A cross-sectional study of food allergy and its psychological aspect among Saudi Arabia population

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Abstract

Although studies reported the prevalence rate of food allergies and caused foods in Saudi Arabia, little is known about the psychological risk. The aims were to determine the latest prevalence rate, food allergens and symptoms, and investigate the main factors associated with psychological aspects of food allergy. Cross-sectional survey studies were administered via the internet and interview (2020). The survey addressed food allergies concerning demographic, allergic characteristics, lifestyle and psychological aspects. Frequencies, descriptive statistics, one-way ANOVA and independent samples t-tests were used. 504 participants were reported with allergies to at least one food. The prevalence was 41.2%, and the most common symptom was an itch. Wheat was the most common food allergen. The main psychological effect of food allergy was anxiety (55.6%). There were significant associations between psychological effects and many factors ($P< 0.05$). A psychological risk with respect to age, educational level, frequency of visiting the hospital, using of food allergy labels, avoiding allergens, and satisfaction with allergen food labelling was noted.

Keywords: Food allergy, psychological, effect, prevalence, symptoms

1. Introduction

Food counted as natural medicine and nutrition linked with many diseases' prevention, but could be harmful in some situations such as food allergy. Food allergy is a condition of abnormal response to a food triggered by the immune system that wrongly recognizes some proteins in food as harmful to the human body, and then the body stimulates many protective measures, including releasing chemicals like histamine, which causes inflammation. Eating allergenic food in small quantities can also lead to danger allergenic symptoms (Yu et al., 2016).

Food allergies affect 6% of young children and 3- 4% of adults. Some children could get rid of their food allergies while growing up. Globally, 90% of people can be exposed to food allergies. The most known food allergens are milk, egg, tree nuts, peanut, soy, wheat, shellfish and fish (Sicherer and Sampson, 2006).

The symptoms of a food allergy may be uncomfortable and may have a serious condition that could threaten life and could be fatal. These symptoms always develop a few seconds or minutes after eating the allergenic food. Food-induced allergic reactions are responsible for a variety of symptoms involving shortness of breath, feeling dizzy, nausea or vomiting, and abnormal pain (Yunginger et al., 1988; Sampson et al., 1992; Bock et al., 2001).

The increasing prevalence of food allergy results in a considerable burden on the healthcare system and significantly compromises the quality of life for the patients. Clinical studies reported that food-allergic patients experience behavioural and emotional problems such as anxiety, depression, attention deficit disorder, hyperactivity disorder, social neurodevelopmental abnormalities and irritability (Meldrum et al., 2012; Ferro et al., 2016; Ferro et

al., 2016). There are several impacts of food allergy that may influence the quality of life, especially the psychological aspects.

Previous studies reported the prevalence of food allergies and caused foods in Saudi Arabia. However, little is known about psychological impacts, food allergy labelling recognition, and health care utilization related to food allergies among the Saudi population. This study aimed to determine the latest prevalence, food allergens and symptoms of food allergy, investigate the main factors associated with psychological aspects of food allergy, and identify differences in food allergy labelling recognition and health care utilization.

2. Subjects and Methods

2.1. Study design

A cross-sectional study design was used to assess the food allergy prevalence and its effects on the psychological aspect, perception toward food allergy labelling and health care utilization in Saudi Arabia. The present study was conducted between September and November 2020.

2.2. Subjects

The participants enrolled in this study were males and females, adults and children in Saudi Arabia. A stratified random sampling technique was used to recruit the study sample. The sample size was determined within 0.03 of the total Saudi population (34,218,169) with a 95% confidence level (the General Authority for Statistics, 2019). The sample size calculations revealed a number of at least 1068 participants enrolled in this study. The inclusion criteria were included healthy and food allergenic participants, who live in Saudi Arabia, and who educated. The exclusion criteria included people who do not live in Saudi Arabia and low literacy populations. The study design was reviewed and approved by the Unit of Biomedical Ethics Research Committee at King Abdulaziz University (Reference No 475-21).

2.3. Instrument and Procedure

The surveys were administered via the internet, which were sent via WhatsApp application and Twitter, and interviews with allergic patients. Online informed consent was obtained before participants started the survey. The survey used during the study was divided into four sections as follows. The first section requested demographic characteristics (age, gender, nationality, geographic region, employment status, educational level, social status, and monthly income). The second section requested allergic characteristics (food allergens, symptoms, health care utilization, family history, and food allergy recovery). The third section included questions about lifestyle (daily routine, food allergy labelling recognition, and purchasing special food products). The fourth section aimed to assess psychological impacts. For content validity, the questionnaire was initially developed in Arabic, and then pre-tested for question accuracy and clarity. To protect the privacy of participants, no personal documentation details were collected, and voluntary participation was ensured.

2.4. Statistical analysis

All statistical analyses for the study variables were performed using the SPSS software version 24. Frequencies were calculated for quantitative data and descriptive statistics (means and SD) for the continuous variables. One-way ANOVA and independent samples t-tests with a 95% confidence level were used for statistical tests. All tests were considered statistically significant at $P< 0.05$.

3. Results and Discussion

3.1. Food allergy prevalence, symptoms, allergens and demographic characteristics

1,222 participants completed the survey that was selected randomly. Out of the total participants, 504, including 118 males and 386 females, reported having a food allergy. Thus, the prevalence rate of food allergies was 41.2%, based on 504 responders who experienced a food allergy in the total sample. It can be estimated that 4 out of 10 Saudis would have a food allergy. Furthermore, only 128 (25.4%) of those food allergy patients had clinically undergone allergy evaluations to confirm their diagnoses.

The study included 386 female and 118 male participants, representing 76.5% and 23.4% of the study population, respectively. The age of the participants ranged from newborn to ≥ 61 years old. 17.4% reported onset during childhood (≤ 11 years). Participants were recruited from various geographic regions and most of them were Saudi 90.6%. Most of the participant's education degree was bachelor 55.5%. Study participants (45.2%) were students, while 4.7% were retired. The highest income average of the study participants was (< 5000 SR/ month) (48.8%). Regarding marital status most of the participants were single (56.9%) (Table 1).

Table.1 showed that there were significant (*P< 0.05*) associations between psychological effects relative to age and education level. Participants who had a high level of education and middle age were less likely psychologically affected.

Table. 1 The association between demographic characteristics and psychological effects

Demographic Characteristics	N (%)	Psychological Effects Mean ± SD
Age		
Newborn – 3	38 (7.5%)	1.89 ± 0.31*
4 – 11	50 (9.9%)	1.78 ± 0.41*
12 – 20	100 (19.8%)	1.67± 0.47*
21 – 30	141 (27.9%)	1.68 ± 0.46*
31 – 40	94 (18.6%)	1.77 ± 0.41*
41 – 60	77 (15.2%)	1.76 ± 0.42*
≥ 61	4 (0.79%)	2 ± 0*
Gender		
Female	386 (76.5%)	1.72 ± 0.44
Male	118 (23.4%)	1.78 ± 0.41
Nationality		
Saudi	457 (90.6%)	1.72 ± 0.44
Residents	47 (9.3%)	1.78 ± 0.41
Employment status		
Student	228 (45.2%)	1.72 ± 0.44
Employee	111 (22%)	1.74 ± 0.43
Unemployed	141 (27.9%)	1.72 ± 0.44
Retired	24 (4.7%)	1.70 ± 0.46
Educational level		
Uneducated	23 (4.5%)	2 ± 0*
< Secondary	76 (15%)	1.78 ± 0.41*
Secondary	92 (18.2%)	1.71 ± 0.45*
Bachelor	280 (55.5%)	1.69 ± 0.46*
High degree	33 (6.5%)	0.15 ± 0.39*
Marital status		
Single	287 (56.9%)	1.77 ± 0.74
Married	198 (39.2%)	1.72 ± 0.44
Divorced	16 (3.17%)	1.81 ± 0.40
Widow	3 (0.5%)	2 ± 0
Monthly income		
< 5,000 SR	246 (48.8%)	1.73 ± 0.44
5,000-10,000 SR	119 (23.6%)	1.73 ± 0.44
10,000-15,000 SR	84 (16.6%)	1.73 ± 0.44
> 15,000 SR	53 (10.5%)	1.71 ± 0.45

*The comparisons were significant at *P< 0.05*

Our results showed that the prevalence of food allergy among respondents was 41.2%. Aba-Alkhail and El-Gamal (2000) reported a food allergy prevalence of 29% (392 of 1341) among asthmatic patients in Jeddah, Saudi Arabia. Our results were higher than the other study (29%). This may be explained by the self-administered questionnaire for responders, who not have been clinically diagnosed. Participants may have confused food allergy with other adverse reactions such as lactose intolerance, foodborne disease, or food additive hypersensitivity. Gupta et al. (2019) reported that adults who believed that they had a food allergy were about twice as high as those with an actual food allergy. This study sample also was not intended for a specific patient group. However, the prevalence of food allergies had increased in recent decades worldwide (Sicherer and Sampson, 2014). According to the results, the percentage of food allergy participants among females (76.5%) was higher than among males (23.4%). The present findings were in agreement with several studies (Aba-Alkhail and El-Gamal, 2000; Sicherer et al., 2004; Scurlock and Jones 2018).

The most common food allergens reported among participants were wheat (30.4%), milk (29.2%), eggs (28.8%), fish or nuts (20.6%), peanuts (15.9%), and soybean (9.5%) (Fig.1). Fruit (apricot, pineapple, strawberry, banana, dates, kiwi, mango, melon, pomegranate, guava, and figs), sesame seeds, legumes, honey, coffee, chocolate, cheese, yeast, shrimp, chicken, meat, vegetables (eggplant, green pepper, squash, tomato, garlic, celery, cucumber, mushroom, and onion), and spices (cinnamon, rosemary, and cardamom) were also mentioned as food allergens. Multiple food allergens were reported by 46.2% of food-allergic participants.

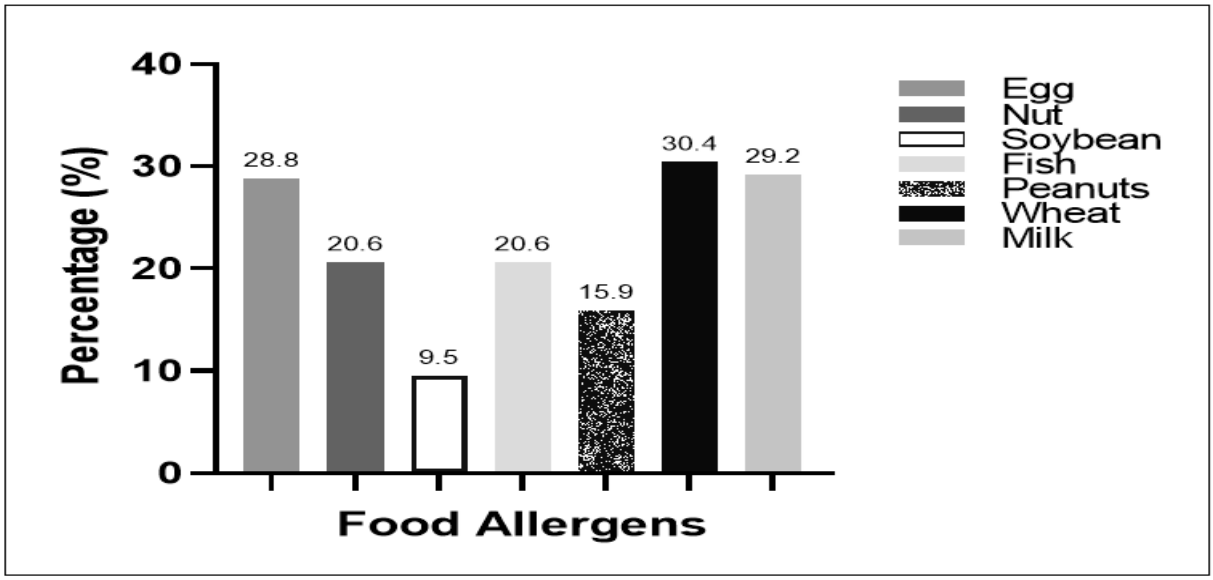

Fig. 1 The distribution of the food allergens among the participants

In this study, the most common food allergens were wheat, milk, eggs, fish, nuts, and peanuts. Similarly, a Saudi study reported that milk and egg were the most common allergic foods (Alanazi et al., 2017). Tayeb et al. (2009) also reported that the top five food allergens were cocoa, peanuts, egg white, milk and strawberry in Makkah, Saudi Arabia (sample size= 80). The current results agree with other studies that the most common types of food allergies among Saudi papulation were milk, eggs, and peanuts. However, the wheat did not show within the top food allergens in other studies. This may be explained by the variation in sample size.

Allergy symptoms experienced by participants are presented in Fig.2. Itching (51.4%), was the most frequent symptom reported, followed by a rash (45.4%), swelling (35.5%), breath shortness (31%), nausea (28.4%), abnormal pain (20.2%), and dizziness (11.7%). In the 'other symptoms of food allergies, some responders listed vomiting, diarrhea, constipation, sore throat, and cough. 71.8% of participants have suffered from two or more food allergic symptoms.

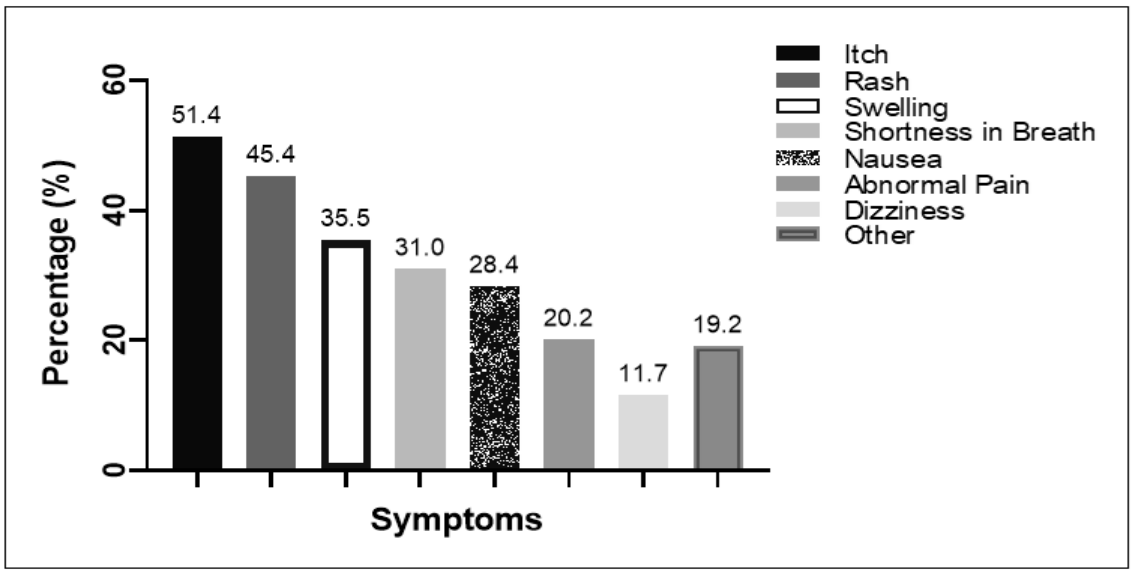

Fig. 2 Primary food allergy symptoms that participants experienced

Our results indicated that the most common food allergy-related symptoms were itching (51.4%), rash (45.4%), swelling (35.5%), breath shortness (31%), nausea (28.4%), abnormal pain (20.2%), and dizziness (11.7%). Similarly, a previous study in Makkah found that itching was the most common reported symptom (53.7%) followed by skin rash (48.4%) (Damanhori, 2015). In addition, Choi et al (2015) reported that urticarial and itching were the most frequent symptoms in Korea. Our results were consistent with the local and international studies' results.

3.2. Health care use and health history

Overall, 257 (50.9%) did not report experiencing symptoms that necessitated a visit to the hospitals or health centers. However, the results illustrated that 19% of the participants have been visiting hospitals once from three to six months or once from six to twelve months, while the least frequency of visiting hospitals was once a week (2.7%). A higher health care use was most commonly observed among participants with milk (71.4%) and egg and/or fish (57.1%) allergies. According to the results, 91.1% of the participants continued suffering from food allergies and using medications to relieve symptoms. In some cases, the patients overcome food allergies with aging. Only 8.9% of the participants reported that they fully recovered from food allergies. Furthermore, among participants clinically diagnosed with food allergy, 35.5% reported having a relative with a food allergy.

Concerning the association between psychological effects and health history, the data of the current study showed that the history of the family with food allergy and the recovery from food allergy did not show significant differences relative to the psychological effects of the participants ($P< 0.05$). On the other hand, there were significant differences between the frequencies of visiting hospitals relative to the psychological effects of the participants ($P< 0.05$). Thus, participants who did not have to visit hospitals or health centers were less likely psychologically affected (Table. 2).

The results illustrated that 19% of the participants have been visiting hospitals once from six to twelve months due to severe reactions. A study found that 8.6% of the US adults with convincing food allergies reported ≥1 food allergy-related emergency visit within a year (Gupta et al., 2019).

This study's results found that most of the participants continued suffering from food allergies and using medications to relieve symptoms. This study is in agreement with previous suggestions that awareness and a sense of responsibility, acclimatization, and a better diet are the best allergy treatment (Sicherer and Sampson, 2006; Williams, Parra and Elkin, 2009). In addition, early identification and subsequent avoidance of symptomatic food allergy is an important preventive factor for reducing food allergies (Aba-Alkhail and El-Gamal, 2000).

Table. 2. The association of health care use and health history with psychological effects

Questions	N (%)	Psychological Effects Mean ± SD
Frequency of visiting hospitals or health centres		
Don't require visiting	257 (50.9%)	0.23 ± 0.48*
Once a week	14 (2.7%)	1.85 ± 0.36*
Once a month	39 (7.7%)	1.92 ± 0.26*
Once from three to six months	98 (19.4%)	1.85 ± 0.34*
Once from six months to a year	96 (19%)	1.81 ± 0.39*
Family history of food allergy		
Yes	179 (35.5%)	1.74 ± 0.43
No	173 (34.3%)	1.71 ± 0.45
I do not know	151 (29.9%)	1.73 ± 1.31
Fully recovered from a food allergy		
Yes	45 (8.9%)	1.69± 0.47
No	459 (91.1%)	1.73± 0.44

*The comparisons were significant at $P < 0.05$

3.3. Recognition of food allergy labelling and avoidance of allergens

Participants with a food allergy showed a high level of perception regarding food allergy labelling (72.8%). Furthermore, 275 (54.5%) participants reported that they always avoided food allergens and purchased special food for their allergies. In addition, most of the participants (80.4%) were unsatisfied with allergen food labelling on restaurants' menus. They reported the difficulty to figure out food allergy labels on the menu because the menu does not contain sufficient information about the allergenic ingredients (Table 3). 85.6% of the participants were eating home-cooked meals more frequently due to the lack of allergen information provision in eating out venues can lead to unnecessary restrictions.

From Table. 3 the data illustrated that there were statistically significant ($P < 0.05$) associations between psychological effects relative to food labels use, avoiding food allergens and purchasing special food products, and satisfaction with allergen food labelling on the menu. Participants who read food labels, avoided food allergens, purchased special food products, and were unsatisfied with allergen food labelling on restaurants' menus were more likely to be psychologically affected.

The present study showed that 54.5% of participants strictly avoided food allergens. Notably, participants who avoided food allergens and purchased special food products were more likely to be psychologically affected. This rate was comparable to that reported by the Greenhawt et al. (2009) study of college students with food allergies, where 40% reported strict allergy avoidance. In the present study, 70% of the participants with food allergies, including a larger proportion of females, reported that their food allergy affected their daily routine including restricting them from attending social events. Warren et al. (2016) found that severe food allergic patients with strict avoidance of food allergens have been shown negative impact on the quality of life. Hassan et al. (2020) also reported a 25% of the students with food allergies, mostly female, reported that their food allergy restricted them from attending social events. The previous authors supported the effect of food allergy on the quality of life inducing daily routine and social life (Williams, Parra and Elkin, 2009; Burks et al., 2012; Scurlock and Jones, 2018). According to a meta-analysis study, a lack of social life has health risks physical and mentally more than obesity (Holt-Lunstad et al., 2015).

In this study, 18.3% of the participants with food allergies did not avoid food allergens, although of reading the presence of a precautionary warning on food labels. However, a study of adolescents and young adults with food allergies revealed that 42% had consumed foods containing the allergen, despite the information on food labels (Sampson et al., 2006). This may be explained by the variation of sample ages; according to the National Institute on Aging, older adults' behaviors are influenced by environmental factors, habits, noncognitive skills, and events that begin in early life (The National Institute on Aging, 2020).

Table. 3 The association of allergen food label perception and avoidance of allergens with psychological effects

Questions	N (%)	Psychological Effects Mean ± SD
Reading the food label		
Yes	367 (72.8%)	1.76 ± 0.42*
No	136 (26.9%)	1.63 ± 0.48*
Satisfaction with an allergen food label on the menu		
Yes	99 (19.6%)	1.62 ± 0.49*
No	405 (80.4%)	1.76 ± 0.43*
Avoiding food allergens/purchasing special food products		
Yes	275 (54.5%)	1.82 ± 0.37*
No	229 (45.4%)	1.60 ± 0.48*

*the comparisons were significant at $P < 0.05$

This study found that 80.4% of the participants were unsatisfied with allergen food information on restaurants' menus. They reported the difficulty to figure out food allergy information on the menu because the menu does not contain sufficient information about the allergenic ingredients. The avoidance of food allergens may not be complete exclusion because of the information lack in foods that contain small amounts of the allergen (Vlieg-Boerstra et al., 2006; Skypala et al., 2015). These findings are in disagreement with Barnett et al. (2018) who reported moderate satisfaction with the availability of allergen information when eating from restaurants in the UK, and the satisfaction was differed based on the food allergens, where those with milk allergies were the least satisfied. However, there is an agreement with Barnett et al. (2018) results regarding the need for an improvement on the allergen information. In addition, this study's participants suggested a separate allergen menu.

3.4. The psychological impact of food allergy

About 70% of the participants diagnosed with food allergy indicated that food allergy restricted them from attending social events and affected their daily routine. This restriction was reported more frequently by females (51.2%) than by males (18.1%).

Overall, 73% of the participants reported that food allergies affect the psychological aspect. Psychological symptoms resulting from a food allergy experienced by participants are presented in Figure (3). The most common symptoms include anxiety (55.6%), sadness (32.3%), stress (27.6%), isolated (22.6%), and depression (20%) as shown in Fig.3. In the 'other psychological symptoms', some participants listed fear, anger, and uncomfortable feeling, especially in children. Furthermore, 40.8% of participants have suffered from two or more psychological symptoms resulting from food allergies.

In this study, 73% of the participants reported that food allergies affected the psychological aspect. This finding correlated with those obtained by Klinnert and Robinson (2008); Ring et al. (2014) and Hidese et al. (2019) who reported that food-allergic patients experience signs of psychological distress. The present results showed that food allergy is a risk factor for psychological distress, which depends on the age, education level, frequency of visiting the hospital, using of food allergy labels, avoiding food allergens and purchasing special food products for their condition, and satisfaction of allergen food information on the menu. In addition, anxiety was the most frequently reported symptom by more than half of the participants. The previous author supported the effect of food allergy on the psychological aspect caused by anxiety (Ring et al., 2014). Moreover, the present results confirmed that food-allergic children were more likely to have anxiety, stress, social isolation and depression symptoms. Their parents or mothers also experienced the same psychological symptoms (Herbert and Dahlquist, 2008; Rouf et al., 2012; Shanahan et al., 2014; Antolín-Amérigo et al., 2016; Boyle et al., 2017; Feng and Kim, 2019).

The current study had limitations. The prevalence of food allergy was totally dependent on a self-reported questionnaire. The food allergic participants were not clinically diagnosed, which may explain our data showing a slightly higher prevalence rate than in previous studies. Further studies based on confirmatory testing of food allergy and higher response rates are needed in Saudi Arabia.

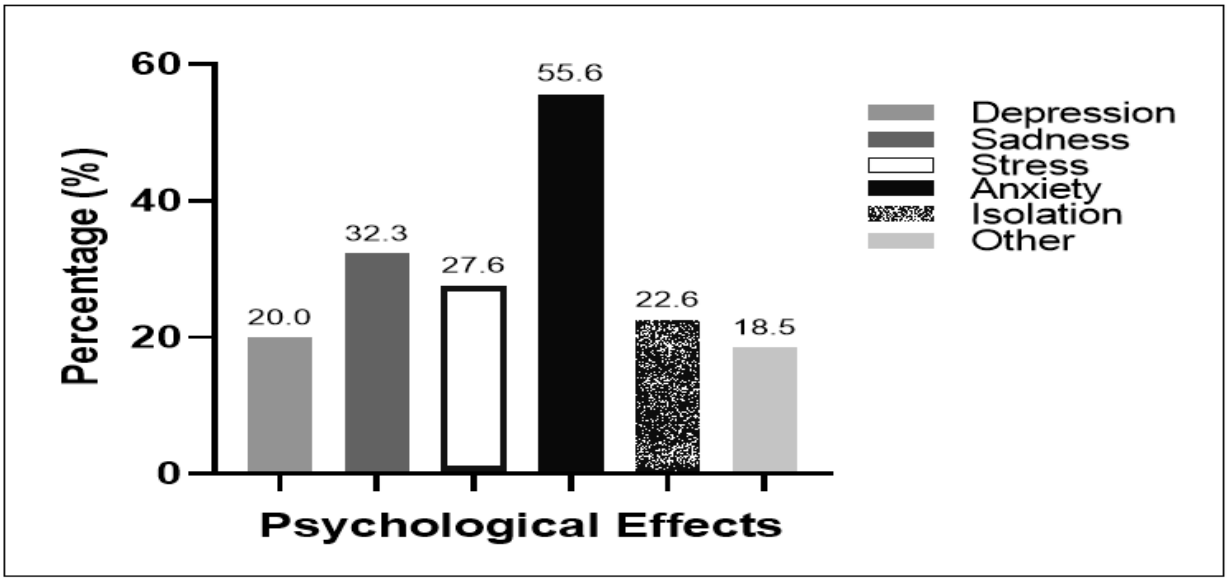

Fig. 3. The distribution of psychological effects of allergic patients

4. Conclusion

Food allergies are a serious health problem and marked variation in their prevalence in Saudi Arabia. The most common food allergens reported among participants were wheat, milk and eggs. The most common psychological symptoms were anxiety, sadness and stress. Food allergy is a risk factor for psychological distress depending on the age, education level, frequency of visiting the hospital, using of food allergy labels, avoiding food allergens by purchasing special food products, and satisfaction with allergen food labelling on the menu.

Interventional strategies are needed to mitigate the risk of allergic reactions among food-allergic patients including establishing associations for food allergy patients and their families, activating health education on food allergy in the community and facilities such as schools and baby day-care, providing 24-hour telephone access to specialists and allergy experts, and binding the food establishments to clarify the food allergenic ingredients in the lists of food such as restaurants. It seems that more studies are required to investigate the different aspects of food allergy in Saudi Arabia.

Conflict of Interest

There are no conflicts of interest.

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