

Evaluation of Inhalant Allergens Sensitization in Year-Round Ocular Allergy and its Severity

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Abstract:

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Background: Ocular allergy is a heterogeneous disorder in which allergic inflammation plays a major role. its manifestation may be seasonal or a perennial with a year-round moderate to severe symptoms like in perennial allergic conjunctivitis (PAC) or Atopic keratoconjunctivitis (AKC). **Objectives:** Our goal is to determine sensitization prevalence of inhalant allergens in ocular allergy. **Patients and Methods:** a cross sectional study conducted from November 2022 to March 2023 on 21 year-round ocular allergic patients with perennial allergic conjunctivitis or atopic keratoconjunctivitis was conducted. Total Ocular Symptoms Score (TOSS) score was used to measure the severity of ocular allergy. Skin Prick test with 7 inhalant allergens, negative and positive control were applied. Participants were recruited from Benha University Hospitals, Egypt after gaining ethical committee approval. **Results:** 80.9 % (17/21) had positive Skin Prick Test of our 21 participants. Only cockroach and dust mites' allergens were significantly associated with ocular allergy severity. **Conclusion:** to our knowledge it is the first study to state that cockroach sensitivity in year-round ocular allergy has

higher prevalence especially in atopic keratoconjunctivitis and is more commonly found in severe ocular allergy patients. So, we enrich the research in this area which could secure an adjuvant treatment that might help in controlling patients' symptoms.

Keywords: Ocular allergy, Inhalant allergens, Sensitization, Skin prick tests

Introduction:

Ocular allergy is a broad group encompassing many disorders in which allergic inflammation plays a major role. Its manifestation may be seasonal such as seasonal allergic conjunctivitis (SAC) and Vernal keratoconjunctivitis (VKC) or a perennial with a year-around moderate to severe symptoms like in Perennial Allergic Conjunctivitis (PAC) or Atopic Keratoconjunctivitis (AKC) ⁽¹⁾. Allergic keratoconjunctivitis could be considered more severe than other types of ocular allergy as while cornea epithelium and periocular area are not affected in allergic conjunctivitis, it may be severely involved in Keratoconjunctivitis ⁽²⁾.

Topical treatment including antihistamines, mast cell stabilizer and NSAID can be tried to alleviate the bothersome symptoms of burning, itching, tearing and conjunctival erythema without major adverse effects but sometimes the necessity of topical steroid to relieve severe ocular allergy phenotypes is confronted by its known concomitant long term use side effects ⁽³⁾.

Allergen driven inflammation through T Helper 2 (TH2) is the foundation of ocular allergy evolution so other atopic diseases such as allergic rhinitis, asthma and atopic dermatitis may be associated with it ⁽⁴⁾.

Eosinophils recruitment and activation had also been involved in severe keratoconjunctivitis and many emerging targeted therapies are underway of development ⁽⁵⁾. Many studies deliberated the allergens sensitization in the diverse ocular allergy diseases ⁽⁶⁻⁸⁾.

Allergen sensitization in ocular allergic patients was studied through skin prick testing and allergen specific Ig E assays in different communities ^(6,7). They concluded

that allergen's role should not be underestimated in ocular allergy symptoms control ^(6,7). Allergen immunotherapy was one treatment modality to use for ocular allergy especially severe types such as vernal keratoconjunctivitis ⁽⁹⁾.

Severity of ocular allergy disorders can be evaluated by a clinical tool called a Total Ocular Symptoms Score (TOSS) score which includes Itching, Tearing and Redness whereas in each symptom a 0 scale means absent symptoms rising to a scale 3 which means severe symptoms ⁽¹⁰⁾. Whereas studies showed that dust mites and pollen allergens sensitization were the most prevalent in ocular allergy disorders ^(11,12), quite-a-few studies studied cockroach sensitization and found that it might resemble a great portion in severe allergic diseases such as allergic rhinitis or asthma ^(13,14).

Patients and Methods:

This is a single center cross sectional study of 21 year-round ocular allergic patients with perennial allergic conjunctivitis or atopic keratoconjunctivitis had been recruited from Benha University Hospitals, *Egypt* from November 2022 to March 2023.

Twenty-one Perennial allergic conjunctivitis or atopic keratoconjunctivitis patients were selected as inclusion criterion by experienced ophthalmologist with history, clinical examination and slit lamp evaluation.

Demographic data were obtained after clinical and ophthalmological examination. Such as age, gender, duration of illness, atopic personal or family history, insect allergy and Total Ocular Symptoms Score (TOSS) score.

Skin Prick Test with inhalant allergen, negative and positive controls had been

tested for every patient according to European Academy of Allergology and Clinical Immunology (EAACI) standardization⁽¹⁵⁾

The study had been approved by Benha medical ethics committee RC 16.11.2022 under declaration of Helsinki principles in 2008 and informed medical consents was obtained from participating subjects.

Statistical methods:

The collected data were tabulated and analyzed using SPSS version 26 software (Spss Inc, Chicago, ILL Company). Categorical data were presented as number and percentages while quantitative data were expressed as mean \pm standard deviation. Inter-group comparison of

categorical data was performed by using chi square test (X^2 -value), ANOVA test was used to compare between mean of more than two groups of numerical data. *P* value <0.05 was considered statistically significant.

Results:

In the present article the demographic characteristics of our recruited patients were tabulated according to TOSS score severity classification. Age and gender are matched between the studied ocular allergic groups. Duration of illness was not significantly important in determining the ocular allergy severity score (table 1).

Table 1: Comparison of the disease severity regarding sociodemographic data

Characteristics	Mild (n=8)	Moderate (n=6)	Severe (n=7)	Test of sig.	p-value
Age (mean \pm SD) years	26.9 \pm 11.1	27.8 \pm 13.8	29.1 \pm 11.5	0.1	0.9
Sex No. (%)					
Female	4 (50%)	5 (83.3%)	4 (57.1%)	1.7	0.5
Male	4 (50%)	1 (16.7%)	3 (42.9%)		
Duration Of illness (mean \pm SD) months	25 \pm 16.8	18.7 \pm 10.3	14.7 \pm 7.3	1.7	0.7

P-value is considered significant when < 0.05 .

7 Inhalant Allergens were tested for all 21 patients and 80.9 % (17/21) had a positive Skin Prick Test (table 2). Only dust mites and cockroach allergens were significantly associated with severity. all severe conjunctivitis was tested positive for cockroach allergen (table 3).

Our results showed that cockroach sensitization was significantly associated with ocular allergy severity (fig 1)

Allergic sensitization positivity was more noted in atopic keratoconjunctivitis than in perennial allergic conjunctivitis and moreover cockroach sensitivity was more prevalent in atopic keratoconjunctivitis (table 4)

Table 2: Prevalence of allergen sensitivity in studied patients.

Age means (S.D.), years	27.9 (11.5)
Female/male No. (%)	13 (61.9)/8(38.1)
Duration Of illness, months	19.8 (12.6)
Risk factors No. (%)	
Sensitization No. (%)	17 (80.9)
Pollen No. (%)	7 (33.3)
Dust Mites No. (%)	9 (42.9)
Cockroach No. (%)	9 (42.9)
Hye No. (%)	9 (42.9)
Mold No. (%)	9 (42.9)
Cat No. (%)	1 (4.8)
Wool No. (%)	4 (19)

Table 3: Comparison of the disease severity regarding inhalant sensitization.

Characteristics	Mild (n=8)		Moderate (n=6)		Severe (n=7)		Test of sig.	p-value
	No.	%	No.	%	No.	%		
Sensitization	6	75.0	5	83.3	6	85.7	0.5	0.9
Pollen	2	25.0	2	33.3	3	42.9	0.7	0.8
Dust Mites	3	37.5	5	83.3	1	14.3	6.02	0.04*
Cockroach	0	0.0	3	50.0	6	85.7	11.7	0.002*
Hye	3	37.5	2	33.3	4	57.1	0.9	0.7
Mold	3	37.5	3	50.0	3	42.9	0.3	0.9
Cat	1	12.5	0	0.0	0	0.0	1.7	0.4
Wool	2	25.0	1	16.7	1	14.3	0.5	0.9

P-value is considered significant when < 0.05.

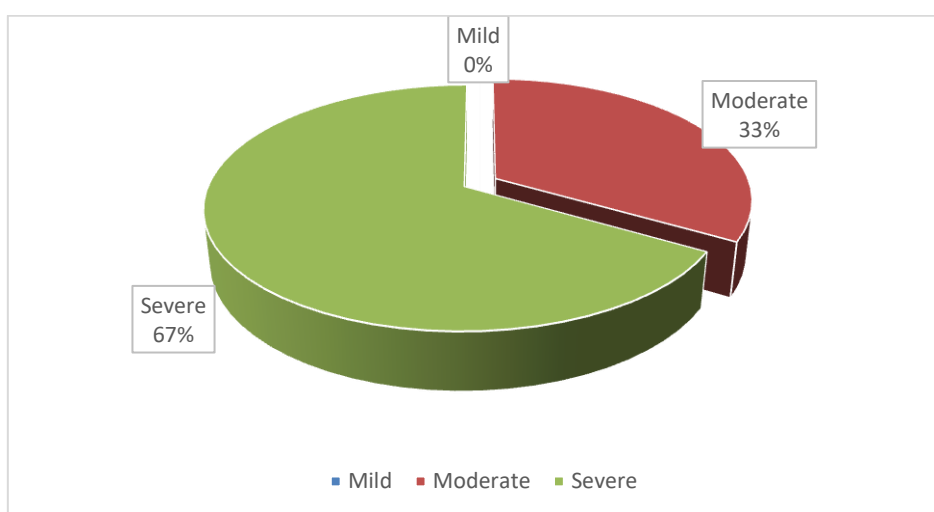


Fig 1: Cockroach sensitization in relation to ocular allergy severity

Table 4: Prevalence of allergen sensitivity in atopic keratoconjunctivitis and perennial allergic conjunctivitis

Characteristics	Perennial allergic conjunctivitis (n=14)		Atopic Keratoconjunctivitis (n=7)	
	No.	%	No.	%
Sensitization	10	71.4%	7	100%
Pollen	4	28.6%	3	42.9%
Dust Mites	7	50.0%	2	28.6%
Cockroach	3	21.4%	6	85.7%
Hye	6	42.9%	3	42.9%
Molds	5	35.7%	4	57.1%
Cat	1	7.1%	0	0.0%
Wool	3	21.4%	1	14.3%

Discussion:

Chronic persistent ocular allergy like atopic keratoconjunctivitis or perennial allergic conjunctivitis was classified as Ig E mediated ocular allergy in most cases⁽¹⁶⁾.

Skin prick tests for evaluating ocular allergy and subsequent allergen immunotherapy AIT as a modality of adjuvant treatment was evaluated and approved in many studies⁽¹⁷⁾. Sublingual allergen immunotherapy had a higher preferable advantage and benefits than subcutaneous shots as it provide an easily applicable way in administration with a higher safer profile and lesser risk of anaphylaxis⁽¹⁸⁾.

Generally, cockroach sensitivity was linked to respiratory allergic disease, especially children with asthma as could affect asthma severity when the inner-city cockroach allergen burden is high⁽¹⁹⁾.

Cockroach allergens were usually a mixture of the two abundant household species that contain its major and minor allergens. The two species that are inhabitant in Egypt are German and Americana cockroach that are also named

Blattella germanica L. and *Periplaneta americana* L. respectively. These species were also mostly inhabited in other areas of world including North America⁽²⁰⁻²¹⁾.

In our present study, co-sensitization of dust mites and cockroach allergens were significant in ocular allergic patients, especially the severe form that correlates with some reports in central Europe. These reports showed although the rarity of cockroach monosensitization, the dust mites allergen sensitization was usually co-sensitized with⁽²²⁾.

In many areas of Asia, the prevalence of cockroach sensitivity was confirmed among allergic asthmatic and rhinitis patients particularly severe ones⁽²³⁾.

Cockroach sensitization in atopic keratoconjunctivitis is more prevalent than in perennial allergic conjunctivitis that may be explained by the degree of severity that the atopic keratoconjunctivitis patients usually had as it might raise the risk to vision loss through corneal opacities complications.

Pollens sensitization was one the least allergen skin positivity in our studied

patients that mirror the year-round ocular symptoms our participants have ⁽²⁴⁾. Although molds sensitization usually denotes severity in allergic asthmatic patients ⁽²⁵⁾, but our study showed no significant difference in mold sensitization and ocular allergy severity.

Apart from studying cockroach allergens in ocular allergy, other studies conducted in different populations revealing dust mites was the most prevalent allergen positivity in ocular allergic patients ⁽²⁶⁾.

More than 10 allergens (Such as Bla g groups, Per a, Chitinase and Vitellogenin) were identified from different cockroach species. Both Ig E mediated with additional T cell response were implicated in the sensitization process. Molecular cockroach allergen specific Ig E usually shows a mixed pattern rather than a single unique allergen prevalence with contrasts with cat and dust mites allergen sensitization which usually include about 90 % from one allergen in different populations ⁽²⁷⁾.

Varied cockroach allergens make it harder to have universally accepted allergic tests or globally approved allergen specific immunotherapy till now, although many local medical institutional authorities had their own.

Our study limitation could be our small sample size and limited locality recruitment. Also, the absence of an accepted standardized cockroach and mold allergens might be another study limitation. However, to our knowledge it is the first study to evaluate the prevalence of cockroach sensitivity in severe year-round ocular allergy aiming to intensify research in this area to give patients an adjuvant treatment that might help in controlling their symptoms.

Conclusion:

Cockroach sensitivity in year-round ocular allergy is prevalent especially in atopic keratoconjunctivitis and it is more commonly found in severe ocular allergy patients.

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