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Foods that cause adverse reactions and ailments: the EuroPrevall survey results in Vilnius (Lithuania)

Andrius Kavaliūnas,

Genė Šurkienė,

Rūta Dubakienė,

Rimantas Stukas,

Kęstutis Žagminas

Faculty of Medicine of Vilnius University, Vilnius, Lithuania

Aim. The aim of this study was to determine foods that cause adverse reactions and ailments to citizens of Vilnius (Lithuania).

Methods. Vilnius University was a partner in the EuroPrevall integrated project – "The Prevalence Cost and Basis of Food Allergy in Europe", which is a EU-funded multi-disciplinary research study. By implementing this project, 4 333 6–12 year old schoolchildren of the 1st–4th grades from primary schools in Vilnius were asked to answer an anonymous questionnaire (3 084 questionnaires were gathered in return, response rate 71.2%). Meanwhile, 3 985 adults were asked to answer similar questions during interviews (2 634 of them agreed to take part in the survey, response rate 66.1%).

Results. Fruits and berries (24.6%), and mostly citrus fruits (7.8%) were the most common foods that caused clinical symptoms among the children. Other important problematic foods were milk and dairy (19.4%), chocolate (10.9%), egg (7.4%). Fruits and berries were also the most common foods that caused clinical symptoms among adults (33.3%); other important foods were nuts (19.6%), vegetables (11.8%), chocolate (9.8%). Meat, crustaceans, cereals were food that caused clinical symptoms least to children and adults (≤2.0%).

Conclusions. The list of the most allergenic foods is different in various countries and regions. Food allergy is closely related with age, nutritional habits of the family and society, culture and religion. Therefore, we can find many similarities and disparities when comparing Vilnius with other cities or places in Europe and the world. In Lithuania, there are congenial conditions to grow and consume fruits, vegetables and dairy, therefore these foods are more likely to become allergens to some part of society.

Key words: food, adverse reactions, hypersensitivity, food allergy

Correspondence to: Andrius Kavaliūnas, Public Health Institute, Faculty of Medicine, Vilnius University, M. K. Čiurlionio 21, LT-03101 Vilnius, Lithuania.
E-mail: andrius.kavaliunas@gmail.com

INTRODUCTION

In recent decades, the prevalence of allergic diseases including food allergy is increasing. This becomes an important health problem (1). The main risk factors that contribute to this are various: genetic predisposition, allergen exposure, environmental pollution, low immune response of the individual critical periods of development. So allergies can be treated as a disease of modern civilization, and they are proposed to apply the concept of common health disorder (2).

Food products can cause various reactions – it is hypersensitivity to food. One of these adverse reactions is allergy to food. European Academy of Allergology and Clinical Immunology (EAACI) proposed a new nomenclature for allergic diseases in 2001. According to it, food allergies are attributed to hypersensitivity to food, and may be immunoglobulin E (IgE)-mediated or non-IgE-mediated; hypersensitivity also includes non-allergic hypersensitivity (previously – food intolerance) (3).

Allergy to food and its natural or artificial ingredients causes many physical and psychological disorders. It is a very serious problem not only for many children and parents, but also to the entire medical staff and local communities. Financial and social burdens associated with this disease are increasing (4). It is thought that number of foods, that can cause allergic reactions, is growing, and the number of serious allergic reactions is increasing, but reliable information on precise magnitude of this problem is missing. The prevalence of food allergies in children, especially of younger age, at primary school, is also a major interest, since the studies show it is higher than in adults. Along with all the social and economic implications to public health, prevention and treatment of allergic reactions to foods are becoming a challenge to scientists, doctors, politicians, and the public (5).

Survey data show that between 5 to 35% of adults believe that they or their children suffer from food allergies, although accomplished studies for that say that 6–8% of young children (up to 3 years) and 3–5% of elder children, and 1.5–3% of adults are really allergic to food. However, to assess the exact prevalence of food allergy is difficult because of the country and regional disparities, as well as differences in the epidemiological data and research methods (1, 6, 7).

Food allergens can be divided into allergens of animal or plant origin. They are typical for particular geographical zone. The most important food allergens are milk, eggs, cereals, nuts, soya, fish, meat, crustaceans, berries, fruits, vegetables and spices (8, 9). In USA, 8 foods cause 90% of all food allergies and they are often named as "the big eight" – milk, eggs, peanuts, other nuts, wheat, fish, crustaceans, soya (10–12).

There are not many studies done in Lithuania to determine a consistent pattern of allergies. And there is lack of data about the prevalence of food allergies, symptoms, problematic products. By knowing the relevancy of the problem and the fact that this disease is more frequent among children, it is very important to have data about the country – what is the situation and how it looks in comparison to other countries. This tackled our aim and contingent of research. Even if the prevalence of allergies differs in the same country's cities and towns, we explored the prevalence of food allergies among children and adults in Vilnius City – the capital and the largest city in Lithuania, hosting diverse nationalities with a variety of lifestyles and nutritional habits.

The aim of our research was to determine foods that cause adverse reactions and ailments to citizens of Vilnius (Lithuania).

MATERIALS AND METHODS

Vilnius University was a partner in EuroPrevall integrated project – "The prevalence cost and basis of food allergy in Europe", that is a EU-funded multidisciplinary research study. To ensure methodological integrity of the study, all participating centres followed the EuroPrevall Manual of Procedures and consolidated methodology. The first objective of the EuroPrevall epidemiological surveys was to obtain estimates of the prevalence of food allergies across different European regions. By implementing this project in Lithuania, community-based surveys among primary school-age children and adults were performed.

Approval of Lithuanian Bioethics Committee was given to conduct this biomedical research (21 December 2005, No. 60); Agreement of Department of Education, Culture and Sport of Vilnius city municipality administration was also got. A special questionnaire, created and approved for this

project by the Institute of Food Research (Norwich, UK) was used in all participating countries. To ensure the integrity of study and data, standardized translation procedures, involving forward translation (from English into Lithuanian), backward translation (comparison and necessary editing) and local piloting, were done. Children got questionnaires at school and took them at home to complete with parents (or just to parents).

Thirteen primary schools out of sixteen in Vilnius City participated in the study with the total number of 190 classes and 4 333 schoolchildren in them. 4 333 questionnaires were distributed and 3 084 (response rate – 71.2%) were collected in return with responses.

Adults were interrogated by making home visits. We took two large outpatient clinical centres (Antakalnis and Šeškinė) and made random samples from patients' lists of these centres. Final sample contained 3 985 adults, 2 634 (response rate – 66.1%) of them agreed to take part in the study.

The prevalence of adverse reactions to food and food allergy was expressed as a point (percentage) and interval estimate (the 95 percent confidence intervals (95% CI) were chosen). Statistical data analysis was performed by statistical packages SPSS 17.0 and WinPEPI 11.0.

RESULTS

Foods that cause adverse reactions and ailments to children

Parents of 4 333 children of Vilnius City primary schools were asked to complete the EuroPrevall food allergy screening questionnaire, that was specially designed for this. 3 084 questionnaires were got in return and used for further analysis. There were 1 531 (49.6%) boys and 1 553 (50.4%) girls out of them. The age of schoolchildren varied from 5 to 12 years (mean – 8.2 ± 1.2 years, median – 8 years). Distribution of children by age and gender is given in Table 1.

Firstly, we evaluated which part of schoolchildren population report that they have illness or trouble caused by eating a food or foods. 1 445 (46.9%) stated that they had ever had such problems, 1 639 (53.1%) responded negatively.

We asked to indicate up to three foods that caused adverse reactions (if there were more than three, we asked to indicate the main three that were the most problematic). The majority of children (1 150; 79.6%) pointed out at least one food; 3.5% did not know and 16.9% did not indicate any. From those children who indicated at least one food, the majority (508; 44.2%) indicated one, 32.1% indicated two and 23.7% indicated three foods that caused adverse reactions for them.

We also asked to name the food that causes troubles or illnesses after eating it. The answers were very different. Some named food accurately (e. g., apple, hazelnut), others named only general groups, like fruits or nuts. We present answers, as they were, systematised in Table 2 and a general picture of these data in Fig. 1 (here foods are taken in such groups: nuts, vegetables, fish, meat, milk and dairy, fruits and berries, cereals, crustaceans, etc.). Consequently, we see that the most important and relevant foods for children are fruits and berries (24.6%), also milk and dairy (19.4%). Crustaceans (0.1%), spice, herbs, seeds (1.0%) are of the least relevance.

It should be noted that citrus fruits (oranges, mandarins, lemons), strawberries and apples were mentioned most often in the fruits and berries

Table 1. Distribution of children by age and gender

Age (years)	Boys		Girls		Total	
	n	%	n	%	n	%
5	2	0.1	2	0.1	4	0.1
6	89	5.8	104	6.7	193	6.3
7	464	30.3	424	27.3	888	28.8
8	333	21.8	359	23.1	692	22.4
9	350	22.9	396	25.5	746	24.2
10	286	18.7	260	16.7	546	17.7
11	5	0.3	7	0.5	12	0.4
12	2	0.1	1	0.1	3	0.1
Total	1 531	100	1 553	100	3 084	100

Table 2. Distribution of foods that caused clinical symptoms to children

Food	Children, that have had a problem or illness caused by eating a food or foods (n = 1 445)		
	n	%	95% CI
Nuts	69	4.8	3.7–6.0
From them:			
Hazelnut	3	0.2	0.04–0.6
Peanut	2	0.1	0.02–0.5
Coconut	2	0.1	0.02–0.5
Almond	1	0.1	0.002–0.4
Vegetables	100	6.9	5.7–8.4
From them:			
Asparagus	1	0.1	0.002–0.4
Bean	5	0.4	0.1–0.8
Cabbage (cauliflower)	6	0.4	0.2–0.9
Carrot	19	1.3	0.8–2.1
Corn	8	0.6	0.2–1.1
Garlic	1	0.1	0.002–0.4
Onion	3	0.2	0.04–0.6
Peas	3	0.2	0.04–0.6
Paprika	7	0.5	0.2–1.0
Potato	9	0.6	0.3–1.2
Tomato	25	1.7	1.1–2.5
Fish	85	5.9	4.7–7.2
From them:			
Salmon	1	0.1	0.002–0.4
Tuna	2	0.1	0.02–0.5
Herring	7	0.5	0.2–1.0
Whitefish, cod, plaice	1	0.1	0.002–0.4
Fruits and berries:	355	24.6	22.4–26.9
From them:			
Apples	19	1.3	0.8–2.1
Bananas	5	0.4	0.1–0.8
Cherries	6	0.4	0.2–0.9
Grape	12	0.8	0.4–1.5
Kiwi	18	1.3	0.7–2.0
Lemon	18	1.3	0.7–2.0
Melon	6	0.4	0.2–0.9
Orange (mandarin)	96	6.6	5.4–8.1
Peach	6	0.4	0.2–0.9
Pear	4	0.3	0.1–0.7
Raspberry (blackberry)	2	0.1	0.02–0.5
Strawberry (wild strawberry)	39	2.7	1.9–3.7
Plum	3	0.2	0.04–0.6
Milk and dairy	280	19.4	17.4–21.5
From them:			
Cheese	3	0.2	0.04–0.6
Cow's milk	106	7.3	6.0–8.8
Yoghurt	18	1.3	0.7–2.0
Meat	24	1.7	1.1–2.5
From it:			
Beef	2	0.1	0.02–0.5
Pork	10	0.7	0.3–1.3
Poultry	10	0.7	0.3–1.3

Table 2. Continued

Food	Children, that have had a problem or illness caused by eating a food or foods (n = 1 445)		
	n	%	95% CI
Cereals	23	1.6	1.0–2.4
From them:			
Buckwheat	8	0.6	0.2–1.1
Rye	1	0.1	0.002–0.4
Wheat (flour)	13	0.9	0.5–1.5
Rice	1	0.1	0.002–0.4
Crustaceans	2	0.1	0.02–0.5
From them:			
Crab	2	0.1	0.02–0.5
Cacao	28	1.9	1.3–2.8
Chocolate	157	10.9	9.3–12.6
Egg	107	7.4	6.1–8.9
Spice, herbs, seeds	14	1.0	0.5–1.6
From them:			
Parsley	1	0.1	0.002–0.4
Sunflowers seed	3	0.2	0.04–0.6
Sesame seed	3	0.2	0.04–0.6
Yeast	2	0.1	0.02–0.5
Soya	5	0.4	0.1–0.8
Others	819	56.7	54.1–59.3

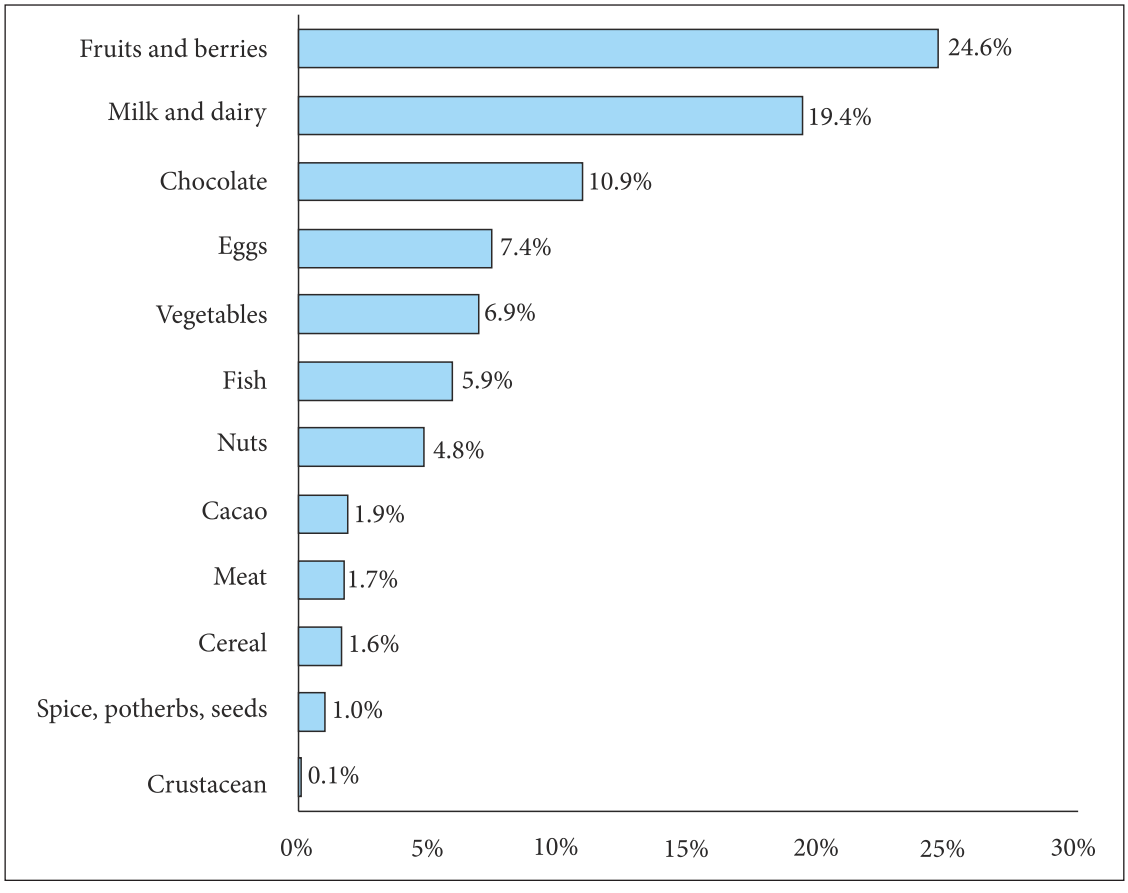

Fig. 1. Distribution of food groups that caused clinical symptoms to children

Table 3. Distribution of adult responders by age groups and gender

Age groups (years)	Men		Women		Total	
	n	%	n	%	n	%
≤24	161	12.5	185	13.7	346	13.1
25–34	435	33.8	429	31.9	864	32.8
35–44	406	31.5	397	29.5	803	30.5
45–54	278	21.6	332	24.7	610	23.2
55≤	8	0.6	3	0.2	11	0.4
Total	1 288	100	1 346	100	2 634	100

group. Tomatoes and carrots were the most popular among the vegetables. If we draw a list of top 10 foods, that cause adverse reactions to children, it can be such: chocolate (10.9%), eggs (7.4%), cow's milk (7.3%), oranges (mandarins) (6.6%), strawberries (wild strawberries) (2.7%), cacao (1.9%), tomatoes (1.7%), apples (1.3%), carrots (1.3%), kiwi (1.3%), lemons (1.3%), yoghurt (1.3%).

Foods that cause adverse reactions and ailments to adults

3 985 adult citizens in Vilnius were visited for completion of the EuroPrevall food allergy screening questionnaire. 2 634 answered the questions. There were 1 288 (48.9%) men and 1 364 (51.1%) women out of them. The age of responders varied from 19 to 57 years (mean – 36.1 ± 19.5 years, median – 36 years). Distribution of adults by age and gender is given in Table 3.

According to our objectives, we evaluated which part of adult population report that they have illness or trouble caused by eating a food or foods. Only 51 (1.9%) stated that they had ever had such problems, 2 583 (98.1%) responded negatively.

We asked to indicate up to three foods that caused adverse reactions (if there were more than three, we asked to indicate the main three that were the most problematic). The majority of adults (38; 74.5%) pointed out at least one; 2.0% did not know and 23.5% did not indicate any. From those adults

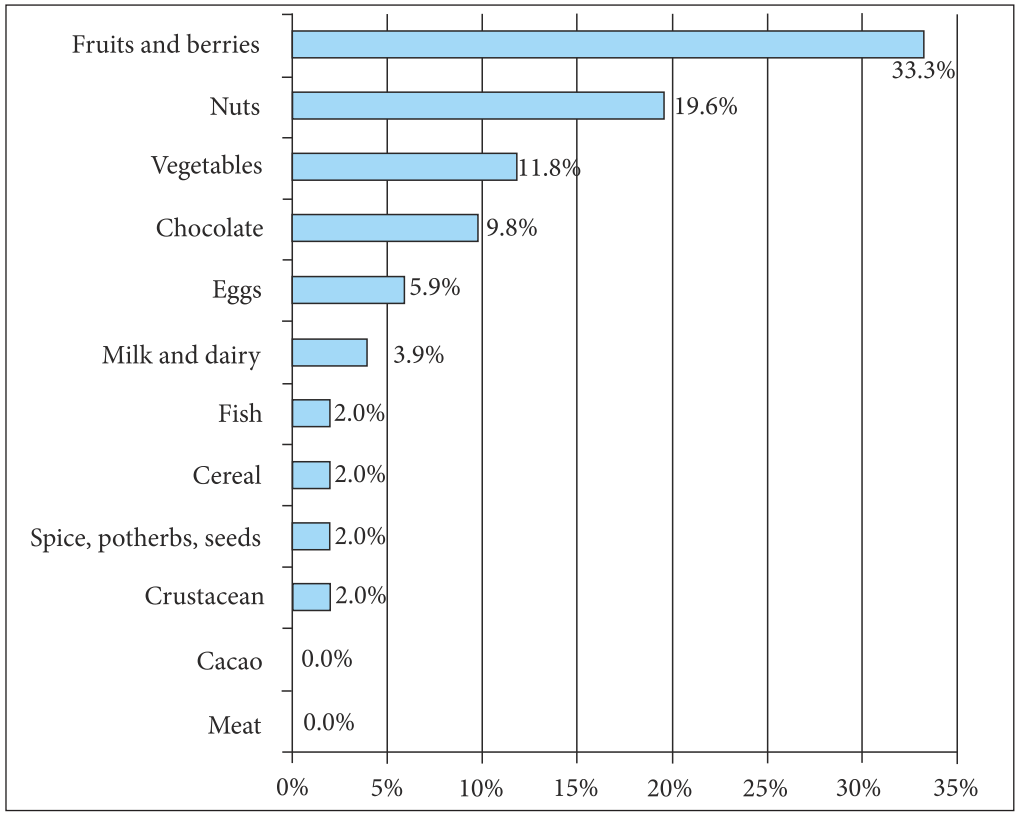

Fig. 2. Distribution of food groups that caused clinical symptoms to adults

Table 4. Distribution of foods that caused clinical symptoms to adults

Food	Adults, that have had a problem or illness caused by eating a food or foods (n = 51)		
	n	%	95% CI
Nuts	10	19.6	9.8–33.1
From them:			
Hazelnuts	3	5.9	1.2–16.2
Peanut	2	3.9	0.5–13.5
Vegetables	6	11.8	4.4–23.9
From them:			
Carrot	2	3.9	0.5–13.5
Potato	2	3.9	0.5–13.5
Tomato	1	2.0	0.1–10.5
Fish	1	2.0	0.1–10.5
From it:			
Whitefish, cod, plaice	1	2.0	0.1–10.5
Fruits and berries	17	33.3	20.8–47.9
From them:			
Apple	3	5.9	1.2–16.2
Kiwi	1	2.0	0.1–10.5
Lemon	1	2.0	0.1–10.5
Orange (mandarin)	5	9.8	3.3–21.4
Strawberry (wild strawberry)	1	2.0	0.1–10.5
Milk and dairy	2	3.9	0.5–13.5
From it:			
Cow's milk	1	2.0	0.1–10.5
Meat	0	0	–
Cereals	1	2.0	0.1–10.5
From them:			
Buckwheat	1	2.0	0.1–10.5
Crustaceans	1	2.0	0.1–10.5
From them:			
Shrimp	1	2.0	0.1–10.5
Cacao	0	0	–
Chocolate	5	9.8	3.3–21.4
Egg	3	5.9	1.2–16.2
Spice, herbs, seeds	1	2.0	0.1–10.5
From them:			
Sunflowers' seed	1	2.0	0.1–10.5
Soya	0	0	–
Others	12	23.5	12.8–37.5

who indicated at least one food, the majority (18; 47.4%) indicated two, 42.1% indicated one and 10.5% indicated three foods that caused adverse reactions.

We also asked to name the food that causes troubles or illnesses by eating them. We present answers, as they were, systematised in Table 4 and a general picture of these data in Fig. 2. Consequently, we see that the most important and relevant foods to adults are fruits and berries, also nuts. Fish, cereals, crustaceans, spice, herbs, seeds are of the least relevance. Meat and cacao, as a food that causes adverse reactions, were not mentioned by anyone. If we draw a list of top 10 foods that cause adverse reactions to adults, it can be such: chocolate (9.8%), oranges (mandarins) (9.8%), eggs (5.9%), apples (5.9%), hazelnuts (5.9%), peanuts (3.9%), carrots (3.9%), potatoes (3.9%).

DISCUSSION

In our study we analyzed which foods usually cause adverse reactions. The majority of respondents (79.6% of children and 74.5% of adults) reported at least one food product that is causing them troubles or illness after eating it. According to the results of the survey that analysed children with food allergy and hospitalized for treatment, the majority of them (44%) were allergic to 1–3 foods (13). Survey results from Spain show that the majority of adults in general population are sensitive to one or two foods (86.7%) (14). Majority of people were sensitive to one food in Portugal (67.6%) and Singapore (70%) (15, 16). Research in Northern Europe shows that the majority (95%) of patients from Sweden, Denmark, Estonia, Lithuania and Russia, that already have food hypersensitivity, are allergic to more than one food (17).

In our survey, fruits and berries (24.6%), and mostly citrus fruits (7.8%) were the most common foods that caused clinical symptoms among children. Other important problematic foods were milk and dairy (19.4%), chocolate (10.9%), egg (7.4%). Fruits and berries were also the most common foods that caused clinical symptoms among adults (33.3%). When we compare these results with those from other countries, we can find both similarities and disparities. This can be attributed to different geographical positions, nutritional habits, culture and traditions, as well as globalization and immigration-emigration processes. For example, fruits (40.9%) were the most common food to cause adverse reactions to adults in our neighbour country, Poland, other important foods were cow's milk (10.8%), eggs (8.5%), chocolate (7.1%), fish (3.2%) at least (18). In USA, the most common food to cause adverse reactions are fruits and vegetables, milk and dairy, but crustaceans and soya are also important (19), and children were mostly allergic to peanuts, milk and crustaceans (20). In the survey on food allergy conducted by phone in 10 European countries, parents pointed out that the most common foods to cause adverse reactions to their children (as in Lithuania, according to our study) is milk (38.5%), fruits (29.5%), eggs (19.0%) and vegetables (13.5%) (21). The most common allergens for Finnish children were milk and eggs, for British children such allergens were milk, eggs and fruits (22).

According to the results of studies, focusing on more concrete food products, the most problematic foods to cause illness in Northern Europe were citrus fruits, chocolate, honey, apples, hazelnuts, strawberries, fish, tomato, egg and milk (in Russia, Estonia and Lithuania); nuts, apples, kiwi and carrots (in Sweden and Denmark). In all these countries children experienced adverse reactions from food more often than adults (17, 23). In France the most common allergens were rosehips (14%), vegetables (9%), milk (8%), and crustaceans (8%), also eggs (4%) and nuts (3%) (24); in Portugal they were fresh fruits (25%) (15); in Spain such allergens were fruits (56.6%) and nuts (22.6%) (25); in United Arab Emirates the most common allergens were eggs, fruits, and fish (26); in Singapore they were eggs (40%), crustaceans (39.0%), peanuts (27.3%), and milk (11.4%) (16).

R. J. Rona's meta-analysis data reveal that according to various studies, hypersensitivity to milk varies from 1.2 to 17%, to egg from 0.2 to 7%, to peanut and fish up to 2%, to crustaceans up to 10% (7). The EuroPrevall systematic review on the prevalence of plant food allergy shows that 0.4–3.5% of adults and even up to 11.5% of children (under 3 years) are allergic to fruits (apples and citrus fruits to be the most common), up to 2% of adults and up to 13.7% of children are allergic to vegetables (mostly tomatoes), up to 7.3% are allergic to nuts, 1–3% to wheat and soya (27).

In conclusion, we can say that food allergy and food hypersensitivity are closely associated with country's geographical position, regional living place. For example, children in Scandinavian and Mediterranean countries have more possibilities and availability to eat fish or peanuts than children in Lithuania. While in Lithuania we have congenial conditions to grow, sell, buy and consume fruits, vegetables and dairy, therefore these foods are more likely to become allergens to a part of our society.

CONCLUSIONS

1. Fruits and berries (24.6%), and mostly citrus fruits (7.8%) were the most common foods that caused clinical symptoms among children. Other important problematic foods were milk and dairy (19.4%), chocolate (10.9%), egg (7.4%).

2. Fruits and berries were also the most common foods that caused clinical symptoms among adults

(33.3%); other important foods were nuts (19.6%), vegetables (11.8%), chocolate (9.8%).

3. Meat, crustaceans, cereals were foods that caused clinical symptoms least to children and adults (≤2.0%).

4. In Lithuania, there are congenial conditions to grow and consume fruits, vegetables and dairy, therefore these foods are more likely to become allergens to some part of the society.

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Andrius Kavaliūnas, Genė Šurkienė,
Rūta Dubakienė, Rimantas Stukas, Kęstutis Žagminas

NEPAGEIDAUJAMAS REAKCIJAS SUKELIANTYS MAISTO PRODUKTAI: EUROPREVALL TYRIMO REZULTATAI

Santrauka

Tyrimo tikslas. Siekta išsiaiškinti, kokie maisto produktai dažniausia sukelia nepageidaujamas reakcijas.

Tyrimo medžiaga ir metodika. Vilniaus universitetas kartu su daugeliu kitų mokslinių tyrimų centrų Europoje dalyvavo Europos Sąjungos finansuojamame projekte EuroPrevall (angl. *The Prevalence, Costs, and Basis of Food Allergy across Europe*). Įgyvendinant šį projektą Lietuvoje, anoniminės anketinės apklausos būdu buvo apklausti 4 333 Vilniaus miesto pradinių mokyklų 1–4 klasių mokiniai, gautos 3 084 užpildytos anketos (atsako dažnis – 71,2 %); taip pat apklausti suaugę asmenys – tyrime sutiko dalyvauti 2 634 iš 3 985 (atsako dažnis – 66,1 %).

Rezultatai. Daugiausia nepageidaujamų reakcijų vaikams sukelia vaisiai ir uogos (24,6 %), nemažai – pienas ir jo produktai (19,4 %), taip pat šokoladas (10,9 %), kiaušiniai (7,4 %).

Dažniausi maisto produktai, sutrikdantys suaugusiųjų sveikatą, buvo vaisiai ir uogos (33,3 %), riešutai (19,6 %), daržovės (11,8 %) ir šokoladas (9,8 %). Mėsa, vėžiagyviai, grūdiniai produktai retai sukėlė sveikatos sutrikimų tiek vaikams, tiek suaugusiesiems (≤2,0 %).

Išvados. Dažniausi maisto produktai, sukeliantys nepageidaujamas reakcijas, įvairiose pasaulio šalyse ir regionuose skiriasi. Alergija maistui yra labai susijusi su amžiumi, mitybos įpročiais šeimoje ir tradicijomis visuomenėje, kultūra, religija, todėl lygindami kitų šalių miestų šiuos rezultatus, galime rasti tiek panašumų, tiek skirtumų. Lietuvoje palankiausios sąlygos auginti ir valgyti vaisius, daržoves, pieną ir jo produktus, todėl jie dažniau ir tampa alergenais.

Raktažodžiai: maisto produktai, nepageidaujamos reakcijos, padidėjęs jautrumas, alergija maistui