Original article

Ragweed sensitization in Egyptian children with bronchial asthma

Background: *Ragweed pollen is a frequent cause of respiratory allergy globally. Published data on ragweed pollen sensitivity among Egyptian children are scant. With our low rainfall seasons and high temperatures, weed pollens are expected to be abundant. We therefore sought to investigate ragweed pollen sensitization among a group of atopic asthmatic children in relation to their clinical and laboratory parameters.* ***Methods:*** *This cross-sectional study comprised 100 children, 6 to 12 years old, with physician-diagnosed bronchial asthma enrolled consecutively from the Pediatric Allergy and Immunology Unit, Children's Hospital, Ain Shams University, Cairo. Sensitization to ragweed was assessed using skin prick testing (SPT).* ***Results:*** *Ragweed sensitization was observed in 41% of the studied children. The wheal diameters ranged between 3 and 8 mm [mean (SD) = 5.15 (1.53) mm] and the corresponding flare values were 13 – 25 mm [18.59 (3.18) mm]. Ragweed sensitization was more prevalent in suburban and rural residents compared to those living in urban regions (p =0.413). Severity of asthma, frequency of flare ups and response to treatment did not influence the rates of ragweed sensitization in our series.* ***Conclusion:*** *Ragweed sensitization seems common among Egyptian children with bronchial asthma; however, it did not impact the severity of asthma or response to treatment. The findings are limited by the sample size. Wider scale studies involving various locations of our country are needed to accurately outline the significance of this allergen.*

Keywords: bronchial asthma; children; ragweed.

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INTRODUCTION

Ragweed sensitivity has been recognized as an important allergen causing allergic rhinitis (AR) and bronchial asthma (BA). In the 1930s, ragweed was identified as the major elicitor of hay fever and asthma.[1,2] About 40 species were defined with *Ambrosia artemisiifolia* (common or short ragweed) and *A. trifida* (giant ragweed) being the most common.[2] Among all Ambrosia species, *A. artemisiifolia* is the most abundant and invasive representing a major cause of allergy in late summer worldwide.[3]

Environmental factors such as temperature and CO2 concentrations have great influences on the ragweed pollen production and hence the allergen amount. These two environmental factors are rising due to climate change and urbanization.[4] Weeds are one of the common inhabitants of the plant kingdom as they require less water and can survive under harsh conditions.[5] Egypt is generally characterized with low rainfall and high temperatures and therefore weeds are expected to grow spontaneously in our environment.

Allergenic potency of the ragweed pollen is outstanding. A single ragweed plant can release up to one billion pollen grains per season.[6] Such abundant pollen counts can lead to a strong increase of the sensitization rates and emergence of symptoms. It has been reported that as little as 10 pollen grains per cubic meter of air can trigger an allergic reaction.[7] Ragweed pollen grains can travel by several hundreds to thousands of kilometers by air and lead to allergy symptoms in areas where the plant is not actually abundant.[3] Due to their widespread existence and severe impact, ragweed pollen-induced AR and BA significantly affect the quality of life, impeding attendance and school performance.[8]

The primary aim of this pilot study was to evaluate the frequency of ragweed sensitization among a group of atopic Egyptian children with

physician-diagnosed BA using SPT. The secondary objective was to assess its possible impact on the patients' demographic data, severity of the manifestations and response to treatment.

METHODS

A cross-sectional study was designed, and patients were recruited from Pediatric Allergy, Immunology and Rheumatology Unit, Children's Hospital, Ain Shams University, Cairo during the period from September 2018 to September 2019. One Hundred school aged children with physician-diagnosed BA were consecutively enrolled after obtaining an informed consent from their parents/caregivers. The study protocol gained approval from the local Research Ethics Committee of the Department of Pediatrics, Ain Shams University.

Inclusion criteria:

- Age between 6 and 12 years.
- Atopic patients: atopy was verified by previous positive SPT to any environmental allergen.
- Physician-diagnosed isolated BA with or without other allergic diseases e.g AR and/or atopic dermatitis.

Exclusion criteria:

- Patients who could not stop antihistamine therapy for 1 week before performing SPT.
- Dermographism or severe eczema.

All patients were subjected to the following:

- Clinical evaluation including age, gender, residency, other allergies, family history of allergy, age of onset of asthma symptoms, possible triggering factors, frequency of flare ups, treatment modality, and adherence and response to treatment.
- Diagnosis of BA was verified according to the Global Initiative of Asthma (GINA)[9] and Allergic Rhinitis and its Impact on Asthma (ARIA) guidelines, 2020.[10]
- SPT for ragweed grass pollen using ragweed extract, Histamine dihydrochloride (10 mg/ml, equivalent to 6 mg histamine) as positive control and saline as negative control (Extracts were obtained from Omega, Canada - Allergy Overseas Consultants Inc., 82 Toor St, Port Said, Egypt). The test was performed in the integrated laboratory of the Pediatric Allergy and Immunology Unit, Ain Shams University Children's Hospital, under aseptic conditions taking into consideration all the pretest precautions and after test care. Precautions to face anaphylaxis were secured. The maneuver was explained to each patient/care giver prior to testing. H1 antihistamines were discontinued at least 1 week earlier. Patients coming in flare ups were postponed until symptoms being controlled. The test was performed in the forearm volar aspect. We did good exposure, sanitization, marking the sites for skin pricks then applying a drop of each reagent on its specific site (being at least 5 cm apart from each other). Gentle pricking of the skin with special lancets was done.

Test Interpretation:

The result was read after 20 minutes. Wheals and flares were carefully blotted prior to taking measurements. The mean diameters of the wheal and flare, using a transparent mm-marked ruler were recorded. A wheal diameter < 3mm was considered a negative result; diameters between 3 to 8 mm meant just sensitization and diameters larger than 8 mm indicated ragweed allergy.[11]

Patient after-care:

Usually itching from skin prick testing subsides within minutes. Some measures were taken to alleviate itching including using an ice pack. Topical corticosteroids and oral antihistamines were sometimes needed. Patients were warned about the rare possibility of a late-phase reaction (LPR).

Statistical analysis

Analysis of data was done using Statistical Program for Social Science version 20 (SPSS Inc., Chicago, IL, USA). Quantitative variables were described in the form of mean and standard deviation (SD). Qualitative variables were described as number and percent. Probability p values < 0.05 was considered significant in comparative and correlative statistics.

RESULTS

This study included 100 children, 49% of them were females and 51% were males. Mean age of the children was 8.19 ± 2.18 years. The mean age at time of diagnosis of persistent wheezers was 3.53 ± 2.45 years. Exposure to common irritant has included passive smoking in 62% of children. Concerning residency, 68% of the children were living in suburban and rural areas and 32% were urban residents (Table1).

Sensitization to ragweed was revealed in 41% of the studied children. The mean wheal diameter was 5.15 (± 1.53) mm ranging between 3-8 mm and the mean flare diameter was 18.59 (± 3.18) mm ranging between 13-25 mm as shown in table 2. Age and sex were comparable in the two groups.

Sensitization to ragweed had no impact on the age of asthma onset. It was noticeable that ragweed sensitization was more prevalent in children living

in suburban and rural areas compared to those living in urban areas as shown in figure 1.

Table (3) shows that 88% of the asthmatic children had associated allergies. They were however comparable as far as ragweed sensitization is concerned. Presence of family history of allergy did not influence the rates of ragweed sensitization as well (table 3).

Ragweed sensitization did not influence the rates of asthma flare up, emergency room (ER) visit or hospital admission among the studied sample (table 4). Similarly, therapeutic modalities needed and response to treatment were comparable between the 2 groups (table 5).

Table 1. Demographic data of the included children

Study parameter		Total no. = 100
Age (years)	Mean ± SD Range	8.19 ± 2.18 6 – 12
Sex	Female Male	49 (49%) 51 (51%)
Age at diagnosis (years)	Mean ± SD Range	3.53 ± 2.45 1 – 10
Exposure to passive smoking	Negative Positive	38 (38%) 62 (62%)
Residency	Urban Suburban and rural	32 (32%) 68 (68%)

SD: standard deviation

Table 2. Ragweed grass pollen skin Prick test results

Studied Parameter		
Sensitization to ragweed (in 100 subjects)	No Yes	59 (59%) 41 (41%)
Wheal diameter (mm)	Mean ± SD Range	5.15 ± 1.53 3 – 8
Flare diameter (mm)	Mean ± SD Range	18.59 ± 3.18 13 – 25

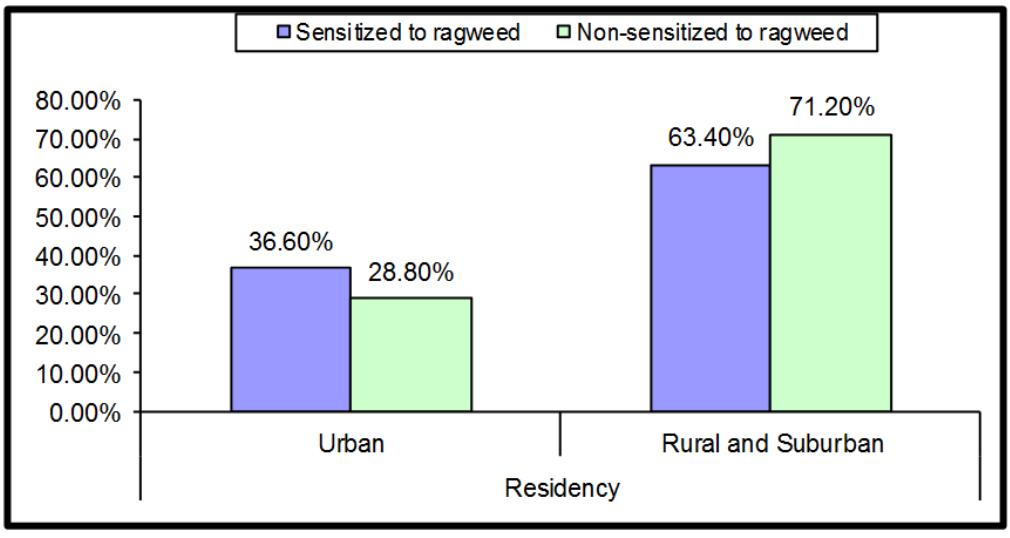

Figure 1. Ragweed sensitization variation according to residency

Table 3. Variation of ragweed sensitization according to concomitant allergy or family history

Study parameter		Sensitized to ragweed		Non-sensitized to ragweed		Test value*	P-value
		No.	%	No.	%		
Atopic dermatitis	No Yes	21 20	51.2 48.8	41 18	69.5 30.5	3.428	0.064
Allergic rhinitis	No Yes	15 26	36.6 63.4	19 40	32.2 67.8	0.207	0.649
Family history	No Yes	6 53	10.2 89.8	4 37	9.8 90.2	0.005	0.946

*: Chi square test

Table 4. Asthma flare ups and hospitalization rates in relation to the status of ragweed sensitization

Study parameter		Sensitized		Non sensitized		Test value	p-value
		No.	%	No.	%		
Frequency of flare ups/ year	< once/month Once/ month > Once/ month	22 4 15	53.7 9.8 36.6	28 2 29	47.5 3.4 49.2	2.688	0.261
Frequency of ER visits in the last year	< 3 times ≥ 3 times	13 28	31.7 68.3	22 37	37.3 62.7	0.331	0.565
Frequency of hospitalization in the last year	No admission Once > once	10 11 20	24.4 26.8 48.8	11 15 33	18.6 25.4 56	6.746	0.034
PICU admission in the last year	No admission Once > once	23 12 6	56.1 29.3 14.6	33 16 10	55.9 27.1 16.9	0.121	0.941
MV in the last year	No Yes	33 8	80.5 19.5	48 11	81.4 18.6	0.012	0.913

ER: emergency room; MV: Mechanical ventilation; PICU: pediatric intensive care unit

Table 5. Relation between ragweed sensitization and asthma controller therapies

Controller therapy		Sensitized to ragweed		Not sensitized to ragweed		Test Value*	p-value
		No.	%	No.	%		
LTRA	No	22	53.7	31	52.5	0.012	0.912
	Yes	19	46.3	28	47.5		
LABA	No	7	17.1	15	25.4	0.983	0.321
	Yes	34	82.9	44	74.6		
ICS	No	2	4.9	3	5.1	0.002	0.963
	Yes	39	95.1	56	94.9		

ICS: inhaled corticosteroids; LABA: long-acting beta agonist; LTRA: leukotriene receptor antagonist. *: Chi-square test

DISCUSSION

Sensitization to ragweed grass pollen was in 41 out of 100 Egyptian children with physician-diagnosed BA. A 3 mm wheal diameter is accepted as the cut off value for ragweed sensitization.[11] In contrary to many other studies, ragweed sensitization was equally detected in both genders in our series.[12,13,14] The reported higher ragweed grass sensitization rates in males was explained by the possible protective effect of estrogen against the expression of allergy in adolescents and the more exposure of boys to environmental allergens.[13]

Noticeably, ragweed grass sensitization was detectable with higher frequency in children living in rural and suburban areas. This might be explained by two factors. First, owing to the consecutive manner of enrolment in our study two thirds of the studied patients were living in rural and suburban areas, and this may have confounded our results. Second, it is possible that urban cities in Egypt are characterized by less plantation and fewer

industrial factories than suburban areas. The latter may lead to excessive CO_2 emission and higher temperature and thus more growth of ragweeds.[4] In European countries, living in a rural environment was protective against ragweed sensitization due to lower temperature and less CO_2 concentration, which in turn, have great influence on pollen production and therefore on the allergen amount.[4] The urbanization march to the rural areas in Egypt and expansion of pollution of the agricultural lands have a major role in the atmospheric changes and ragweed distribution though. It was noticed in another study conducted on 404 school children, that ragweed associated allergic rhino-conjunctivitis was more frequent in urban areas rather than rural ones.[15] The number of residents in purely rural areas in our series is limited and does not allow for conducting matched comparisons.

Ragweed sensitization was observed in the asthmatic children who suffered other allergic manifestations, especially AR. Nevertheless, the concurrent AR had no impact on the severity of manifestations, age of onset of symptoms, frequency of flare ups or response to treatment in our series. Detection of ragweed sensitization in allergic children was a common finding in many studies whatever the site of allergy is.[16,17,18]

Family history of allergy was found in most of the studied children; however, it did not influence the status of ragweed sensitization. On the contrary, Agnew and colleagues, recorded a strong relation between parental or sib atopy and ragweed sensitization.[11]

Children in our series who were sensitized to ragweed did not differ from their non-sensitized peers as far as the disease severity and response to treatment are concerned. Similar observations were noted from several studies in which sensitization to ragweed was not associated with increased risk or severity of asthma, wheeze, or eczema[11] and patients favourably responded to conventional lines of therapy.[3] On the other hand, many investigators noticed association between ragweed sensitization and the recurrence of flare ups of AR and BA in adults and elderly[19,20,21] and the response to conventional therapy was limited.[22,23]

In conclusion, ragweed sensitization seems common among school-age Egyptian children with bronchial asthma. However, sensitization with ragweed did not seem to increase the risk of flare ups or severity of asthma or to influence the choice of therapeutic modalities. This pilot study is limited by the sample size and consecutive manner of sampling. The latter did not allow for even distribution of the sample according to study variables including residential classification, concomitant allergies, and disease outcome. A future prospective study would better help to identify the impact of ragweed sensitization on disease flare ups and progression. We also need to investigate the real extent of ragweed sensitization and allergy through wider scale studies at various locations of our country. This will indeed outline the extent of the problem and hence the need for ragweed immunotherapy in the Egyptian children.

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