Journal of Clinical and Advanced Medicine (JCAM)

Open Access Journal

Research Article

Volume 2 (2026)

Adverse Reactions to Food in Children: Prevalence, Clinical Manifestations and Risk Factors, a Population-Based Study

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Received: 20-Dec-2025**, Accepted:** 22-Dec-2025, **Published:** 17-Jan-2026

ABSTRACT

Background: Adverse reactions to food are common events which generally occur in early childhood and usually result in stress and anxiety not only in the child, but also in babies' parents or caregivers especially because occasionally it leads to life-threatening reactions such as anaphylaxis.

Materials& Methods: A cross-sectional population-based study has performed in south of Tehran, capital of Iran in 450 less than seven years old children to determine the prevalence, clinical manifestations and risk factors of Food allergy by interviewing the mothers based on a structured questionnaire. The children attended in 5 health centers to perform health care, growth and development monitoring or vaccination have selected conveniently.

Findings: The prevalence of FA was 20% (88 cases) which included 49(56%) females and 39(44%) males. The age range of the most involved children was 24-72 months (56 cases,64%). The most frequent food causing FA included egg (16 cases, 20%), cow milk (14 cases, 16%), and tree nuts (8 cases, 9%). Dermatologic symptoms were the most frequent adverse reactions to foods (48 cases, 54%). The statistically significant risk factors for FA were child's age, history of allergy in the child, his/her mother or siblings, time of starting supplemental food or raw cow milk in the baby. Outgrowing the FA symptoms following food challenge have occurred in 19 cases (21%) and mostly has happened for egg and cow milk.

Conclusion: Though most of the findings of this study are in favor of other reports, performing large scale prospective cohort studies is highly recommended in order to obtain reliable results and confirm the findings.

Keywords: Adverse reaction; Food; Allergy; Prevalence; Child; Risk factors

INTRODUCTION

An adverse reaction to food or Food Allergy (FA) is defined as an abnormal response has happened following ingestion of food. It is usually classified in two categories: IgE-mediated in which the adverse reactions occur immediately and non-IgE-mediated in which the clinical presentations are delayed [1-4]. FA mostly happen in young children and is a multisystem disorder. Its presentation may result in skin, respiratory, and/or gastrointestinal symptoms or even severe reactions such as anaphylaxis. The disorder usually affects the quality of life in the child and his/her parents or caregivers, because, it usually leads to stress and anxiety in them [1,5-8]. The diagnosis of FA is primarily based on personal and family history, physical examination and impact of elimination diet. Because the prevalence of FA in Iranian children is not known yet, this study has designed to determine the

prevalence, clinical manifestations and risk factors of food allergy among them and compared our results to other studies' findings.

MATERIALS AND METHODS

This cross-sectional study has performed in less than 7- year- old children in south of Tehran, capital of Iran. This area includes low and middle economic classes of population with almost 2.5 million people. First of all, 5 health centers in this area have randomly selected from 33 health centers. Then, 90 under 7- year- old children attended for health care's, growth and development monitoring or vaccination have selected conveniently from each center. A questionnaire has designed for data collection of each child and contained the following child's characteristics: age, sex, dominant milk consumed in the first 6 months of baby's life, the month of starting supplemental food, presence of a pet or a smoker person at the home, the maternal age, history of allergy in the child, his/her parents or siblings, and the egg or raw cow milk consuming in the first 6 months of baby's life. Each of the cases' mothers has undergone an interview by trained personnel for completing the questionnaire. Furthermore, in the cases with FA, more questions included such as the age of the first onset of adverse reactions to food, the clinical manifestations of FA in the baby such as respiratory symptoms (including coughing, wheezing, dyspnea, coryza), allergic conjunctivitis, angioedema, gastrointestinal symptoms(including nausea, vomiting, diarrhea, abdominal pain or dysentery), dermatologic symptoms(including rash, itching, urticaria) or generalized reactions (including hypotension, faint, headache, anaphylaxis) and the type of the responsible food. Also, the time has taken for appearing symptoms after the food consuming, type of reaction to withdrawing or challenging the responsible food as well as the age of outgrowing the symptoms following challenging the responsible food has asked the mothers.

RESULTS

In this cross-sectional study, 450 less than 7- year-old children included. They contained 253 females (55%) and 197(45%) males. The prevalence of FA was 19.6% (88 cases) which included 49(56%) females and 39(44%) males. The age range of the involved children was as following: 0-6 months old: 2 cases (2%), 7-23 months: 30 cases (34%), 24-72 months: 56 cases (64%). The most frequent food causing FA included egg (16 cases, 20%), cow milk (14 cases,16%), tree nuts (8 cases, 9%), shrimp (5 cases, 6%), peanut (4 cases, 4.5%), and others (13 cases, 14%) (Table 1).

Table 1: The frequency and percent of the foods causing FA in the studied children.

Food Item	Number	Percent (%)
Egg	16	20
Cow milk	14	16
Tree nuts	8	10
Shrimp	5	6
Peanut	4	4.5
Honey	3	3.3
Soya	3	3.3
Additives	3	3.3
Fish	2	2
Wheat	1	1
Cinnamon	1	1
Tomato	6	7
Kiwi	2	2
Lemon (Limon)	2	2
Orange	3	3.3
Banana	3	3.3
Watermelon	1	1
Eggplant	1	1
Beans	1	1
Kiwi & Tomato	2	2

Kiwi & Melon	2	2
Kiwi & Orange	1	1
Kiwi & Egg	1	1
Kiwi & Eggplant	2	2
Eggplant & Tomato	1	1

25 cases (29.5%) had shown reactions to vegetables or fruits mostly to tomato or Kiwi (Table 1) of 88 cases, 79 cases (90%) and 9 cases (10%) have shown FA to one food or two foods respectively (Table 1). The most frequent clinical manifestations were urticaria (15, 17%), skin rash (12, 13.6%), skin rash and itching (12, 13.6%), itching alone (9, 10.2%), respiratory symptoms (19, 21.5%), angioedema (3, 3.4%), and gastrointestinal symptoms (18, 21.3%).

The mean age of the cases for FA onset was 12.67 months. In detail, the age of FA onset was less than 6 months of age in 6 cases (7%), between 6 months to 12 months of age in 47 cases (53%) and after 12 months of age in 35 cases (40%). The time has taken for appearing FA symptoms in the cases was immediately, less than 1 hour, 1-2 hours or more than 2 hours after consuming the food which contained 5 cases (5.5%), 26 cases (29.5%), 44 cases (50%) and 13 cases (14.5%) respectively. There was significant statistical relation between FA in the cases and cases' age, the time of starting supplemental food or raw cow milk, positive history of FA in the child, his/her mother or siblings, and maternal age (Table 2). No significant statistical relation was found between FA in the case and case's sex, type of milk consuming in less than 6 months of age, positive history of FA in the case's father, Egg consuming in first 6 months of the life, and existence of a smoker or pet at home (Table 2). In 83 cases (95%), the occurrence of symptoms have withdrawn following the food elimination and, in the others, (5 cases, 5%) haven't. The mean age of outgrowing the symptoms following challenging the food were 28.5 months. In 19 cases (21.5%), the responsible food never has used again. In 11 cases (12.5%) and 8 cases (9%), the age of outgrowing the symptoms following the food challenging was 1-2 year or more than 2 years respectively. The most common foods have shown outgrowing were cow milk (9, 46%) and egg (5, 26%). Furthermore, in 50 cases (56.5%) appearing of FA symptoms still have persisted. Generally, the minimum and maximum ages for resolution of the symptoms of FA were 12 months and 67 months respectively.

Table 2: The frequency, percent and p value of the cases' characteristics by food allergy.

Case Characteristics	Category	Number	Percent (%)	P value
Sex	Male	39	44	No significant
	Female	49	56	
Age	< 7 months	2	2	< 0.001
	7-24 months	30	34	
	25-72 months	56	64	
Type of milk consumed in under 6 months	Breast milk	59	67	No significant
	Mixed	29	33	
Time of starting supplemental food	< 7 months	51	58	< 0.001
	≥ 7 months	37	42	
History of allergy in the case	Yes	39	44	< 0.001
	No	49	56	
Pet at home	Yes	25	28	No significant
	No	63	72	
Smoker at home	Yes	40	45	No significant
	No	48	55	
History of allergy in the father	Yes	23	26	No significant
	No	65	74	

	Yes	39	44	
History of allergy in the mother	No	49	56	< 0.001
	Yes	40	45	
History of allergy in siblings	No	48	55	< 0.001
Egg consumption in first 6 months of life	Yes	17	40	
	No	71	60	No significant
	< 6 months	6	7	
Time of starting raw cow milk	≥ 6 months	82	93	< 0.001
	< 20 years	5	5	
	20–35 years	80	92	
Maternal age	> 35 years	3	3	< 0.01

DISCUSSION

In this case series, the prevalence of FA in less than 7- year- old children was almost 20%, like reports from Carpathians and Ukraine, however, much higher than the figures in west countries or China and less than the results in Brazil [9-15]. This difference might be due to data collecting methods, as well as population genetics or geographical location. Besides, the food diversity and nutritional habits in different cultures are other possible explanations for this disparity. Moreover, in this study no laboratory test for confirmation of FA could be performed because of the resource restrictions. Apposite to the results of other studies, we found that FA is more frequent in the females, though the relation between FA and sex was not statistically significant; of course, the number of females in our study was more than males because of our sampling method which was convenient [14,16,17]. Overall, in this study, similar to other reports, the FA has mostly appeared in the children up to 3 years old (mean:12.67 months), as until this age almost all of the children consumed most of the known foods or foodstuffs [9,15,18-20] (Table 3).

Table 3: The distribution of mean, median, Standard Deviation (SD), range, minimum, and maximum of the numerical variables in the study.

Variable	Mean	Median	SD	Range	Minimum	Maximum
Child age (months)	27.34	21.5	20.75	79	1	80
Maternal age (years)	27.61	27	4.46	24	18	42
Time of starting supplemental food (months)	4.76	5	1.98	7	3	10
Time of starting raw cow milk (months)	8.47	8	1.68	13	1	14
Age of food allergy onset (months)	12.67	12	6.4	35	1	36
Time of FA onset after food consumption (hours)	1.32	1	1.03	4	0	4
Age of food allergy outgrowing (years)	28.68	24	14.13	55	12	67

Egg, cow milk, tree nuts and peanuts were the most common foods have resulted to FA, like the other studies, however, fish, shrimp, shellfish, crustacean or other types of sea foods was not reported often as the causative food in our study, because they are not consumed frequently by our people, especially during childhood [5,7,9,10,14,15]. Despite fruits and vegetables caused more than ¼ of our FA, these types of foods have not mentioned frequently as the etiology of FA in other reports; the possible causes of this condition might be the transient nature and frequent occurrence of FA to these types of food as well as scarce usage of them in early childhood [14,18-24]. As expected, dermatologic reactions such as rash and/or itching have occurred mostly in the cases with FA (50%), followed by respiratory (21%) or gastrointestinal symptoms (21%), in favor of the results of other articles [18,25,26].

As expected, positive history of allergy in the child or his/her family members such as his/her mother or siblings has been associated with higher risk of FA, therefore, it sounds that a genetic predisposition or hereditary factor play a role in occurrence of FA

[14,22,27]. In this study, like a couple of other studies, exclusive breastfeeding, or early introduction of complementary foods was not a preventive strategy to decrease the risk of developing FA [7,22]. Besides, starting egg or raw cow milk in less than 6 months of age, might have a protective role in onset of FA, similar to the results of other studies, however, it sounds these relations need to be confirmed by large scale perspective cohort studies among children, as the results of the reports from different parts of the world are controversial [6,7,28,29]. Although, other studies have shown a protective role for pet exposure at home with regard to FA, this relation has not found in this study [14, 30-32]. Of course, the kind of pet, duration of spending time with pet by the baby and location of the pet at home (indoor or outdoor) haven't assessed in this study. Existence of a smoker at babies' home in contrary of the other reports hasn't increased the risk of FA in our babies, though, the relation between FA and existence of smoker hasn't found statistically significant [33-36]. According to the cases' mothers report, egg and cow milk (14-77%) were the most common foods which have shown outgrowing following the food challenging similar to other studies; nevertheless, with regard to a few number of these cases, this finding should be interpreted with caution, as 50 cases have still shown the adverse reactions to food challenge and in 19 cases the responsible food has never been consumed again [7,9,14,24]. Moreover, outgrowing the FA symptoms following food challenge in this study have occurred in 19 cases (21%); this result has been dependent on the mothers' recall and require to obtain more accurate data bases on prospective studies, because some studies have reported outgrowing the FA to these foods in early school age or even adolescence [14,24].

CONCLUSION

It sounds that the prevalence of FA in less than 7 years old Iranians might be an overestimate. One of the pitfalls in cross-sectional retrospective population-based studies which are performed by interviewing is recall bias. Therefore, though lots of our findings regarding clinical manifestations, etiology and risk factors of FA are in consistence of the results of other studies, designing and directing prospective cohort studies is highly recommended in order to gather accurate and more reliable data due to FA incidence, symptoms and risk factors in children.

DECLARATION

Conflicts of interest

The author declares no conflict of interest.

Funding

No financial support was received for this specific work.

Authors' contribution

The author solely contributed to the conception, design, analysis, and writing of this manuscript and approved the final version for publication.

Ethical approval

This article does not contain any studies with human participants or animals performed by the author. Ethical approval was not required for this study.

Patient consent for publication

Written informed consent for publication of the babies, without any potential identifying information, was provided by the parents of the cases.

Data availability

Not applicable.

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DOI: *To be assigned.*

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