Hot Topics in Pediatric Allergy

Baked milk/egg diets

Peanut component testing

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Highland Park, Illinois
Baked milk diet
Cow’s milk is most common childhood food allergen

- Affects 1-3% of young children
- Causes up to 13% of fatal food anaphylaxis
- 75% tolerate extensively heated milk

2 types of IgE-mediated milk allergy
1. Tolerant of heated but not unheated milk
2. Reactive to all forms of milk

Bock et al. JACI 2007
Nowak-Węgryzn A et al. JACI 2008
# Degrees of Heat

<table>
<thead>
<tr>
<th></th>
<th>Fahrenheit</th>
<th>Celsius</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pasteurization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HTST (&quot;pasteurized&quot;)</td>
<td>161 for 15-20 sec</td>
<td>72 for 15-20 sec</td>
</tr>
<tr>
<td>UHT (&quot;ultra pasteurized&quot;)</td>
<td>275 for 1 sec</td>
<td>135 for 1 sec</td>
</tr>
<tr>
<td>Homogenization</td>
<td>140-160</td>
<td>60-72</td>
</tr>
<tr>
<td>Boiling</td>
<td>212</td>
<td>100</td>
</tr>
<tr>
<td>Baking</td>
<td>350-425</td>
<td>180-220</td>
</tr>
<tr>
<td>Broiling</td>
<td>550</td>
<td>290</td>
</tr>
</tbody>
</table>
Challenges

Baked milk
• Muffin containing 1.3 g of milk protein
• Baked at 350°F for 30 minutes

Baked cheese
• Cheese pizza containing 4.6 g of milk protein
• Baked at 425°F for at least 13 minutes

Unheated milk
• Skim milk or yogurt containing 8-10 g protein
## Results

<table>
<thead>
<tr>
<th>Final status</th>
<th>Initially baked milk tolerant (n=65)</th>
<th>Initially baked milk reactive (n=23)</th>
<th>Comparison (n=60)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fully tolerant, n (%)</td>
<td>39 (60)</td>
<td>2 (9)</td>
<td>13 (22)</td>
</tr>
<tr>
<td>Baked tolerant, n (%)</td>
<td>18 (28)</td>
<td>3 (13)</td>
<td>13 (22)</td>
</tr>
<tr>
<td>Avoiding Strictly, n (%)</td>
<td>8 (12)</td>
<td>18 (78)</td>
<td>34 (56)</td>
</tr>
</tbody>
</table>
Development of Tolerance

Initially baked milk tolerant vs. reactive

Baked milk-tolerant 28 times more likely than baked milk-reactive to develop full tolerance; $p = .0002$

Treated vs. Comparison

Baked milk-tolerant (active) 16 times more likely than comparison to develop full tolerance; $p < .0001$

Kim JS et al. JACI 2011
Baked-milk tolerance indicates transient cow’s milk allergy

Kim JS et al, JACI 2011

How can we identify children who are baked-milk tolerant?
## Baked milk OFC predictors (n=100)

Nowak-Wegrzyn A et al. JACI 2008

<table>
<thead>
<tr>
<th>Milk IgE (kU\textsubscript{A}/L)</th>
<th>&lt;0.35</th>
<th>0.35 to &lt;5</th>
<th>5 to &lt;20</th>
<th>20-100</th>
<th>&lt;35</th>
<th>&gt;15</th>
<th>&gt;35</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tolerant</td>
<td>6/6 (100%)</td>
<td>51/57 (89.5%)</td>
<td>12/18 (66.7%)</td>
<td>4/14 (28.6%)</td>
<td>72/89 (80.9%)</td>
<td>6/17 (35.3%)</td>
<td>1/7 (14.3%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Milk SPT wheal (mm)</th>
<th>0 to &lt;3</th>
<th>3 to &lt;5</th>
<th>5 to &lt;8</th>
<th>&lt;10</th>
<th>≥8</th>
<th>≥10</th>
<th>&gt;14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tolerant</td>
<td>2/2 (100%)</td>
<td>7/7 (100%)</td>
<td>32/39 (82.1%)</td>
<td>58/68 (85.3%)</td>
<td>31/45 (68.9%)</td>
<td>15/25 (60%)</td>
<td>2/6 (33.3%)</td>
</tr>
</tbody>
</table>
Baked egg diet
Follow-up Baked Egg Study
JACI 2012 Aug;130:473-80

**BE, Baked egg**
- Intent-To-Treat Group, n=79
  - Reacted to BE at baseline, n=23 (29%)
  - Tolerated subsequent BE challenge, n=14 (18%)
- Per-Protocol Group, n=70
  - Tolerated BE at baseline, n=56 (71%)
  - Tolerates RE, n=42 (53%)
- Continues BE, n=28 (36%)
- Avoids all egg, n=9 (11%)

**RE, regular egg**
- Comparison Group, n=47
- Natural History
  - Tolerates RE, n=13 (28%)
  - Tolerates BE, n=6 (13%)
  - Avoids all egg, n=28 (59%)

Regular egg tolerance was 12x more likely to occur in baked egg tolerant than in baked egg reactive. 95% CI, 3.7-40.3, \( P < .001 \)

Per-protocol group \( \rightarrow \) ~15x more likely to tolerate regular egg than comparison group over follow-up period

HR 14.6
95% CI, 5.8-36.4; \( P < .0001 \)
Outcomes of 100 consecutive open, baked-egg oral food challenges in the allergy office

- Ingestion of baked egg may accelerate tolerance development to natural/raw egg
- First 100 OFCs with regimented baked-egg recipe in outpatient food allergy clinic retrospectively evaluated

Lieberman JA, Huang FR, Sampson HA, Nowak-Węgrzyn A. JACI 2012 Jun;129:1682-4
100 open baked-egg OFCs

Lieberman JA, Huang FR, Sampson HA, Nowak-Węgrzyn A. JACI 2012 Jun;129:1682-4

<table>
<thead>
<tr>
<th>Egg white slgE (KU/L)</th>
<th>Sensitivity (%)</th>
<th>Specificity (%)</th>
<th>PPV (%)</th>
<th>NPV (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5</td>
<td>87</td>
<td>48</td>
<td>44</td>
<td>89</td>
</tr>
<tr>
<td>5</td>
<td>56</td>
<td>69</td>
<td>46</td>
<td>77</td>
</tr>
<tr>
<td>10</td>
<td>20</td>
<td>94</td>
<td>60</td>
<td>71</td>
</tr>
</tbody>
</table>
HealthNuts Study: Egg allergy

- 5276 infants recruited at 12 months
- 264 with egg allergy (+OFC to raw egg)
- 158 participated in baked egg OFC
  - Baked egg tolerated in 80%
- 140 followed until 2yo
  - Egg allergy resolved in 47%
    - 13% in baked egg-reactive
    - 56% in baked egg-tolerant

Peters RL et al. JACI 2014 in press
Association between frequency of baked egg ingestion and resolution of egg allergy

Peters RL et al. JACI 2014 in press
PEANUT
“Components”
or specific proteins within foods
### What’s the bottom line?

<table>
<thead>
<tr>
<th>Factors that make component testing <strong>LESS</strong> likely to be informative</th>
<th>Factors that make component testing <strong>MORE</strong> likely to be informative</th>
</tr>
</thead>
<tbody>
<tr>
<td>A recent convincing clinical reaction</td>
<td>Mild reactions or no reaction history</td>
</tr>
<tr>
<td>Remote significant clinical reaction in a patient with PN-IgE ≥15</td>
<td>Remote clinical reaction with development of birch sensitization over time</td>
</tr>
<tr>
<td>PN-IgE &gt;25 or &lt;0.35 kUₐ/L</td>
<td>PN-IgE 0.35-15 kUₐ/L</td>
</tr>
<tr>
<td>Lack of birch sensitization</td>
<td><strong>Birch sensitization</strong></td>
</tr>
<tr>
<td>Younger children</td>
<td>Older persons</td>
</tr>
</tbody>
</table>

Thank You

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