

Beyond Oat Bran

Reaping the benefits without gorging on the grain

By JANET RALOFF

More than a dozen studies in as many years have demonstrated oat bran's cholesterol-lowering benefits for people with seriously elevated serum cholesterol levels. Over the past five years, researchers have traced these benefits to beta-glucan, a long, glucose-based molecule that resembles a kinked cellulose fiber.

But oat bran is not the only source of this key ingredient. And some of the other sources, described last month at the American Chemical Society meeting in Boston, might reduce cholesterol more efficiently than oat bran itself.

To obtain optimal amounts of beta-glucan from oat bran, a person with elevated cholesterol needs to consume roughly 100 grams — about three bowls full — of bran each day, notes Yrjö Mälkki, director of technical research at the Food Research Center in Espoo, Finland. If that sounds unappealing, Mälkki offers an alternative: Eat breads and other baked goods fortified with a beta-glucan-enriched concentrate.

Mälkki makes his concentrate by grinding whole oats in a mix of water and alcohol, then washing away most of the starch and oil. The fibrous fraction that remains contains two to three times the beta-glucan concentration offered by the bran in the starting grain. However, not all the chain-like beta-glucan molecules in this concentrate — or in oats themselves — contain the same number of repeating links. And Mälkki's data suggest that the length, or molecular weight, of a beta-glucan chain plays an important role in determining the cholesterol-lowering ability of this soluble fiber.

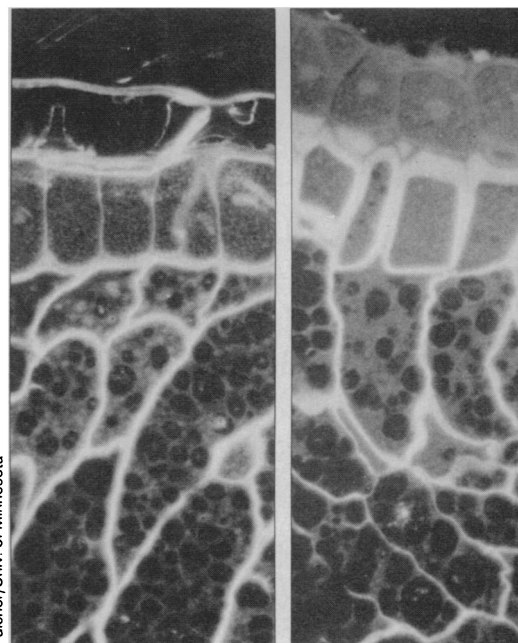
Molecular weight is the sum of the atomic weights for all atoms in a molecule. In rats, Mälkki found that concentrates of beta-glucan molecules having a molecular weight of 1 million lowered serum cholesterol levels 10 percent; beta-

glucan with a molecular weight of 2 million lowered cholesterol as much as 20 percent; and beta-glucan with a molecular weight of 3 million slashed cholesterol levels almost 30 percent. Longer or shorter chains, however, proved largely ineffective. Ironically, Mälkki says, many of the purification and processing steps used by cereal manufacturers can break the relatively fragile beta-glucan chains into ineffectively small pieces.

The rat studies indicate that the concentrate with the longest effective chains offers, per gram of beta-glucan, up to 2½ times the cholesterol-reducing potency of the intact bran, Mälkki reports. He suspects the reason traces to the stomach and gut, where water may have a hard time getting past oils in the bran to dissolve and swell the gummy beta-glucan within.

As beta-glucan molecules soak up water, they become viscous and decrease the diffusion of bile acids — which help digest dietary fats — to the intestinal wall. Bile acids that reach the intestinal wall eventually get recycled. But those captured by beta-glucan are excreted, forcing the body to draw upon its cholesterol stores to replace them. The end result: less cholesterol circulating through blood vessels, where it can accumulate to form artery-clogging deposits.

Before he recognized the importance of molecular weight, Mälkki had conducted a small clinical trial in which 13 men with elevated cholesterol ate two beta-glucan-enriched wheat rolls each day for eight weeks. Each pair of rolls contained a total of 7.5 to 15 grams of a beta-glucan concentrate. Mälkki now attributes the small (about 5 percent) average cholesterol reduction observed in these men to the relatively short beta-glucan chains used in the concentrate, and says he expects better results from formulations with longer chains. Food-



Micrographs show the food-storage region, or endosperm, of two oat varieties. Light areas mark rich beta-glucan concentrations. While beta-glucan's botanical function remains unknown, cereal chemist R. Gary Fulcher says he suspects this gum helps a planted seed absorb and hold the water it needs for proper germination.

fortifying concentrates based on his patented process could reach the market in Finland later this year, he adds.

At the USDA's Northern Regional Research Center in Peoria, Ill., scientists are developing another beta-glucan concentrate. It not only offers the cholesterol-lowering benefits of oat bran, but also could substitute for animal fat in a range of foods — from milkshakes and cheese to mayonnaise, creamy gravies and cookie fillings.

Bio-organic chemist George E. Inglett mixes either oat bran or oat flour with water, then adds an enzyme that degrades the starches into starch gums. Sieving insoluble materials out of the resulting soup leaves a mix of gums, which he dries into granules or powder. Depending on the starting mix, this gelatin — which Inglett calls "oatrim" — contains from 1 to 25 percent beta-glucan by weight.

Inglett says tests on chicks fed a high-cholesterol diet for 10 days suggest his concentrate offers potentially significant benefits. Some 2.2 percent (by weight) of the oatrim-enriched diet consisted of beta-glucan. On average, compared with control chicks given corn- and soy-derived fiber in place of the oatrim, test chicks had 18 percent less serum cholesterol, 15 percent less triglycerides (a form of lipids) and a whopping 49 percent lower concentration of low-density lipo-

protein (LDL) cholesterol, Inglett reports. At the same time, their concentrations of high-density lipoprotein (HDL) cholesterol — known as the “good” cholesterol — were 18 percent higher than those of control chicks.

Oatrim containing up to 20 percent beta-glucan holds up to frying and bakes into “a perfectly good bread,” Inglett says. But he thinks the biggest commercial appeal of the odorless, nearly tasteless gel will come from its ability to replace fats in low-temperature applications such as frozen desserts. He reports that 18 experienced taste-testers rated ice milk made with oatrim as “very creamy” — approaching the taste, feel and density of premium ice cream. Unlike the comparison ice cream, which had 298 calories and 22 grams of fat per 4-ounce serving, the oatrim-enriched product contained only 135 calories and 0.5 gram of fat, he says.

Commercial demand for oat fiber has risen sharply since claims of its cholesterol-lowering ability were first widely popularized in 1987, prompting sales by the Quaker Oats Co. to skyrocket from 1 million pounds of oat bran a year to 2 million pounds a *month* by the end of 1989, according to company spokesman Ron Bottrell in Chicago. Barley producers now hope that research findings from Montana State University will create a similar hunger for the fruits of their labors.

Most U.S. barley goes into livestock feed, which explains why Walt Newman, an animal nutritionist at Montana State in Bozeman, became interested in the grain. In 1978, he found he could lower cholesterol in rats by feeding them barley. Since barley has a high beta-glucan content, the rat study suggested a possible explanation for the poor growth of poultry raised on it.

He and his wife, human nutritionist Rosemary Newman, reported findings in 1984 that not only confirmed a weight reduction among chickens eating barley instead of corn, but also revealed greasier feces — evidence that the barley-fed birds excreted more fat and cholesterol. The researchers later showed that chickens fed barley also have lower blood levels of cholesterol, especially LDL cholesterol.

To establish the role of barley's beta-glucan, the Newmans went on to feed chickens barley-enriched diets, some of which contained beta-glucanase, the enzyme that breaks down beta-glucan. Only the chickens on the enzyme-free diets showed dramatic reductions in serum cholesterol, they found. However, even the enzyme-fed chickens showed lower serum cholesterol levels than the corn-fed controls, leading the scientists to suspect that a second cholesterol-lowering agent was at work.

Studies by Asaf A. Qureshi and his colleagues at the University of Wisconsin-Madison identified that agent as tocotrienol, an oily antioxidant related to vitamin E. Further work by Qureshi, the

Newmans and others now indicates this chemical operates by inhibiting the body's synthesis of cholesterol. Says Rosemary Newman, “We have not seen any other grain that carries barley's double whammy” — high levels of cholesterol-counteracting beta-glucan and tocotrienol.

Over the past decade, the Newmans have assayed barley cultivars in search of the richest beta-glucan source. They have found that something about the genetic makeup of “hull-less” barleys with “waxy-type” starch appears to optimize the soluble fiber's production. Whereas oat and barley grains typically contain about 5 percent beta-glucan, the Newmans have identified hull-less, waxy cultivars that produce 7 to 15 percent. Moreover, they say, it's possible to winnow the milled grain down to a relatively coarse fraction containing as much as 23 percent beta-glucan.

Rosemary Newman reports data from a pair of human trials — one lasting four weeks, the other six — confirming the ability of barley-based high-fiber diets to lower serum cholesterol as effectively as oats and up to 18 percent more effectively than wheat flour. Most volunteers started the trial with significantly elevated cholesterol levels. And to date, she says, roughly one-third of them have successfully used barley to keep their cholesterol from returning to pretrial levels.

The trick to getting people to consume effective quantities of this long-overlooked grain, she says, lies in finding

About that other study . . .

A glance down any supermarket cereal aisle reveals box after box of breakfast fare boasting the presence of oats — testimony to how eagerly America has bought the oat-bran message. At least until January, that is, when a research report in the *NEW ENGLAND JOURNAL OF MEDICINE* sowed seeds of consumer doubt (SN: 1/20/90, p.36).

Though several fiber researchers have since publicly criticized the study's design and its conclusion that oat bran has no special cholesterol-lowering ability, cereal manufacturers are still reeling from a loss in consumer confidence.

The study, conducted at Harvard Medical School and Brigham and Women's Hospital in Boston, met with particularly strong criticism from endocrinologist James Anderson at last month's meeting of the American Chemical Society. He asserted, for example, that a “placebo effect” could not be ruled out, since “18 out of 20 [study participants] knew what product they were on” — the high-soluble-fiber oat bran or the low-fiber Cream of Wheat.

Moreover, although the study's designers claim fiber content was the only important difference between the test diets, “the [subjects'] fat intake on the oat bran phase of the study was curiously 18 percent higher than during the control [diet] and baseline period,” Anderson notes. He also contends the Boston group “made some arithmetic errors in their statistics.”

Anderson, of the Veterans Administration Medical Center in Lexington, Ky., has detailed these charges in a letter to the *NEW ENGLAND JOURNAL OF MEDICINE*, which he says has been accepted for publication in June.

Nutritionist Rosemary Newman of Montana State University in Bozeman says she has trouble extrapolating broadly from the Boston study's findings, because the participants already had low serum cholesterol levels at the outset of the study. Dietary changes generally don't have much effect on serum cholesterol unless it's severely elevated to begin with, she says. Initial cholesterol levels in the Boston study averaged only 186 milligrams per de-

ciliter — well below the 200 mg/dl deemed borderline-high.

Moreover, if one accepts the emerging view that the higher a person's ratio of total cholesterol to HDL (“good”) cholesterol, the greater one's risk of coronary artery disease (SN: 9/9/89, p.171), then the Boston study's findings *do* suggest an advantage to oat bran. Although the authors claim there was no significant difference in participants' cholesterol measurements between diets, the total-to-HDL ratio averaged 3.43 before the study started, fell to 3.38 on the low-fiber diet, then fell substantially more — to 3.17 — on the oat bran diet, notes David Kritchevsky of the Wistar Institute in Philadelphia.

Scientific debate notwithstanding, the Boston group's claims “have had a devastating effect” on oat bran sales, says Quaker Oats Co. spokesman Ron Bottrell. He notes that while many nutrition-oriented publications have challenged the January report and have continued to advocate consumption of oat bran, Quaker's sales have yet to register any rebound. — J. Raloff

interesting ways to incorporate it into the diet. Over the past two years she has been developing new recipes, in part to keep former study participants on the barley bandwagon.

One commercially available source of barley for baking and cooking is a beer-brewing byproduct known as malted barley. Though malting removes the beta-glucan, it doesn't erase barley's cholesterol-fighting potential, says food scientist Frank E. Weber of the Miller Brewing Co. in Milwaukee. That's because malting and beer brewing concentrate the oily tocotrienol, he explains. Weber reports data from a pair of month-long studies involving a total of 73 people with elevated serum cholesterol, indicating that daily consumption of as little as 3 to 5 tablespoons of malted barley can lower serum cholesterol by as much as 15 percent.

In the first study, 4 tablespoons of malted-barley bran daily lowered serum cholesterol an average of 6 percent. In the second study, participants ate a low-fat diet along with a daily dose of either 3 tablespoons of malted-barley bran or the oil derived from 4 tablespoons of the bran. Their cholesterol levels dropped an average of 10 percent, Weber says.

Moreover, the cholesterol-lowering effect of bran flour made from malted

barley "is more persistent than oat bran's," he asserts. "You can stop taking [malted] barley bran and tocotrienol, and eight weeks later your cholesterol is still lower [than before the supplementation began]."

"Beta-glucan has proven cholesterol-lowering effects," says James Anderson, who pioneered oat bran's use in the dietary management of high cholesterol at the Veterans Administration Medical Center in Lexington, Ky. However, he adds, beta-glucan and tocotrienol are not panaceas. Some people with high cholesterol show little or no response to them. And among those who do respond, he points out, "we seldom see a [diet-induced] blood cholesterol reduction of greater than 20 percent. I think that's sort of the limit of its potency." Patients who need more dramatic reductions to bring their serum cholesterol into the healthy range "probably need a more powerful drug," Anderson says.

What about people whose serum cholesterol is already in the healthy range? Dietary changes may not lower it much, if at all, these researchers observe. But beta-glucan's benefits extend to another front. The National Cancer Institute recommends eating at least 20 to 30 grams of fiber daily — about twice what most U.S. adults now consume. And beta-glucan, whatever its source, could help many people fill that fiber gap. □

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ably go way up," Hall predicts.

USDA scientists tend to downplay such dire scenarios. So far, they note, government brigades using hormone-drenched traps have captured and then killed more than 13,700 northward-moving African swarms in Mexico. Taylor and other critics say that number is minuscule compared with the more than 2 million managed hives in Mexico and the large, uncensused population of wild bees. But USDA officials maintain the delaying tactic has worked, and they say the bees' impact in the United States will be greatly reduced with expanded trapping of intruding swarms, periodic requeening using certified European queens, and mass releases of European drones.

Ultimately, everyone agrees, the final picture will depend on just how much hybridization really occurs, how well the hybrids will compete in temperate environments and how hybridization will influence bee behavior.

"It's obvious to me that hybridization is occurring in some transition zones," says USDA's Sheppard. That observation leads him to believe that the bees will not pose such an extreme problem by the time they become a permanent part of the U.S. landscape. "But am I right about that? I'll know in 25 years, at the end of my career." □

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