Research Article

Correlation between house dust mites' sensitization and allergic diseases - A retrospective study of Saudi Arabia

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ABSTRACT

Background: Globally, inhalant allergen sensitization (IAS) in allergic diseases (ADs) is commonly associated with indoor allergens, mainly house dust mites (HDMs). **Objective:** The objective of this study was to determine the association between HDM sensitization (HDM-SN) and ADs. **Materials and Methods:** A retrospective study was conducted which included all patients with allergies, >15 years of age, and seen over a 1-year period at the Allergy Center, Lalune clinics, Jeddah, Saudi Arabia. Results of serum specific immunoglobulin E (sIgE) to 30 common inhalant allergens (INHs) were collected by medical students. Severity of sensitization was classified as 1–6 (1–2 being mild, 3–4 being moderate, and 5–6 being severe). Medical records of patients with HDM-SN were reviewed to determine any clinical diagnosis of ADs and other associated IAS. **Results:** A total of 55 adults with HDM-SN, 34 males (62%) and 21 females (38%), with an age range of 15>56 years were studied. ADs associated with HDM-SN were allergic rhinitis (AR) (27%), asthma (22%), allergic conjunctivitis (AC) (18%), atopic dermatitis (ATD) (16%), allergic sinusitis (9%), and chronic urticaria (8%). The average severity class of HDM-SN in our sample was moderate (Dermatophagoides pteronyssinus [2.3] and Dermatophagoides farinae [2.2]). Other IAS found to be associated with HDM-SN were cockroaches (13.86%), *Alternaria* (12.4%), cats (12.4%), Bermuda (11.67%), and mesquite (10.21%). **Conclusion:** Average HDM-SN severity class was moderate in the studied group of patients (early to middle adult ages). HDM-SN is always associated with other IAS (INH-SNs) which explains the importance of obtaining an all-INH panel in patients with HDM-SN. IAS which most frequently had an association with HDM-SN was cockroaches, *Alternaria*, and cats with two outdoor allergens Bermuda, and mesquite, following closely. HDM-SN is usually associated with multiple ADs mainly involving INHs including AR, asthma, and AC, and less commonly ATD, sinusitis, and chronic urticaria.

KEY WORDS: Houses Dust Mites; Inhalant Allergen Sensitization; Allergens; Allergic Diseases; Skin Prick Test

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INTRODUCTION

Indoor inhalant allergens (INHs) are the most common type of allergens and cause perennial allergies. The main diseases caused by these allergens are allergic rhinitis (AR), allergic sinusitis, asthma, and allergic conjunctivitis (AC). The most commonly implicated allergens are house dust mites (HDMs),

cockroaches, cats, and molds. HDMs are considered as the most common INH worldwide. Dogs may be more common than cats in homes with dogs living with them. This pattern contrasts the seasonal morbidity caused by pollen.[1]

HDMs are tiny bodies which can only be seen by an electron microscope. They live in fabric, textiles, and textures. They are concentrated in humid, dark areas, and feed mainly on dead human skin, which is common in sleeping rooms. They commonly inhabit mattresses, pillows, carpets, and curtains. Their bodies do not cause allergy; however, the excreta which is inhaled during sleep is allergenic. Simple vacuum cleaning cannot remove HDMs from fabrics and they need more sophisticated measures.[2]

HDMs mainly cause inhalant allergic diseases (ADs) such as AR, allergic sinusitis, AC, and asthma. This is due to direct contact between the allergen and the mucosal surface of the nose, sinuses, eyes, and respiratory tree, respectively. Exposure to HDMs is continuous because it is common within homes. Other allergies such as eczema and contact dermatitis can also be caused by HDMs. House dust mite sensitization (HDM-SN) alone without any allergic symptoms is not considered clinically significant.[3]

Complete HDM avoidance is impossible due to its ubiquitous nature. However, sleeping rooms are the main source as patients spend most their time there. Measures to avoid HDM exposure in sleep rooms include putting mattresses and pillows inside HDM covers, replacing fabric curtains with plastic or aluminum ones, and fabric carpets with ceramic. However, there is limited evidence as to the effectiveness of these measures.[4]

HDMs cause many morbidities because they are underdiagnosed due to the lack of allergy testing. This is mostly due to common misconceptions of regarding their significance in allergy diagnosis, cost, and the lack of accessible laboratories. However, not diagnosing the causative allergen would significantly affect patients' quality of life. HDMs and other indoor allergens can be managed by avoidance, therapeutic drugs, and immunotherapy.[5] The aim of this study is to determine the association between HDM sensitization (HDM-SN) and ADs.

MATERIALS AND METHODS

This was a retrospective study conducted in June 2018 in the Asthma and Allergy Center at Lalune clinics, Jeddah, Saudi Arabia. Data were collected from the medical record department by medical students from two universities in the western region of Saudi Arabia. Reports of patients with an inhalant allergen panel were reviewed and those positive for HDM allergies (Dermatophagoides pteronyssinus [DP] and Dermatophagoides farinae [DF]) were included for this study.

Our sample comprised 55 urban adults, of which there were 34 males and 21 females from Jeddah city. All clinical diagnoses of ADs (ACs, AR, allergic sinusitis, asthma, eczema or atopic dermatitis [ATD], food allergy, and urticaria) were obtained from the patient records. Patients who did not have HDM-SN and those aged <15 years were excluded from this study.

A blood test was used to measure serum specific IgE (sIgEs) to INHs. The machine used was the RIDA® Allergy Screen (a product of R-Biopharm company) done by digital photos in RIDA® X-Screen or RIDA® maXi-Screen. The score report obtained ranged from 0 to 6 (0 meant negative and 1 and above were positive). A higher score indicated a higher sensitization severity. Positive results had to be correlated with the clinical context as they were not considered an allergy in the absence of a corresponding history. Thus, the test was read by an expert to classify the result accordingly.

The inhalant allergen panel tests for sIgEs to 30 allergens. All other INHs which were commonly associated with positive HDMs were obtained including cockroach, Bermuda grass (BDG), rye grass, alder, birch, oak white, olive, acacia, mesquite tree, desert palm pollen, ragweed, chamomile, plantain, *Parietaria* (wall pellitory), orach, *Chenopodium album*, alfalfa, animal's epithelium (cat, dog, and horse), camel hair, sheep's wool, Penicillium notatum, *Cladosporium herbarum, Aspergillus fumigatus*, *Alternaria alternata*, and latex.

Data were recorded on an Excel sheet and summarized in four tables - demography of patients with positive HDMs sensitization, class score average of positive HDMs sensitization, frequency of ADs associated with positive HDM-SN, and frequency of other INH sensitizations associated with positive HDM-SN.

RESULTS

About 62% of our patients were male and 38% were female. 75% of the patients were between 15 and 45 years of age [Table 1].

Table 1: Demography of patients with positive HDMs sensitization (*n*=55)

Age groups (Years)	Male	Female	Total (%)
15–25	8	5	13 (24)
26–35	10	6	16 (29)
36–45	6	6	12 (22)
46–55	7	2	9 (16)
>56	3	2	5 (9)
%	62	38	100
Total	34	21	55

HDMs: House dust mites

In our sample, the average class score severity was consistent with mild HDM sensitization (DP 2.3 and DF 2.2); however, this sensitization level needed clinical correlation with ADs. In addition, this sensitization score does not reflect low morbidity [Table 2].

The most common AD associated with HDMs sensitization was AR (23 cases [27%]) and the least common was chronic urticaria (7 cases [8%]). ADs associated with HDM-SN in descending order of frequency were AR (23 cases [27%]), asthma (19 cases [22%]), acute conjunctivitis (16 cases [18%]), ATD (14 cases [16%]), sinusitis (8 cases [9%]), and chronic urticaria (7 cases [8%]). The total number of ADs repetition with 55 cases is 87 AD (158%) [Table 3].

Other INH sensitizations associated with positive HDM-SN in descending order of frequency were as follows: Cockroach (19 patients [13.86%]), *Alternaria alternata,* and cat epithelium (17 patients [12.4%]), BDG (16 patients [11.67%]), mesquite (14 patients [10.21%]), *C. herbarum* (11 patients [8%]), acacia and orach (10 patients [7.3%]), birch (7 patients [5.1%]), oak white, and *Aspergillus fumigatus* (6 patients [4.38%]), and plantain (4 patients [3%]). The total number of INHs repetition with 55 cases is 137 (249%) [Table 4].

DISCUSSION

In our study, the average HDM-SN score was 2.3 DP and 2.2 DF which falls in the mild to moderate sensitization grade. However, this does not mean mild clinical allergy or low morbidity level. HDM sensitization is not considered a clinical allergy; unless, it is associated with allergic symptoms. Hence, it is crucial to review the detailed allergic history in tandem with allergy testing results. HDM-SN indicates the presence of sIgEs against HDMs on the surface of mast cells. This can happen after the initial exposure to HDMs. On reexposure, mast cells release allergy mediators including histamine, prostaglandins, and leukotrienes. This results in allergic symptoms in some patients [Table 2].

Does HDM exposure in early age cause ADs in future? In a study conducted in the USA, in 2003, 97 infants who were exposed to HDMs were followed clinically through their first 7 years of life. The study concluded that the early exposure to HDM in infancy was positively linked to asthma symptoms. However, controversy exists as to whether HDMs are linked to the occurrence of bronchial hypersensitivity in future years. In our study, HDM-SN involved early adult ages (75% of the sample) more than late adult ages [Table 1].[6]

In this study, 158% repetitions between ADs implied all 55 cases are cases of multiple allergies [Table 3]. That is why allergy patients benefit more from visits to allergists more than other specialties. The main role of allergists is to identify and treat allergy triggers. Patients are managed with a combination of three treatment modalities: Environmental, therapeutic, and immunological (allergy immunotherapy). If allergy patients are treated by a single modality alone, they will not be relieved. A study from the United Kingdom, in 2003, concluded that HDM covers alone will not relieve asthma symptoms.[7]

Inhalant ADs are the main clinical allergies associated with HDM-SNs (67%) [Table 3]. In descending order of frequency, they include AR, asthma, and ACs. AR and asthma are

Table 2: Class score averages of positive HDMs sensitization

Mite	Class score average
DP	2.3
DF	2.2

HDMs: House dust mites, DP: Dermatophagoides pteronyssinus, DF: Dermatophagoides farinae

Table 3: Frequency of ADs associated with positive HDM-SN

AD	Frequency (%)
AR	23 (27)
Asthma	19 (22)
AC	16 (180
ATD	14 (16)
Sinusitis	8 (9)
Chronic urticaria	7 (8)
Total	87 (100)
% of repetition	87/55=(158)

HDM-SN: House dust mites-sensitization, AR: Allergic rhinitis, ATD: Atopic dermatitis, ADs: Allergic diseases, AC: Acute conjunctivitis

Table 4: Frequency of other INH sensitization associated with positive HDMs sensitization

Other INHs associated with HDM	Frequency (%)
Cockroach	19 (13.86)
Alternaria alternata	17 (12.4)
Cat epithelium	17 (12.4)
BDG	16 (11.67)
Mesquite	14 (10.21)
C. herbarum	11 (8)
Acacia	10 (7.3)
Orach	10 (7.3)
Birch	7 (5.1)
Oak white	6 (4.38)
Aspergillus fumigatus	6 (4.38)
Plantain	4 (3)
Total	137 (100)
% of repetition	137/55=(249)

HDMs: House dust mites, INH: Inhalant allergen, BDG: Bermuda grass, *C. herbarum: Cladosporium herbarum*

Table 5: MS distribution according to geographical area

Country	*Alternaria*	*Aspergillus fumigatus*	*Cladosporium*	*Penicillium*	*Mucor*
Saudi Arabia (desert climate)	Most common indoor	Indoor uncommon	Indoor 2nd to *Alternaria*		
Europe (temperate climate)	Outdoor common	Indoor common	Outdoor common	Indoor common	Indoor common

MS: Mold sensitization

Table 6: Local studies in Saudi Arabia on Bermuda and MQG

Authors	Article	Journal	Bermuda in Saudi	Mesquite in Saudi
Alqahtani JM *et al*.	Environmental determinants of bronchial asthma among Saudi School children in Southwestern Saudi Arabia	Int J Environ Res Public Health. 2016	Common	
Almogren A	Airway allergy and skin reactivity to aeroallergens in Riyadh	Saudi Med J. 2009	Common (53.8%)	
Kwaasi AA *et al*.	Aeroallergens and viable microbes in sandstorm dust. Potential triggers of allergic and non-allergic respiratory ailments	Allergy. 1998	Common	
Suliaman FA *et al*.	Pattern of immediate-type hypersensitivity reactions in the Eastern Province, Saudi Arabia	Ann allergy asthma immunol. 1997	Common (29%)	Common (46%)
Al Anazy FH, Zakzouk SM	The impact of social and environmental changes on AR among Saudi children. A clinical and allergological study	Int J Pediatr Otorhinolaryngol. 1997	Common	Common
Sorensen H, Ashoor AA, Maglad S.	Perennial rhinitis in Saudi Arabia. A prospective study	Ann allergy. 1986	Common	
Sørensen H	The occurrence of IAs in Saudi Arabia	Ann allergy. 1985	Common	

IAS: Inhalant allergen sensitization, AR: Allergic rhinitis, MQG: Mesquite grass

clinically associated in 80% of cases and empirical treatment of one in the presence of the other is a good preventive step. In addition, this implies that physicians have to focus more on these diseases by obtaining a detailed history on the first visit. The remaining allergies (33%) are distributed between eczema, sinusitis, and chronic urticaria.[8]

About 249% frequency repetition of INHs association with HDM-SNs means that HDM is always associated with others INHs [Table 4]. This finding demonstrates the importance of allergy testing to diagnose other INH sensitization in patients with HDM. In addition, this explains the importance of discovering other INHs when HDM allergy morbidity does not improve despite maximal treatment. Consequently, it would be reasonable to perform a complete INH panel assessment when HDMs are positive.[9]

Five INH allergens comprised 60.54% of the INHs associated with HDM-SN, while the remaining 39.46% were mainly pollen. The allergens constituting the 60.54% of the INHs associated with HDM-SN included three indoor (cockroach, *Alternaria*, and cat) and two outdoor (Bermuda and mesquite). Association of indoor INH sensitization and HDM-SN seems logical in a coastal city like Jeddah; however, we were unable to explain the presence of pollen in this region. The plausible explanation is that some patients were visiting from agricultural areas such as Taif and Abha. The sensitization involving other molds (except *Alternaria*) requires further investigation [Table 4].

In asthmatic children, HDM and cockroach sensitizations have been shown to be positively related. The US-based study in 2001 investigated the relationships between INH and HDM-SN in 1041 asthmatic children. Their result demonstrated that as the sensitization level to HDM increased, the level of cockroach allergen sensitization also increased. This finding can be validated by a skin prick test, radioallergosorbent test serum levels of sIgEs, and the total IgE levels. Cat, mold, and dog sensitizations did not show this positive relation with HDM-SN, which may be attributed to the presence of unknown confounding factors.[10]

Mold sensitization (MS) distribution differs according to the geographical area. In Saudi Arabia, MS occurs mainly indoors. *Alternaria* is the most common in Saudi Arabia with *C. herbarum* following closely. *Aspergillus fumigatus*, however, is uncommon in Saudi Arabia. In Europe (temperate climate), MS can occur both indoors and outdoors. Indoor MS commonly include *Penicillium* and *Mucor*, while outdoor MS include *Cladosporium* and *Alternaria* [Table 5].[11]

Grass sensitization is common in Saudi Arabia, particularly BDG and mesquite grass (MQG). While five local studies mentioned that only BDG is common in Saudi Arabia, the study by Al Anazy *et al*. stated that both grasses were commonplace. However, the study by Suliaman FA *et al*. concluded that MQG is more common than BDG. The two studies which mentioned MQG had been published relatively early (1997). The picture seems to have changed recently with the study in 2016 by Alqahtani *et al.* which showed only the presence of BDG. The highlight overall is that BDG is the most common grass in Saudi Arabia [Table 6].

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