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ORIGINAL ARTICLE

Assessing the quality of life and environment safety for Saudi food allergic patients in the Makkah region, Saudi Arabia

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ABSTRACT

Background: Food allergy is a costly health issue that can have a negative impact on a patient's well-being. The current study aims to evaluate the quality of life of patients with food allergies using the healthcare system, coping strategies, management knowledge, and environmental safety.

Methods: This was a descriptive cross-sectional, survey-based study, including patients with food allergies in the Makkah region, Saudi Arabia. To achieve the study's aim, an online survey with 21-items was created and distributed between April and June 2021. Data were exported automatically to Excel onto Statistical Package for the Social Sciences for analysis.

Results: A total of 90 food allergy patients were included. About two-thirds (67.8%) had anaphylaxis. The most common reported food allergies were eggs and seafood equally (44.4% for each), followed by some types of fruits (41.1%), then nuts (25.6%). Regarding using the healthcare system, (63.3%) were diagnosed with food allergy by a doctor, and only (13.3%) routinely followed up. Excellent management knowledge was detected among (65.6%) of the participants. Around a third (36.7%) have at workplace/school a certified first-aid provider for allergic food reactions. For coping strategies, the patients were open to sharing their health condition with their family and friends (88.9% and 51.1%, respectively) compared to carrying a card or a self-injection of epinephrine (1.1% for each item).

Conclusion: The current study revealed excellent levels of knowledge among food-allergic patients. Nevertheless, poor practices toward the healthcare systems and inadequate environmental safety were observed. Educational projects for food-allergic patients are critical.

Keywords: Quality of life, coping, safety, food allergy, Saudi Arabia.

Introduction

Food allergy is a potentially life-threatening health issue caused by an abnormal immunological response to the contents of certain foods. It is a common condition affecting children and adults, and several of these food allergies can persist for a lifetime since there is no approved treatment [1,2]. Food allergy can vary in severity and the direct impact on the patient's life and their caregivers [1]. For the past two decades, food allergies have been on the rise, with hospital admissions for food-induced anaphylaxis increasing four-fold from 2 in

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1998-1999 to 8.2 in 2011-2012 [3]. According to a recent nationwide study conducted in Saudi Arabia, locally, 19.7% of people have food allergies [4]. The current best management is absolute avoidance of allergens to prevent potentially fatal reactions combined with immediate access to rescue medication [5]. Intramuscular injection of epinephrine is the first-line treatment for an anaphylactic shock. The early detection of signs and symptoms of food allergy is critical and helps lower the rate of hospitalization and mortalities [6]. Food allergy is a costly health issue that can have a negative impact on a patient's well-being [7]. Health-related quality of life (QoL) is one of the most critical aspects for any patient, particularly those with chronic disorders such as food allergies that have no known cure [1]. This subject has been investigated previously worldwide [8-10]. Impaired QoL among children with food allergies and their caregivers was significantly associated with continuous allergen avoidance and the looming threat of anaphylaxis [8]. Locally, up to the author's knowledge, only one study measured the QoL in the pediatric population with food allergies in Saudi Arabia. It reported that food allergy significantly impacts kids and their families, affecting the QoL in multiple aspects. However, no significant differences were detected between age groups or gender in the overall score [1].

Little is known about the burden of food allergy among adult patients in Saudi Arabia. Much remains to be learned about the patient-level consequences of food allergy in Saudi Arabia, including their coping with food allergy and emergencies, allergen type, management knowledge, and healthcare system usage. This study aimed to provide comprehensive, representative estimates of the burden of food allergy and the coping strategies among adult patients with food allergy in the Makkah region, Saudi Arabia.

Subjects and Methods

An observational, cross-sectional study among food-allergic patients of Makkah region, Saudi Arabia. The study was conducted between April and June 2021. The study enrolled all adult patients aged ≥18 years with a self-reported history of food allergy. People who have a medical background (as health care workers or medical sciences students) and non-Saudi patients were excluded. The sample size was calculated according to two studies conducted in the Makkah region, people diagnosed with food allergies range from 70 to 100 [4,11]. As a result, based on previous literature, the sample size should be 80; 90 patients were included. A modified questionnaire from published studies was used for data collection [12-14]. The tool was pilot tested before data collection, and all necessary modifications were performed before the data was collected. It was created in the Arabic language (the participants' native language), then distributed electronically via Google forms across various social media platforms (WhatsApp, Twitter, and Snapchat). Data were re-translated into English for further analysis and dissemination. The questionnaire comprised 21-items, divided into four parts. Part one involved general information, including basic information regarding age, gender, level of education, history of anaphylaxis, and type of allergic food. Part two involved using the healthcare system and the management knowledge about food allergies. Part three detailed questions about coping with food allergies. Part four involved environmental safety in the workplace or school, and restaurants. Evaluation of the knowledge about the management of food allergy and practice using the healthcare system was performed using a questionnaire with 3-items for each of them. All correct/yes answer was coded as 1, and the incorrect/no answers were coded as 0. By summing up all items, total scores ranged from 1 to 3. For the knowledge, excellent knowledge was determined by scores equal to 3. Fair knowledge scores less than 3. Regarding the practice, scores of 2 or more are classified as good practice, and scores of less than two are classified as poor practice. Data were statistically described as mean ± standard deviation (SD) for continuous data and frequency (percentage) for categorical data. Pearson's chi-square test was used for categorical values to assess the association between management knowledge and sociodemographic data, anaphylaxis history, and practice using the healthcare system. Statistical analysis was performed using IBM Statistical Package for the Social Sciences software version 21.0, and results with a p value of less than 0.05 were considered to be statistically significant. Ethical approval was obtained for this study from the Biomedical Ethics Committee, College of Medicine, Umm Alqura University, Makkah. Approval No (HAPO-02-K-012-2021-03-631). The study participants were informed about the aim of this study and the benefits of their participation, and the participation was completely voluntary.

Results

Characteristics of the participants with food allergy

Table 1 shows the sociodemographic characteristics of 90 food-allergic participants. More than half (65.6%) of the participants were female. The age range was from 18 to 80 years old, and the highest percentage of participants (37.8%) was in the age group (40-59 years). Around two-thirds of the participants (64.4%) completed their bachelor's degree. Slightly more than two-thirds (67.8%) had a previous history of anaphylaxis.

Common types of allergens

The most common reported food allergies among adults were eggs and seafood equally (44.4% for each). Followed by some types of fruits (41.1%), then nuts (25.6%), milk and dairy products (23.3%), and some types of vegetables (20.0%). Figure 1 shows the distribution of the type of food allergies among participants with food allergies (n = 90).

Table 1. *Sociodemographic characteristics of patients with food allergy in Makkah region, Saudi Arabia (n = 90).*

Variables		No	%
Gender	Female	59	65.6
	Male	31	34.4
Age (in years)	18-28 years	25	27.8
	29-39 years	16	17.8
	40-59 years	34	37.8
	60-80 years	15	16.7
Level of education	Under high school	3	3.3
	High school/ diploma	8	8.9
	Bachelor's degree	58	64.4
	Postgraduate studies	21	23.3
History of anaphylaxis	Yes	29	67.8
	No	61	32.2

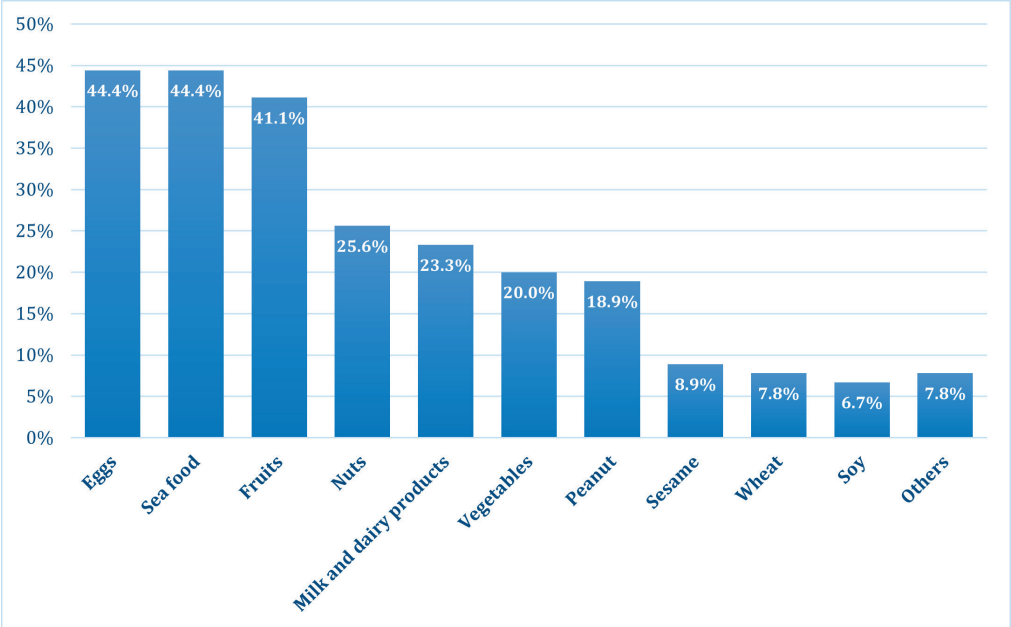

Figure 1. *Most common types of allergens among the patients with food allergy in Makkah region, Saudi Arabia.*

The practice of using health care system and management knowledge

Regarding the practice of using the healthcare system among patients with food allergies (Table 2), slightly less than two-thirds (63.3%) were diagnosed with food allergy by a doctor, only (13.3%) routinely followed up with their doctors, and (14.4%) visited food allergy awareness campaigns. 68 (75.5%) patients had poor practice in using the healthcare system (score < 2), and good practice was detected among 22 (24.4%) of patients (score ≥ 2) knowledge about the management of food allergy among food-allergic patients is presented in Table 2. The mean knowledge score was 2.59 (SD of 0.6). About two-thirds, 59 (65.6) of the participants, had excellent knowledge (score = 3), while the remaining 31 (34.5%) had adequate knowledge (score < 3). According to Table 2, most food allergic patients (80%) do not believe that using a daily antihistamine would prevent food allergy reactions. Also, (88.9%) indicated that avoiding allergens is the best method to prevent food allergy reactions. Moreover, the majority (90.0%) believed that treating food allergies with herbal medicine without guidance from a doctor is impossible

The QoL

The QoL in coping with food allergies and emergencies was assessed by eight questions presented in Table 3. Only 1 (1.1%) indicated that he carries a card identifying

Table 2. *Practice of using the healthcare system and management knowledge among patients with food allergy in Makkah region, Saudi Arabia (n = 90).*

Practice using healthcare system		
Items		**Yes No (%)**
Have you been diagnosed with a food allergy by a doctor?		57 (63.3)
Do you follow up routinely with your doctor?		12 (13.3)
Have you ever visited a food allergy awareness campaign?		13 (14.4)
Overall practice scores	Good practice	22 (24.4)
	Poor practice	68 (75.5)
Management knowledge		
Questions		**Correct answer No (%)**
Do you think daily taking an antihistamine can prevent food allergy reaction (F)		72 (80.0)
Do you think avoidance of the allergen is the best way to prevent food allergy reactions from occurring? (T)		80 (88.9)
Do you think using herbal medicine can treat your food allergy without guidance from a doctor? (F)		81 (90.0)
Overall scores	Excellent knowledge	59 (65.6)
	Fair knowledge	31 (34.5)

(F), False; (T), True.

Table 3. *The QoL in terms of coping with food allergies and emergency situations among food allergy patients in the Makkah region, Saudi Arabia (n = 90).*

N	Questions	Yes No (%)	No No (%)
1	Do you carry a card stating that you have a food allergy as a precaution?	1 (1.1)	89 (98.9)
2	Do your friends at work or school know that you suffer from a specific food allergy?	46 (51.1)	44 (48.9)
3	Do your family members know the type of allergy you suffer from?	80 (88.9)	10 (11.1)
4	Are you practicing strict allergen avoidance (five)	42 (46.7)	48 (53.3)
5	Are you able to treat a food allergy reaction if it occurred	64 (71.1)	26 (28.9)
6	Have you ever heard of a self-injected epinephrine syringe (adrenaline pen)?	38 (42.2)	52 (57.8)
7	Do you know how to use it properly? [a]	15 (16.7)	23 (25.6)
8	Do you always carry a self-injection of epinephrine (adrenaline)?	1 (1.1)	89 (98.9)

[a] This question is only for those who have answered with "Yes" to the previous question.

their food allergy as a precaution. The vast majority (88.9%) of respondents said their family is aware of their food allergies. While half of the patients (50.1%) claim that their colleagues are aware of the exact food to which they are allergic. Nearly half of patients (46.7%) follow a strict allergen avoidance diet. Around three-quarters (71.1%) said they could treat a food reaction if it occurred. Upon asking the patients about the Epinephrine pen, only (42.2%) of the patients had heard about it, only (16.7%) knew how to use it properly, and just one (1.1%) always carries an Epinephrine pen.

Environmental safety

Environmental safety is assessed in the workplace and restaurants. Around a third of the patients (36.7%) said their workplace or school has a certified first-aid provider for allergic food reactions. When patients were asked about their behavior in restaurants, nearly half (45.6%) consistently inquired about allergens, whereas the remaining (40%) did nothing, and just (6.7%) usually received a warning (Table 4).

Association between the level of knowledge and Sociodemographic data

Table 5 shows the association between patients' management knowledge and sociodemographic data. Excellent knowledge was detected among 67.8% of males compared to 61.3% of females with no statical significance (p = 0.537). As for age, a nearly equal percentage of 68.0% for each patient aged 18-28 years, 29-39 years, and 40-59 years compared to 53.3% of patients aged 60 or more (p = 0.754). Regarding the level of education, (100%) of those in high school had excellent knowledge compared to 60.3% of patients with

Table 4. *Environmental safety for patients with food allergy in Makkah region, Saudi Arabia (n = 90).*

N	Questions	Yes No (%)		No No (%)	
1	In your work or study environment, is there anyone who can help or provide the first aids in the case of the occurrence of an allergic reaction to the food?	33 (36.7)		57 (63.3)	
2	If you went to a restaurant, do you find an explanation and a warning about the allergens, or are you the one who initiates a question and clarify that you suffer from an allergy?	I usually ask	I found warning	Both	Nothing
		41 (45.6)	6 (6.7)	7 (7.8)	36 (40.0)

Table 5. *Association between the level of knowledge about food allergy management and sociodemographic data of patients with food allergy in the Makkah region, Saudi Arabia (n = 90).*

Items		Level of knowledge about food allergy management				*p*-value
		Fair knowledge		Excellent knowledge		
		Freq	%	Freq	%	
Gender	Male	19	32.2	40	67.8	0.537
	Female	12	38.7	19	61.3	
Age in years	18-28 years	8	32.0	17	68.0	0.754
	29-39 years	5	31.3	11	68.8	
	40-59 years	11	32.4	23	67.6	
	60-80 years	7	46.7	8	53.3	
Level of education	Under high school	0	0.0	3	100.0	0.262
	High school/ diploma	1	12.5	7	87.5	
	Bachelor's degree	23	39.7	35	60.3	
	Postgraduate studies	7	33.3	14	66.7	
Anaphylaxis history	Yes	10	34.5	19	65.5	0.996
	No	21	34.4	40	65.6	
Use of health care system	Good practice	22	32.4	46	67,6	0.463
	Poor practice	9	40.9	13	59.1	

bachelor's degrees ($p = 0.262$). Also, excellent knowledge was detected among those who had anaphylaxis and those without history nearly equally (65.5% for each) ($p = 0.996$). As for the practice of using the healthcare system, 67.6% of those who had good practice had excellent knowledge compared to 59.1% of those with poor practice ($p = 0.463$).

Discussion

This cross-sectional study assesses the QoL among adults with food allergies in the Makkah region. The current study found that patients with food allergies have excellent management knowledge; however, poor practice in the healthcare system is noticed. Nevertheless, most of the patients do not carry a card stating their type of food allergy, only one patient always carries a self-injected epinephrine pen.

The most common food allergens reported in the present study were eggs, seafood, and some types of fruits. These results seem to be consistent with other local studies. A recent nationwide cross-sectional study found eggs, shellfish and shrimps, and peanuts [4]. Similarly, another study in Jeddah city found that eggs, fish, and bananas were the most common allergens [15]. Regarding local clinical studies, two small studies investigated common types of allergens. A study done at King Khalid University Hospital found that the most common allergens among 280 participants were milk (61.96%), egg whites (59.78%), wheat (45.65%), and peanuts (38.04%) [16]. At the same time, another study conducted in a private lab in Makkah city found that among 80 patients, the commonest allergens were cocoa (22, 27.5%), peanuts (14, 17.5%), egg white (12, 15%) [11].

Nevertheless, the patterns of food allergy vary widely among countries, reflecting the diverse diets consumed in each [17]. Currently, most of the available data locally is based on self-reporting, with limited reported clinical studies in Saudi Arabia. Even though the top three reported food allergens have some variability, the most prevalent types of allergens in the kingdom appear to be comparable, suggesting and reflecting that the country's nutrition habits are consistent. Moreover, more clinical studies are essential to understand the extent of the food allergy problem in Saudi Arabia.

Knowledge about food allergy management is a crucial element to be delivered by physicians to patients with food allergies. The current study revealed that about two-thirds of the patients with food allergies had excellent management knowledge as 88.9% think allergen avoidance is the best way to prevent food allergy reactions. These results are similar to those reported by Alharbi et al. [15] in a cross-sectional study done in Jeddah city. It found that 87.8% of the patients think avoiding allergic food is the best way to prevent food allergy reactions [15]. It is critical to provide accurate information and facts to patients with food allergies. They must be educated about managing their condition in terms of long-term allergen avoidance and, most importantly, the avoidance of non-beneficial treatments such as daily antihistamines and herbal medicine.

The food allergy condition is diagnosed by taking a detailed history, physical examination, and some investigations such as skin prick tests. The skin is punctured superficially and exposed to an allergen to see the response after 15 minutes [18]. Other tests are Specific IgE levels, which detect the serum IgE to a specific allergen, and oral food challenge (OFC), which means allergen exposure to provoking the allergy; it must be performed under supervision. The OFC test is the gold standard for diagnosing the food allergy and is only requested if the previous two tests are negative [18,19].

Most people who have a food allergy are self-reported, while fewer underwent medical diagnosis [20]. This study demonstrated that a doctor diagnosed 63.3%, while only 13.3% routinely followed up with their doctor. These results seem consistent with Alharbi et al. [15] They found that a doctor diagnosed 57.1% by investigating a blood test or a skin test. In contrast to earlier findings, a lower percentage has been reported locally as the percentage of clinically diagnosed food allergies was 33.1% among university students [21] and 22.5% among children [22]. Similar to the study conducted in the United States indicated that 19% of adult participants (n = 40,443) self-reported food allergies; nevertheless, this prevalence was reduced to 10.8% when including only convincing reports [7]. This result highlights a poor correlation between self-reported and clinically confirmed food allergies. Also, underline the known issue of self-reporting allergies tending to overestimate actual prevalence [4].

The discovery of food allergy has a significant impact on the individuals' life, not only in dietary restrictions. However, it is also frequently accompanied by a constant threat situation due to the risk of severe allergic reactions, including life-threatening anaphylaxis. Patients with food allergies must obtain instruction on managing emergencies and making the best decision. Hence, well-educated patients about their condition rarely have adverse severe allergic reactions [23]. The dread of allergic reactions, on the other hand, has a substantial impact on QoL. The current study has assessed the QoL and environmental safety among the included patients. It revealed that Saudi society is more inclined to mutual interaction, as they were more open to sharing their health condition with their family and friends (88.9% and 51.1%, respectively) compared to carrying a card or a self-injection of nephrine (1.1% for each item). Inconsistent with a previous study published in New York and New Jersey among adult patients with severe allergic reactions revealed a deficit in several aspects, including a defect in the management and epinephrine auto-injectors use [24]. Another study conducted among 1,126 caregivers showed poor QoL among patients with food allergies [25]. These findings indicate the need for educational projects for the patients about the importance of self-preparation for possible emergencies.

Although the current study represents one of the first food allergy assessments among the Makkah population, the authors acknowledge several limitations. First, a convenient sample due to the online survey that was performed may affect the generalizability of the results. Second, since the study was dependent on self-reported information, reporting bias may be possible as it might be influenced by the patients' understanding, standards, and feelings. Last, as the current study followed a cross-sectional design, the ability to make causal conclusions is precluded.

Conclusion

In conclusion, the current study revealed an excellent level of knowledge among patients with food allergies. Nevertheless, poor practices toward the healthcare systems and inadequate environmental safety were observed. These findings suggest a multidisciplinary protocol should be established to improve environmental safety in workplaces/schools, and restaurants. Moreover, it indicates the need for educational projects for patients with food allergies about the importance of self-preparation for possible emergencies.

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List of Abbreviations

QoL	Quality of life
SD	Standard deviation
OFC	Oral food challenge

Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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None.

Consent to participate

Electronic informed consent was obtained from each participant prior to answering the questionnaire. Participant

privacy was ensured, and any participant's names or phone numbers were not requested.

Ethical approval

The current study received ethical approval (HAPO-02-K-012-2021-03-631) from the Biomedical Ethics Committee at the Faculty of Medicine, Umm Al-Qura University (UQU), Makkah, Saudi Arabia, dated: 18/03/2021.

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References

1. Qari YH, Abu Alnasr AA, Bazaid AM, AlHarbi HA, ALJahdali N, Goronfolah LT. The impact of childhood food allergy on quality of life of the paediatric population in Jeddah, Saudi Arabia. Australas Med J. 2020;13(6):213–20. https://doi.org/10.35841/1836-1935.13.6.213-220
2. Gohal G. Food allergy knowledge and attitudes among school teachers in Jazan, Saudi Arabia. Open Allergy J. 2018;9(1):1–7. https://doi.org/10.2174/1874838401809010001
3. Mullins RJ, Dear KBG, Tang MLK. Time trends in Australian hospital anaphylaxis admissions in 1998-1999 to 2011-2012. J Allergy Clin Immunol. 2015;136(2):367–75. https://doi.org/10.1016/j.jaci.2015.05.009
4. Althumiri NA, Basyouni MH, AlMousa N, AlJuwaysim MF, BinDhim NF, Alqahtani SA. Prevalence of self-reported food allergies and their association with other health conditions among adults in Saudi Arabia. Int J Environ Res Public Health. 2021;18(1):347. https://doi.org/10.3390/ijerph18010347
5. Cummings AJ, Knibb RC, King RM, Lucas JS. The psychosocial impact of food allergy and food hypersensitivity in children, adolescents and their families: a review. Allergy. 2010;65(8):933–45. https://doi.org/10.1111/j.1398-9995.2010.02342.x
6. Simons FER, Ardusso LRF, Bilò MB, El-Gamal YM, Ledford DK, Ring J, et al. World Allergy Organization anaphylaxis guidelines: summary. J Allergy Clin Immunol. 2011;127(3):522–87. https://doi.org/10.1016/j.jaci.2011.01.038
7. Gupta RS, Warren CM, Smith BM, Jiang J, Blumenstock JA, Davis MM, et al. Prevalence and severity of food allergies among US adults. JAMA Netw Open. 2019;2(1):e185630. https://doi.org/10.1001/jamanetworkopen.2018.5630
8. Warren CM, Otto AK, Walkner MM, Gupta RS. Quality of life among food allergic patients and their caregivers. Curr Allergy Asthma Rep [Internet]. 2016;16(5):38. https://doi.org/10.1007/s11882-016-0614-9
9. Couratier P, Montagne R, Acaster S, Gallop K, Patel R, Vereda A, et al. Allergy to peanuts impacting emotions and life (APPEAL): the impact of peanut allergy on children, adolescents, adults and caregivers in France. Allergy Asthma Clin Immunol [Internet]. 2020;16:86. Available from: https://pubmed.ncbi.nlm.nih.gov/33042203; https://doi.org/10.1186/s13223-020-00481-7
10. Arik Yilmaz E, Cavkaytar O, Buyuktiryaki B, Soyer O, Sahiner UM, Sekerel BE, et al. Factors affecting food allergy-related quality of life from parents' perception in Turkish Children. Allergy Asthma Immunol Res. 2018;10(4):379–86. https://doi.org/10.4168/aair.2018.10.4.379
11. Tayeb MMS, Koshak EA, Qutub MMA. Sensitization to common food allergens in Makkah City. Egypt J Hosp Med [Internet]. 2009;35(1):288–94. Available from: https://ejhm.journals.ekb.eg/article_17575.html; https://doi.org/10.21608/ejhm.2009.17575
12. Goossens NJ, Flokstra-de Blok BMJ, van der Meulen GN, Botjes E, Burgerhof HGM, Gupta RS, et al. Food allergy knowledge of parents - is ignorance bliss? Pediatr Allergy Immunol. 2013;24(6):567–73. https://doi.org/10.1111/pai.12099
13. Alsuhaibani MA, Alharbi S, Alonazy S, Almozeri M, Almutairi M, Alaqeel A. Saudi teachers' confidence and attitude about their role in anaphylaxis management. J Fam Med Prim Care. 2019;8(9):2975–82. https://doi.org/10.4103/jfmpc.jfmpc_562_19
14. Karam M, Scherzer R, Ogbogu PU, Green TD, Greenhawt M. Food allergy prevalence, knowledge, and behavioral trends among college students - a 6-year comparison. J Allergy Clin Immunol Pract [Internet]. 2017;5(2):504–6.e5. https://doi.org/10.1016/j.jaip.2016.11.035
15. Alharbi R, Malibary H, Siddiqui J, Alandijani S. Awareness about diagnosis and management of food allergy among general pop ulation in Jeddah, Saudi Arabia. Med Sci. 2020;24:905–11.
16. Mesned RKA, Shakoor Z, Musibeeh NB, Anazi SA, Hassan GA, Yahya MA. Screening for food specific IgE antibodies among Saudi patients with clinical suspicion of food allergy; 2016. Available from: https://www.longdom.org/proceedings/screening-for-food-specific-ige-antibodies-among-saudi-patients-with-clinical-suspicion-of-food-allergy-7633.html
17. Loh W, Tang MLK. The epidemiology of food allergy in the global context. Int J Environ Res Public Health. 2018;15(9):2043. https://doi.org/10.3390/ijerph15092043
18. Ralston SH, Penman I, Strachan M, Hobson R. Davidson's principles and practice of medicine e-book. 23rd Edition. Amsterdam, Netherlands. Elsevier Health Sciences. 2018. Available from: https://www.elsevier.com/books/davidsons-principles-and-practice-of-medicine/ralston/978-0-7020-7028-0
19. World Allergy Organization. Food allergy [Internet]. Available from: https://www.worldallergy.org/education-and-programs/education/allergic-disease-resource-center/professionals/food-allergy
20. Sicherer SH, Sampson HA. Food allergy: a review and update on epidemiology, pathogenesis, diagnosis, prevention, and management. J Allergy Clin Immunol. 2018;141(1):41–58. https://doi.org/10.1016/j.jaci.2017.11.003
21. Hassan A, Alsaihati A, Al Shammari M, Alaithan H, Al-Johani W, Alshamlan N, et al. Food allergy among

university students: uncharted territory. Allergy, Asthma Clin Immunol [Internet]. 2020;16(1):1–6. https://doi.org/10.1186/s13223-020-0415-5

22. Alotaibi N, Habib L, Alyamani W, Borah R, Alquwayz R, Nashar B. Food allergy awareness among parents of food allergic child in Saudi Arabia. J Biochem Technol. 2021;11(4):110–8. https://doi.org/10.51847/MGYog7gV2E
23. Lange L. Quality of life in the setting of anaphylaxis and food allergy. Allergo J Int [Internet]. 2014;23(7):252–60. Available from: https://pubmed.ncbi.nlm.nih.gov/26120535; https://doi.org/10.1007/s40629-014-0029-x
24. Taylor R. A survey of attitudes and practices of adults with severe food allergies. Cornell University Library. New York, United States. 2008. Available from: https://ecommons.cornell.edu/handle/1813/11140
25. Springston EE, Smith B, Shulruff J, Pongracic J, Holl J, Gupta RS. Variations in quality of life among caregivers of food-allergic children. Ann Allergy, Asthma Immunol [Internet]. 2010;105(4):287–94.e3. Available from: https://www.sciencedirect.com/science/article/pii/S1081120610007350; https://doi.org/10.1016/j.anai.2010.08.003