Food induced anaphylaxis: In children

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Disclosure

In relation to this presentation, I declare that there are no conflicts of interest.
Contents

- Diagnosis
- Epidemiology
- Management
  - Severity and treatment
  - Risk reduction
- Food-dependent exercise-induced anaphylaxis in children
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4 years old boy developed skin flushing with wheezing and dyspnea immediately after taking Udon noodle in hospital.

Ebisawa M : Food-induced Anaphylaxis and Food Associated Exercise-induced Anaphylaxis, FOOD ALLERGY, ELSEVIER SAUNDERS. 2011 : 113-27
What is anaphylaxis?

Definition
“a serious, life-threatening generalized or systemic hypersensitivity reaction” or “a serious allergic reaction that is rapid in onset and might cause death”

Diagnosis
Anaphylaxis is highly likely when any one of the following three criteria is fulfilled.
1. Acute onset of an illness (minutes to several hours) with involvement of the skin, mucosal tissue, or both (eg, generalized urticaria, itching or flushing, swollen lips-tongue-uvula)

AND AT LEAST ONE OF THE FOLLOWING:
A) Respiratory compromise
   (eg, dyspnea, wheeze-bronchospasm, stridor, reduced PEF, hypoxemia)
B) Reduced blood pressure or associated symptoms of end-organ dysfunction
   (eg. hypotonia collapse, syncope, incontinence)
Clinical criteria for diagnosing anaphylaxis

2. Two or more of the following that occur rapidly after exposure to a likely allergen for that patient (minutes to several hours)

A) Involvement of the skin-mucosal tissue
   (eg, generalized urticaria, itch-flush, swollen lips-tongue-uvula)
B) Respiratory compromise
   (eg, dyspnea, wheeze-bronchospasm, stridor, reduced PEF, hypoxemia)
C) Reduced blood pressure or associated symptoms
   (eg, hypotonia collapse, syncope, incontinence)
D) Persistent gastrointestinal symptoms
   (eg, crampy abdominal pain, vomiting)

Simons FE. J Allergy Clin Immunol 2010; 125: S161-81
Clinical criteria for diagnosing anaphylaxis

3. Reduced blood pressure after exposure to known allergen for that patient (minutes to several hours)

A) Infants and children: low systolic blood pressure (age-specific) or greater than 30% decrease in systolic blood pressure
B) Adults: systolic blood pressure of less than 90 mm Hg or greater than 30% decrease from that person’s baseline

Diagnosis of anaphylaxis is based on these clinical findings
Symptoms of anaphylaxis

- 2 nationwide (public and patient), cross-sectional survey.
- Public survey included 1,000 adults.
- Patient survey included 1,059 responders.

- Respiratory: 74%
- Skin: 73%
- Cardiovascular: 31%
- Neurological: 40%
- Gastrointestinal: 17%

n=344

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# Summary of anaphylaxis survey

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Cases (n)</th>
<th>Age (years)</th>
<th>Trigger of anaphylaxis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1st</td>
</tr>
<tr>
<td>Webb et al.</td>
<td>2006</td>
<td>601</td>
<td>37 (1-79)</td>
<td>foods</td>
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<tr>
<td>Decker et al.</td>
<td>2008</td>
<td>211</td>
<td>29 (0-78)</td>
<td>foods</td>
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<tr>
<td>Worm et al.</td>
<td>2014</td>
<td>3333</td>
<td>26.7% of the cases were &lt; 18</td>
<td>foods</td>
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<tr>
<td>Lin et al.</td>
<td>2008</td>
<td>1972</td>
<td>&lt; 20</td>
<td>foods</td>
</tr>
<tr>
<td>Wood et al.</td>
<td>2014</td>
<td>2059</td>
<td>&gt; 18</td>
<td>medications</td>
</tr>
</tbody>
</table>
Triggers of anaphylaxis by age

First European data from the network of severe allergic reactions (NORA)

- From 2011 to 2014, tertiary allergy, dermatology and pediatric units in 10 European countries conducted “European Anaphylaxis Registry”.

<table>
<thead>
<tr>
<th>country</th>
<th>cases</th>
<th>children</th>
<th>Female</th>
<th>AR</th>
<th>BA</th>
<th>AD</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
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<tr>
<td>Austria</td>
<td>185</td>
<td>20</td>
<td>10.8</td>
<td>103</td>
<td>55.7</td>
<td>23</td>
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<tr>
<td>Bulgaria</td>
<td>48</td>
<td>17</td>
<td>35.4</td>
<td>20</td>
<td>41.7</td>
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<td>France</td>
<td>433</td>
<td>183</td>
<td>42.3</td>
<td>212</td>
<td>49</td>
<td>103</td>
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<tr>
<td>Germany</td>
<td>1970</td>
<td>445</td>
<td>22.6</td>
<td>1025</td>
<td>52</td>
<td>344</td>
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<tr>
<td>Greece</td>
<td>40</td>
<td>40</td>
<td>100</td>
<td>14</td>
<td>35</td>
<td>1</td>
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<td>Ireland</td>
<td>23</td>
<td>23</td>
<td>100</td>
<td>6</td>
<td>26.1</td>
<td>7</td>
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<td>Italy</td>
<td>49</td>
<td>2</td>
<td>4.1</td>
<td>18</td>
<td>36.7</td>
<td>4</td>
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<tr>
<td>Poland</td>
<td>57</td>
<td>5</td>
<td>8.8</td>
<td>30</td>
<td>52.6</td>
<td>10</td>
</tr>
<tr>
<td>Spain</td>
<td>143</td>
<td>22</td>
<td>15.4</td>
<td>79</td>
<td>55.2</td>
<td>35</td>
</tr>
<tr>
<td>Switzerland</td>
<td>385</td>
<td>132</td>
<td>34.3</td>
<td>188</td>
<td>48.8</td>
<td>117</td>
</tr>
<tr>
<td>All countries</td>
<td>3333</td>
<td>889</td>
<td>26.7</td>
<td>1695</td>
<td>50.9</td>
<td>660</td>
</tr>
</tbody>
</table>

Modified by Worm et al. Allergy 2014; 69: 1397-1404
Comparison of triggers of anaphylaxis - Children vs. Adults -

Children: n=889
- Foods: 65%
- Insect stings: 20%
- Medications: 5%
- Others: 10%

Adults: n=2444
- Foods: 20%
- Insect stings: 48%
- Medications: 22%
- Others: 10%

Worm et al. Allergy 2014; 69: 1397-1404
Causative foods of anaphylaxis among children

### Top 3 causative foods of anaphylaxis in children were different among countries

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Cases (n)</th>
<th>Country</th>
<th>Caused by food-induced anaphylaxis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rudders et al.</td>
<td>2010</td>
<td>846</td>
<td>USA</td>
<td>Peanuts</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cow’s milk</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Tree nuts</td>
</tr>
<tr>
<td>Russell et al.</td>
<td>2010</td>
<td>124</td>
<td>USA</td>
<td>Peanuts</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Shellfish</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cow’s milk</td>
</tr>
<tr>
<td>Grabenhenrich et al.</td>
<td>2016</td>
<td>1092</td>
<td>Europe</td>
<td>Peanuts</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Tree nuts</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cow’s milk</td>
</tr>
<tr>
<td>de Silva et al.</td>
<td>2008</td>
<td>104</td>
<td>Australia</td>
<td>Peanuts</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cashew nut</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cow’s milk</td>
</tr>
<tr>
<td>D. L. M. Goh et al.</td>
<td>1999</td>
<td>124</td>
<td>Singapore</td>
<td>Bird's nest</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Crustacean Seafood</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Egg and milk</td>
</tr>
<tr>
<td>Piromrat et al.</td>
<td>2008</td>
<td>-</td>
<td>Thailand</td>
<td>Prawn</td>
</tr>
<tr>
<td>Imai et al.</td>
<td>2016</td>
<td>428</td>
<td>Japan</td>
<td>Egg</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cow’s milk</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Wheat</td>
</tr>
<tr>
<td>Lee et al.</td>
<td>2016</td>
<td>740</td>
<td>South Korea</td>
<td>Cow’s milk</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Egg</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Walnuts</td>
</tr>
</tbody>
</table>
Frequency of food-induced anaphylactic shock among causative foods

- Wheat (347)
- Buckwheat (65)
- Nuts (67)
- Shellfish (99)
- Peanut (151)
- Fish egg (109)
- Fish (58)
- Milk (645)
- Fruits (118)
- Egg (1153)

*Many cases diagnosed as wheat-dependent exercise-induced anaphylaxis induced by hydrolyzed wheat protein in facial soap

Data were described among causative food that was over 50 participants.

Worldwide cases of fatal food-induced anaphylaxis

**USA**
1994-1999
32 cases*
- Peanut 20
- Tree nuts 10
- Milk 1
- Fish 1

*Including a case of antigen suspected to cause anaphylaxis.


**USA**
2001-2006
31 cases
- Peanut 17
- Tree nuts 8
- Milk 4
- Shrimp 1

JACI 2007,119:1016-8

**UK**
1999-2006
48 cases
- Peanut 9
- Nuts 9
- Milk 6
- Fish 1
- Shellfish 1
- Snail 1
- Sesame 1
- Egg 1
- Tomato 1
(uncertain 18)

JACI 2007,119:1018-9

**Japan**
1999-2004
4 cases
- Shrimp 1
- Buckwheat 1
- Fish 1
- Chocolate 1

Nihon Kyukyu Igakukai Zasshi2005,16 : 564-6

**Australia**
1997-2005
7 cases
- Peanut 3
- Fish 1
(uncertain 1)

Ebisawa M : Food-induced Anaphylaxis and Food Associated Exercise-induced Anaphylaxis, FOOD ALLERGY, ELSEVIER SAUNDERS. 2011 : 113-27
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A case of milk-induced anaphylaxis

He developed itching, skin rash, persistent cough and wheezing after drinking cow’s milk.
## Grading system evaluating the severity of anaphylaxis

<table>
<thead>
<tr>
<th></th>
<th>1 (mild)</th>
<th>2 (moderate)</th>
<th>3 (severe)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Skin</strong></td>
<td>Localized urticaria, exanthema, wheal, pruritus</td>
<td>Generalized urticaria, exanthema, wheal, pruritus</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Swollen eyelid or lip</td>
<td>Swollen face</td>
<td>-</td>
</tr>
<tr>
<td><strong>Gastrointestinal tract</strong></td>
<td>Pruritus of the throat or oral cavity</td>
<td>Throat pain</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Mild abdominal pain</td>
<td>Moderate abdominal pain</td>
<td>Cramps</td>
</tr>
<tr>
<td></td>
<td>Nausea, emesis, diarrhea</td>
<td>Recurrent emesis, diarrhea</td>
<td>Continuous emesis, loss of bowel control</td>
</tr>
<tr>
<td><strong>Respiratory tract</strong></td>
<td>Intermittent cough, nasal congestion, sneezing, rhinorrhea</td>
<td>Repetitive cough</td>
<td>Persistent cough, hoarseness, “barky” cough</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chest tightness, Wheezing through a stethoscope</td>
<td>Audible wheezing, dyspnea, cyanosis, saturation &lt;92%, swallowing or speaking difficulties, throat tightness, respiratory arrest</td>
</tr>
<tr>
<td><strong>Cardiovascular</strong></td>
<td></td>
<td>Pale face, mild hypotension, tachycardia (increase &gt;15 beats/min)</td>
<td>Hypotension, dysrhythmia, severe bradycardia, cardiac arrest</td>
</tr>
<tr>
<td><strong>Neurological</strong></td>
<td>Change in activity level, tiredness</td>
<td>Light-headedness, feeling of “pending doom”, somnolence</td>
<td>Confusion, loss of consciousness, incontinence</td>
</tr>
</tbody>
</table>

*Japanese anaphylaxis guideline*
A protocol for the initial management of anaphylaxis in the emergency department

**EVALUATE Airway, Breathing and Circulation**

- **Cardio-respiratory arrest**
  - **Treat as per protocol**

- **Respiratory distress, hypotension or collapse**
  - **GIVE I.M. ADRENALINE**
    - **Consider lower threshold to treatment with adrenaline if:**
      - Previous severe reaction
      - Exposure to known/likely allergen
      - Coexistent asthma

  - **Hypotension or collapse:**
    - **High flow oxygen**
    - **Normal saline or colloid, 20ml/kg I.V. / I.O.**
    - **I.V. / I.O. corticosteroid**
    - **I.V. / I.M. antihistamine**

  - **If no response in 5-10 minutes:**
    - Repeat I.M. adrenaline
    - Repeat fluid bolus
    - Set up adrenaline I.V. (infusion)

  - **Stridor**
    - **High flow oxygen**
    - **Nebulized adrenaline**

  - **Wheeze**
    - **High flow oxygen**
    - **Nebulized beta-2-agonist**

  - **If respiratory distress or no response within 5-10 minutes:**
    - **I.M. adrenaline**
    - **Nebulized corticosteroid**
    - **I.V. access**

  - **If respiratory distress or no response within 5-10 minutes:**
    - **I.V. adrenaline**
    - **Nebulized beta-2-agonist**
    - **I.V. / I.O. corticosteroid**
    - **I.V. / I.M. antihistamine**

  - **If no response in 5-10 minutes:**
    - Repeat nebulised beta-2-agonist
    - Consider further I.M. adrenaline
    - Consider I.V. beta-2-agonist
    - **I.V. / I.O. corticosteroid**
    - **I.V. / I.M. antihistamine**

**Angioedema or urticaria ONLY**

- **Antihistamine orally**
- **If known to be asthmatic give inhaled beta-2-agonist and oral prednisolone**
- **Observe for 4 hours – as this may be an early presentation of anaphylaxis**

**PLUS**

**Persistent Vomiting and/or abdominal pain – CONSIDER I.M. Adrenaline**

**Discharge check list:**
1. Provision of self-injectable adrenaline device with written instructions on how to administer it correctly
2. Discharge therapy: antihistamine and prednisone (1-2 mg/kg) for 72 hours
3. Discharge letter for the family doctor
4. Priority access to the allergist for the allergy diagnosis and the provision of the individualized management plan

Anaphylactic patients need to prepare an adrenaline auto-injector.
When should person use an adrenaline auto-injector for the public? - Recommendation of JSPACI -

JSPACI: Japanese Society of Pediatric Allergy and Clinical Immunology

<table>
<thead>
<tr>
<th>Organ</th>
<th>Gastrointestinal tract</th>
<th>Respiratory tract</th>
<th>Generalized</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Continuous vomiting</td>
<td>Severe abdominal pain</td>
<td></td>
</tr>
<tr>
<td>Gastrointestinal tract</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tight throat and/ or lung</td>
<td>Hoarse voice</td>
<td>“barky” cough</td>
</tr>
<tr>
<td></td>
<td>Repetitive cough</td>
<td>Wheezing</td>
<td>Difficulty breathing</td>
</tr>
<tr>
<td>Respiratory tract</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pale nails and lips</td>
<td>Weak pulse</td>
<td></td>
</tr>
<tr>
<td>Generalized</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hazy state</td>
<td>Limp</td>
<td>Wet pants</td>
</tr>
</tbody>
</table>

By Japanese anaphylaxis guideline
Contents

- Diagnosis
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The Natural History of Hen’s Egg Allergy (from 0 to 6 years)

In the patients who had not acquired tolerance by 6 years of age, number of anaphylaxis episodes was significantly higher.

The Natural History of Hen’s Egg Allergy
(from 6 to 12 years)

Elimination rate (%)

\(\text{tolerance rate:} 14.6\%\)

\(\text{40.8\%}\)

\(\text{60.5\%}\)

Kaplan-Meyer survival estimation

Taniguchi et al. 65th Japanese Society of Allergology
Protocol of low dose OIT for food-induced anaphylaxis

<table>
<thead>
<tr>
<th></th>
<th>Hospital 5 days</th>
<th>At home 12 months</th>
<th>Hospital 3 days</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Baseline OFC</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Build up</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Escalation</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Loratadine</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>1st OFC (Low dose)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>2nd OFC (Middle dose)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Egg**
- **Low dose**: 1/32 of whole egg (194mg)
- **Middle dose**: Half whole egg (3100mg)

**Cow’s milk**
- **Low dose**: Pumpkin cake containing 3ml of heated milk (102mg)
- **Middle dose**: Pumpkin cake containing 25ml of heated milk (850mg)

**Wheat**
- **Low dose**: 2g of “Udon” noodle (52mg)
- **Middle dose**: 15g of “Udon” noodle (390mg)

**Peanut**
- **Low dose**: 0.5g of peanut (133mg)
- **Middle dose**: 3g of peanut (795mg)
## Patients’ Profile

<table>
<thead>
<tr>
<th></th>
<th>Cow’s milk</th>
<th>Hen’s egg</th>
<th>Wheat</th>
<th>Peanut</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients’ number (n)</td>
<td>10</td>
<td>6</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Age, years</td>
<td>9.4 (6.5–13.1)</td>
<td>8.5 (5.8–9.7)</td>
<td>7.3 (5.8–8.4)</td>
<td>8.4 (6.7–11.8)</td>
</tr>
<tr>
<td>Male sex</td>
<td>2 (50.0)</td>
<td>6 (60)</td>
<td>2 (40)</td>
<td>5 (100)</td>
</tr>
<tr>
<td>Past history of anaphylaxis</td>
<td>4 (67)</td>
<td>8 (80)</td>
<td>5 (100)</td>
<td>4 (80)</td>
</tr>
<tr>
<td>AD, current</td>
<td>1 (17)</td>
<td>5 (50)</td>
<td>1 (20)</td>
<td>2 (40)</td>
</tr>
<tr>
<td>BA, current</td>
<td>1 (17)</td>
<td>5 (50)</td>
<td>3 (60)</td>
<td>3 (60)</td>
</tr>
<tr>
<td>AR, current</td>
<td>4 (67)</td>
<td>5 (50)</td>
<td>2 (40)</td>
<td>3 (60)</td>
</tr>
<tr>
<td>Ag-s IgE at starting OIT (Ua/ml)</td>
<td>44.1 (5.4–210)</td>
<td>39.4 (1.7–278.0)</td>
<td>151 (4.5–399)</td>
<td>56.0 (17–328)</td>
</tr>
<tr>
<td>Threshold of baseline OFC (mg)</td>
<td>86.8 (62–223.2)</td>
<td>30.6 (25.5–102)</td>
<td>52 (19.5–52)</td>
<td>132.5 (26.5–132.5)</td>
</tr>
</tbody>
</table>

Data are expressed as the median (25–75th percentile) or n (%). AD, atopic dermatitis; BA, bronchial asthma; AR, allergic rhinitis.

Results of low-dose OIT in a 1-year follow up

- **Cow's milk** (n=6): 30% dropout, 20% desensitization, 40% tolerance to low dose, 20% tolerance to middle dose.
- **Hen's egg** (n=10): 17% dropout, 33% desensitization, 50% tolerance to low dose, 20% tolerance to middle dose.
- **Wheat** (n=5): 20% dropout, 60% desensitization, 20% tolerance to low dose.
- **Peanut** (n=5): 100% dropout.

Symptoms and treatments related with OIT at home during the first year

<table>
<thead>
<tr>
<th></th>
<th>Low-dose OIT (n = 26)</th>
<th>Rush OIT (n = 220)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate of symptoms</td>
<td>15.5%</td>
<td>15.0%</td>
<td>0.430</td>
</tr>
<tr>
<td>Rate of moderate or severe symptoms</td>
<td>1.6%</td>
<td>2.3%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Treatment rate</td>
<td>2.7%</td>
<td>4.3%</td>
<td>0.014</td>
</tr>
<tr>
<td>Rate of adrenaline use</td>
<td>0.04%</td>
<td>0.13%</td>
<td>0.035</td>
</tr>
</tbody>
</table>

Immunological change: specific IgE

Milk

(kUa/L)

Casein

(kUa/L)

β-lactoglobulin

(kUa/L)

Yanagida et al. Int Arch Allergy Immunol 2015;168:131–137
Immunological change: specific IgG and IgG4

Casein-specific IgG

Casein-specific IgG4

Yanagida et al. Int Arch Allergy Immunol 2015;168:131–137

n=12
Contents

- Diagnosis
- Epidemiology
- Management
  - Severity and treatment
  - Risk reduction
- Food-dependent exercise-induced anaphylaxis in children
A case of food-dependent exercise-induced anaphylaxis

A 14-year old junior high school student developed anaphylaxis after eating seafood in his lunch and playing football with his friends

Ebisawa M : Food-induced Anaphylaxis and Food Associated Exercise-induced Anaphylaxis, FOOD ALLERGY, ELSEVIER SAUNDERS. 2011 : 113-27
Age distribution of FDEIA reported from 1979 to 2004

Aihara Y, Arerugi 2007
Flow Chart of Diagnosis of FDEIA

Medical history

IgE CAPRAST, SPT (prick to prick)

Food + Exercise provocation

Positive

Aspirin + Food + Exercise provocation

Positive

Food elimination before exercise

Negative

Repeat provocation with re-evaluation

Symptom (+)

Symptom (-)

“Japanese Pediatric Guideline for Food Allergy 2016”
Provocation tests for the diagnosis of FDEIA

Asaumi et al. Pediatric Allergy Immunol 2016

Suspected to have FDEIA
n=67

Provocation tests
n=53

No provocation tests
n=14
(no consent for tests)

Immediate-type allergy
n=6
(confirmed by food challenges)

Included subjects
n=41

Exercise-induced anaphylaxis
n=6
Causative foods of FDEIA based on provocation test in children

<table>
<thead>
<tr>
<th>Patients’ profile</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients (n)</td>
<td>41</td>
</tr>
<tr>
<td>Age (years)</td>
<td>12 (5-22)</td>
</tr>
<tr>
<td>Male: female</td>
<td>30:11</td>
</tr>
<tr>
<td>Number of provocation tests per person</td>
<td>4 (1-15)</td>
</tr>
</tbody>
</table>

The result of provocation test

- **Negative**: 51%
- **Positive**: 49%

N=41

Asaumi et al. Pediatric Allergy Immunol 2016
Causative foods of FDEIA in children

- Wheat: 17%
- Fruit: 14%
- Wheat + Shrimp: 10%
- Other combination: 30%
- Wheat + Apple: 7%
- Wheat + Chicken: 3%
- Flat fish: 3%
- Shrimp: 3%
- Tangerine: 3%
- Carrot: 3%
- Corn: 3%
- Buckwheat: 4%

N = 30

Asaumi et al. Pediatric Allergy Immunol 2016
Take home message

• Food is most frequent trigger of anaphylaxis among children.

• Causative foods are different among countries.

• A low dose OIT might be a novel approach for accelerating the tolerance to causative foods in anaphylactic patients.

• The patients with FDEIA are most frequently recognized from teenagers to young adults.
Acknowledge

- Nationwide survey of immediate type food allergies in Japan:
  Takanori Imai, Chizuko Sugizaki,
- Natural history of hen’s egg allergy:
  Kiyotaka Ohtani, Hiroaki Taniguchi,
- Low dose OIT:
  Noriyuki Yanagida,
- FDEIA:
  Tomoyuki Asaumi,

Thank you for your attention!