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A questionnaire-based survey to assess knowledge and attitude regarding food allergy among public and food allergic patients in Makkah region, Saudi Arabia: A comparison study

Rawan Alosaimy[1], **Murouj Almaghrabi**[1], **Ahaad Basahal**[1], **Amjad Alharthi**[1], **Bashaer Khawandanah**[1], **Ghofran Zamil**[1], **Ruba Alansari**[1], **Amna Alotiby**[2*]

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Authors' Affiliation:
[1]Department of Medicine, Faculty of Medicine, Umm Al-Qura University, Makkah, Saudi Arabia
[2]Department of Haematology and Immunology, Faculty of Medicine, Umm Al-Qura University, Makkah, Saudi Arabia

[*]**Corresponding author**
Department of Haematology and Immunology, Faculty of Medicine, Umm Al-Qura University, Makkah,
Saudi Arabia
Email: aamogaty@uqu.edu.sa

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ABSTRACT

Background: This study compares knowledge and attitude regarding food allergy (FA)—a growing global problem—among the general population and FA patients. *Methods:* This was a cross-sectional study including the public in the Makkah region, Saudi Arabia. Participants were contacted via social media to participate in a 22-item self-administrated questionnaire survey about FA between April and June 2021. Data were collected in Excel documents and analyzed using SPSS. *Results:* The study included 487 participants: 397 from the general population; 90 FA patients. FA patients (65.6%) possessed better FA knowledge compared to the general population (49.9%) with reported statistical significance (P=0.007). Knowledge was most vital regarding symptoms and severity among both study groups. Females and younger participants possessed better FA knowledge (P<0.001). Both FA patients (81.1%) and the general population (72.0%) revealed a positive attitude. Female gender and high school/diploma education level were significantly associated with a positive attitude: P=0.014, 0.018, respectively. *Conclusions:* Both groups exhibited insufficient FA knowledge, but a positive attitude. Therefore, FA awareness programs are crucial to mitigate FA risks and complications.

Keywords: food allergy, awareness, general population, Saudi Arabia

1. INTRODUCTION

Approximately 2.5% of the global population has a food allergy (FA). The prevalence data, however, indicates this figure to be 10% (World Allergy

Organization, 2021). Locally, the prevalence of FA in Saudi Arabia is 19.7% (Althumiri et al., 2021). FA is a condition in which the immune system breaks its tolerance toward certain foods, recognizes them as foreign molecules, and attacks them (World Allergy Organization, 2021.). The clinical presentation of FA is varied: from mild to severe, leading to life-threatening anaphylaxis (Boyce et al., 2010). Additionally, the absence of a cure and limited treatment choices exacerbate the problem. The first-line treatment for an anaphylactic shock is an intramuscular injection of epinephrine (Gupta et al., 2009; Simons et al., 2011). Unfortunately, the most popular elicitor of anaphylaxis-related hospital admissions is accidental consumption of food allergens. Therefore, avoidance of allergens, knowledge of treatment, and early detection of signs and symptoms is critical to lower hospitalization and mortality rates (Simons et al., 2011).

Knowledge about proper FA diagnosis and management, and positive public attitude is essential to raise awareness. Several studies have investigated this subject among different groups, including food handlers and teachers (Alsuhaibani et al., 2019; Asiri et al., 2021; Gohal, 2018; Loerbroks et al., 2019), but only a few studies have investigated this subject among the general population, concluding that FA knowledge needed to be improved (Alharbi et al., 2020; Gupta et al., 2009). In a study conducted in the US, out of approximately 2,000 participants, 64.9% (range, 12.5%–100.0%) answered knowledge-based items correctly and higher scores were significantly associated with self-report of prior knowledge/training in FA; perception regarding FA was generally well-distributed (Gupta et al., 2009). Given the increasing prevalence of FA patients, community awareness of FA is essential, especially among FA patients.

Therefore, this study compares the knowledge, attitude, and beliefs regarding FA among the general population and FA patients in the Makkah region, Saudi Arabia. This study will help fill the research gap, and produce data, about the attitude and knowledge toward FA among the general population and FA patients. The current study data can facilitate actions required for our community to enjoy a high quality of life and meet the KSA 2030 vision goal of raising social awareness about health issues and reducing hospitalization and mortality rates.

2. DESIGN AND METHODS

Research design, population, and sample size determination

This was a cross-sectional study conducted via an online survey and distributed to the public, with or without previous diagnosis with FA in the Makkah region. The study was conducted between April and June 2021 and included 487 adults (≥18 years); people with medical background (e.g., healthcare workers, medical students) and non-Saudi participants were excluded. The participants were categorized into two study groups depending on their FA history: general population and patients with FA.

Regarding the sample size calculation for the general population group, the minimum sample size required was calculated using OpenEpi version 3.0 (Sullivan et al., 2009). Considering the population size of the Makkah region is about 8.8 million inhabitants (General Authority for Statistics, 2021.) and assuming 50% prevalence of FA knowledge, the estimated sample size was 385 participants, based on a confidence level of 95% and 5% margin of error; 397 participants were included. Regarding sample size calculation for patients with FA, two studies show that the number of diagnosed FA individuals is about 70 to 100 in the Makkah region (Althumiri et al., 2021; Tayeb et al., 2009). Therefore, the estimated sample size, based on previous literature, should be 80; 90 FA patients were included.

Study instrument

A modified questionnaire was designed, inspired by previous studies (Alsuhaibani et al., 2019; Goossens et al., 2013; Gupta et al., 2010; Radke et al., 2016). It was designed in Arabic (participants' native language) and distributed via Google forms on different social media platforms (Twitter, WhatsApp, and Snapchat). It was then translated to English for analysis and publication. The questionnaire comprised 22 items, divided into three sections. Section one contained items about general information, including basic information regarding age, gender, level of education, and source of medical information. Section two contained items about FA knowledge, assessing four main domains: definition, prevalence, and risk factors; allergen avoidance; identification of symptoms and severity; and emergency and treatment. Section three contained items about the attitude and beliefs toward FA including: general beliefs, stigma, and acceptability.

FA knowledge was evaluated using a questionnaire with 11-items. The most appropriate answer was identified and marked for each question; the correct answer was coded as 1, and incorrect as 0. For item Q9, more than one answer could be marked as correct. The total score ranged from 1 to 13. Next, the mean and SD of the knowledge scores were determined. Based on the mean, knowledge was categorized as good knowledge [13 to 7]—determined by scores greater than mean (approximately)—and poor knowledge [6 to 1], that is, scores less than the mean.

Participants' attitude toward FA was measured via six questions, using a 5-point Likert scale, where "strongly disagree" was coded as 1, "disagree" as 2, "neutral" as 3, "agree" as 4, and "strongly agree" was coded as 5. The total score was calculated by adding scores for all six questions—the minimum score was 5; the maximum, 30. Using the cutoff point of 80% of the total score, scores of 25–30 were classified as a positive attitude, and scores of 24–5 were classified as a negative/neutral attitude.

Statistical analysis

After extraction in an Excel document, the data were revised, cleaned, coded, and exported to the Statistical Package for the Social Sciences (SPSS) software, version 21 for statistical analyses. Descriptive statistics were used to summarize the data and report the variables. Data were presented using frequencies, proportions, and means ± standard deviations (SD) for continuous variables, when appropriate. Pearson's Chi-square test was used for categorical values to assess the distribution of participants' FA status, knowledge, and attitude levels according to their socio-demographic data and determine any possible association between them. Results with $P<0.05$ were considered statistically significant.

3. RESULTS

Demographics and general characteristics

A total of 487 participants were included in the study: 397 from the general population (male 51.6%, female 48.4%), 90 FA patients (male 34.4%, female 65.6%). Table 1 summarizes the participants' demographic characteristics. Participants' overall age ranged from 18 to 80 years, but the majority—in both study groups—were aged 40–59 years: 48.1% in the general population, 40% in FA patients. A total of 63.2% subjects in the general population and 64.4% among FA patients possess a bachelor's degree.

Regarding the source of medical information, 34.3% among the general population and 38.9% among FA patients gathered medical information from "search engines" (e.g., Google), followed by "social media apps" for 25.7% in the general population. In comparison, 22.2% of FA patients procured information by "reading books." A minor source of medical information used by both study groups—2.0% of the general population and 1.1% of FA patients—was documentaries.

Table 1 Distribution of the general population and patients with food allergy in Makkah region by their socio-demographic characteristics

		General population (N=397)		*Patients with food allergy (N=90)*	
Variables		*n*	%	*n*	%
Gender	Female	192	48.4	59	65.6
	Male	205	51.6	31	34.4
Age (in years)	18-28 years	77	19.4	25	27.8
	29-39 years	64	16.1	16	17.8
	40-59 years	191	48.1	34	37.8
	60-80 years	65	16.4	15	16.7
Level of education	Under high school	13	3.3	3	3.3
	High school/ diploma	62	15.6	8	8.9
	Bachelor's degree	251	63.2	58	64.4
	Postgraduate studies	71	17.9	21	23.3
Sources of medical information	Documentary movies	8	2.0	1	1.1
	Friends and family	81	20.4	11	12.2
	TV or radio	14	3.5	4	4.4
	Books and reading	56	14.1	20	22.2
	Search engines (e.g., Google)	136	34.3	35	38.9
	Social media apps	102	25.7	19	21.1

Knowledge about food allergy

Table 2 illustrates the level of knowledge among the participants in the two study groups. Overall, the mean score for the general population was 6.99 (SD 2.04)—slightly higher than the mean for FA patients (6.47; SD 2.22). Performance by domain is summarized below.

First domain: Definition, prevalence, and risk factors. On average, the general population correctly answered 50.7% of questions, compared to 54.9% by FA patients.

Second domain: Allergen Avoidance. On average, the general population correctly answered 33.5% of questions, compared to 30.4% by FA patients. However, regarding identifying the risk of eating a tiny amount of allergen, the percentage of correct answer in the general population group (55.7%) was significantly higher than in the other group (46.7%) (P=0.003). Additionally, the percentage of correct answer for identifying the risk of removing allergen from a prepared meal was significantly higher for the general population group (22.7%) compared to the other group (21.1%) (P=0.013).

Third domain: Identifying symptoms and severity. Knowledge was most vital regarding symptoms and severity. On average, the general population group correctly answered 65.4% of the questions, compared to 74.2% by FA patients. Considering the items independently, 53.3% of FA patients could identify the sign of allergic food reaction, that is, "Swelling of tongue and throat," which was significantly higher than the 36.3% in the general population group (P=0.003).

Fourth domain: Emergency and treatment. On average, the general population group correctly answered 41.1% of the questions, compared to 45.6% by the patients with FA group. Examining the items independently, 18.9% of FA patients correctly answered the initial drug used in anaphylaxis as "epinephrine injection," which was significantly higher than the 8.3% in the general population group (P<0.001).

Table 2 Knowledge about food allergy among the study groups in Makkah region, Saudi Arabia

Domain	Items	Knowledge score, correct No (%)		P value
		General population N=397	Food allergy patients N=90	
Overall Mean score		6.99+2.04	6.47+2.22	
Definition, prevalence, and risk factors	1. Food allergy is an abnormal immune response to the protein in certain foods (T)	184 (46.3)	45 (50.0)	0.81
	2. Food allergy is more common in children less than five years (T)	177 (44.6)	38 (42.2)	0.52
	3. Genetic factor is a risk factor for getting food allergy (T)	265 (66.8)	62 (68.8)	0.21
	4. Asthma, allergic rhinitis, or eczema are risk factors for food allergy (T)	179 (45.1)	53 (58.9)	0.056
Allergen Avoidance	5. Food additives are common food allergens (F)	88 (22.2)	21 (23.3)	0.715
	6. A person with a food allergy can safely eat a tiny amount of the food they are allergic to (F)	221 (55.7)	42 (46.7)	0.003*
	7. Taking food allergen out of a prepared meal is a way to make it safe for a person with a food allergy (F)	90 (22.7)	19 (21.1)	0.013*
Identify symptoms and severity	8. Eczema may be the first sign of food allergy (T)	350 (88.2)	85 (94.4)	0.22
	9. Which of the following are signs of an allergic food reaction?			
	Hives / rashes (T)	334 (86.6)	82 (91.1)	0.248
	Trouble breathing (T)	201 (50.6)	52 (57.8)	0.22
	Swelling of tongue and throat (T)	144 (36.3)	48 (53.3)	0.003*

Emergency and Treatment	10. The right action if you saw a person is having a severe food allergic reaction, like trouble breathing? - Call 911(T)	293 (73.8)	65 (72.2)	0.686
	11. Initial drug used in case of anaphylaxis - Epinephrine injection (T)	33 (8.3)	17 (18.9)	<0.001*

Abbreviations: (F), False; (T), true.

*Note: P: Pearson X^2 test | * P < 0.05 (significant)*

Only correct answers appeared in this table, detailed answers in supplementary data (Table 1) at Appendix

Attitude toward food allergy

A total of 81.1% of FA patients had a positive attitude toward FA compared to 72.0% of the general population. Conversely, a negative or neutral attitude was detected among 18.9% of FA patients and 28.0% of the general population. Responses to individual Likert items distributed by study groups are detailed in Table 3 and summarized by domain as follows:

First domain: General beliefs. Most respondents—the general population group, 94.9%; the patients with FA group, 95.5%—agreed that public knowledge about FA should be high. Additionally, 91.9% of the general population group and 95.5% of the patients with FA group agreed that food servers and restaurant chefs should be knowledgeable about FA.

Second domain: Stigma and acceptability. A total of 47.8% of FA patients and 36.5% of the general population disagreed that "Most people have general knowledge about FA" (P=0.027). Among FA patients, 75.6% agreed that "most people underestimate the problems caused by food allergies," whereas 60.4% of the general population group agreed with this notion (P=0.005). A total of 97.5% respondents among the general population group and 98.9% among the patients with FA group agreed that schools should be informed about children with FA. Additionally, 93.9% among the general population group and 96.6% among the patients with FA group agreed that children with FA should carry a card that states the type of FA.

Table 3 Attitude and beliefs about FA among the study groups in Makkah region, Saudi Arabia

Items		General population (n=397)			Food allergy patients (n=90)			P value
		Agree *n (%)*	Neutral *n (%)*	Disagree *n (%)*	Agree *n (%)*	Neutral *n (%)*	Disagree *n (%)*	
General beliefs	1. General population should be knowledgeable about Food Allergy (FA)	377(94.9)	15(3.8)	5(1.3)	86(95.5)	2 (2.2)	2 (2.2)	0.11
	2. Food servers and chefs in restaurant should be knowledgeable about FA	365 (91.9)	20 (5.0)	12 (3.0)	86 (95.5)	2 (2.2)	2 (2.2)	0.32
Stigma and acceptability	3. Most people have a general knowledge about FA	112 (28.2)	140 (35.3)	145(36.5)	26 (28.9)	21(23.3)	43(47.8)	0.027*
	4. Most people underestimate the problems caused by food allergies.	240(60.4)	101(25.4)	56(14.2)	68(75.6)	12 (13.3)	10 (11.1)	0.005*
	5. It is important to tell the school that your child has a FA	387(97.5)	7(1.8)	3(0.8)	89(98.9)	0 (0.0)	1 (1.1)	0.304
	6. It is essential for the child with a food allergy to carry a card stating the allergy type.	373(93.9)	16(4.0)	8(1.1)	87 (96.6)	1 (1.1)	2 (2.2)	0.195

	Overall attitude level	Positive (286; 58.7%) 72.0%?	Negative/ Neutral (111; 22.8%) 28.0	Positive (73; 81.1%)	Negative/ Neutral (17; 18.9%)	

*Note: P: Pearson X^2 test | * P < 0.05 (significant)*

In order to evaluate policy issues, multiple-choice questions were asked (Figure 1). The participants were asked to identify the single most crucial step to improve the lives of FA patients. Responses were widely distributed among the study groups, with promoting public awareness being more frequently selected among the general population group (37.8%) and identifying the cause being the most selected answer among the patients with FA group (37.8%) (P=0.097).

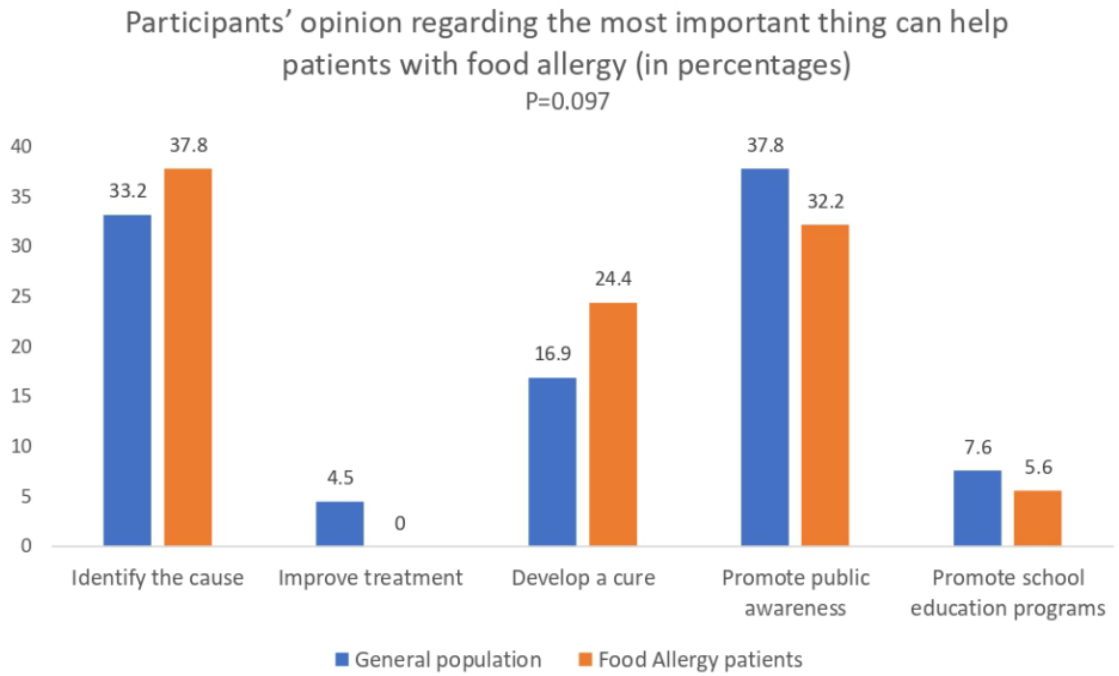

Figure 1 Comparison between the general population and food allergy patients' opinion regarding the most important thing that can help patients with food allergy

Association between level of knowledge and socio-demographic data

Table 4 shows the distribution of participants' level of knowledge about FA according to their socio-demographic data. Regarding the study group and their level of knowledge, about two-thirds (65.6%) of patients with FA had good knowledge about FA compared to almost half (49.9%) of the general population with reported statistical significance (P=0.007). Additionally, 62.2% of female participants had good knowledge compared to 42.8% of males (P<0.001). Regarding age, 60.8% and 61.3% of participants aged 18–28 years and 29–39 years, respectively, possessed good knowledge in comparison to 35.0% of elderly participants, that is, those aged 60–80 years (P<0.001). Other factors, including the level of education and source of medical information, had no significant relation with knowledge level. Although education level was not significant, 55.3% graduate participants and 52.2% postgraduate participants possessed good knowledge compared to 31.3% participants with education below high school level (P=0.196). Moreover, 58.5% of the participants who obtained medical information from search engines possessed good knowledge compared to 33.3% of the participants who obtained information from TV, radio, or documentary movies (P=0.075).

Table 4 Association between the level of knowledge about food allergy and socio-demographic data of the study participants in Makkah region, Saudi Arabia

Socio-demographic data		*Level of knowledge about food allergy*				*P-value*
		Poor knowledge		*Good knowledge*		
		Freq	*%*	*Freq*	*%*	
Study groups	Food allergy patients	31	34.4	59	65.6	*0.007**
	General population	199	50.1	198	49.9	
Gender	Male	135	57.2	101	42.8	*<0.001**
	Female	95	37.8	156	62.2	
Age in years	18-28 years	40	39.2	62	60.8	*<0.001**
	29-39 years	31	38.8	49	61.3	
	40-59 years	107	47.6	118	52.4	
	60-80 years	52	65.0	28	35.0	
Level of education	Under high school	11	68.8	5	31.3	0.196
	High school/ diploma	37	52.9	33	47.1	
	Bachelor's degree	138	44.7	171	55.3	
	Postgraduate studies	44	47.8	48	52.2	
Sources of medical information	Documentary movies	6	66.7	3	33.3	*0.075*
	Friends and family	52	56.5	40	43.5	
	TV or radio	12	66.7	6	33.3	
	Books and reading	33	43.4	43	56.6	
	Search engines	71	41.5	100	58.5	
	Social media	56	46.3	65	53.8	

*Note: P: Pearson X^2 test | * P < 0.05 (significant)*

Association between attitude level and socio-demographic data

Regarding participants' attitudes according to their socio-demographic data (Table 5), a positive attitude was detected among 78.5% of female participants compared to 68.6% of male participants with recorded statistical significance (P=0.014). Regarding the level of education, 85.7% of participants with a high school or diploma degree possessed a positive attitude compared to 64.1% of participants with postgraduate studies (P=0.018). Other factors, including different study groups, age, and source of medical information, had no significant relation with the attitude level. As illustrated, most participants in both study groups: 81.1% of FA patients and 72% among the general population group had a positive attitude with no statistical significance (P=0.078). Additionally, 82.2% of the participants aged 18–28 years had a positive attitude compared to 68.40% of those aged 40–59 years (P=0.058). Moreover, 80.7% of the participants who used search engines as a source of information had a positive attitude toward FA compared to 61.1% of those who used TV or radio (P=0.144).

Table 5 Association between the attitude toward food allergy and socio-demographic data of the study participants in Makkah region, Saudi Arabia

Socio-demographic data		*Attitude toward food allergy*				*P-value*
		Neutral/Negative		*Positive*		
		Freq	*%*	*Freq*	*%*	
Study groups	Food allergy patients	17	18.9	73	81.1	0.078
	General population	111	28.0	286	72.0	
Gender	Male	74	31.4	162	68.6	0.014*
	Female	54	21.5	197	78.5	
Age in years	18-28 years	18	17.6	84	82.2	
	29-39 years	19	23.8	61	76.3	0.058

	40-59 years	71	31.6	154	68.4	
	60-80 years	20	25.0	60	75.0	
Level of education	Under high school	3	18.8	13	81.3	0.018*
	High school/ diploma	10	14.3	60	85.7	
	Bachelor's degree	82	26.5	227	73.5	
	Postgraduate studies	33	35.9	59	64.1	
Sources of medical information	Documentary movies	2	22.2	7	77.7	0.144
	Friends and family	27	29.3	65	70.7	
	TV or radio	7	38.9	11	61.1	
	Books and reading	25	32.9	51	67.1	
	Search engines	33	19.3	138	80.7	
	Social media	34	28.1	87	71.9	

Note: P: Pearson X^2 test | * P < 0.05 (significant)

4. DISCUSSION

FA incidents are increasing worldwide (Loh and Tang, 2018) and locally (Althumiri et al., 2021). Community awareness, therefore, has become crucial for preventing serious complications caused by FA and anaphylaxis as well as for promoting health and quality of life to the affected. The present study compares knowledge and attitude among the general population and FA patients in the Makkah region.

Knowledge level about food allergy and its determinants

This cross-sectional survey has shown that both the general population and FA patients included in the study have insufficient knowledge regarding the nature of FA—such studies focusing on the adult population in Saudi Arabia are scarce. Only one study conducted in Jeddah city assessed the knowledge level of appropriate FA diagnosis and management: it found a significant deficiency in knowledge level among participants with and without FA (Alharbi et al., 2020). However, several studies, with different study populations, have been conducted. For example, a study in Jazan revealed that 59.7% of the school teachers had a medium insufficient knowledge about FA (Gohal, 2018). Another study conducted in Taif on mothers of allergic children found that the participating mothers had significantly poor knowledge of FA (p = 0.026) (Gomaa et al., 2020). Similarly, a study in Tabouk city showed that 96.1% of the parents were aware of FA, but only 53.6% agreed that severe FA could lead to life-threatening complications (Alanazi et al., 2017).

In the current study, only 45.1% of the general population group recognized asthma, allergic rhinitis, or eczema as risk factors for FA in comparison to 58.9% of FA patients. These nearly statically significant results can be attributed to the fact that all the participants do not have a medical background. Hence, they do not understand the etiology of those diseases and how they could be related. Internationally, a study conducted in the US on 2,184 participants revealed that knowledge was poor regarding the differentiation between FA and food intolerance, the absence of a cure, and current treatments of FA (Gupta et al., 2009). Symptoms of FA can range from mild to severe. Among the general population group, 88.2% and among the patients with FA group, 94.4% recognize that eczema might be the first sign of FA. Conversely only 36.3% in the general population group and 53.3% in the patients with FA group identified swelling of the tongue and throat as a symptom. This disparity might be attributed to the previous experiences of such symptoms by the affected; more importantly, it indicates a gap in understanding the severity of symptoms for the FA patients and general population.

Currently, avoiding allergens is the primary treatment to prevent potentially life-threatening complications. This study revealed that 44.3% respondents in the general population group and 53.3% in the patients with FA group agreed that a person with FA could safely consume a tiny amount of the food they are allergic to; 77.3% and 78.9% among the general population and patients with FA groups, respectively, believe that removing food allergen from prepared meal makes it safe. Our results seem consistent with other international studies on food handlers in the US, Germany, and Turkey (Loerbroks et al., 2019; Radke et al., 2016; Tatli & Akoğlu, 2020). This misconception poses risks for FA patients to develop a hypersensitive reaction and life-threatening anaphylaxis, albeit in the worst-case scenario. Hence, it is important to raise awareness among the general population and FA patients about the severity of such events and about the importance of early recognition of the symptoms and signs of anaphylaxis to reduce complications caused by treatment delay.

Prompt administration of epinephrine injection can reduce the mortality rate of anaphylaxis. Furthermore, it remains the first-line treatment in case of anaphylactic shock (Simons et al., 2011). Recent studies conducted locally on school teachers to assess their knowledge regarding FA treatment in case of anaphylaxis showed that 31.3% of teachers had knowledge of epinephrine as medication. However, only 14.3% of them were aware of using an EpiPen, the self-injection medication (Asiri et al., 2021). Another study revealed that 16.4% reported using epinephrine injection. Moreover, most of the teachers (77.3%) did not know the manner in which the injection had to be applied (Gohal, 2018). Furthermore, only 15.4% teachers knew about epinephrine medication and 37.2% were aware of the administration method of self-injection EpiPen (Alsuhaibani et al., 2019; Asiri et al., 2021).

Interestingly, the current study results found that only 8.3% of the general population and 18.9% of FA patients knew about epinephrine injection as an initial drug in case of anaphylaxis. This lack of awareness indicates raising issues that impact patients' health and might contribute to increased morbidity. Therefore, it is crucial to provide awareness programs that focus on managing anaphylactic shock and facilitate the availability of epinephrine injections in the public utilities. The current study revealed the general population's significantly poor knowledge compared to FA patients. This finding is compatible with studies that reported insufficient knowledge about FA among the general population (Alharbi et al., 2020; Alotaibi et al., 2021; Gomaa et al., 2020). Therefore, society needs to possess enough knowledge to deal with different FA scenarios, including complex challenges such as life-threatening anaphylactic shock. Additionally, instructive messages need to be delivered by physicians to the general population and more explicitly to FA patients.

This study also showed a significant association between age and knowledge level: younger participants possessed good knowledge. Two other studies in different regions of Saudi Arabia assessed participants' age in terms of their knowledge. In contrast to this study, a study conducted in Taif among mothers of FA patients showed that mothers older than 40 years had good knowledge (Gomaa et al., 2020). However, another study reported no significant correlation between age and knowledge (Alotaibi et al., 2021). Interestingly, all studies approved that there was no significant difference between the participants' knowledge and education level. Perhaps other factors affect the result; accordingly, these findings need more observable study.

Attitude toward food allergy and its determinants

Participants who have FA express a generally positive attitude (81.1%). Most FA patients (75.7%) believe that people underestimate the problem caused by food allergen, compared to only 60% of the general population (P=0.005). Additionally, 47.8% of FA patients think that most people do not possess general knowledge about FA, compared to only 36.5% of the general population (P=0.03). This could disturb FA patients to cope with their situation. So, proper awareness is vital to help FA patients cope with their situation and improve their quality of life.

Regarding the attitude's determinants, few studies can be compared with the current study because of the difference in tools measuring the attitude and the limited number of local studies. The current study found that females had a significantly positive attitude compared to males—an observation in line with a study in the US that measured the attitude of restaurant staff to find that females had good attitude. This can be explained by the fact that females are more receptive toward nutritional problems, which is reflected in healthier diets and greater nutritional competence when compared to men (Loerbroks et al., 2019).

Interestingly, a significant association between a low level of education and a good attitude was detected in this study; this might be explained as follows: those with higher educational levels can have better proficiency in understanding health information, but hesitate in terms of attitude. The source of medical information is one of the most critical factors affecting the validity of public information, which is reflected in behavior and attitude. Therefore, this study found that a higher percentage of search engines users were associated with a positive attitude. There may be several possible reasons: its universal accessibility, the lack of treasury hospitals and specialized physicians, etc.

Strengths and limitations of the study

The present study had a few limitations. It was a self-reported online survey-based study. Given the fact that self-reporting surveys could be fast and have high data quality, it may bias the results. Regarding the setting, the study focuses on one region only (Makkah), which could prevent the generalization of results. Additionally, we relied on a previously published questionnaire, but modified it according to the desired information, assessing validity. Despite all this, our study provided significant findings. To the best of the authors' knowledge, this is among the first studies to compare the general population's knowledge, attitude, and beliefs with those of FA patients regarding FA in the Makkah region.

5. CONCLUSION

The participants in both the general population and patients with FA groups exhibited insufficient knowledge of FA risk factors, high-risk behaviors, and severe allergic reaction symptoms. Additionally, one crucial misconception was found. However, both groups expressed a positive attitude. Therefore, education programs to improve FA awareness among the general population and FA patients are crucial and needed to mitigate the risk for FA patients from complications and life-threatening reactions.

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Author Contributions

All authors were equally made substantial contributions in terms of conception, design, data acquisition, data analysis and interpretation, and article drafting and critical revision and agreed to submit to the current journal, giving final approval of the version to be published and agreeing to be accountable for all aspects of the work.

Ethical approval

The study was approved by the Biomedical Ethics Committee, Faculty of Medicine, Umm Al-Qura University, Makkah, Saudi Arabia Approval No (HAPO-02-K-012-2021-03-631).

Appendix: Supplementary Data Table 1

Table 1. Description of knowledge answers about food allergy among general population and food allergy patients in Makkah region, Saudi Arabia

Domain	Items	BOTH (N=487)		General population N=3		Food Allergy patients N=90		P value
		n	%	n	%	n	%	
	Knowledge mean score (Total score =13)	Min=1, Max=12 Mean=6.57+2.195		Min=2, Max=12 Mean=6.99+2.04		Min=1, Max=12 Mean=6.47+2.22		
Definition, prevalence, and risk factors	Food allergy (FA) is an abnormal immune response to the protein in certain foods							
	Yes (correct)	229	47.0	184	46.3	45	50.0	0.81
	No	38	7.8	31	7.8	7	7.8	
	Don't know/unsure	220	45.2	182	45.8	38	42.2	
	FA is more common in children less than five years							
	Yes (correct)	215	44.1	177	44.6	38	42.2	0.523
	No	98	20.1	76	19.1	22	24.4	
	Don't know/unsure	174	35.7	144	36.3	30	33.3	
	Genetic factor is a risk factor for getting FA							
	Yes (correct)	327	67.1	265	66.8	62	68.9	0.214
	No	57	11.7	43	10.8	14	15.6	
	Don't know/unsure	103	21.1	89	22.4	14	15.6	
	Asthma, allergic rhinitis, or eczema are risk factors for FA							
	Yes (correct)	232	47.6	179	45.1	53	58.9	

	No	88	18.1	74	18.6	14	15.6	0.056
	Don't know/unsure	167	34.3	144	36.3	23	25.6	
Identify allergens and allergen avoidance	Food additives are common food allergens							
	Yes	192	39.4	154	38.8	38	42.2	
	No (correct)	109	22.4	88	22.2	21	23.3	0.715
	Don't know/unsure	186	38.2	155	39.0	31	34.4	
	A person with a food allergy can safely eat a tiny amount of the food they are allergic to							
	Yes	153	31.4	112	28.2	41	45.6	
	No (correct)	263	54.0	221	55.7	42	46.7	0.003*
	Don't know/unsure	71	14.6	64	16.1	7	7.8	
	Taking food allergen out of a prepared meal is a way to make it safe for a person with a food allergy							
	Yes	298	61.2	223	58.7	65	72.2	
	No (correct)	109	22.4	90	22.7	19	21.1	0.013
	Don't know/unsure	80	16.4	74	18.6	6	6.7	
Identify symptoms and severity	Eczema/skin rash may be the first sign of FA							
	Yes (correct)	435	89.3	350	88.2	85	94.4	
	No	21	4.3	19	4.8	2	2.2	0.219
	Don't know/unsure	31	6.4	28	7.1	3	3.3	
	Which of the following are signs of an allergic food reaction?							
	All 3 correct answers only (Trouble breathing, Hives/rashes and swelling of tongue and throat)	113	23.2	88	22.2	25	27.8	
	Only 2 correct answers (Trouble breathing, Hives/rashes and swelling of tongue or throat)	82	16.8	68	17.1	14	15.5	
	Only 1 correct answer (Trouble breathing, Hives/rashes and swelling of tongue or throat)	207	42.5	190	47.9	29	32.2	
	Incorrect answer	85	17.4	51	12.8	22	24.5	
	# Participants knowledge about the allergic food reaction							
	Hives / rashes (correct)	426	87.5	344	86.6	82	91.1	0.248
	Trouble breathing (correct)	253	52.0	201	50.6	52	57.8	0.22
	Swelling of tongue and throat (correct)	192	39.4	144	36.3	48	53.3	0.003
	Headache	33	3.5	24	6.04	9	10.0	
	Fever	42	4.4	28	7.05	14	15.56	

Emergency and Treatment	Which of the following is the right action if you saw a person is having a severe food allergic reaction, like trouble breathing?							
	Call 911(correct)	358	73.5	293	73.8	65	72.2	0.686
	Suggest that the person throw up	66	13.6	55	13.9	11	12.2	
	Suggest that the person drink water	63	12.9	49	12.3	14	15.6	
	Initial drug used in case of anaphylaxis							
	Epinephrine injection (correct)	50	10.3	33	8.3	17	18.9	<0.001
	Ani-histamine tablet	174	35.7	134	33.8	40	44.4	
	Pain-relieving	24	4.9	21	5.3	3	3.3	
	Herbal medicine	11	2.4	7	1.8	4	4.4	
	Don't know	228	46.8	202	50.9	26	28.9	

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Conflicts of interest

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

REFERENCES AND NOTES

1. Alanazi M, Aalsubaie A, Aalkhozym S, Alanazi G, Alyami S, Zuiran A, Merghani T. Food allergy experience and perception of parents in Tabuk City, Kingdom of Saudi Arabia. Int J Med Res Prof 2017; 3:26–9.
2. 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.
3. Alotaibi N, Habib L, Alyamani W, Borah R, Alquwayz R, Nashar B Bin. Food Allergy Awareness among Parents of Food Allergic Child in Saudi Arabia. J Biochem Technol 2021; 11:110–8. doi: 10.51847/mgyog7gv2e.
4. Alsuhaibani MA, Alharbi S, Alonazy S, Almozeri M, Almutairi M, Alaqeel A. Saudi teachers' confidence and attitude about their role in anaphylaxis management. J Family Med Prim Care 2019; 8:2975–82. doi: 10.4103/jfmpc.jfmpc_562_19.
5. 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; 18:347. doi: 10.3390/ijerph18010347
6. Asiri KA, Mahmood SE, Alostath SA, Alshammari MD, Al Sayari TA, Ahmad A, Alsaleem SA. Knowledge and practices regarding anaphylaxis management in children and adolescents among teachers in KSA. Int J Health Clin Resh 2021; 4:56–60.
7. Boyce JA, Assa'ad A, Burks AW, Jones SM, Sampson HA, Wood RA, Plaut M, Cooper SF, Fenton MJ. Guidelines for the Diagnosis and Management of Food Allergy in the United States: Summary of the NIAID-Sponsored Expert Panel Report. J Allergy Clin Immunol 2010; 126:1105–18. doi: 10.1016/j.jaci.2010.10.008.
8. General Authority for Statistics. Saudi Arabia (KSA) Population Statistics. Retrieved Jan, 2021, from https://www.stats.gov.sa/ar/779.
9. Gohal G. Food Allergy Knowledge and Attitudes among School Teachers in Jazan, Saudi Arabia. Open Allergy J 2018; 9. doi: 10.2174/1874838401809010001
10. Gomaa NI, Abdullah TI, Alharthi WM, Altowairqi AT, Binbaz SS, Alamri NM. Knowledge and awareness about food allergy among mothers with allergic children in Taif city, Saudi Arabia. Int J Med Dev Ctries 2020; 4:49–53. doi: 10.24911/IJMDC.51-1569571928

11. Goossens NJ, Flokstra-de Blok BM, van der Meulen GN, Botjes E, Burgerhof HG, Gupta RS, Springston EE, Smith B, Duiverman EJ, Dubois AE. Food allergy knowledge of parents - is ignorance bliss? Pediatr Allergy Immunol 2013; 24:567–73. doi: 10.1111/pai.12099.
12. Gupta RS, Kim JS, Springston EE, Smith B, Pongracic JA, Wang X, Holl J. Food allergy knowledge, attitudes, and beliefs in the United States. Ann Allergy Asthma Immunol 2009; 103(1):43-50. doi: 10.1016/S1081-1206(10)60142-1.
13. Gupta RS, Springston EE, Smith B, Kim JS, Pongracic JA, Wang X, Holl J. Food allergy knowledge, attitudes, and beliefs of parents with food-allergic children in the United States. Pediatr Allergy Immunol 2010; 21(6):927-34. doi: 10.1111/j.1399-3038.2010.01005.x.
14. Loerbroks A, Tolksdorf SJ, Wagenmann M, Smith H. Food allergy knowledge, attitudes and their determinants among restaurant staff: A cross-sectional study. PLoS One 2019; 14:(4):e0214625. doi: 10.1371/journal.pone.0214625.
15. Loh W, Tang MLK. The Epidemiology of Food Allergy in the Global Context. Int J Environ Res Public Health 2018; 15. doi: 10.3390/ijerph15092043.
16. Radke TJ, Brown LG, Hoover ER, Faw BV, Reimann D, Wong MR, Nicholas D, Barkley J, Ripley D. Food allergy knowledge and attitudes of restaurant managers and staff: an EHS-Net study. J Food Prot 2016; 79:1588–98. doi: 10.4315/0362-028X.JFP-16-085.
Simons FE, Ardusso LR, Bilò MB, El-Gamal YM, Ledford DK, Ring J, Sanchez-Borges M, Senna GE, Sheikh A, Thong BY; World Allergy Organization. World Allergy Organization anaphylaxis guidelines: summary. J Allergy Clin Immunol 2011; 127(3):587-93.e1-22. doi: 10.1016/j.jaci.2011.01.038.
17. Sullivan KM, Dean A, Soe MM. On Academics: OpenEpi: A Web-Based Epidemiologic and Statistical Calculator for Public Health. Public Health Rep 2009; 124:471–4. doi: 10.1177/003335490912400320.
18. Tatli M, Akoğlu A. Food Allergy Knowledge, Attitudes and Practices of Restaurant Employees in Istanbul. Akademik Gida 2020; 18:125–34. doi: 10.24323/akademik-gida.758812.
19. Tayeb MMS, Koshak EA, Qutub MMA. Sensitization to Common Food Allergens in Makkah City. Egy J Hosp Med 2009; 35:288–94. doi: 10.21608/ejhm.2009.17575.
20. World Allergy Organization WAO. Food Allergy. Retrieved Jan, 2021, from https://www.worldallergy.org/education-and-programs/education/allergic-disease-resource-center/professionals/food-allergy.