

Allergen Data Collection:**Watermelon** (*Citrullus lanatus*)

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Abstract

Watermelon is a member of the gourd family, Cucurbitaceae, which is cultivated in the Mediterranean area as well as in tropical and subtropical areas worldwide. Allergy to watermelon is most frequently associated with symptoms of the oral allergy syndrome. Nevertheless cutaneous and respiratory symptoms, and even anaphylaxis have been reported. A taxonomic association of sensitization is likely between different members of the Cucurbitaceae family, which also includes melon, cucumber, pumpkin, and zucchini). Moreover, sensitization to ragweed pollen is high in watermelon allergic subjects.

Several IgE-binding proteins with molecular masses between 15 and 90 kDa have been identified. Cross-reactivities of watermelon to cucumber, zucchini, carrot, celery, and ragweed pollen have been documented.

The present data collection reviews detailed information on the prevalence and symptoms of allergy to watermelon as well as diagnostic features, and the occurrence of cross-reactivities in tabular form. (Internet Symposium on Food Allergens 2001, 3(3):153-58)

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Disclaimer

The reference lists of the Allergen Data Collections are based mainly on searches of Medline and FSTA (Food Science & Technology Abstracts) databases up to the related dates of publication. The scientific rigor of the studies listed is variable and not subject of critique or evaluation by the authors or the editor of the Allergen Data Collections. The reader should be aware of considerable problems in comparing data from different studies (eg. patient cohorts, diagnostic performances, possible flaws in allergen preparations and methodologies for allergen characterization) and is encouraged to review the original publications.

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1 Prevalence of Watermelon Allergy

It is difficult to do an estimation of prevalence of watermelon allergy due to differences in study populations (latex allergy, pollen allergy, food allergy, fruit allergy, etc.), differences in dietary habits, geographical areas, or differences in diagnostic procedures. Prevalence data are based on different diagnostic procedures. While the prevalence of sensitization can be estimated by SPT, RAST, and immunoblot, a clinical relevant sensitization (allergy) is evaluated by convincing history or food challenge tests (ideally by DBPCFC).

1.1 Subjects with Atopic or Other Diseases

Country / Subjects	Allergy / Sensitization	References
Italy, Florence 54 episodes of food-dependent anaphylaxis in 44 children (age of 1 month to 16 years) (from 1994-1996)	watermelon 1.9%	Novembre et al. 1998
Italy, Genoa 132 pollen and food sensitive patients	watermelon 0.7% (self-reported)	Troise et al. 1992
Italy, Milan 262 fruit and/or vegetable allergic patients	watermelon >5% and <10% (clinical history)	Ortolani et al. 1988
Italy, Milan 100 fruit and/or vegetable allergic patients	watermelon 4% (clinical history)	Ortolani et al. 1989
Spain, Madrid 19 patients with confirmed allergy to melon	watermelon 32% (DBPCFC or convincing episode of anaphylaxis)	Rodríguez et al. 2000
Spain, Madrid and Toledo Patients with allergy to <i>Rosaceae</i> fruits a) 11 without pollinosis (mean age 26 years) b) 22 with associated pollinosis (mean age 22 years)	watermelon a) 0% and b) 18% (Clinical history and SPT and/or RAST)	Fernandez-Rivas et al. 1997
Spain, Plasencia (Caceres) a) 262 patients with pollinosis b) 24 melon allergic patients	a) watermelon 3.8% (self-reported) b) watermelon 33% (SPT)	Garcia-Ortiz et al. 1995
Spain, Salamanca 57 fruit allergic patients (age of 6-56 years, mean 21.5)	watermelon 19% (clinical history)	Garcia Ortiz et al. 1998
USA, Rochester, NY a) 2067 allergic patients including b) 1447 with pollinosis c) 90 patients who report symptoms of oral pruritus to melon and/or banana	a) watermelon 2.4% (cause of oral pruritus, interview survey; all cases occurred in subgroup b) c) watermelon 56% (oral pruritus, interview survey)	Anderson et al. 1970
USA, Long Beach, CA 137 patients with latex allergy	watermelon 4.1% (convincing history of possible IgE mediated symptoms occurring within 60 minutes of ingestion)	Kim & Hussain 1999

1.3 Prevalence of Associated Allergies

Country / Subjects	Sensitization / Allergy			References
		RAST	I	
USA, Detroit, MI 192 patients allergic to watermelon, cantaloupe, honeydew melon, cucumber, zucchini, banana, and/or ragweed pollen	watermelon	33%	1.000	Enberg et al. 1987
	cantaloupe	25%	0.896	
	honeydew melon	18%	0.820	
	zucchini	32%	0.873	
	cucumber	22%	0.794	
	banana	13%	0.632	
	ragweed pollen	63%	0.509	
	I: Correlation of specific IgE with watermelon			
USA, Detroit, MI 63 patients sensitive to watermelon	ragweed pollen 95% (RAST)			Enberg et al. 1987

2 Symptoms of Watermelon Allergy

Symptoms & Case Reports	References
<u>Systemic reactions</u> anaphylaxis (5)	(1) Enberg et al. 1987 (2) Jordan-Wagner et al. 1993 (3) Temesvari & Becker 1993 (4) Garcia Ortiz et al. 199 (5) Novembre et al. 1998 (6) Reindl et al. 2000
<u>Symptoms of skin and mucous membranes</u> atopic dermatitis (2), contact urticaria (3), urticaria (2)	
<u>Gastrointestinal symptoms</u> laryngeal edema (2), itching in mouth (1), itching in throat (1), itching of tongue (1), oral allergy syndrome (2, 4, 6), oropharyngeal symptoms (1), swelling of lips (1)	
<u>Respiratory symptoms</u> asthma (6), dyspnea (2)	
Onset of Symptoms Onset of symptoms within 5 min after ingestion lasting from 15 to 120 minutes (26 watermelon allergic patients) (1)	

3 Diagnostic Features of Watermelon Allergy

Parameters / Subjects	Outcome	References
Gender of Patients a) 26 watermelon allergic patients (10 to 71 years of age, mean 34 years) b) 29 watermelon sensitive patients (10 to 67 years of age)	a) 77% of patients were male b) 58% of patients were male; all 6 symptomatic patients were male	Enberg et al. 1987 Enberg et al. 1988
Specific IgE 26 watermelon allergic patients (10 to 71 years of age, mean 34 years)	Watermelon specific IgE: 6.9 +/- 4.2 (units unknown) (control group: 1.02 +/- 0.25)	Enberg et al. 1987
IgE and Clinical Relevance 29 watermelon sensitive patients (with specific serum IgE)	21% of patients were clinically symptomatic	Enberg et al. 1988

IgE, IgG Subtypes 29 watermelon sensitive patients	Neither levels or binding patterns of IgE, IgG ₁ , or IgG ₄ specific for watermelon allergens in IEF-PAGE immunoblot were predictive of symptomatic or asymptomatic subjects	Enberg et al. 1988
IgE and Clinical Relevance 13 patients with clinical symptoms to watermelon, cucumber, carrot, and/or celery	6 patients had detectable specific IgE to one or more of the 4 foods	Jordan-Wagner et al. 1993
SPT, Fresh Food and Commercial Extracts 10 watermelon allergic patients	Positivity in SPT: Fresh food 60% Commercial extract 20%	Garcia-Ortiz et al. 1995

5 Composition of Watermelon

5.1 Distribution of Nutrients (fresh fruit)

For other watermelon products see: [USDA Nutrient Database](#)

Nutrients: Content per 100 g		
Energy 149 kJ (35 kcal) Water 93.2 g Protein 0.6 g Lipid 0.2 g Carbohydrate 7.7 g Fiber 0.2 g Minerals 0.4 g	Fluoride 11 µg Iodine 1 µg	Carbohydrates Glucose 1800 mg Fructose 3500 mg Sucrose 2400 mg
Minerals Sodium 1 mg Potassium 160 mg Magnesium 3 mg Calcium 10 mg Manganese 20-200 µg Iron 400 µg Copper 70 µg Zinc 100 µg Phosphorus 11 mg Chloride 8 mg	Vitamins Carotin 440 µg Vitamin E 50 µg Vitamin B1 45 µg Vitamin B2 50 µg Nicotinamide 150 µg Pantothenic acid 1600 µg Vitamin B6 70 µg Folic acid 5 µg Vitamin C 6 mg	Lipids Palmitic acid 45 mg Stearic acid 9 mg Oleic acid 22 mg Linolic acid 25 mg Linoleic acid 40 mg
	Amino Acids Phe 10 mg Trp 7 mg Tyr 10 mg	Others Salicylic acid 480 µg

Reference: Deutsche Forschungsanstalt für Lebensmittelchemie, Garching bei München (ed), **Der kleine "Souci-Fachmann-Kraut" Lebensmitteltable für die Praxis**, WVG, Stuttgart 1991

5 Allergens of Watermelon

Proteins / Glycoproteins	Allergen Nomenclature	References
Allergens: 15, 28, 29, 30, 37, 40, 70, and 90 kDa		Jordan-Wagner et al. 1993

6 Isolation & Preparation

Extract / Purified Allergens	Methods	References
Protein extract	Fresh watermelon was diced, liquified in a blender, and centrifuged	Enberg et al. 1987
Protein extract	Fresh watermelon without rind and seeds was blenderized, added to ammonium hydrogencarbonate buffer (1:1, v/v), and stirred overnight at 4°C; afterwards centrifuged, filtered, dialyzed, frozen and freeze-dried	Jordan-Wagner et al. 1993

7 Cross-Reactivities

Cross-Reacting Allergens	Subjects / Methods	References
Watermelon: (fruits, vegetables, pollen) cucumber, carrot, celery, and mountain cedar pollen	Pooled serum from 6 patients allergic to watermelon, cucumber, carrot, and/or celery: <u>EAST inhibition</u> Almost identical inhibition curves of IgE binding between the 4 foods as inhibitors or solid phase bound extracts; lower maximal inhibition of 60 to 70% by mountain cedar pollen; <u>immunoblot inhibition</u> Mutual inhibition of IgE binding to a 15 kDa allergen present in all 4 food extracts and inhibition of all other IgE binding proteins by all food extracts with the exception of a 28 kDa allergen in watermelon (which was detected by only one serum in SDS-PAGE immunoblot); no inhibition by mountain cedar pollen extract	Jordan-Wagner et al. 1993
Watermelon: (vegetables) zucchini	4 zucchini allergic patients: Approximately 45% inhibition of IgE binding by watermelon extract to zucchini extract with 2 sera (EAST inhibition) With 2 sera most of zucchini proteins above 29 kDa were inhibited by watermelon extract; with 1 serum 2 zucchini proteins with approximately 15 kDa were inhibited completely by watermelon extract (immunoblot inhibition)	Reindl et al. 2000
Watermelon: (pollen) ragweed pollen	Pooled serum from watermelon allergic patients: Strong inhibition of IgE binding to watermelon extract by ragweed pollen extract and vice versa, but significant differences in slopes of inhibition curves of watermelon and ragweed pollen indicating only partial identity of allergens (RAST inhibition) 6 watermelon allergens with identical pI to ragweed allergens were detected (IEF-PAGE immunoblot)	Enberg et al. 1987

* multiple sensitization (not proven by inhibition-tests)

8 Allergen Sources

Reported Adverse Reactions	References
Food / Food additives After ingestion of fresh fruits (1)	(1) see 2 Symptoms of Watermelon Allergy

10 References

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