

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}

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