Allergen Data Collection:
Melon *(Cucumis melo)*

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Abstract

Melon belongs to the gourd family, Cucurbitaceae, which also includes watermelons, cucumbers, and zucchini. Melons are cultivated worldwide in warmer regions and greenhouses. Most common varieties are honeydew, cantaloupe, and muskmelon. IgE-mediated reactions to melon are most frequently seen in pollen allergic subjects. In particular an association between ragweed pollinosis and allergy to melon and banana has been reported. In almost 90% of cases seasonal rhinitis, asthma, or both preceeded the first reaction to melon. In contrast, sensitization to melon occurred primary to latex sensitization in fruit allergic subjects. The spectrum of symptoms ranges from local symptoms as part of the oral allergy syndrome, which is most frequent in melon allergic subjects, to systemic symptoms including anaphylaxis.

To date there has only been a very small number of studies on melon allergens. IgE-binding proteins with molecular masses of 14 kDa, 31 kDa, and above 40 kDa have been identified.
The present data collection reviews detailed information on the prevalence and symptoms of melon allergy as well as diagnostic features, and the occurrence of cross-reactivities in tabular form.
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1 Prevalence of Melon Allergy

It is difficult to do an estimation of prevalence of melon 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
France, Paris a) 24 patients with latex and pollen allergy b) 20 patients with latex allergy (no pollen allergy) c) 25 patients with pollen allergy (no latex allergy)	clinical symptoms SPT a) melon in 0% and 38% b) melon in 5% and 5% c) melon in 4% and 32%	Levy et al. 2000
France, Pierre Benite 580 patients with adverse reactions to food (study period 1984-92)	melon 11% (RAST)	Andre et al. 1994
Germany 136 latex allergic patients	melon 19% (RAST) melon 5.8% (self-reported)	Brehler et al. 1997
Italy, Genoa 132 pollen and food sensitive patients	melon 2.2% (self-reported)	Troise et al. 1992
Italy, Milan 262 fruit and/or vegetable allergic patients	melon 16% (clinical history)	Ortolani et al. 1988
Italy, Milan 100 fruit and/or vegetable allergic patients	melon 7% (clinical history)	Ortolani et al. 1989
South Africa, Cape Town 112 children with atopic dermatitis (age of 5 months to 13 years)	melon 3.4% (questionnaire)	Steinman & Potter 1994
Spain, Madrid 29 plant-derived food allergic patients	melon 38% (SPT)	Diez-Gomez et al. 1999
Spain, Madrid 95 pollen allergic patients	melon 14% (skin test) melon 7.4% (oral challenge test)	Cuesta-Herranz et al. 2000
Spain, Madrid and Toledo Patients with allergy to *Rosaceae* fruits a) 11 without pollinosis (mean age 26 years) b) 22 with associated pollinosis (mean age 22 years)	melon a) 0% and b) 50% (clinical history and SPT and/or RAST)	Fernandez-Rivas et al. 1997
Spain, Pamplona 7 patients with latex- fruit syndrome	melon 50% (SPT) melon 14% (clinical history)	Latasa et al. 1995
Spain, Plasencia (Caceres) 262 patients with pollinosis	melon 9.1% (self-reported)	Garcia-Ortiz et al. 1995

Spain, Salamanca a) 57 fruit allergic patients (age of 6-56 years, mean 21.5) b) 30 subjects with positive SPT and/or RAST to muskmelon.	a) muskmelon 58% (clinical history and SPT and/or RAST) b) muskmelon 10% (reporting symptoms)	Garcia Ortiz et al. 1998
Sweden, Halmstad / Malmö a) 380 birch pollen allergic patients b) 103 patients without birch pollen allergy	a) melon 3% b) melon 2% (questionnaire)	Eriksson et al. 1982
Switzerland, Vaudois 111 patients with pollen- associated food allergy	melon 40% (RAST)	Bircher et al. 1994
Switzerland, Zurich 383 food allergic patients (study period 1990-94)	melon 2.9% (clinical history, diagnostic tests)	Etesamifar & Wüthrich 1998
USA, Rochester, NY a) 2067 allergic patients including b) 1447 with pollinosis	Percentage in group a) melon and/or banana 4.2% cantaloupe 3.6% honeydew melon 1.7% (cause of oral pruritus, interview survey) all cases occurred in subgroup b)	Anderson et al. 1970

1.2 Prevalence of Associated Allergies

<table>
<tr><th>Country / Subjects</th><th>Sensitization / Allergy</th><th>References</th></tr>
<tr><td>Spain, Madrid
10 children sensitized to melons</td><td>pollen approximately 90% (SPT)</td><td>Crespo et al. 1995</td></tr>
<tr><td>Spain, Plasencia (Caceres)
24 melon allergic patients (age of 8-50 years, mean of 23 years)</td><td><table>
<tr><th>RAST</th><th></th></tr>
<tr><td>grass</td><td>100%</td></tr>
<tr><td>Plantago</td><td>100%</td></tr>
<tr><td>olive</td><td>63%</td></tr>
<tr><td>Chenopodium</td><td>38%</td></tr>
<tr><td>Artemisia</td><td>29%</td></tr>
<tr><td>Parietaria</td><td>29%</td></tr>
<tr><td>Rumex</td><td>17%</td></tr>
<tr><th>SPT</th><th></th></tr>
<tr><td>monosensitized to melon</td><td>46%</td></tr>
<tr><td>watermelon</td><td>33%</td></tr>
</table></td><td>Garcia-Ortiz et al. 1995</td></tr>
<tr><td>Spain, Madrid
19 patients with confirmed allergy to melon</td><td>avocado 37%
banana 37%
kiwi 32%
watermelon 32%
peach 26%
(DBPCFC or convincing episode of anaphylaxis)

asthma / allergic rhinitis 95%
(clinical history and SPT)</td><td>Rodríguez et al. 2000</td></tr>
<tr><td>Spain, Salamanca
33 melon allergic patients</td><td>latex 91% (SPT and/or RAST)
latex 10% (clinical history)</td><td>Garcia Ortiz et al. 1998</td></tr>
</table>

USA, Detroit, MI 192 patients allergic to cantaloupe, honeydew melon, watermelon, cucumber, zucchini, banana, and/or ragweed pollen	<table><tr><th></th><th>RAST</th><th>I</th><th>II</th></tr><tr><td>cantaloupe</td><td>25%</td><td>1.000</td><td>0.849</td></tr><tr><td>honeydew melon</td><td>18%</td><td>0.849</td><td>1.000</td></tr><tr><td>watermelon</td><td>33%</td><td>0.896</td><td>0.820</td></tr><tr><td>zucchini</td><td>32%</td><td>0.897</td><td>0.835</td></tr><tr><td>cucumber</td><td>22%</td><td>0.807</td><td>0.900</td></tr><tr><td>banana</td><td>13%</td><td>0.664</td><td>0.666</td></tr><tr><td>ragweed pollen</td><td>63%</td><td>0.498</td><td>0.432</td></tr></table>I: Correlation of specific IgE with cantaloupe or II: honeydew melon	Enberg et al. 1987
USA, Detroit, MI a) 48 patients allergic to cantaloupe b) 34 patients allergic to honeydew melon	a) ragweed pollen 96% (RAST) b) ragweed pollen 100% (RAST)	Enberg et al. 1987
USA, Rochester, NY 90 patients who report symptoms of oral pruritus to melon and/or banana	watermelon 56% banana 52% citrus fruits 16% peach, unpeeled 12% tomato 8.9% celery and walnut 6.7%, each cucumber and pear 5.6%, each green pepper, apple, grape, and pineapple 4.4%, each other < 4% (oral pruritus, interview survey) ragweed pollen 100% (SPT, clinical history) prevalence of asthma 78% (control group 47%)	Anderson et al. 1970

2 Symptoms of Melon Allergy

Symptoms & Case Reports	References
Systemic reactions anaphylaxis (5, 8), hypotension (8), systemic reactions (not specified) (1) Symptoms of skin and mucous membranes angioedema (8), urticaria (7), generalized urticaria (8) Gastrointestinal symptoms abdominal pain (4), laryngeal edema (6), lip / mouth angioedema (3), nausea (8), oral allergy syndrome (1, 5, 7, 8), oral itching (2, 4), oral pruritus (3), oropharyngeal symptoms (8), vomiting (8), in general / not specified (3) Respiratory symptoms rhinoconjunctivitis (8), wheezing (8)	(1) Ortolani et al. 1988 (2) Ortolani et al. 1989 (3) Garcia-Ortiz et al. 1995 (4) Latasa et al. 1995 (5) Garcia Ortiz et al. 1998 (6) Asero 2000 (7) Asero et al. 2000 (8) Rodríguez et al. 2000

Percentage of Reactions

Symptoms / Ref.	(1)	(2)	(3)	(4)
Systemic symptoms		2.4%*		
Anaphylaxis				11%
Cutaneous				
Angioedema (facial)				11%
Flare of eczema	1.1%			
Itching hands	1.1%			
Rash	1.1%			
Rhinoconjunctivitis				5%
Urticaria-angioedema	2.2%			
Oral allergy syndrome (OAS)		83%		89%
Isolated OAS				74%
Itching throat	82%			
Oral pruritus			92%	
Swollen lips	3.3%			
Swollen throat	1.1%			
Gastrointestinal			4%	
Angioedema of lips / mouth			8%	
Cramps and diarrhea	7.8%			
Gassiness and indigestion	14%			
Sore mouht or tongue, canker sores	6.7%			
Vomiting	2.2%			
Respiratory				
Hoarseness	2.2%			
Nasal congestion	3.3%			
Wheezing	1.1%			5%
Others				
Itching ears	3.3%			
Headache	1.1%			
No. of patients	90	42	24	19

(1) symptoms to melon (including symptoms to both melon and banana) reported by patients with melon and/or banana
(2) melon allergic patients (extra-oral symtoms in 12%)
* also having oral allergy syndrome
(3) melon allergic patients (age of 8-50 years, mean of 23 years)
(4) patients with confirmed allergy to melon

(1) Anderson et al. 1970
(2) Ortolani et al. 1988
(3) Garcia-Ortiz et al. 1995
(4) Rodríguez et al. 2000

Onset of Symptoms

Onset of symptoms within 5 min after ingestion (1 melon allergic patient, open food challenge) (1)
Onset of symptoms within 30 min after ingestion (17 melon allergic patients, DBPCFC positive) (2)
Onset of symptoms in less than 1 h after ingestion in 2 patients with history of convincing anaphylaxis induced by melon (2)

(1) Ortolani et al. 1989
(2) Rodríguez et al. 2000

Age at Onset of Melon Allergy

Age at onset of ranged from 6 to 45 years (median 27 years) in 19 melon allergic patients (1)

(1) Rodríguez et al. 2000

3 Diagnostic Features of Melon Allergy

Parameters / Subjects	Outcome	References
Primary Sensitization 17 melon allergic patients	Seasonal rhinitis, asthma, or both preceeded the first reaction to melon in 88% of patients	Rodríguez et al. 2000
Primary Sensitization *(latex)* 57 fruit allergic patients	In all patients, clinical symptoms of fruit allergy preceeded latex allergy, fruits mostly associated to latex sensitization: melon, peach, and banana	Garcia Ortiz et al. 1998
IgE and Clinical Relevance 8 latex allergic patients with self-reported melon intolerance	Melon specific IgE (RAST): Sensitivity 38% Specificity 82%	Brehler et al. 1997
SPT, IgE and Clinical Relevance melon allergic patients (positive clinical history)	Positivity in SPT: Fresh food 76% (n=21) Positivity in RAST: 0% (n=7)	Ortolani et al. 1988
SPT, IgE and Clinical Relevance 7 patients with clinical history of melon allergy	Positivity in SPT: Fresh food (prick-to-prick) 43% Positivity in RAST: 0%	Ortolani et al. 1989
Reported Reactions, Food Challenges 53 patients reporting adverse reactions to melon	**Positivity** History of anaphylaxis 4% Open food challenge (n=51) 49% DBPCFC (n=25) 68% Overall clinical reactivity (n=53) 36%	Rodríguez et al. 2000
SPT, IgE and Clinical Relevance a) 53 patients reporting adverse reactions to melon including b) 19 patients with clinical reactivity to melon	**in a)** / **SPT** / **RAST** Positivity 68% 43% Positive predictive value 42% 44% Negative predictive value 77% 70% b) 79% had positive SPT and/or RAST to melon	Rodríguez et al. 2000
IgE, SPT, Fresh Food and Commercial Extracts 24 melon allergic patients (age of 8-50 years, mean of 23 years)	Positivity in SPT: Fresh food 100% Commercial extract 13% Positivity in RAST: 88%	Garcia-Ortiz et al. 1995

4 Therapy of Melon Allergy

Treatment *	Outcome	References
Pollen Immunotherapy A 34-year-old woman with long-standing pollinosis and oral allergy syndrome after ingestion of melon, fennel, and cucumber was treated with two commercial depot aluminium hydroxide-adsorbed extracts of grass pollen, mugwort pollen, and ragweed pollen	After 36 months of specific immunotherapy, the patient tolerated both fresh fennel and cucumber on open oral challenge tests; after 43 months of immunotherapy, the patient tolerated fresh melon as well on open oral challenge; vegetables were reintroduced in her normal diet	Asero 2000

* Studies may be experimental, unproved, or controversial. Please notice the disclaimer !

5 Composition of Melone (Honeydew Melon)

5.1 Distribution of Nutrients (fresh fruit)

For other melon products see: USDA Nutrient Database

Nutrients: Content per 100 g		
Energy 231 kJ (54 kcal) Water 87.0 g Protein 0.9 g Lipid 0.1 g Carbohydrate 12.4 g Organic acids 0.1 g Fiber 1.0 g Minerals 0.4 g **Minerals** Sodium 20 mg Potassium 330 mg Magnesium 10 mg Calcium 6 mg Iron 200 µg Copper 85 µg Zinc 200 µg Phosphorus 20 mg Iodine 1 µg	**Vitamins** Carotin 1750 µg Vitamin E 140 µg Vitamin B1 60 µg Vitamin B2 20 µg Nicotinamide 600 µg Pantothenic acid 230 µg Vitamin B6 55 µg Biotin 2 µg Folic acid 30 µg Vitamin C 30 mg **Amino Acids** Lys 20 mg Met 4 mg Phe 25 mg Trp 5 mg	**Carbohydrates** Glucose 1600 mg Fructose 1300 mg Sucrose 9500 mg **Lipids** Palmitic acid 22 mg Stearic acid 4 mg Oleic acid 11 mg Linolic acid 13 mg Linoleic acid 2 mg **Others** Malic acid 25 mg Citric acid 75 mg Oxalic acid 0

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

6 Allergens of Melon

Proteins / Glycoproteins	Allergen Nomenclature	References
Allergens: 14, 31, and 40 to 92 kDa		Garcia Ortiz et al. 1996

7 Isolation & Preparation

Extract / Purified Allergens	Methods	References
Protein extract	Fresh fruits (cantaloupe, honeydew melon) were diced, liquified in a blender, and centrifuged	Enberg et al. 1987
Protein extract	Melon was extracted with ammonium bicarbonate buffer (pH 8.5) (ratio 10%, w/v), stirred for 60 min at room temperature, centrifuged, dialyzed, membrane filtered, and lyophilized	Garcia Ortiz et al. 1996

8 Cross-Reactivities

Cross-Reacting Allergens	Subjects / Methods	References
Melon: *(fruits, vegetables)* significant associations to: watermelon and tomato*	262 fruit and/or vegetable allergic patients (clinical history, SPT, RAST)	Ortolani et al. 1988
Melon: *(fruits)* apple	1 patient with apple and pollen allergy: Approximately 95% inhibition of IgE binding to melon extract by apple peel extract (RAST inhibition)	Asero et al. 2000
Melon: *(pollen)* *Dactylis*, *Plantago*, and olive pollen	Maximum inhibition of IgE-binding to melon extract by *Dactylis*, *Plantago*, and olive pollen were 84%, 84%, and 45%, respectively (pooled serum from melon sensitive patients, RAST inhibition)	Garcia-Ortiz et al. 1995
Melon: *(pollen)* *Dactylis* and *Plantago* pollen	IgE-binding to melon allergens almost completely inhibited by grass and *Plantago* pollen extracts; melon extract inhibited IgE-binding to various allergens of *Dactylis* at high Mr and partially to 14 kDa and 40 kDa protein; almost complete inhibition of IgE-binding to *Plantago* extract by melon extract (immunoblot inhibition, 3 sera from patients allergic to melon, and *Dactylis glomerata* and *Plantago lanceolata* pollens)	Garcia-Ortiz et al. 1996
Melon: *(latex)* latex	5 latex allergic patients with melon sensitivity: 81-100% (mean 96%) inhibition of IgE binding to melon allergens by latex extract; 26-100% (mean 55%) inhibition of IgE binding to latex extract by melon extract (RAST inhibition)	Brehler et al. 1997

* multiple sensitization (not proven by inhibition-tests)

9 Allergen Sources

Reported Adverse Reactions	References
Food / Food additives After ingestion of fresh fruits (1)	(1) see 2 Symptoms of Melon Allergy
Overripe Melon Anaphylactic reaction to endogenous ethanol in overripe-melon in a 24 year old woman with history of intolerance to beverages containing ethanol	Mallon & Katelaris 1997

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