FEATURES OF FOOD ALLERGY IN HOT CLIMATE CONDITIONS AND CROSS ALLERGIC REACTIONS TO FOOD

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Abstract. *Clinical manifestations of food allergy cover a wide range of diseases of the gastrointestinal and respiratory tract, skin. One of the manifestations of food allergy is oral allergy syndrome (OSAS), associated with pollen sensitization. Homologous proteins found in plant foods cause allergic reactions in target organs. The main principle of diet therapy for food allergies is the elimination of allergens and allergen components specific to the region and individually for each patient.*

Key words: *food allergy, food allergens, syndrome of cross-reactivity, immunoglobulin E, fungi.*

ОСОБЕННОСТИ ПИЩЕВОЙ АЛЛЕРГИИ В ЖАРКИХ КЛИМАТИЧЕСКИХ УСЛОВИЯХ И ПЕРЕКРЕСТНЫХ АЛЛЕРГИЧЕСКИХ РЕАКЦИЙ НА ПИЩЕВЫЕ РЕАКЦИИ

Аннотация. *Клинические проявления пищевой аллергии охватывают широкий спектр заболеваний желудочно-кишечного и респираторного тракта, кожи. Одним из проявлений пищевой аллергии является синдром оральной аллергии (СОАС), связанный с пыльцевой сенсибилизацией. Гомологичные белки растительной пищи вызывают аллергические реакции в органах-мишенях. Основным принципом диетотерапии при пищевой аллергии является устранение аллергенов и компонентов аллергенов, специфичных для региона и индивидуально для каждого больного.*

Ключевые слова: *пищевая аллергия, пищевые аллергены, синдром перекрестной реактивности, иммуноглобулин Е, грибы.*

INTRODUCTION

Food allergy (FA) is a widespread disease with prevalence ranging from 0.1% to 50% in the population. Clinical symptoms of FA cover a wide range of diseases of the skin, gastrointestinal tract and respiratory tract, among which one of the most common is OAS associated with sensitization to pollen. OAS is characterized by homology of thermolabile proteins of plant pollen, fresh fruits, and vegetables.

An understanding of the characteristic clinical presentation can help with diagnosis. Diagnostic testing is highly sensitive and often identifies clinically irrelevant sensitization. Testing therefore must be selected and interpreted in the context of the patient's clinical history. Prognosis varies depending on the food allergen, and food allergy is a risk factor for other atopic diseases [3].

Pollen-food allergy syndrome or oral allergy syndrome (OAS) is a common disorder in which oral symptoms, pruritus is a common disorder in which oral symptoms, itching of the throat and occasionally mild oral edema occur immediately upon the ingestion of certain foods, most commonly raw fruits and vegetables, but also certain nuts, e.g. hazelnuts and peanuts can trigger these symptoms. These complaints are due to specific IgE antibodies directed to

aeroallergens that cross-react with certain food proteins. It is often useful to perform skin tests with fresh fruits and vegetables to confirm the diagnosis, and component protein testing for hazelnut (Cor a 9 and 14) and peanut (Ara h 8) will identify IgE to the birch pollen cross-reactive protein, Bet v 1 [1].

OAS is an allergic reaction in the oral cavity subsequent to the consumption of food, such as fruits, nuts, and vegetables, which occurs in adults who suffer from allergic rhinitis. Here we investigate the prevalence and triggers of birch pollen-related food allergy. It has been described under various names including «pollen-food allergy syndrome», «pollen-food syndrome» and «pollen-associated food allergy syndrome» [8, 9, 11].

MATERIALS AND METHODS

OAS in adults probably represents the most common allergic reaction caused by food; and more than 60% of all FA are actually cross-reactions between food and inhaled allergens. Unlike other food allergies, OAS is a reaction limited to the oral mucosa, lips, tongue, and throat. OAS belongs to the allergy type I group, that is, allergic reactions mediated by immunoglobulin E (IgE). In susceptible patients, the immune system produces IgE antibodies against the proteins of pollen which causes hay allergy. Pollen allergies are caused by repeated exposure to the pollen of some plants, which are usually pollinated by air and have such pollen quantities that inhalation of the pollen easily reaches the surface of the pulmonary alveoli. The proteins which are structurally similar to pollen are also found in food [8, 11, 16].

The OAS, more common in adults and adolescents, presents symptoms mainly affecting the oropharynx, and depends on a polysensitization to inhalant and food allergens. Rawapple, peanuts, almonds, hazelnuts, and other fruits of the Rosaceae family are commonly implicated in patients with allergy to birch, while banana, kiwi, and melon are the eliciting foods in patients allergic to ambrosia, and melon and tomato are responsible for symptoms ingrass allergy patients. In this phenotype, the IgE against pollen cross-reacts with homologous proteins in plant foods [10].

Clinical symptoms of FA cover a wide range of diseases of the skin, gastrointestinal tract and respiratory tract, among which one of the most common is OAS associated with sensitization to pollen. OAS is characterized by homology of thermolabile proteins of plant pollen, fresh fruits, and vegetables. Thus, 23-76% of patients with allergic rhinitis in different countries have a history of allergy symptoms to at least one food, and more than half of patients with OAS suffer from intolerance to more than two types of plant foods. In European countries, 70% of patients with sensitization to birch pollen have OAS associated with the consumption of fruits from the Rosaceae family, such as apples, peaches and pears. In this regard, the high prevalence of cross-reactivity to food of plant origin in patients with OAS dictates the need to develop innovative diagnostic methods and an algorithm for providing medical and preventive care.

Today allergy is a global public health problem and needs to be addressed both at the level of individual countries and the world community. It should be noted that the diagnostic value of immunological tests in vitro diagnostics is quite high and amounts to 87-90%, the information content of skin tests with food allergens is only 49% [15].

According to foreign authors, all allergens, including household, pollen, fungal, food allergens are divided into 130 protein families, depending on the functional properties and the similarity of the amino acid sequence. Currently, more than 130 allergenic molecules are available for in vitro diagnostics of specific immunoglobulin E (IgE) [14, 18].

The aim of the study was to study important allergens characteristic of the country, identify hidden allergens and interpret the results for the diagnosis of type I allergic reactions. It is known that the molecules of allergens differ depending on the biological function as well as the structure of the protein families. Some molecules have common epitopes (antigen binding sites), and IgE antibodies can bind to allergen molecules that have identical structures. Their origin can be different, the identification of allergens, with cross-reactivity is of great importance and will give clinicians information about the sensitization of the patient's body to different allergens.

Having information about which molecules of allergens the patient is sensitized to, it is possible to predict the tendency to develop a systemic or local reaction and the persistence of clinical symptoms. The high prevalence of allergic diseases in our republic dictates the development of innovative diagnostic methods, which have a particular social and medical significance.

In the clinics of the republic, after a detailed analysis of the anamnesis, clinical symptoms of patients with allergic diseases (Food Allergy, Allergic rhinitis, Bronchial asthma, Atopic dermatitis) at the age of 1-75 years (n=161) in order to study important allergens characteristic of the country, determine hidden allergens, for further choice of an appropriate diet, specific IgE was determined. antibodies to food, vegetable, professional (latex), household and fungal allergens typical for our region.

RESEARCH RESULTS

All patients were examined by immunoblotting test to determine the sensitivity to food allergens. Of the 161 patients, the control group consisted of 74 (46%) patients who received negative results, the study group consisted of 87 patients. 1/3 of the patients were men, and 2/3 were women.

In 16 (9.9%), monosensitization was noted, they observed sIgE antibodies to one food allergen, while in 71 (44.1%) polysensitization was observed, in which sensitivity was observed to two or more food allergens.

Of 161 adult patients (aged 1–75 years) who consulted an allergist, 10 (6.2%) had allergic reactions to chicken meat, 6 (3.7%) had FA to chicken meat and egg protein, 3 (1.9%) had no adverse reactions to food.

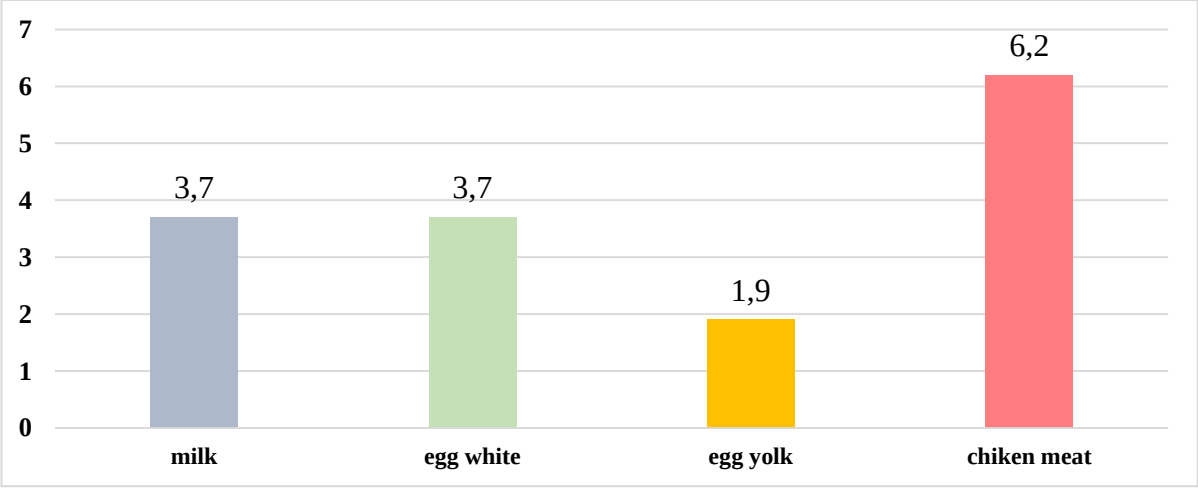

Figure 1. Allergic reactions to food allergens of animal origin (n=161, %)

Among the widespread allergens are fruits from the Rosaceae family: peaches, apples, pears, apricots, strawberries and other trees with stone fruits. Allergy to apples in many patients is combined with allergy to birch pollen due to the identity of their allergenic proteins, symptoms of damage to the oral cavity and pharynx are mainly observed, sometimes it can be accompanied by allergic rhinitis, bronchial asthma and gastrointestinal disorders. As the test results showed, the patients showed cross-reactions between Rosaceae group allergens: strawberries (14.3%), peaches (15.5%), apples (18.6%), apricots (19.3%).

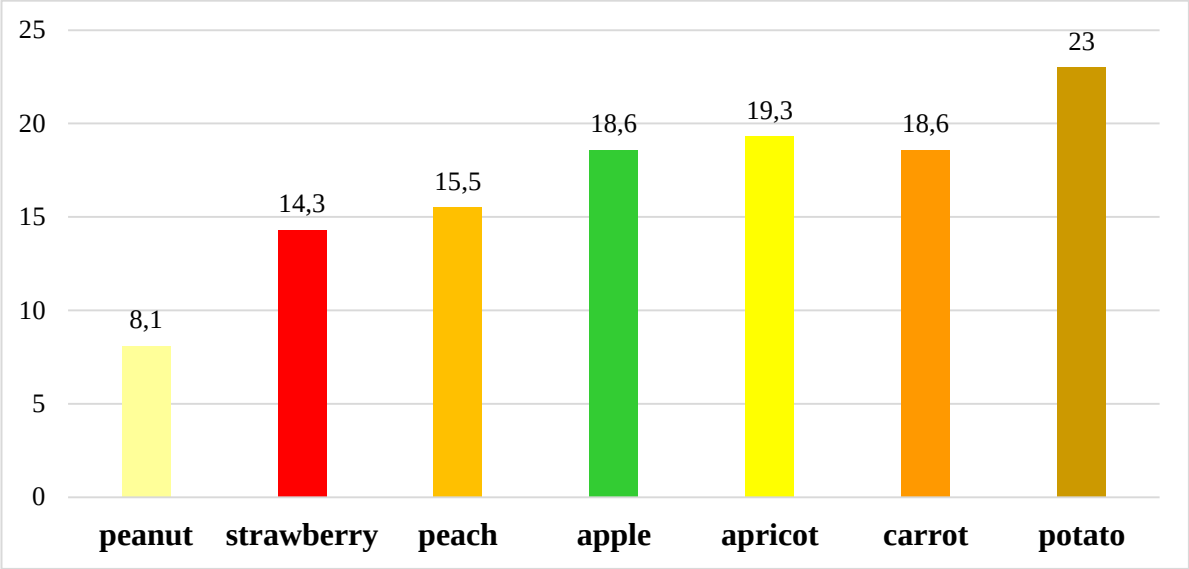

Figure 2. Vet V 1 homology (n=161, %)

Allergic reactions were caused by apiaceae: carrot (18,6%), solanaceae (23%).

In addition, we detected IgE antibodies to peanuts (8.1%), walnuts (14.3%) and sunflower seeds (11.8%). These allergens characterized storage proteins.

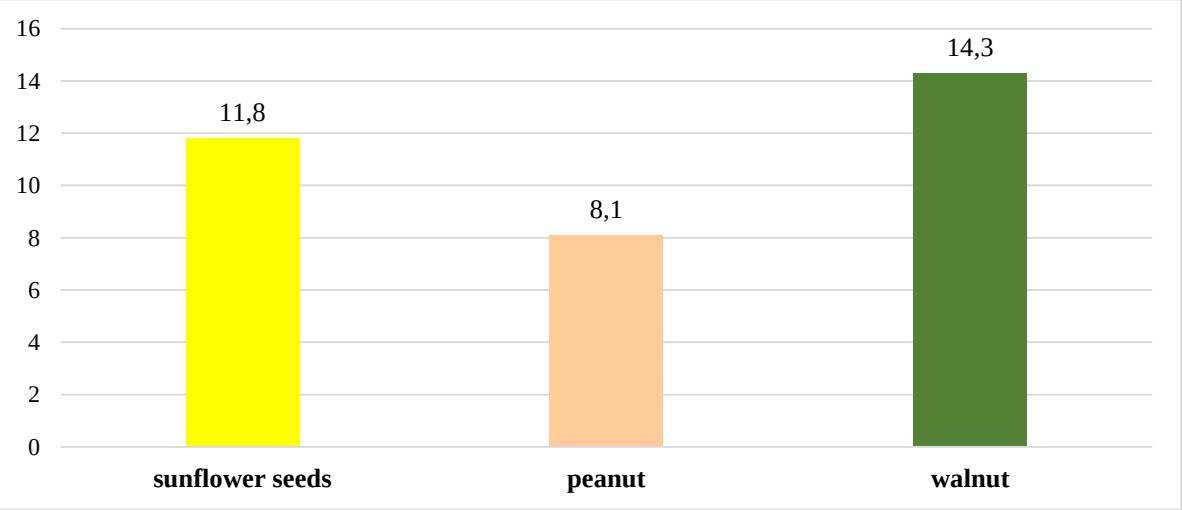

Figure 3. Storage proteins (n=161, %)

Mushroom allergens include about 350 species of fungi that have been found to have allergic properties. Fungi are eukaryotic, single- or multicellular organisms that exist as

saprophytes or parasites of plants and animals. The structure of fungal spores differs from pollen spores, since the inhalation particles of fungi consist of living cells capable of growing and secreting allergens in vivo [4].

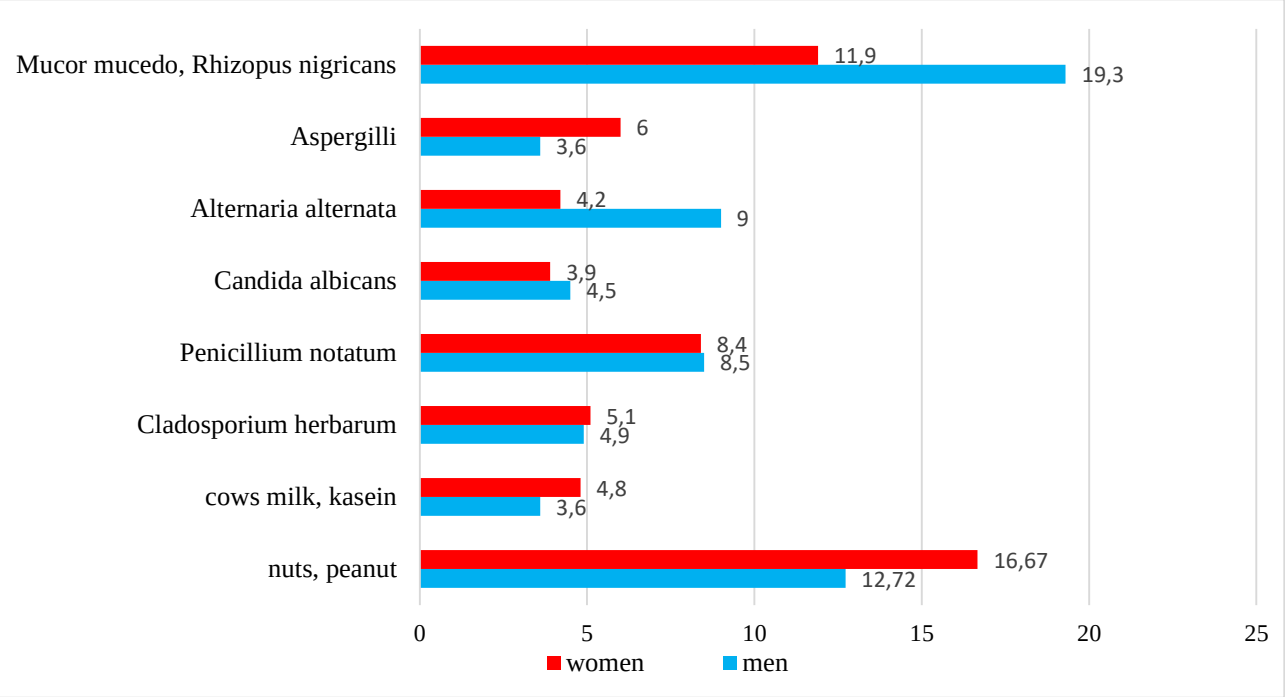

Figure 3. Allergik reactions to fungi and food (n=558, %, P<0,05)

In patients aged 18-75 years, sensitivity to food allergens of animal origin (cow's milk) and vegetable origin (nuts, peanuts) as well as fungi was found. Families of fungi that are widespread in our climate are now known, which give cross-reactions and cause sensitization in patients with AD. Of all the data obtained in the republic for positive results on RAST within the range of 1-6, the largest percentage of fungi was found for Mould fungi: Mucor mucedo, Rhizopus nigricans (avg 14,9%), and also sIgE indices were detected for fungi: Penicillinum notatum (avg 8.4%), Alternaria alternata (avg 6.1%), Cladosporum herbarum, Aspergilus nigrus (avg 5%), Candida albicans (avg 4.1%). The patients had clinical signs in the form of allergic rhinitis, conjunctivitis, contact dermatitis, urticaria, bronchial asthma.

DISSCUSSION

According to foreign authors, individuals with allergies to Rosaceae, especially in the case of sensitization to PR-10 proteins (apple - Mal d 1, peach - Pru p 1) or profilins (peach - Pru p 4), more often have a local reaction, because these proteins are destroyed by high temperatures and digestive enzymes. Sensitization to lipid transfer (LTP) proteins (peach - Pru p 3), characterized by clinical manifestations of a different nature (asymptomatic course, anaphylaxis), as a rule, is a marker of anaphylaxis, which is provoked by other factors (physical activity, medication, wheat, etc.) [13].

In patients with pollen allergies, cross-reactivity between airborne allergens and food can cause FA. Symptoms can range from oral allergy syndrome to severe anaphylaxis. Clinical manifestations associated with IgE sensitization to cross-reactive components of aeroallergens and food allergens have been characterized for many plant sources (pollen-food syndromes and

associations, such as birch-apple, cypress-peach and celery-mugwort-spice syndromes, and mugwort-peach, mugwort-chamomile, mugwort-mustard, ragweed-melon-banana, goosefoot-melon associations), fungal origin (*Alternaria*-spinach syndrome), and invertebrate, mammalian or avian origin (mite-shrimp, cat-pork, and bird-egg syndromes) [7].

Global climate changes have affected the amount of pollen, its allergenicity, and the duration of the dusting season. The use of new technologies in the food industry has radically changed the concept of the composition of a particular product. Animal products may contain plant allergens (for example, sausages may contain soy proteins, spices, etc.) [12].

Prior to OAS, sensitization to pollen containing proteins homologous to certain fruits and vegetables often develops. In such a case, a pollen sensitive patient may react to a food allergen without first contacting it. For example, sensitization to birch pollen can be combined with OAS after eating Rosaceae, especially apples, peaches and cherries. In practice, cases are described about cross-reactions between latex and banana, avocado, peach, kiwi, apricot, grapefruit, pineapple.

There is cross-reactivity among the carrots, walnuts, peanuts, celery, apples, cherries, pears, buckwheat and pollen of birch; watermelon, banana, sunflower seeds, honey and chamomile with ragweed pollen. Watermelon, oranges, cherries, potatoes provide cross reaction with pollen of grasses. This is called «pollen-fruit» syndrome. Celery can cause both oropharyngeal symptoms and system reactions like urticaria, asthma and anaphylactic shock.

The tactics of prescribing an elimination diet, which takes into account the exclusion of causally significant allergens from the patient's diet, primarily depends on the timely diagnosis of causal allergens, the severity of clinical symptoms, and the patient's age. Establishing the «culprit» - allergen and knowing its ability to cross-reactivity, resistance to heat treatment, as well as the correct determination of the appropriateness and duration of elimination of the allergen is an important task of the nutritionist-allergist.

In our country, the diagnosis of allergic diseases is difficult due to the lack of unified methodological approaches and standardized diagnostic methods to determine the mechanisms of allergy development. It should be noted that pseudo-allergic reactions are often clinically identical with allergic ones, but there are differences in their mechanisms. So, during pseudo-allergic reactions, specific antibodies are not formed, the reaction depends on the dose of the food product consumed and, unlike allergic reactions, is triggered at the first contact.

The same problem can arise with two well-known types of FA; wheat-dependant exercise induced anaphylaxis and allergy to non-specific Lipid Transfer Protein allergens, both of which might only manifest when linked to a cofactor such as exercise. Many of these risk factors for food anaphylaxis have a common link; the public's engagement with popular concepts of health and fitness. This includes the development of a food and exercise culture involving the promotion and marketing of foods for their health-giving properties i.e., meat substitutes, wheat substitutes, supplements and alternative, or “natural” remedies for common ailments. Some of these foods have been reported as the cause of severe allergic reactions, but because they are often viewed as benign unlikely causes of severe allergic reactions, could be considered to be hidden allergens [17].

Allergenic proteins can contain linear or conformational epitopes or be heat stable or heat labile. Food allergens can be modified by food processing or are affected by specific methods of

cooking, which can denature the protein or, conversely, render a protein more allergic through various known chemical pathways [5].

Among the allergenic proteins of animal origin, the most clinically significant are caseins and lipocalins: the main milk allergens, a family of protease inhibitors, and calcium-binding proteins: parvalbumin, the dominant fish allergen [2].

As you know, milk and its processed products are widely used in the confectionery industry. Thermally stable milk protein casein enhances moisture retention in sweets and candies, in melted dairy products it improves crust color and strength, milk proteins serve as a whipped marshmallow base. Casein and caseinates are often used as salad dressings, fillers and spices in sausages, soups and stews, sauces, and ice cream [4]. Some food products (cow's milk, peanut, egg) contain several epitopes, ensuring their allergenicity. Increased sensitization to chicken eggs, especially chicken protein, is a widespread problem that affects 1-2% of children worldwide. Mainly 4 egg allergens: ovomucoid, ovalbumin, ovotransferrin and lysozyme cause hypersensitivity in patients [6].

Meat is a histamine liberator, rarely causes allergies, consumption in large quantities can lead to the development of pseudo-allergic reactions, possibly due to the effect on mast cells by a non-specific mechanism. The antigenic composition of the meat of different animals differs, therefore, in patients with beef allergy, chicken, pork and lamb meat may not cause an allergy. Lamb is considered a mild food allergen, but shares common allergens with beef and sheep wool. The allergenic potential of meat is reduced by heating and by exposure to pepsin. This variant of sensitization in the determination of simultaneously specific IgE (sIgE) antibodies to egg and chicken meat in medicine is called the «bird-egg» syndrome.

Patients who are allergic to chicken meat may react to meat from other birds such as turkey. Albumin of different animals has a high degree of structural similarity and in the presence of hypersensitivity to albumin of one species of animal, patients may react to the epithelium and meat of other animals [4]. Haptens, which can combine with other dietary proteins, can also become complete allergens. When the immune barrier of the gastrointestinal tract is disturbed, a huge amount of antigens can enter the body. With the normal functioning of the gastrointestinal tract and the hepatobiliary system, sensitization to food supplied by the enteral route does not develop [6].

When determining specific antibodies of the IgE class, the nature of allergic food intolerance is confirmed, which makes it possible to compile a list of products that are contraindicated for patients. Eating an appropriate diet is considered the primary way to truly prevent food allergies. In our republic, the main food allergens include cow's milk, eggs, cereals, gluten, peanuts, nuts, sesame seeds, buckwheat, celery. However, individual selection of the most likely food allergens for testing should be based on the patients' specific diet.

Based on the above, the development of dietary rations, considering the climatic features of patients with food allergies, the component composition and allergenic properties of foods, with the help of modern methods of diagnosis becomes actual and perspective. After determining the cause-significant allergens, it is recommended that they be completely eliminated from the patient's diet. It is necessary to avoid skin, inhalation ways of getting these allergens into the body of sensitized patients. The diet should be strictly individual and it is necessary to make a diet, being guided by the anamnesis, clinical symptoms, age of the patient taking into account cross reactions between allergens.

Thus, we can conclude that the creation of dietary rations taking into account the climatic properties of the region, the individual characteristics of patients with food allergies, the component composition and allergenic properties of food products using modern diagnostic methods is becoming relevant and promising. Attention should be paid to the fact that the diet should be strictly individual and when compiling it, it is necessary to be guided by the history, clinical symptoms, age of the patient, taking into account cross-allergic reactions between different groups of allergens. For all patients, there cannot be a single «standard» elimination diet.

CONCLUSION

Based on the above, the development of diet, considering the climatic features of patients with food allergies, the component composition and allergenic properties of food, with the help of modern methods of diagnosis become actual and perspective.

As a result of many years of research, we have recommended a list of «guilty» food products with high allergenic activity in our republic, such as cow's milk, eggs, cereals, gluten, peanuts, nuts, sesame seeds, buckwheat and celery. Due to the fact that these food products have major allergenic components, the problem of managing latent allergens and their labeling is an urgent task of medicine.

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