

## Wheat sensitization: which allergic diseases are commonly associated? A retrospective study: Jeddah – Saudi

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### Abstract

**Background:** Wheat is the chief table food with wide spectrum products. Wheat sensitization (WS) is a worldwide suspected immunological problem.

**Objective:** To recognize the commonest clinical allergic diseases which are linked to WS?

**Methods:** A study conducted in Jeddah – Saudi Arabia during the year 2020. This study was done on 162 patients (87 males, 75 females) with median age of (36.1 years). Patients age range between 1–86 years. It's a retrospective study using the *in vitro* RAST food blood test. Patients with positive WS results were enrolled only. Additionally, patient's demography was added. Moreover, diagnosis of allergic diseases was taken. All data were used in excel sheet then 4 tables were extracted.

**Results:** Gender distribution of 162 patients with positive WS was approximately equal between the two genders: 87 (53.7%) males, 75 (46.3%) females. Age distribution of positive WS patients was mainly in adult and middle ages as: 48 (29.7%) between 30–40 years, 33 (20.4%) from 40 to 50 years, 27 (16.6%) in the range of 20 to 30 years respectively. Respiratory diseases were the commonest association with WS: allergic rhinitis and sinusitis 71 (44%), asthma 43 (26%). Atopic dermatitis (AD) and food allergy (FA) were the next association with WS: atopic dermatitis 33 (20%), food allergy 21 (13%). Commonest WS severity class was mild: class 1–2 as 63 (39%), class 2–3 as 48 (30%). This is followed by moderate class: class 3–4 as 20 (12%), class 4–6 as 15 (9%).

**Conclusion:** WS in Jeddah city becomes more prevalent in adult and middle age. Respiratory system diseases (allergic rhinitis, sinusitis and asthma), atopic dermatitis and food allergy are the commonest allergic diseases associate with WS respectively. Mild sensitization is the commonest class severity in Jeddah city.

**Keywords:** wheat sensitization; wheat allergy; asthma; allergic rhinitis; atopic dermatitis

### Introduction

Wheat is one of the most important table foods. Wheat is composed of several proteins which can be classified according to solubility's. Albumin is the only wheat protein which is soluble in water. Other wheat proteins (globulin, gliadin, glutenin) aren't soluble in water, but in other solutions. Gliadin and glutenin wheat proteins are the major part of wheat grain as 80%, each one of them is 40%. Last wheat protein is prolamin which is known as a storage protein.<sup>1</sup>

Wheat proteins can trigger immune system and induce type I hypersensitivity reaction. This reaction is characterized by secretion of a specific IgEs against wheat proteins from B lymphocytes. This process happens very quickly in a matter on 10 minutes and wheat allergy symptoms will appear quickly after wheat ingestion. That's why this reaction is called an immediate hypersensitivity reaction. These symptoms may involve any system like: GIT, nose, sinuses, chest and skin. Symptoms severity may range from mild symptoms to florid anaphylaxis.<sup>2</sup>

However, wheat proteins can induce non-IgE reactions also. Diseases of non-IgE reactions against wheat proteins are eosinophilic esophagitis and eosinophilic gastritis. Non-IgE reactions to wheat proteins are characterized by chronic inflammations due to eosinophilic infiltrations. That's why upper GIT endoscopies are needed in both of eosinophilic esophagitis and gastritis to take tissue biopsies. In a matter of fact, the treatment of choice for the two pathologies is the complete wheat avoidance. Measuring sIgE levels against wheat proteins is useless here.<sup>3</sup>

WS alone don't mean a clinical wheat allergy. WS means the presence of sIgEs to wheat over mast cells surface without any clinical presentation. Nonetheless, if clinical presentation is added then this will be a clinical wheat allergy. This clinical presentation may appear in any form of allergic diseases. Unfortunately, in this regard medical mistakes may happen like what some patient do! Themselves they used to read their *in vitro* sIgE lab results and misinterpret sensitization as a clinical allergy! Certainly, reading allergy testing's a job of physicians only.

### Methodology

A sample of 162 patients with positive (high) *in vitro* sIgE level against wheat proteins were enrolled in this study. These positive results were named as WS. Patients age range between 1–86 years. This study was conducted during the year of 2020 in private clinic in Jeddah - Saudi. This data was collected from patient files retrospectively. The system which was used is RIDA® system. After results were added to excel sheet, four tables were extracted. Positive results

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of WS alone aren't enough. That's why the diagnosis of clinical allergic diseases of the 162 patients was added to this study like: allergic rhinitis, allergic sinusitis, asthma, atopic dermatitis, food allergy, urticaria, angioedema, drug allergy, contact dermatitis and allergic conjunctivitis. This correlation between WS positive results and the associated clinical allergic diseases is essential. In this way it will be easy to know which clinical allergic diseases are most commonly associated with WS. Positive WS class severity scores are in a scale from 1 to 6. Any score below 1 was excluded from this study. Class severities are divided according to sIgE levels against wheat. Class 1-2 are considered as a mild WS. Class 3-4 are named as a moderate WS. Class 5-6 are called as a severe WS. Score values are: class zero (0.00-0.34 IU/ml), class 1 (0.35-0.69 IU/ml), class 2 (0.7-3.49 IU/ml), class 3 (3.5-17.49 IU/ml), class 4 (17.5-49.9 IU/ml), class 5 (50-100 IU/ml), class 6 is any level more than 100 IU/ml. Four tables were extracted. (Tables 1 and 2) are about the demographic distributions for both age and gender. Table 3 is about the correlation between WS and allergic diseases. Table 3 is the actual aim of this study because it can reveal which allergic diseases are most commonly associated with WS. Table 4 is about the association between WS and class severity scores. This table reflects which grade of severity score is more

**Table 2:** WS cases versus age distribution

Age in years	Birth – 10	10 – 20	20 – 30	30 – 40	40-50	50-60	>60	Total
Wheat sensitization	16	8	27	48	33	19	11	162
%	9.8	4.9	16.6	29.7	20.4	11.8	6.8	100

Which allergic diseases are considered as the most common association with WS? Respiratory diseases are the commonest (Table 3). Respectively they are: allergic rhinosinusitis as 71 (44%) followed by asthma as 43 (26%).

**Table 3:** WS relation to allergic diseases

	Allergic rhinitis, sinusitis	Asthma	Atopic dermatitis	Food allergy	Urticaria, Angioedema	Drug, Allergy	Contact dermatitis	Allergic conjunctivitis
Wheat Sensitization	71	43	33	21	10	10	7	6
%	44	26	20	13	6	6	4	3

WS class severities can be divided into 3 categories (Table 4): mild class (1-3), moderate class (3-5) and severe class (5-6). Mild class WS is the commonest: 63 (39%) between class 1-2, 48 (30%) between class 2-3. Moderate class

**Table 4:** Wheat sensitization versus class severities

Severity class	1-2	2-3	3-4	4-5	5-6
	Mild		Moderate		Sever
Wheat sensitization	63	48	20	15	16
%	39	30	12	9	10

commonly associated with WS.

## Results

162 patients with positive WS lab results were enrolled in this study (Table 1). Gender distribution of this sample was approximately the same for both sexes: 87 (53.7%) males, 75 (46.3%) females. Their range of age is between 1–86 years. Median age is 36.1 years.

**Table-1:** The gender distribution of 162 patients with positive WS

	Wheat Sensitization	%
Male	87	53.7
Female	75	46.3
Total cases	162	100

Which age period is the commonest to have WS? From (Table 2), the most common age distribution which is between 20 to 50 years: 48 (29.7%) in period between 30-40 years, 33 (20.4%) between 40-50 years and 27 (16.6%) in the range of 20 to 30 years in consecutive order. This followed by the age between 50-60 years as 19 (11.8%). WS in other age groups is rare.

Next allergic associations are: atopic dermatitis 33 (20%) and food allergy 21 (13%). Least common associations are: urticaria and drug allergies 10 (6%), contact dermatitis 7 (4%) and allergic conjunctivitis 6 (3%).

WS is less common: 20 (12%) between class 3-4, 15 (9%) between class 4-5. Severe class WS is the least common as 16 (10%) between class 5-6. WS class severities alone aren't adequate; it has to be correlated with patient symptoms.

## Discussion

Prevalence of WS is equal in both genders (Table 1). In adults, FA prevalence is 3.2% and it keeps increasing progressively. FA risk factors are: pollens, occupational aeroallergens sensitization and the enormous food habit changes. Wheat allergy prevalence is also increasing worldwide because wheat is a major daily food plus to its presence in many food types. Certainly, adults do consume huge daily amounts of wheat especially in fast foods.<sup>4</sup>

WS is more prevalent in adult and middle age (Table 2). Wheat allergy may start in childhood and continue to adulthood, or it can start in adulthood. Wheat allergy is universal health problem because of its huge use. Immediate type I hypersensitivity to wheat may involve any organ. Diagnosis of wheat allergy depends mainly on detailed history then lab tests. Lab tests are either: *in vivo* skin prick test on *in vitro* RAST food test. These lab tests are enough in most cases. However, in few cases more tools may be needed like: wheat elimination, wheat diary and wheat challenge.<sup>5</sup>

Current studies correlate mostly between respiratory allergies and wheat inhalation not wheat eating! Wheat inhalation predispose to wheat occupational diseases which can happen in bakeries. Previously work change was the only solution; currently wheat immunotherapy can give a reasonable answer. Recent studies prove that wheat extract sublingual immunotherapy can improve respiratory symptoms in bakery workers. In a cohort Italian study in 2020, wheat flour extracts were given sublingually to several bakery workers who have respiratory symptoms. Their asthma biomarkers were improved after three years follow up.<sup>6</sup>

AD is the next common allergic disease which is associated with WS (Table 3). It's well known that food allergens can trigger AD especially in children, not only wheat. Food allergens which can trigger AD are: cow's milk, egg white, wheat, seafood's, nuts, sesame and peanut. If AD symptoms affect daily life, then allergy testing's are needed to diagnose and avoid food triggers. These tests are: *in vitro* sIgE food test or *in vivo* sIgE skin prick test. Determining and avoiding food allergy triggers can ameliorate AD symptoms.<sup>7</sup>

WS severity grade is mostly of mild class as 69% (Table 4). Class severity grade alone is inadequate information because it must to be combined with patient history. Additionally, class severity grade don't necessarily mean the same clinical severity level. As an example, mild severity class can be accompanied with sever symptoms and vice versa. Moreover, sever class grade may be asymptomatic because simply it's only atopy. By all means, detailed history is the cornerstone in allergy clinic while severity class is only lab interpretation.<sup>8</sup>

Wheat avoidance is the treatment of choice in wheat allergy; however it's not an easy issue. Generally the act of food avoidance differs from one food to another one.

Avoidance of some foods is easy while avoidance of others is difficult. This can be due to several reasons: how much is the demand to that food? How much forms are available from that food in market? As an example: many forms are available from wheat in each market while only few are available from strawberry. That's why wheat and cow's milk avoidance is more difficult than strawberry and mango avoidance. Dieticians have to educate patients about wheat sources and alternatives.<sup>9</sup>

Immunotherapy is a new hope in wheat allergy treatment. Immunotherapy is to give gradual increasing doses of wheat either orally or sublingually. This procedure will induce an immunological modulation which is termed as desensitization. Wheat desensitization means that the body will secrete sIgGs against wheat proteins instead of sIgEs. In USA double blind study, it was clear that low or high oral wheat doses can induce 50% desensitization after one year. This recent advance can help wheat allergy patients in many aspects.<sup>10</sup>

Can wheat allergy patients tolerate wheat again or not? Actually, wheat allergy prognosis is better than other foods like peanut, nut and sesame. It was established that patients can tolerate wheat after a period of full avoidance. In cohort study in 2019, wheat allergy patients were placed on wheat free diet and followed prospectively. After 5 years of follow up it was revealed that 9 out of 10 patients can tolerate wheat well and their sIgEs to wheat was lower. Nonetheless the sample of this study was low and this area needs more studies.<sup>11</sup>

## Conclusions

WS in Jeddah city becomes more prevalent in adult and middle age. Respiratory system diseases (allergic rhinitis, sinusitis and asthma), atopic dermatitis and food allergy are the commonest allergic diseases associate with WS respectively. Mild sensitization is the commonest class severity in Jeddah city.

## Conflict of Interest Statement

It's a retrospective article, no direct human contact (ethical approval N/A).

## Consent for publication

Yes

## Availability of data and material

N/A

## Competing interests

There is no competing interest

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## Authors' contributions

I am a single author

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