



Arla egg replacers demonstrate functionality while aiding bakers in supply chain issues

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ABSTRACT

Challenges in modern industrial baking are prompting bakers to seek solutions to address volatile supply chain costs and meet growing consumer demand for cleaner, more natural baked products. Egg replacement ingredients are emerging as a viable method to address these issues, from cost containment to a healthier nutritional profile. Arla Foods Ingredients' Nutrilac® range of fractionated whey proteins are an ideal egg replacer supported by extensive research showing that they perform just like eggs and produce baked goods comparable to those made with traditional egg recipes. This article will detail background on fractionation technology and specifics on the Nutrilac® range. It will explain the long-term, value-added benefits of switching to egg-free baking and present research on how the ingredient performs at 100% and 50% replacement rates in a pound cake application.

Baking Challenges

Flour, fat, sugar and eggs--the basic formula for a traditional cake. But despite the simplicity of this recipe, bakery manufacturers are increasingly under pressure to create fresh, tasty and wholesome baked goods in the face of rising costs.

Things look set to get ever more challenging now, following implementation on 1 January 2012 of new Europe-wide animal welfare legislation. The Welfare of Laying Hens Directive will ban use of cramped battery cages, forcing egg producers to accommodate hens in larger cages with space to move and perch. However, producers in more than a dozen European Union countries have already admitted they will not be ready to comply with the requirements—prompting concerns over potential egg shortages and price increases.

The potential problems in the EU egg market for industrial bakers as a result of this legislation will only escalate an already difficult pricing environment and competitive landscape.

As a result, smart bakers are looking for solutions, and many are now turning to egg replacement ingredients as a viable solution to address market. These alternatives to eggs can help bakers contain costs, while creating innovative, healthier products and better controlling their supply chain for the long term.

Fractionated Whey Proteins

Egg replacers are typically made using a variety of ingredients, ranging from modified food starch to milk. But not all egg replacers are created equal, with some producing drier cakes and other formulation issues. Fractionated milk proteins made from whey have emerged as the most practical and cost effective option.

With 30 years of dedication and experience in fractionation technologies, Arla Foods Ingredients (AFI), a subsidiary of Arla Foods, has designed a range of fractionated whey protein ingredients called Nutrilac®, which are showing strong functionality and a wide range of benefits as egg replacers.

Using fractionation and modification technologies, Arla Foods Ingredients has discovered how to pull apart whey proteins and rearrange them for various functions that allow them to consistently perform just like eggs. The Nutrilac® ingredients are proven to produce a comparable product for a variety of bakery applications, ranging from cakes and breads to pies, cookies, muffins, pastries, and brownies as well as fillings.



These functional milk proteins are made from whey protein, a by-product of dairy manufacturing. Whey protein from milk comprises a family of more than 200 proteins, each with distinct properties and roles. In whey, there is 0.6 percent whey protein, which is the starting point for the Nutrilac® range.

In developing the Nutrilac® range, Arla Foods Ingredients used advanced filtration and separation techniques to extract individual proteins. From countless tests and analysis, Arla's research and development team identified the functional properties of each of these and discovered how they behave when modified.

Fractionation separates the proteins by characteristic, and they can be arranged to produce various functions including egg-like characteristics, such as emulsification, whipping and gelling. Developed from specific combinations of the protein building blocks, Nutrilac® ingredients can simulate the natural chemical makeup of egg protein, without compromising the quality of the final product.

Comparable to Eggs

While ingredient replacement technologies are often thought to produce a lower quality finished product, baked goods made with fractionated milk proteins instead of eggs offer an end product that, in some applications, is actually considered superior to the original recipe. Arla scientists are conducting ongoing studies comparing the characteristics of baked goods, such as pound cakes and muffins, made using full egg recipes, and using 50% egg replacement and 100% egg replacement. For example, the functionality of Nutrilac® BK-7781 was demonstrated in baking trials using a test pound cake recipe compared with a 50% reduced egg pound cake and an egg-free pound cake. The research verified that the ingredient produces pound cakes with similar cake quality, taste and texture to those made with liquid or powdered eggs.

Table 1

Batter Characteristics for Pound Cakes.

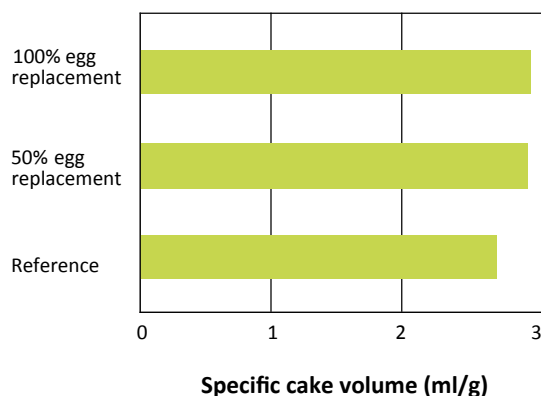
Batter viscosities were subject to sensory evaluation on a scale from 1 to 10.

	Reference	50% replacement	100% replacement
Batter Temperature (°C)	24.5	24.4	24.3
Batter Density (g/100 ml)	106	108	111
Batter Viscosity	5.0	5.5	5.5

Measurements of batter densities showed that the pound cakes in which egg was replaced had a slightly higher density. Batter viscosities were also slightly higher in the egg replace trial cakes.

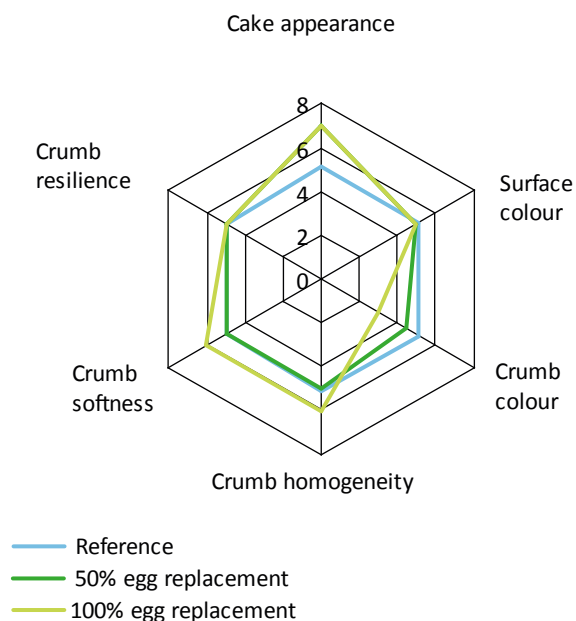


Pound cake volumes were also higher in egg replaced trials than in the reference cake



A sensory panel was used to evaluate the cakes on various subjective parameters, including cake appearance, crumb resilience, crumb softness, crumb homogeneity, crumb colour and surface colour. Rated on a scale from 1 to 10, a high score indicates a high effect on the characteristic, while a low score means a lower effect. The traditional or reference cake received a score of 5 for all parameters.

Sensory evaluations of pound cakes





The sensory evaluations show that the 50% egg replacement recipe produced a higher volume cake with better appearance. It was similar to the reference cake with regard to crumb softness and resilience but received lower marks for crumb colour. The egg-free cake also received high evaluations for appearance and crumb softness, while crumb resilience was similar to the traditional recipe. Crumb color in this cake was significantly lower than the reference cake.

So the most significant differences observed were in crumb texture and colour. This lower colour value does enable production of whiter pound cakes, if desired, although beta carotene can be added for a more traditional yellow colour.

The standard formula for obtaining comparable cake characteristics at 50% egg replacement is 10g Nutrilac® BK-7781, 15g cake flour and 75g water in place of 100g liquid eggs. For higher egg substitution or egg-free cakes, the formula is 10.5g Nutrilac® BK-7781 with 14.5g cake flour and 75g water. The egg-free formulation may need further adjustment to obtain cakes of similar quality. The dose of the ingredient can also be varied to meet specific requirements for cake volume and crumb resilience as needed.

In some cases, the Nutrilac® egg substitutes produce a product with characteristics that are preferable to those made with eggs. For example, the milk protein contributes to a very stable cake batter leading to increased batter viscosity. This produces a higher more desirable cake volume, as well as resilient cake structure and low crumbliness.

The milk proteins that help achieve moistness and reduced crumbliness also contribute to easier handling and often an increased shelf-life for finished products. Bakery goods made with Nutrilac® egg replacer stay moist and resilient giving a more elastic crumb structure to the final cake. This resilience offers a processing advantage, preventing product damage, especially if the cake is to be cut before wrapping.

Whey protein egg replacers themselves boast a longer microbiological shelf life than eggs –stored at room temperature, too. Refrigeration is not required—an important advantage over both liquid and powder eggs. The longer shelf life also gives manufacturers broader distribution opportunities with baked goods keeping a fresh baked quality for up to 18 weeks.

Value-Added Benefits

Beyond versatility and performance, Nutrilac® egg replacers offer numerous other advantages over eggs. As one of the world's largest dairy producers, Arla Foods, generates huge amounts of whey, left over from its cheese-making operations. The company has been focused on finding a productive use for this byproduct over the past three decades. As such, whey is both plentiful and less expensive than eggs: every 100kg of milk generates 10kg of cheese and approximately 90kg of whey. Derived from premium quality milk, Nutrilac® egg replacers are also 100% natural and declarable as milk protein or whey protein concentrate, helping companies to achieve coveted 'clean label' status.

Expensive liquid whole egg or egg powder ingredients are subject to constant price fluctuation, availability issue and seasonality. But fractionated milk proteins are consistently less expensive, offering an average cost saving to the industrial baker of 20%.



Egg ingredients typically make up close to 40% of the ingredient cost for baked goods. Egg replacers made from whey eliminate this price variable, so bakery manufacturers can ensure cost containment, reduce their exposure to future uncertainties and secure higher profits.

Whey-based egg replacers also offer a more favourable nutritional profile than eggs. For example, Arla Food Ingredients' Nutrilac® egg replacers have one-third the calories of eggs, 95% less fat than eggs and zero cholesterol. What's more, the whey proteins that are the building blocks of the Nutrilac® range have been shown to contain essential amino acids required by the body.

In addition, an emerging body of science now links whey proteins to further health properties, such as immune support, satiety and enhanced recovery. These characteristics are increasingly attractive to consumers with specific dietary needs, such as gluten intolerance or overall weight management concerns.

Custom product innovation

It is important to note that some egg replacement solutions do not necessarily fit all potential needs and applications. However, fractionated milk proteins also have the potential to contribute ingredient solutions for new product development or applications that address growing consumer demand for natural, healthy and clean-label products.

Arla Foods Ingredients' in-house Bakery Innovation Group specializes in developing next generation, cost-effective ingredients with strong nutritional benefits. Using a three-tiered programme, the group provides custom-client solutions that start with the customer's specific needs, challenges and goals at the outset, and then continues to assist them throughout the product development and manufacturing process and all the way to market.

Arla Foods Ingredients' state-of-the-art test bakery allows application trials and replication production on a small scale. Such processes ensure that new formulations work well and perform consistently before being tested on a customer's production lines. Commercial trials provide final proof that a concept really works. Minimal fine-tuning is typically all that is required before large scale production can commence.



Conclusion

Fractionated milk proteins are a cost-effective and long-term solution in bakery formulations with proven functionality and benefits as an egg replacer. With the upcoming implementation of the Welfare of Laying Hens Directive, the coming months will be an ideal time for bakers to make the shift to egg-free baking. But beyond that, it is an important step for bakers seeking to control costs, protect their supply chain and maintain a competitive edge with high quality ingredients and strong nutrition benefits in the future.

About Arla Foods Ingredients

Arla Foods Ingredients is a leading developer and supplier of nutritional and functional milk-based ingredients to the global food industry. The company operates production facilities in Denmark, Sweden, Argentina and Germany, applications centres in Denmark and Argentina, with a worldwide network of sales offices. Arla Foods Ingredients is a subsidiary of Arla Foods Group, one of Europe's principle dairy groups.

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