

FOOD PRODUCT DESIGN

The Best is Yet to Come: Beverages for Healthy Aging

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By Kimberly J. Decker, Contributing Editor

By now you've probably seen the statistics, heard the predictions and mused over references to the baby boomer generation as "the pig in the python." If not, here are the numbers: The 65-and-over population will grow from 38.7 million in 2008 to 88.5 million by 2050, according to the U.S. Census Bureau.

But getting old ain't what it used to be. Medical advances, improved nutrition and sheer willfulness have conspired to breed a current crop of seniors who are among the healthiest and most active ever.

They'll do what it takes to stay that way, too, making them an ideal market for beverages that fuel their golden years.

Can't stop the clock

Whether you call it the new old age, positive aging or "70 as the new 50," the way we approach aging in the year 2012 really does deserve the label "paradigm shift." Never before have we seen seniors charge into their golden years better prepared to embrace the good and resist the bad. And they do so because they can. The additive effects of better medicine, the fitness boom of the late 20th century and improved nutrition mean that people now enter old age in good health, letting them live not only longer, but better.

No matter how we spin it, though, even the "new" old age is still old age, with the breakdown and senescence that entails. According to 2008 research from SymphonyIRI Group, Chicago, 60% of those over age 65 suffer from arthritis, half from high cholesterol, one-third from osteoporosis and one-fifth from diabetes. Today's seniors aren't wringing their hands over creeping debility, though. They're taking charge of their health, giving their new Medicare cards a workout and applying a three-pronged strategy of physical exercise, mental activity and—especially—savvy nutrition to keep their systems as sharp as possible for as long as possible.

From strength to strength

It's a question beverage manufacturers are answering in every formulation. And more often, those formulations include protein. "Demand for protein beverages is up dramatically right now," says Walt Postelwait, vice president, sales and marketing, BI Nutraceuticals, Long Beach, C, and that's in large part thanks to seniors.

For good reason: Sarcopenia, the age-related loss of muscle mass, function and strength, is a pressing concern. Multiple studies have shown that as many as 30% of those over age 60 and half over age 80 experience the condition, with the average loss of muscle mass ranging from around 0.5% to 1% per year beginning at about age 40, according to *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences* (200; 55:M716-M724).

"Emerging research suggests that higher-protein diets may help preserve lean muscle in older adults," says Mickey Rubin, Ph.D., vice president, Dairy Research Institute, Rosemont, IL. "This may allow the aging consumer to be active for a longer period." He notes that beverage manufacturers can "leverage" whey protein to address mature consumers' desire to maintain the muscle strength needed to stay on the go.

With practical, process-friendly dairy-protein ingredients, that's easier to do. Research suggests that the elderly should consume 1 to 1.5 grams of protein per kilogram of body weight per day. However, more research is needed to determine the optimal protein intake regimen for this population.

Kimberlee "K.J." Burrington, ingredient applications coordinator, Wisconsin Center for Dairy Research (WCDR), University of Wisconsin, Madison, points out ready-to-drink beverages can pack anywhere from 2% to 7% protein without concerns for safety, digestibility, processing or product texture.

"Whey protein has good solubility in the typical pH range for beverages, from 3 to 7," Burrington says. "It has its best solubility and heat stability at pH 3 to 3.4, but has slightly lower heat stability at pH 3.5 to 4.5, and the least stability at pH 6 to 7." When beverage clarity is at a premium, whey protein hydrolysates with 90% protein are the best choice in beverages at pH 3.5 to 4.5. "Non-hydrolyzed whey protein isolates don't have the ability to be as clear in this pH range because they have a higher potential for protein-protein interaction due to more attractive forces between whey protein molecules," she says. "This attraction creates a solution with more turbidity." She also notes that UHT treatments can be "strenuous" on whey proteins, and suggests hydrolyzed forms—or a combination of whey and casein in neutral applications—to increase heat stability.

As for taste, whey protein is famously mild, but Burrington says it can bind flavors over time, possibly requiring increased flavor use. From pH 4.5 down to 3, she says whey proteins work best with mango, peach, citrus, pineapple, apple and cranberry profiles, and less so with typical berry notes like strawberry and raspberry, which can accentuate the protein flavor. At higher protein levels (5% to 7%), astringency can also be a factor, she adds, although it's nothing a little extra sweetener or the addition of fiber and fat can't correct.

Soy power

Of course, muscle-building protein can also come from soy, but that's hardly the only healthy-aging benefit soy ingredients provide. Soy isoflavones, a class of phytoestrogens found naturally in the soybean, may inhibit bone resorption and stimulate bone formation. A 2003 study in *The Journal of Clinical Endocrinology & Metabolism* (88(3):1048) found consuming soy protein with calcium enhanced bone formation in postmenopausal women by 69%.

For some time now, researchers have also known that replacing animal protein with 25 to 50 grams of soy protein per day can lower circulating levels of low-density lipoprotein (LDL), or "bad," cholesterol. That finding prompted FDA to authorize a health claim linking soy protein to reduced risk of heart disease; products that contain at least 6.25 grams of soy protein per reference amount customarily consumed and meet FDA requirements for total fat, saturated fat, cholesterol and sodium qualify.

To make soy proteins and isoflavones more palatable in functional beverages, Courtney Kingery, marketing manager, oilseed division, ADM, Decatur, IL, says the company recently upgraded its isolated soy protein plant "to produce a more neutral-tasting protein." It also offers isolated soy protein ingredients designed to maintain transparency in low-pH beverages and allow for use levels that earn the FDA heart-health claim. "All of these ingredient advances were in direct response to taste and sensory preferences by consumers," she says.

Long chains for long life

Two other nutrients receiving FDA approval for a heart-health claim (albeit a qualified one) are the long-chain polyunsaturated omega-3 fatty acids docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA). Epidemiological studies and randomized controlled trials suggest that increased dietary intake of DHA and EPA reduce risk for cardiovascular disease via multiple mechanisms: lowering LDL cholesterol, preventing the arrhythmias that lead to sudden cardiac death, decreasing thrombosis risk, slowing the growth of atherosclerotic plaque, improving vascular endothelial function, slightly lowering blood pressure and reducing inflammation.

The American Heart Association, Dallas, recommends patients with documented coronary heart disease consume 1 gram of EPA and DHA per day, and that those lowering triglycerides increase the dose to 2 to 4 grams daily, whether from food sources like fatty fish or supplements administered under a physician's direction.

Higher up on the body, DHA is a major structural and functional component of cells in the eyes and brain, where it plays a part in visual and neurological maintenance as we age. A cohort of the Framingham Heart Study found that subjects in the highest quartile for plasma concentrations of DHA had a 47% decreased risk for all dementia and a

39% decreased risk for Alzheimer's compared to those in the bottom three quartiles. Meanwhile, a 2009 National Eye Institute (NEI) study using Age-Related Eye Disease Study (AREDS) data revealed that participants reporting the highest dietary levels of omega-3s were 30% less likely than their lower-level counterparts to develop macular degeneration over a 12-year period.

Formulating beverages to include omega-3 fatty acids has never been a snap, thanks to the nutrients' notorious fishy aroma, their fat-solubility and their tendency to oxidize (which only exacerbates that unpleasant fishiness). But ingredient suppliers are deploying cutting-edge technologies to head off these problems at the pass. Microencapsulation improves solubility, but the encapsulated particles often remain large enough to render the finished beverage opaque. Particle-size reduction now allows manufacturers to "shrink" the emulsified omega-3 beadlets to the nanometer scale, making possible the production of crystal-clear omega-3-enriched beverages. As for improving flavor, protecting the fatty acids from oxidation via antioxidants, encapsulation or enzymes is an oft-chosen route. So, too, is the conversion of the ingredients to water-soluble powders, which are naturally less liable to oxidize. And if all else fails and oxidation does occur, manufacturers can always lean on masking flavors to overcome the sensory results.

The body's best defenders

Reduced risk for macular degeneration is among the anti-aging benefits associated with antioxidants, a huge class of nutrients comprising everything from the mineral selenium to vitamin C to coenzyme Q10. That should come as no surprise considering that most degenerative diseases of aging—not just cancer and atherosclerosis, but Alzheimer's, osteoporosis and more—include an oxidative component. "Aging itself is the cumulative effect of a lifetime's worth of oxidation," says Doug Lynch, vice president, business development and marketing, LycoRed Corp., Orange, NJ. "Smoke, pollution, UV radiation and even normal cell metabolism produce the free radicals that promote oxidation and stress our systems, making maintenance and repair harder over the years."

Dietary antioxidants can quench those free radicals, neutralizing them and slowing down their associated degenerative effects. Exhibit one is resveratrol, an anthocyanin abundant in grape-based foods—including red wine—and that may account for the famed French Paradox: the observation that despite a high-fat diet and penchant for cigarettes, the French suffer significantly less heart disease than do other Westerners.

Vitamin E is another antioxidant with anti-aging activity. Vitamin E actually comprises several forms of tocopherols and tocotrienols, the whole collection of which works with other antioxidants, including vitamin C, selenium and the carotenoids, to reduce the risk for heart disease, strengthen immune function and defend cells against oxidative attack.

As a fat-soluble vitamin, E needs a little "help" in water-based beverage formulations, and Lynch notes that his company provides it in a microencapsulated, water-dispersible preparation that not only makes beverage application easy, but protects the vitamin from light, oxidation and interaction with other beverage ingredients.

Speaking of carotenoids, these red, orange and yellow pigments in vegetables, fruits and even some shellfish have attracted attention for reducing the risk of multiple conditions of aging. Among the 600-plus carotenoids present in nature, three of the most studied are beta-carotene, lycopene and lutein. "And what we're learning about carotenoid antioxidants," Lynch says, "is incredibly positive."

Consider lutein and its carotenoid cousins astaxanthin and zeaxanthin. By absorbing light in the blue range of the visible spectrum, these pigments prevent the oxidation known to cause age-related macular degeneration. "High concentrations of lutein and zeaxanthin in the macula—an oval-shaped spot near the retina's center—are especially important for preventing the blurred vision, central vision loss and ultimate blindness that can result," Lynch says.

Years of sun exposure leave their oxidative mark on skin, as well, and Lynch notes that researchers at the Institute of Experimental Dermatology, University Witten/Herdecke, Witten, Germany, found that 12 weeks of oral supplementation with an antioxidant cocktail containing lycopene, lutein, beta-carotene, alpha tocopherol and selenium increased skin density and thickness by 7% and 14%, respectively; meanwhile, subjects taking a placebo saw their skin density increase only 0.3% and its thickness fall 1.4%.

Recent research indicates that carotenoids may reduce osteoporosis risk, too. "People think of bone health with respect to calcium and vitamin D," Lynch says. "And those nutrients are important. But osteoporosis is also exacerbated by oxidative processes, as free radicals weaken the cells that build bone while promoting formation of

the cells that break bone down." The latter are called osteoclasts, and the carotenoid lycopene appears to prevent their formation in vitro, thus reducing the rate of bone resorption. Meanwhile, lycopene's effect on bone-building osteoblasts appears to be stimulative.

But lycopene can't work alone. "The strongest anti-aging benefits come when people consume the natural lycopene complex extracted directly from the tomato," Lynch says. "This complex includes not only the lycopene itself, but the phytosterols phytoene and phytofluene, which work synergistically with lycopene to effect the most benefits." One of lycopene's better-established benefits—the reduction in heart disease risk—illustrates this. "Researchers in one study found that a natural, tomato-derived complex of lycopene, phytoene and phytofluene reduced LDL oxidation by 85% to 90%," he says. "Contrast that with considerably lower reductions when lycopene alone was used."

Although there is no official RDA for lycopene—or for many other carotenoids—a report on lycopene and its health benefits published in the July/August 2003 issue of AGROFood Industry Hi-Tech settles on a suggested daily intake of 5 to 10 mg per day. Lynch notes that this is easily achieved through diet, and recommends that product developers aim to include roughly 20% of the total in a beverage serving.

All in good taste

Beverage watchers will speak of using ingredients like lycopene and other nutrients in "lifestyle" beverages. But "lifestyle" isn't just a handy buzzword here. It reflects seniors' growing demand that beverages support their independence and day-to-day activities while fitting into the way they live. In this sense, older beverage consumers are no different than their younger counterparts.

"Variety is the spice of life with this group, so they also want variety in their beverages," Kingery notes. "For breakfast, some will be looking for fruit-based smoothies that offer satiety through a combination of protein and fiber, along with wholesome fruit. For an afternoon refresher, lighter fruit-juice blends may hit the spot. And after a day of activities, a recovery drink that hydrates might be what this consumer is seeking."

But given the vitamins, minerals and proteins involved, making these varied beverages palatable can be challenging. Technologies for masking their off notes have improved, but alas, "there is no magic chemical out there that allows us to create a flavor that's going to mask everything," Postelwait says.

The trick lies in finding profiles that "work" with the nutraceuticals, Postelwait suggests. "If an ingredient has a brown, grassy note, for example, then work with that brown note and incorporate other notes like brown caramel flavors, vanilla flavors with a caramel background or a latte flavor with a coffee background. Those brown notes will work well with the brown note in the ingredient." In other words, don't "create flavors in an upstream fashion," he says. "Flow with the current."

Attending to the tastes of seniors is further complicated by changes that occur in the sense of taste in old age. But while a dulling of the taste buds is the usual result, the flipside is that this may liberate seniors to try an expanding range of beverage flavors. "You do get a shifting of the palate" as you age, says Postelwait, but "it's not so much that things taste different as the difference is in what they're open to." Nevertheless, beverage designers should remain "cognizant of that tastes of the demographic group" they're designing for, he continues.

Special delivery

And do your aging audiences a favor and make their beverages easy to drink. Speaking of his own 80-plus father, Postelwait says, "He's much more inclined to buy a beverage that's already whipped up and ready than he is to pull powder out of a canister and mix it up himself." Beverage developers should be sensitive to the limitations their older consumers face. "Convenience, speed and access all go to that," Postelwait says, "with consumers looking for shelf stability in ready-to-drink platforms."

After all, today's seniors are seasoned consumers who know what they want. Moreover, they don't appear to mind being marketed to as long as you speak to them not just as seniors, but as consumers with unique needs. In the end, Kingery says, "There is no one-size-fits-all consumer, so no one beverage will meet all their needs."

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What do seniors want?

HealthFocus International, St. Petersburg, FL, found in 2010 that 31% of those surveyed cited future good health as their primary driver for seeking better nutrition, a motivation that held even stronger among the survey's older respondents. Topping the list of concerns in the survey were cardiovascular health, eye health, cancer, retaining mental sharpness, engaging in normal activities, lack of energy, stress, muscle health and osteoporosis. A closer look at the change in concern between 2006 and 2010, however, shows that the biggest gainers weren't so much the "killers" like hypertension, high cholesterol or cancer (up only 3%, 4% and 5%, respectively) but conditions that affect independence, mobility and wellbeing: Alzheimer's (up 14%), eye health (12%), lack of mental sharpness (10%), stress and arthritis (both 7%) and tiredness/lack of energy (6%).

"We talk to the major players in the beverage industry and their R&D teams, and there is an increased focus in marketing and development efforts for functional beverages that provide either a unique advantage for health or something that's more of an 'umbrella' health profile," says Walt Postelwait, vice president, sales and marketing, BI Nutraceuticals, Long Beach, CA. Particularly popular among aging boomers—even aging Gen Xers—are what he calls "healthy-lifestyle beverages."

However, the aging demographic is no monolith, and different seniors seek different benefits. Postelwait sees the "old-old" as less likely to seek out beverages that address wellness and lifestyle. "The older you get, the less you may be concerned about obesity or cosmeceuticals," he says. But "among those who are younger and spryer, there is more interest in augmenting nutrition to feel better," he says. "Quality of life and experiences through nutrition are top of mind for a large percentage" of the younger old.

Whatever seniors' concerns, the number of nutrients with the potential, or proven, ability to fight them keeps growing. While acknowledging that science still has "a ways to go" in establishing "what's really effective and what's not," he insists we've clearly come a long way: "If you look at it from five- or eight-year window, the amount of science that's available today on the direct relation to what certain nutrients do for us is tremendously greater than what we had eight to 10 years ago," Postelwait says. The question, he says, "is how best do you deliver these nutrients to get the right efficacy?"

Superfruits: Can They Improve Memory in Old Age?

By 2012, the 50 and older population in the United States will reach 100 million. However, with increased life expectancy comes a high probability that this demographic will exhibit the common changes that occur with aging, such as deficits in motor and cognitive performance. Therefore, it becomes important to try to forestall or reduce the likelihood of their development.

Previous findings from our laboratory and others have suggested this might be accomplished by increasing the dietary intake of so-called "superfruits." The beneficial effects of these fruits may be the result of direct effects on brain signaling or indirect effects through antioxidant and anti-inflammatory properties of the phytochemicals in these fruits. Phytochemicals are naturally occurring chemicals in plants that, although not essential nutrients like vitamins, may be beneficial for health. Research from our lab has demonstrated "superfruits" like blueberries and strawberries can reduce age-related deterioration of motor function, learning and memory in rats, possibly by reducing pro-inflammatory gene expression and cytokines in the brain (*Journal of Agricultural and Food Chemistry*, 2010; 58:3,996-4,000). Another "superfruit," açai, also has been shown to decrease the amount of inflammation produced in brain cell cultures and in rat brains. Our research also has found that these fruits may enhance cellular autophagy, a brain housekeeping mechanism that prevents the buildup of toxic proteins in our brains as we age.

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