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"THE PREVALENCE OF FOOD ALLERGIES TO FRUITS AND VEGETABLES IN THE CHILDREN OF TIRANA"

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Abstract-Food allergies to fruits and vegetables are common in pediatric age globally and in the Balkan region. However, the specific prevalence and distribution of allergies varies from one region to another and from one study to another.

The purpose of this study is to identify the most frequent allergens of the class of fruits and vegetables in 0-12 years old in the city of Tirana

Material and method; This is a random retrospective study. The study population consists of 93 children presented at the Geniuslab laboratory, 46 females and 47 males of pediatric age 0-12 years. Each patient has performed the food-specific IgE test with several allergens

Results:

• Females make up 49.5% of patients and males 50.5%. The distribution is equal between the two sexes.

• In all analyzed age groups, Pea is the vegetable with the largest number of positive IgE cases, with 13 cases in total (13.9%)

• In all age groups, bananas are the most common fruit for IgE-positive cases, holding this position in the age groups 0-3 years, 3-6 years, and 6-12 years, with an increase in cases in the older age group .

The laboratory data processed with the SPSS version 21 program have verified:

• for vegetables; Avocado, Celery, Garlic, and Onion have strong and significant statistical relationships between them, while the age factor does not show obvious correlations.

• For fruits, it turns out that there is a weak negative relationship between age and positive IgE from bananas.

Conclusion; Analyzes have revealed strong associations between certain vegetables and a weak negative association between age and banana allergies. The results emphasize the need for careful monitoring of allergies and the inclusion of different factors in their management.

Keywords: Fruits And Vegetables, Positive Ige, Children, Tirana.

I. INTRODUCTION

A food allergy is the immune system's reaction to a specific food that contains allergens. This reaction can range in strength and degree from moderate to severe, even life-threatening. Allergic reactions appear

through numerous methods. Some processes of allergic reactions are discussed below in connection to the causative allergens as well as the most common symptoms that these reactions produce.
Mechanism of allergy, Allergens and Symptoms

Mechanism	Allergens	Symptoms
IgE-Mediated	Peanuts, tree nuts, fish, shellfish, milk, eggs, soy, wheat, fruits, vegetables	Skin: Urticaria, angioedema. Respiratory: Rhinoconjunctivitis, laryngospasm, wheezing/bronchospasm. Gastrointestinal: Nausea, abdominal pain, vomiting, diarrhea, gastrointestinal anaphylaxis. Multi-system: Generalized anaphylaxis, oral allergy syndrome.
Combination of IgE-Mediated and Non-IgE Mediated Reactions	Milk, eggs, soy, wheat, peanuts, tree nuts, fish, shellfish	Skin: Atopic dermatitis/eczema. Gastrointestinal: Vomiting, diarrhea, abdominal pain.
Non-IgE-Mediated	Milk, soy, eggs, wheat, fish, shellfish, meat	Gastrointestinal: Food protein-induced enterocolitis, enteropathy, proctocolitis. Skin: Contact dermatitis. Heiner syndrome.
Gluten	Gluten	Skin: Dermatitis herpetiformis. Gastrointestinal: Celiac disease (diarrhea, bloating).

Food allergy symptoms can impact multiple parts of the body at once. Allergic symptoms can develop within minutes to an hour of taking the food. The following are the most prevalent food allergy symptoms. However, each youngster can have unique symptoms. Symptoms may include vomiting, diarrhea, cramps, edema, eczema, itching, tightness in the throat, difficulty breathing, and low blood pressure.

Global Prevalence of Fruit and Vegetable Food Allergies in Pediatrics

Globally, the prevalence of food allergies in pediatric age is about 5-8% [1]. Fruit and vegetable allergies account for a significant portion of this prevalence, although the specific percentage for each category is not always available [2]. Fruits and vegetables are often common allergens, and their sensitivity is increasing [3].

In Europe, the prevalence of food allergies in children is also about 5-8% [4]. Fruits and vegetables make up a significant portion of allergies in this region. Common fruits that cause allergies include others, sometimes causing oral allergy syndrome [5]. Vegetables such as peas and celery are also mentioned in some studies [6].

In the Balkans, the prevalence of food allergies in pediatric age is about 4.5-5.5% [7]. Fruits and vegetables are also implicated in this prevalence, with some studies suggesting that allergies to peas, avocados, and other fruits are common [8][9].

Allergies to fruits, such as bananas, citrus, and kiwi, are common and often associated with oral allergy syndrome [10].

Vegetables such as peas, celery, and avocado are also common allergens in pediatric age [12]. Allergies to these vegetables can vary in intensity and prevalence [13].

II. MATERIALS AND METHOD

The study's sample

This study is retrospective and randomized. The study population includes 93 children aged 0-12 years, 46 of them are female and 47 of them are male, who were presented at the Geniuslab laboratory. Information was obtained about age, gender, food allergy type, and IgE levels.

Analyzing the sample

The measurement of specific IgE was performed with the Indirect ELISA method using Policheck LOT 18 REF.WB05 reagents. The analysis of the tests was carried out according to the laboratory protocols related to pre-analytical, analytical, and post-analytical phases. The laboratory tests were carried out in the Genius Shpk laboratory.

III. RESULTS

Table 1. The table below presents the frequencies and percentages of patients in the study by gender.

		Frequencies	percentages
Valid	*Females*	46	49.5
	Males	47	50.5
	Total	93	100.0

The total number of patients is 93, with nearly equal percentages for females and males: 49.5% and 50.5%, respectively.

Table 2. The following table shows the frequencies and percentages of patients by age

Age

		Frequency	Percent
Valid	0.5	1	1.1
	0.6	1	1.1
	0.7	2	2.2
	1.0	9	9.7
	2.0	14	15.1
	3.0	6	6.5
	4.0	8	8.6
	5.0	7	7.5
	6.0	7	7.5
	7.0	6	6.5
	8.0	4	4.3
	9.0	2	2.2
	10.0	11	11.8
	11.0	3	3.2
	12.0	12	12.9
	Total	93	100.0

Group 0-3 years -33 patients (35.7%) suggesting that food allergies often appear early in life.

• Group 3-6 years 22 patients (23.6%) which coincides with a period of increased diet and may affect the development of allergies.

• The group 6-12 years old 38 patients (40.9%) has the largest number of patients, suggesting a high prevalence in this period, which is important for the management and ongoing treatment of allergies.

Table 3. The table below shows the frequencies and percentages of patients according to allergy classes:

Patient distribution based on allergy classifications			
		Frequency	Percent
Valid	0	13	14.0
	1	17	18.3
	2	34	36.6
	3	19	20.4
	4	3	3.2
	5	2	2.2
	6	5	5.4
	Total	93	100.0

- Class 0 (IgE <0.35): 13 patients, which constitute 14.0% of the total.
- Class 1 (0.35-<0.7): 17 patients, accounting for 18.3% of the total.
- Class 2 (0.7- < 3.5): 34 patients, which make up 36.6% of the total. This is the class with the largest percentage of patients.
- Class 3 (3.5- < 17.5): 19 patients, accounting for 20.4% of the total.
- Class 4 (17.5 - < 50): 3 patients, accounting for 3.2% of the total.
- Class 5 (50 - < 100): 2 patients, accounting for 2.2% of the total.
- Class 6 (> 100): 5 patients, accounting for 5.4% of the total.

In conclusion, most patients are in class 2 (36.6%), indicating low antibody concentration, followed by class 3 and class 1. Class 4 and 5 have the least number of patients.

Table 4. Number of cases with Positive IgE according to Age Group for the class of Vegetables The following table summarizes the number of cases with positive IgE for different vegetables divided according to age groups 0-3 years, 3-6 years, and 6-12 years.

Age Group	Avocado	Peas	Soy	Celery	Garlic	Onion
0-3 years	2	5	0	1	1	1
3-6 years	1	3	0	1	1	1
6-12 years	2	5	1	3	2	2

Pea is the most common and stable allergen for all age groups, while avocado, celery, garlic and onion also have stable sensitivities with age. Soy has low sensitivity in the younger age groups and starts to appear more in the 6-12 age group

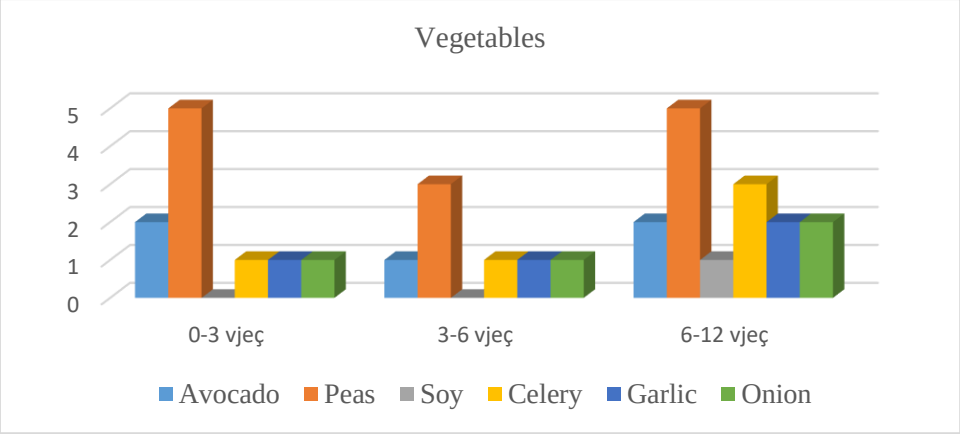

Figure 1. Number of cases classified by age groups with positive IgE for Vegetables.

Table 5. This is a table of Pearson correlations that shows the relationships between several different variables

Correlations								
		Age	Avocado	f12Pea/	f14 Soybean /	f85Celery	f47Garlic	f48Onion
Age	Pearson Correlation	1	.019	-.104	.036	.074	.002	.058
	Sig. (2-tailed)		.856	.319	.729	.481	.987	.578
	N	93	93	93	93	93	93	93
Avocado	Pearson Correlation	.019	1	-.022	.088	.809**	.790**	.854**
	Sig. (2-tailed)	.856		.838	.402	.000	.000	.000
	N	93	93	93	93	93	93	93
f12Pea/	Pearson Correlation	-.104	-.022	1	-.021	-.012	-.011	-.013
	Sig. (2-tailed)	.319	.838		.841	.909	.917	.898
	N	93	93	93	93	93	93	93
f14 Soybean	Pearson Correlation	.036	.088	-.021	1	.080	.078	.109
	Sig. (2-tailed)	.729	.402	.841		.447	.459	.297
	N	93	93	93	93	93	93	93
f85Celery	Pearson Correlation	.074	.809**	-.012	.080	1	.961**	.965**
	Sig. (2-tailed)	.481	.000	.909	.447		.000	.000
	N	93	93	93	93	93	93	93
f47Garlic	Pearson Correlation	.002	.790**	-.011	.078	.961**	1	.974**
	Sig. (2-tailed)	.987	.000	.917	.459	.000		.000
	N	93	93	93	93	93	93	93
f48Onion	Pearson Correlation	.058	.854**	-.013	.109	.965**	.974**	1
	Sig. (2-tailed)	.578	.000	.898	.297	.000	.000	
	N	93	93	93	93	93	93	93

**. Correlation is significant at the 0.01 level (2-tailed).

- The variable "age" has no apparent relationship with any of the other variables in this analysis. All correlations are very small and none are statistically significant.
- Avocado, Celery, Garlic, and Onion have strong and important connections with each other.
- Peas have no apparent relationship with the other variables in this data set.

Table 6. Number of Positive IgE by Age Group for the class of Fruits The following table summarizes the number of cases with positive IgE for different fruits divided by age groups 0-3 years, 3-6 years, and 6-12 years.

Age group	Tomato	Banana	CitrusMix	f84Kiwi	f13Peanut	f17Hazelnut
0-3 years	1	25	5	1	4	3
3-6 years	2	19	5	3	2	4
6-12 years	4	23	5	2	2	5

Banana is the most common allergen across all age groups, accounting for the majority of IgE-positive cases.Tomatoes and kiwi show a sensitivity that either increases or remains stable with age.CitrusMix has a consistent sensitivity across all age groups.Peanuts and hazelnuts exhibit sensitivity that may change with age, with a noticeable increase in sensitivity to hazelnuts as children grow older.

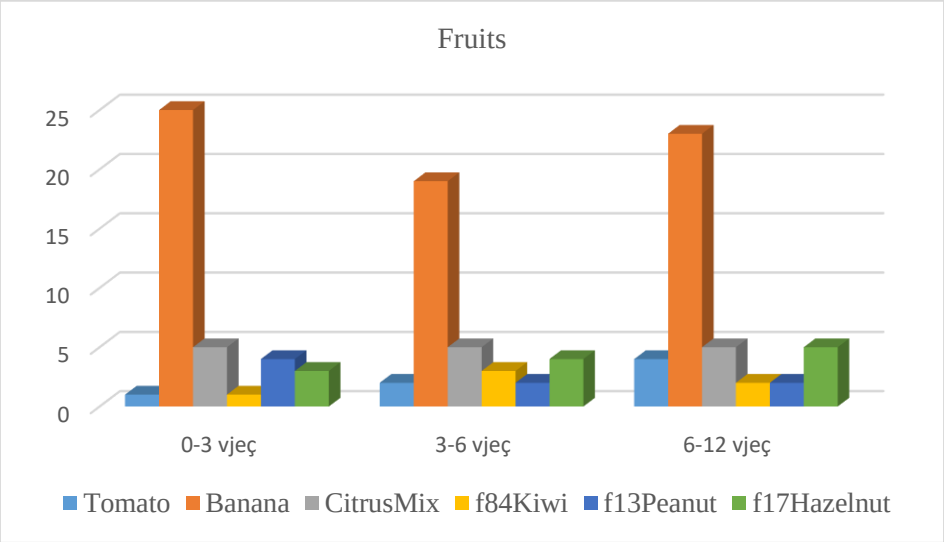

Figure 2. Number of cases classified by age groups with positive IgE for Fruits.

Table 8. This is a table of Pearson correlations that shows the relationships between several different variables

Correlations								
		Age	Tomato	Banana	Citrus Mix	f84 Kiwi	f13Peanut	f17Hazelnut
Age	Pearson Correlation	1	-.003	-.249*	.003	.082	-.104	-.066
	Sig. (2-tailed)		.974	.016	.977	.436	.322	.530
	N	93	93	93	93	93	93	93
Tomato	Pearson Correlation	-.003	1	-.038	.731**	.807**	-.006	.287**
	Sig. (2-tailed)	.974		.720	.000	.000	.952	.005
	N	93	93	93	93	93	93	93
Banana	Pearson Correlation	-.249*	-.038	1	.186	-.026	-.036	.223*
	Sig. (2-tailed)	.016	.720		.075	.803	.731	.032
	N	93	93	93	93	93	93	93
Citrus Mix	Pearson Correlation	.003	.731**	.186	1	.792**	-.030	.294**
	Sig. (2-tailed)	.977	.000	.075		.000	.779	.004
	N	93	93	93	93	93	93	93
f84Kiwi	Pearson Correlation	.082	.807**	-.026	.792**	1	-.017	.410**
	Sig. (2-tailed)	.436	.000	.803	.000		.872	.000
	N	93	93	93	93	93	93	93
f13Peanut	Pearson Correlation	-.104	-.006	-.036	-.030	-.017	1	-.017
	Sig. (2-tailed)	.322	.952	.731	.779	.872		.869
	N	93	93	93	93	93	93	93
f17Hazelnut	Pearson Correlation	-.066	.287**	.223*	.294**	.410**	-.017	1
	Sig. (2-tailed)	.530	.005	.032	.004	.000	.869	
	N	93	93	93	93	93	93	93
*. Correlation is significant at the 0.05 level (2-tailed).								

**. Correlation is significant at the 0.01 level (2-tailed).

- According to the statistical processing in SPSS version 21, it turns out that there is a weak negative relationship between the variable "age" and positive IgE from Bananas. When age increases, there is a weak tendency for the values of IgE Positive to Bananas to decrease. Other statistically significant relationships are also:
    - Tomato has strong positive correlations with Citrus Mix and f84Kiwi.
    - Banana has a weak positive correlation with f17Hazelnut
    - Citrus Mix has strong positive correlations with f84Kiwi and a moderate positive correlation with f17Hazelnut
    - f84Kiwi has a strong positive association with f17Hazelnut

IV. DISCUSSION

The discussion of this study aims to analyze and interpret the results related to the prevalence of food allergies in pediatric children in Tirana, with a particular focus on allergies to fruits and vegetables. Using IgE tests and statistical analyses, this study provides a clear overview of the sensitivity to these allergens in the children included in the study.This study observed an equal gender distribution, with a slightly higher prevalence in males (50.5%) compared to females (49.5%). The age distribution shows that the school-age group (7-12 years) was the most represented, comprising 40.9% of the total. This may be related to greater exposure to various foods in this age group, as well as increased parental awareness of potential allergic symptoms.However, for the majority of allergens, the correlation between age and IgE levels was weak or non-significant, indicating that age is not a major factor in the frequency of these allergies. The study found a relationship between age and positive IgE in the case of banana allergies, showing a decrease in sensitivity to bananas with increasing age.Peas were found to be the most common vegetable allergy in all age groups, compared to avocado, celery, garlic, and onion, showing the highest levels of IgE.. Given that peas are known to trigger IgE-mediated allergy responses, their high allergenic protein concentration may have something to do with this.

The significant connections between allergies to avocado, celery, garlic, and onion indicate a common sensitivity to these allergens, which could be related to structural similarities in their proteins or cross-sensitization between them. These findings are consistent with previous research, which has shown that people who are allergic to one vegetable are generally sensitive to others too.
Regarding fruits, bananas were the most common cause of allergic responses in all age categories.This finding is consistent with the literature, which suggests that bananas contain profilins, proteins that frequently induce allergic reactions, particularly in young children.Moreover, the strong positive correlations between allergies to tomatoes, Citrus Mix, and kiwi suggest a tendency for shared sensitivity to these fruits, which may be related to the presence of similar proteins or oral allergy syndrome.

V. CONCLUSION

Allergies to fruits and vegetables are common in pediatric age groups, with significant distribution across different age ranges. Researchers have found that the prevalence of food allergies in children is increasing, reflecting heightened sensitivity to fruits and vegetables. This increase has been associated with various factors, including dietary changes, early exposure to allergens, and alterations in the gut microbiome that may affect immune system development (Sicherer & Sampson, 2018; Sicherer & Fenton, 2019).Peas and bananas, in particular, are common triggers of allergies in childhood. This aligns with other research identifying peas as a common source of allergy due to their proteins being similar to allergens in other legume groups, which often cause cross-reactions (Hiller & Salvatore, 2018). Bananas

are also well-known for their proteins' similarity to allergens in other fruits and their potential to cause allergic reactions due to increased sensitivity to latex-like proteins (Sánchez-Gómez & García-Sánchez, 2016). In my study, bananas may cause cross-reactions with fruits and vegetables containing latex-like proteins, such as avocados, kiwis, and tomatoes.Based on the specific IgE class, most patients fall into class 2 (0.7 - < 3.5), indicating that the level of IgE antibodies is moderate for most children. Previous research has found that an important number of children with food allergies had moderate IgE levels (Vickery & Sampson, 2018; Palomares & Akdis, 2019).In our study, age had no significant effect on positive IgE levels for the majority of factors. This is consistent with research that show that a child's age does not always have a substantial influence on allergy sensitivity. According to a study published in the Journal of Allergy and Clinical Immunology, allergy sensitivity is more strongly connected to allergen exposure and environmental factors than to age (Bunyavanich & Smith, 2016). This is also consistent with studies, which found that changes in the IgE profile frequently occur in reaction to environmental and nutritional changes, rather than as people age.

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