Anaphylaxis in an 8-Year-Old Boy Following the Consumption of Poppy Seed

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The seeds of the poppy (*Papaver somniferum*) are traditionally used as ingredients in cakes and bread and for garnishing and are rarely considered a cause of food allergy [1]. The most common hypersensitivity reactions to seeds are those induced by sesame, with 0.1%-0.2% of the world's population being allergic. In contrast, few data are available regarding hypersensitivity to poppy seeds. The adverse effects associated with poppy seed consumption affect the gastrointestinal tract, the skin, and the respiratory system [2]. Anaphylactic reactions may occur, particularly in patients with concomitant allergy to hazelnuts and pollens. Poppy seeds can induce both immunological and nonimmunological hypersensitivity [3], and physical effort may also be a cofactor in reactions [4].

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

An 8-year-old boy was admitted to our department following 2 incidents of anaphylaxis after consuming products containing poppy seeds. The first incident occurred at the age of 6 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 2 years later, when the same symptoms were observed a few minutes after consuming a poppy seed roll. The patient's medical history revealed that he had periodically reported discomfort in the mouth and redness of the conjunctiva after eating chocolate. Laboratory tests (ImmunoCAP ISAC) indicated an increased concentration of tIgE (733 kU/L) and sIgE for poppy seeds (28.3 kU_A/L) (Table). Sensitization to hazelnut (9.6 kU_A/L), soybean (0.91 kU_A/L), sesame seed (3.4 kU_A/L), and alder pollen (1 kU_A/L) were also demonstrated. The result of prick-by-prick testing was positive for fresh poppy seeds extracted in liquid nitrogen. Molecular diagnostics using the ALEX test identified the presence of sIgE for poppy extract (13.17 kU_A/L), Pap s 2S albumin (2.31 kU_A/L), and nut extract, as well as pumpkin, sunflower, and sesame seeds. Component-resolved diagnostics performed using the ISAC method identified allergy to hazelnut Cor a 9, sesame seed Ses i 1, and soybean Gly m 6 (Supplementary Table 1). Based on the clinical history and test results, the patient was diagnosed with anaphylaxis to poppy seeds.

Few descriptions of anaphylactic reactions to poppy seed have been published, especially those regarding children (Supplementary Table 2). Such reactions usually result from oral ingestion, 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 (*Papaver 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 to anaphylactic reactions. Panasoff [7] reported 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 author emphasized that only a trace amount of allergen was responsible for the symptoms. Similarly, the anaphylactic reactions observed in the present patient occurred after only 1 bite of cake.

As in most case reports [1,3,5-7] and in contrast with Kutting and Brehler [4], in the present case, physical effort

Table. Sensitization to Poppy Seed in the Present Case Assessed Using Different Methods

Allergen Test							
SPT[a]		asIgE[b,c]		CRD[d]			
Allergen Extract	Diameter	Allergen Extract	Concentration, kU_A/L		Allergen		Concentration, kU_A/L
Poppy seed	7 mm	Poppy seed[b]	28.3	Poppy seed[d]	Pap s 2S Albumin	2S albumin	2.31
		Poppy seed[c]	13.17				

Abbreviations: SPT, skin prick test; asIgE, allergen specific IgE; CRD, component-resolved diagnosis.
[a]Prick by prick method, histamine diameter 3 mm, negative control diameter 0 mm.
[b]ImmunoCAP, allergen extract.
[c]ALEX, MacroArrayDX (extracts, kUA/L).
[d]ALEX; MacroArrayDX (allergens, kUA/L).

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was not found to be a cofactor of reaction after ingestion of poppy seed.

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

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

The best-known allergens of poppy seed are Pap s 1, Pap s 2, and Pap s 34 kD, although reported data also support the possible role of other allergenic molecules, such as 2S albumin [3,9]. The main poppy allergen is believed to be a 45-kD glycoprotein, which, owing to its homologous structure, may cross-react with Bet v 1. Poppy seed also displays cross-reactivity with proteins present in wheat, rye flour, buckwheat, sesame, rice, and kiwi [2-3]. Varga et al [8] reported the case of a patient allergic to an 11S globulin who experienced anaphylaxis to buckwheat and showed symptoms of oral allergy syndrome after ingesting poppy seed. 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 prolamins of other seeds, nuts, and legumes. Asero et al [10] reported cross-reactivity between sesame and poppy protein extracts (molecular mass, 10-12 kDa) and suggested that the major sesame allergens Ses i 1 or a Ses i 2 may cross react with poppy seed 2S albumin [10]. Although not yet registered in the official allergen database IUIS, a poppy seed 2S albumin is included in the ALEX microarray. It is noteworthy that in the ALEX macroarray, we can assess only sensitization to the whole poppy seed extract and to 2S albumin. The patient in the present report may by sensitized to other poppy seed allergens, since sIgE to the whole extract in ALEX was 13.17 kU/L, whereas sIgE to Pap s 2S was only 2.31 kU_A/L.

In the case we report, the main culprit allergen was 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 patient had consumed hazelnut products on several occasions, reporting only oral allergy syndrome and minor conjunctival redness.

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

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Conflicts of Interest

The authors declare that they have 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, Antepara 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.

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Supp Tab. 1. Type of sensitization observed in the described case.

ALLERGEN TEST							
SPT[1]		**asIgE[2,3,4]**		**CRD[5,6]**			
Allergen extract	Diameter (mm)	Allergen extract	Concentration (kUA/l)	Allergen			Concentration (kUA/L)[5] Level (ISU-E)[6]
Food allergens							
Poppy seed	7 mm	**Poppy seed[3]**	**28.3**	**Poppy seed[5]**	**Pap s 2S Albumin**	**2S albumin**	**2.31**
		Poppy seed[4]	**13.17**	Hazelnut[5]	Cor a 9	11S gobulin	0.51
		Peanut[2]	0.47		Cor a 11	7S globulin	0.48
		Hazelnut[2]	**9.60**	**Sesame seed[5]**	**Ses i 1**	**2S albumin**	**18.1**
		Banana[2]	0.25	**Soybean[5]**	**Gly m 6**	**11S globulin**	**1.74**
		Soybean[2]	**0.91**	Hazelnut[6]	Cor a 9	11S globulin	0.40
		Sesame seed[2]	**3.40**	**Sesame seed[6]**	**Ses i 1**	**2S albumin**	**4.60**
		Egg white[2]	0.18	**Soybean[6]**	**Gly m 6**	**Glycinin**	**4.60**
		Sesame seed[3]	**16.8**				
		Pumpkin seed[4]	**24.4**				
		Sesame seed[4]	**9.44**				
		Sunflower seed[4]	**4.55**				
		Buckwheat[4]	**2.16**				
		Cashew nut[4]	**5.61**				
		Brrazil nut[4]	**5.65**				
		Pistachio[4]	**4.18**				
		Almond[4]	**3.87**				
		Walnut[4]	0.52				
		Macadamia[4]	0.37				
		Hazelnut[4]	0.87				
		Soybean[4]	0.68				
		Chickpeas[4]	0.68				
		Oat[4]	**4.80**				
		Quinoa[4]	0.92				

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Airborne allergens			
	Birch pollen[2]	0.25	
	Gray alder pollen[2]	**1.00**	

[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 Polycheck (bold ≥-0.7 kUA/l, i.e. ≥ class 2)
[3] asIgE – allergen specific IgE assay by ImmunoCAP (bold ≥-0.7 IU/ml, i.e. ≥ class 2)
[4] ALEX; MacroArrayDX, Wien, Austria – allergen extracts (kUA/L) (bold ≥ 1 kUA/l i.e. medium/high/very high)
[5,6] CRD – component-resolved diagnosis:
[5] ALEX; MacroArrayDX, Wien, Austria – allergens (kUA/L) (bold ≥ 1 kUA/l i.e. medium/high/very high)
[6] ImmunoCAP ISAC kits; Thermo Fisher Scientific, U.S. – allergens (ISU-E) (bold ≥-0.9 ISU-E, i.e. medium/ high/very high)

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Supp Tab. 2. Poppy seed allergy - summary of published case reports.

References according to year of publication	**Child**	**Adult**	**Symptoms**	**Atopy**	**Poppy seed**	
					SPT*	**asIgE****
Kalyoncu AF, et al. Allergy to poppy seed. Allergy 1993;48:295.		27 y ♀	breathing difficulties, swelling of throat	+	+	+ class 5
Vocks E, et al. Common allergenic structures in hazelnut, rey grain, sesame seeds, kiwi, and poppy seeds. Allergy. 1993;48:168-172.	15 y ♂		angioedema of the glottis, anaphylactic shock.	+	+	+
	11 y ♂		vomiting, diarrhea, angioedema of the face	+	+	+
		33 y ♀	generalized urticaria	+	+	+
		19 y ♂	angioedema of lips and palpebrae	+	+	+
		25 y ♀	asthma, angioedema of the glottis, anaphylactic symptoms	+	+	+
Gamboa PM, et al. Allergic contact urtricaria from poppy flower (Papaver rhoeas). Contact Dermatitis 1997;37:141		20 y ♂	Reaction past contact with poppy flower (P. rhoeas) - contact urtricaria, facial oedema	+	+ (with poppy flower extract)	+ class 3 (poppy flower) - (poppy seed)
Jensen-Jarolim E, et al. Serological characterization of allergens in poppy seeds. Clin Exp Allergy. 1999;29:1075-9.	5 y ♀		OAS, exacerbation of AD, cough	+	+	3,00 PRU/ml
	8 y ♂		OAS, exacerbation of AD, rhinoconcjunctivitis	+	+	52,5 PRU/ml
	10 y ♂		asthma, exacerbation of AD	+	+	24,3 PRU/ml
	12 y ♀		OAS, urtriacaria	+	+	26,6 PRU/ml
	15 y ♂		vomiting, exanthema, wheezing	+	+	3,30 PRU/ml
	16 y ♀		OAS, urtricaria, pruritus	+	+	4,30 PRU/ml
		28 y ♂	OAS, vomiting, abdominal pain, diarrhoea, flush	+	-	18,1 PRU/ml
		29 y ♂	anaphylaxis, eczema, exacerbation of AD	+	+	11,7 PRU/ml
		30 y ♂	OAS, abdominal pain, nausea, rhinitis, wheezing	+	-	7,00 PRU/ml
		39 y ♂	OAS, rhinoconjuctivitis, pruritus	+	-	40,8 PRU/ml
		40 y ♀	OAS, nausea, wheezing, pruritus	+	+	90,2 PRU/ml

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Kutting B, et al.. Exercise-induced anaphylaxis. Allergy. 2000;55:585-6.		46 y ♂	generalized urtricaria (eating poppy seed cake in combination with physical exercise)	-	+	13,4 kUA/l
Frantzen B, et al. Immediate-type allergy caused by poppy seed. Allergy. 2000;55:97–98.		52 y ♀	epigastric pain, angioedema, respiratory distress	-	+	1,69 IU/ml
Bant A, i in. Hypersensitivity to poppy seeds. Wiadomości Lekarskie. 2005;7–8:447-50.		21 y ♀	abdominal pain, nausea, vomiting, urtricaria, angioedema	+	+ (codeine sulfate)	-
		31 y ♂	urtricaria, angioedema, laryngeal edema, dyspnea, fall in blood pressure	-	+ (codeine sulfate)	+ class 2
Keskin O, et al. Poppy seed allergy: A case report and review of the literature. Allergy Asthma Proc. 2006;27:396-8.	16 y ♂		angioedema, urtricaria, pruritus, rhinorrhea, sneezing, cough, wheezing, dyspnea, erythema, conjunctivitis,	+	+	3,36 kUA/l
Oppel T, et al. Cross-sensitization between poppy seed and buckwheat in a food-allergic patient with poppy seed anaphylaxis. Int Arch Allergy Immunol. 2006;140:170-3.	17 y ♀		nausea, heat sensation, abdominal pain, dyspnea	-	+	287 kUA/l
Panasoff J. Poppy seed anaphylaxis. J Investig Allergol Clin Immunol. 2008;18:224-5.	17 y ♂		acute abdominal pain, diffuse urtricaria, low a blood pressure, tingling and burning sensation in mouth	-	+	28,4 kUA/l

* in cases where SPT was performed with allergens other than poppy seeds, the name of the test allergen is given in brackets

** the methods used to identify asIgE against poppy allergens differed from case to case; the given values are consistent with the described method

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