COOKING UP TEMPTING, FAT-FIGHTING FOODS AND INGREDIENTS

From chewy, all-natural apple bars to a rice flour that helps keep excess cooking oil out of your savory fried zucchini, ARS scientists are cooking up a storm of new, obesity-fighting foods and food ingredients for you. Their investigations have yielded some compounds that might help our bodies absorb less fat or can take the place of fat in foods we sometimes crave—like chocolate-chip cookies.

Still more inventions slim down the fat content of familiar foods such as mozzarella cheese, making pizza, for example, a less calorie-laden choice. In all, their tantalizing, all-natural new foods and innovative food additives are intended to help us prevent unwanted weight gain, yet still enjoy what we eat.

What's more, these scientists help move their calorie-cutting creations from their laboratories to your local supermarkets or neighborhood restaurants—the fast-food eateries and the white-tablecloth establishments alike. They do that by teaming up with specialists—chefs, growers, and executives of food companies ranging from small, entrepreneurial firms to Fortune 500 giants.

PEGGY GREB (D433-1)

Research leader Tara McHugh (left) and food technologist John Roberts prepare apple bars at the ARS Western Regional Research Center, in Albany, California.

Apple Bars—Loaded With Orchard-Fresh Flavor

Take apple bars, for instance. These moist, chewy, all-natural snacks are packed with what is likely the richest, most intense apple flavors your taste buds have ever experienced. That's due, in part, to a patented process by which the bars are made. Apples are pureed, mixed with apple concentrate, and shaped, in a food-processing machine, into a bar that's about the size of a typical granola bar, but slightly slimmer.

The process compresses the flavors and nutrients of two freshly harvested apples into one handy bar for kids to take to school in their lunches or grown-ups to enjoy as an afternoon snack.

PEGGY GREB (D431-1)

Moist, chewy, all-natural apple bars can be made not only with apples, but also with delicious combinations of apples and other fruits.

The good-for-you bars don't crumble, and they stay fresh without artificial preservatives. They're the newest additions to the line of all-fruit snacks from the laboratories of food technologist Tara H. McHugh. She's the leader of the ARS Processed Foods Research Unit at the Western Regional Research Center in Albany, California.

Gorge Delights of Hood River, Oregon, uses crisp, delicious apples from the region's picturesque orchards to make the bars and markets the nutritious treats under the "Just Fruit" label. GFA Brands, Inc., the Cresskill, New Jersey-based marketers for Earth Balance and Smart Balance brands, markets the bars under the Earth Balance name.

Just launched last year, the apple bars—and equally pleasing apple combos with a second fruit—are already showing up in natural-foods stores nationwide, according to GFA president Robert M. Harris.

Unlike other energy-bar type snacks, the apple bars contain no added sugar or sodium, Harris points out.

That's also true of Earth Balance pear bars, another Gorge Delights product line that Harris's company markets.

C-Trim May Mean Saying "Yes" to Chocolate

There's even more happening in the science-based battle of the bulge. One target: Saturated fat in cocoa butter, which can make eating foods like chocolate cookies and candies such a guilty pleasure—if you're counting calories.

Not to worry, though.

George E. Inglett and colleagues are on the case. And they're on your side.

The ARS chemist aims to ease the guilt with C-Trim. It's a new, healthful food additive he created from oats and barley to cut the fat and carbohydrates in your favorite comfort foods, like chocolate.

Besides flavor, fats and carbs impart a pleasing "mouthfeel" and other desirable properties. After all, it's fats and carbs that put the comfort in comfort foods.

PEGGY GREB (D426-1)

In the future, C-Trim may be used in baked goods, dark chocolate, peanut spreads, and low-fat yogurt to reduce fat and carbohydrates in these products.

But, as the cliché goes, there's no free lunch.

Eating fat- and carb-rich foods can overburden the body with more calories than it can burn, notes Inglett, with ARS's National Center for Agricultural Utilization Research, in Peoria, Illinois.

There, Inglett created C-Trim as a one-two punch against unwanted buildup of pounds. "In addition to its lower carb content, our new product has biological activity from its increased amount of soluble fiber, namely, beta-glucan," he says.

Epidemiological and clinical studies, conducted elsewhere, have shown that beta-glucan helps regulate blood sugar level and lower so-called bad cholesterol, diminishing the risk of obesity-related complications like heart disease.

"C-Trim fights the calorie load because of the texture it induces, which allows the food manufacturer to considerably decrease carbs or fats—or both," says Inglett. Depending on the formulation,

Texture, total solids content, and whey properties of yogurt enriched with beta-glucan from C-Trim were similar to full-fat and low-fat yogurts.

C-Trim has only 2.5 to 3.5 calories per gram (compared to 4 calories per gram for carbs like starch and 9 calories per gram for fats).

Another plus: C-Trim's beta-glucan content is also, gram for gram, 5 to 10 times that of rolled oats, oat flour, and oatmeal.

C-Trim also packs more beta-glucan than Inglett's earlier "Trim" technologies, namely, Oatrim, Z-Trim, Nu-Trim, Soy-Trim, and Rice-Trim. And C-Trim is rich in protein.

Formulated as a white, odorless powder having virtually no taste, C-Trim "can be added to all classes of food products, including yogurt, smoothies, and baked goods," Inglett says. "In one test, we're replacing some of the cocoa butter in dark chocolate with C-Trim, which really cuts down on the fat and calories."

C-Trim Tests Well in Cookies, Peanut Spreads

Kathleen A. Warner, an ARS food technologist in Peoria, has tried C-Trim in sugar cookies and peanut spreads, substituting 5 to 30 percent of the fats and flour used in these foods. Fats, such as vegetable shortening, keep the cookies moist and tender; flour lends body and texture.

Based on evaluations by taste testers, Warner determined that the optimal range for adding C-Trim was between 5 percent and 10 percent—a significant savings of carbs. At 30 percent C-Trim, however, the cookies became hard and difficult to chew.

In peanut spreads, "We can substitute about 15 percent of the fat with C-Trim and still have an acceptable product," reports Warner, who was one of 10 researchers to present C-Trim findings at a 2005 American Chemical Society national meeting in Washington, D.C.

Yogurt Appears Promising, Too

Another presenter at that meeting, ARS food technologist Mukti Singh, also in Peoria, added C-Trim to yogurt. The live cultures of beneficial microbes in yogurt confer gastrointestinal and other human-health benefits.

But yogurt doesn't meet the body's need for fiber.

"Yogurt has many health advantages, and we've known about them for a long time," says Singh. "I want to combine the benefits of both yogurt and beta-glucan for a cumulative effect. But first, we have to make sure we're able to make a good product."

In her studies, she found that the texture, total solids content, and whey properties of yogurt enriched with 1 percent beta-glucan from C-Trim were similar to full-fat and low-fat yogurts.

Adding C-Trim didn't interfere with the live cultures' job of fermenting the yogurt. In upcoming work, "We'll look at how active these cultures are" in the finished product, says Singh. "We'll also do taste tests."

Marvelous Mozzarella With Less Fat

Pizza is an American favorite, especially among kids.

But a pie is only as good as its combination of toppings, and what would pizza be without stretchy mozzarella cheese?

Unfortunately, most regular mozzarella cheese is about 23 percent fat. That's why ARS researchers developed a delicious, pizza-ready mozzarella that contains less than 10 percent fat—yet is still stretchy and tastes very much like its full-fat counterpart.

In 1992, scientists at the Eastern Regional Research Center in Wyndmoor, Pennsylvania, responded to a call for more nutritious mozzarella in the USDA-assisted National School Lunch Program.

Cheese is an important source of calcium and protein for kids—and adults, too. Low-fat mozzarella was already on the market at the time, but people were not embracing the product.

PEGGY GREB (D425-1)

Chemist Michael Tunick measures the stretchability of low-fat mozzarella cheese on a commercial take-out pizza. Tunick was part of a team that developed the cheese, which is now being used in the National School Lunch Program.

A team of researchers in the Dairy Processing and Products Research Unit, including chemist Michael H. Tunick, went to work on creating a reduced-fat mozzarella that would have more appeal.

The Wyndmoor scientists determined that a high-quality, low-fat cheese could be manufactured using ordinary cheese-making procedures, but at lower temperatures. And they showed that modifying the structure of casein (pronounced KAY-seen)—a protein from milk that's the chief nutritional ingredient in cheese—could increase the storage life of refrigerated, low-fat mozzarella.

Their innovative technologies resulted in a reduced-fat mozzarella that melts perfectly and has an excellent, creamy-

yet-stretchy texture. Student taste-tasters at several schools gave the cheese high marks, according to Tunick.

Cheesemakers Adopt Wyndmoor Technologies

Using these advances, three cheese manufacturers developed a low-fat mozzarella cheese in 1995 for the School Lunch Program, which reaches about 29 million kids at nearly 100,000 public and nonprofit private schools and residential child-care centers.

Tunick says so far about 38.5 million pounds of the low-fat mozzarella, which has only about half the fat of regular mozzarella, have been produced for school lunches at an estimated value of about $57 million.

With the nationwide epidemic of childhood obesity (about 16 percent of U.S. children and adolescents are obese), trimming fat is a significant way to improve a food they love.

SCOTT BAUER (K8290-1)

Biochemist Kim Daigle and chemist Fred Shih demonstrate the fried chicken coating made from low-fat-uptake rice flour batter.

Better Batter Battles Fat

Even deep-fried foods, which many calorie-counting dieters have had to relegate to their forbidden foods list, might be OK as an occasional indulgence for the weight-conscious—if the fried favorite is made with a fat-fighting rice-flour batter.

Typically, fried drumsticks, crispy fries, or glistening donuts are loaded with oil and fat that can contribute to obesity and heart disease. But ARS chemist Frederick F. Shih and his colleagues from the Southern Regional Research Center in New Orleans, Louisiana, have formulated a rice-based batter as an alternative coating for fried foods. When compared to traditional, wheat-based batters, the new rice mixture reduces oil absorption by more than half.

Why rice?

"Rice is plentiful, and flours and starches made from it are among the least likely to cause food allergies," says Shih, now temporarily relocated to Louisiana State University, Baton Rouge. By using rice, he's also taking advantage of a basic scientific fact: oil and water don't readily mix.

"Because of rice's ability to retain water, it's better able to repel oil," he says.

About 4 years ago, Shih and biochemist Kim W. Daigle tested their rice flour mixture on chicken breasts and nuggets. The new batter absorbed 60 percent less oil than one made with wheat.

More recently, the researchers wanted to see how veggies dipped in the rice-flour mixture fared when plunged into hot oil. "In contrast to animal products, like chicken and fish, which are also commonly deep-fried, vegetables are fat-free," says Shih. "Batters are responsible for soaking up most of the oil and fat when vegetables are battered and fried."

Okra Chosen for Culinary Challenge

How this oil uptake occurs in foods that are battered versus those that aren't is what interests Shih. The vegetable that he and Daigle turned to for their study was a natural choice: fried okra, a culinary favorite across the South.

When dipped in the rice-based coating, the okra absorbed 50 percent less oil than when coated with a traditional wheat batter.

But what will fried-okra fans think of this new, slimmed-down version? While those opinions might be hard to gauge until the new batter actually hits the market, the research center's Karen L. Bett-Garber—a sensory evaluation expert—did the next best thing. She asked volunteers to evaluate the less oily, more heart-healthy okra.

The panelists reported that the okra made with the rice batter was "just as crispy and tasty as traditionally battered and fried okra," says Bett-Garber. Some tasters even found its rich, golden-brown color to be superior to wheat-batter okra.

The rice batter still awaits commercialization, so it's too early to unearth the deep-fryer from the back of your kitchen cabinet. But like the apple bars, pear bars, low-fat mozzarella or C-Trim-enriched foods, the rice-flour batter may soon join the parade of imaginative, calorie-conscious ARS products making their way from researchers to us.—By **Marcia Wood, Jan Suszkiw, Jim Core,** and **Erin Peabody,** ARS.

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