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Original Article

An exploratory public health investigation of the correlation between food allergies and pediatric obesity

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Abstract

Aim: The study compared Skin Prick Test results in different age groups and different Body Mass Index categories, in order to investigate a possible association between allergies and pediatric obesity.

Materials and Methods: Forty-four 4-16 year-old children, who were referred to Istanbul Kagithane State Hospital with allergies and at least one positive test result, were retrospectively evaluated in cross-sectional analysis of ecological design.

Results: Children with walnut allergies had a higher Body Mass Index mean value. Twenty-eight children with walnut allergies had a BMI mean of 25.96 and sixteen children without walnut allergies had a BMI mean of 21.97. It has been suggested that Skin Prick Test is an easy method to apply in identifying allergies. The study revealed a significant difference for BMIs only in cases with walnut allergies. Mean ages of children with chicken, cocoa, white flour allergies were high. Mean age of children with chicken meat, white flour, cocoa allergies differed significantly.

Conclusion: Current research suggests that careful consideration should be given to nutritional awareness and the adoption of informed dietary practices in childhood.

Keywords: Allergy; BMI; children; teenager; public health

INTRODUCTION

The incidence of allergic diseases is steadily increasing in children. Genetic determinants and environmental influences pose critical causal and contributing factors. Studies show that genetic factors set the scene for allergic diseases, to be further influenced by maternal-fetal environmental exposures during pregnancy. Asthma, allergic rhinitis, atopic dermatitis, food and drug allergies are clinically common allergic diseases. In childhood and in adolescence, allergic diseases impact almost 50% of all clinical conditions (1-3).

Allergic diseases are diagnosed with history-taking, physical examination, skin tests and allergen-specific immunoglobulin E (IgE) blood measures. The Skin Prick Test (SPT) is simple, inexpensive, easy to apply, and acceptably precise. It is a type 1 allergic sensitivity test, used to determine the type of allergic sensitivity. Positive skin test results of clinical relevance contribute substantially to the diagnosis and treatment of allergic diseases (1,4-6).

Allergies and obesity are major public health concerns globally. The rapid increase among children within the last century is a continuing trend worldwide. We approached the issue from a different perspective to investigate a possible association between allergies and obesity, and thus, determined the allergy prevalence according to age and Body Mass Index (BMI) in children who presented to Kagithane State Hospital for allergic diseases.

MATERIALS and METHODS

A 4-16 year-old paediatric patient population of Istanbul Kagithane State Hospital were included in the study, between years 2014 and 2015. Children with at least one allergic sensitization by SPT were studied in the retrospective analysis of ecological design. The Clinical Research Ethics Committee at Biruni University officially approved the study on 26 February 2, 2018, before data collection was initiated. The association between allergies and childhood obesity was explored.

A wheal diameter ≥3mm was considered a positive response for SPT. Sixteen parameters were tested. Allergen extracts used were: 1- histamine (positive control), 2- serum physiological (negative control), 3- plant extract, 4- fungal mold (house dust), 5- fungal mold, 6- mold, 7- storage mites, 8- grass, 9- cockroach, 10- walnut, 11-

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chicken meat, 12- apple, 13- white flour, 14- strawberry, 15- tomato, 16- cocoa.

WHO Child Growth Standards BMI-for-age cutoffs were used for classification. The 5th-85th percentile (PCTL) was considered healthy weight, <5th PCTL underweight, 85th-95th PCTL overweight, and ≥95th PCTL obese (7).

Data were analyzed using STATA Version 14.1. Means, standard deviations, frequencies, and percentages were calculated. For categorical variables, Chi-square and Fisher's exact tests were used to compare frequencies between groups. Pearson Chi-square and Fisher exact Chi-square tests were used to compare descriptive statistics, frequency and percentages, as well as qualitative data interpretation. The groups were tested by the Shapiro-Wilk test to determine if the groups to be compared were normally distributed. All groups met the normality assumption at 0.05 ($p>0.05$). Thus, the difference between two groups was tested by two independent sample t-tests independent of the parametric tests. The variances of the groups were compared with the f-test. The level of significance was assessed at $p<0.05$.

RESULTS

A total of 44 cases, consisting of 23 boys (52.3%) and 21 girls (47.7%) were included in the study. The mean age of the cases was 9.63±3.39. Mean BMI was 24.51±5.69. Fourteen cases were of healthy weight (31.8%) and 30 were obese (68.2%). Fourteen children were ≤11 years-old (31.8%) and 30 were >11 years-old adolescents (68.2%) (Table 1).

Table 1. Distribution of descriptive properties

	n	%
Weight		
Within normal range (The 5th-85th percentile)	14	31.8
Obese (≥95th obese)	30	68.2
Age		
Child (≥11 years-old)	30	68.2
Adolescent (<11 years-old)	14	31.8
Gender		
Boy	23	52.3
Girl	21	47.7
Types of Allergies		
Plant extract		
Negative	18	40.9
Positive	26	59.1
Fungal mold in house dust		
Negative	27	61.4
Positive	17	38.6
Fungal mold		
Negative	23	52.3
Positive	21	47.7
Mold		
Negative	28	63.6
Positive	16	36.4
Storage mites		
Negative	20	45.5
Positive	24	54.5
Grass		
Negative	22	50.0
Positive	22	50.0
Cockroach		
Negative	28	63.6
Positive	16	36.4
Walnut		
Negative	16	36.4
Positive	28	63.6
Chicken meat		
Negative	13	29.5
Positive	31	70.5
Apple		
Negative	26	59.1
Positive	18	40.9
White flour		
Negative	20	45.5
Positive	24	54.5
Strawberry		
Negative	28	63.6
Positive	16	36.4
Tomato		
Negative	27	61.4
Positive	17	38.6
Cocoa		
Negative	27	61.4
Positive	17	38.6
	44	**100.0**

With the use of SPT, 26 children were shown to have allergies for plant extracts (59.1%), 17 for fungal spores in house mold (38.6%), 21 for fungal mold (47.7%), 24 for mold (36.4%), 22 for grass (50%), 16 for cockroach (36.4%), 28 for walnut (63.6%), 31 for chicken meat (%70.5), 18 for apples (40.9%), 24 for white flour (54.5%), 16 for strawberries (36.4%), 17 for tomatoes (38.6%) and 17 for cocoa (38.6%) (Table 1).

Statistical analysis revealed no significant differences in terms of "gender" or in the "healthy weight versus obesity" and "childhood versus adolescence" categories.

Results for walnut allergies were notable. The mean BMI for 28 cases with walnut allergies was 25.96 and the mean BMI was 21.97 for 16 cases without walnut allergies. The 3.99 difference between these means was statistically

significant at the p<0.05 level (p=0.023). Those with walnut allergies had a higher mean BMI value (Table 2).

Table 2. Comparison of BMI means of walnut allergy and non-walnut allergy cases

	n	BMI mean	BMI mean difference	t	p
Walnut allergy					
Negative	16	21.97	3.99*	2.35	0.023
Positive	28	25.96			

Independent two sample t test, *p<0.05

Whether there are statistically significant differences between mean ages of the cases in which each type of allergy was noted and each type of allergy not noted was investigated. A significant difference was found between the mean ages cases with chicken meat, white flour and cases with and without cocoa allergy (Table 3).

Results for chicken meat, white flour, and cocoa allergies were also meaningful. The mean age of 31 cases with chicken meat allergy was 10.19 years and the mean age of 13 cases without chicken meat allergy was 8.31 years. The 1.88 years of difference between these means was statistically significant at the p<0.10 level (p=0.093). The mean age of the 24 cases with white flour allergy was 10.50 years and the mean age the 20 cases without white flour allergies was 8.60 years. The 1.90 years of difference between these means was statistically significant at the p<0.10 level (p=0.063). The mean age of the 17 cases with cocoa allergy was 11.35 and the mean age was of the 27 cases without cocoa allergy 8.55 years. The 2.80 years of difference between these means was statistically significant at the p<0.01 significance level (p=0.006). According to these results, the mean ages of chicken meat, white flour, and cocoa allergies were higher than those without these allergies (Table 3).

Table 3. Comparison of ages with cases with allergies and cases without allergies

	n	Age mean	Age mean difference	t	p
Chicken meat allergy					
Negative	13	8.31	1.88*	1.72	0.093
Positive	31	10.19			
White flour allergy					
Negative	20	8.60	1.90*	1.90	0.063
Positive	24	10.50			
Cocoa allergy					
Negative	27	8.55	2.80**	2.88	0.006
Positive	17	11.35			

Independent two sample t-test, *p<0.10, **p<0.01

DISCUSSION

The prevalence of allergic diseases continues to rise at the global level. Disease burdens pose a public health concern calling for action. Allergic dermatitis, asthma, and atopic dermatitis are prevalent. An interaction between environmental and intrinsic factors is commonly detected in genetically susceptible atopic individuals. Recent studies indicate significant gene-environment interactions in the development of food sensitivities (8,9).

The frequencies of persistent wheezing, rhinitis, atopic eczema complaints in studies performed on 6-7 year-old children were 20.3%, 37.0%, and 7.5% respectively (5). In 313 allergic children in the 4-month to 18-year age group, 57.1% had asthma, 20.4% had allergic rhinitis, 11.7% had atopic dermatitis, and 8.1% had urticarial symptoms (10). It is important to be aware of the etiology in allergy treatment. Among allergic patients between ages 5-66 years, 18.1% had a positive SPT result for house dust mites, 13.8% for grass pollen, and 8.6% for mantel mold (11). In a study conducted on 739 children of ages 2-17 years, 45.9% of atopic cases were found to be positive for at least one allergen. In the same study group, 97% were positive for house dust mite and 30.6% for plant pollens such as grass, weed, and tree (12). In another study, SPT results showed that up to 23.6% were susceptible to meadow, tree and grass pollens and 15.5% to house dust mites, 7.2% to fungal mold, and 6.8% to food (13). In another study population, house dust mite allergies were noted by 39.8% to be the most frequent, followed by 26.0% of the same population with tree pollen allergies (14). The SPT results in a different evaluation showed sensitivities for at least one allergen in 220 patients with allergic rhinitis. Of this group, 20.3% were positive for meadow, 16.3% for mixed herbs, and 13.6% for mites (15). The research presented in this current article revealed 59.1% allergies for plant extracts, 70.5% for chicken meat, and 63.6% for walnuts, based on SPT results. Unlike other studies, the food allergy rate was high.

In one study, infantile food allergies were frequent, while aero-allergens were common in older ages. The most common food allergies were seen between ages 0-2, with a sensitivity of 60.9% and a maximum egg sensitivity of 39.2% (9). In the research presented in this article, when mean ages and allergens were compared, the mean ages for allergies such as chicken meat, white meat, and cocoa were found to be higher than those of all other allergens.

Allergies and obesity are two important public health problems that have caught attention in recent years. When the mean BMI was taken into consideration, it was found to be higher in cases with walnut allergies, when compared to those without walnut allergies.

There are several studies conducted to investigate the relationship between two major health problems, allergies and obesity. One study showed no relationship between asthma and obesity (16). In a study conducted on adults, atopic sensitization was found to be associated with

obesity (17). On another investigation, obesity was found to increase the prevalence of allergic rhinitis and atopic dermatitis in children, but not associated with asthma, food, or drug allergies (18). Data from a study population of subjects from three different countries provided strong evidence that wheezing and airway obstruction are associated with BMI in childhood .Total IgE levels were determined to be higher for children of higher weight in the current study. Obesity may contribute to a higher prevalence of allergic diseases in children, especially in the presence of food allergies. Systemic inflammation may play a role in the development of allergic diseases (20). Increased circulating pro-inflammatory factors from adipose tissue may impair intestinal barrier function, increase mucosal permeability, and ultimately damage systemic immunity. Conspicuously, obesity can increase the risk of food allergies (21), which in turn is quite a notable corollary. Microbial changes caused by a high-fat diet are defined as risk factors for experimental food allergy and the study distinguishes the pathogenic role of a high-fat diet-related microbiome from obesity.

From a wider perspective, this correlational investigation is an effort help promote the importance of preventive medicine and public health, in the global effort to improve health-related quality of life.

Observational ecological studies may contain some degree of bias and confounding because they are group-level studies. In interpreting the results of our study, authors recommend taking caution to extrapolating either to individuals within the group level of measurement or rely on further studies which further elaborate on the findings presented in this article for generalizability. An ecological study was used for the purpose of detecting nutritional factors in child rearing which may contribute to the development and monitoring of public health strategies, minimizing risk factors in the population, with the long term vision of transforming eating habits as a concept for a future societies. The study hereby presented is unique in content and design, thus declared by the authors to be a preliminary investigation of a novel attribution. The relationship between allergy and childhood obesity was examined in 44 children, most of whom were obese. Results are therefore open to intepretations and may raise possible controversy over a random relationship, however the study merits attention, as it accentuates an area for further research.

CONCLUSION

In an effort to contribute an original perspective to two global public health concerns, the link between allergies and obesity were investigated in a pediatric population in Istanbul.

Research hereby provides evidence that food allergies seem more common in older ages in the population evaluated. Thus, a question is raised regarding exposures to environmental effects as a major contributing component in relevant process. In other studies, the food allergy seen in early ages emphasized the importance of the advanced age shift in our case, the difference of regional allergens in the other study results.

Although the case of obesity is not a conclusive across-the-board finding, the increase in walnut sensitivity average means carries the discussion to the decisive statement that "the triad of environmental factors, allergies, and obesity" is important. With evidence obtained in this research, and by means of the conclusions, larger samples may be evaluated for broader generalizations.

Comprehensive research, adequate prevention, and effective treatment strategies for will improve long-term outcomes, raise quality of life, reduce costs, relieve burdens, and contribute to society.

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