

THE SECRET TO CREATING DELICIOUS, ALLERGEN-FREE FOOD

For food companies looking to stand out, the label is the new place to make an impact. More consumers are adopting plant-based and flexitarian diets, which are mostly vegetarian with occasional exceptions, and consumers have shifted their preferences toward allergen-free options too.^{1,2}

One-quarter of Americans avoid allergens when buying food, according to a 2020 report from McKinsey & Company.³ Plant-based milks are a go-to substitute, and they represent 35% of the total market for plant-based foods.⁴ Start-ups have introduced fan-favorite plant-based milks. Established food companies have also entered the race, as consumers appear willing to spend a little more for an allergen-free option.



Common food allergens include soy, nuts, eggs, dairy, gluten, and seafood.

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The same shift is underway for other allergens. For example, gluten, a protein found in wheat, barley, and rye, causes severe illness in people with celiac disease or other gluten sensitivities. But, as with milk, even people without allergies are choosing gluten-free items: a 2016 study in *JAMA Internal Medicine* reported an increase in gluten-free diets, despite no rise in rates of celiac disease.⁵

The market for plant-based milk and gluten-free foods are expected to double over the next 10 years, reaching \$31 billion and \$14 billion, respectively.^{6,7} Yet while the market for each grows, dethroning allergens is not so easy. Matching (or beating) taste has been difficult.⁸ Matching the many roles of dairy milk—from making frothy foam on a latte to yogurt, cheese, and baked goods—has been even harder.⁹ Even the nutritional advantages aren't a given: the US Food and Drug Administration recently announced that it was “taking steps to help consumers better understand some of the nutritional differences between milk and plant-based milk alternatives.”¹⁰

Grains, nuts, and legumes can replace dairy milk, and other plants can help replace wheat flour. But it's the other stuff that makes or breaks the taste or texture of a product. The secret to a successful allergen-free product lies in choosing the right high-quality ingredients.

FORTIFYING FORMULATIONS

The food and beverage industry's move to meet demand for allergen-free products varies in timing and degree around the world, but the direction appears consistent. “We've seen over the past couple of decades an expansion of the categories around dairy and bread,” says Amy Levine, the director of consumer products at Clarkston Consulting who authored a recent report on food industry trends.¹¹

Early on, soy dominated the alternative milk scene because of its low cost and its high protein content, which rivals that of cow's milk. But that market has changed a lot over the past 10 years. In 2013, almond milk surpassed soy as the option of choice in the US. By 2020, almond milk had reached a 63% share. Today, oat milk is gaining ground.¹²



Oats, soybeans, and almonds are common ingredients in nondairy milks.

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About 68% of the world's population is intolerant to lactose, a key sugar found in dairy milk. Yet consumers also cite nutritional and environmental reasons for switching what's in their fridge.^{13,14}

“Milk has been in decline for many, many years,” says Levine, who worked more than 20 years in the dairy industry before becoming a consultant. Milk still dominates the market, as around 90% of households in the US buy cow's milk. “The size of the [market for] plant-based milks is not even close to that, but they're chipping away.”

Consumers identify alternative milk by the plant on the label: almond, oat, rice, and so on. Though the plant is the star of the show, food manufacturers give just as much attention to the supporting cast of nutrients. Companies fortify plant-based milks with calcium salts, for example, like calcium carbonate, calcium lactate, and tricalcium phosphate.¹⁵

Fortifying plant-based milks provides nutrients lacking in dairy milk, such as calcium, iron, iodine, vitamin A palmitate, and vitamin B₁₂. Alternatively, they can add health-promoting ingredients such as carotenoids, curcuminoids, and polyphenols. These ingredients appeal to people with plant-based or flexitarian diets. For example, Ripple Foods fortifies its pea milk with magnesium citrate and dibasic potassium phosphate.

It's also critical to use high-quality ingredients that are bioavailable. “Just because you've got calcium or vitamin D or vitamin B₁₂ . . . in the food doesn't necessarily mean it's going to get into your body,” says David Julian McClements, a food chemist and nanotechnologist who studies plant-based milk at the University of Massachusetts Amherst.¹⁶

Not all calcium salts are created equal. You want your calcium to be soluble, since that's what allows the body to absorb it. But soluble calcium salts affect taste and pH.¹⁷ Positively charged calcium ions also cause negatively charged proteins to aggregate and form an undesirable sediment in the drink.¹⁸ An insoluble salt like calcium carbonate is a popular choice, according to McClements. It's insoluble at pH 7, but the calcium dissolves and becomes bioavailable in stomach acid.

LOOKING THE PART

Even when plant-based milk is at its most nutritious, brands have a hard time replicating dairy milk's taste, creaminess, and multifunctionality.

"It's very difficult to get the unique flavor profile and appearance and mouthfeel," McClements says. It's even more challenging to get the milk's versatility to create products like cheese, butter, whipped cream, or ice cream, he adds. A true milk substitute should hold up not only in a glass but in savory cuisine, desserts, and breakfast dishes.

You can lose those features when you take dairy out of the mix. But it's not impossible to regain them.

Colloids, colloidal polymers, plant fragments, and oil droplets will scatter light to give a creamy look and feel, according to McClements. "Whether the product feels rough or smooth depends on the presence of these small particles and polymers as they lubricate your mouth," he says.

Studies show that mineral salts can mask undesirable plant flavors in milk, but companies still must formulate to get the right look and taste.¹⁵ Plant proteins often come with "off-flavors and off-colors," McClements says.

Food additives can mask the brownish color or bitter taste of plant molecules. Natural additives like curcumin and carotenoids give better yellow, orange, or red hues, but those can fade with time, exposure to extreme temperatures and to oxygen, and changes in pH. Synthetic flavors and colors are often more stable. Oil helps balance the saltiness or bitterness of calcium salts. Silk uses sunflower oil in its oat milk, while Oatly and Chobani use rapeseed oil. These oils also help make the texture of the final product closer to that of dairy milk.



Companies that make milk from grains or nuts typically fortify the drink with minerals like calcium carbonate.

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But all these ingredients stir up a problem: dense components like insoluble salts, plant fragments, and proteins tend to sink; lighter components such as oils and fats rise like cream in milk. Homogenizing the mixture becomes crucial, and food companies use gums to meet that imperative.

A WINNING TEXTURE

Guar gum, xanthan gum, and locust bean gum act as crucial binders and thickeners in providing a stable structure and improving the texture of the liquid. They're big, hydrophilic molecules that increase viscosity and stick to fat droplets, thus preventing them from aggregating and floating to the top.

Gums can improve a plant-based milk's mouthfeel and create froth for a more multipurpose milk substitute,¹⁹ which makes them popular with brands that market plant-based coffee creamers. For example, Oatly put both xanthan gum and guar gum in its Creamy Oat, an alternative to dairy cream. Trader Joe's almond beverage contains gellan gum and locust bean gum.

Economists forecast that the market for xanthan gum will increase nearly 7% annually for the next 10 years.²⁰ But dairy-free products aren't alone in driving that growth—gluten-free foods are, too.

Consider what baked goods lose without wheat. Gluten is one of the largest known proteins. It provides texture and structure, and it interacts with the other ingredients in baked goods in unique ways. Proofed doughs are essentially foams that solidify in the oven. Gluten keeps the small bubbles locked in. Simply swapping out wheat flour for almond flour in pizza turns a strong, chewy crust into something dense and crumbly.

Gums pick up that slack. They provide a stable structure akin to a network of gluten strands. This helps improve the texture in gluten-free products for home baking, as well as for industrial packaged goods like bread, pasta, crackers, and cookies.

Schär pairs guar gum with corn flour for its table crackers, and Conagra combines rice flour with xanthan gum in its Udi's pizza crust. Duncan Hines makes its "keto-friendly" cake mix with gum and almond flour, and Banza lists xanthan gum as the fourth ingredient in its chickpea pasta. Canyon Bakehouse mixes xanthan gum with rice, amaranth, buckwheat, oat, sorghum, and tapioca to produce its Ancient Grain bread.



Gluten-free grains alone can't provide the structure that wheat does, so bakers use binders like xanthan gum.

Credit: philipimage/Getty Images

Cutting out wheat opens the door to nixing other allergens in baked goods. Food companies replace eggs in those and other products with commodity ingredients. Pectin, lecithin, calcium sulfate, and agar gelatin can all do the job. Some home bakers get similar results with applesauce or by combining acetic acid and sodium bicarbonate (baking soda).²¹ Bob's Red Mill Natural Foods sells an allergen-free egg replacement that contains only four ingredients: potato starch, tapioca flour, baking soda, and psyllium husk fiber. Just Egg adds gellan gum to its formulation.

New York-based Erin McKenna's Bakery is vegan and allergen-free: that means no nuts, soy, dairy, eggs, or refined sugars. Her recipes are so in demand that she opened a site in Walt Disney World in 2015.

BEYOND BREAD AND BEVERAGES

The demand for allergen-free foods will rise with consumers' concerns about and awareness of ingredients. Yet reformulation remains difficult when the substitutes don't appeal to enough people.

"Ice cream is a great example," Levine says. "A lot of people have lactose intolerance, but they may think, 'I know I'm going to have some stomach pain. But that looks so good. I'm gonna do it anyway.'" Consumers want a substitute to be as good as or better than the traditional option.



More and more consumers are trying allergen-free foods, but they come back only if a product is a good alternative.

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Levine notes that cheese is especially hard to re-create without dairy. “You lose taste, you lose texture,” she says. “Plant-based products in that category haven’t done well. There hasn’t been much traction, because consumers aren’t willing to give up what they love about it.”

But there’s good reason to expect that to change. Food chemists are learning more about how commodity ingredients can help fine-tune a food. They have many levers to pull for flavor. For example, monosodium glutamate (MSG) adds the savory taste we get from meat and aged cheese. Calcium citrate and glucono- δ -lactone give vegan cream cheese its vital tang. And brands can fashion more complex textures than ever.

“If you’re trying to make a meat analog, you’re often trying to have a semisolid texture. You can use gums to try and get that,” McClements says. “When we mix gums and proteins together, they can form meat-like fibers.”

A recipe is only as good as the ingredients used to make it, and “it’s hard to get reliable plant-based ingredients,” he says. Suppliers have different processing and storage methods, which can affect a product’s quality and consistency. That ultimately puts pressure on components like stabilizers to buffer against variation and on companies to find the right suppliers of food-grade ingredients.

Levine suspects that if food companies can figure out how to capture the best properties of tricky foods like melty cheese, demand will follow. “There’s been a growth and then a plateau,” Levine says. “But if you can create a product that consumers love—then you’re going to get them.”

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