

## Can whole grains and fiber work together?

Yes, but the right fiber ingredients and the right benefits must be used.

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Fiber and whole grains ranked first and second, respectively, among components adults most want to add to their diets, according to a survey by the International Food Information Council (IFIC). In the 2009 IFIC Foundation Food and Health Survey, 37% of respondents put fiber among the top three “potentially beneficial components” they want in foods and beverages while 34% listed whole grains.

Turning such desires into reality presents certain challenges to bakery formulators, yet a number of major bakers now market “double fiber” bread. Examples include Flowers Foods, under its Nature’s Own brand, which now offers a Double Fiber Wheat bread, made with whole-wheat flour and inulin, a fiber supplement, and providing 5 g of dietary fiber per serving. In comparison, Nature’s Own 100% Whole Grain bread contains 12 g of whole grains (a blend of millet, oats, flax, whole-wheat flour, buckwheat, brown rice, spelt, rye, barley, Kamut and triticale) and 3 g of fiber per serving.

In November 2008, EarthGrains, a Sara Lee brand, launched a Double Fiber variety of whole-wheat bread, reporting that it carries twice the fiber of wheat bread. Hostess Brands (formerly Interstate Bakeries Corp.) included Double Fiber 100% Whole Wheat bread in the February 2009 launch of its new Nature’s Pride line of breads. It contains 5 g of fiber per slice. In its Whole Grain line of bread Pepperidge Farm produces a Double Fiber variety, with the packaging’s front panel noting that it contains 100% whole wheat and is “an excellent source of fiber.”

Here’s the question: Does that extra fiber dilute the product or enhance its overall nutritional value? Actually, it does both.

**WHOLE-WHEAT FIBER.** Whole-wheat flour, being a whole-grain ingredient, carries a nice amount of fiber, nearly always enough to qualify bread as an “excellent” source of fiber. But still, the formulator and baker must be careful with their whole-wheat flour specifications.

“Specifying whole-wheat flour is complicated by its water level,” explained Bill Atwell, PhD, bakery category technical leader at Cargill’s Product Innovation Center, Minneapolis, MN. “Flour is typically 11 to 12% water as delivered, so its dietary fiber content ranges 9 to 12%, and this fiber, at the lower range, consists of 8% soluble fiber and 1% insoluble. If specifying on a dry basis, the fiber numbers will be higher, and if specifying at 14% moisture, the numbers will be lower.”

Dr. Atwell also recommended careful evaluation of protein content and quality when selecting wheat varieties for whole-wheat flours. The wheat’s gluten, already diluted by the presence of fiber-enhancing ingredients and bran, must be capable of carrying this extra inert weight while also fulfilling its necessary structuring function in the dough. “Whole-wheat flour doesn’t perform like white flour,” he continued. “In specifying flour, you must make sure that the gluten is sound, and that it is made from a wheat with the right performance characteristics. Specifications are important.”

**BRING UP LEVELS.** Although whole-wheat flour carries a considerable amount of dietary fiber, bakery formulators contemplate adding more through use of supplementary ingredients. Such additions, however, will affect not only the demand on protein but also the dough's flow characteristics.

"When adding fiber, you have to consider the processing aspects," Dr. Atwell said. "And if you put in high levels of fiber, you risk flavor and texture problems. These could be addressed by adding flavors or softening the crumb with mono- and diglycerides. Overall, you have to be careful not to compromise the product by overly diluting the gluten."

The formulator should first decide the target levels for both whole-grain content and fiber addition, according to Elizabeth A. Arndt, PhD, director of R&D, ConAgra Mills, Omaha, NE. She offered the example of the company's Sustagrain barley as the dietary fiber source. The identity-preserved, waxy barley contains 30% total dietary fiber, the highest level of any whole grain.

"With pan bread or other yeast-raised products, a great place to start is a 15 to 25% replacement of flour with Sustagrain barley," Dr. Arndt said. "In quick breads, muffins and cookies, usage level can go even higher." The barley works well with ConAgra Mills' Ultragrain whole-wheat white wheat flour. By using 15% Sustagrain with 35% Ultragrain, the formula reaches the 51% whole grain threshold required by rules covering whole-grain labeling, and the barley provides "an extra boost of fiber," according to Dr. Arndt so its dietary fiber content exceeds that of products made with the flour only.

Polydextrose, a fiber ingredient that contains 90% dietary fiber, proved its usefulness as a fiber supplement in white bread, according to Peter Thomson, applications specialist, bakery and cereal technology, Danisco (UK) Ltd., Redhill, Surrey, UK. He described a recent project in Europe that targeted children and elders, two population groups that generally prefer white bread. The added fiber consisted of Litesse polydextrose in powdered form. "It was added with the flour, with the only adjustment being water content," Mr. Thomson said. "A taste panel found no difference from the control, and as bakers know, getting more water into the dough increases batch yield."

This application involved an English white bread, noting that bakers in the US and Mexico are looking at similar white bread applications, according to Mr. Thomson. Although work with wheat and brown breads has yet to take place, "you can add polydextrose to whole-wheat formulas as long as you adjust the water," he observed.

**FIBER SPECTRUM.** To increase the fiber content of baked foods, formulators have many choices for dietary fiber supplementation. Some are made from grains, others from fruits and vegetables, and yet more from starches derived from these and other plant sources.

"Our 'go to' solution is Sustagrain barley," said ConAgra's Dr. Arndt. High in total dietary fiber, particularly beta-glucans, it can support the barley heart health claim. Because it is lower in starch than other grain-based fibers, it measures lower in glycemic index, a benefit when formulating products targeted at the health-and-wellness market. "We have a full portfolio of whole-wheat flours, including Ultragrain, rye and the Ancient Grains line," she added.

At Cargill, Oliggo-Fiber inulin, derived from chicory roots, is described as an "invisible fiber" because it does not affect the taste or texture of foods. "We also have ActiStar, a resistant

starch made from tapioca, which does not affect the rheology of the dough because it does not bind water,” Dr. Atwell said.

Another inulin is BENE0-Orafti’s proprietary long-chain inulin ingredient, OrafitiHPX, which Joseph O’Neill, executive vice-president of sales and marketing, North America, BENE0-Orafti, Inc., Morris Plains, NJ, described as ideal for fiber fortification of high-fiber breads. “It has been developed to minimize enzyme degradation during the proofing phase of yeast-raised baked foods,”

he said. “Its long-chain inulin molecules have an increased resistance to hydrolysis from the yeast enzymes. This feature minimizes sticky doughs and avoids lump formation during high-fiber bread manufacture.”

The inulin family is composed of native inulin and long-chain inulin with average degrees of polymerization (DP) of 11 and 23, respectively, according to Mr. O’Neill. Like oligofructose, native inulin ingredients are also invisible sources of fiber offering prebiotic benefits without any negative texture, taste or aftertaste aspects.

BENE0-Orafti also offers oligofructose in powder and liquid form with DP levels from two to eight and fiber contents between 85 to 95%. The oligofructose products can be widely used in the bakery as a source of prebiotic fiber and/or an all-natural sweetener. Mr. O’Neill pointed out that both Orafiti inulin and oligofructose are very well suited for use in the full range of baked food applications. No special processing adaptations are needed. Oligofructose is useful in improving flavor development and browning reactions in cookies and breads because of the reducing sugars present in the ingredient.

At Danisco, the key ingredient for such applications is Litesse polydextrose. Mr. Thomson described it as a formula-friendly, multipurpose ingredient that is easy to formulate into bakery foods. As well as powder form, Litesse is available in a solution of 70% solids, hydrated with water. A 50:50 blend of polydextrose and lactitol can replace glucose or invert syrups in cakes, biscuits, nutrition bars and other baked foods. A soluble dietary fiber, polydextrose is very concentrated.

Resistant starch provides another way to enhance the fiber content of baked foods. “Resistant starch is white, relatively tasteless and has a minimal impact on the organoleptic qualities of baked foods,” said Rhonda Witwer, senior business development manager, nutrition, National Starch Food Innovation (NSFI), Bridgewater, NJ. The company’s Hi-maize resistant starch, a natural insoluble fiber, and its Nutriose soluble fibers are well suited to bakery applications. “Two to five grams of fiber can easily be added to baked foods with either or both of these dietary fiber sources,” she added.

**WATER DIMENSIONS.** “Whenever you start putting extra things into a formula, you compromise the product,” Dr. Atwell said. “Fiber dilutes the gluten and can add an abrasive texture to the crumb. All fiber breads are different, especially measured against standard white bread.

“But when making such additions, we recommend you keep the processing the same,” he added. In other words, success with fiber additions will depend on maintaining the dough’s consistency and flow characteristics that affect its handling throughout the breadmaking process. Thus, when selecting fibers, the formulator must consider water-binding capacity.

Often, added-fiber ingredients compete for the dough's water, resulting in less-than-optimal gluten formation and a dry mouthfeel.

"Fiber tends to dry out doughs," Dr. Atwell observed, "but some forms of fiber make dough characteristics better. It's best to use a blend of fibers that bind water and other fibers that allow flow." He cited an example involving Cargill's OligoFiber inulin, which acts as a plasticizer, making the dough flow better. "Then you can put in additional fibers that tend to absorb moisture, and the whole system works better."

That extra absorption can have benefits as well. "Sustagrain barley does have higher absorption, and so does the end product," Dr. Arndt said. "The benefit to the finished product is both higher perceived and actual moisture content. It helps extend shelf life and when re-heated in a microwave oven. This moisture benefit is important to sandwich and pizza applications, as well as tortillas, which become softer and more rollable. Quick breads also gain from better control over moisture during microwave preparation and for shelf life extension."

Hygroscopicity is a key characteristic of polydextrose, too. "You have to formulate to achieve the right absorption for the flour and for the Litesse polydextrose," Mr. Thomson observed.

The variety of wheat used will determine the amount of extra water required. He offered, as a starting point, that 1 to 2% extra water will be required for an 8% addition of Litesse. (All percentages are flour weight basis.) "More water means better yield and bread that remains soft over a longer shelf life," he added.

In the case of Citri-Fi from Fiberstar, Inc., Willmar, MN, its main function is to assist in moisture retention, fresh-keeping and reduction of calories and costs, according to Brock Lundberg, Fiberstar's vice-president of technology. "Generally, our products are not added to increase fiber but to allow the customer to make better finished products when fibers are used to reach a claim," he said. "Formulators use Citri-Fi for its cost-saving and moisture-retention functions. To achieve these benefits, usage level is very low, 1% or less, but additional water should be added, which Citri-Fi will tightly bind through cooking and over the shelf life of the product."

Several forms of dietary fiber do not bind water. For example, Fibersym RW and FiberRite RW from MGP Ingredients, Atchison, KS, are resistant wheat starches that deliver 85% and 75% dietary fiber, respectively. They are widely used in bakery, pasta, noodle and snack products because of their compatibility with the wheat flour in those product formulations, according to the company.

**THE PAYOFF.** Consumer interest in whole grains and fiber is part of the larger lifestyle concern over health and wellness. As Mr. O'Neill observed, "Digestive health is the number one trend in 2009 and already looks to be a leading trend for 2010 in functional foods including baked foods and cereals. Ingredients that influence digestive health will play an important role in healthy weight management. Similarly, the public is also well aware that most people do not get enough fiber."

An ever-increasing base of scientific nutritional research backs up the benefits of dietary fiber, thus enhancing its value as ingredients that can be added to baked foods, including whole-grain products.

“New studies show the potential of the prebiotic fibers inulin and oligofructose in healthy weight management and the important role of low-caloric and low-glycemic ingredients in weight management,” Mr. O’Neill said. “The use of prebiotic fibers is an excellent source of nutritional and technological advantages in foods designed for healthy weight management.”

Research strongly supports the benefits of resistant starch. Ms. Witwer observed, “To date, Hi-maize is supported by 308 published studies, including 89 human clinical trials, clearly demonstrating significant health benefits — some of which have been demonstrated with other dietary fibers and some of which are unique to natural resistant starch.”

One new study, done at Kansas State University, reported how MGP Ingredients’ Fibersym RW, a resistant wheat starch belonging to the RS4 classification, is effective in developing food products with a lower glycemic and insulin response. The study used nutrition bars and demonstrated the beneficial results, even when high-glycemic ingredients such as brown sugar and corn syrup represented 31% of the nutritional bar formula.

“One of our key messages is that not all dietary fibers are the same,” Ms. Witwer stated. “Different dietary fibers deliver different benefits.”

She stated that NSFI consumer research has shown that dietary fiber is not a benefit for consumers. Instead, she urged that the benefits are better communicated in terms of regularity, weight management, satiety, glycemic management, improved insulin sensitivity or calcium bioavailability. But it is also important that foods making these claims, whether stated or implied, be held to account for substantiation.

“It’s no longer true that fiber equals fiber and the cheapest one will suffice,” she said.