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2012 FIBER REVIEW

Consumers tune in to fiber

Innovations help busy consumers fill the gap

PEOPLE OF ALL AGES KNOW BY NOW THAT FIBER IS "good for you," and that they should be consuming more of it. A new study from Tate & Lyle, Decatur, Ill., revealed that nearly 90 percent of Americans believe that their digestive health is a top priority, and that consumers are interested in buying products with a "nutritional punch" of fiber.

Many shoppers are already scanning supermarket shelves for whole grain products, choosing "heart healthy" fiber-rich cereals and breads, and checking nutrition labels for dietary fiber values. Some are seeking gut-friendly prebiotic products to boost their digestive health and using supplement powder mixes that provide added servings of fiber to their diets.

The "cardboard factor" associated with dense bran muffins of the past left a lasting impression with many, despite recent consumer interest in fiber. But that's all changing due to new and innovative ingredients available to manufacturers. Beverages now are getting their fair share of the fiber spotlight by adding ways for consumers to get their recommended daily amount of fiber.

A new study from Tate & Lyle revealed that nearly 90 percent of Americans believe that their digestive health is a top priority.

MORE THAN JUST BULK

Campaigns around whole grains and prebiotics have spurred considerable consumer awareness of fiber, setting the stage for the acceptance of new fortified products that can increase fiber intake and provide health benefits from an entirely new angle.

The diverse family of dietary fibers is complex and not fully understood by most — even consumers who are aware of the topic might possess only a basic knowledge of specific items such as particular health benefits or daily recommended values.

"Fiber means lots of things to a lot of different people," says Deborah Schulz, product manager at Cargill Health & Nutrition, Minneapolis. "Fiber in and of itself can have a lot of different health benefits."

Fiber added to a weight loss beverage will mean one thing to one audience, she explains, whereas fiber added to a flavored drink might have a different marketing appeal to another audience. Any way you look at it, people are drawn to both proven and potential health benefits and are accepting the idea that fiber can be about much more than bulk and roughage.

The International Food Information Council (IFIC) found that a majority of Americans are interested in foods and beverages that can provide a host of health benefits, based on its 2011 Functional Foods/Foods for Health Consumer Trending Survey. These health benefits included the following: maintaining overall health and wellness; improving heart health, bone health and digestive health; and contributing to a healthy body weight.

The survey found that 62 percent of Americans were already consuming fiber for its associated heart health benefits, and 64 percent were aware of fiber's associated health and weight management benefits. Seventy-two percent were aware of the benefits of prebiotics and prebiotic fiber, which is a significant increase since 2009, IFIC reports.

Santiago Vega, senior manager of nutrition marketing at Westchester, Ill.-based Corn Products International, which acquired National Starch Food Innovation in 2010, sees the "aura of healthfulness" around prebiotics in dairy foods and beverages as the connection to recent increases in awareness.

"Dairy beverages overall are a very good fit in terms of application and the perceived benefits from consumers," he says. "But we're also seeing more and more in innovative shelf-stable beverages."

Shelf-stable beverages are an area that generally is targeted toward younger populations, he explains, and it's where he expects to see the most activity.

Fiber does have a broader audience beyond the baby boomer generation, Vega says. Digestive health is a hot topic that crosses all demographics, and although the primary audience for fiber is baby boomers interested in digestive health and overall well-being, active and health-aware adults ages 18 to 34 also are a target market, he adds.

Fiber is top of mind for parents, too. Tate & Lyle recently reported that more than 85 percent of parents believe fiber is important for their own diets, and 9 out of 10 parents believe it is important to include it in their children's diets.

No matter the demographic, consumers will only be interested in fiber-fortified beverages if they taste great, experts say. Expense, taste, availability and convenience — in that order — are cited by IFIC as barriers to consumption of functional foods.

A NUTRIENT OF CONCERN

Although consumer awareness about the need for fiber is on the rise, it's no surprise that Americans don't eat enough fruit and vegetables, which is why the U.S. Department of Agriculture (USDA) 2010 Dietary Guidelines for Americans identified dietary fiber as a "nutrient of concern."

Recommended fiber intake, according to the report, is 25 grams of dietary fiber a day for women and 38 grams each day for men (based on 14 grams per 1,000 calories). The average intake (AI) in the United States is only 15 grams a day, roughly half of what's recommended.

In January 2011, the Beneo-Institute, a resource of Belgium-based Beneo, published a report on the dietary fiber gap in its *Window to Science* publication, providing a global view on the topic. It concluded that the fiber gap unquestionably exists globally as well as in the United States.

"When you look at the hard facts, the [World Health Organization (WHO)] and also the USDA recommend 25 grams per day of fiber for women and 38 grams for men, and the actual intake is just 11.5 grams for women and 21.1 grams for men," says Christian Niederauer, market research manager at Beneo.

The company reports that various government agencies worldwide have developed recommendations for intake because the epidemiological data substantially links dietary fiber levels in the diet to "a number of physiological conditions or chronic diseases."

Despite the cultural diversity in eating habits and a slight variation in recommendations for intake from country to country, the statistics clearly show that actual intake does not meet the respective recommendations in most countries.

In the report, the company notes that the global fiber gap is "impressive, despite the widespread knowledge that fibers are 'good for you' and despite the dietary recommendations from health advisory groups."

BEVERAGE OPPORTUNITIES

Dairy and weight loss drinks will continue to dominate the fiber-enriched market for now, but consumers are looking more and more to functional foods that can support a wider range of benefits beyond pure digestive health, experts say. Whether they are looking for grams of fiber or for specific health benefits,

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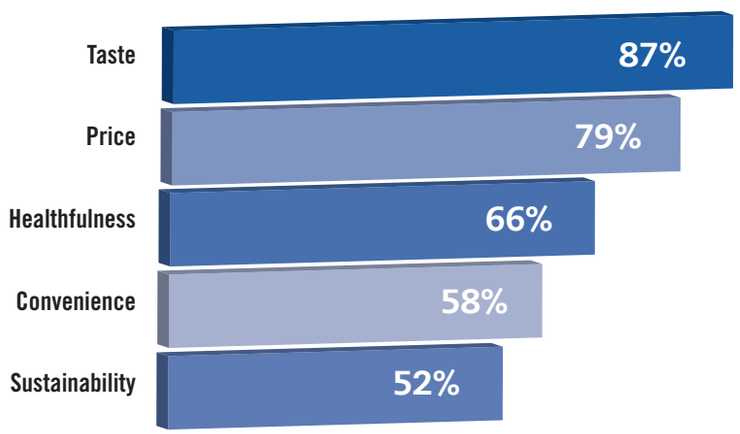
Factors influencing food and beverage purchasing decisions



Source: International Food Information Council, 2011 Functional Foods/Foods for Health Consumer Trending Survey.

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sneaking more fiber into the diet is top of mind.

Although taste continues to be one of the main drivers of purchasing decisions when it comes to foods and beverages, price is rising as a significant factor, followed by healthfulness and convenience, experts say. Many beverage subcategories can take advantage of the opportunity to offer innovative options that meet desires for great taste and added value.

Fiber-enriched dairy drinks remain in high demand, but industry experts concur that fruit juices and juice beverages are the most promising of all sub-categories for the near term. Consumers know that fruit and vegetables contain fiber, and will look to juices to provide more fiber in their diets, experts say.

A lot of people believe that fruit juice contains a lot of fiber, when in fact it doesn't, so it's a natural fit for enrichment from a marketing standpoint, Schulz explains. Beneo's Niederauer agrees that consumers will accept the idea of added fiber in juices as opposed to other beverage categories that might not have the same association with fiber.

"Other sectors do not have this natural fit with fiber and people still have some obstacles against products that they think should not have a fiber claim from a natural point of view," he explains.

Similarly, drinks that already have some association with functional benefits or nutritional enhancements, such as vitamin-enhanced waters, flavored drink mixes and nutrition drinks, will be the enriched products most readily accepted by consumers, experts suggest.

Corn Products International's Vega says there also might be opportunities with products such as shots that feature nutritional or functional benefits, but says the primary categories of opportunity are dairy and shelf-stable beverages. In general, the focus on innovation from a manufacturing standpoint is on shelf-stable beverages, he notes.

Functional water could play a big role, too, especially in the U.S. market where successful vitamin-enhanced and functional water brands already tout myriad health benefits, experts say. Added fiber could provide serious bang-for-the buck for those also mindful of increasing water intake for both adults and children, they add.

Enriched hot beverages have not hit the U.S. market with fanfare yet, but abroad — especially in Asia — fortified teas are appealing because the fiber provides an added enhancement to antioxidant-rich products, experts say.

"[Teas] may be a category that can grow from a fiber standpoint in the future," says Corn Products International's Vega. Less of an interest exists in coffee, but fortification might be a good way to bring innovation to that category, he notes. **BI**

HEALTH BENEFITS OF FIBER

Insoluble fibers like psyllium husk, which is found in Metamucil, have long been known as the key to helping folks stay "regular" due to its ability to provide bulk amounts, but fiber is about more than just regular bowel activity. Properties of fiber beyond solubility and insolubility, such as fermentability and viscosity, now also are understood as important factors in the physiological effects of fiber.

The Academy of Nutrition and Dietetics, formerly the American Dietetic Association, reports that high fiber diets overall reduce the risk of chronic disease and have beneficial effects on risk factors for developing disease.

According to the Academy of Nutrition and Dietetics, a wealth of health benefits are attributed to a fiber-rich diet, including the following:

- Cardiovascular health: A high intake of soluble fiber may help lower total blood cholesterol levels by lowering LDL cholesterol levels. Studies have shown that increased fiber in the diet can lower blood pressure, improve serum lipid levels and reduce inflammation, which are important factors in reducing risk factors and increasing heart health.
- Bowel function: Fiber increases stool weight and promotes laxation. Normalized bowel movements and overall bowel health decrease the risk of constipation, hemorrhoids, irritable bowel syndrome and diverticular disease.
- Digestive health: Prebiotic fibers have gained consumer awareness in recent years for their positive effect on colon health because they stimulate the growth of beneficial intestinal bacteria in the colon.
- Weight control: Fiber serves as an aid in weight loss primarily because it hastens and sustains the feeling of fullness.
- Diabetes prevention and management: Soluble fiber can slow the absorption of sugar and help to control blood sugar levels for people with diabetes. Insoluble fiber has been associated with reducing the risk of type 2 diabetes.
- Bone health: Fibers including inulin, oligosaccharides and resistant starch have been found to affect bone mineral content, bone structure and mineral absorption, particularly for calcium.
- Immune health: Prebiotic fibers have a positive effect on gut health and stimulate the growth of *bifidobacteria* in the colon, which has an overall immune health benefit.
- Effects on cancer: Fiber's effect on cancers, including colorectal and breast cancers, is still unclear but continues to be studied extensively. **BI**

Understanding fiber fortification

Myriad options available for enhancing drinks

IN A BROAD SENSE, YOU'VE PROBABLY HEARD FIBER categorized as insoluble and soluble, but the classifications are even more complex. Fiber can be subcategorized in a number of ways including by viscosity, fermentability, physiological effect, source or chemical structure. Understanding fiber through these various lenses is the key to producing products that can speak to today's consumers, experts note.

Simply put, dietary fibers are indigestible plant carbohydrates. The terms insoluble and soluble refer to the fiber's ability to dissolve in water, but also hint at the different functions of these fibers. Insoluble fiber is known for its ability to move through the gastrointestinal (GI) tract, provide bulk and regulate bowel activity, whereas soluble fibers absorb water and can become gelatinous, slowing the movement of food through the digestive tract. Prebiotic soluble fibers can be fermented in the colon by the normal bacteria that live in the gut and provide digestive, immune and bone health benefits.

Newer soluble fiber ingredients such as inulin and oligofructose are non-viscous and sometimes are

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DIVERSITY OF DIETARY FIBERS

FIBER TYPE	Non-starch polysaccharides (NSP)				Resistant Starches (RS)	Non-digestible Oligosaccharides	Synthetic carbohydrates compounds
FIBER SOURCE	Cell walls of cereals, vegetables, fruits	Storage carbohydrates	Algal polysaccharides	Other polysaccharides			
INGREDIENT OPTIONS	Cellulose Beta-glucans Hemicelluloses: • Arabans • Arabinoxylans • Galactans • Glucomannans • Xyloglucans Pectins	Fructans • Inulin Galactomannans • Guar	Galactans • Agar agar • Carageenan Polyuronic acid	Xanthans Mucilages Chitin	RS1: Physically inaccessible starch RS2: Native starch granules RS3: Retrograded starch RS4: Chemically modified starch	Oligofructose/ Fructo-oligosaccharides Galacto-oligosaccharides	Polydextrose Indigestible dextrins Modified celluloses

Source: Beneo-Institute, *Window to Science*, Edition 1/2011. Reprinted with permission by Beneo-Institute.

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referred to as invisible for their clear and tasteless characteristics. Soluble fiber ingredients are the most relevant to today's beverage market because their non- or low-viscous properties mean that lighter drinks, such as juices and waters, are now possible to fortify, suppliers explain. Commercially produced soluble fibers like psyllium, beta-glucan and pectins have been available for many years, and generally work well in applications with plenty of texture and body, suppliers say.

A variety of low molecular carbohydrates are increasingly used in food processing, the Academy of Nutrition and Dietetics reports. These include resistant starch, polydextrose, and non-digestible oligosaccharides including fructo-oligosaccharides (FOS) and galacto-oligosaccharides (GOS). Resistant starch can be used as a functional fiber and, in fact, is oftentimes categorized as a dietary fiber because it is not digested in the small intestine.

Fibers originate from a wide variety of sources including wheat, corn and chicory root, so they can be categorized by origin but also by their chemical structure, such as non-starch polysaccharide (NSP), oligosaccharide, synthetic carbohydrate or non-resistant starch.

New low-viscous soluble fibers present an opportunity for fiber fortification, not just in terms of new beverage formats and applications, but also in terms of offering a wider array of health benefits, which could set these fibers apart from their traditional counterparts.

BEVERAGE APPLICATIONS

With novel fiber ingredients at their fingertips and strong demand in the marketplace, beverage formulators are poised to develop creative drinks that get consumers excited about upping their fiber intake.

Santa Monica, Calif.-based Nutrition Innovation provides product formulation, marketing and regulatory support for the dietary supplement and functional beverage industry. Alan Roberts, chief executive officer and founder of Nutrition Innovation, says that with so many new fibers now accessible to developers, he finds himself at the intersection of fiber enrichment, where many players are seeing the opportunity for what was once a very niche market.

"What's happening in our industry is that there's a lot of overlap, because functional food manufacturers want to give value-added propositions to their consumers, and the supplement companies want to have products outside of just pills and capsules, so they are looking to beverages," he says.

Fiber formulation can pose many challenges, such as an unwanted effect on mouthfeel and texture, the presence of off-flavors, issues with digestive tolerance, or degradation of the fiber content due to hydrolyzation under high heat processing or acidic conditions.

The biggest challenge in formulation, Roberts says, is "trying to fit a high amount of fiber into a serving. Depending on the fiber source, it can change the consistency or the organoleptic profile of the beverage."

Janae Kuc, senior research and development scientist at Gum Technology Corp., Tucson, Ariz., agrees saying: "High amounts of fiber tend to make beverages chalky. The most prevalent challenge to formulating a fiber-enriched beverage is providing a favorable texture while incorporating enough soluble and insoluble fiber into the system to meet a high fiber claim."

Roberts says the choice of fiber comes down to the format of the product and the claim the manufacturer wants to make in order to create a marketable product. One thing is for sure, he says, "With formulation, it's got to be cost effective."

Before technological advances were mastered in extracting, purifying and producing soluble fibers, formulators wanting to enrich food products were limited mostly to insoluble fibers, such as cellulose, that boosted the dietary fiber content in grain-based products.

Viscous soluble fibers, such as psyllium, some gums, beta-glucan and pectins, have been commercially available for some time; although they do provide a fiber boost in products, in beverage applications oftentimes their viscous nature means that they are primarily used in drinks that require some additional body or texture, suppliers say.

A number of inexpensive, low- and non-viscous fiber ingredients have been developed in the last decade due to extensive fiber research and technical advancement, which has opened doors for beverage formulators who previously thought lighter, clearer beverage applications were off limits when it came to fortification.

First identified and named in 1995, prebiotics are a type of soluble fiber that nourish the good bacteria that live in the digestive system. They are poorly digested by the upper GI tract and remain intact until they reach the large bowel, where they are fermented by the colon and stimulate the growth of beneficial bacteria, such as *bifidobacteria* and *lactobacilli*, and serve many important functions including helping to support the immune system and digestive tract.

Tate & Lyle offers Promitor soluble fibers that have prebiotic effects and remain clear in beverages, such as flavored water.

A number of positive effects are associated with prebiotics, including the enhancement of mineral absorption and support for overall health. Many fibers including GOS also are fermentable to a certain extent, though the most prevalent forms discussed in the industry today are inulin and oligosaccharides.

The newer non-viscous, invisible soluble fibers not only have implications for color and texture, but their effect on health claims is important, too. They can be added to beverages at levels high enough for fiber claims without detection by consumers, and they also bring with them an entirely new set of health benefits that manufacturers can use to market the products, according to suppliers.

INULIN AND OLIGOSACCHARIDES

Inulin and oligosaccharides, which are part of inulin and sometimes referred to as FOS or scFOS for the short-chain form, are the most common of these invisible fibers. Often sourced from chicory or Jerusalem artichoke, these fibers are fermented in the colon, and are commonly added to yogurts and dairy beverages that contain active cultures to increase the digestive benefits through their prebiotic nature.

Inulin has implications for bone health and weight loss as it has been proven to aid in the absorption of calcium and in appetite control.

Beneo carries two fibers derived from chicory root in its portfolio: oligofructose and inulin, says Rudy Wouters, vice president of the Beneo-Technology Centre. Both are soluble fibers, although the oligofructose is considered more soluble, he notes. Their flexibility in terms of function, he says, make the fibers valuable ingredients.

Inulin can be used to improve the body and mouthfeel of low-fat products to deliver a creaminess in the product, which is why, in part, it is commonly used in dairy applications.

The company's inulin also can be used in non-dairy applications that benefit from reduced sugar and an improved mouthfeel such as a high-fiber, reduced-calorie dry mix drink. For example, Beneo's Orafti GR, an ingredient made with 92 percent granulated inulin and containing about 8 percent glucose, fructose or sucrose, can be added to this type of formulation at about 1.14 percent. In this example, sucrose is the only ingredient that would require adjustment due to the added inulin, reduced from about 3.7 percent to 2.5 percent, according to the company. The granulated inulin has a good dispersibility and can improve dispersibility of the overall mix. The company's gel form, Orasti ST Gel, could be a viable substitution for the granulated form in some applications, the company says.

Beneo's oligofructose is available in liquid or powder form, and with its moderately sweet taste also can be used as a natural sugar replacer, it notes. Oligofructose is more soluble than sucrose and is known to eliminate, in part, the artificial aftertaste associated with some high-intensity sweeteners, according to Beneo. The company says that certain fruit flavors also are more pronounced when used in combination with oligofructose. The product is easy to use in regard to fiber enrichment, the company notes. For an enriched apple juice, for example, Orafti L95, a liquid ingredient with an oligofructose content of 95 percent, could be added at just 1 percent, followed by flash pasteurization and refrigeration.

Both inulin and oligofructose are considered easy to use in most applications. Deborah Schulz, product manager for Minneapolis-based Cargill Health & Nutrition, agrees that inulin is especially popular for its adaptable applications. Schulz stresses that fiber's multi-functional use in formulation, which includes acting as a fat mimetic, bulking agent and masking agent, are what make it so great to work with.

Inulin is used a lot in replacing

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'ELEVATED' FIBER APPLICATION

Whether consumers will line up for fiber-enriched water is yet to be seen, but in terms of creating a fortified product that is truly undetectable by consumers and delivered in the most traditional of formats, it's the holy grail of fiber-enriched beverage applications, experts say.

"Water is more challenging than any other beverage. It has to do with the fact that water is pH neutral," Beneo's Wouters says.

Puerto Rican company 9-12 Corp. manufactures Elevate Enhanced Fiber Water, a flavored water fortified with 6 grams of soluble fiber from maltodextrin in each 16.9-ounce bottle.

"It was not easy to find a soluble fiber that was completely tasteless and would not alter the body … it took a bit of time to find the adequate fiber in the correct quantities," says 9-12 Corp. President Jose Lazoff.

The product drinks like water,

Lazoff says. At $5.99 to $6.99 for a six-pack, it's a distinctive product with no current competition, he says.

"It's a very unique product, so we have to create the demand for it," Lazoff says, noting the company has marketing plans in place for Elevate. **BI**

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calories, she explains, and also can be used to aid the mouthfeel and replace the texture lost when sugar is removed, without contributing calories. A common practice of using a high-intensity sweetener in combination with inulin provides a double benefit of adding fiber and improving mouthfeel, she says.

One of the things about inulin that's so remarkable is that "if you stir it into water, it still looks like water," Schulz says. On the flip side, she explains, one of the challenges specifically for inulin is that if you are formulating something with a low pH, like a canned juice beverage, the fiber is susceptible to breakdown by the low pH and the acid in the system, which needs to be accounted for.

The company's line of inulin comes in a variety of chain lengths, which designates the degrees of polymerization. Native inulin, such as Cargill's Oliggo-Fiber Instant inulin, can be easily incorporated in beverages such as meal replacements, dairy-based beverages and dry mixes; whereas a shorter chain inulin, such as Oliggo-Fiber F97 oligofructose, can be used for delivering fiber for clear beverages due to its higher solubility, the company says.

Cargill's Oliggo-Fiber inulin products have caloric values ranging from 1.1 to 1.3 calories per gram, which is in comparison to general carbohydrates with 4 calories per gram, it notes. The company's inulin is made of chicory root, so the ingredient can appear on a label under a variety of names, from inulin or vegetable fiber to fructo-oligosaccharide to chicory fiber.

'STEALTH' FIBERS

Fibers besides inulin also have what's come to be known as stealth formulation properties due to their low viscosities. Cargill's Barliv barley betafiber is invisible when added to beverages and thus can be applied to clear beverages, according to the company. It is a concentrated, 70 percent pure source of barley beta-glucan, which is a natural soluble fiber found in certain cereal grains, including barley and oats. Similar to oats, it is shown to lower low-density lipoprotein (LDL) cholesterol and is an authorized source of soluble fiber for a U.S. Food and Drug Administration health claim for reducing the risk of heart disease, Cargill notes.

Barliv can be used in a variety of applications, from carbonated beverages to energy drinks to dairy. As an example in a juice application, only 0.45 percent of barley betafiber is needed in order to deliver 0.75 grams of betafiber in an 8-ounce serving. Similar to inulin and oligofructose, betafiber also can be used to add viscosity and a creamy mouthfeel, though it also can be used for moisture control, the company says. For beverage applications, Cargill recommends premixing the betafiber with other dry ingredients for effective dispersion and/or preblending it in vegetable oil, corn syrup or another non-solvent to effectively hydrate the ingredient.

Another invisible fiber with interesting health benefits is larch arabinogalactan. Lonza Inc., Allendale, N.J., offers the fiber in the form of ResistAid, a proprietary "natural immune support ingredient" produced from larch trees that, according to the company, has been shown to display an array of immune health benefits. ResistAid consists of the soluble polysaccharide arabinogalactan and bioactive flavonoids with antioxidant properties. Its highly branched structure makes it very soluble in hot or cold water, the company says. ResistAid is stable in a wide range of temperatures and pH levels and is self-affirmed generally recognized as safe (GRAS) and approved as a direct food additive.

A variety of wheat and corn dextrins also are being used in beverages for their tasteless, odorless, non-viscous properties.

Decatur, Ill.-based Archer Daniels Midland Co. (ADM) and Japan-based Matsutani market Fibersol-2, a digestion-resistant maltodextrin. This soluble corn fiber is offered in the form of a spray-dried powder that is soluble up to 70 percent and is readily dispersible in water, meaning it produces a totally soluble, clear solution, the company says. Fibersol-2 has no inherent flavor, and can be used up to 10 grams in any given beverage, including juices, coffees, teas, protein drinks, soy beverages and beverages with high-intensity sweeteners, the company says. The product is acid, heat and retort stable.

Fibersol-2 contains 1.6 kilocalories per gram of carbohydrates and 0.2 grams of sugars per 10 grams, so it can be used in products with no added sugar, the company says. Depending on the beverage application, Fibersol-2 can be used multifunctionally to provide flavor and texture balance to the product, the company says. For example, in a juice application, the addition of the fiber could mask acidic notes, provide a smoother taste and reduce bitterness of citrus notes.

The fiber also can be used in a dry blend for individual serving stick packs, as the company has demonstrated in a prototype. One stick pack can contain about 5.6 grams of Fibersol-2, which provides 5 grams of dietary fiber and meets the requirements for an "excellent source" claim. According to the company, in a dry beverage mix Fibersol-2 can be dry-blended with powdered flavor, acidulant, high-intensity sweetener and/or sugar, and other ingredients. The ingredient is able to readily dissolve in water when mixed thoroughly, the company explains.

ADM notes that formulating fiber-enriched beverages can pose many different challenges, including the possible hydrolyzation of fiber under high heat processing and acidic conditions, which causes a loss of fiber content.

Heat- and acid-stable ingredients like Fibersol-2 are not limited by this issue, which has implications for extended shelf-life stability, the company says.

The companies also offer Fibersol-LQ corn syrup, a soluble corn fiber that can be used to add sweetness and humectancy to a product.

Decatur, Ill.-based Corn Products International, which also owns National Starch Food Innovation, Bridgewater, N.J., distributes a range of clean-tasting, instantly dispersible soluble fibers manufactured by Roquette and marketed under the brand Nutriose. These wheat and corn dextrins have a high fiber content of up to 85 percent, and sugar as low as 0.5 percent.

Santiago Vega, the company's senior manager of nutrition marketing, says the Nutriose line is one of the most resilient fibers in its portfolio for a range of applications within beverages. "I think that [Nutriose ingredients] are a very good option in terms of overall flexibility and versatility in terms of usage as it relates to beverage," he says.

The agglomerated form of Nutriose dissolves quickly and disperses instantly, making it a good option for beverages such as juices, soft drinks and flavored waters, the company says. A combination of high solubility, low viscosity and excellent digestive tolerance means it can be used at high levels. Because it is acid stable in pH 2.5 to 7, it can be used in acidic products, such as soft drinks, and in products that require a long shelf life without danger of fiber degradation, it adds.

Decatur-Ill.-based Tate & Lyle also offers a soluble corn fiber under the Promitor brand name. The ingredient is available in dry or liquid forms and in 70 or 85 percent fiber. It can be labeled as "soluble corn fiber" or "maltodextrin," and the powder form dissolves easily and remains clear in beverages. Promitor Soluble Corn Fiber 85 is a good choice for a high fiber, low sugar (meaning less than 2 percent sweetener) application with prebiotic properties.

GALACTO-OLIGOSACCHARIDES

GOS are prebiotic, naturally occurring oligosaccharides found in human milk and traditionally used in infant formula.

Gums can play an important role in fiber-enriched beverages when manufacturers need to texturize the product, according to Gum Technology Corp.

In addition to its prebiotic NutraFlora, Corn Products International and its subsidiary National Starch Food Innovation offer Purimune, a white powder of 90 percent pure GOS that is enzymatically derived from milk lactose. The fiber is highly soluble, stable in extreme processing conditions such as high heat and low pH of 4.5 to 7 at a 10 percent solution, and offers efficacy at low inclusion levels. Purimune is open to a whole range of beverages including those that are shelf stable.

Purimune has a clean and, like many prebiotic fibers, slightly sweet flavor and minimal contribution to viscosity, the company says. Its relative sweetness in comparison to sucrose is 30 to 35 percent, due to some residual sugars —lactose, galactose and glucose — at less than or equal to 10 percent on a dry basis, the company notes. In beverage applications, it can be pre-blended with other powders and requires low shear mixing to disperse and solubilize, Corn Products notes. The company suggests refrigeration when the pH is above 3.0 to prevent hydrolysis.

As a prebiotic, Purimune is marketed as supporting "immunostimulation" and reduction of inflammation related to immune response, in addition to having anti-infective and allergy preventative properties. No milk allergens are detected at the detection limit of less than 2.5 parts per million.

ALTERNATIVE OPTIONS

Gums, a category of hydrocolloids, are typically derived from plants and seaweeds as well as through the fermentation of sugars. Gums oftentimes are used in viscous beverage products, such as shakes or smoothies, because of their inherent thickening properties. Most gums are comprised of about 85 percent soluble fiber, but because they are not used at more than 1 percent in applications, gums typically play only a supporting role in fiber enrichment.

"Using a gum as a primary fiber generally isn't practical unless you're talking about gum acacia," says Allen Freed, chief executive officer of Gum Technology Corp., Tucson, Ariz. "The truth is that gums are not used at very high quantities, so that if you wanted to make a fiber claim, you would have to add soluble fiber along with it."

Gum acacia, an extract of the acacia tree, is the exception to the rule, he says. It has the unique property among gums to not thicken until it is used at a high percentage. Freed says if the desired application seeks to get a lot of fiber into a low viscosity beverage, gum acacia would be practical.

Gums can play an important role in fiber-enriched beverages when manufacturers need to texturize the

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product, he notes.

"You get the texturing benefit in addition to increasing the fiber content," Freed explains. "The overall benefit is that when you use a gum, you do get some fiber."

Which gum to select all depends on the final product being developed, he says. For high-viscosity products, a number of gum options are available. Freed adds that konjac and fenugreek gums are exciting options to explore from a marketing standpoint because of their proven health benefits such as a feeling of satiety and a reduction in LDL cholesterol.

Gum Technology's Konjac A is a high-viscosity glucomannan derived from the elephant yam plant, with properties similar to starch, the company explains. Konjac contains up to 95 percent soluble fiber and provides "an excellent way to provide fiber content when a stabilizer is needed," the company says. It is a thickening agent oftentimes used to replace fat, according to Gum Technology. Studies have shown that konjac can provide a feeling of satiety, offer glycemic control and lower cholesterol, the company says. In beverage applications, Konjac A can be used at 0.1 to 0.3 percent.

The company's fenugreek gum contains 85 percent dietary fiber in a ratio of 75 percent soluble and 10 percent insoluble fiber, and can be used at 0.1 to 0.25 percent to add viscosity and provide suspension in a beverage system, according to Gum Technology. The gum, which is a purified galactomannan, is extracted from fenugreek seeds and has been shown to reduce LDL cholesterol and increase HDL cholesterol levels. It is soluble in cold water and highly tolerant to extreme pH levels, the company notes.

Aloe vera also is feeling its way through the market as fiber sources that provide additional qualities and benefits. Austin, Texas-based Aloecorp Inc.'s Qmatrix purified inner leaf aloe vera powder, which has affirmed GRAS status, has interesting implications for fiber-enriched beverages with digestive health benefits, explains Aloecorp Vice President and Chief Science Officer Ken Jones.

"I wouldn't characterize it as being simply a fiber material, but this particular soluble fiber is a unique acetyl-mannan polysaccharide that's been shown to directly affect a number of factors of health in humans," Jones says. "Aloe is very well-known to positively affect digestive health and the cause of that is more complicated than merely the effects of fiber."

Early studies indicate that Qmatrix has prebiotic properties and possibly also positive effects on the increase of Phase-2 enzymes that can lead to the reduction of oxidated stress, the company says. This is in addition to the well-researched digestive and skin benefits generally attributed to aloe, Jones notes. The product has a low viscosity and a very mild aloe aroma and taste.

MAKING CLAIMS

With a broad spectrum of valuable health claims that overlap even within the use of a single fiber, manufacturers and marketers have many options for creating products that benefit and speak to consumers. Claiming the benefits on labels or in marketing can be the most important issue and, in some cases, is the product's primary purpose in terms of function and appeal to a particular audience.

As an example, a product containing Corn Products International's NutraFlora scFOS prebiotic fiber that is derived from beet or cane sugar can be incorporated at 2.7 grams per serving and 5.4 grams per serving, respectively, to deliver nutrient content claims, the company says.

In comparison, structure and/or function claims at lower inclusion levels could include support of healthy digestion, increases in levels of good bacteria and increases in calcium absorption, the company adds.

The company's Vega sees claims as a key factor in determining success for beverage developers. As companies delve deeper into which health benefits they want to focus on through fiber enrichment, he says, "Companies will prevail if they can support and defend strong claims." **BI**

U.S. FOOD AND DRUG ADMINISTRATION SPECIFIC REQUIREMENTS FOR NUTRIENT CONTENT CLAIMS

Fiber Nutrition Claim	Requirement for Labeling
"High" "Rich in" "Excellent source of"	Food or beverage contains 20 percent or more of the reference daily intake (RDI) or daily reference value (DRV).
"Good source of" "Contains"	Food or beverage contains 10 to 19 percent of the RDI or DRV.
"Provides"	
"More" "Fortified" "Enriched" "Added" "Extra" "Plus"	Food or beverage contains at least 10 percent more than the DRV for fiber.
Fiber claims	If a claim is made with respect to the level of dietary fiber and the food is not low in total fat as defined by the U.S. Food and Drug Administration, then the label shall disclose the level of total fat per labeled serving.

Source: U.S. Food and Drug Administration (FDA), 21CFR101.54

Fortification **increasing** on the shelf

Manufacturers roll out fortified beverages

ADVANCEMENTS IN SOLUBLE FIBERS HAVE GIVEN beverage developers a whole new set of tools for delivering products that help to fill the fiber gap. Although even the savviest of consumers might not know the difference between inulin and oligofructose, they are beginning to explore the growing number of fiber-rich options available outside of the bread and snack bar categories.

A report by Mintel's Global New Products Database (GNPD) shows that between 2009 and 2011, 92 beverage products launched in the United States that touted a "high or added fiber" claim. The subcategory of meal replacement beverages remained the leader in launches and overall growth throughout all subcategories, with 30 new launches in 2011 alone.

The next fastest growing subcategories are juice, beverage mixes and nectars, according to GNPD. Fiber-enriched sports drinks, energy drinks, fruit and fruit-flavored still drinks, water and coffee products also launched in the United States in this time period, although at a much lower rate than other subcategories.

Although manufacturers might or might not meet the requirements needed to make a formal U.S. Food and Drug Administration (FDA) health claim on their packaging, the marketing messages on these new high-fiber beverages are loud and clear. New products are "smart," "boosted," "enhanced" and "elevated," the report notes.

An allure for shoppers seeking increased digestive health, immune health and weight loss has captured as well as added appeal in convenient, on-the-go formats like powdered drink sticks and bottled shakes. Familiar flavor options such as coconut, blueberry, green tea and pomegranate play off of ingredients that have already established a "good for me" image in the minds of consumers, according to GNPD.

For product examples, see page 12

NEW U.S. BEVERAGE PRODUCT LAUNCHES WITH "HIGH OR ADDED FIBER" CLAIMS

	2009	2010	2011
Total beverage products	15	29	48
BY SUB-CATEGORY			
Beverage mixes	1	5	0
Coffee	0	0	1
Energy drinks	0	0	3
Flavored water	5	0	3
Fruit or flavored still drinks	0	1	1
Juice	0	4	5
Meal replacements and other drinks	9	13	30
Nectars	0	0	5
Sports drinks	0	4	0
Water	0	2	0

Source: Mintel Global New Products Database (GNPD)

Products containing fiber

Sunsweet PlumSmart 100 percent Plum Juice
Yuba City, Calif.-based Sunsweet Growers builds on the healthful image of plums with its PlumSmart juice, a blend of plum and grape juice from concentrate featuring the dietary fiber dextrin. The company notes that one 8-ounce serving offers 3 grams of dietary fiber. The juice also is available as PlumSmart Light, with 60 percent fewer calories and sugar than the original.

Naked Blue Machine Boosted 100 percent Juice Smoothie
A wholly owned subsidiary of PepsiCo, Naked Juice, Monrovia, Calif., offers its Blue Machine Boosted smoothie in a 64-ounce newly designed multi-serve package. The smoothie contains Fibersol-2 dietary fiber and contains 7 grams of dietary fiber in each serving.

YZ Digestive Health Drink Mix
Displayed at Natural Products Expo East last year, YZ (Wise) Digestive Health Drink Mix was designed by Centerbrook, Conn.-based Tower Brands to promote digestive health along with good hydration. In addition to its Green Tea variety, YZ's Lemon Ginger flavor contains 3 grams of prebiotic fiber and electrolytes.

Abbott Ensure Immune Health Shake
Targeted at baby boomers wanting to boost their immune health, Abbott Laboratories, Columbus, Ohio, created Ensure Immune Health Shakes featuring a blend of prebiotic fiber to help promote the digestive tract and immune health. Available in Vanilla, Milk Chocolate, and Strawberry and Cream flavors, the shakes retail in 8-ounce four-packs, are gluten-free, have omega-3 fatty acids and 24 essential vitamins and minerals.

Froose Beverages
Froose Brands, Media, Pa., provides innovation for children's beverages through its low-sugar, functional Froose beverage. Marketed to parents as a low-sugar "whole food beverage," it comes in a variety of natural fruit flavors. Froose is available in kid-friendly sip boxes with 3 grams of soluble and insoluble fiber, including inulin.

Benefiber Fiber Drink Mix
Novartis Consumer Health, Parsippany, N.J., now offers Benefiber drink mix in flavored stick packets, making it easier for consumers to mix the 5-ounce stick of powder into a bottle of water when they are on-the-go. The mix contains 3 grams of soluble wheat dextrin fiber in each serving and is said to support digestive health. The drink mixes are available in Cherry Pomegranate and Strawberry varieties, and also in the Original "Taste-Free" version that can be added to a variety of beverages or soft food to boost fiber intake, according to the company.