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Prevalence and Associated Factors of Food Allergies among Saudi Children in Al-Madinah Al-Munawara

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Food allergy (FA) is an immune-mediated reaction to specific foods, and its prevalence is rising globally. However, population-based data from Saudi Arabia are limited. This study assessed the prevalence and risk factors of FA and the impact of the type and timing of weaning foods on FA development among Saudi children in Al-Madinah Al-Munawara, with a focus on the type and timing of weaning foods. A cross-sectional survey of 1,160 children (160 with FA and 1,000 controls) was conducted using a parent-completed online questionnaire. Among clinically confirmed FA cases (via IgE and skin prick testing), 49.3% were receiving treatment. Peanuts were the most common allergen, followed by bananas, shrimp, sesame, eggs, milk, and strawberries ($p < 0.05$). Significant risk factors included older age, male gender, low maternal education, maternal allergy history, delayed introduction of allergenic foods such as fish, and coexisting allergic condition particularly asthma and eczema ($p < 0.05$). FA is relatively common among children in Al-Madinah Al-Munawara and strongly associated with asthma, eczema, and weaning practices. These findings underscore the need for updated region-specific policies for FA prevention and management.

Keywords: Food Allergies; Prevalence; Associated risk factors Saudi Children; Al-Madinah Al-Munawara.

Food allergy is a global problem that affects both children and adults, both males and females.[1] Food allergy is increasing worldwide and has become a significant public health concern, placing a growing burden on healthcare systems.[2] Numerous studies indicate that both the prevalence of food allergies in children and the number of related emergency visits have risen in developed countries, particularly over the past decade. [3-5] Globally, food allergies affect an estimated 6%–13% of the population. [6] However, the exact prevalence of food allergy in Saudi Arabia has not yet been clearly established. [7]

The causes of food allergies in children are multifactorial and include genetic predisposition, environmental influences such as lifestyle changes and increased consumption of processed foods containing additives, and various nutritional factors. These nutritional factors encompass the use of formula milk, the timing and method of introducing complementary foods, and the types of foods consumed. [8] Although breastfeeding may help protect against food allergies, some evidence suggests it may also contribute to their development in certain cases. [9] Children up to fifteen years of age are particularly prone to developing food allergies.

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Recent studies indicate that the prevalence is considerably higher in children than in adults, and encouragingly, many childhood food allergies resolve over time. Nevertheless, some food allergies may persist into adulthood and remain lifelong. [10-11]

Food allergies involve adverse immune-mediated reactions that occur after exposure to specific foods and recur with each subsequent exposure to the same allergen. After consuming an allergenic food, a child may experience allergic reactions that can affect the skin, as well as the digestive and respiratory systems. In some cases, food allergies can trigger a severe, life-threatening reaction called anaphylaxis, characterized by airway constriction, throat swelling, and difficulty breathing. This condition requires immediate medical attention.[12] Children with asthma or drug allergies have a higher risk of developing fatal anaphylaxis compared to those without these conditions. Additionally, other allergic disorders such as allergic rhinitis and eczema are recognized risk factors for developing food allergies.[13] Poorly managed dietary substitutions in children with food allergies can result in nutrient deficiencies and reduced energy intake, leading to growth and nutritional problems such as poor weight gain, short stature, kwashiorkor, and rickets due to vitamin D deficiency. [14]

The nine most common food allergies include milk, egg, peanut, tree nut, fish, shellfish, wheat, soybean, and sesame. In the Kingdom of Saudi Arabia, the prevalence of parent-reported FA was 15.2%. Eggs are the most common food allergen, affecting 6.2% of individuals, followed by tree nuts (4.1%), peanuts (4.0%), milk (3.8%), and sesame (3.2%).[15] As with any medical condition, diagnosing a food allergy requires a comprehensive medical history, physical examination, and specific tests such as measurement of IgE antibodies and supervised oral food challenges.[16] Among these, the oral food challenge is considered the gold standard for confirming a food allergy. Identifying modifiable risk factors is essential for preventing or reducing the prevalence of food allergies.[17]

Until now, the only way to manage food allergies is to eliminate the food that causes the allergy, which puts the affected children at nutritional risk, if it is not replaced with an appropriate diet. [18] Studies on food allergies in children are still limited. To our knowledge, and based on the available literature, data on the prevalence of food allergies in Saudi Arabia are limited. Specifically, in the Al-Madinah Al-Munawara region, no published statistics currently exist regarding the proportion of children affected by food allergies. Knowing the percentage of those affected, the association with other allergic diseases and studying the associated risk predictors that cause food allergies are essential to designing appropriate interventions to improve nutritional status and general health and reduce complications associated with food allergies. Therefore, this study aimed to estimate the prevalence of food allergies and their associated risk factors, as well as to examine their relationship with other allergic conditions including bronchial asthma, allergic rhinitis, and eczema. It also sought to assess the impact of the type and timing of weaning foods on the development of food allergies among Saudi children in Al-Madinah Al-Munawara, with the goal of reducing allergy-related complications.

MATERIALS AND METHODS

Study Design and Participants

The study employed a cross-sectional descriptive observational design to assess the prevalence and predictors of food allergies among children aged 5 to 18 years in Al-Madinah Al-Munawara. Data were collected through an online questionnaire completed by parents. Caregivers of children younger than 5 or older than 18 years, non-Saudi children, respondents with incomplete data, and those not residing in the Al-Madinah Al-Munawara region were excluded from the study.

Sample Size Calculation

The target sample size for this study was estimated using Epi Info™ (version 30, CDC, Atlanta), based on a 95% confidence level and a 5% margin of error. The study focused on Saudi children aged 5 to 18 years with diagnosed food allergies, residing in Al-Madinah Al-Munawara.

Data Collection Instrument and Procedures

This observational, cross-sectional survey was conducted between December 2024 and May 2025. A total of 1,160 children aged 5 to 18 years were recruited through an online questionnaire distributed via social media platforms as WhatsApp, and Telegram in Al-Madinah Al-Munawara, Saudi

Arabia. Participants were excluded if they provided incomplete data, were non-Saudi nationals, did not reside in Al-Madinah Al-Munawara, or were older than 18 years. The questionnaire, prepared in Arabic, was reviewed by non-content experts, and its clarity and comprehensibility were evaluated by 50 randomly selected individuals; their responses were not included in the final analysis.

The Questionnaire

The data collection tool used in this study was a questionnaire consisting of several questions. The questionnaire gathered detailed information on factors associated with food allergies, beginning with demographic and social characteristics, such as the parents' marital status, education level, and employment. It also included information on the children's age, gender, weight, and height, which were plotted on a growth curve to determine whether the child was underweight or had a low height for age. The questionnaire also explored participants' medical history and allergy related information, including the duration of their condition, family history of food allergies, previous allergic reactions to food intake. It also addressed the presence of other coexisting allergic conditions, such as asthma or eczema, and assessed potential risk factors. These factors included early childhood nutrition practices, such as breastfeeding versus formula feeding, duration of breastfeeding, the timing of solid food introduction, and the types of foods introduced. Furthermore, the questionnaire focused on identifying common allergy symptoms, such as skin reactions, respiratory symptoms, gastrointestinal discomfort, and anaphylaxis, while also determining specific allergy triggers. A severe allergic reaction was defined as a parent-reported occurrence of at least two of the following symptoms: rash, swelling of the lips or tongue, difficulty swallowing, throat or chest tightness, trouble breathing, wheezing, vomiting, chest pain, rapid heartbeat, fainting, dizziness, or low blood pressure.

Additionally, it inquired about any allergy tests they had undergone, such as skin prick or serum IgE test, and whether they had experienced severe allergic reactions requiring hospitalisation. the questionnaire evaluated participants' management practices regarding food allergies, including their use of medications such as antihistamines and epinephrine auto-injectors.

Participants were categorized into two groups: Group I (control group), consisting of 1,000 children without food allergies, and Group II, comprising 160 children diagnosed with food allergies.

Ethical Considerations

The study received ethical approval from the Committee of the College of Applied Medical Sciences at Taibah University (Certificate No. 2025/216/206 CLN). Informed consent for the publication and reporting of findings was obtained, with assurances that no personally identifiable information such as names or other sensitive data would be disclosed.

Statistical Analysis

All statistical analyses were performed using SPSS for Windows, version 30.0 (Statistical Package for the Social Sciences, Armonk, NY: IBM Corp). The study included 1,160 children, with data collected through questionnaires completed by their mothers. The data were processed, tabulated, and analysed using the following methods. The Shapiro-Wilk test was applied to assess the normality of the data distribution. Descriptive statistics, including mean ± standard deviation (SD), were used to summarize demographic characteristics, the prevalence of allergenic foods, manifestations of food allergies, and factors influencing their development. Categorical data were presented as frequencies (n) and percentages (%). Chi-square tests were employed to examine associations between categorical variables, such as gender and socioeconomic status, and the presence of food allergies. Additionally, logistic regression was used to calculate odds ratios while adjusting for multiple explanatory variables. A p-value of d" 0.05 was considered statistically significant.

RESULTS

A total of 1,160 mothers who met the inclusion criteria completed the study questionnaire. Their ages ranged from 23 to 54 years, with a mean age of 34.6 ± 11.9 years. The fathers' ages ranged from 26 to 59 years, with a mean age of 37.9 ± 12.2 years. Table 1 presents a sociodemographic comparison of fathers and mothers of a control group of normal children (Group I), and children with positive food allergies (Group II).

Table 1. Comparison of parental sociodemographic characteristics and anthropometric measures between a control group of healthy children (Group I) and children with confirmed food allergies (Group II)

Parent personal data		Normal children (Control group) N=1000 (group I)		Children with Positive food allergies N=160 (group II)		Chi square	P-value
		No	(%)	No.	(%)		
Gender of children	boys	520	52.0	93	58.1	1.049	0.305
	girls	480	48.0	66	41.9		
Mothers' age	<25 Years	80	8.0	12	7.5	0.021	0.88
	>25 years	920	92.0	148	92.5		
Fathers' age	<25 years	-	-	-	-	Not computed	
	>25 years	1000	100	260	100		
Mothers' education	College	770	77.0	128	80.0	5.96	0.113
	High school	130	13.0	26	16.3		
	Middle school	20	2.0	3	1.9		
	Primary school	80	8.0	3	1.9		
Fathers' education	College	750	75.0	115	71.9	2.719	0.43
	High school	150	15.0	35	21.9		
	Middle school	60	6.0	6	3.8		
	Primary school	40	4.0	4	2.5		
Mothers' occupation	Employee	470	47.0	86	53.8	1.12	0.289
	Unemployed	530	53.0	74	46.3		
Fathers' occupation	Employee	860	86.0	145	90.6	1.328	0.249
	Unemployed	140	14.0	15	9.4		
Children height (cm)	Normal height for age	1000	100	64	40.0	1.691	0.03*
	-Low height for age	-	-	96	60.0		
Children weight (kg)	-Normal weight for age	1000	100	75	46.9	0.1113	0.04*
	-Low weight for age	-	-	85	53.1		

*P-values were calculated using the chi-square test and were significant.

As regards mothers' ages, most mothers in both groups were 23 years or older. There was no statistically significant difference in the distribution of mothers' ages between the two groups ($p = 0.88$). All fathers included in the study were aged 25 years or older, and, similar to mothers, no significant difference was observed in the distribution of fathers' ages between the groups.

Regarding maternal education, the majority of mothers in both groups held a college degree—80% in Group II and 77% in the control group (Group I). Overall, the distribution of

Table 2. Presents clinical presentations of food allergies in the sample studied of children with positive food allergies

Variables		Children with Positive food allergies (N=160) N	%	Chi square	P value
Onset of allergy symptoms	After 6 months of age	122	76.3	44.1	<0.001**
	Before 6 months of age	38	23.8		
Onset of symptoms after exposure to food allergens	After Days	5	3.1	78.53	<0.001**
	After hours	59	36.9		
	Directly	96	60.0		
Duration of symptoms	2 hours	68	42.5	3.6	0.057
	2-8 hours	92	57.5		
Child's receives antihistamine	Yes	48	30.0	25.6	<0.001**
	No	112	70.0		
Child receives epinephrine	Yes	31	19.4	60.02	<0.001**
	No	129	80.6		
Symptoms of bronchial asthma	Yes	102	63.8	13.39	<0.001**
	No	56	35.0		
Symptoms of bronchial asthma	1-Shortness of breath	36	35.3	13.84	0.003**
	2-Cough	24	23.5		
	3-Wheezes	11	10.8		
	More than two symptoms	31	30.4		
History of Skin symptoms	Yes	156	97.5	144.4	<0.001**
	No	4	2.5		
Skin symptoms	1-Redness	19	11.9	314.62	<0.001**
	2-Itching	11	6.9		
	3-Dryness	1	0.60		
	4-Skin rash	8	5.0		
	More than two symptoms	121	75.6		
Eyelid swelling	Yes	38	23.8	44.1	<0.001**
	No	122	76.3		
Mouth swelling	Yes	47	29.4	27.22	<0.001**
	No	113	70.6		
Symptoms of allergic rhinitis	Yes	83	51.9	0.018	0.137
	No	77	48.1		
History of GIT symptoms	Yes	141	88.1	93.02	<0.001**
	No	19	11.9		
GIT symptoms	Nausea	17	17	93.00	<0.001**
	Vomiting	11	11		
	Diarrhoea	4	4		
	Abdominal pain	35	35		
	Constipation	4	4		
	>two GIT symptoms	70	17		

** P-values were determined using the chi-square test and were found to be highly significant.

Table 3. Comparison between children with food allergies and control *groups* regarding their feeding practices during infancy period

Variables		Normal children (controls)		Children with Positive food allergy		Chi square	P- value
Food introduction practice		No	%	No	%		
Types of infants feeding	Breastfeeding	310	31.0	40	25.0	1.419	0.4922
	-Formula feeding	210	21.0	32	20.0		
	-Both	480	48.0	88	55.0		
Duration of breast feeding	6 months	340	34.0	49	30.6	0.956	0.6199
	One year	290	29.0	42	26.3		
	Two years	370	37.0	69	43.1		
Baby receives the colostrum.	Yes	830	83.0	133	83.1	0.357	0.979
	No	170	17.0	27	16.9		
Age onset of introducing eggs to baby	-Before 6 months	90	9.0	14	8.8	1.175	0.556
	- From 6 months 1 year	310	31.0	60	37.5		
	- After 1 year	600	60.0	86	53.8		
Age onset of introducing wheat to infants	-Before 6 months	170	17.0	22	13.8	1.358	0.501
	- From 6 months 1 year	540	54.0	98	61.3		
	- After 1 year	290	29.0	40	25.0		
Age onset of introducing peanuts to infants	-Before 6 months	40	4.0	7	4.4	0.193	0.901
	- From 6 months 1 year	150	15.0	21	13.1		
	- After 1 year	810	81.0	132	82.5		
Age onset of introducing fishes to infants	-Before 6 months	90	9.0	2	1.3	9.573	0.008**
	- From 6 months 1 year	110	11.0	24	15.0		
	- After 1 year	800	80.0	134	83.8		

**P-values were determined using the chi-square test and were highly significant.

Table 4. Distribution of children with food allergies according to the type of food allergen, expressed as a percentage of affected children

Variables	Children with food allergy (n=160) NO	%	Chi square	P value
Peanut	66	41.2	104.15	<0.05*
Strawberry	20	12.5		
Banana	38	23.7		
Mango	10	6.2		
Milk	26	16.2		
Nuts	52	32.5		
Sesame	30	18.7		
Egg	27	16.8		
Fish	16	10		
Shrimp	36	22.5		
Wheat	14	8.7		
Chocolate	16	10		

*P-values were calculated using the chi-square test and were significant.

Table 5. Multivariable logistic regression analysis of risk factors for food allergies in children

Variables	Estimate	OR	Exp(B)	95% CI lower	u p p e r	P- value
Age of children	0.22	0.17	1.24	0.44	3.50	0.037*
Gender of children	2.92	4.06	18.57	1.08	318.56	0.044*
Fathers' age	3.28	4.94	26.46	1.47	474.99	0.06
Mothers' age	1.36	0.98	3.88	0.27	56.56	0.321
Fathers' education	-3.05	3.50	0.05	0.00	1.15	0.061
Mothers' education	-3.29	4.09	0.04	0.00	0.90	0.043*
Positive history of Fathers' food allergy	-0.90	0.53	0.41	0.04	4.58	0.466
Positive history of Mothers' food allergy	0.47	2.42	1.59	0.89	2.87	0.012*
Both parents are allergic	-0.49	0.99	0.61	0.23	1.61	0.320
Family history of food allergy	-0.01	0.11	0.99	0.93	1.05	0.736
Children with bronchial asthma	0.56	3.86	1.75	1.00	3.06	0.049*
Children with Eczema	-0.77	7.18	0.46	0.27	0.81	0.007*
Children with allergic rhinitis	-0.97	3.89	0.38	0.14	0.99	0.07
Early weaning with allergens such as fish.	-0.97	4.14	0.38	0.15	0.97	0.042*
Short duration of breast feeding	-0.08	0.04	0.92	0.41	2.09	0.847
Early introduction of artificial feeding	0.19	0.43	1.21	0.68	2.17	0.514

*P-values were determined using the chi-square test and were statistically significant.

educational levels between the two groups did not differ significantly (p = 0.113). Similarly, for paternal education, a high proportion of fathers in both groups held a college degree with 71.9% in Group II and 75% in the control group. The difference in educational levels among fathers was also not statistically significant (p = 0.43).

Regarding mothers' occupations, the proportions of employed and unemployed mothers were similar across both groups, with no statistically significant difference observed (p = 0.289). Likewise, the distribution of fathers' employment status did not differ significantly between the groups (p = 0.249).

Overall, the findings suggest that children with food allergies and those in the control group were generally similar in terms of sociodemographic characteristics, including parental age, education levels, occupation, and the children's gender. The average age of children was similar between the two groups, with Group II (children with food allergies) averaging 9.21 ± 3.71 years and the control group 8.65 ± 4.18 years, showing no statistically significant difference. Gender distribution was also balanced, with no significant difference in the proportions of boys and girls between the groups ($p = 0.305$).

Regarding height, the mean value for Group II was 129.27 ± 26.92 cm, compared to 148.67 ± 24.48 cm in the control group, showing a statistically significant difference. Furthermore, a higher proportion of children in the control group had heights within the normal range compared to children with food allergies ($p = 0.03$).

In terms of weight, children in Group II had a lower mean weight of 32.73 ± 13.82 kg, while the control group averaged 42.77 ± 15.20 kg, a statistically significant difference. The proportion of children with weight appropriate for their age also differed significantly between the groups ($p = 0.04$).

Regarding symptoms onset after exposure to food allergens, the majority of children (60.0%) developed symptoms immediately after exposure, with a highly significant p-value (< 0.001).

Regarding the duration of allergy symptoms: Most children experienced symptoms lasting no more than 2 hours (70.0%). A smaller proportion had symptoms lasting 2 to 8 hours (30.0%). This difference was highly statistically significant ($p < 0.001$). Out of 160 children whose food allergies were identified based on parental observation and experience, 49.4% were medically diagnosed by a pediatrician, 30% had previously been treated with antihistamines, and 19.4% had a history of severe symptoms requiring treatment with epinephrine , indicating that a smaller proportion had experienced severe anaphylactic reactions.

A notable proportion of children (63.8%) exhibited symptoms of bronchial asthma, with a highly statistically significant p-value ($p < 0.001$), indicating a strong association between food allergies and bronchial asthma in this group. Shortness of breath was the most frequently reported specific symptom of bronchial asthma (35.3%). Cough was also common (23.8%). Wheezes were reported by a smaller percentage (10.8%). The significant p-value (0.003) highlights the varying prevalence of these respiratory symptoms.

An overwhelming majority of children had a history of skin symptoms related to their food allergies (97.5%). Only a very small percentage did not have such a history (2.5%). This difference is highly statistically significant ($p < 0.001$), suggesting a strong association between food allergies and skin manifestations. Skin symptoms: More than two distinct skin symptoms were the most common presentation, occurring in 75.6% of cases. Redness (11.9%), itching (6.9%), dryness (0.60%), and skin rash (5.0%) were also reported with varying frequencies with highly significant p-value (< 0.001).

A significant majority of children did not experience eyelid swelling (78.3%). A notable proportion did experience eyelid swelling (23.8%). This difference is highly statistically significant ($p < 0.001$). Regarding mouth swelling, the majority of children (70.6%) did not experience it, while 29.4% did. This difference was also highly statistically significant ($p < 0.001$).

Allergic rhinitis symptoms were present in approximately 52% of children with food allergies, while 48% showed no symptoms. The difference was not statistically significant ($p = 0.137$).

A large majority of children had a history of GIT symptoms related to their food allergies (88.1%). Only a small percentage did not have such a history (11.9%). This difference is highly statistically significant ($p < 0.001$), indicating a strong association between food allergies and gastrointestinal symptoms. Abdominal pain was the most frequently reported specific GIT symptom (35.0%). Nausea (11.0%), vomiting (11.0%), diarrhoea (4.0%), and constipation (4.0%) were also reported. A significant proportion experienced more than two GIT symptoms (17.0%). The highly significant p-value (< 0.001) highlights the variety of gastrointestinal manifestations of food allergy.

Finally, this table clearly demonstrates the diverse range of clinical presentations in children with positive food allergies. The majority experienced symptom onset shortly after allergen

exposure, primarily within 2 hours. A significant portion experienced respiratory (asthma), skin, eyelid, mouth, and gastrointestinal symptoms. Skin and GIT symptoms were very common in this group. The highly significant p-values for most variables indicate strong patterns and associations in how food allergies manifest in these children.

Table 3 presents food introduction practices during infancy, comparing children with food allergies to those in the non-allergic control group. The distribution of infant feeding types including breastfeeding, formula feeding, and mixed feeding was similar between the allergy and control groups, with no statistically significant differences observed ($p = 0.4922$). Similarly, there were no significant differences in breastfeeding duration (whether 6 months, one year, or two years) ($p = 0.6199$), and the majority of children in both groups received colostrum ($p = 0.979$). The timing of introducing specific allergenic foods, including eggs ($p = 0.556$), wheat ($p = 0.501$), and peanuts ($p = 0.901$), did not differ significantly between the groups. However, a highly significant difference was observed in the age at which fish was introduced ($p = 0.008$).

Table 4 shows the distribution of specific food allergens among the 160 children diagnosed with food allergies. Peanuts were the most commonly reported allergen, affecting 41.2% of the children, followed by tree nuts (32.5%), banana (23.7%), and shrimp (22.5%). Moderately prevalent allergens included sesame (18.7%), egg (16.8%), milk (16.2%), and strawberries (12.5%). Less frequently reported allergens were fish and chocolate (each 10.0%), wheat (8.7%), and mango (6.2%). The differences in the distribution of food allergens were statistically significant ($p < 0.05$).

Table 5 presents the results of a multivariable logistic regression analysis evaluating potential risk factors for food allergies in children. The table provides each predictor's estimated coefficient, odds ratio (OR), exponentiated coefficient [Exp(B)], 95% confidence interval (CI) for the OR, and the corresponding p-value. Predictor variables with p-values less than 0.05 were considered statistically significant risk factors.

The study showed several significant risk factors associated with the development of food allergies in children. Older age in children was linked to a higher likelihood of having food allergies, as indicated by a positive estimate (0.22) and an odds ratio (OR) of 1.24 ($p = 0.037$). Male children were significantly more likely to develop food allergies compared to females, with an estimated coefficient of 2.92 and an odds ratio (OR) of 18.57 ($p = 0.044$). The maternal education had a significant p-value of 0.043. The maternal history of allergies also emerged as a significant factor, with children of allergic mothers showing higher odds of food allergies (estimate = 0.47, OR = 1.59, $p = 0.012$). Similarly, children with other allergic conditions such as bronchial asthma or eczema had increased odds of developing food allergies (estimate = 0.56, OR = 1.75, $p = 0.049$). Lastly, early weaning with allergenic foods such as fish was associated with significantly lower odds of developing food allergies (estimate = -0.97, OR = 0.38, $p = 0.042$).

On the other hand, several factors, including both fathers' and mothers' ages, were not significantly associated with the risk of food allergies in children ($p = 0.061$& $p=0.321$ respectively), fathers' education ($p = 0.061$), paternal history of food allergies ($p = 0.466$), both parents being allergic ($p = 0.320$), allergic rhinitis ($p =0.07$), and family history of food allergies ($p = 0.736$) did not show significant associations. Moreover, infant feeding practices, including short duration of breastfeeding ($p = 0.847$) and early introduction of artificial feeding ($p = 0.514$), were also not significantly related to the development of food allergies in the children studied.

In summary, the multivariable analysis identified several significant risk factors associated with food allergies in children, including older child age, male gender, lower mothers' education, and positive history of maternal allergies. Interestingly, the analysis also revealed an association between food allergies and bronchial asthma, eczema in the child and late introduction of common allergenic foods such as fish.

DISCUSSION

Food allergies (FA) represent an abnormal immune response to certain foods and differ from food intolerances, although both may present with similar symptoms.[19-20] FA are the leading cause of anaphylaxis in children and contribute significantly to paediatric morbidity and mortality.[21] Research

on the prevalence of food allergies among children in Saudi Arabia is limited. Consequently, this study is the first to estimate the prevalence of food allergies and identify associated risk factors among Saudi children in Al-Madinah Al-Munawara. It also examines the relationship between food allergies and comorbid conditions such as asthma, allergic rhinitis, and eczema, as well as the impact of the type and timing of weaning foods on the development of food allergies in this population.

The study assessed the prevalence of food allergies using parent-reported data. Our findings revealed that 160 children (16%) in Al-Madinah Al-Munawara had a medically diagnosed food allergy with a documented history of antihistamine or epinephrine use. This prevalence is higher than that reported in the Eastern Region of Saudi Arabia by Al Ghadeer et al., [22] and exceeds the 11.5% reported in Al-Karak, Jordan, based on parent reports. Internationally, prevalence rates vary, ranging from 6.5% in Athens to 24.6% in Lodz, Europe [23] , and in the United States, where the prevalence among children increased from 3.9% to 18% between 1997 and 2007. [24] In Lebanon, 6% of 2,610 schoolchildren aged 3–17 years were reported to have food allergies, a figure like those recorded in the U.S. [25]

In our study, the most common allergens were peanuts (41.2%), tree nuts (32.5%), bananas (23.7%), and shrimp (22.5%). Moderately prevalent allergens included sesame (18.7%), eggs (16.8%), milk (16.2%), and strawberries (12.5%), while less common allergens were fish and chocolate (10% each), wheat (8.7%), and mango (6.2%) ($p < 0.05$). These results are consistent with U.S. studies, which report peanuts as the leading allergen. [26-28] In contrast, studies from China, Korea, and Brazil identified seafood as the most prevalent allergen, [29-32] whereas eggs were the most common allergen in Taif, Saudi Arabia, and the UAE. [33-34] Within Saudi Arabia, fish allergy is rare in central regions, highlighting the influence of local diet and environmental exposures on allergen prevalence. [35] Globally, the most common allergens vary by region: cow's milk and dairy products in Italy, followed by eggs [36] ; peanuts in the United States [37] ; and shrimp in Mexico. [38]

In our study, skin manifestations were the most common symptoms, affecting 97.5% of children ($p < 0.001$), and included redness, rash, and itching, followed by gastrointestinal symptoms (88.1%) and respiratory symptoms (63.8%). These findings align with studies from Aseer[39], Taif[40], China[28] , Europe[29], Lebanon[25] , and Kuwait[41], all of which reported skin symptoms as the most prevalent, followed by respiratory and gastrointestinal manifestations.

We also examined the relationship between food allergy prevalence and early life factors, including weaning age, type of feeding, duration of breastfeeding, and age of cow's milk introduction. No significant associations were observed, consistent with the findings of Yousef et al. [42]. However, a study from Bahrain reported that formula-fed children were at higher risk of developing food allergies. [43]

Breastfeeding, particularly early colostrum intake may offer protection against food allergies because of its antibodies and immune components that support immune and gut development. However, factors such as prolonged breastfeeding and the timing of introducing solid foods can also influence allergy risk.[44] Early introduction of allergenic foods like eggs, peanuts, and wheat has been associated with a higher risk of developing allergies[45] , whereas shorter breastfeeding duration and early formula feeding may contribute to sensitization. [46] In our study, neither feeding type nor breastfeeding duration differed significantly between children with and without food allergies ($p = 0.4922$ and $p = 0.6199$, respectively). Most children in both groups received colostrum ($p = 0.979$). Additionally, infant feeding practices such as shorter breastfeeding duration ($p = 0.847$) and early initiation of artificial feeding ($p = 0.514$) were not significantly associated with the development of food allergies in the studied population.

A study conducted in the Eastern Province (in Saudi Arabia) showed that 53.2% of children with food allergies received food from their parents between the ages of 4 and 6 months.[22] The same study found that in 60% of cases, allergic symptoms appeared immediately after ingestion, and symptoms lasted for two to eight hours in 57.5% of the children. However, our study found that allergic symptoms appeared predominantly after six months of age in 76.3% of children, compared to 23.8% before complementary food introduction with a highly significant difference ($p < 0.001$). Furthermore, 42.5% of children

developed symptoms within two hours of exposure, 57.5% within 2 to 8 hours, and 3.1% after several days. Notably, this is the first study to examine the link between immediate symptom onset and symptom duration of two to eight hours.

Our study demonstrated a significant association between the late introduction of fish and the development of food allergies in children ($p = 0.008$). This finding is consistent with Al Ghadeer et al. [22], who reported that delayed exposure to allergenic foods increases the risk of sensitization, whereas earlier introduction may promote immune tolerance.

Multivariable analysis in our study identified several significant risk factors for food allergy development. These included older child age, male gender, older paternal age, a maternal history of allergies, and the presence of other allergic conditions such as bronchial asthma, and eczema. Lower maternal education and delayed introduction of common allergenic foods particularly fish were also significant predictors. In contrast, the timing of introducing other allergenic foods, including eggs ($p = 0.556$), wheat ($p = 0.501$), and peanuts ($p = 0.901$), showed no significant association with food allergy risk.

Specifically, older children in our study were more likely to develop food allergies. This contrasts with findings from Alzahrani et al. [40], who reported a higher risk of food allergies among younger children in Saudi Arabia. These differing results may reflect variations in allergen exposure, immune system development, or population characteristics, and highlight the need for further research into age-related susceptibility. Male gender was also identified as a significant risk factor for food allergies in our study, aligning with findings reported by Akosy et al. [47] In addition, in our study, a maternal history of food allergies was significantly associated with childhood food allergies. These findings align with our results, which demonstrated a strong association between a family history of allergic disease and the risk of food allergy in children, with a notable predominance of maternal influence. The risk increased further when more than one family member was affected. However, Alzahrani et al. [40] reported that paternal history played a more significant role. Similarly, de Jong et al. [48] identified family history as a strong predictor of food allergies, suggesting possible differences in maternal and paternal genetic or environmental contributions. Evidence shows that having one family member with an allergic condition increases a child's risk of food allergy by 1.4-fold, while having two or more affected relatives raises the risk to 1.8-fold. [49] A Japanese study also found a significant positive association between parental allergic disorders and the presence of food allergies in their children.[50]

Recent research has shown a higher prevalence of food allergies in children with coexisting atopic conditions such as allergic rhinitis, asthma, eczema, and allergic conjunctivitis. [41] Children with these disorders are more likely to develop food allergies than those without atopic disease. Our findings further support this evidence, demonstrating a strong association between food allergies and comorbid allergic conditions, particularly bronchial asthma and eczema.

Our study found a statistically significant association between maternal education level and the risk of food allergies, whereas no significant association was observed between overall parental education levels and food allergy risk. This aligns with the findings of Alzahrani et al. [40] and suggests that genetic and environmental factors may play a more substantial role than parental educational attainment in the development of food allergies. Additionally, our results showed no significant association between advanced paternal or maternal age and food allergy risk, which is also consistent with the findings reported by Alzahrani et al. [40]

CONCLUSION

The findings indicate that food allergies are a common health problem in this region and underscore the growing number of affected children, emphasizing the importance of recognizing food allergies as a significant public health concern. In our study, significant risk factors associated with food allergies in children, including older child age, male gender, maternal history of allergies, and the presence of other allergic conditions as bronchial asthma, and eczema. Interestingly, the analysis also revealed an association between food allergies and early introduction of common allergenic foods. A health education program about food allergy is recommended to educate parents about food allergies and its management.

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Ethics Statement

The study received ethical approval from the Committee of the College of Applied Medical Sciences at Taibah University (Certificate No. 2025/216/206 CLN).

Informed consent statement

Informed consent for the publication and reporting of findings was obtained, with assurances that no personally identifiable information such as names or other sensitive data would be disclosed

Clinical Trial Registration

This research does not involve any clinical trials

Permission to reproduce material from other sources

Not Applicable

Author contributions

The sole author was responsible for the conceptualization, methodology, data collection, analysis, writing, and final approval of the manuscript

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