

The Role of Baked Egg and Milk in the Diets of Allergic Children



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KEYWORDS

• Food allergy • Egg allergy • Milk allergy • Baked egg • Baked milk • Immunotherapy
• Eosinophilic esophagitis

KEY POINTS

- Most children with an immunoglobulin E-mediated food allergy to egg or cow's milk can tolerate these foods in baked form.
- Eating baked goods containing egg or cow's milk may hasten the development of tolerance to these foods in an unheated form.
- Given the poor performance of standard allergy sensitization tests for baked egg and baked milk tolerance, most patients with egg or milk allergy should be considered for an oral food challenge to baked goods.
- Diets containing egg and milk in baked goods are well-tolerated after passing a challenge and can improve the quality of life for families with food allergy.

INTRODUCTION

Hen's egg and cow's milk (CM) allergy are the most prevalent immunoglobulin E (IgE)-mediated food allergies in young children, affecting up to 1.8% of children younger than 5 years.¹ The current standard-of-care recommendations for IgE-mediated food allergy include strict dietary avoidance of the food in all forms, education, and recognition of reactions.² Patients must also carry rescue medication at all times and should always have an epinephrine autoinjector available when eating any foods. Various forms of immunotherapy for egg and CM remain under investigation, with some promising preliminary results; but this is not yet considered part of routine clinical practice, as more research is required.³

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Egg and CM are found in an abundance of foods across many cultures, particularly in baked and/or processed products. This dietary restriction can be difficult with increased psychosocial burden and risks of inadequate nutrient intake in egg- and CM-allergic children.⁴ Both egg and CM allergy have a good prognosis, with most children outgrowing their allergy.^{5,6} However, it seems that tolerance is taking longer to develop than previously observed, with egg and CM allergies persisting longer into adolescence and adulthood.^{7,8} Several studies have demonstrated that the incorporation of egg and CM in baked form into the diets of allergic children offers several benefits: it may accelerate the development of tolerance to unheated egg and CM, enhance the quality of life for the child and family via liberalization of the diet, and improve nutritional status.⁴ Diets containing egg and CM in baked goods may represent a safe and well-tolerated alternative form of oral immunotherapy (OIT) with similar immunologic changes that are observed in OIT clinical trials.

ALTERING THE ALLERGENICITY OF MILK AND EGG

In both egg and CM allergy, food processing alters the allergenicity of various proteins within the food. Heating denatures the structure of heat-labile food proteins. With the destruction of heat-labile proteins, the IgE binding sites may be altered and affect the ability for food-specific IgE antibodies to bind. This decreased binding and allergenicity of baked egg and baked CM may permit individuals to eat and tolerate baked egg and baked CM without adverse reactions, despite continued sensitivity to unheated egg and CM.

In egg white (EW), the proteins ovalbumin (Gal d I) and ovomucoid (OVM, Gal d III) are the predominant allergens but have different levels of heat susceptibility.⁹ Ovalbumin is the most abundant protein fraction in egg and is heat sensitive with resultant decreased allergenicity.^{10,11} In contrast, OVM is thought to be the major allergen and is heat resistant; however, when OVM is complexed with gluten in wheat and sufficiently baked, it is largely unable to be bound by egg specific IgE (sIgE).¹² In a clinical study, Urisu and colleagues¹² demonstrated decreased allergenicity during oral food challenges (OFCs) with heated and OVM-depleted egg compared with heated egg in individuals with high sIgE values to EW.¹¹

Similar to egg protein, CM proteins are denatured with high heat. The predominant protein, casein, which constitutes 80% of CM protein, is heat resistant, whereas whey, the remainder of CM protein, is heat labile. Specifically, casein bands via gel electrophoresis have been shown to remain stable after 50 minutes of boiling (203°F), whereas whey protein bands were undetectable after 15 minutes of heating. Bloom and colleagues¹¹ also found that subjects who reacted to baked milk had stronger IgE binding to casein when compared with subjects who did not react.

In addition to heated food proteins, combination with other ingredients like protein, fats, and sugars can modify allergenicity. Kato and colleagues¹³ found that EW mixed with wheat flour and then baked led to the formation of high-molecular-weight complexes with decreased antigenic activity of OVM and little to no IgE binding to OVM. When compared with heated egg/milk products alone, heated egg/milk with wheat has shown decreased IgE reactivity via immunoblot.^{11,14} This interaction between wheat and allergic food proteins has been attributed to the formation of a matrix between gluten from the wheat flour and the suspected food protein, thereby decreasing bioavailability and exposure to the immune system.^{11,13}

PREDICTABILITY OF ALLERGY TESTING FOR BAKED EGG OR BAKED MILK TOLERANCE VERSUS ALLERGY

Before considering any particular biomarker or cutoff value, it is important to assess a history of clinical tolerance to baked goods when evaluating patients with suspected egg or CM allergy. Most patients who declined a baked egg challenge in one study did so because they were already tolerating baked egg products in their diet ($n = 76$ of 106).¹⁵ If patients demonstrate a reliable history of tolerance to baked goods, an OFC is not needed; they should be encouraged to continue eating those foods, following the recommendations included in [Boxes 1](#) and [2](#).

Unfortunately, reliable biomarkers for baked egg or baked CM tolerance have yet to be identified. Several studies have attempted to establish particular cutoffs or predictive values using skin prick testing (SPT) and serum sIgE measurements; however,

Box 1

Recommendations for dietary introduction of baked egg after passing oral food challenge

Baked Egg Instructions

Your child has passed a physician-supervised OFC to baked egg and is now approved to eat baked/extensively heated egg products at home and should do so on a regular basis.

Continue to carry your epinephrine autoinjector at all times. If your child has an allergic reaction to baked egg, administer appropriate care and document what your child ate (ingredients, food preparation) and his or her symptoms. Please call our office once your child is stable to evaluate your child's reaction. Avoid eating baked egg until you speak with your allergist.

We recommend that your child eat at least 1 serving of baked egg per day in the following forms:

- Eat homemade baked goods with 1 egg per 1.0 c of flour. All homemade baked products should be baked at 350°F or greater for at least 30 minutes.
- All baked products should be cooked throughout, without soft or soggy areas.
- If your child is not allergic to wheat, wheat flour should be used (do not use gluten-free flours).
- Eat store-bought baked products with egg listed as a minor ingredient. Egg should be listed as the fourth ingredient or lower (not in the top 3) when viewing the list of ingredients.

Continue to STRICTLY AVOID any unbaked egg, including the following:

- Any store-bought baked product with egg listed as the first, second, or third ingredient
- Mayonnaise
- Creamy salad dressings (Caesar, ranch, blue cheese, Thousand Island, and so forth)
- Eggnog
- Meringue or meringue powder
- Ice creams containing eggs
- Hollandaise or béarnaise sauces
- Soufflé
- Quiche
- Deviled foods
- Marshmallow cream
- Angel food cake
- Eclairs, custard, mousse, frosting or whipped desserts containing eggs
- Bavarian cream, fondants, nougats, frosting or icings or other candies containing eggs
- Health drinks or orange Julius drinks made with eggs
- Scrambled eggs or other cooked eggs (hardboiled, scrambled, or poached)
- French toast, waffles, or pancakes (if egg is first or second ingredient)
- Egg noodles
- Foods breaded with egg, like chicken nuggets or other fried foods (unless reheated at $\geq 350^\circ$ for >30 minutes)

Box 2**Recommendations for dietary introduction of baked milk after passing the oral food challenge***Baked Milk Instructions*

Your child has passed a physician-supervised OFC to baked milk and is now approved to eat baked/extensively heated milk products at home and should do so on a regular basis.

Please continue to carry your epinephrine autoinjector at all times. If your child has an allergic reaction to baked milk, administer appropriate care and document what your child ate (ingredients, food preparation) and his or her symptoms. Please call the physician's office once your child is stable to evaluate your child's reaction. Avoid eating baked milk until you speak with your allergist.

We recommend that your child eat at least 1 serving of baked milk per day in the following forms:

- Eat homemade baked goods containing *no more* than 1.0 c of milk per 1.0 c of flour; all homemade baked products should be cooked at 350°F or greater for at least 30 minutes.
- All baked products should be cooked throughout, without soft or soggy areas.
- If your child is not allergic to wheat, wheat flour should be used (do not use gluten-free flours).
- Eat store-bought baked products with milk listed as a minor ingredient. Milk should be listed as the fourth ingredient (not in the top 3) or lower when viewing the list of ingredients.
- If milk-containing baked goods include waffles or pancakes, these should be prepared as instructed by the food product and need to be thoroughly heated.

Continue to STRICTLY AVOID any unbaked milk or milk-based products including the following:

- Any store-bought baked product with milk listed as the first, second, or third ingredient
- All milk/milk products that are unheated: regular milk, cream, cheese, yogurt, cottage cheese, butter, sour cream, evaporated milk, condensed milk, buttermilk, instant breakfast, or nutritional supplements with milk
- Milk chocolate chips
- Pizza
- Lasagna or raviolis
- Casseroles containing milk or cheese
- Creamed meats or vegetables
- Milk-containing gravy
- Unbaked desserts, such as ice cream, pudding, sherbet, milk chocolates, custard, caramel, and nougat

these have yielded varying results. The initial study by Lemon-Mulé and colleagues¹⁶ published in 2008 attempted to define valid clinical predictors of tolerance to baked egg. Those who tolerated baked egg had generally lower, but nonsignificant, EW and OVM sIgE as well as smaller EW SPT. The study showed that only an extremely elevated (>50 kU_A/L) sIgE to OVM was highly predictive of a reaction to baked egg but without a 100% likelihood of failing. Notably, some patients who had a very high EW sIgE or large SPT did not undergo OFC. A retrospective study by Bartnikas, and colleagues¹⁷ included home and open in-office OFCs to baked egg; all patients with a negative SPT to EW passed the baked egg OFC, whereas some patients with an undetectable (<0.35 kU_A/L) sIgE to OVM and/or EW failed. This study identified a 90% negative predictive value (NPV) for sIgE to EW of 6.00 kU_A/L, OVM of 0.35 kU_A/L, and EW SPT of 11.00 mm. However, a 90% positive predictive value (PPV) or 90% probability of failing a baked egg OFC could not be calculated; the study concluded that OVM was not superior to EW at diagnosing baked egg tolerance. Similarly, the HealthNuts study, in a subset of their healthy birth cohort, could not establish a 95% PPV for baked egg.¹⁸

Although the data for baked egg are poor, there are even less data for baked milk. A retrospective review of 35 observed OFCs to baked milk in a standard muffin containing 1.3 g of milk protein found a greater than 90% NPV for casein sIgE at 0.9 kU_A/L and CM sIgE at 1.0 kU_A/L. As with the baked egg studies, one child failed a baked milk OFC despite having a CM sIgE of less than 0.35 kU_A/L.¹⁹ In a larger study (n = 225) analyzing data from children in both prospective and retrospective cohorts, Caubet and colleagues²⁰ proposed a positive decision point for casein sIgE of 20.2 kU_A/L (meaning that at more than this level, patients are unlikely to pass). A small prospective study included 30 milk-allergic children with an SPT to CM of 8 to 14 mm.²¹ They performed SPT using a baked milk muffin slurry and found a greater than 90% NPV of 4 mm for the muffin slurry and casein sIgE of 6 kU_A/L. All children with a negative muffin SPT passed OFC. Similar to the baked egg studies, a larger SPT to CM and higher sIgE values to CM and casein trended toward a higher likelihood of failing baked milk OFC.

Many providers have attempted to use various sIgE cutoffs for EW, CM, casein, and/or OVM to improve the safety of OFCs or ensure higher pass rates; but unfortunately, there is limited evidence to support specific cutoff values. The poor quality of many of the studies, as discussed elsewhere in this article, and the lack of homogeneity have added to this challenge. A recent systematic review could not recommend any cutoff values for baked milk or baked egg.²² Given the poor performance of all biomarkers at predicting baked egg or baked milk tolerance, it is reasonable to consider offering an OFC to all patients. Those patients with a mild reaction to CM or egg can be considered for home challenge; or, alternatively, all patients who have not previously tolerated baked goods can be offered an observed, in-office OFC.

ORAL FOOD CHALLENGES TO BAKED EGG AND BAKED MILK

Several studies have demonstrated high pass rates to baked egg and baked milk challenges in egg- and CM-allergic children. In a study performed by Nowak-Węgrzyn and colleagues,²³ 75% (n = 75 of 100) of confirmed CM-allergic children (mean age 7.5 years) tolerated baked CM on observed OFCs, in the form of a baked muffin or cooked waffle, containing 1.3 g CM protein. Muffins were baked at 350°F for 30 minutes in an oven, and waffles were cooked at 500°F for 3 minutes in a waffle maker. Similarly, 80% (n = 126 of 157) of confirmed egg-allergic children (mean age 14.5 months) tolerated a baked egg muffin challenge.¹⁵ Muffins were baked for 30 minutes at 350°F and contained 1.1 g egg protein. In contrast to these studies, Ando and colleagues²⁴ reported a lower pass rate of 43% (n = 29 of 67) to baked egg in children (median age 34.5 months) with proven egg allergy. In this study, liquid EW was heated to 194°F, freeze dried, and turned into a powder substance. The lower pass rate for heated EW, compared with previous studies, may be attributed to the lower heat temperature and lack of wheat matrix, both of which have been demonstrated to reduce food protein allergenicity. Overall, rates of tolerance to egg and CM in baked goods of roughly 70% to 80% have been duplicated in several studies, despite differing methodologies.²⁵

In a multicenter longitudinal study evaluating CM allergy in children aged 3 to 15 months, Wood and colleagues⁵ reported that of children with CM allergy, 20.6% (n = 32 of 155) were already ingesting some baked CM products. They also noted CM-allergic children who were tolerating baked CM without a reaction had increased food allergy resolution (relative hazard, 4.1; $P < .0001$) compared with children who had an adverse reaction to baked CM products (relative hazard, 0.28; $P = .72$).

The muffin recipes developed by nutrition staff and used for baked egg and baked milk OFCs at National Jewish Health in Denver, Colorado are included in **Boxes 3** and **4**. The baked egg recipe contains approximately 2.2 g of egg protein or one-third of an egg per muffin. Notably, this is double the amount of egg that patients are instructed to eat per serving after passing the OFC. The baked milk recipe contains approximately 1.3 g of milk protein per muffin and is also double the amount recommended per serving. **Box 5** includes recommendations for baked-egg and baked-milk observed OFCs, which includes dosing steps and protein contents. Some providers may wish to take more caution when performing an OFC in certain patients and could consider a more conservative dosing schedule than what is included in **Box 5** (eg, starting with a dose of one thirty-second of a muffin).

SAFETY OF BAKED MILK AND BAKED EGG ORAL FOOD CHALLENGES

Given the lack of predictable markers for heated CM and egg tolerance and the potential for mild to severe food allergic reactions, most children should undergo a

Box 3
Baked egg recipe developed at National Jewish Health

Yield: 6 muffins (approximately 2.2 g egg protein or one-third egg per muffin)

Serving size: 1 muffin

Average muffin weight = 73.65 g (–4.45/+3.65 g)

Ingredients

Dry Ingredients

- ☐ 1.0 c all-purpose flour (or wheat-free substitute)
- ☐ 0.5 c sugar
- ☐ 0.25 tsp salt
- ☐ 1.0 tsp baking powder

Wet Ingredients

- ☐ 2.0 tbsp milk or milk alternative if your child is allergic to milk (rice, oat, soy, or almond milk)
- ☐ 2 large eggs
- ☐ 0.5 tsp vanilla extract
- ☐ 0.25 c oil (vegetable, corn, olive, or canola oil)
- ☐ 1.0 c ripe banana or apple sauce

Directions

1. Preheat the oven to 350°F.
2. Line a muffin pan with 6 muffin liners and spray with cooking spray so that the product does not stick to the liner.
3. Mix together the wet ingredients (milk/milk substitute, eggs, vanilla extract, oil, and mashed banana or apple sauce). Set aside.
4. In a separate mixing bowl, mix together the dry ingredients (flour, sugar, salt, and baking powder). Set aside.
5. Add the liquid ingredients to the dry ingredients. Stir until combined. Some small lumps may remain.
6. Divide the batter into the 6 prepared muffin liners (about 0.33 c of batter per muffin). Depending on the size of your muffin tin, you may need to fill the muffin liners all the way to the top.
7. Bake for 20 to 25 minutes or until golden brown and firm to the touch.

Note: Muffins will freeze well. Wrap each muffin tightly in plastic wrap before freezing. Thaw for 24 hours in the refrigerator.

Box 4**Baked milk (egg-free) recipe developed at National Jewish Health**

Yield: 6 muffins (approximately 1.3 g milk protein per muffin)

Serving size: 1 muffin

Average muffin weight = 59.13 g (–2.09/+1.87 g)

*Ingredients***Dry Ingredients**

- ☐ 1.0 c all-purpose flour
- ☐ 2.0 tbsp sugar
- ☐ 0.25 tsp salt
- ☐ 1.0 tsp baking powder

Wet Ingredients

- ☐ 22.5 g (7.8 g protein) dry milk, reconstituted with 4.0 oz of water
- ☐ 1.0 tsp Ener-G egg replacer, beaten in 2.0 tbsp water
- ☐ 2.0 tbsp oil (vegetable, corn, olive, or canola oil)
- ☐ 1.0 c ripe banana or apple sauce

Directions

1. Preheat the oven to 350°F.
2. Line a muffin pan with 6 muffin liners and spray with cooking spray so that the product does not stick to the liner.
3. Mix together the wet ingredients (dry milk, egg replacement, oil, and mashed banana or applesauce). Set aside.
4. In a separate mixing bowl, mix together the dry ingredients (flour, sugar, salt, and baking powder). Set aside.
5. Add the liquid ingredients to the dry ingredients. Stir until combined. Some small lumps may remain.
6. Divide the batter into the 6 prepared muffin liners (about 0.25 c and 1.0 tsp of batter per each muffin). Depending on the size of your muffin tin, you may need to fill the muffin liners all the way to the top.
7. Bake for 30 to 35 minutes or until golden brown and firm to the touch.

Note: Muffins will freeze well. Wrap each muffin tightly in plastic wrap before freezing. Thaw for 24 hours in the refrigerator.

physician-supervised OFC before eating these foods at home. Although uncommon, anaphylaxis to baked CM and egg can occur. Out of 100 OFCs to baked egg in children aged 1 to 19 years, with a known egg allergy, 31% experienced an adverse reaction to baked egg.²⁶ Of these 31 reactions, most were mild, whereas 13% (n = 4) required intramuscular epinephrine for anaphylaxis. During an OFC to heated CM of 100 children with CM allergy, 23% reacted to baked milk.²³ Of those who reacted, 35% (n = 8) experienced anaphylaxis and were treated with intramuscular epinephrine.²³ Among other studies on baked egg and baked CM, the failure rate typically ranges from 15% to 35%, with less than one-third of subjects requiring epinephrine.²⁵

TOLERANCE AND ADHERENCE TO DIETS CONTAINING BAKED MILK AND EGG

On successful OFC, regular incorporation of baked egg and baked CM is generally well-tolerated by children. Given the importance of decreased allergenicity via extensive heating and formation of a matrix, it is essential to provide patients and families with clear dietary guidelines of products containing baked CM and baked egg that are safe to eat. In the study by Nowak-Wegrzyn and colleagues,²³ one subject who

Box 5

Baked egg and milk dosing regimen

We recommend following the standard procedure and preparation for a supervised-physician OFC.

☐

If the facility is unable to provide baked products, provide the baked egg or milk recipe to the family.

☐

The family should anticipate bringing in at least 2 muffins.

☐

The muffin portions should be consumed in 30-minute intervals between doses with a 2-hour observation period after completion.

Challenge procedure doses for baked egg

Assuming each muffin contains 2.2 g egg protein, dosing is as follows:

Dose	Product Weight (g)	Food Protein (g)
☐ Dose 1: one-sixteenth of muffin	4.60	0.14
☐ Dose 2: one-eighth of muffin	9.21	0.28
☐ Dose 3: one-quarter of muffin	18.41	0.55
☐ Dose 4: remainder of muffin	41.4	1.26
☐ Sum	73.62	2.23

Challenge procedure doses for baked milk

Assuming each muffin contains 1.3 g milk protein, dosing is as follows:

Dose	Product Weight (g)	Food Protein (g)
☐ Dose 1: one-sixteenth of muffin	3.70	0.08
☐ Dose 2: one-eighth of muffin	7.40	0.16
☐ Dose 3: one-quarter of muffin	14.79	0.33
☐ Dose 4: remainder of muffin	33.30	0.72
☐ Sum	59.10	1.29

previously passed a baked milk challenge reported oral pruritus when later eating baked milk at home, in the form of bread and Belgian waffles. The subject passed a repeat OFC to baked milk, and her reaction was attributed to ingestion of insufficiently heated milk products. Therefore, children who successfully pass an OFC should be provided with strict dietary instructions on appropriate cook times, protein content, and types of foods that are safe to consume. Some common sources of undercooked baked goods that can cause reactions include cakes baked in pans with larger surface areas, overly wet breads that do not cook fully in the center (eg, some banana bread recipes), and milk chocolate chips in baked products. See [Boxes 1](#) and [2](#) for recommendations to provide to patients after passing baked egg or baked milk OFCs.

BAKED MILK AND BAKED EGG DIETS AS ORAL IMMUNOTHERAPY

Given that regular consumption of baked goods with CM or egg are well-tolerated and likely lead to improved quality of life for families with food allergy, it is an appealing option to consider as a form of OIT. Although study quality is often weak, there is evidence to suggest that tolerance to extensively heated egg or CM products and regular consumption accelerates resolution of unheated egg or milk allergy. When evaluating the natural history of milk allergy, Wood and colleagues⁵ reported that children who were ingesting baked milk without adverse reactions were 4 times more likely to experience resolution of their CM allergy compared with those who were baked-milk reactive. In a study evaluating 88 CM-allergic children, aged 0.5 to

21.0 years with positive SPT or CM sIgE and a recent history of anaphylaxis, subjects who tolerated and continued eating baked milk products were 16 times more likely to develop unheated milk tolerance.²⁷ Similarly, Sicherer and colleagues²⁸ characterized 213 egg-allergic children into 3 cohorts. Of the children who were regularly consuming baked egg, 70.8% developed tolerance to unheated egg. This finding was compared with only 42.5% of children who were tolerant to but did not consume baked egg and 57.1% who were not tolerant to baked egg. Leonard and colleagues²⁹ evaluated 79 subjects, aged 0.5 to 25.0 years with IgE-mediated egg allergy (defined as sIgE ≥ 0.35 kUa/L or positive SPT to EW with a recent 6-month history of anaphylaxis or OFC); subjects who tolerated and continued eating baked egg were 14.6 times more likely to develop unheated egg tolerance compared with those who could not tolerate baked egg ($P < .001$). These studies are some of many demonstrating that baked egg and CM can accelerate the development of tolerance to unheated egg and CM. However, there are significant methodologic differences between them. Further, none of the studies were blinded or placebo-controlled and comparison groups were often retrospective if included.³⁰

Diets containing baked egg and milk products have shown immunologic changes similar to those observed among patients enrolled in OIT clinical trials. Compared with heated-egg or milk-reactive children, those who tolerated baked egg or baked milk products, with regular consumption, were found to have decreasing SPT wheal size, decreasing values of sIgE to EW, OVM, CM, and casein, along with increasing immunoglobulin G4 values.^{23,27,29,31,32} These changes add credence to the idea that baked egg and baked milk may be a form of immunotherapy despite the limitations of these studies.

BAKED CHEESE

Unique for milk allergy is the possibility of performing an intermediate challenge to baked cheese. This challenge can be done once patients are regularly consuming baked milk but before an OFC to unheated CM. Although this is common practice among some food allergists, the evidence is lacking. Based on clinical experience and expert opinion, the British Society for Allergy and Clinical Immunology's guidelines have proposed a "milk ladder" recognizing the increasing allergenicity of milk in a variety of forms.³³ This idea builds on the notion that with consumption of less-allergenic forms of milk, allergic subjects will slowly develop tolerance to increasingly allergenic forms of milk. The study by Kim and colleagues²⁷ prospectively challenged 88 subjects to baked cheese, who were previously consuming baked milk. They used a commercially available cheese pizza baked at 425°F for 13 minutes, containing 4.6 g of milk protein. If baked cheese was passed, following a period of consumption, they proceeded with an OFC to unheated CM. Most subjects who passed baked cheese OFCs were able to tolerate unheated CM (60%). Further study is needed to determine the utility of OFC to baked cheese and its role in the development of tolerance to unheated CM. This study can help identify which patients may benefit from a period of baked cheese ingestion.

EOSINOPHILIC ESOPHAGITIS

Although a definitive causal relationship remains to be established, there is concern that OIT may induce eosinophilic esophagitis (EoE).³⁴ Food avoidance of some of the major allergens, including milk and egg, is one therapeutic treatment option for EoE. If diets containing baked egg and/or baked milk are to be considered as a well-tolerated form of OIT, the relationship to EoE must be further investigated, as

evidence is lacking in this area. However, a retrospective study ($n = 16$) in children without IgE-mediated food allergy found that 73% of patients maintained histologic remission of EoE while eating baked milk (2–3 servings per week) for 6 weeks.³⁵ The safety of baked egg in patients with EoE is unknown, and caution is recommended with the introduction of baked goods into the diets of patients with EoE.

SUMMARY

CM and hen's egg represent the most common IgE-mediated food allergies in young children, but they are commonly outgrown. Most children with these allergies can tolerate CM or egg in baked form. Given the poor performance of standard allergy sensitization tests for baked egg and baked milk tolerance, most patients with egg or CM allergy should be considered for an OFC to baked goods. Eating baked goods containing egg or CM may hasten the development of tolerance to these foods in unheated forms, and this can be considered a form of oral immunotherapy. Diets containing egg and CM in baked goods are well-tolerated after passing an OFC and can improve the quality of life for families with food allergy. Children with a new diagnosis of egg or CM allergy, but prior tolerance of these foods in baked goods, should be instructed to continue eating the allergenic food in baked form. Further research is needed to confirm the effects of consuming baked goods on the development of tolerance to unheated egg or CM, understand the role for baked cheese, and ultimately develop valid biomarkers of tolerance to baked goods.

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