

# Vegan Egg Replacement

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Egg replacement is one of the most important ingredient trends in the food industry. It's become so important that the largest baking companies around the world have established dedicated R&D teams with the sole job of developing and testing alternative raw materials and ingredients to eggs that maintain all relevant quality attributes in baked goods.

According to an “Egg Replacers Market” report, the egg replacement (ER) market was valued at approximately USD 1.4 billion in 2020, and it is predicted to reach USD 1.6 billion by 2025 (Market Data Forecast, 2019). Consequently, it is evident that demand from consumers and requirements of food producers for alternatives to eggs in food are increasing.

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# Egg Replacement in the Baking Industry

Egg replacement in the baking industry has been focused primarily on sweet baked goods, such as cakes, muffins and cake doughnuts. The major drivers for change include high production costs and market/consumer trends.

Economic factors that expedited egg replacement are high cost and difficulties in transporting and storing refrigerated fresh eggs or their liquid whole egg counterparts, based on limited cold-chain distribution and low microbial stability.

The following list summarizes a few other reasons why eggs are increasingly being replaced in baked goods:

- Health concerns (high cholesterol content, egg allergy, avian influenza)
- Dietary preferences
- Personal beliefs
- Religious reasons
- Vegan or vegetarian consumer trends



## Looking for vegan egg replacement systems?

Bake PB from Holton Food Products is a plant-based product that can completely replace whole eggs or egg whites in baked goods. Bake PB promotes batter aeration and provides volume and consistent cell structure. [Learn all about it.](#)

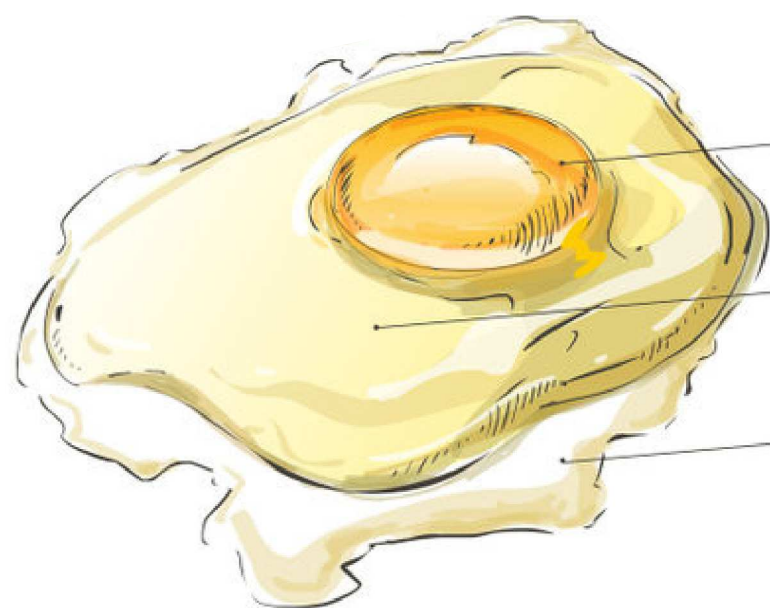


# Function of Eggs in Sweet Baked Goods

Eggs have unique properties in sweet baked goods. They possess excellent whipping ability which accounts for their use in angel food and sponge cakes where they act as the leavening agent. Eggs also act as a thickening agent in custards, a binding agent to hold ingredients together in many foods, and a stabilizing agent to maintain the integrity of complex and highly dynamic colloidal systems, such as cake batters.

## Eggs perform the following functions in baked goods:

- Hydrators or moisteners: thanks to their moisture content (liquid nature)
- Structure builders: thanks to the presence of egg proteins
- Foaming agent: thanks to the presence of albumin in the white fraction
- Emulsifiers/stabilizers: thanks to the natural surfactants found in egg yolks
- Flavoring and coloring: thanks to the presence of carotene and xanthophylls



**Egg proteins:** ovalbumin and ovomucin are essential in cakes

**Ovomucin:** occurs more in the thick egg white + is largely responsible for gel-like characteristics.

**Ovalbumin:** coagulates readily + is involved in both heat coagulation and whipping.

In order to replace eggs in a sustainable way, it is important to fully understand the specific role eggs play during cake production—particularly during mixing and baking. This way, replacers can be optimized to match those functionalities coming from eggs.



## EGG'S ROLE IN CAKE BATTER MIXING

During mixing, a stable emulsion must be formed. It is well known that batters are highly unstable colloids in which large fat particles and air cells are disrupted into smaller ones given the intense mechanical agitation. So, lowering of interfacial tension at oil-water and air-liquid interfaces is essential for preserving colloidal integrity.

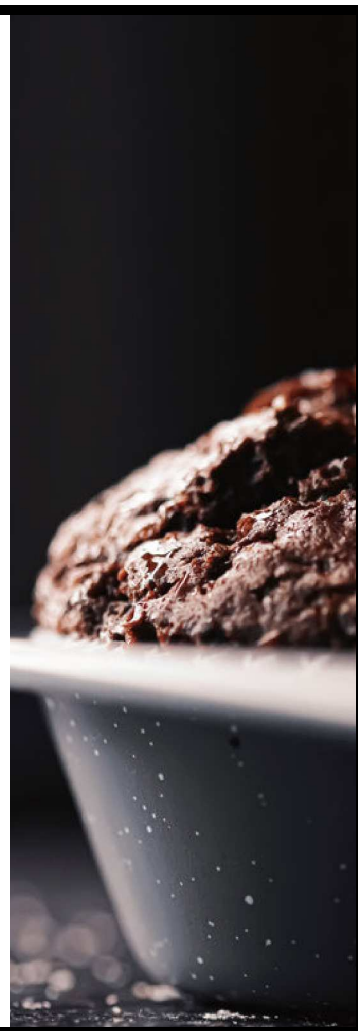
Some lipoproteins and phospholipids found in the livetin fraction of egg yolk are very efficient in lowering the interfacial tension which is essential to avoid emulsion breakdown and gas bubble coalescence.



## EGG'S ROLE IN CAKE BAKING

During the creaming method, large numbers of gas cells are incorporated and retained in the fat phase of the batter. During early stages of baking, when the fat crystals melt and gas cells migrate from the fat to the water phase, the egg white proteins stabilize the gas cells. Different egg white proteins contribute to foam formation and stabilization by a rapid conformational rearrangement and subsequent film formation around the gas cells.

As a result of both starch gelatinization and egg protein coagulation, the liquid batter changes into a solid foam during the latter stages of baking. When ovalbumin, the most abundant protein in egg whites, denatures at 85°C, the heat setting of egg whites is complete. At 65°C, the main component that contributes to a gel network is low density lipoprotein. When denatured, both the egg white and yolk protein become involved in a protein network.



## Vegan Egg Replacers for Cakes

Egg proteins and natural lecithin phospholipids play a crucial role in cake quality, so replacing eggs is a significant challenge. Plant-based proteins are the most preferred vegan egg replacers. When used in proper combination with other ingredients, such as enzymes, emulsifiers and/or hydrocolloids, they can imitate egg properties. Here are some common replacements:

### Plant-based Options

- Wheat protein
- Vital wheat gluten
- Soy
- Pea
- Lentil
- Lupin
- Chickpea

### Hydrocolloid Options

- Gum arabic
- Carrageenan
- Carboxymethyl cellulose (CMC)
- Guar gum
- Glycerol monostearate (GMS)
- Hydroxypropyl methylcellulose
- Xanthan gum

From a technological point of view, egg replacement with one ingredient will likely not perform well in an application. Instead, combinations and synergies of plant-based protein sources along with hydrocolloid gums and emulsifiers do the trick. However, the selection of an ideal egg replacer for baked products such as cakes requires research and development in-house studies.

## KEY PARAMETERS FOR EGG REPLACEMENT SYSTEMS

### Batter Processing Attributes

- Specific gravity (extent of aeration)
- Batter viscosity
- Textural properties
- Gas cell size distribution
- Oven loss during baking

### Finished Product Quality Attributes

- Specific volume
- Cake color
- Crumb flavor, structure and texture
- pH
- Water activity
- Moisture content



## “ Why are eggless cakes lighter in color than cakes with eggs?

Eggless cakes are definitely lighter (or less yellow) in color than regular cakes due to the lack of carotenoids and xanthophylls that are missing in the formulation. Maillard browning reaction could also play a role so optimum amounts of protein and simple sugars must be added when formulating eggless cakes. Adjusting oven temperature during baking for optimum crust color results is a processing change that should also be accounted for.

## “ Can enzymes fully replace liquid whole eggs in cakes?

Enzymes in cakes are usually used to extend the softness and reduce the staling rate. The function of enzymes is different from the function of the emulsifiers found in egg yolks. Amylase can be added to slow down staling through affecting starch retrogradation. Enzymes like phospholipase have the capacity to enhance emulsion and foam stability by creating more efficient polar lipids already found in the flour and natural sunflower lecithin added to the recipe.

However, on their own, enzymes cannot replace eggs since they are not bulk ingredients and only play a very specific role on existing proteins and on other functional polymers already added at large amounts.

### Cover All Your Egg Replacement Needs

Holton Food Products' **Bake PB** completely replaces whole eggs or egg whites in most baked goods by providing excellent aeration, emulsification, and crumb structure. **Meringue Base PB** creates a stable foam for vegan meringues, marshmallow, and aerated icings. **Bake PB-GF** is especially formulated for gluten-free yeast-raised baked goods. [Find the right replacement system for you here.](#)



## “ Do eggless cakes stale faster than regular cakes?

It really depends on the replacement system, and if it has fat or emulsifiers. When you replace eggs, don't forget, you have to replace some of the fats and lecithin in the egg yolk. Then, your eggless cakes would be less crumbly.

One of the main contributors to staling is the lack of springiness in the cake product. Springiness is a textural attribute that is improved by specific volume. Egg replacement causes an increase in specific gravity, due to the lack of foaming from the egg whites. Therefore, if you find a solution that decreases the specific gravity of your eggless cake, you might be able to obtain an eggless cake that stales less than a regular cake.



This BAKERpaper is brought to you by Holton Food Products. Their novel technology is the leading edge of egg replacement. Whether the goal is vegan, eliminating an egg allergen, or replacing whole eggs or egg whites, Holton's plant-based systems can provide the solution. As part of the *SIMPLY* line, these clean label egg replacers are all non-GMO, and some organic-compliant. [Learn more here.](#)

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