among sensitized individuals (16). There is however some evidence suggesting that there is a time lag between high pollen counts and allergen levels (17) that could possibly explain the variations between the pollen counts and symptom scores for grasses and birch pollen (18). Presence of highly allergenic pauci-submicronic particles have been implicated in the lack of correlation between allergic symptoms and pollen counts. These particles are not only present during the pollinating seasons but are also present outside the pollen season resulting in persistent skin prick reactivity observed in the present study (19). The hot desert environment along with less than 10 mm annual rainfall and possible presence of pauci-submicronic particles particularly in Riyadh region may be important contributing factors in persistent exposure of local population to aeroallergens. The pattern of skin test reactivity observed in the present study supports high ambient pollen load throughout the year.

Seasonal variations are influenced by the climate change and have direct bearing on allergic disorders (20). Changes in the environmental temperature influence the growth of *Lolium perenne* with stunting of its growth at low soil temperature (21). The effects of seasonal change have been demonstrated by reloacting *Lolium perenne* from cooler to a warmer location with induction of growth spurt (22). Moreover, high ambient temperature has also been implicated not only in increased environmental pollen counts (23) but has also been shown to have a significant contribution in enhancing the allergenicity of the pollens (24). An increase of 1oC in the temperature has been shown to result in a 14% increase in the number of patients seeking medical assistance (25). Additionally, high environmental temperature is also known for its association with early start and prolongation of pollen season (26). The persistently high skin test reactivity to common allergens in Riyadh region with average temperature of 45oC with extended summer time could possibly be due to presence of high allergen exposure lacking seasonal variations.

Aerobiological studies assessing the environmental allergen load in the local environment may provide valuable information for better understanding the interplay between the allergen load and sensitization status of the local population. An optimum allergen exposure over a prolonged period of time is essential for induction of allergy symptoms as high dose of allergen exposure has been shown to be capable of inducing tolerance (27).

In conclusion, based on the skin prick test reactivity it was observed that reactivity to aeroallergen was high in Riyadh region. The pattern of reactivity against both the indoor and outdoor allergen was devoid of seasonal variation and was persistently high during the year. This was a single center study from Riyadh region and the findings of the present study may not be applicable to the Kingdom of Saudi Arabia. Large scale studies across the Kingdom are recommended to assess the seasonal variations of aeroallergens and their impact on the local population.

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