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WHAT WE EAT

Asked to Get Slim, Cheese Resists

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Dairy Research Institute

CURDS AND WHEY Cheese makers at the Wisconsin Center for Dairy Research.

MILWAUKEE — In the centuries that Americans have been making cheese, they have gotten very good at it, producing world-class Cheddars and chèvres, to name just two varieties. But more recently, cheese making has been something of a struggle.

Under pressure to reduce sodium and saturated fats in American diets — especially those of children — the cheese industry has tried to make products with less salt or fat that consumers will like.

It has not had great success.

"We've made some progress in that arena," said Gregory D. Miller, president of the Dairy Research Institute. "But we have not been able to crack the code."

Dr. Miller, whose group is financed by the dairy industry, was referring to efforts to reduce salt, but he had a similar appraisal of the challenges of low-fat cheese. "When you take a lot of the fat out, essentially cheese will turn into an eraser," he said.

The trouble with cheese is that salt and fat are critical components, responsible for far more of its character than consumers might think.

Salt helps control moisture content and bacterial activity — the starter culture that is added to the milk and naturally occurring strains. All of them can flavor the cheese, for better or worse, as it ages.

"Salt serves as a preservative, as a director of flavor development," said Mark Johnson, senior scientist with the Wisconsin Center for Dairy Research at the University of Wisconsin-Madison. "If I remove it, my flavor goes in a different direction."

Fat affects moisture levels, too — less fat generally means more water, which can speed spoilage — and helps govern texture, balancing out proteins so a cheese slices properly and feels right when chewed.

Because salt and fat both affect moisture, it is particularly difficult to make a product that is low in both.

“If you really want to make bad cheese, make a low-fat, low-sodium one,” said Lloyd Metzger, a professor of dairy science at South Dakota State University.

To be sure, few people are talking about tinkering with specialty cheeses — making a low-fat Camembert, say, or a low-salt Roquefort. “I’m buying those cheeses at a premium,” Dr. Johnson said, “and I want that premium flavor.”

But what the cheese industry calls “American type” (natural Cheddar, Colby and similar varieties) and “Italian type” (mozzarella, provolone and others) together account for about four-fifths of the more than 10 billion pounds of cheese made in the United States each year. So producing good-tasting, good-textured versions with “reduced” fat or salt (defined by the government as at least 25 percent less than typical) or “low” fat or salt (containing a specific small amount) could have a large effect on Americans’ diets.

There are some cheeses, like Swiss and mozzarella, that are naturally lower in salt than others, and cheese companies have had success marketing reduced-fat mozzarellas, particularly for school-lunch foods like pizza. But food shoppers have not flocked to most other lower-fat or lower-salt cheeses.

Some cheeses are especially problematic. Most processed cheeses, in which natural cheeses are heated and mixed with other ingredients, use sodium-containing emulsifiers for blending and to control melting. A typical slice of American cheese can contain more than twice the sodium that the same amount of a natural Cheddar has.

At its most basic, cheese making is a straightforward process. Bacteria is added to milk, converting lactose (milk sugar) to acid and starting the curdling process. Enzymes are added that break down the proteins in the milk and help the curdling, and salt is usually added to limit the bacterial action and draw out more of the liquid whey from the curds. The curds then settle or are formed into a block of cheese.

But there are countless variations in the process, which account for the hundreds of cheese varieties made around the world: the source of the milk (cow, sheep, goat and even more exotic animals, including reindeer), its fat content, whether it is pasteurized, the strain of

starter bacteria used, when and how the salt is added, whether the curds are “cheddared” (cut up, allowed to set, then cut and stacked several times, a process that was developed in Cheddar, England), whether the block is pressed or molded, how long and where it is ripened — the permutations are almost infinite.

“Cheese is just this big biochemistry experiment,” said Tonya C. Schoenfuss, a professor of food science and nutrition at the University of Minnesota.

It’s an experiment in which salt plays a large role, and cheese makers “really haven’t found a magic approach” to reducing sodium, said Dr. Miller of the Dairy Research Institute. “It’s a real technical challenge.”

Most efforts focus on young, mild cheeses, because even though the reduction of salt may make it more difficult to control bacterial activity, the cheeses are not aged long enough for this to affect flavor, Dr. Metzger said. But no cheese maker is going to spend the time and money to age a Cheddar for several years, for example, and risk that it may develop off flavors.

A common salt-reduction technique is to replace a portion of the sodium chloride with potassium chloride, which has a similar ability to control bacteria and provides a similar salty taste. But that chemical presents other problems.

“Potassium salt by itself also gives a bitter note,” Dr. Johnson said. “If you get it too high, then you taste that as an off flavor.” So some cheese manufacturers add compounds that bind with the taste buds so the potassium salt does not. “They’re natural ingredients, not any weird chemical,” he continued. “It masks the unpleasantness.”

David McCoy, vice president for product research at the Dairy Research Institute, said one avenue of study was to look for bacterial strains that are more sensitive to sodium — so less salt would have to be added to control them — but still produce the right flavors. “But that’s a long-term process,” he said.

Several years ago, Dr. Miller and others analyzed the sodium content of more than 1,650 samples of Cheddar, mozzarella and processed cheeses from manufacturers around the country.

“What we learned was that there’s a lot of variability within brands and across brands,” Dr. Miller said. By improving manufacturing processes, he added, companies should be able to make cheeses with consistent, and lower, sodium content and meet some of the targets established by efforts like the National Salt Reduction Initiative, a partnership led by the

New York City health department. The initiative has a goal of a 5 percent sodium reduction in most cheeses by the end of this year and a 15 percent reduction by 2014. Targets for processed cheeses are stiffer.

Dr. Johnson said that the industry might meet some sodium-reduction goals by slowly lowering the salt content so consumers became accustomed to the change in taste.

It is relatively easy to produce a cheese with 10 percent less sodium by just cutting the salt, Dr. Johnson said. “If I gave you that cheese, and gave you a full-sodium one, you’d know the difference,” he said. “But if I didn’t ever give you the higher one, and gave you the lower one, you’d go, ‘Mmmmm, that’s not bad.’ ”

When it comes to fat, there are different challenges, said Dr. Schoenfuss of the University of Minnesota, who has worked on several varieties of cheese, including blue. “For something like blue, fat is really important for flavor,” she said. “Will we ever have a low-fat blue? I kind of doubt it.”

But texture is a big issue, too. The structure of many cheeses can be thought of as a network of casein and other proteins, interspersed with balls of fat. Remove a lot of the balls and the cheese is denser. And an inadequate amount of fat can leave the proteins exposed when the cheese is heated, allowing them to burn.

One approach, Dr. Schoenfuss said, is to put something else in to break up the protein network. Hydrocolloids — substances like carrageenan, which form a gel with water — are one possibility.

Most lower-fat cheeses are made from lower-fat milk. But David M. Barbano, a professor of food science at Cornell, developed a process for removing fat from full-fat Cheddar. The cheese is shredded and warmed, and much of the fat is spun off in a centrifuge, said Michael Adams, a doctoral student in Dr. Barbano’s lab. A little water is added back, and the defatted shreds are once again formed into a block.

“We’ve reduced the fat in the cheese, but we’re still permitting it to have the flavor of a full-fat cheese,” he said.

The technique has not been adopted by manufacturers in part because it would require an investment in costly equipment to produce a cheese that might not prove popular.

Undaunted, researchers in the lab are working on improvements to the process. Rather than adding just water to the defatted shreds, one new technique adds rennet, lactic acid and a casein concentrate as well.

“We use that centrifuged cheese as a flavoring component, but remake the cheese,” Mr. Adams said. The result is softer than most low-fat Cheddars, although the researchers still have to do some work on the texture, he said.

It cannot be called Cheddar, because it no longer conforms to strict federal standards. Instead, it is a “Cheddar cheese product.”

“But the flavor’s actually excellent,” Mr. Adams said.

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