INTRODUCTION

Allergy is a widespread global public health problem.\(^1\) It has continuously escalating rates, and it can lead to serious complications.\(^1,2\) The etiology of allergy is due to interactions between both environmental factors, with the permissive genetic factors.\(^3\) Allergy is a hypersensitivity reaction in which the immune mechanism responds (by IgE antibody) to the environmental materials (allergen) that are normally considered harmless.\(^4\)

Allergic disorders have multi-organ presentations such as allergic rhinitis, asthma, urticaria, eczema and anaphylaxis.\(^1\) They are eco-system related conditions, with variations in predictors, and triggering allergens from different countries.\(^3\) The increasing rates of allergy may be attributed to changes in the lifestyles and living conditions.\(^2\) Such increase is well recognized globally during the previous few decades.\(^2,5,6\) Worldwide, allergic disorders affected up to onethird of the world’s populations.\(^7\) It was estimated, 2014, that 400 million...
persons had allergic rhinitis, 300 million suffered from asthma, and about 200-250 million complained from food allergies. Furthermore, it was estimated that 10% of the world’s people had allergy caused by drugs. Allergy can be associated also with increased economic burden, and results in an annual cost of billions of dollars. Urbanization and globalization resulted in marked environmental changes, and lead to increased allergens in the environment.

Asthma was ranked as one of the most common chronic diseases in Saudi Arabia. During college years, allergies may affect students’ quality of life by interrupting their daily activities, diminishing faculty attendance, precipitating poor sleep quality, and diminishing the ability to accomplish academic and extra-curricular activities. A study conducted among 112 medical students from Albaha, Saudi Arabia, revealed a high prevalence of asthma symptoms. Nowadays, there is an increasing interest in the field of allergy among medical students. However, there is lack of adequate number of comprehensive epidemiological research done among a large sample of medical students from Jeddah. So, such study is required. The main study was done to determine the prevalence, types, triggers, and predictors of allergic disorders among medical students and interns from King Abdulaziz University (KAU), Jeddah.

STATISTICAL ANALYSIS: Data analysis was done using the SPSS version 20. Descriptive and inferential statistics were done. A stepwise multiple logistic regression analysis was done to delineate the predictors of allergic disorders. P-value < 0.05 was considered statistically significant.

Ethical consideration: The study was approved by the Institutional Review Board (IRB). The study followed the “ethical values of Helsinki declaration.” Official approvals were obtained. Each participant wrote an informed written consent.

RESULTS

The mean age of participants was 22±1.7 years, with a male to female ratio of 1:1.05. Prevalence of diagnosed allergic disorders (≥ 1 type) among the participants was 36.2% as shown in Table-I. Cutaneous (33.8%), respiratory (29.5%) and eye allergies (11.2%) were the most prevalent types. The most frequently reported skin allergy was eczema (14.3%). Concerning respiratory allergy, the most prevalent types were nasal congestion & allergic rhinitis (AR). Asthma was reported by 6.8% of the participants. The commonest triggering factors of allergy were the house dust (45.6%), smoke (30.4%) and cold air (28.6%). Table-II.

Females had much higher prevalence of allergy (43.5%) compared to males (28.4%). Table-III. A highly statistical significant difference was present (X²=14.8, P<0.001). Participants from families with higher income, and whose fathers obtained a university degree or above reported a higher rate of allergy than others. Smokers had a slightly higher prevalence of allergy compared to others (P > 0.05). Furthermore, allergy rate was slightly higher among those exposed to stress, during 6 months preceding the study, compared to others (P > 0.05). Participants with family history of allergic disorders were about 5 times more prone to have allergy compared to others (OR= 4.7, 95% C.I.: 3.22-6.87). In addition, those who complained of water leaks and molds contamination near their houses had a significantly higher prevalence of allergy than others (X²=3.98, P < 0.05).

First predictor of allergy among medical students and interns was having family history of allergic
disorders (aOR= 4.35, 95% CI: 2.96-6.39), followed by being a female (aOR= 1.50, 95 % CI: 1.04-2.15).

Table-IV: Regarding medications, 62.2% of the participants who had allergy reported receiving drugs. The commonest received treatment were the antihistaminic drugs (30.4%), corticosteroids (11.1%), bronchodilators (10.4%) and decongestants (8.1%). In addition, 40.0 % of them used more than one treatment modalities (anti-histaminic, cortisone, decongestants, immunotherapy, etc.). Those who used cortisone in any form (either separate or in combinations) accounted for 31.9%. Regarding the source of medications, 41.5% of the students with allergy used over the counter (OTC) drugs. In addition, 30.0% of them attended hospital for receiving oxygen, and 62.6% had never admitted to hospital for allergy. Regarding outcome of allergy, 16.1% of students with allergy reported missing their classes due to it, and 28.6% complained from sleep disturbance during allergic attacks.

Table-I: Prevalence, clinical types, presentations of the diagnosed allergic disorders among medical students and interns, King Abdulaziz University (n=600).

| Type of allergy | No. | %     |
|----------------|-----|-------|
| Any type of allergy (≥ 1) | 217 | 36.2  |
| Skin (cutaneous) allergy | 203 | 33.8  |
| Eczema (atopic eczema) | 86  | 14.3  |
| Contact dermatitis | 54  | 9.0   |
| Itchy rashes | 41  | 6.8   |
| General itching | 36  | 6.0   |
| Hives | 22  | 3.7   |
| Other symptoms | 35  | 4.8   |
| (swelling, pimply rashes, etc.) | | |
| Respiratory or airway allergy | 177 | 29.5  |
| (upper, lower) | | |
| Nasal congestion | 106 | 17.7  |
| Allergic rhinitis (AR) | 100 | 16.7  |
| Running nose | 83  | 13.8  |
| Asthma | 41  | 6.8   |
| Wheezy chest | 37  | 6.2   |
| Chest tightness | 31  | 5.2   |
| Shortness of breath | 23  | 3.8   |
| Hay fever | 1   | 0.2   |
| Others (post nasal drips, itchy nose, sinus allergy) | 102 | 17  |
| Ophthalmic allergy | 67  | 11.2  |
| Food allergy | 64  | 10.7  |
| Anaphylaxis | 24  | 4.0   |
| Food | 10  | 1.7   |
| Drug (e.g. penicillin) | 8   | 1.3   |
| Latex (rubber) | 1   | 0.2   |
| Other | 5   | 0.8   |

Table-II: Frequencies of different triggering allergens among medical students & interns with allergic disorders at King Abdulaziz University (n=217).

| Triggering allergens | No | %     |
|----------------------|----|-------|
| House dust | 99 | 45.6  |
| Smoke | 66 | 30.4  |
| Cold air | 62 | 28.6  |
| Perfumes | 58 | 26.7  |
| Weather changes | 58 | 26.7  |
| Pollution | 51 | 23.5  |
| Cats | 45 | 20.7  |
| Odours | 42 | 19.4  |
| Grass | 29 | 13.4  |
| Formalin | 28 | 12.9  |
| Stress | 27 | 12.4  |
| Insecticides | 26 | 11.9  |
| Hay | 21 | 9.7   |
| Pets (dogs) | 21 | 9.7   |
| Humidity | 21 | 9.7   |
| Cosmetics | 19 | 8.8   |
| Mud & mildew | 19 | 8.8   |
| Exercise | 17 | 6.5   |
| Leaves | 14 | 6.4   |
| Basement floors | 13 | 5.9   |
| Latex | 10 | 4.6   |
| Milk/dairy products | 9  | 4.1   |
| Menstruation | 5  | 3.7   |

NB: Each question was separately asked.

Among the participants diagnosed with allergy, only 30 (13.8%) conducted skin-prick test. Results found that the most common separate specific IgE (sIgE) allergens was related to foods as shrimps (8 cases; 26.7%), insects (4 cases; 13.3%), pet dander (4 cases; 13.3%), dust mites (3 cases; 10.0%) and moulds (3 cases; 10.0%). Furthermore, in 26.7% of the tested cases had a poly-sensitization to more than one allergens.

DISCUSSION

The overall prevalence of allergy among our participants was 36.2%, which agrees with results of nine cohorts among third year medical students from Zurich, Switzerland, and with results among Turkish adolescents and adults. However, our rate is higher than rates reported between Polish female university students (2009 & 2015). This discrepancy may be due to differences between countries, populations, or time of studies. Increase environmental allergens of indoor and outdoor pollution & decreased biodiversity may contribute to the high allergy prevalence nowadays.
Prevalence of allergy among our females is more than males, which agrees with results from Ajman, UAE. Estrogens endogenous female sex hormone may support allergic reactivity by working through estrogen receptor-α of mast cells. Our participants from families with better income and paternal education had higher prevalence of allergy than others. This may be because prevalence of IgE

Table-III: Relationship between presence of allergy and the study variables among medical students and interns at King Abdulaziz University.

| Variable                      | Allergy (n=217) | No allergy (n=383) | X²   | (p)     | OR (CI) |
|-------------------------------|-----------------|--------------------|------|---------|---------|
|                               | No.  | %     | No.  | %     |        |        |
| Gender                        |      |       |      |       |        |        |
| Female                        | 134  | 43.5  | 174  | 56.5  | 14.8   | (0.000)| 1.93   | (1.38-2.72) |
| Male                          | 83   | 28.5  | 209  | 71.6  |        |        |        |
| Marital status                |      |       |      |       |        |        |        |
| Single                        | 202  | 35.9  | 361  | 64.1  | 0.3    | (0.57) | 0.82   | (0.42-1.62) |
| Married                       | 15   | 40.5  | 22   | 59.5  |        |        |        |
| Educational level:            |      |       |      |       |        |        |        |
| Basic                         | 59   | 35.8  | 106  | 64.2  | 0.02   | (0.90) | 0.98   | (0.67-1.42) |
| Clinical & interns            | 158  | 36.3  | 277  | 63.7  |        |        |        |
| Father education              |      |       |      |       |        |        |        |
| University or above           | 175  | 38.3  | 282  | 61.7  | 3.76   | 0.049  | 1.62   | (1.07-2.46) |
| Less than university          | 42   | 29.4  | 101  | 70.6  |        |        |        |
| Mother education              |      |       |      |       |        |        |        |
| University or above           | 134  | 35.6  | 242  | 64.4  | 0.04   | (0.84) | 1.04   | (0.73-1.47) |
| Less than university          | 78   | 34.8  | 146  | 65.2  |        |        |        |
| Father Occupation             |      |       |      |       |        |        |        |
| Professional                  | 159  | 38.8  | 273  | 63.2  | 0.27   | (0.6)  | 1.11   | (0.78-1.65) |
| Non-professional              | 58   | 34.5  | 110  | 65.5  |        |        |        |
| Mother occupation             |      |       |      |       |        |        |        |
| Professional                  | 96   | 36.8  | 165  | 63.2  | 0.07   | (0.78) | 1.05   | (0.75-1.47) |
| Non-professional              | 121  | 35.7  | 222  | 64.3  |        |        |        |
| Father income                 |      |       |      |       |        |        |        |
| Not enough, Enough            | 213  | 36.5  | 370  | 63.5  | 1.21*  | (Fisher’s exact test) | 1.87 | (0.60-5.81) |
| Enough and exceed             | 4    | 23.5  | 13   | 76.5  |        |        |        |
| Current smoker                |      |       |      |       |        |        |        |
| Yes                           | 29   | 39.2  | 45   | 60.8  | 0.34   | (0.56) | 1.16   | (0.70-1.91) |
| No                            | 188  | 35.7  | 338  | 64.3  |        |        |        |
| Passive smoker                |      |       |      |       |        |        |        |
| Yes                           | 113  | 36.0  | 201  | 64.0  | 0.12   | (0.73) | 1.06   | (0.76-1.49) |
| No                            | 99   | 34.6  | 187  | 65.4  |        |        |        |
| Stress                        |      |       |      |       |        |        |        |
| Yes                           | 29   | 39.2  | 45   | 60.8  | 3.3    | (0.07) | 1.41   | (0.97-2.05) |
| No                            | 188  | 35.7  | 338  | 64.3  |        |        |        |
| Family history of allergy     |      |       |      |       |        |        |        |
| Yes                           | 169  | 50.8  | 164  | 49.2  | 68.9   | (0.000)| 4.70   | (3.22-6.87) |
| No                            | 48   | 18.0  | 219  | 82.0  |        |        |        |
| Wood/Coal Stove               |      |       |      |       |        |        |        |
| Yes                           | 43   | 35.8  | 77   | 64.2  | 0.02   | (0.90) | 1.03   | (0.68-1.56) |
| No                            | 169  | 35.2  | 311  | 64.8  |        |        |        |
| Water leaks & molds contamination |   |       |      |       |        |        |        |
| Yes                           | 25   | 49.1  | 26   | 50.9  | 3.98   | (0.04) | 1.79   | (1.01-3.182) |
| No                            | 192  | 34.9  | 357  | 65.1  |        |        |        |

* Fisher’s exact test.
Allergy among medical students & interns

Food allergy occurred among about one-tenth of medical students and interns in the current study. However, a higher rate (17%) was reported from Alba University, and this difference may be due to differences between the target populations. Concerning ophthalmic allergy, 11.2% of our participants complained of it, which is much lower than the rate reported from Ajman. This may be due to the differences between both countries.

In the present study, drug-induced anaphylaxis (especially that induced by antibiotics) was reported by 1.3% of the participants. The prevalence of drug hypersensitivity reported among medical students from Turkey was 4.7%. The cause of lower rate from the current study may be because we inquired about anaphylaxis not all types of hypersensitivity.

Regarding respiratory allergy, the presence of AR from the current study was 16.7%, which coincides with results from a recent study, 2017, done among adolescents from Korea. On the other hand, our rate is higher than the rate of AR (10%) from household surveys in five Middle East countries; based on physicians’ diagnosis. The cause of such discrepancy may be due to differences between the age of the target populations, or the method of reporting and diagnosis the cases. Similarly, a lower rate of AR (7.0%) than that of our study was reported from seven Emirates of UAE.

The prevalence of asthma & wheezy chest among the participants from the present study were found to be 6.8% and 6.2%, respectively. Our rate of asthma coincides with a rate (7.5%) from South India. However, a lower rate of asthma (4.05 %) was reported from a Saudi household survey done among population aged ≥15 years. The cause of this discrepancy may be due to differences between the age group and the types of the target populations.

**Table IV: Predictors of allergic disorders among medical students and interns at King Abdulaziz University.**

| Variable          | B     | P   | aOR  | 95% C.I. |
|-------------------|-------|-----|------|----------|
| Family history of allergy | 1.471 | 0.000 | 4.35 | 2.96-6.39 |
| Gender (Female)   | 0.402 | 0.030 | 1.50 | 1.04-2.15 |
| Constant          | -1.656 |      |      |          |

sensitization to Aeroallergens is increased among persons with high salaries.

Our study found that family history of allergy was the first predictor of allergy among participants, which agrees with other studies. This could be one evidence of the inheritance in allergy. These findings agree with the possible genetic effect in of allergy among family members and with the recent genetic researches which identified many genetic loci at different Interleukin (IL) such as IL1RL1, IL18R1, HLA-DQ, IL33, SMAD3, ORMDL3, GSDMB & IL2RB and these are found to be related to allergic disorders.

The skin is one of the largest immunologic organs that is affected by both external and internal factors, as well as by innate and adaptive immune responses. Our study also revealed that cutaneous allergy was the commonest type allergic disorders. This result coincides with that reported among medical students from Turkey. Regarding different clinical presentation of allergy, the current study showed that prevalence of eczema (atopic eczema) was 14.3%. Similar rates were reported from Alba, and Lebanon.

Regarding respiratory allergy, the prevalence of AR from the current study was 16.7%, which coincides with results from a recent study, 2017, done among adolescents from Korea. On the other hand, our rate is higher than the rate of AR (10%) from household surveys in five Middle East countries; based on physicians’ diagnosis. The cause of such discrepancy may be due to differences between the age of the target populations, or the method of reporting and diagnosis the cases. Similarly, a lower rate of AR (7.0%) than that of our study was reported from seven Emirates of UAE.

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**CONCLUSION**

The prevalence of the diagnosed allergic disorders was high (36.2%) among medical students and...
interns at KAU. The predictors of allergic disorders were family history of allergy and the female gender. Cutaneous and respiratory were the commonest types of allergies. The most important reported allergenic triggers were house dust, smoke, cold air, and perfumes. Regarding the outcome of allergy, 16.1% of students with allergy reported missing their classes due to it, and 28.6% complained from sleep disturbance; during allergy attacks. Detection of allergens is needed for avoiding them. Conduction of awareness campaigns about allergy, triggers and preventive measures are also needed. Screening and management of allergy cases is needed.

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Authors' Contribution:

NKK: Selected the topic, designed the study, analyzed data, writing, editing manuscript & the corresponding author.

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