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Is cooked whole egg really less allergenic than pasteurized raw whole egg powder? Reply
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Reply to Mauro Calvani

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Key words

Allergy prevention, complementary feeding, eczema, egg, food allergy, oral tolerance, randomized controlled trial.

Calvani et al\textsuperscript{1} have raised an interesting question with regard to our recent randomised controlled trial (RCT) on the effects of early regular egg exposure in infants with eczema\textsuperscript{2}. The protocol for this trial included a medically supervised cooked egg exposure at eight months of age, during which infants in both groups were given 2 teaspoons of mashed hard-boiled whole egg. The dose equated to 1/6 of an egg, which was equivalent to the amount of pasteurized raw egg the infants in the intervention group had been consuming daily. Twelve of the 75 (16\%) infants who had the cooked egg exposure had an allergic reaction, 6/40 (15\%) in the egg group and 6/35 (17\%) in the control group (RR 0.88; 95\% CI 0.31 to 2.47; \textit{P}=0.80). Table 1 details some of the characteristics of these twelve infants. Four of the infants in the intervention (egg) group who had an allergic reaction to the cooked egg exposure also had a previous allergic reaction to the pasteurized raw egg powder and hence the study powder use was ceased. However it was of particular interest that two infants who had an allergic reaction to the cooked egg exposure had regularly consumed the pasteurized raw egg powder. Both of these infants showed increased egg-specific IgG4 levels between the ages of four and eight months, as described in Table 1. It is important to note that both of these infants did have persistent moderate to severe eczema symptoms during the intervention.
period. Investigating this further, we have found that the mean objective SCORAD score on the day of the cooked egg exposure was higher ($P=0.046$) for those infants who had an allergic reaction (mean objective SCORAD $= 17.5 \pm 14.1$) compared to those who tolerated the cooked egg (mean objective SCORAD $= 8.3 \pm 6.7$). We might speculate whether improving the condition of the infant’s skin through optimal eczema treatment may be an important management strategy prior to new food introduction, so this could suggest an important new avenue of investigation in light of our observations. Other possible factors which may alter the immune response around the time of consumption of an ‘allergenic’ food may also play a role. This has been observed in some participants in oral immunotherapy studies who have previously tolerated a particular dose of a food during the desensitization phase but subsequently had allergic symptoms after exposure to the same form and dose of the food during a concurrent illness$^3$.

In the majority of egg-allergic individuals, cooked egg has been shown to be less allergenic than raw egg due to changes in protein (allergen) conformation that occurs with cooking. This was seen in our RCT where 32 infants were diagnosed with IgE-mediated egg allergy at 12 months of age, however 23/32 (72%) of these infants tolerated hard-boiled egg (n=21) or baked egg containing foods (n=23). The two infants who reacted to cooked egg despite tolerating the pasteurized raw egg study powder appear to be an anomaly, and their allergic reaction to the cooked egg exposure could have been a result of an altered immune status on the day. In conclusion, caution should always be taken when introducing egg to infants with eczema, but the introduction of cooked egg should be tried to allow a more varied nutritious diet when tolerated.
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References:

Table 1: On the day of the cooked egg exposure: characteristics of infants (n=12) who had an allergic reaction to the cooked egg.

<table>
<thead>
<tr>
<th>Infant sex</th>
<th>Study powder (ceased due to allergic reaction)</th>
<th>Parent with allergic disease</th>
<th>Objective SCORAD score</th>
<th>Breastfed at cooked egg exposure</th>
<th>Symptoms after cooked egg exposure</th>
<th>Egg-specific IgG4 levels at 4 months old (mg/L)</th>
<th>Egg-specific IgG4 levels at 8 months old (mg/L)</th>
<th>Egg-specific IgE levels at 4 months of age (kU/L)</th>
<th>Egg-specific IgE levels at 8 months of age (kU/L)</th>
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</thead>
<tbody>
<tr>
<td>Male</td>
<td>Egg (No)</td>
<td>Mother + Father</td>
<td>10.9</td>
<td>No</td>
<td>Skin rash, urticaria</td>
<td>&lt;0.07</td>
<td>2.0</td>
<td>&lt;0.1</td>
<td>17.3</td>
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<td>Egg (No)</td>
<td>Mother</td>
<td>45.9</td>
<td>No</td>
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<td>&lt;0.07</td>
<td>18.7</td>
<td>0.39</td>
<td>0.6</td>
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<tr>
<td>Male</td>
<td>Egg (Yes)</td>
<td>Father</td>
<td>7.2</td>
<td>No</td>
<td>Vomiting</td>
<td>&lt;0.07</td>
<td>1.0</td>
<td>&lt;0.1</td>
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</tr>
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<td>Egg (Yes)</td>
<td>Mother + Father</td>
<td>7.2</td>
<td>No</td>
<td>Vomiting</td>
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<td>&lt;0.07</td>
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<td>Mother + Father</td>
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<td>No</td>
<td>Skin rash, urticarial, facial swelling</td>
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<td>0.86</td>
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<td>Mother</td>
<td>19.2</td>
<td>Yes</td>
<td>Facial swelling, vomiting</td>
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<td>2.07</td>
<td>7.06</td>
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<tr>
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<td>Rice (No)</td>
<td>Mother + Father</td>
<td>22.0</td>
<td>Yes</td>
<td>Skin rash, urticaria, facial swelling, vomiting</td>
<td>Not done*</td>
<td>Not done*</td>
<td>Not done*</td>
<td>Not done*</td>
</tr>
<tr>
<td>Male</td>
<td>Rice (No)</td>
<td>Mother + Father</td>
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<td>Yes</td>
<td>Skin rash, urticaria</td>
<td>&lt;0.07</td>
<td>&lt;0.07</td>
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<td>Rice (No)</td>
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<td>Yes</td>
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<td>Not done*</td>
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<td>Rice (No)</td>
<td>Mother</td>
<td>24.9</td>
<td>No</td>
<td>Generalised skin rash</td>
<td>&lt;0.07</td>
<td>Not done*</td>
<td>Not done*</td>
<td>0.31</td>
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<td>Rice (Yes)</td>
<td>Father</td>
<td>11.1</td>
<td>Yes</td>
<td>Urticaria, vomiting, respiratory difficulties (anaphylaxis)</td>
<td>Not done*</td>
<td>0.23</td>
<td>Not done*</td>
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<td>4.13</td>
<td>43.6</td>
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</table>

* Unsuccessful blood collection