

Anaphylaxis in an Eight-year-old Boy Following the Consumption of Poppy Seed

Short title: Anaphylaxis to Poppy Seed in a Child

Kowalczyk A¹, Kuczyńska R¹, Żbikowska-Gotz M², Bartuzi Z², Krogulska A¹

¹Department of Paediatrics, Allergology and Gastroenterology, Ludwik Rydygier Collegium Medicum Bydgoszcz, Nicolaus Copernicus University Torun, Poland

²Department of Allergology, Clinical Immunology and Internal Diseases, Ludwik Rydygier Collegium Medicum Bydgoszcz, Nicolaus Copernicus University Torun, Poland

Corresponding Author:

Agnieszka Kowalczyk

Department of Pediatrics, Allergology and Gastroenterology CM Bydgoszcz, NCU Torun

ul. M. Curie Skłodowskiej 9, 85-094 Bydgoszcz, Poland

[E-mail: a.kowalczyk@cm.umk.pl](mailto:a.kowalczyk@cm.umk.pl)

This article has been accepted for publication and undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as doi: 10.18176/jiaci.0493

Keywords: Anaphylaxis. Poppy seed. Food allergy. Child. Molecular diagnosis.

Palabras clave: Anafilaxia. Semillas de amapola. Alergia alimentaria. Niño. Diagnóstico molecular.

The seeds of the poppy (*Papaver somniferum*) are traditionally used as ingredients in cakes, bread and for garnishing, and are rarely considered as a cause of food allergy [1]. Among seeds, hypersensitivity reactions are most commonly observed against sesame, with 0.1-0.2% of the world's population being allergic. In contrast, little data exists regarding poppy hypersensitivity. The side effects associated with poppy seed consumption concern the gastrointestinal tract, the skin and the respiratory system [2]. Anaphylactic reactions are also possible, particularly for patients with concomitant allergy to hazelnuts and pollens. Poppy seeds can induce both immunological and non-immunological hypersensitivity [3]. Physical effort may act as a reaction cofactor [4].

The aim of the present article is to raise awareness of poppy seed anaphylaxis in children. It is also the first case study which confirmed the sensitization to a 2S albumin from poppy seeds by means of molecular diagnosis tests.

An eight-year-old boy was admitted to our Department following two incidents of anaphylaxis experienced after consuming products containing poppy seeds. The first incident occurred at the age of six years; a few minutes after biting into a poppy seed cake, the child experienced generalized urticaria, runny nose, sneezing, conjunctival redness, wheezing and shortness of breath. The second incident occurred two years later, when the same symptoms were observed a few minutes after consuming a poppy seed roll. His medical history revealed that he had periodically reported discomfort in the mouth and redness of the conjunctiva after eating chocolate. Laboratory tests indicated increased concentration of tIgE (733 kU/L) and asIgE for poppy seeds (28.3 kUA/L) by ImmunoCAP (Tab.1). Sensitisation to hazelnut (9.6 kUA/L), soybean (0.91 kUA/L), sesame seed (3.4 kUA/L) and alder pollen (1 kUA/L) were also demonstrated. Prick-by-prick SPT was positive for fresh poppy seeds extracted in liquid nitrogen. Molecular diagnostics using the ALEX test identified the presence of asIgE for poppy extract (13.17 kUA/L), Pap s 2S Albumin (2.31 kUA/L) and nut extract, as well as pumpkin, sunflower and sesame seeds. Component diagnostics performed using the ISAC method identified allergy to hazelnut Cor a 9,

sesame seed Ses i 1 and soybean Gly m 6 (Tab.2). Based on the history and research results, anaphylaxis to poppy seeds was diagnosed.

Few descriptions of anaphylactic reactions to poppy seed have been published, especially those regarding children (Tab.3). Such reactions usually result from the consumption of poppy seeds, although a case of anaphylaxis has also been described following inhalation [5]. Contact urticaria and swelling of the face after contact with a poppy flower (*P.rhoeas*) have also been demonstrated in the absence of allergy to poppy seed [6].

The course of poppy allergy can vary from mild oral allergy syndrome (OAS) to anaphylactic reactions. Panasoff et al. describe the case of a 17-year-old boy who experienced anaphylactic reactions in the form of "acute abdominal pain" with generalized urticaria and hypotension after eating poppy seed cake. The authors emphasize that only a trace amount of allergen was responsible for the symptoms [7]. Similarly, the anaphylactic reactions observed in the present patient occurred after only one bite of cake.

As in the most of described cases and opposite to Kutting et al. in our patient, physical effort was not found to be cofactor of reaction after ingestion of poppy seed [1,3,5-7].

Hazelnut allergy is commonly found to co-occur in patients with poppy seed allergy [1,3-5,7,8], and was also identified in our patient.

Among the previous descriptions of the methods used to diagnose poppy allergy, only Oppel et al. used an oral food challenge (OFC) with ground poppy seed [1]. Our case report is the first to describe the use of molecular diagnostics in the setting of making a diagnosis of an allergy to poppy seeds.

The best known allergens of poppy seeds are Pap s 1, Pap s 2 and pap s 34 kD, but there is also data that supports the possible role of other allergenic molecules, like 2 S albumin [3,9]. The main poppy allergen is believed to be a 45 kD glycoprotein which, due to its homologous structure, may cross-react with Betv1. Poppy seed also displays cross-reactivity with proteins present in wheat, rye flour, buckwheat, sesame, rice and kiwi [2-3]. Varga et al. described a patient allergic to a 11S globulin who experienced an anaphylaxis to buckwheat and showed symptoms of OAS after ingesting poppy seed [8]. The presence of antibodies produced through contact with buckwheat or hazelnut allergens may cause a cross-reaction with the 11-S poppy globulin. It is also possible that the antibodies raised against 2S of poppy albumin may also cross-react with prolamines of other seeds, nuts and legumes. Asero et al. showed cross - reactivity between sesame and poppy protein

extracts (to proteins with molecular mass of 10-12 kDa) and suggested that the major sesame allergens Ses i 1 or a Ses i 2 may cross react with poppy seed 2 S albumin [10]. Although not yet registered in the official allergen database IUIS, a poppy seed 2S albumin is included in the ALEX microarray. It's important to notice that in the ALEX macroarray we can assess only sensitization to the whole poppy seed extract and to 2S albumin. It's possible that our patient may be sensitized to other poppy seed allergens, since the sIgE to the whole extract in ALEX was 13.17 kU/l, while to Pap s 2S was only 2.31 kU/l.

For the patient we described, the primary responsible allergen was considered to be poppy seed. Both the ImmunoCAP ISAC study and the ALEX study detected the presence of antibodies to the hazelnut 11S globulin Cor a 9, which is a marker of primary sensitization and is responsible for systemic reactions. However, the antibody concentration was low, and the boy had consumed hazelnut products on several occasions, reporting only OAS and minor conjunctival redness.

Although rare, allergy to poppy seed is often rapid, generalized and potentially life-threatening; exposure to poppy seeds should therefore be considered as a causative agent in the diagnosis of anaphylaxis.

Funding

There is no funding sources for the study.

Conflict of interest

There is no conflicts of interest.

References:

1. Oppel T, Thomas P, Wollenberg A. Cross-sensitization between poppy seed and buckwheat in a food-allergic patient with poppy seed anaphylaxis. *Int Arch Allergy Immunol*. 2006; 140: 170-3.
2. Patel A, Bahna SL. Hypersensitivities to sesame and other common edible seeds. *Allergy*. 2016; 71: 1405-13.
3. Jensen-Jarolim E, Gerstmayer G, Kraft D, Scheiner O, Ebner H, Ebner C. Serological characterization of allergens in poppy seeds. *Clin Exp Allergy*. 1999; 29: 1075-9.
4. Kutting B, Brehler R. Exercise-induced anaphylaxis. *Allergy*. 2000; 55: 585-6.
5. Keskin O, Sekerel BE. Poppy seed allergy: A case report and review of the literature. *Allergy Asthma Proc*. 2006; 27: 396-8.
6. Gamboa PM, Jauregui I, Urrutia I, Gonzalez G, Barturen P, Antepará I. Allergic contact urticaria from poppy flower (*Papaver rhoeas*). *Contact Dermatitis*. 1997;37:141
7. Panasoff J. Poppy seed anaphylaxis. *J Investig Allergol Clin Immunol*. 2008; 18: 224-5.
8. Varga EM, Kollmann D, Zach M, Bohle B. Anaphylaxis to buckwheat in an atopic child: A risk factor for severe allergy to nuts and seeds? *Int Arch Allergy Immunol*. 2011;156: 112-6.
9. Moreno FJ, Clemente A. 2S Albumin Storage Proteins: What Makes them Food Allergens? *Open Biochem J*. 2008;2:16-28.
10. Asero R, Mistrello G, Roncarolo D, Antoniotti PL, Falagiani P. A case of sesame seed-induced anaphylaxis. *Allergy*. 1999;54:526-7.

Tab. 1. Sensitization to poppy seed in the described case, using different methods.

ALLERGEN TEST							
SPT ¹		asIgE ^{2,3}		CRD ⁴			
Allergen extract	Diameter (mm)	Allergen extract	Concentration (kUA/l)	Allergen			Concentration (kUA/L)
Poppy seed	7 mm	Poppy seed ²	28.3	Poppy seed ⁴	Pap s 2S Albumin	2S albumin	2.31
		Poppy seed ³	13.17				

¹ SPT – skin prick test with native allergen - prick by prick method, histamine diameter-3 mm, negative control diameter-0 mm

² asIgE – allergen specific IgE assay by ImmunoCAP, allergen extract

³ asIgE ALEX; MacroArrayDX, Wien, Austria – allergen extracts (kUA/L)

⁴ CRD – component-resolved diagnosis: ALEX; MacroArrayDX, Wien, Austria – allergens (kUA/L)