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Prevalence of Food Allergy among Children with Bronchial Asthma

Amal Hassan Atta[1], Rabab Abdelhamid Elbehady[2], Asmaa Fathi Elshobaky[3], Reham Mohamed Elshabrawy[4].

[1]Medical Microbiology and Immunology, Faculty of Medicine, Zagazig University, Zagazig, Egypt.
[2] Pediatrics, Faculty of Medicine, Zagazig University, Zagazig, Egypt.
[3]Medical Microbiology and Immunology, Faculty of Medicine, Zagazig University, Zagazig, Egypt.
[4]Medical Microbiology and Immunology, Faculty of Medicine, Zagazig University, Zagazig, Egypt.
Corresponding author: Asmaa Fathi Elshobaky
Demonstrator of Medical Microbiology and Immunology, Faculty of Medicine, Zagazig University, Zagazig, Egypt
Email: asmaaelshobaky497@gmail.com

Abstract

Background: Asthma and food allergy are closely related. They can share the same risk factors, such as the family history of allergy, atopic eczema, and allergen sensitization. Asthmatic children with food allergy have an increased risk for severe asthma, especially during anaphylaxis. The prevalence of both conditions has been increasing over recent decades. Patients with food allergy should be educated to eliminate food to which they are allergic. The avoidance of allergic food is the cornerstone of the treatment of IgE mediated food allergy.

Methods: This study included 113 asthmatic children attending to the pediatric outpatient clinic. For each patient, assessment of asthma severity, quality of life questionnaire and serum specific IgE of food allergen were measured when indicated.

Results: The prevalence of food allergy among asthmatic children included in this study was about 38.9%. Children who suffer from both bronchial asthma and food allergy had more severe asthma and poorer quality of life when compared with asthmatic children who have no evidence of food allergy.

Conclusion: food allergy is a common coincidence with asthma in the pediatric population**.**

Keywords: Prevalence; Food allergy; Bronchial asthma**.**

I. Introduction

Asthma affects patient's quality of life. Some people may need to miss school or work because they have asthma. Others may need to care for a family member with the condition. In addition, asthma may prevent some people from participating in certain activities, especially sports [(1)]**.**

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When asthma and food allergy coexist, they adversely influence the course of each other. Asthma attacks can be elicited by food allergens in sensitized children [2]**.** Primary food sensitization may occur through the intestinal route because of the immaturity of the intestinal barrier and the immune system in infants [3,4]**.**

Both bronchial asthma and food allergy show an increase in prevalence worldwide, this makes the management of children with food allergy and asthma a growing concern[5]**.** Population studies have shown that an early food sensitization or food allergy in the first year of life may precede the development of asthma [6,7]**.**

Under-diagnosis of food allergy in children with bronchial asthma, increases the severity of asthma and renders the condition difficult to control [8]. The aim of this was to detect the prevalence of food allergy among asthmatic children in Zagazig University Hospital and to detect the effect of food allergy on the severity of bronchial asthma.

II. Patients and Methods

Study design and subjects:

This randomized controlled trial included 113 asthmatic children admitted to the pediatric clinic. The study was held in Allergy and Immunology Unit, Medical Microbiology and Immunology Department, Faculty of Medicine, Zagazig University from June 2019 to September 2020. Written informed consent was taken from patients**.** IRB approval number was 5390. Inclusion criteria include Patients aged from 4 to 18 years.

Exclusion criteria include Parent's refusal of consent, Children less than two years, Children who had received immunosuppressants, antibiotics, systemic corticosteroids within 4weeks, Children who had immunodeficiency disease, Children who used probiotic preparations within 4 weeks, Children suffered from broncho-pulmonary disorders, infectious diseases, Non-cooperative patients and Patients received immunotherapy before the start of the study.

Diagnosis of asthma: Patients who suffered from bronchial asthma were diagnosed according to the GINA guidelines [9]**.**

The selected patients were subjected to Full detailed allergy history, Asthma severity assessment, Standardized Pediatric Asthma quality of life questionnaire (PAQLQ) and Specific IgE level measurement.

Asthma severity grading: We classified patients into intermittent, mild persistent, moderate persistent, severe persistent according to symptoms, nighttime awakening, drugs used, interfering with normal activity, lung function [10]**.**

Diagnosis of food allergy: Through history, taking was essential to suspect food allergy and determine further steps.

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Specific IgE for food allergens: Specific IgE assay for food allergen (AllergyScreen / AlleisaScreen Spec. IgE) made in Germany. Immunoblot assay for the quantitative determination of specific IgE in human serum.

Food elimination: The patient who were known to be allergic to a certain type of food by history or positive specific IgE, were instructed to eliminate this food for 2-4 weeks from their diet after this period food was reintroduced again under medical supervision [(11)].

Oral food challenge test (OFC): OFC test was done for sensitized children to confirm the diagnosis of food allergy [(12)] . We started with a small amount of the food (half spoonful) and after a period of time, usually 15-30 minutes, if no symptoms were present a slightly larger amount was eaten (doubling). Before each subsequent dose, careful evaluation was performed and monitoring of vital signs to look for any symptoms.

Statistical Analysis:

Data collected throughout history, basic clinical examination, laboratory investigations and outcome measures coded, entered and analyzed using Microsoft Excel software. Data were then imported into Statistical Package for the Social Sciences (SPSS version 22.0) (Statistical Package for the Social Sciences) software for analysis. According to the type of data qualitative represented as number and percentage, quantitative continues group represent by mean ± SD, the following tests were used to test differences for significance; Differences between frequencies (qualitative variables) and percentages in groups were compared by Chi-square test.

III. Results

- **Prevalence of children suffer from food allergy among asthmatic children:**

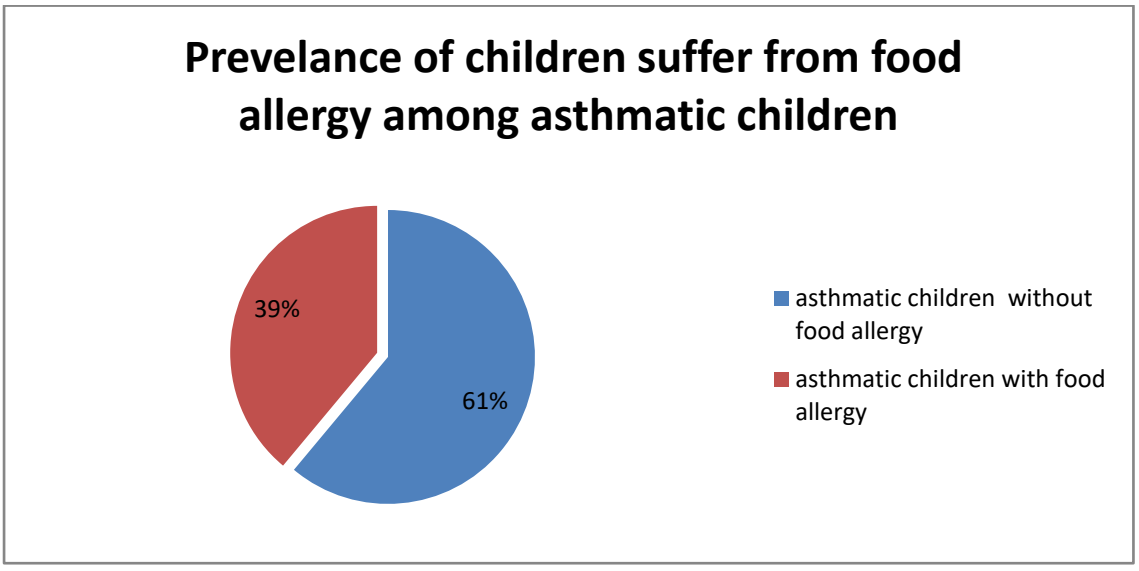

Figure (1): Prevalence of children suffer from food allergy among asthmatic children

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Figure (2): Gender distribution between group I (Asthmatic children without food allergy and group II (Asthmatic children with food allergy):

There were no statistical significance differences between the studied patients as regard gender distribution

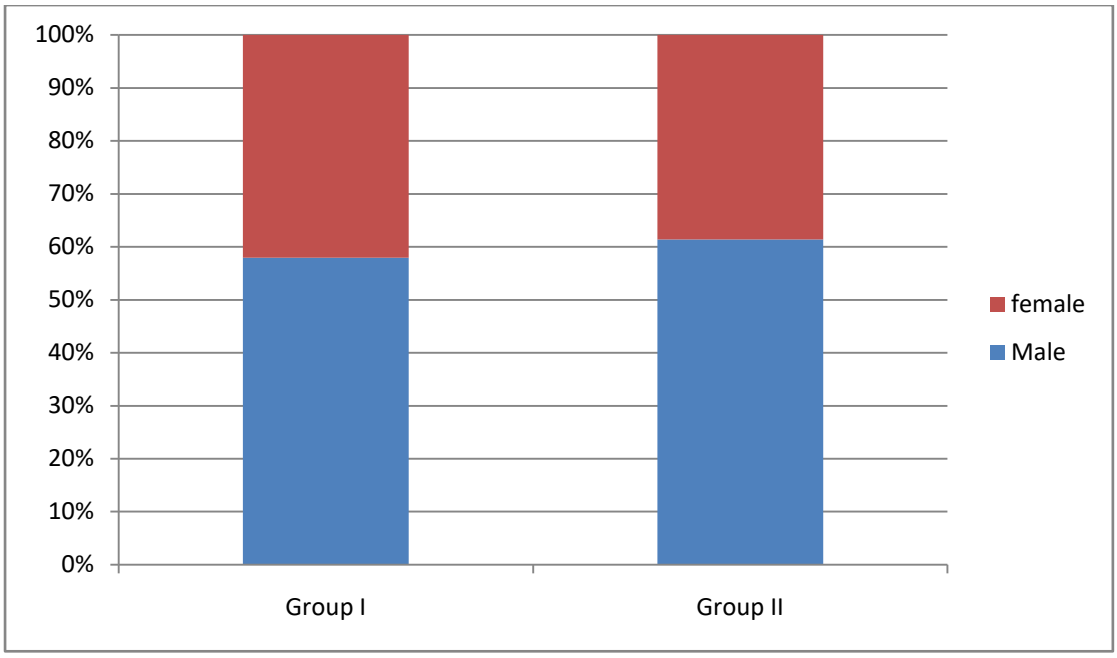

Table (1): Gender distribution of the studied groups.

Variable	Group I		Group II		χ^2	P
Sex	**N**	**%**	**N**	**%**		
Male	**40**	**57.97%**	**27**	**61.36%**	**0.152**	**0.87 NS**
Female	**29**	**42.02%**	**17**	**38.63%**		

χ^2: Chai square test. NS: Non significant (P>0.05)

Table (2): Grading of asthma severity between group I (Asthmatic children without food allergy and group II (Asthmatic children with food allergy):

There was statistical significance increase in grading of asthma severity in group II.

Variable	Group I		Group II		χ^2	P
Grade:	**N**	**%**	**N**	**%**		

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Mild persistent	**20**	**28.98%**	**2**	**4.45%**		
Moderate persistent	**31**	**44.92%**	**7**	**15.9%**	**29.87**	**0.034 ***
Severe persistent	**18**	**26.08%**	**35**	**79.54%**		

χ^2: Chai square test. *: Significant (P<0.05)

Figure (3): Sensitization of food allergen among children

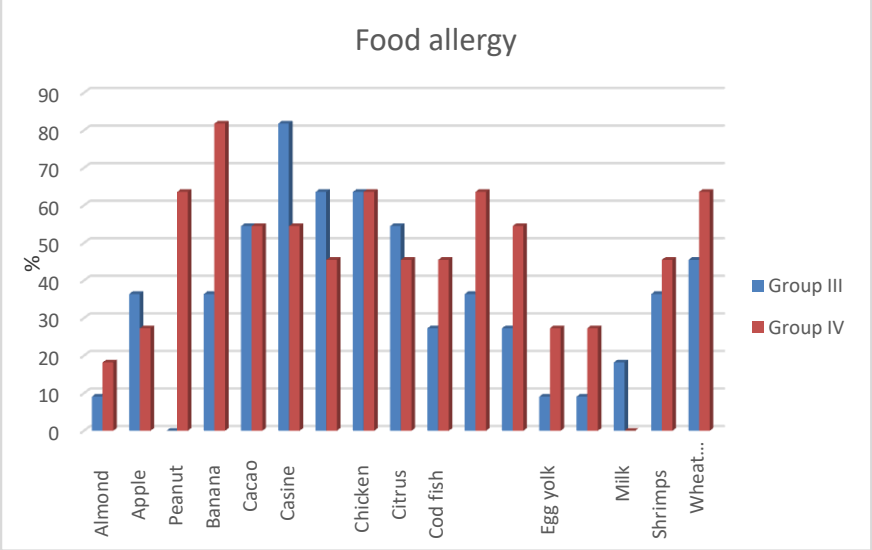

Figure (3): Food allergen among the studied groups.

IV. Discussion

The relationship between food allergy and asthma is a growing concern. They can share the same risk factors and they often coincide in the same child [13].

In this study; out of 113 asthmatic children, 44 children had food allergy so the prevalence of food allergy in asthmatic children was about 38.9% **(Figure 1)**.

This study was consistent with other studies as ***Roberts and lack,*** [14] reported that 48% of asthmatic patients had food allergy. Other studies had found that 34% to 78% of asthmatic patients reported food-related symptoms [15, 16, 17]. Also, ***Aba-Alkhail and El-Gamal,*** [18] reported that the prevalence of clinical sensitivity to food was 29%**.**

El Shabrawy et al., [19] found that around one third (30.5%) of the 1373 allergic patient included in the study was found to be sensitized to one or more food allergen.

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Moreover, food sensitization was commonly informed in allergic patients in several studies. in a study done in Islamabad (Pakistan), out of 689 patients suffering from allergic diseases, sensitization to food allergens was found in 270 (39.2%) [20]. Other studies reported 32–35% and 41.7 % sensitization to various food allergens in allergic patients from India [21] and Hungary [22] respectively, the results from different studies in different parts of the world are comparable to our findings, reflecting the significant role that food allergens might play in allergic disorders.

The prevalence of food allergy and food allergy sensitization might be also affected by other factors, including society (increased in Black and Asian children compared with White children), the composition of the microbiome, obesity and the timing and route of first exposure to foods. Additionally, differences in genes, feeding habits including vitamin D insufficiency, reduced consumption of omega-3 and antioxidants, and increased use of antacids have been related to variability in prevalence [23]**.**

On the other hand, ***Krogulska et al.,*** [24] reported that IgE-related food allergy was present in 9.8% of children with asthma. The lower prevalence may be due to differences in food habits, genes and environmental conditions.

As regard comparing gender distribution between the two groups, there was no statistically significant difference between them, but Asthma was more prevalent in boys than girls in each group **(Table 1).**

Zedan et al., [25] found the prevalence in boys was higher than that in girls, although others reported that boys were more likely to wheeze or have asthma [26]**.**

There is a controversy about sex and asthma prevalence. It has been reported that asthma occurs more common in boys during childhood with a male-to-female ratio of 2:1 until puberty when the male-to-female ratio becomes 1:1 and symptoms are more likely to decrease in boys by adolescence [27]**.** The exact reason for male predominance is unknown but it may be related to a greater degree of bronchial liability in males. Airways in boys are also smaller in comparison to their lung sizes when compared to girls. Also, it was hypothesized that boys have a more severe airway hyper-responsiveness than girls [28]**.** Higher exposure of males to outdoor allergens may partially explain this finding as most of them tend to spend most of their time outside the home.

On the other side, ***Chereches-Panta et al.,*** [29] informed that wheeze and asthma were higher in girls than boys. This could be attributed to other risk factors for allergies that may have an association with sex and lead to an increase in allergies in girls because girls are more susceptible to the effects of air pollution than boys [30]. In addition, the age of puberty plays a big role in the development of asthma and allergies [31]**.** Oestrogens are pro-inflammatory and can increase the immune response to allergens while male testosterone hormones have an anti-inflammatory effect [32]**.**

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When comparing asthma severity between patients, there was a statistical significance increase in severity grading in group II which include asthmatic children with food allergy **(Table 2)**.

Severe asthma has a great impact on the quality of life (QOL) of patients and their families. QOL is defined as the perception that individuals have of their position in life, in the context of the culture and system of values in which they live and in relation to their objectives, expectations, standards and concerns [(33)].

There is evidence that suggests that exposure to food allergens can be a risk factor for life-threatening asthma. In a study of children with peanut allergy, 9% (4/46) of the children died from an exacerbation of asthma that represents a significantly higher fatality rate for an asthmatic population [(34)].

Roberts et al., [(35)] compared children aged 1–16 years with life-threatening asthma (defined as requiring admission to pediatric intensive care) to those without non-life-threatening asthma and showed that life-threatening asthma was significantly associated with having food allergy and having multiple previous admissions for asthma.

Ernst et al., [(36)]conducted a study in patients aged 5–54 years and 129 of the patients had "fatal" asthma. The main finding in this study was that over 10 prescriptions or more of bronchodilators was associated with an increased risk of near-fatal asthma, but they also found that food allergy was an independent risk factor for near-fatal asthma. Similarly, a case–control study showed that patients with near-fatal asthma (defined as requiring ventilation on intensive care unit) were more likely to be food allergic and/or have had anaphylaxis [(37)]. ***Vogel et al.,*** [(38)] compared children who had ward-based care or ambulatory care (i.e., no hospitalization required) with children with potentially fatal asthma (requiring pediatric intensive care admission) and also found food allergy to be a risk factor for life-threatening asthma.

This may be because the specific-IgE antigens bind to mast cells and basophils causing an inflammatory response within the airways, which over time can cause airway modeling. The host immune response to allergens activates an inflammatory process causing allergic cytokines to be released and a subsequent rise in IgE levels, which have been shown to be associated with an increased risk of asthma [(39)]**.**

As regard measurement of specific IgE level , the commonest food allergens were casine (15 children), chicken (14 children), banana (13 children), strawberry (12 children) and the less common food allergens were milk (2 children) and almond (3 children). All included children had multiple food-allergens **(Figure 3)**.

El Shabrawy et al., [(19)] showed that the most common allergen to which the adult patients were sensitized were Jalapeno Pepper 123 (36%), Egg 122 (35.7%) followed

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by Tomato 120 (35.1%), Peanut 11(32.2%), and fish 109 (31.9%). The least common were lentils 26 (7.6 %) and crab 20 (5.8 %). Among children, peanut 31(39.7%) was the most common sensitizing food allergen, followed by fish 29 (37%), egg 18 (23%), and strawberry 17 (21.79%).

In 2012, a survey by World Allergy Organization (WAO) was performed to collect information on the global patterns and prevalence of food allergy in children. Results have shown that in children less than 5 years, allergens generally including cow's milk, egg, peanuts and seafood, with regional variations in the relative frequency. However, in older children (>5 years), peanuts, tree nuts, seafood, egg and milk tend to be common in most regions. It was noted that these studies were based on clinical experience and symptoms [(40)].

In a study on Egyptian asthmatic children, the most common incriminated sensitizing food allergen were fish, milk, egg, and wheat [(41)]. Another study by ***Hossny et al.,*** [(42)] concerning peanut allergy in Egyptian children with asthma, reported that 7% of their studied patients were sensitized to peanuts. Across the gulf countries, allergies to fish, shellfish, eggs, cow's milk, fruit, vegetables, peanuts and tree nuts were found to be associated with allergic manifestations. In Morocco, eggs, peanuts, wheat flour34 and Fish (2.5%) were mostly incriminated [(43)].

Liu et al., [(44)] reported that the risk for being sensitized to milk, egg, peanut, shrimp, or multiple foods is higher in asthmatic patients. ***Krogulska et al.,*** [(45)] revealed that the foods most commonly associated with patient complaints were chocolate, cow's milk, citrus fruit, hen's egg, and strawberries. ***Calamelli et al.,*** [(46)] reported that the most frequent food allergens were wheat and peanuts, while ***Patelis et al.,*** [(47)] reported that they were citus fruit and hazelnuts.Meanwhile, ***Mou et al.,*** [(48)] said that the most common food allergens were fish, shrimp and peanut allergy in asthmatic and non-asthmatic groups, with no significant difference between both groups.

Different results can be attributed to several factors including age factor, eating habits, different panel of food allergens tested, the use of different forms of extracts with wide variety of preparations, variations in the equipment used in SPT/PPT, and sIgE test kits used in the study.

V. Conclusion

According to this study, we conclude that; food allergy is a common coincidence with asthma in the pediatric population. Food allergy with asthma affects the quality of life and increases the severity of asthma.

Declaration of interest: The authors report no conflicts of interest.

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