

## FOOD ALLERGIES AND EGG ALLERGENS

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Allergies are the immune system's inadequate or exaggerated reaction to substances which, in most cases, do not lead to symptoms. The symptoms of allergic diseases can appear as a consequence of chemical substances getting in contact with skin, inhaling of dust, pollen (or other substances) or after the ingestion of certain kinds of food (egg, milk, peanut, hazelnut, soybeans, cereals, fish, crustaceans and Sulphite in concentrations of 10 mg/kg or more).

Allergy to eggs is caused by the immune system's reaction to some proteins in eggs (Gal d 1, Gal d 2). Egg allergy appears mainly, in children and it is the second most important food allergy. Two factors are necessary for a food allergy to occur – genetic predisposition and exposure to the food. The seriousness of reactions to eggs varies from mild to life-threatening, depending on the person and the amount of egg eaten.

The used methods to detect allergens are: Rapid tests, Enzyme-Linked Immunosorbent Assay, Electrophoresis techniques, Immunoblotting technique.

EC Legislation about food allergens is very important and food producer according to this are obligate to labeling all the ingredients they are used.

*Key words:* Food allergies; Food intolerance; Allergens; Food quality; Egg and derivatives.

### INTRODUCTION

Food allergies affect almost any individual at some point. These types of allergies affect a percentage of 6% to 8% in the case of children, but only 2% of the adults. Prone to food allergies appear are especially people with atopic field, which means that they have an inherited tendency towards developing allergic. Food allergy is mediated by immune system. An allergic reaction to food usually begins within minutes but may be delayed 2–4 hours, usually lasts then one day<sup>(1)</sup>.

Food intolerance is also an abnormal reaction to certain kinds of food and its symptoms can be similar to those of food allergies, but they are not mediated by the immune system. Nevertheless, food intolerance is much more widespread than food allergies; it develops in a variety of body reactions<sup>(2)</sup>.

### The Allergy Mechanism

If someone is allergic the organism will react in an exaggerated manner to a harmless allergen treating it as if it were a serious threat. Actually, the immune system is responsible for this false alarm. The immune system, by producing a large number of antibodies typical for a certain allergen called **Immunoglobulin type E (IgE)**, releases its protective reaction. These antibodies get attached to certain body. The next time when the organism gets in touch with an allergen, these in turn get attached to antibodies in the shape of a key. This bond leads to the releasing of inflammatory substances throughout the body: histamines, prostaglandins, etc. These substances, including histamines, move towards certain parts of the body such as the breathing system causing allergic symptoms: sneezing, eye itching, coryza, etc. Allergy

exposure at a time when the immune system is weak (viral infections, pregnancy and puberty) can contribute to allergy development. Women are more prone to allergies than men. Allergic symptoms can be diminished by aging, but can only rarely disappear altogether.

The allergic symptoms and their intensity depend on the type of allergen, on the organs affected, the level of sensitivity and the individual reaction to allergies; for instance, bronchitis, asthma, cyanosis, fever, hay fever, nausea, vomiting/regurgitation, sneezing. The allergic rhinitis acts similar to a common cold or sinusitis; food allergies lead to nausea, regurgitation.

### FOOD ALLERGENS IN EGG AND DERIVATES

Some foods provoke allergic reactions because they contain some kind of proteins. The most common allergy, especially in children till twelve months is eggs allergy. The egg allergy is not one of that who is tending to be life-long – such as peanuts allergy, it usually disappears after five to seven years.

Both the white and the yolk of eggs content of numerous proteins which are potentially allergenic, although white eggs cause more reactions than yolk ones.

In picture below is shows the structure of egg.

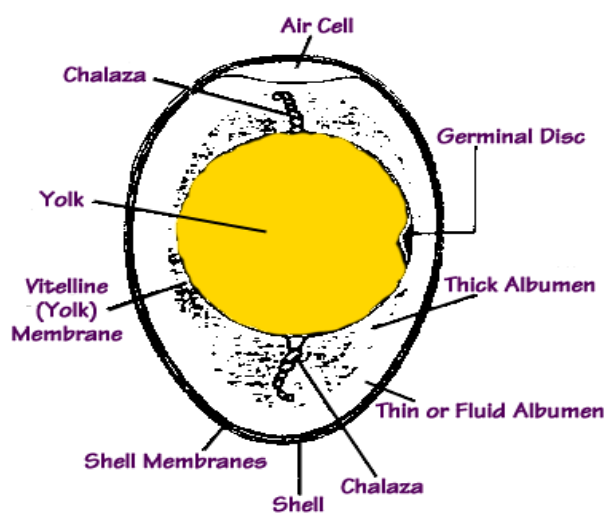


Fig 1. The egg structure.

The chemical structure of the egg (Table 1) is depending of species, race and the ways of harming<sup>3</sup>.

Table 1

The chemical structure of the white and the yolk egg

Components	The white, %	The yolk, %
Water	88	48
Proteins	10.5	16
Lipids	0.03	34
Glucids	0.8	0.9
Ash	0.7	1.1

The proteins found in white egg are presenting bellow (Table 2).

Table 2

The proteins in white egg

Proteins	Content in white egg, %
Ovalbumin	54
Conalbumin	13
Ovomucoid	11
Globulins	8
Ovomucin	3.5
Lysozyme	3.5
Ovoglycoprotein	1.0
Ovomacroglobulin	0.5
Ovoflavonoprotein	0.8
Ovoinhibitor	1.5
Avidin	0.5

The strong antigens in the white egg are four proteins: ovomucoid, ovalbumin, conalbumin and lysozyme.

Ovomucoid is also called *Gal d 1* and ovalbumin is known *Gal d 2* are the most common target of immune- system attack.

The yolk egg contains also a several potential antigens: livetin, lipovitelin and fosfovitin.<sup>4</sup>

From person to person eggs allergy are different aspects. For a person it's possible to react only to a protein in the yolk but it's easily to tolerate egg whites, or vice versa. For adds the reaction came when they eat entire egg. For the moderate allergy, foods with small traces of egg can be eaten, but those with more eggs (mayonnaise) may be avoid.<sup>5</sup>

There are some people who even with a small trace of egg can develop a severe allergy – anaphylaxis. To prevent anaphylaxis they must use EpiPen immediately.

A small number of people who are allergic to eggs can develop an allergy to poultry meats.<sup>6</sup>

In some people white egg provoke a non-allergic response, named **egg white intolerance**. In this case these proteins from white egg are implicated in the release of histamine. This mechanism is classified as a *pharmacological reaction* with a response in the gastrointestinal tract and is considered a *food intolerance*. Symptoms may include abdominal pain, diarrhea.<sup>5</sup>

## REGULATIONS IN THE EU FOR ALLERGENS IN EGG AND DERIVATES AND LABELLING

As one of the eight most common food allergens, eggs are covered by current labeling regulations that require the presence of eggs to be marked on labels in bold print and clear. This can provide an added measure of security when labels are unclear.

It is important for the human health even to label the traces of eggs.

New food allergen labeling rules were introduced by Directive 2003/89/EC. This directive obliges food manufactures to indicate the potential allergens by reference the source of allergen at any level if they are used as an ingredient.

Than the Directive 2007/68/EC establishes a new list of food ingredients which must be indicated on the label of foodstuffs as they are likely to cause adverse reaction in susceptible individuals, the eggs and their products are included.

In Romanian law regarding the labeling of foodstuffs is the Government Decision nr. 751/2008 which is equivalent of *Annex III a* from EU Directive 2007/68/EC.

**Foods which may contain egg are:** egg substitutes, egg shampoo, ice creams *e.g.*, vanilla cream, seasonings and natural flavors may contain egg proteins which are not labeled as egg, bread, cakes, desserts, baked goods with glazes, coffee, yellow baked goods; shiny glaze on baked goods; white chocolate, broths and homemade wines and homemade root beer; lecithin is usually from soy, but occasionally may be from egg.

## TESTING METHODS FOR SPECIFIC ALLERGENS FOR EGG

Testing methods have been developed that can now detect these allergens in finished products at very low levels.

Rapid tests are the new challenge in the future. They detect the food allergen and provide a quick and definitive result that allows manufacturers to dispose of or relabeled contaminated products before they are released. It also alerts them to areas of their processing facilities that need to be decontaminated or to production lines that need to be used for other products.

Other techniques such electrophoresis and immunoblotting are use to separate or detect proteins (allergens) from foods.

Using electrophoresis technique we can identify allergen proteins from products which are analysed. The proteins are compared with a marker- MK (Fig.1).

Immunoblotting techniques use antibodies to identify target proteins among a number of unrelated protein species. They involve the identification of protein target through antigen-antibody specific reactions (Fig. 2).

Techniques such as the Enzyme Linked Immunosorbent Assay (ELISA) and Polymerase Chain Reaction (PCR) can detect levels of these contaminants at concentrations in the low parts mg/Kg, (ppm) ranges.

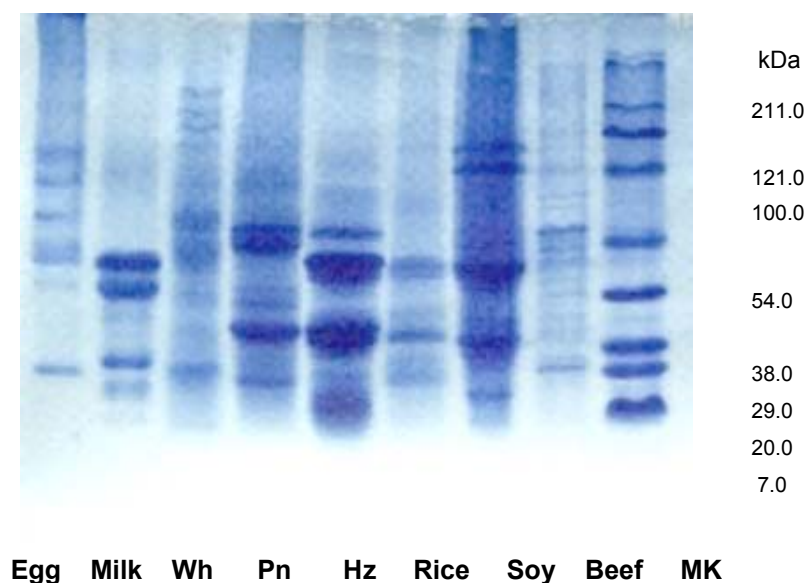


Fig. 2. Image of SDS-PAGE for some allergenic foods.

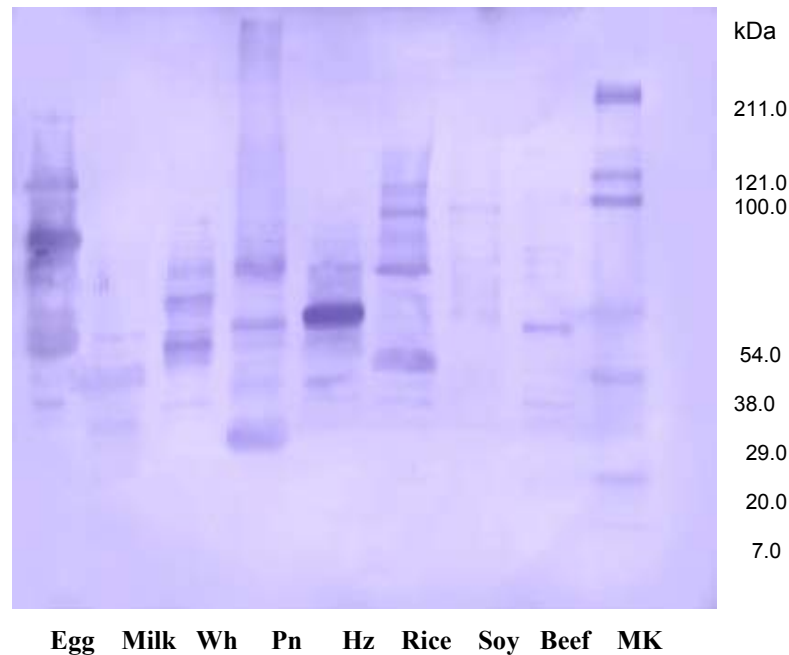


Fig. 3. Immage of immunobloting for some allergenic foods.

ELISA methods detect the actual allergen protein molecule by binding antibodies to the allergen and then using an enzyme linked conjugate to create a colorimetric change that can be measured. The measurement is made photometrical at nm values indicated for kit. The absorbance is proportional to the egg (white) proteins concentration of the sample. Before that we made the calibration curve.

PCR methods, which are more sensitive and detect the DNA molecules of these allergens, can be used in raw and cooked products and are not affected by the heating process because DNA typically remains intact after being exposed to the cooking temperatures of most foods.

## CONCLUSIONS

With today's higher automatic processing, additional contaminants such as food allergens are becoming an increasingly important issue in food safety.

A major cause for concern is the use of processing lines for multiple products during manufacturing and packaging. If certain types of food products such as eggs, and eggs derivatives are processed on the same lines as foods that are meant to be free of these ingredients, there is a risk that these agents could contaminate products.

For the safety of the food allergic people, the labeling of products which contain or may contain eggs is very important.

We considered that all Food Laboratories conducts testing for all eight allergen groups using especially ELISA which is a sensitive method, a qualitative and fast determination with very good performance criteria.

Raw, finished and cooked products can now be analyzed for most common allergens including milk, egg, fish, gluten, soy, and various types of nuts.

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## REFERENCES

1. National Institutes of Health (2005), *NIAID Allergy Statistics 2005* <http://www.niaid.nih.gov/factsheets/allergystat.htm>
2. Carina Venter; Isabel Skypala (2009). *Food Hypersensitivity: Diagnosing and Managing Food Allergies and Intolerance*. Wiley-Blackwell. pp. 129–131. ISBN 1-4051-7036-0.
3. Constantin Banu (2009). *Foods Technology*, Ed. ASAB, Bucuresti, p252, ISBN 978-973-7725-67-.
4. Thomas Platts-Mills; Ring, Johannes (2005). *Allergy in Practice*. Berlin: Springer. p. 106. ISBN 3-540-00219-7.
5. Antony Ham Pong (2008), *Egg allergy information*. British Egg Information Service. [www.nutritionandeggs.co.uk](http://www.nutritionandeggs.co.uk),
6. Li, Shu Jie (2005). "Structural details at active site of hen egg white lysozyme with di- and trivalent metal ions". *Biopolymers* 81 (2): 74–80. doi:10.1002/bip.20367