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Original article

Prevalence of self-reported food allergies among the Saudi population and investigation of the challenges faced by people with food allergy: a cross sectional online survey-based study

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Abstract. *Background:* The issue of food allergy (FA) is widely studied and investigated in developed countries. However, there are lack of published data concerning FAs prevalence in the middle east region including Saudi Arabia (KSA). Therefore, we aimed to assess the prevalence of self-reported FAs among children and adults in KSA and to identify the most common types of FAs. *Methodology:* An online survey was distributed to collect information about the prevalence of self-reported FA, type of FA and challenges faced by food allergic people. the target population was Saudi children and adults. Mothers or the legal guardians of the children enrolled in the study filled the questionnaire for their children and gave consent for participation. *Results:* We received 15142 responses of those 3237(21%) subjects were diagnosed with FA or taking care of someone with FA. About 15% of food allergic subjects were ≥18 years and 6.4% were <18 years. Egg was the most reported allergenic foods among our study sample for both age groups, followed by peanut and milk among the children group and crustacean and wheat in the adult group. About 22% of the adult group have experienced food anaphylaxis at least once in the past 12 months. While 15% of the children group had food anaphylaxis at least once in the last year. Subject's characteristics such as age, income has shown to be linked to the odds of experiencing food anaphylaxis ($p<0.05$). *Conclusion:* The current study recorded a relatively high prevalence of self-reported FA in KSA. It also highlighted some of the challenges faced by participants with food allergies such as lack of proper meal options for their allergic condition in restaurants and unclarity of allergenic food in the menus. These findings shed light on the need to implement policies in favour of people with FA such as allergen labelling in restaurant's menus and food delivery platforms.

Key words: Food allergy, IgE, allergens, Allergenic food, Food anaphylaxis

1 Introduction

The topic of FA is widely studied and investigated in developed countries, and the prevalence of food allergies has been established in many studies (1-5). There is growing evidence of the increasing prevalence of food allergies globally for an unknown reason (1, 4, 5). The latest systematic review focusing on the prevalence of FA in European countries found that the adult lifetime prevalence of self-reported FA ranged from 9.5% to 35% (6). In the United States (U.S.), 8% of children and 10% of adults have food allergies (3). Food allergies affect 5–10% of children under five in the United Kingdom (U.K.), Norway, and Australia 6. Developing countries have not fared any better than earlier mentioned countries in terms of FA prevalence. Thailand, China, and South Africa, for example, have reported similar rates of challenge-confirmed FA (4, 6).

In KSA, the few published studies to date that examined FA have either focused on specific subpopulation groups such as children, patients, students or been conducted among residents of specific and scattered localities (7-10). Even the most current study on FA, which included participants from all regions of the Kingdom, was limited to adults and did not constitute a representative sample of the national population (7). A recent study estimated that the prevalence of FA was 19% among Saudi adults (7). Their results implies that FA may impact a greater proportion of Saudi people than it is globally recognized. Thus, it could be argued that FA is a significant public health concern, given the increased prevalence that has been observed not just in developed but also in developing nations (11). Uncertainty about the prevalence of FA on a national scale may significantly contribute to wider uncertainties about FA service provision, food labelling legislation, and management strategies. Yet, there are no studies performed at the national level in Saudi Arabia concerning the prevalence of food allergies for both adult and children age groups.

In an attempt to reduce the burden of food allergies, the Saudi Food and Drug Authority (SFDA) mandated the declaration of fourteen allergenic foods (wheat, crustacea, milk, fish, eggs, peanuts, soybeans, walnuts, mustard, sesame, clams, celery, lupin) on pre-packaged food products and on restaurant's food menus (12). However, understanding the effectiveness of these regulations on allergic people and determining the need for more initiatives are still under investigation, and not yet studied. Understanding the challenges that people with FA and their families may experience when dining out is vital for directing the development of appropriate approaches to avoid harmful exposure to potential food allergens.

To our knowledge, no studies have previously assessed the prevalence of FA among the Saudi population, both adults and children at the national level; thus, this study was conducted to achieve this purpose. Furthermore, it aimed to identify the most common types of FA and to address the challenges faced by people suffering from food allergies. Finally, we aimed to identify the frequency of anaphylactic shocks experienced by people with food allergies.

2 Methodology

2.1 Study design and participants

In this cross-sectional study, the target population was Saudi children and adults. Adult participants either healthy, diagnosed with IgE mediated FA or taking care of someone diagnosed with FA were eligible to participate in the study. Mothers or the legal guardians of the children enrolled in the study filled the questionnaire for their children and gave consent for participation. Non-Saudi participants were excluded from this study. Data collection was started on Dec 2020 for eight weeks. The survey was first promoted via various social media platforms, in addition, we sent emails to specific groups concerning food allergies awareness such as the Saudi allergy, asthma and immunology society. Chain-referral sampling was then performed to achieve adequate convenience sample of the general population of Saudi Arabia.

2.2 Survey development

The instrument was adopted from the validated survey by Gupta et al. 2009 [13] and modified by the researchers from Taibah University and the National Nutrition Committee in the SFDA. The survey was then pilot tested on 25 laypeople and 12 dietetic professionals to assess the clarity and comprehension of the translated instrument, and it was then adjusted accordingly.

Description of the survey:

The survey assessed the prevalence of self-reported FA among the Saudi population (supplementary materials). The survey consisted of 26 items that comprised 2 main sections:

- Section one: This section was started with a screening question to ensure that all participants were Saudis. The 12 questions in this section collected information about the demographic's information of the participants related to their age, region of residence, gender, educational level and economic status.
- Section two: This section was started with a screening question to ensure that the participants either have food allergy confirmed by IgE test or the participants are taking care of subjects with food allergy confirmed by IgE test and giving information on their behalf (e.g mothers of children with food allergies). We asked about the type of food allergy, the options included 14 potential allergenic food including: wheat, crustacea, milk, fish, eggs, peanuts, soybeans, walnuts, mustard, sesame, clams, celery, lupin) on pre-packaged food products and on restaurant's food menus). The rest of the questions collected information about the frequency of experiencing food anaphylaxis in past 12 months (once, twice, many times, did not experience food anaphylaxis), food anaphylaxis was defined as severe allergic rection that required hospital visit. The survey also collected information about the eating behavior of people with food allergies such as eating in restaurants or ordering food from online platforms and about the obstacles and challenges individuals face as a result of their allergic condition.

2.3 Ethical considerations

Ethical approval was obtained from the ethical committee at the College of Applied Medical Sciences, Taibah University, certificate number (2020/57/204/CLN). Participation in this research was voluntary as the participants would not be compelled or enticed to take a part in this research. Participants identified in this study remained anonymous, and no identification details were obtained in conjunction with the survey results. The participant information sheet was included on the first page of the online survey, and participants were asked to give their consent to take part in this study. For the children included in the study, the parents or the legal guardians provided consent for their participation. The consent was taken by including a compulsory answer question that they agreed to participate. Only those who actively clicked to give consent were given access to the rest of the survey.

2.4 Sample size calculations

Although the sampling in this study was not a random sampling, sample size calculation attempted to ensure that enough samples will be available to reflect the current picture/situation. The estimated minimum sample size required was 600 participants using Raosoft sample size calculator. The calculation was based on a total population of 34 million (according to united nation census) a margin error of 5, and a confidence level of 99%. This study was intended to be performed on a national level, to ensure a prevalence estimate with ±1% accuracy with 95% confidence we aimed for a target enrolment of 13,000 participants over two months (14).

2.5 Statistical analysis

The statistical analyses were conducted using the Statistical Package for the Social Sciences (SPSS) version 23 (Armonk, NY: IBM Corp.). The normality of the data was assessed by Shapiro-Wilk test. The statistical analysis included descriptive data presented as frequencies and [percentages (%)]. As all variables were normally distributed, data was presented as mean and ± standard deviations (SD). A hierarchical binary logistic regression analysis was performed to assess the effects of the participant's characteristics and behaviors on the likelihood of experiencing anaphylactic shocks.

3 Results

3.1 General characteristics of the study participants and the prevalence of food allergy:

A total of 15142 responses were received; of those around 21.3 % (n=3237) of the participants were diagnosed with FA identified by IgE test as reported by the respondents. About 15.0% (n=2273) of the participants diagnosed with FA were 18 years of age or older, and only 6.4% (n=964) were younger than 18 years (Figure 1). The prevalence of FA in all regions of Saudi Arabia is presented in Table 1. Table 2 describes the general characteristics of people diagnosed with food allergies. The average age of the adults diagnosed with FA in the study was 30.61±12.2, and the average age of the children was 7.04±4.9. The majority of the participants were female [80.3% (n=2600)]. The highest number of participants came from the Western region and accounted for almost 32.5%(n=4925) of the responses. Most of the participants lived in cities [88% (n=2859)] rather than villages.

Figure 1 shows that the total number of participants is 15142, the prevalence of food allergy is about 21%, (15.0% of the subjects are older than 18 years, and 6.4% are younger than 18 years.

3.2 Type of food allergies among the Saudi population:

In the current study, it has been shown that egg was the most common allergenic foods among food-allergic patients for both age groups [<18 years old 300 (31%), ≥18 years old 646 (28%)], followed by peanut and milk among the group younger than 18 years and crustacean and wheat in the older group (Table 3).

3.3 Challenges faced by people with food allergies when they eat outside:

A large percentage (nearly 70%) of the study participants indicated that they eat at least once a month from restaurants and 63% of the participants indicated that they check allergenic foods in restaurant's menus, and about 22% reported that they did not eat outside at all (Figure 2). The main reported reason was that allergenic foods were not clearly identified in the menus (Figure 3). Our study indicated that about 45% of the people with food allergies experienced some difficulties when ordering food from online platforms. About 43% reported that allergenic foods are not clearly identified in the menus, and roughly 23% indicated that they do not find proper meal options for their allergic condition (Figure 3).

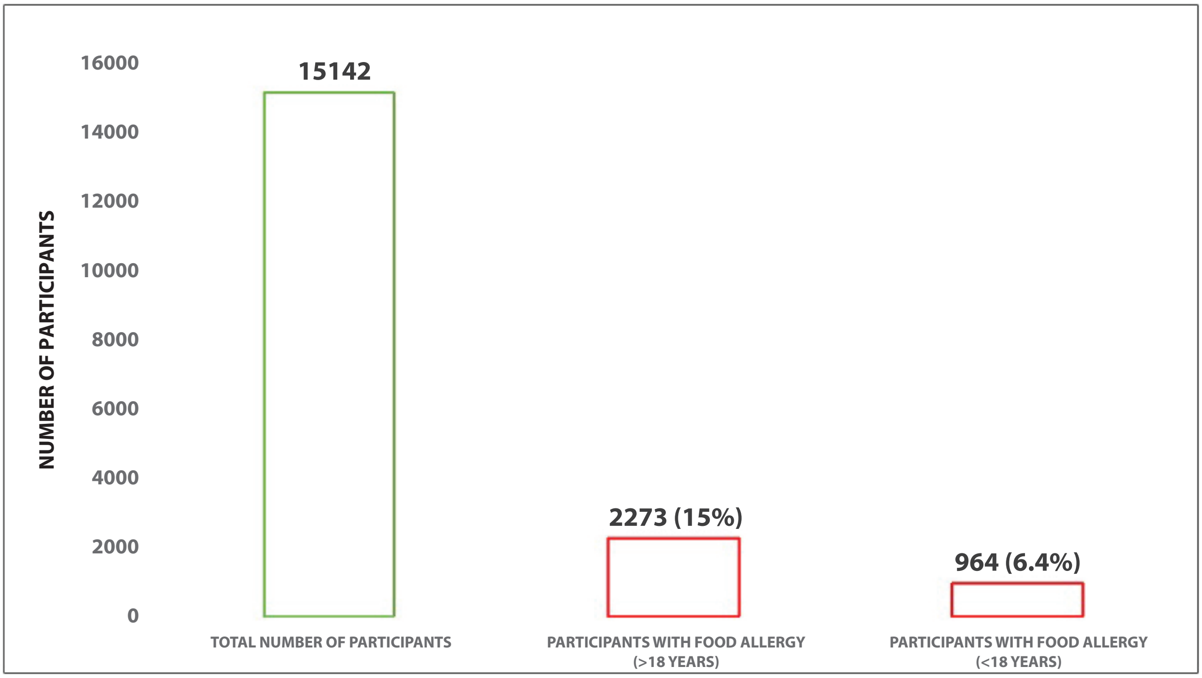

Figure 1. Prevalence of food allergy among Saudi population.

Table 1. Prevalence rates of the study participants diagnosed with food allergy.

Region				**Central region**			**South region**			**North region**			**East region**			**West region**		
Province	**All regions**			**Riyadh, Al-Qassim**			**Najran, Jizan, Al-Bahah**			**Tabuk, Al-Jawf, Ha'il, Northern Borders**			**Eastern**			**Makkah, Madinah**		
Total number of responses -n(%)	**15142 (100%)**			**2388 (15.8%)**			**1332 (8.8%)**			**4122 (27.2%)**			**2375 (15.7%)**			**4925 (32.5%)**		
	Total	<18 years	≥18 years	Total	< 18 years	≥18 years	Total	<18 years	≥18 years	Total	< 18 years	≥18 years	Total	<18 years	≥18 years	Total	<18 years	≥18 years
Allergic subjects - n	3237	964	2273	703	182	521	303	57	245	744	253	490	480	151	329	1009	320	685
Prevalence rate of food allergy according to total number of allergic subjects	100%	100%	100%	21.7%	18.9%	22.9%	9.3%	5.9%	10.8%	22.9%	26.2%	21.6%	14.8%	15.7%	14.5%	31.2%	33.2%	30.3%
The prevalence rate of food allergy according to the total number of responses from this region	21.4%			29.4%			22.7%			18%			20.2%			20%		

Table 2. General characteristics of the study participants with food allergies and the carers of the participants with food allergies.

Variables		Total	Participants caring for subjects with food allergies (< 18 years)	Participants caring for subjects with food allergies (≥18 years)	Participants with food allergies (≥18 years)
Number (n)		3237	964	485	1788
Participant's' Age (Years)		23.6±15.11	7.04±4.9*	35.34±16.6*	29.19±10.48
Gender	**Male**	637(19.7%)	128(13.3%)	120(24.7%)	289(21.7%)
	Female	2600(80.3%)	836(86.7%)	366(75.3%)	1400(78.3%)
Region	**Central region**	703 (21.7%)	182(18.9%)	90(18.5%)	431(24.1%)
	Easter region	480 (14.8%)	151(15.7%)	71(14.6%)	258(14.4%)
	Western region	1011 (31.2%)	321(33.3%)	162(33.3%)	528(29.5%)
	Northern region	744 (23%)	253(26.2%)	119(24.5%)	371(20.7%)
	Southern region	303 (9.3%)	57(5.9%)	55(9.1%)	201(11.2%)
Residential area	**City**	2859 (88.3%)	861(89.3%)	417(85.6%)	1584(88.5%)
	Village	378 (11.7%)	103(10.7%)	275(14.4%)	205(11.5%)
Education	**Uneducated**	52(1.6%)	5(0.5%)	1(0.2%)	46(2.6%)
	High school level or less	751(23.2%)	197(20.4%)	99(20.4%)	455(25.4%)
	Diploma	334(10.3%)	91(9.4%)	57(11.7%)	186(10.4%)
	Bachelor's degree	1882(58.1%)	605(62.8%)	303(62.3%)	976(54.6%)
	Master level	174(5.4%)	51(5.3%)	23(4.7%)	100(5.6%)
	PhD	44(1.4%)	15(1.6%)	3(0.6%)	26(1.5%)
Income	**Less than 3000**	1557(48.1%)	438(45.4%)	242(49.8%)	879(49.1%)
	3000-6000	523(16.2%)	169(17.5%)	75(15.4%)	279(15.6%)
	6001-8000	217(6.7%)	52(5.4%)	42(8.6%)	123(6.9%)
	8001-10000	259(8%)	68(7.1%)	38(7.8%)	153(8.6%)
	10001-15000	342(10.6%)	130(13.5%)	49(10.1%)	164(9.2%)
	15001-20000	159(4.9%)	50(5.2%)	16(3.3%)	93(5.2%)
	20001-25000	66(2%)	21(2.2%)	5(1%)	40(2.2%)
	More then 25000	113(3.55%)	36(3.7%)	19(3.9%)	58(3.2%)
Employment status	**Students**	1138 (35.1%)	288 (29.9%)	199(40.9%)	651(36.4%)
	Employed/working for my own business	1092 (33.7%)	341 (35.3%)	156(32.1%)	595(33.3%)
	Unemployed	918 (27.1%)	313 (32.5%)	111(22.8%)	494(27.6%)
	Retired	82 (2.5%)	13 (1.3%)	20 (4.1%)	49 (2.7%)

*Age presented as mean and ±SD for participants with food allergy only.

3.4 Presence of food anaphylaxis among food allergic participants

The results showed that about half of the participants in both age groups did not experience food anaphylaxis in the past 12 months. However, among the group younger than 18 years of age almost 15% of them experienced food anaphylaxis once, 14% twice, and about 13% had food anaphylaxis more than twice in the past 12 months. Among the older group (≥18 years

Table 3. Most commonly reported types of allergenic foods among the food allergic patients in different age groups.

Allergenic foods	Frequency	Prevalence rate according to the total number of food allergic patients (n=3237)	Prevalence rate according to total number responses from food allergic subjects (n= 6481)	Prevalence according to the total number of subjects (n=15142)
Egg	948	29%	15%	6%
Crustaceans*	678	21%	10%	5%
Wheat	647	20%	10%	4%
Peanuts	615	19%	9%	4%
Milk	536	17%	8%	4%
Fish	529	16%	8%	4%
Nuts	469	15%	7%	3%
Sesame seeds	360	11%	6%	2%
Soybeans	235	7%	4%	2%
Mollusks*	161	5%	2%	6%

*Participants were able to report food allergy to more than one allergenic food
*Crustaceans includes shrimp, lobster and others
*Mollusks such as squid and others

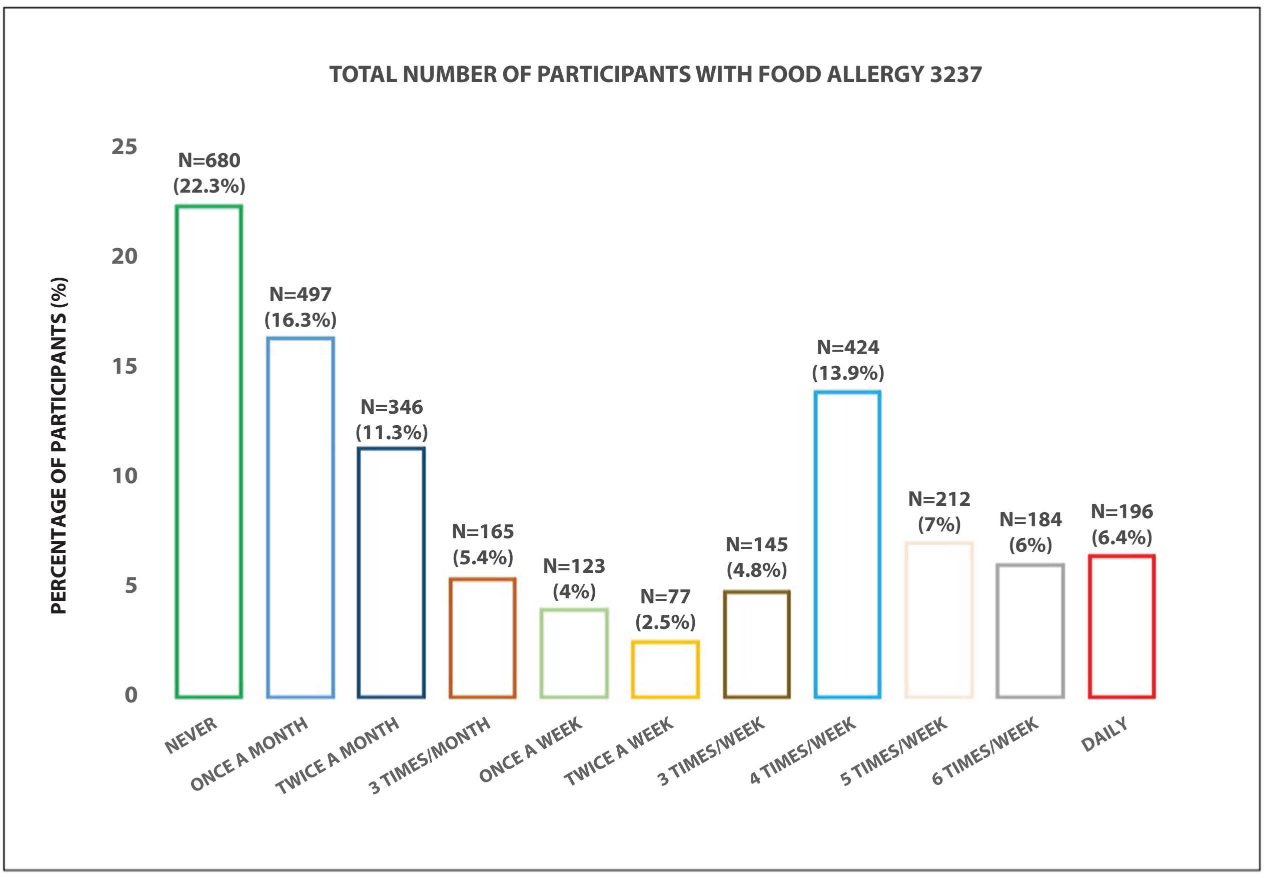

Figure 2. Frequency of eating in restaurants by food-allergic patients.

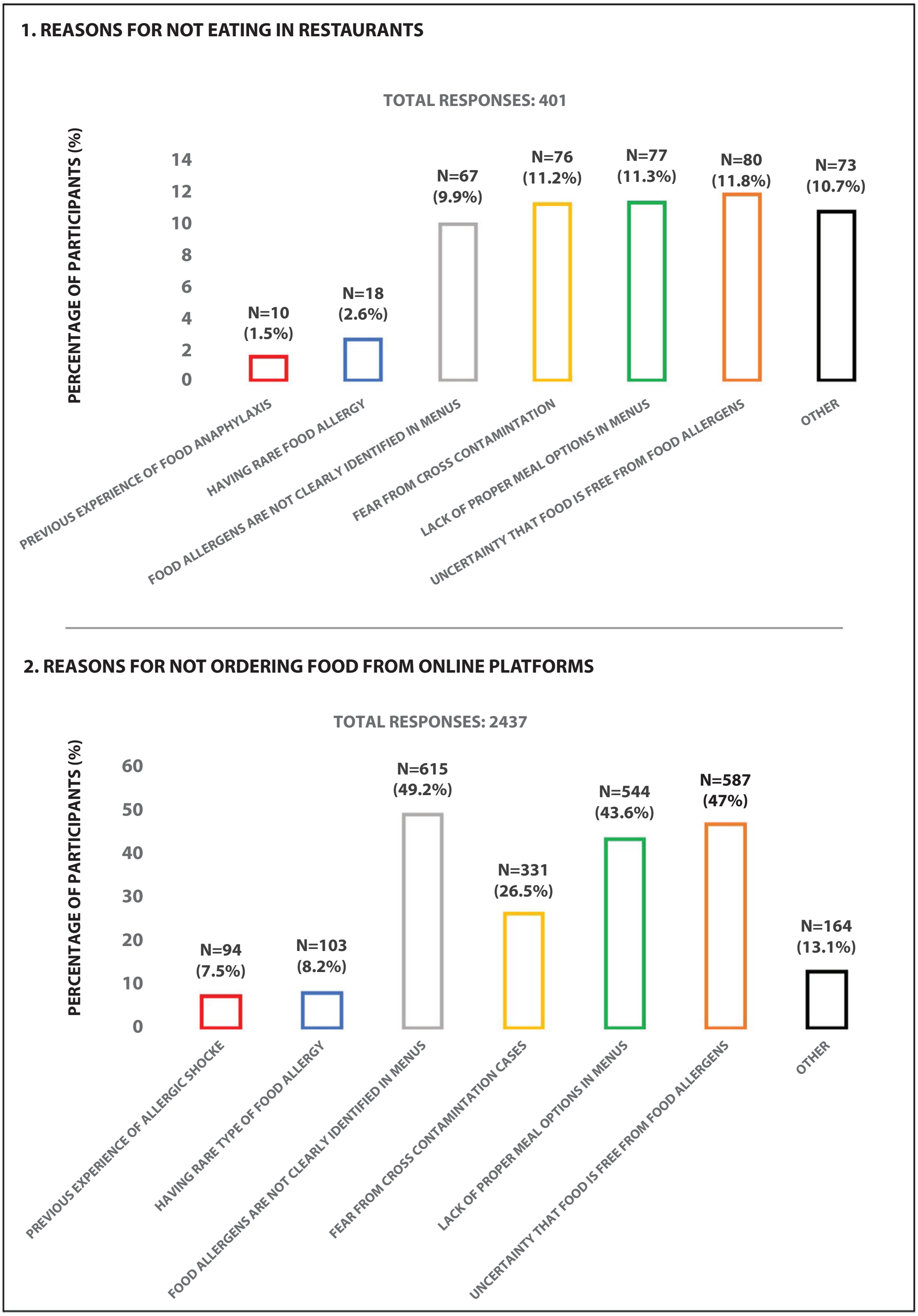

Figure 3. Most identified barriers for eating outside and ordering food from online platforms by food-allergic patients.

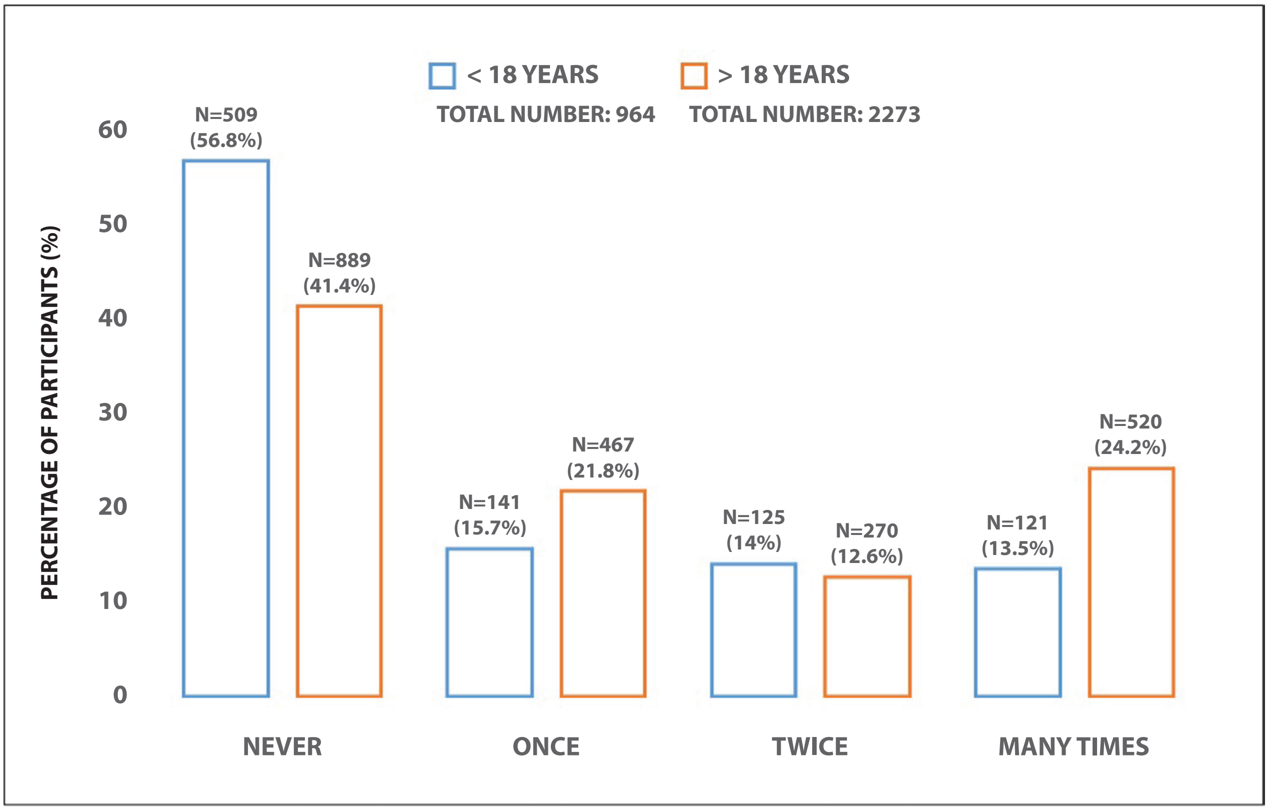

Figure 4. Frequency of food anaphylaxis experienced by food-allergic patients in the past twelve months.

old), nearly 22% experienced food anaphylaxis a least once, 12% twice, and 24% had food anaphylaxis more than twice in the past 12 months (Figure 4). The results also showed that among the adult group, the food anaphylaxis was associated with consumption of food prepared at home, at gatherings and in restaurants in 26%, 21% and 20% of the participants, respectively. In children, the food anaphylaxis was associated with consumption of food prepared at home, at gatherings and in the restaurants in 24%, 13%, and 11% of the participants, respectively (Figure 5).

Tables 4 describes nine hierarchical binary logistic regression models for assessing the effects of subject's behaviors and characteristics (age, residential area, education, being a health practitioner, frequency of eating outside, income, following up with dietitian, checking food labels, clarity of allergenic foods in menus) on the odds of experiencing food anaphylactic shock. The odd ratio $\chi 2$ for all the models were significant ($p<0.05$), except for model 8. Older participants had higher odds of experiencing food anaphylaxis compared to younger participants, and the effect was significant in all models ($p<0.05$). At the same time, in model 6, the result showed that lower income predicted higher odds of experiencing food anaphylaxis by 6.7% ($p<0.001$). The effect of income level on getting food anaphylaxis remains significant after adjusting for multiple variables including following up with a dietitian, checking food labels, clarity of allergenic foods in menus. In model 8 the clarity of allergenic foods in menus ($p<0.05$) statistically predicted the odds of experiencing food anaphylactic shock. Subjects who indicated in the questionnaire that allergenic foods were not explicit in menus had higher odds of having food anaphylaxis compared to those who indicated that allergenic foods were clear in the food menus by OR= 1.26 [95% CI: 1.075-1.481]). Other independent variables, such as residential area, education, career field, and frequency of eating outside, did not significantly predict the odds of experiencing food anaphylaxis during the last 12 months.

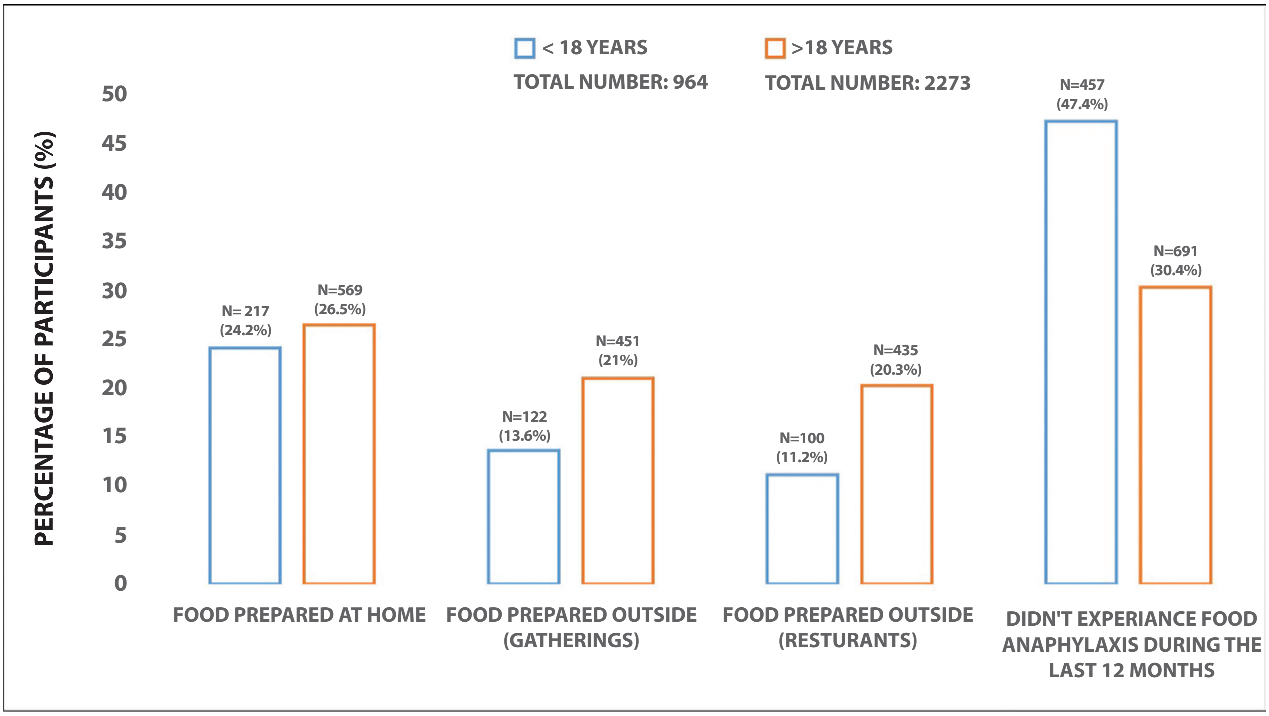

Figure 5. Commonly identified causes of food anaphylaxis among the food allergic patients.

4 Discussion

In this cross-sectional study, we explored the prevalence of FA and investigated the challenges faced by people with food allergies in Saudi Arabia. Our results showed that about 21% of the participants were diagnosed with FAs and had at least one type of FA. Allergies to eggs, crustaceans, wheat, peanuts, milk and their products were the most common allergenic foods in the Kingdom.

Our study recorded an increasing prevalence of food allergies compared to previously published reports in Saudi Arabia (15, 7). An earlier study has shown that the prevalence of FAs among children in Saudi Arabia was almost 6% (10). Other studies performed in adult population have shown that the prevalence of FAs ranged between 9% and 19% (7, 10). However, the aforementioned studies investigated the prevalence of food allergies in specific regions of Saudi Arabia and were not representative of the whole country.

The findings of the current study are in line with the global trend of increasing prevalence of food allergies (4). Studies in the U.S., and Canada have indicated that the rates of food allergies related to emergency department visits are increasing among both children and young adults, which reflects the increasing rate of FAs prevalence (1, 16). The increased prevalence of food allergies can be explained in part by environmental, lifestyle and dietary factors (16). The recorded high prevalence of FAs might also be related to inaccuracy in estimating the prevalence, overestimation can be found with self-reported data (17). This issue was mentioned by Gupta et al. (2011) where they indicated that the number of adults who believed that they had a FA (19%) was considerably higher than those who had food allergic conditions (10.8%) (18). Therefore, it is argued that the definition of FAs might affect the determination of the prevalence of food allergies in the community (19). Although we specifically asked about IgE test as the diagnostic method of FA in the current study, a limited number of studies indicated that it may not be a definitive diagnostic test for the diagnosis of FAs (16, 21).

Our results showed that the prevalence of FAs differed between the regions of Saudi Arabia. We have shown that FAs were more prevalent in the Central

Table 4. Logistic regression analysis to identify factors influencing the odds of experiencing food anaphylaxis.

Model	**1**			**2**			**3**			**4**			**5**			**6**			**7**			**8**		
Model statistics χ2	χ2 (1) =77.56, p value= 0.000			χ2 (2) =71.71, p value= 0.000			χ2 (3) =69.49, p value= 0.000			χ2 (4) =45.78, p value= 0.000			χ2 (5) =39.69, p value= 0.000			χ2 (6) =37.68, p value= 0.000			χ2 (7) =20.16, p value= 0.010			χ2 (8) =12.8, p value= 0.119		
Nagelkerke R2	0.002			0.003			0.003			0.003			0.004			0.010			0.012			0.034		
Classification accuracy	54%			54%			54%			54%			54%			54%			54.3%			54.7%		
Variables	OR	95% CI	P-value	OR	95% CI	P-value	OR	95% CI	P-value	OR	95% CI	P-value	OR	95% CI	P-value	OR	95% CI	P-value	OR	95% CI	P-value	OR	95% CI	P-value
Age	1.006	1.001-1.011	**0.018**	1.006	1.001-1.011	**0.018**	1.006	1.001-1.011	**0.018**	1.006	1.001-1.011	**0.019**	1.006	1.001-1.011	**0.018**	1.007	1.002-1.012	**0.006**	1.007	1.002-1.012	**0.004**	1.006	1.001-1.011	**0.023**
Residential area				0.073	0.861-1.345	1.076	0.075	0.862-1.348	1.078	0.080	0.866-1.354	1.083	0.083	0.869-1.360	1.087	0.062	0.850-1.333	1.064	0.055	0.838-1.333	1.057	0.086	0.854-1.391	1.090
Education							0.010	0.941-1.085	0.779	0.011	0.941-1.086	0.773	0.010	0.940-1.085	0.779	0.044	0.971-1.125	0.242	0.069	0.993-1.157	0.077	0.049	0.969-1.137	0.234
Being a health practitioner										-0.121	0.745-1.053	0.170	-0.124	0.743-1.051	0.162	0.886	0.762-1.080	0.272	0.883	0.771-1.111	0.406	0.926	0.757-1.107	0.364
Frequency of eating outside													-0.005	0.975-1.016	0.637	-0.005	0.974-1.016	0.620	-0.004	0.975-1.018	0.995	0.005	0.980-1.030	0.996
Income																-0.070	0.899-0.967	**0.000**	-0.077	0.892-0.962	**0.000**	-0.089	0.880-0.952	**0.000**
Following up with dietitians																			-0.144	0.732-1.025	0.094	-0.068	0.778-1.122	0.464
Clarity of allergenic foods on menus[d]																						0.232	1.075-1.481	**0.004**

*Note: Dependent variable: likelihood of experiencing food anaphylaxis (coded as 1), not experiencing food anaphylaxis (code as 0)

[a.] City coded as (coded as 1), village (code as 2), reference category is City.

[b.] Health care practitioner (coded as 1), Not Health care practitioner (code as 2), Reference category is Health practitioner.

[c.] Following up with dietitians (coded as 1), Not following up with dietitians (code as 2), Reference category is following up with dietitians.

[d.] Participants indicated that allergenic foods are clear in the restaurant's menu (coded as 1), participants indicated that allergenic foods are not clear in the restaurant's menus (code as 2), reference category is allergenic foods clear in the menus.

region (29.4%). It has been suggested that food allergies may differ between regions due to variations in dietary habits (20).

In the current study, we asked about 14 possible allergenic foods that are identified as the most popular allergenic foods by the SFDA. However, since the prevalence of allergies to celery, mustard and lupine was less than 1%, we only reported the data of the top 10 food allergies among the Saudi population. The most common types of food allergies among our sample were allergies to eggs (29%), crustaceans (21%), wheat (20%), peanuts (19%), milk, and their products (17%). Researchers found that the types of allergenic foods differ between age groups (4). Among our sample in the adults' group, eggs (28%), crustaceans (24%), wheat (23%), fishes (18%), milk (16%) were the most commonly reported types of food allergies. Our findings are consistent with the findings from a recent study by Althumiri et al (2021) where they found that the most frequently reported allergenic foods in adults were egg (3.1%), shellfish and shrimp (3.1%), peanut (3.0%), milk (2.6%), fish (2.5%) [7]. In children, we have shown that egg (31%), peanuts (26%), milk (18%), sesame seeds (16%), wheat (14%) were the most frequently reported type of food allergies in our population. These findings matched findings from other studies performed globally where they indicated that milk, eggs, peanuts, wheat, and seafood were the most common types of food allergies among children (21, 13).

In this study, we asked the participants if they experienced food anaphylaxis. According to the American Academy of Allergy, Asthma & Immunology, anaphylaxis is an immediate, life-threatening systemic allergic reaction with varying causes, triggers, clinical manifestations, and severity. It is defined as an IgE reaction involving two or more bodily systems occurring immediately after exposure to a known allergen (1,2). We found that older participants had higher odds of experiencing food anaphylaxis compared to younger participants; this is similar to findings by Cianferoni & Muraro (2012), where they indicated that adults are highly exposed to severe anaphylaxis. Additionally, we demonstrated that lower income predicted higher odds of experiencing food anaphylaxis by 6.7% ($p<0.001$) (22). This can be explained by the fact that families with low socioeconomic status tend to have low access to physicians and nutritional consultation, which might affect anaphylactic food allergies prevention, treatment and management (23). Furthermore, other studies showed that low-income food allergic people experience difficulties accessing appropriate foods. In addition, children from lower-income families are more susceptible to anaphylaxis due limitation of access to medical care, allergen-free foods and emergency intervention such as: epinephrine (24, 25).

In this study, we tackled the challenges faced by people with food allergies when eating outside. Our results revealed that 22% of the participants did not eat outside home. Lack of suitable meal options on the menus and fear of cross-contamination were the most frequently reported barriers to eating in restaurants or eating food prepared outside the home. In addition, a considerable number of our study participants indicated that they experienced food anaphylaxis as a result of eating at restaurants or at gatherings. Similar to our finding, in the U.K. about 92% of the surveyed people with food allergies have reported that eating in restaurants is their biggest concern (26). In their study, they indicated that about 20% of adult participants had experienced food anaphylaxis due to eating food prepared outside the home or in restaurants (26). These findings are similar to the results from another study where they also reported that 25% of food anaphylaxis happened while eating out at restaurants (16). Dining out, whether in restaurants, cafes, and take-out, can result in accidental exposures to allergenic foods, which can result in minor or major allergic reactions (26). This scenario is most likely to occur in the absence of clear and appropriate information on restaurant menus, which explains why people with food allergies avoid eating out.

People may experience unnecessarily restrictive social and behavioral reactions as a result of the lack of allergen information on restaurant menus which may lead to a diminishes of the quality of life. Our study indicated that an explicit declaration of allergenic foods on food menus significantly correlates with the risk of anaphylactic shock. Participants who indicated in the questionnaire that allergenic foods were not apparent in menus had higher odds of having food anaphylaxis compared to those who indicated that allergenic foods were clear in the food menus. Therefore, it is vital to enact policies that encourage persons with allergies to dine fearlessly in restaurants. This may involve requiring allergenic foods to be listed on the main menu or offering separate allergenic foods-free food menus for clients with food allergies, as well as training personnel to prepare meals safely and avoid cross contamination. Furthermore, establishing regulatory policies targeting food delivery online platforms, could also help people suffering from food allergies, especially with increasing the use of these platforms globally. In addition, the implementation of educational and social support programs directed to allergic people to educate them about diet modification and potentially harmful allergenic foods would benefit their quality of life (27).

Strengths and limitations

A key strength of this study is that it is the first national study to estimate the prevalence of food allergies in all regions of Saudi Arabia. In addition, this study included both adults and children. Our study provided a unique opportunity to advance our knowledge about the most common types of food allergies in the area. Additionally, it enabled researchers to better understand how food allergies may hinder the quality of life of the affected individuals.

The limitations of the study included its convenience sampling, which may increase the risk of selection bias and did not allow for recruiting of a balanced study sample in terms of age, location, and gender. This may be a possible explanation for a noticeable gender bias where 80.3% of the participants were females. However, it has been reported previously that gender is a potential bias affecting the completion and or dropout rates in most online surveys-based studies as men usually tend to quit participation early (28). The internet use might also be a potential bias, however, according to the world bank of development indicators in 2020, more than 95% of Saudi population have access to internet (29). This study was also limited by the fact that the prevalence of food allergies was self-reported; however, the majority of studies that investigated the prevalence of food allergies at the national level were based on self-reported data.

5 Conclusion

Food allergy is a public health concern because it threatens the lives of the affected individuals. The current study recorded a relatively high prevalence of food allergies in Saudi Arabia. The study findings support the recent evidence of increasing prevalence of food allergies worldwide. Adequate interventional strategies are needed to mitigate the risk of severe reactions among food-allergic patients and to investigate more food allergens sources. Further studies covering different geographical locations should be encouraged to guide and influence the development of practical approaches that support those people avoiding harmful exposure to food allergen and improve their quality of life. The study's observations highlight the need for future studies looking at risk factors of food allergies in the Saudi community.

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