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Shining a Light on Sun Protection Health Claims

In May, FDA turned its enforcement eye to nutricosmetic dietary supplements that make "sun protection" claims. FDA Commissioner Scott Gottlieb, MD, announced on May 18 that FDA sent warning letters to four makers of ingestible supplements the agency said made claims beyond what's legal for dietary supplements—claims that would cause the products to be considered drugs.

These beauty-from-within supplements boasted effects ranging from the ability to "protect you from both UVA and UVB rays" to the ability to "[treat] skin disorders such as psoriasis, eczema, polymorphic light eruption, and sunburn." Read more about these claims on page 12.

FDA permits sun protection claims for topical sunscreen products, which the agency regulates as over-the-counter drugs. FDA maintains a prescribed list of approved topical sunscreen ingredients the agency deems safe and effective based on scientific evidence.

While FDA regulates topical sunscreens as OTC drugs, the agency regulates nutricosmetics as dietary supplements. (The agency does not recognize "nutricosmetics" as an official product category unto itself.) To be a legal dietary supplement, then, nutricosmetics must restrict themselves to the ingredients and health claims permitted for supplements. These ingestible beauty products can still make structure-function claims, based on FDA's stance on these particular products. But in regard to the firms FDA sent warning letters at law firm Kelley Drye & Warren LLP (Washington, DC), "FDA guidance cautions about drawing bright-line rules between permissible and impermissible dietary supplement claims."

A more prudent approach would be to look within. If you're a supplement maker engaged in or interested in the nutricosmetic space, the best practice when deciding which claims to make would be to follow directions as usual: review the soundness of the evidence substantiating your claims, and keep in mind that "FDA will look at the intended use of the product based on the marketing claims to determine what category the product falls into—e.g., cosmetic, dietary supplement, or drug," says Wolf.

If your product is intended to be a dietary supplement, claims of diagnosing, curing, mitigating, treating, or preventing a disease are firmly off the table. Nutricosmetic firms can use FDA's warning letters as a caution to, if warranted, go back and take a hard look at their own products and claims. Just don't rely on FDA's actions against other companies to determine whether or not your company is in the clear. "Determining the level of scientific evidence necessary to support a claim is fact specific, and companies should not simply rely on blanket rules regarding whether a certain type of evidence can support a claim," says Olsen.

Jennifer Grebow
Editor-in-Chief
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FDA Warns Nutricosmetic Brands Making “Sun Protection” Health Claims

In late May, FDA announced it sent warning letters to four makers of ingestible nutricosmetic supplements whose products make illegal “sun protection” drug-level claims of preventing sunburn, reducing early skin aging resulting from sun exposure, or protecting consumers from the risk of skin cancer. Only certain topical sunscreen ingredients are approved as legitimate sunscreens, the agency says. FDA classifies topical sunscreens as over-the-counter drugs and reviews sunscreen ingredients before they can be sold.

On May 18, FDA sent warning letters to the following companies: GliSODin Skin Nutrients (maker of Advanced Skin Brightening Formula), Napa Valley Bioscience (maker of Sunsafex Rx), Pharmacy Direct Inc. (maker of Solaricare), and Sunergerized LLC (maker of Sunergetic). All brands sell ingestible pills advertised as dietary supplements.

According to a May 22 statement published on FDA’s website by FDA Commissioner Scott Gottlieb, MD, “These companies...are putting people’s health at risk by giving consumers a false sense of security that a dietary supplement could prevent sunburn, reduce early skin aging caused by the sun, or protect from the risks of skin cancer.”

In the warning letters to these companies, FDA censures the companies for making unapproved drug claims that their products can cure, mitigate, treat, or prevent disease. Many of the claims FDA highlights are claims that products provide sun protection by reducing UV ray–induced oxidative stress.

In the warning letter to GliSODin, FDA said the brand’s Advanced Skin Brightening Formula marketing states: “The good news is there is a simple and natural way to strengthen your skin’s defenses against ultraviolet radiation in the form of a daily supplement designed to improve skin health.” FDA said the company also claimed that the product can “reduce oxidative stress (one of the harmful effects of UV light)” and that it “enhances photoprotection,” which FDA said it classifies as a drug claim.

Napa Valley Bioscience was targeted for claims such as “protect you from both UVA and UVB rays” and “just one capsule per day provides natural, healthy...protection from UV rays.” FDA also took issue with the claim that “Sunsafex Rx uses specific ingredients [which] can promote your skin’s natural defenses against UV rays. These powerful antioxidants help your body quench free radicals created by ultraviolet radiation before they can do extensive damage.” In addition, according to FDA, the company made a claim that “lutein and zeaxanthin protect your eyes from the oxidative stress of UV rays and may help fight the causes of age-related macular degeneration.”

The other two companies also made drug-type claims. Pharmacy Direct’s SolariCare product, for instance, claimed to contain an ingredient (Polypodium leucotomos extract) used “for treating skin disorders such as psoriasis, eczema, polymorphic light eruption, and sunburn.” Sunergerized’s Sunergetic product provided directions such as “take an additional capsule if exposed to excess sunlight” and featured product reviews mentioning skin cancer and “repairing sun damage.”

FDA regulates topical sunscreens as over-the-counter drugs. The agency reviews the active ingredients in sunscreens to determine whether those ingredients are generally recognized as safe and effective (GRASE). So far, the agency has approved a limited list of sunscreen ingredients it considers GRASE; in 2014, the Sunscreen Innovation Act (SIA) was enacted to further outline the timeline for these FDA ingredient reviews.

The products FDA regulates as sunscreens include lotions, creams, sticks, and sprays. “All of these formulations are applied topically over the skin and must pass certain tests before they’re sold,” Gottlieb said in his FDA website announcement. Sunscreens are required to be tested to measure the level of UV radiation exposure, with and without the sunscreen, that will cause sunburn.

In his statement published on FDA’s website, Commissioner Gottlieb said, “There’s no pill or capsule that can replace your sunscreen.”

FDA’s warning letters to the aforementioned nutricosmetic firms are part of what Gottlieb described as the agency’s current efforts “to advance the FDA’s framework for sun-protection products,” he said. In addition to the warning-letter news, Gottlieb announced a new FDA draft guidance related to Maximal Usage Trials (how much sunscreen usage and absorption is safe) for those sunscreen ingredients being evaluated for inclusion in an OTC sunscreen monograph, as well as a guidance outlining FDA’s enforcement approach to OTC sunscreens being “marketed without approved applications during the period before a final OTC sunscreen monograph becomes effective.”

Gottlieb also said FDA continues to encourage the sunscreen industry to perform more research on sunscreen active ingredients in order to study their safety and to determine whether and how active sunscreen ingredients are absorbed by the skin. This vetting is crucial, Gottlieb said, as consumers are more often advised to apply sunscreen frequently or even daily.
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Nutricosmetics, also sometimes called “beauty foods,” are meeting growing demands for convenient, proactive tools for looking youthful longer. These beauty products combine elements of functional foods, dietary supplements, and cosmetics. The majority of nutricosmetics in the market are nutritional supplements designed to support the structure and function of the skin. Nutricosmetic ingredients include micronutrients such as vitamins with antioxidant properties, as well as omega-3 fatty acids, carotenoids, and flavonoids to protect the skin from damaging ultraviolet light. There are also products for hair and nail care, with more mainstream beverages starting to tout claims related to these areas.

Worldwide Appeal
Nutricosmetic sales are growing globally. While the more established market is in Asia, growth is actually stronger in North America and Western Europe, where aging populations are looking to maintain health, including appearance, into later life.

Nutricosmetics’ share of the overall dietary supplement market is still small. According to Innova Market Insights data, just under 2% of global dietary supplement launches recorded in 2017 were specifically targeted at hair, skin, and/or nail health, up from 1% of product launches five years previously. In Asia, unsurprisingly, nutricosmetic launch activity is higher, accounting for nearly 3% of the region’s supplement launches in 2017. The United States was well below the global average, by comparison; just 1% of U.S. supplement launches targeted hair, skin, and/or nail health. Still, this percentage is an improvement over the 0.6% share that such supplement launches had in the U.S. in 2012.

Brand Activity
Imedeen was probably the first global nutricosmetic brand to come to market. The brand was developed in the late 1980s in Scandinavia and is available globally today. The company’s range of skincare tablets was promoted as working from within to nourish the deep layer of skin “untouched by traditional creams and lotions.”

One of the most recent entrants to the U.S. nutricosmetic market is direct marketer Avon, which launched its Espira range of health and wellness supplements in early 2018. The line is segmented into Restore, Boost, and Glow sub-brands, with the Glow range focusing on hair, skin, and nail care and featuring key ingredients such as antioxidants, biotin, vitamin C, and collagen peptides. The Glow range includes an AM Protect product for protecting skin and building healthier hair and nails, as well as a PM Restore product, a powdered mix to support better skin and nail quality in just 30 days.

Many nutricosmetic launches focus their marketing on skin, hair, and nail health and avoid mentioning the term beauty specifically, perhaps in order to reduce the risk of challenges over claims. There are some products, however, that do feature beauty in their names. One example is Viata’s Better Beauty supplement, which is launching this fall.

Finally, there is ongoing interest in developing more mainstream food and drink products with a beauty positioning, although Japan is the only part of the world where this is really an established part of the market. Beauty food and drink launches have been largely confined to the dairy and beverage categories. In the U.S., activity is highest in beverages. Oftentimes, these are soft drinks, particularly juice-based lines, that offer a range of active ingredients targeting a variety of health concerns, one of which is maintaining beauty and skin health.

Beauty Ingredients
In the U.S., ingredients used in beauty drinks have mainly been vitamins, minerals, and high-antioxidant botanical extracts. In the tea-based drinks market, products often promote a high antioxidant content, but instead of making specific beauty-related claims, these products rely on consumer awareness of the relationship between antioxidants and antiaging properties in areas such as skin, hair, and nail health.

Plant-based waters and juice drinks have seen a high level of nutricosmetic activity, with launches such as Botanic Water’s 100%...
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Plant-Based Rose Water for “multifunctional hydration,” purification of toxins, and improvements to skin texture. Meanwhile, Bonafide Prairie’s Glow Drinkable Veggies + Bone Broth includes collagen, protein, and nutrients from whole organic vegetables, while Lakewood Organic’s Cold-Pressed Super Veggie Juice claims to keep eyes and skin healthy, as well as promote normal cell growth.

In the hot-beverages category, herbal and fruit teas are leveraging their natural image and traditional health associations. Recent launches include the mainstream Tetley brand with its Tetley Glow Pineapple & Citrus Herbal Infusion containing vitamin B7 for glowing skin, as well as Bigelow Tea’s Bigelow Benefits Radiate Beauty Blueberry & Aloe tea, which also features rosehips, acerola, and elderberries.

**Room for Growth**

Outside of Asia, the beauty food and drinks market is still in its infancy, but is increasingly being driven by the growing number of customers, primarily women, who want to maintain or achieve a youthful and beautiful outward appearance. The “beauty from within” concept is now more widely recognized and, along with interest in antiaging products in general, is driving demand among all age groups.

Viatal’s Better Beauty supplement uses biotin, selenium, and select vitamins, minerals, and herbs to boost skin elasticity and hair health. Better Beauty is expected to launch this fall.

**Viatal’s Better Beauty**

**Plant-Based Rose Water**

Botanic Water’s Rose Water answers consumer demand for plant-based functional beverages. This rose water drink is said to help keep skin hydrated as well as purify toxins in the skin.

**Botanic Water’s Rose Water**

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VIRGINIA DARE
Collagen sales are skyrocketing, with foods and beverages expanding the ingredient’s fan base.

BY KIMBERLY J. DECKER

FROM THE LOOKS OF THINGS, THE HEALTH AND WELLNESS INDUSTRY IS HAVING NO TROUBLE CONVINCING AMERICANS TO TAKE THEIR COLLAGEN. SALES OF SUPPLEMENTS TOUTING THE STRUCTURAL PROTEIN AS A PRIMARY FUNCTIONAL INGREDIENT WERE UP AN ASTOUNDING 33.8% IN THE U.S., HITTING $46.6 MILLION, IN THE 52 WEEKS ENDING FEBRUARY 25, 2018, PER RESEARCH FROM SPINS LLC (CHICAGO).

So it makes sense that Google Trends tracked an all-time high in consumer awareness of and interest in collagen this year. And it makes sense, as well, that the ingredient was the talk of recent trade shows, with booths at March’s Natural Products Expo West in Anaheim, CA, overflowing with collagen powders, teas, bars, and even baked goods.

And that underscores yet another development that could elevate collagen even further: that while dietary supplements and topical beauty products have traditionally been the protein’s home, foods and drinks are emerging as novel platforms for launching collagen to an even wider audience.

Branching Out

Until now, when American consumers thought of collagen—if they thought of it at all—it was usually in the context of cosmeceuticals, nutricosmetics, and beauty. But lately, says Lauren Clardy, president, NutriMarketing Group (Santa Rosa, CA), “Collagen has moved well beyond the beauty-from-within category and now has traction in the joint, bone and muscle support, sports, and digestive health markets. Brands present in a small number of product categories, but its proven health benefits and ease of formulation will propel it into the spotlight.”
in multiple channels are segmenting into these specific targeted end points.”

Clardy sees the evolution as a consequence of the category’s maturation, and a sign that the protein is “moving more toward the footprint that you see in the Asian market,” where collagen-containing supplements, topicalis, and foods and beverages aimed at skin, hair, and nail support have long been commonplace.

As we learn more about collagen’s role in mobility maintenance and athletic performance, more consumers—and from a broader range of age groups and need states—are also turning to the protein. “In the coming year,” says Juliana Erickson, senior marketing manager, Lonza (Basel, Switzerland), “we anticipate that manufacturers will continue to account for a diverse demographic when developing joint-health products. And while it’s been traditionally seen as a market for the aging population, there’s a growing need for collagen ingredients and dosage forms to address the needs of younger active consumers.”

**Breaking Down the Building Blocks**

Another collagen driver: protein supplementation. For years, consumers and formulators dismissed collagen as a protein source because, lacking the amino acid tryptophan, it ranked as nutritionally “incomplete.” But given its presence—and prevalence—in everything from connective tissue and blood vessels to skin, intestinal walls, and the cornea, collagen, which accounts for roughly 30% of the body’s protein content, must not be all that shabby vis-à-vis our physiological needs.

And yet collagen achieves its physiological effects in a manner somewhat different from how other nutrients work. Whereas a compound like the long-chain omega-3 fatty acid docosahexaenoic acid (DHA) might go from a fish oil supplement through the digestive tract, into the bloodstream, and, ultimately, to its target tissues in, say, neural cell membranes, collagen—in its typical supplementary form—enters the system as a short peptide fragment rather than the full-length protein. When cellular receptors primed to detect the complete protein intercept these shorter fragments, they get
the message that the body’s collagen is being broken down, and that it has to ramp up production to make more.

In other words, collagen supplementation doesn’t supply the building blocks for collagen regeneration, per se, but rather provides the body with an incentive for doing so. It’s a sneaky mechanism of action, but an ingenious one, nonetheless.

Prioritizing Protein
So while collagen sales in performance nutrition “began picking up speed in 2016,” notes Kimberly Kawa, SPINS’s retail reporting analyst, “a major shift in marketing collagen as a protein source changed the direction of growth in favor of the protein supplements and meal replacements category.”

Once again, that slight shift in positioning is roping in a larger consumer base for collagen, chiefly by tilting the functionality focus away from serious athletic and competitive performance to “a more general health-and-wellness protein boost,” Kawa says. Over the 52 weeks ending February 25, 2018, in fact, sales of collagen products targeting the protein-supplementing crowd grew by 751%, earning the category $8.7 million in said sales.

Indeed, observes Vo, “The increasing need for proteins that are easy not only to digest but to absorb, that nourish the aging human body, and that are also pure and sustainable is the driving force for this trend. With solid scientific research proving its health benefits, and with ingredient technologies allowing for its easy breakdown and absorption, collagen has become the perfect choice to meet this need.”

Eat It
Edible and drinkable applications are becoming the perfect vehicles for delivering collagen. As Heather Arment, marketing coordinator, North America, Gelita (Sergeant Bluff, IA), notes, “While collagen has been successfully used for years in topical beauty and personal care products such as lotions, face creams, and more, recent scientific evidence confirms that the highest efficacy can be achieved when collagen is ingested orally. This has created new opportunities for beverage, food, and supplement manufacturers.”

Yet because typical dose loads run from the roughly 2.5 g/day of type I collagen needed to see dermatologic results to the 7- to 10-g/day doses of type II collagen shown to promote joint improvement, any supplementary pill or capsule big enough to carry that much collagen would be a tough one to swallow, literally.

“That’s why it lends itself so brilliantly to delivery and packaging technologies such as RTD beverages, shots, jellies, chocolate chews, and more,” Clardy says. “We’ll see collagen in mainstream functional foods such as protein chips and snacks, bars, confections of various types, and beverages where it’s featured prominently and the brand value proposition will be centered on collagen.”

To Market, to Market
In fact, we’re already seeing it. And according to Nan Callan-Zamora, public relations and communications manager, Twinlab Consolidation Corp. (Boca Raton, FL), the reason is twofold.

First, as an odorless, tasteless powder that dissolves readily, remains stable in solution, and tolerates a range of processing temperatures, storage conditions, and formulation environments, “Collagen ingredients are easily incorporated into these different forms,” Callan-Zamora says.

And second, “Brands want to provide trendy ways to ensure consumer compliance,” she notes. So it should come as no wonder that the number of products in the grocery category featuring collagen as a functional ingredient skyrocketed 430.3% over the 52 weeks ending February 25, 2018, bringing the department $2.3 million in sales, SPINS says.

Such products include ReserveAge’s (Boca Raton, FL) Collagen Replenish and FibeHer powders, its BeauTea, and its collagen chews and beauty shots. The products, which Twinlab distributes, contain Gelita’s Verisol brand proteins.
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of collagen peptides, Callan-Zamora says, and a placebo-controlled clinical study shows that women aged 24 to 50 with moderate cellulite who received 2.5 g of the peptides during the six-month study period saw a statistically significant decrease in the degree of cellulite and skin waviness on their thighs, as well as a significant improvement in dermal density, relative to subjects taking the placebo. “This is a truly novel application for collagen,” notes Callan-Zamora, “or, in this case, Verisol collagen peptide.”

Another novel collagen application is the meat bar, which checks two big boxes on contemporary consumers’ grocery lists: protein bars and meat snacks. As Eugene Kang, CEO and cofounder, Country Archer Jerky Co. (San Bernardino, CA), points out, “Protein bars are projected to grow 8% from now until 2021, according to a 2017 Technavio report. And the meat snacks category has had incredible momentum, reaching $2.8 billion.”

So using collagen to add more protein to a snackable meat bar “seemed like a natural fit,” Kang continues. Available in cayenne beef, sweet barbecue bacon, and herb-citrus turkey varieties, each 42-g bar contains 15 g of protein, 4 g of which come from collagen peptides. The meat itself is extra-lean grass-fed beef, uncured bacon, or cage-free turkey raised without antibiotics or hormones, and all other ingredients are suitably “natural” to meet prevailing consumer standards. Thus, says Kang, “We’re tapping into multiple segments while still appealing to the growing number of clean eaters and special dieters following Whole30, Paleo, and Ketogenic.”

Staying in the bar aisle, NeoCell (Irvine, CA) introduced a pair of vastly more dessert-like collagen cookie bars in coconut chocolate chunk and peanut butter crunch flavors at this spring’s Expo West. Each 45-g bar contains 12 g of protein, including some from grass-fed collagen, along with other all-natural ingredients. The company also debuted a raspberry lemon flavor of its Super Collagen Powder that adds a new twist to the unflavored powder the company launched in 1998.

And don’t forget bone broth, adds Lisette Van Lith, global director of the Peptan brand from Rousselot (Son, Netherlands). “Collagen-rich foods in the form of bone broth, commonly used in all regions of China due to its overall health benefits, have also seen growing popularity in the U.S.,” she notes. “In fact, bone broth has become one of the key drivers for collagen sales in the U.S. market, with retail sales tripling to $19.7 million in 2016.”

For her part, Clardy is bullish on collagen-boosted coffee creamers, like Vital Proteins’ (Elk Grove Village, IL) line of coconut-milk–based Collagen Creamers, and she expects to see collagen-containing yogurts and puddings, dairy-based and otherwise, “hitting shelves in the near future.” As a mainstream food and beverage ingredient, Clardy concludes, collagen may “still have a long way to go. But there’s a bright future ahead for the collagen market.”

Kimberly J. Decker writes for the food and nutrition industries from her base in the San Francisco area, where she enjoys eating food as much as she does writing about it.

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Collagen has already taken the food and drinks market by storm in Asia. In Japan, consumers have been partaking in collagen-enriched dishes for the better part of a decade. It’s not unusual to see collagen jams, collagen noodles, and collagen candies on Tokyo store shelves, while a growing industry of “beauty restaurants” serve Japanese citizens with collagen-enriched meals. In Singapore, the MeiRenGuo (“Beauty Pot”) is a popular dish among young women. One restaurant, Beauty in the Pot, serves hot soups that incorporate a collagen-enriched, shark cartilage–derived soup base. But it’s not just Asian countries seeing unique new collagen supplements and foods entering the market. Nowadays, innovative collagen candies, collagen combination kits, collagen-infused salmon broth, and even collagen-enriched gin are making their way to North American shelves.

New kinds of collagen products continue to drive category growth, both in the United States and abroad. Grand View Research estimates that the food and beverage segment of the collagen market will be the primary reason for collagen’s overall global industry growth through to 2025, with a 7% projected revenue increase.1 This broadening market opens up all kinds of opportunities for unique new product formats and formulations. Here are some of the creative ways collagen marketers are branching out.

Sports Supplements Target Older Athletes
While collagen’s primary application has historically been as a beauty and skin health aid, research is now showing that it has value as a sports supplement, especially for aging athletes and active seniors. Lauren Clardy, CEO of NutriMarketing Group (Santa Rosa, CA), says that collagen products are well suited to the sports niche, and new discoveries are making collagen supplements more valuable for active seniors.

“Our bodies are over 90% collagen,” Clardy says, “so supplementing our diet with collagen can have a significant impact on joint, bone, and skin health. As clinical research continues to investigate collagen and its role in blood vessels and wound recovery, I think we’ll see more collagen continue to grow for more condition-specific sports applications.”

Clardy anticipates that the sports nutrition market will soon see the popularization of collagen-enriched protein supplements. Collagen protein powders for athletes are already on the market, with sports supplement brands like Bulletproof and ProteinCo selling collagen-enriched sports powders in the United States and Canada.

Heather Arment, marketing coordinator, North America, Gelita (Sergeant Bluff, IA), supplier of a range of collagen ingredients, says that the growing demand for collagen in sports nutrition is driving new research and market diversification around specific collagen peptides. “Collagen supplementation is not a one-size-fits-all solution,” Arment says. “Different collagen peptides offer benefits that are optimized for different areas of the body.”

RTDs and Shots Gain Ground
While the American functional foods market lags behind those of other countries, functional drinks are an ideal vehicle for ingredients like collagen. Says Clardy: “We haven’t
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yet seen what you see in Japan, which is collagen marshmallows, etc. But we are seeing a bevy of collagen RTDs and shots hit the market, most direct-to-consumer. She says that because collagen is a tasteless and odorless substance, it is easy to include in functional beverages and foods.

“We still haven’t seen a mainstream blockbuster product hit the functional food market,” Clardy adds, however. “There are lots of powders that are popular, but they’re dietary supplements.”

Beyond the standard food market, Clardy predicts that collagen products will play an important role in the medical foods market, saying that she hopes to see the development of a bone-building collagen product in a medical line. She predicts that collagen products may develop around benefits like wound healing and post-surgical recovery.

“My prediction is that we’ll see the introduction of a range of medical foods for specific conditions like sarcopenia, osteopenia, post-surgical recovery, and fracture recovery,” she says.

Armint says that collagen drinks, whether RTD or powdered, offer manufacturers a variety of new opportunities for innovation. “Collagen peptides are highly versatile,” Arment says. “They’re a pure source of protein, non-allergenic, and free of additives, cholesterol, fat, gluten, sugar, and proteins. In their natural form, they don’t react with other ingredients, making them ideal for diverse applications.”

Manufacturers are now focusing on formulating collagen beverages with unique flavor profiles as well as exciting textures, she adds.

**Collagen Candy and More**

Move aside, Wonka Bars: Consumers with a sweet tooth are now also looking to their candy to help fend off wrinkles. Arment says that edible collagen supplements are veering into the confectionery aisle, with products like chews and gummies already on store shelves.

“These portable, convenient supplements offer all the benefits of collagen in a fun and indulgent delivery system,” says Arment. “Even in the nutritional bar category, collagen lends itself well. We’re seeing bars offering exciting and worldly flavors along with the benefits of collagen.”

Candy-style collagen supplements range from fruit chews to chocolates to gummy bears, with some health bloggers even offering do-it-yourself home recipes for creating decadent collagen sweets.

Lisa van Lith is the global director for Peptan, a branded and patented collagen peptide manufactured by Rousselot (Son, The Netherlands). Van Lith says that collagen’s push into the candy space is part of an increasing trend of “supplements to go” and supplements that fit in with consumers’ existing eating habits. Says van Lith: “Pioneering clean-label solutions like yogurts, gummies, beverages, and chocolates are continuing to emerge, from on-the-go formulations to everyday diets. A number of unusual collagen products have hit the market recently, from collagen beer in Japan to collagen creamer in the United States.”

**Beauty Kits**

Clardy says that one of the most creative types of collagen products to hit the market in recent years is the collagen kit: a product set that incorporates an ingestible collagen supplement, a topical collagen cream, and some type of delivery device. Collagen kits come in a variety of forms, sometimes featuring a mask-like device designed to infuse collagen into the skin in 20-minute application sessions.

In the past, *Nutritional Outlook* has explored the question of whether nutricosmetics are more effective than topical cosmetics. For her part, Gelita’s Arment says that orally ingested collagen is typically more effective than topical collagen creams. However, she also notes, again, that collagen supplementation is not one-size-fits-all and that different collagen peptides serve different purposes. Clardy told *Nutritional Outlook* in 2014 that while oral supplements work better than topical creams, both topical and ingested collagen have benefits—and they often work well in conjunction with each other.2

Douglas Jones, head of sales and marketing at BioCell Technology LLC (Irvine, CA), says that ingested collagen is particularly effective at stimulating production of new collagen in the skin. “Determining bioequivalence is nearly impossible when comparing different collagen ingredients,” Jones says, “but the science shows that collagen peptides can be absorbed intact and stimulate regenerative cells like fibroblasts.” He adds that clinical studies show that daily ingestion of his company’s BioCell Collagen and patented collagen ingredient increased the type I and type III collagen content in skin and stimulated the production of type II collagen. One open-label human clinical trial funded by BioCell Technology followed 29 healthy female subjects aged 35 to 59 for 12 weeks, with participants receiving 1 g of ingested BioCell collagen or a placebo once daily. This trial found that ingested collagen supplementation reduced skin scaling and dryness and increased the collagen content in the skin.3

As further studies prove the value and viability of ingested collagen, expect more combination kits to enter the market.4

Mike Straus is a freelance journalist living in Kelowna, BC, Canada. He has written for publications including Canadian Chiropractor, Massage Therapy Canada, and Iconic Concierge Vancouver.

**References**


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just like a wedding photographer or a landscape architect, a nutritional ingredient can gain a real market advantage when it specializes. Look no further than the carotenoid lutein, which may come closer than any other to being a household name thanks to its widely publicized—and even more widely substantiated—association with ocular health.

And yet the more we learn about just how embedded—literally—lutein is with healthy vision, the more evidence we uncover that its benefits redound elsewhere. And that should open up eyes to lutein’s benefits well beyond its traditional base of—let’s be honest—older fans.

As Brian Appell, marketing manager for OmniActive Health Technologies (Morristown, NJ), puts it, “Right now, lutein’s primary driver is consumers concerned about age-related conditions like macular degeneration. But new studies on lutein are showing that it has benefits in other fast-growing categories, like brain health, sports nutrition, skin health, and sleep. This new science is expected to increase demand in different consumer segments.” And it should signal a bright future for lutein and those who use it.

The Eyes Have It
Ceci Snyder, MS, RD, global vision product manager, human nutrition & health, Kemin (Des Moines, IA), shares Appell’s bullishness. “The more you know about lutein, the more amazed you are at its potential to help at all ages,” she says. “Based on the number of new products that cross age groups and body systems, interest in lutein beyond eye health is growing.”

That’s growing lutein’s sales, as well, with the ingredient’s global take expected to rise at a CAGR of 6.3% from 2017 to 2022, topping out above $350 million by the end of that timeframe, according to a report by MarketsandMarkets.

But despite lutein’s spread into untapped systems and need states, its calling card remains its reputation for ocular support. For it’s here, Appell says, where “the science on lutein is most well established.”

What that science tells us is that of the 600-plus carotenoids found in nature, only three—lutein and the zeaxanthin isomers RR-zeaxanthin and RS (meso)-zeaxanthin—congregate in the eye, forming a protective layer in the macula, a structure located in the rear of the eye that’s responsible for clarity in the direct field of vision.

But while the macula is the part of the retina most involved in high-level visual performance, it’s also the part most susceptible to photo-oxidative damage as a result of its continual exposure to high-energy light—particularly light with a wavelength in the blue portion of the spectrum.

And this is where lutein and zeaxanthin—collectively known as macular carotenoids—come in. As Appell explains, they “play two primary roles in the eye.” One, they quench the free radicals that flood the eye subsequent to photo-oxidation. And, two, they filter some of the high-energy blue-wavelength light that causes the most damage. Given these defensive actions, Appell concludes, “the more macular carotenoids you can build up in the macula, the greater the protection for the eye and ability to see clearly.”

Arresting AMD
How this plays out with respect to cataracts and age-related macular degeneration (AMD)—present in its advanced stage in 2.1 million Americans age 50 and older and likely to affect one in 10 Americans by the time they turn 80, according to the National Eye Institute of the National Institutes of Health—has long been a topic of inquiry.

As Snyder notes, results of the Age-Related Eye Disease Study 2 (AREDS2) showed that in subjects with the lowest dietary intake of lutein and its carotenoid cousin zeaxanthin, supplementation with the two macular pigments reduced the risk of progression to advanced AMD by 26% above the effects of the supplement formula used in the earlier AREDS study, which didn’t include lutein and zeaxanthin. (In the dietary supplements industry, lutein and zeaxanthin are most often commercially sourced from the marigold flower, pictured above.)
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"Based on that study," she says, "the National Eye Institute recommended adding 10 mg lutein and 2 mg zeaxanthin to the AREDS formula." Study results also show that subjects supplementing with both lutein and zeaxanthin saw a significant reduction in risk of progression to cataracts or cataract surgery compared to those who took no lutein and zeaxanthin.

**Blue Alert**

While the role of lutein and zeaxanthin in the AREDS results has been shaping opinions and interventions vis-à-vis eye health for years, Appell notes that "there’s new science on how the macular carotenoids can protect against the more immediate effects of exposure to high-energy blue light."

This matters because blue light is a primary emission product not only of electronic device screens—think laptops, mobile phones, and even old-fashioned televisions—but of now-ubiquitous LED and compact-fluorescent lights, as well. And, says Shaheen Majeed, worldwide president, Sabinsa (East Windsor, NJ), supplier of lutein-plus-zeaxanthin ingredient ZeaLutein, "Studies have shown that higher exposures to blue light is damaging to your eyes—particularly to the retina."

"In this digital era," Majeed continues, "as people spend considerable time every day with their devices, they’re experiencing the eye fatigue, eye strain, and headaches collectively termed ‘computer vision syndrome.’ The problem arises from uninterrupted focusing on a computer or mobile display for a prolonged period. And though it’s temporary in nature, it can seriously influence visual acuity in the long run."

Fortunately, research shows that the higher the level of macular pigment optical density (MPOD)—which Snyder describes as "a measure of lutein and RR-zeaxanthin status in the eye"—the greater the protection against excess blue light.

Appell notes that the BLUE (Blue Light User Exposure) study, which explored how macular carotenoids can protect against the effects of the blue spectrum, found that supplementing with OmniActive’s Lutemax 2020 (containing 20 mg lutein and 4 mg RR- and RS-zeaxanthin) yielded a statistically significant decrease in symptoms of computer vision syndrome, including an almost 30% reduction in eye strain, eye fatigue, and headache frequency.

"These study results," he says, "have implications across all age groups and offer a simple, effective solution to protect the eyes from daily exposure to digital screens." And because most people don’t consume enough lutein and zeaxanthin from natural sources like green leafy vegetables, supplementation, he says, "is the only way to get sufficient levels of these important nutrients."

Snyder agrees. "Consumers might not be aware of the connection between screen time and downstream deleterious effects. But lutein suppliers are getting the message out. "Based on the prevalence of digital devices and the likelihood of continued use even after learning about blue light," she adds, "we see opportunities for brands to develop products for all demographic profiles."

**Food (and Supplements) for Thought**

"Vision will always play a big role in the lutein market because—well, vision loss is a top concern, and the macular carotenoids are critical components in protecting eyes," Appell says. "The challenge has been bridging the importance of lutein to a younger consumer who isn’t necessarily supplementing to prevent a condition like AMD."

With supplier efforts like clinical research and marketing campaigns, he continues, "We’re seeing the momentum build as consumers understand how lutein and the macular carotenoids help protect not only their eyes well into old age, but also it can have more immediate effects that these consumers want to address."

Take improved cognition. Turns out that lutein’s ability to promote eye health underscoring how it helps nearby structures in the brain. As Snyder explains, "The connection between the proximity of retinal tissue, the optical nerve, and brain tissue allows for brands to explain the similar role that lutein plays in different parts of the body."

Indeed, "Lutein’s role in the brain is an exciting area of growing research," she says. "Observational studies provide the foundation for interest, such as looking at the relationship between MPOD and temporal processing speed as a marker of central nervous system health."

Last year saw publication of results from two intervention studies showing, respectively, that Kemin’s FloraGL O lutein and ZeaONE natural zeaxanthin ingredients support neural response and blood flow to specific areas of the brain in healthy older adults, and that supplementation with the two carotenoids improves cognitive function in healthy older adults as measured by complex attention and cognitive flexibility.

Appell points to a study showing that subjects taking OmniActive’s Lutemax 2020 supplement exhibited higher levels of brain-derived neurotrophic factor (BDNF), a protein that participates in neuroplasticity—"the ability to grow and differentiate the growth of neurons," he says—as well as in learning, memory, and cognition. The Lutein, Vision, and Mental Acuity II (LAMA II) study also showed the supplement’s effects on lowering cortisol levels, which are associated with stress, by 50% and in producing higher scores on subjects’ health-status questionnaires.

**Skin Deep**

Just as lutein collects in the macula to protect it against the effects of photo-oxidation, it’s selectively deposited in the skin to perform a similar service.

In 2016, OmniActive launched the Beautiful Skin Forever study to examine the role of Lutemax 2020 in skin health and found that supplementation with 10 mg for 12 weeks “demonstrated a rare combination of benefits,” Appell says: increases across the board in overall skin tone, lightening, and elasticity, and an increase in the minimal erythema dose (MED), a measure of how much UV light is needed to elicit a burn response. A higher MED means greater sun protection. And unlike other carotenoids, Appell says—think beta-carotene—Lutemax 2020 doesn’t produce carotenoderma, the supplement-induced yellowing of the skin.

"Consumers are looking for whole-body approaches to skin and beauty, as with collagen and similar supplements," Appell says. "Even though this is a new category for lutein, it’s unique because it addresses some of the big concerns consumers have—skin tone and sun protection, to name a few. This is a major benefit for the beauty-from-within category."

And it’s a major benefit to consumers who are discovering all that lutein can do."
Kimberly J. Decker writes for the food and nutrition industries from her base in the San Francisco area, where she enjoys eating food as much as she does writing about it.

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1. “Lutein Market by Form (Powder & Crystalline, Oil Suspension, Beadlet, Emulsion), Source (Natural, Synthetic), Application (Food, Beverages, Dietary Supplements, Animal Feed), Production Process, and Region - Global Forecast to 2022.” MarketsandMarkets, December 2017.


As if wine lovers needed another reason to uncork, the French paradox supplied ample inspiration for toasts when scientists first elucidated it in the late 1980s. But the seemingly contradictory observation that heart disease rates remain low in France despite the relatively high-fat diet—and the theory that the resveratrol in red wine might be responsible—was so compelling that even teetotalers began eyeing Cabs and Pinots in a longing new light.

But that was several decades ago, and these days a mention of resveratrol is as likely to raise consumers’ eyebrows as it is their wineglasses. Among the scientific community, however, resveratrol retains its mojo, as active inquiry into the benefits of the compound—a phenolic antioxidant produced naturally in more than 70 species of plants, including pine trees, peanuts, coconuts, blueberries, raspberries, and, yes, wine grapes—continues.

Notes Gene Adamski, national sales manager, Evolva (Reinach, Switzerland), “Any widely used ingredient like resveratrol tends to have its ups and downs in the nutritional marketplace over time.” That said, “I do feel resveratrol is mounting a comeback based on its proven benefits in the antiaging, women’s health, cardiovascular, skin, bone, and especially cognitive health categories,” he says. “Resveratrol science continues to grow with positive results. And our industry is starting to recognize the benefits again.”

Dimming Limelight

It was the purported link with heart health, as evidenced by the French paradox, that first put resveratrol on the public’s radar. But, says Dan Lifton, president, proprietary branded ingredients group, Maypro (Purchase, NY), the French paradox may, in fact, have done resveratrol supplementation little favor. “The only thing we’d been hearing for years is how we get resveratrol from wine, so if we drink red wine, we’re set,” Lifton observes. As a consequence, he says, “the value proposition for resveratrol supplementation got lost in the smoke of the ‘just drink wine to get your resveratrol’ message, which was incorrect.” After all, you’d have to toss back 41 glasses of red wine to get the 20 mg of resveratrol found in a typical resveratrol dietary supplement, Lifton notes.

On the other, says Shaheen Majeed, president worldwide, Sabinsa Corp. (East Windsor, NJ), the science itself is partially responsible for resveratrol’s dimmed limelight. “Most of the previous findings were based on cell cultures or laboratory animal experiments, he says, “with very few human studies demonstrating long-term benefits.” But with the latest research “trying to fill these gaps with well-planned human studies,” he says, “resveratrol is ready to bounce back.”

Active Areas of Inquiry

And, oh, what studies there are. Hugh Welsh, president, general counsel and secretary, DSM North America (Parsippany, NJ), did a quick PubMed search on December 13, 2017, and netted over 10,000 studies, “with more than 120 clinical trials and the total number of publications increasing year over year,” he says.
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Unique new metabolites are formed during the process, such as organic acids, oligosaccharides, sugars, vitamins, and more bioavailable minerals. Some of these new metabolites have their own bioactive effects. For example, brewers yeast *Saccharomyces cerevisiae* can transform plant polysaccharides into bioactive beta-glucans. Also, fermentation of plant flavonoids by a clostridium probiotic created an amino acid metabolite with powerful interferon boosting capabilities.

**The probiotic may also add** its own compounds. Brewer’s yeast, for example, adds B vitamins and bioactive GTF chromium.

Unique Enhanced Flavor Profiles
The increase in free amino acids, nucleic acids, and peptides creates unique flavor profiles, some that have umami characteristics that can both promote appetite and improve assimilation. New compounds may include cysteine, aspartic acid, guanylic acid, inosine, and glutamic acid.

Examples of fermented foods made by other producers that have better taste and possibly improved health benefits include kimchi, miso, red yeast rice, sauerkraut, aged cheeses, aged garlic, wine, beer, seaweeds, and pickled beets. Fermented liquid or powered yeast, mushroom extracts, and soy sauce are also widely used to enhance flavor.

Cosmetics and Personal Care Applications
For cosmetic and personal care products, Draco’s fermentation technology can help generate clean, natural ingredients. For example, Draco has developed a certified organic glycerin from organic corn using a living cell derived process. Cosmetic bioactives such as sorbitol, glycols, and organic acids can also be made ecologically without the need for petrochemical starting points. Other areas of new product development include high bioavailability actives useful for their anti-aging, skin whitening, anti-inflammation, moisturizing, and UV-blocking effects.

Customization
Draco can customize fermented product blends based on your recipe. We can make Traditional Chinese Medicine formulas for various health indications, including immune support, digestive health, sleep and relaxation, and weight loss. Or we can customize a formula based on food recipes, such as kimchi vegetables or kombucha mushrooms for either food or health applications.
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The extract in the liquid form is then inoculated with a pure form of the bacteria, yeast, or fungus to initially grow a seed culture, which is then added to the larger batch of extract.

3. Fermentation
The inoculated batch of extract is held in large tanks at an optimal fermentation temperature for up to 7 days. Since the probiotic organisms are pure and not contaminated with pathogens, the mixture does not need to be pasteurized.

Herbs, fruit and vegetables generally contain more than enough prebiotic constituents that are food for the probiotic, such as inulin (fructo-oligosaccharides), pectin, and other polysaccharides to strongly promote probiotic bacteria/yeast growth in the fermentation process once it gets started. Near the end of fermentation, a safe low heat (50-55° C) is applied to cause probiotic cell lysis, helping release the compounds contained in the probiotic cell.

4. Spray Drying
The fermented extract is spray dried into a fine powder. This operation is very quick, which helps preserve heat sensitive compounds, like B vitamins and antioxidants, and helps ensure adequate levels of live probiotic bacteria will be present in the final powdered form.

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Case Studies

**Immunity and Anti-inflammation**

_In vitro_ studies of fermented TCM herb formula extracts produced by Draco were conducted at Hong Kong University, yielding powerful, positive results on immunity and anti-inflammation. Of the samples, 31 out of 33 showed an induction effect on the immune messenger IL-1β which normally results in a widespread immune response in the body. Two of the samples gave particularly potent effects that were 69 and 52-fold increases compared to control.

For anti-inflammation, one of the fermented herb formula samples showed an effect almost 6 times stronger than the potent synthetic anti-inflammatory drug dexamethasone. Another fermented sample was tested in an IL-6 metabolic pathway, which is up-regulated in chronic states of inflammation that often involve symptoms of depression and lower levels of serotonin, resulting in an anti-inflammatory effect 2.5-fold greater than the dexamethasone control.

**Fermented Mung Bean**

Fermented mung bean has antidiabetic properties and was shown to significantly reduce blood sugar in hyperglycemic conditions, while lowering serum levels of cholesterol, triglycerides, and LDL. It also helped improve antioxidant activity. Fermented mung bean had increased levels of GABA and free amino acids as well.

**Fermented Sea Kelp**

Fermented sea kelp at a dosage of 1.5g per day given to otherwise healthy subjects with high levels of the liver enzyme GGT showed a significant decrease in the enzyme, as well as the free radical indicator malondialdehyde. Antioxidant SOD and catalase activities were significantly improved compared to placebo group after 4 weeks of use. In a separate study on liver enzymes, a fermented turmeric extract showed promising results in lowering liver enzymes.

**Neurological Benefits**

Fermentation of some medicinal herbs can provide neuroprotection and memory benefits. _Reishi_ mushroom extracted in water, then fermented with lactic acid bacteria, significantly enhanced learning memory and cognitive function of scopolamine-induced rats in passive avoidance tests. Cholinergic activity in the brain was improved by reducing the activity of the enzyme acetylcholinesterase, which breaks apart neurotransmitter acetylcholine.

Fermented _Codonopsis_ using probiotics increased phenolic levels and DPPH free radical scavenging activities. The extract also improved memory deficits in mice, had significant neuroprotective effects against glutamate-induced cell death, and reduced acetylcholinesterase levels.

References available upon request

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And the clinical trials on resveratrol increasingly target a variety of challenging “therapeutic indications,” Majeed adds, with respiratory infections, obesity, osteoarthritis, hepatitis, type 2 diabetes, cancer, and cardiovascular disorders among them.

But for many resveratrol watchers, the compound’s real potential lies in its relationship to health—what Adamski calls “the most relevant area of activity.” With the population aging, Adamski says, “there remains an unprecedented need for safe dietary interventions to help support and preserve optimal cognitive function.” Resveratrol, it appears, might help.

Get the Backstory
Precisely how resveratrol effects its antiaging benefits “is yet to be understood clearly,” Majeed concedes.

One possibility: “Cognitive performance is a matter of flow and preservation,” Adamski explains, “and research shows resveratrol to be effective in supporting many key neurological functions in an aging population.” It may do so via its influence on mitochondria, the functioning of which diminishes with age and compromises our bodies’ systems as a result. In research that Adamski calls “well received,” resveratrol has been shown “to penetrate cells and help rejuvenate the mitochondria, thus supporting healthier aging.”

Majeed adds that some studies have shown that in certain species of yeast, roundworms, and fruit flies, as well as in human cell cultures, resveratrol appears to turn on genes that make sirtuins, which are “ancient proteins found in virtually all species.” The genes controlling sirtuins’ expression may confer a survival advantage upon organisms during especially stressful times. “Hence,” Majeed says, “activating sirtuins is thought to give rise to a response that fights disease and prolongs life. However, extensive research is still needed to understand its mechanism better.”

The Best Is Yet to Come
Resveratrol watchers seem willing to wait for it. “We’re certainly optimistic about resveratrol’s future,” Majeed says. “It’s exciting as well as logical to unearth the exact mechanisms of action of such a life-extending molecule that is believed to modulate genes that are involved in longevity. This would provide new possibilities for understanding the process of aging in humans.”

Once we do that, perhaps the industry can rejuvenate resveratrol’s own life as a popular dietary supplement. And we might start, Lifton says, by emphasizing the case that red wine isn’t going to do the trick—“that we need supplementation if we want the associated health benefits,” he says. “Once this message is delivered effectively, then we can move on to which forms are superior. Consumers first have to know that they need a mousetrap before we can make the case for a better one!”

In the meantime, take a moment to bring yourself up to date on some of the latest resveratrol science.

Go with the Flow
Global dementia data for those aged 65 and older shows that the prevalence of dementia in women is 14% to 32% higher than it is in men, and that by age 80, women make up 63% of dementia sufferers—a trend that experts expect to intensify as the population ages.

No wonder scientists are exploring how to bend that curve. As it happens, “a recently published study1 reported that postmenopausal women consuming a resveratrol supplement had increased verbal memory and overall cognitive function scores compared to placebo,” notes DSM’s Welsh.

In the randomized, placebo-controlled intervention trial, researchers had 80 postmenopausal women aged 45 to 85 take either 75 mg trans-resveratrol—the more bioavailable of the compound’s two isomers—twice daily, or a placebo, for 14 weeks, after which the researchers assessed the subjects’ cognitive performance, cerebral blood flow velocity and pulsatility index in the middle cerebral
artery (an indicator of arterial stiffness), and cerebrovascular responsiveness (CVR) to both cognitive testing and hypercapnia (carbon-dioxide retention). The subjects also completed mood questionnaires.

Relative to the placebo, resveratrol elicited 17% increases in CVR to both hypercapnic and cognitive stimuli, as well as significant improvements in verbal memory tasks and overall cognitive performance. Though mood improved on multiple measures in the resveratrol group, the changes weren’t significant.

In addition to showing that resveratrol supplementation can enhance cerebrovascular function and cognition in postmenopausal women, the results “suggest that some of the observed effects on brain blood flow may have real-world implications, especially in the context of aging,” Welsh says.

Feel Good about Getting Older

The team of scientists responsible for the previous study examined another aspect of resveratrol’s cerebrovascular effects in an intervention trial that began with the premise that pain common among postmenopausal women and often related to degradative joint diseases like age-related osteoarthritis may be a product of the vascular dysfunction that comes with declining estrogen levels.

“Resveratrol science continues to grow with positive results,” says Evolva’s Gene Adamski.

So the researchers evaluated how supplementation with resveratrol might change that scenario. Once again, 80 healthy postmenopausal women took either 75 mg of resveratrol twice daily, or a placebo, for 14 days. The researchers measured aspects of wellbeing including pain, menopausal symptoms, sleep quality, depressive symptoms, mood, and quality of life at baseline and following treatment, with rating scales averaged to give a composite overall wellbeing score. Also, measures of cerebral vasodilator responsiveness to hypercapnia served as a marker for cerebrovascular function.

The researchers found that compared to the placebo, resveratrol supplementation yielded a significant reduction in pain, and improvement in total wellbeing emerged—both of which, along with quality of life, correlated with improved cerebrovascular function. While more study is needed, the researchers write, the findings indicate resveratrol’s potential to reduce chronic pain in age-related osteoarthritis and possibly boost perceptions of wellbeing in postmenopausal women.

Evolva’s Adamski says the same group of researchers is conducting a bigger follow-up
† Results compared to baseline


*These statements have not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure, or prevent any disease.
study to these two previous investigations wherein they plan to examine the effects of trans-resveratrol on cerebrovascular function, cognitive performance, and bone health in a longer crossover trial involving 160 postmenopausal women. "First results from this study are expected by mid-2019," he says.

Stronger Together
Resveratrol, notes Sabinsa’s Majeed, is poorly bioavailable. "Though a number of human clinical trials have been performed over the years," he says, "conflicting findings have precluded its applicability in clinical settings, partially due to this poor bioavailability."

Yet in a randomized, double-blind, placebo-controlled clinical trial published in 2016 in the journal *Applied Physiology, Nutrition, and Metabolism*, researchers investigating the combined effects of resveratrol supplementation plus exercise on human skeletal muscle mitochondrial capacity coincidentally demonstrated that piperine, "a natural bio-enhancer from black pepper that research shows enhances bioavailability for a variety of nutritional substances," Majeed says, appears to also enhance the bioavailability of resveratrol. The study used Sabinsa’s proprietary piperine ingredient, BioPerine.

In the trial, 16 healthy young adults underwent four weeks of supplementation with resveratrol at 1,000 mg and piperine at 20 mg. Results showed that volunteers in the resveratrol-piperine group demonstrated significant muscle oxidative capacity recovery following short bouts of exercise compared to the placebo group. Notes Majeed, "The influence of resveratrol on low-intensity stimulus during submaximal endurance training is one of the most eye-catching recent findings." The current data, he said, "could be significant to the general population, especially to those who may be unable to perform high-intensity exercise."

References

Kimberly J. Decker writes for the food and nutrition industries from her base in the San Francisco area, where she enjoys eating food as much as she does writing about it.
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ORGANIC BY NATURE. CLEAN BY DESIGN.
Coconut products have been on the market for some time, as evidenced by the mainstream adoption of everyday products like coconut oil and coconut water. But whereas products that have been on the market for quite a while can often become stale and incapable of innovation, coconut is still a major source of inspiration for a variety of brands. Manufacturers are innovating increasingly creative and unusual coconut products, satisfying a growing consumer appetite for coconut.

Margaret Gomes of ingredient supplier NP Nutra (Gardena, CA) says that coconut product sales have skyrocketed in the last decade, growing from essentially zero to USD $612.5 million since the early 2000s. "It’s easy to understand why coconut products are so popular," Gomes says. "Coconut is one of nature’s perfect foods—easily digested and rich in nutrients like vitamins, minerals, amino acids, and cytokines. It’s also a very versatile product, with both the coconut meat and water used in a multitude of functional food and beverage applications."

Gomes notes that the diversification of the coconut product market is the result of both consumer demand and supplier innovation, with no end in sight to the market’s expansion. "You name it; we’re seeing it. The focus has shifted. We’re not just talking about innovative new products; we’re talking about new delivery formats. Nutrient-infused energy pods, gels, chews, sprays, blends—the sky is the limit right now. Anything with coconut in it has a good chance of selling."

So, how are today’s innovators determining which coconut path to follow? Ahead, we take a look at brands that have found success through experimentation.

**Coconut Granola for the Gluten-Free**

On its face, gluten-free granola sounds like an oxymoron. Granola’s base ingredient, oats, are by definition rich in gluten. But the team at GrandyOats (Hiram, ME) has found a tasty, gluten-free granola alternative made with a coconut base.

GrandyOats’ “Chief Granola Officer” Aaron Anker says that coconut granola is gaining popularity thanks to two attributes: its taste and its nutritional profile. Says Anker: "The market has been asking for a grain-free granola, so we started playing around with different varieties. We wanted something with similar nutritional benefits—not just filler—that also tastes good. The vast majority of people like coconut, and coconut contains heart-healthy oils. It’s a great product for our purposes.”
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Food & Beverage Trends

Anker points to coconuts’ light sweetness as the ideal flavor profile for a granola base, as it pairs well with sweeteners like maple syrup and honey as well as other granola ingredients like nuts, seeds, and chocolate. He notes that while classic granola has contained coconut since the 1970s, his company’s “coconola” is the first granola to use coconut chips as a base.

Anker notes that his product exists in a dual space. Coconut is part of GrandyOats’ unique selling proposition, but he considers coconola to be first and foremost a granola product. “When you do a blend, you have to market it differently than you would a single-origin product. With coconut water, for example, it’s all about the origin of the coconut. But with a blend, you’re marketing the whole product: a paleo, grain-free granola with a nice blend of organic ingredients that aren’t overly sweet.”

Anker says that using coconut as a base also yields a variety of cost benefits. Non-grain granola bases tend to be expensive, he says, but coconut is quite affordable and nutritionally dense.

Anker says he expects the coconut market to grow significantly over the next year. “I’ve been in the market for 20 years, and I’ve seen trends come and go. The one that has been the most consistent is coconut.”

We All Scream for Coconut

It’s not just the gluten-free market that’s capturing coconut brands’ imagination. The alternative-dairy market is also seeing an influx of coconut products.

Australia-based product manufacturer COYO (Yandina, Queensland) is meeting demands for vegan yogurts and ice creams with dairy treats made from natural organic coconut milk. COYO “National Sales Jedi” Aaron Wallace (Indianapolis, IN) says that COYO is capitalizing on an increasing demand for dairy-free yogurt.

“People are moving away from dairy products,” Wallace explains. “I used to work for a dairy company before I joined COYO. Dairy products are in decline across the board because people are learning about the benefits of plant-based alternatives like coconut yogurt.”

Wallace says consumers are becoming more conscious about how their bodies respond to various foods, leading them to try alternative products to determine what works best for them. In that quest for healthier alternatives, he says, coconut is a prime choice.

“Coconut is a great superfood that you can use in a variety of ways. The drink category definitely propelled it into the mainstream, with coconut water being rich in MCTs and electrolytes. Obviously, that means there are now more competitors. But consumers want to see new things, and more people are finding out that you don’t have to sacrifice taste with some of these alternatives.”

Wallace says that coconut’s growing popularity will pose challenges for brands that will be forced to differentiate themselves in more ways. He also notes that ethical sourcing will become increasingly difficult, as there are a finite number of coconut groves in existence. Wallace adds that COYO is solving the marketing challenge with a grassroots movement that leverages connections with nutritionists and independent grocers to tell the COYO story.

Coconut Chips: A Healthy Junk-Food Alternative for Consumers with Food Sensitivities

Coconut’s presence in the snack foods category extends beyond health-conscious options like granola. In fact, coconut is now revolutionizing the “junk food” category with healthier innovations like coconut chips.

Mitch Compton, cofounder of Coconut Beach (Bonita, CA), says that the coconut-based snack space is just now starting to see growth, with a few first movers working to drive consumer adoption. “Coconut snacks are very different from coconut water,” Compton explains. “We sell coconut chips (made from coconut copra), which is quite unique in this space. There’s a lot of runway for coconut snacks, but it’ll involve getting people to try the products. We need a trial in the snack area to hook people.”

Coconut Beach’s strategy involves capitalizing on the popularity of other coconut verticals in order to introduce consumers already familiar with coconut to increasingly diverse products. Basically, Compton says, driving consumer adoption involves leveraging the existing coconut products industry. Says Compton: “Coconuts are weird; people usually love them or hate them. But someone who likes coconut water is more likely to gravitate toward trying other coconut products like coconut chips.”

Compton says that coconut snacks like coconut chips also offer potential for making inroads into the allergy-conscious foods market. Coconuts aren’t actually nuts, he says, which means coconut chips and similar products are ideal for those with nut allergies and other food sensitivities.
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Coconut Coffee and Tea: Reinventing RTDs and Non-Dairy Creamers

Adding coconut oil to coffee is a habit that a variety of health gurus have touted for years, but now it seems that savvy coffee manufacturers are building on coffee bloggers' enthusiasm for coconuts with new innovations that are changing the coffee and tea market.

Coffee and tea manufacturers are also experimenting with coconut in other ways, with companies like RealBeanz (Brooklyn, NY) introducing RTD iced coffees made with 20% coconut water. Cold-brew coffees are also seeing the introduction of coconut as a main ingredient, as evidenced by product launches by the numerous cold-brew coconut coffee companies at recent Natural Products Expo West trade shows.

Coconut Sugar: A Natural Low(GI)-GI Sweetener That’s Rich(er) in Minerals

Once thought to be relatively harmless, traditional refined table sugar now finds itself at the center of a major scientific controversy. Scientific studies continue to demonstrate the health dangers of excessive sugar intake, leading consumers to search for healthier sweetener alternatives. One 2015 in vivo clinical trial, for instance, found that participants who reduced dietary sugar intake and substituted with starch saw improvements in blood pressure, cholesterol levels, insulin response, and body weight. The study authors said that sugar’s negative health effects are independent of its caloric density or its effect on weight gain and pinpointed fructose specifically as a problematic sugar to be limited or avoided.

Coconut sugar, in contrast, offers some minor advantages over standard white and brown sugar. Coconut sugar—made by evaporating the water out of coconut sap—is high in inulin, a fiber that has been found to promote weight loss through fat oxidation and reduce body weight in randomized clinical trials involving pre-diabetic patients. One randomized double-blind clinical trial also found that coconut-derived D-xylose has a lower glycemic index than table sugar; however, this study failed to account for coconut sugar’s high fructose level.

Some research indicates that coconut sugar is still a sugar and thus it should still be used sparingly. However, coconut sugar manufacturers can confidently say that coconut sugar has a lower glycemic index than white table sugar, making it a good alternative for health-conscious consumers. Coconut sugar manufacturer Big Tree Farms recommends using coconut sugar as a 1:1 replacement for regular brown sugar.

Coffee and tea manufacturer CACafe (Upland, CA) is incorporating coconut into its superfood coffee and tea formulas, with a product line that includes coconut coffee, coconut tea, and even coconut cocoa. However, these products are marked by a few key differences that set them apart from the do-it-yourself recipes that have populated the blogosphere in recent years.

While most at-home recipes involve adding coconut oil to coffee or tea, CACafe’s product line consists of natural whole-coconut products that make use of both the coconut’s oil and its milk. These products are capitalizing on the growth of the functional coffee market and a growing consumer preference for dairy alternatives that evidently extends beyond products like yogurt into dairy creamers.
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As coconut sugar continues to grow in popularity, manufacturers and distributors will likely face unique challenges in the form of sugar industry resistance.

The research on sugar, at first glance, appears to be mixed. A 2016 literature review published in *Annals of Internal Medicine* claims that dietary restrictions on sugar are based on low-quality evidence. But digging deeper, the real story emerges: Scientists are speaking out on the dangers of excessive sugar intake, and the sugar industry is pushing back with “science” of its own. In 2016, *The New York Times* reported on the above-mentioned literature review, which lambastes health experts who advise consumers to cut back on sugar.

The pro-sugar *Annals review*, which concludes that “guidelines on dietary sugar do not meet criteria for trustworthy recommendations and are based on low-quality evidence,” declared the International Life Sciences Institute (ISLI) as its primary funding source. *The New York Times* reporting found that ISLI receives funding from food and agrochemical corporations, including General Mills, Kraft Foods, Coca-Cola, Monsanto, and Hershey’s—a clear conflict of interest.

*The New York Times* reporting also unveiled a variety of methodological and scientific shortcomings in the review, and compares the paper to tobacco industry efforts to influence scientific literature on the health effects of smoking.

Against this type of backdrop, companies in the coconut sugar niche could soon face a unique challenge: navigating the war between scientists and Big Sugar without getting caught in the crossfire.

**Coconut Jerky: High-Protein, Meatless Jerky**

Coconut’s appeal to the vegan market extends beyond dairy alternatives. Now, the ingredient’s unique oil and fat profile has made it ideal for use in meat analogues.

Kelly Shone, director of innovation for Bioriginal (Saskatoon, SK, Canada), says that the popularity of coconut oil has led to market saturation that forced coconut product manufacturers to innovate. The result is surprising new products like Bioriginal’s coconut jerky.

“We saw multiple supportive trends that helped us identify coconut jerky as something that would appeal to multiple markets,” Shone says. “Consumers are looking for more choices in their coconut products, which is why brands that have diverse lines will be the most successful.”

Bioriginal’s coconut jerky—launched last year at the Natural Products Expo West trade show—also capitalizes on the gluten-free and high-protein verticals. Shone says that coconut’s healthy oils and unique fatty acid profile make it ideal for use in a jerky. However, he notes that market trends and supply chain issues present challenges that coconut product manufacturers will need to plan for in the future. “We have to make sure that we’re ready for any issues that come up, whether that be a supply matter due to tropical storms or common storage problems associated with coconuts.”

Shone says that Bioriginal plans for these challenges with a well-planned supply chain shaped by close and careful analysis of the latest market trends.

**Coconut Market Still Fertile Ground for Innovative New Brands**

NP Nutra’s Gomes says that the coconut products industry is currently undergoing significant diversification, with industry players developing products to meet consumer demands for functional foods and beverages, dietary supplements, and even cosmetic products. She points to coconut’s

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**Coconut’s unique oil and fat profile has made it ideal for use in meat analogues.**

**PHOTO FROM BIORIGINAL**

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widespread availability in a variety of formats and the various studies proving its nutritional benefits as two of the main factors that make coconut an ideal ingredient for nearly any nutraceutical or healthy food application.

The expanding coconut market still has plenty of space for new brands and new innovations, and experts say the category’s top contenders will be companies that find a way to successfully brand themselves, source coconuts ethically, and maintain market share as multinational brands start to buy out smaller coconut companies.

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In Search of Clean Energy

Conventional energy drinks, snacks, and supplements remain popular, but “cleaner,” “more natural” versions are occupying a greater portion of new product launches.

BY MAUREEN KINGSLEY

Consumer products offering increased, longer-lasting energy are evolving. While those featuring refined sugars, large doses of caffeine, preservatives like benzoates and propionates, and the amino acid taurine remain popular, consumers are also increasingly asking for healthier, cleaner, more-natural energy-conferring foods, beverages, and supplements. In fact, Mintel noted in a 2017 report that by mid-2016, introductions of energy drinks bearing an “organic” claim, in particular, had reached a record high.

By July 2016, 6% of global energy-drink launches for the year bore the “organic” claim. “The rise in organic launches comes as consumers show strong interest in more natural energy drinks,” the report states. “Indeed, one in four (26%) U.S. consumers say they would be more comfortable drinking energy drinks or shots made with all-natural ingredients,” the authors wrote. “The rise in global organic energy-drink offerings illustrates how the sector is attempting to appeal to a broader audience by conveying a more natural image.”

“Hose the foreseeable future, brands will remain under pressure to reformulate with better-for-you ingredients,” they concluded. That future is here, and the current “clean” trend in foods, beverages, and supplements remains strong and influential—but which ingredients are viewed as “clean” in the energy products market? According to suppliers and their customers, “clean” refers primarily to four types of ingredients: 1) caffeine from “pure,” natural, and organic sources; 2) botanicals and their extracts; 3) low-glycemic sweeteners; and 4) slow-release, recognizable carbohydrates.

The Rise of “Clean Caffeine”

As the stimulant identified in coffee, black and green teas, and chocolate, traditional caffeine has long been a player in the energy-ingredient field. What’s new to the game is what suppliers and brands alike call “clean caffeine.” Caffeine sources considered “clean” include yerba mate, whole coffee fruit, organic roasted coffee beans plus medium-chain triglycerides (MCTs), and guayusa. The following products represent some developments in the clean-caffeine market.

Yerba Mate and Green Coffee Bean

Mamma Chia brand founder and CEO, Janie Hoffman, defines her energy drinks’ “clean caffeine” as “the naturally occurring, organic energy sources of our organic yerba mate and organic green coffee bean. It is devoid of any
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harsh chemicals found in many energy drinks on the market. "The company's new Organic Clean Energy Beverages contain 90 mg of this "natural" caffeine per serving, she says.

Coffee Fruit
FutureCeuticals (Momence, IL), supplier of Coffeeberry Energy extract, gleans its "clean caffeine" from the whole coffee fruit (or coffee "cherry"), the company's Corporate Communications and PR Manager Vicki Gawinski shares.

"The coffee beans are on the inside of the whole coffee fruit," she explains. "The outside of the fruit is referred to as 'cascara,' which in Spanish means the skin or husk of the coffee fruit. In conventional coffee production, the green coffee bean is removed and is roasted for coffee, while the cascara is typically discarded. Coffeeberry Energy, on the other hand, Gawinski continues, "is our proprietary combination of organic caffeine and unique polyphenols from the whole coffee cherry—cascara plus bean." The extract delivers 70% standardized levels of caffeine, she adds, plus the benefit of chlorogenic acids found in the cascara, and is applicable to energy drinks, coffees, teas, protein drinks, dairy and dairy-alternative beverages, and waters.

Organic Roasted Coffee Beans Plus MCTs
Wonder Fuel coffee-flavor energy drink likewise features a potentially better-for-you caffeine ingredient, in this case from organic roasted coffee beans. In its coffee-flavored version, Wonder Fuel combines 90 mg of caffeine from organic coffee with 7 g of organic coconut medium-chain triglycerides (MCTs). "The way MCTs are metabolized—providing long-lasting cellular energy—makes the caffeine effect become smoother, longer lasting, and without the typical crash," the company told Nutritional Outlook.
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Outlook via spokesperson Tana Siebold, Orca Communications Unlimited.

According to Wonder Fuel, the concept of combining caffeine and MCTs originated in Nepal, where tea was served with MCT-containing yak butter to lend the person drinking it additional energy and stamina in the high altitudes of the Himalayas.

Guayusa

Applied Food Sciences (Austin, TX), an ingredient supplier, is capitalizing on the clean-caffeine movement via its Amatea guayusa extract, which it markets as an energy-conferring ingredient. Guayusa, a cafefinated leaf of the holly species *Ilex guayusa* that grows in the Amazonian regions of Ecuador and Peru, is described by Applied Food Sciences as “one of the most exciting new ingredients in energy.”

Guayusa’s polyphenol makeup, the supplier explains, includes the antioxidants found in green coffee beans, including chlorogenic acids, plus the catechins found in green tea. The company’s own research has found that its Amatea guayusa extract “was able to regulate the release of epinephrine, a key part of the fight-or-flight adrenal response, upon caffeine ingestion,” says Applied Food Sciences’ creative director Brian Zapp, resulting in a less-jittery, smoother caffeine buzz for the consumer.

In addition to its “clean caffeine” and antioxidant components, guayusa has “a very pleasant taste profile” and “a refreshing sweetness,” Zapp says, thanks to its relatively low level of tannins and, therefore, lack of astringency. The ingredient lends itself to functional-beverage and sports-nutrition applications, he adds.

Likewise, Lisa Kim, director of digital marketing for beverage company Runa, reports that her brand’s “clean energy drinks” provide 150 mg of natural caffeine from brewed guayusa leaf, which is more than is offered by yerba mate, but without any of that same bitterness or astringency mentioned by Applied Food Sciences’ Zapp.

Consequently, Kim explains, no artificial ingredients or sweeteners need to be added to Runa’s energy beverages to mask bitterness. “The guayusa leaves are grown and harvested by Ecuadorian farmers who own the land,” she says. “Runa pays a fair-trade price for the leaves, which are brewed like tea into a concentrate. Then we add natural and organic flavors and carbonated water. Some flavors also include organic cane sugar.” She adds that formulating other energy drinks based on other caffeine sources is “more complicated.”

Botanicals and More

As evidenced by some of the ingredients highlighted above, the appeal of a variety of botanicals credited with boosting energy in the consumer and perceived as “natural” remains strong. Director of R&D for Dracco Natural Products (San Jose, CA), Brien Quirk, confirms that his clients’ demand for energy-conferring botanicals for food, beverage, and supplement applications is high.

“We have numerous project requests all the time both in the United States and internationally,” he says, citing Asia as a particularly big market. “The growth has been amazing, and it continues to be the most sought-after application we get requests for.”

Green tea with caffeine is one botanical ingredient in which he sees “strong customer interest” for energy-conferring products, as well as astragalus, rhodiola, reishi, schisandra, ginseng, eleuthero, and goji berry. “Most of these are the main energy-tonic herbs described in traditional Chinese medicine as being ‘qi’ or ‘chi’ tonics, a term which designates them as supporting vital energy,” Quirk says.

The company blends its energy-conferring botanicals in various combinations it calls “Action Synergized Formulas,” which, Quirk claims, “have overall better efficacy than standalone herbs.” One such formulation contains naturally occurring nitrates from beets and celery, along with nitric
oxide–stimulating herbs such as notoginseng. (Quirk points to a 2016 study published in Experimental and Therapeutic Medicine that suggests that enhancing a person’s nitric oxide levels with beet juice can “significantly increase exercise endurance and oxygenation for an overall increased energy effect,” he says.)

Draco is also involved with a coffee-based product that includes MCTs "plus a metabolism-stimulating, insulin-sensitizing omega-7 palmitoleic acid and omega-9 lipid-rich oil specially processed from egg yolk, called Yolk Oil," Quirk reports. He says that delving into omega-7 fats is a new direction for the company and an area that is generally underappreciated. Palmitoleic acid can increase fat metabolism and insulin sensitivity, he says, “which relate directly to energy production.”

Another newer energy product featuring botanicals is InnoBev’s WakeUp, developed with the Technion-Israel Institute of Technology and the Weizmann Institute of Science (also in Israel). The daily-dose shot includes extracts of guarana, ginkgo biloba, elderberry, and FruitUp (a low-glycemic-index fruit syrup), and was developed in part as a response to the “growing [complaints] expressed against the high-caffeine, high-sugar energy drinks,” according to Eli Faraggi, cofounder and CEO of InnoBev.

The company says the product “improves alertness and cognitive performance for at least 120 minutes with minimal caffeine, no heart-rate effects, and no tolerance effect over time,” and Faraggi cites a small study published in the Israel Medical Association Journal in 2013 to support this claim.

### Sustained-Energy Carbs

Carbohydrates have gotten a bad rap over the years, earning a reputation for contributing to weight gain, diabetes, and crash-and-burn energy dips. Suppliers such as Beneo (Morris Plains, NJ) and Ingredion (Westchester, IL), however, have formulated carbohydrate-based ingredients for nutrition brands looking for “clean, low-glycemic-index carbs to incorporate into their functional foods and beverages.

Beneo’s Palatinose (isomaltulose) is a non-GMO carbohydrate made from sugar beets, President Jon Peters says. He describes it as “fully digestible” and “slow release.” This low-glycemic-index (32) ingredient, at a concentration of 4 kcal/g, provides the same amount of energy as sucrose; “however,” Peters adds, “because of its stable molecular makeup, this functional carbohydrate is digested more slowly and delivered in a sustained way to the body’s cells.”

Ingredion’s Sustra 2434, another slowly digested carbohydrate, was just recently launched in September of 2017. Containing corn starch and tapioca flour and best suited for cold-pressed-bar and smoothie applications, this ingredient is “clean-label, gluten-free, easy to formulate with, and certified in conformity with Ingredion’s TrueTrace program for non-genetically modified ingredients,” says Patrick Luchsinger, marketing manager, nutrition, for Ingredion Inc. "This starch blend has been scientifically shown to effect a lower glycemic index and steadier blood-sugar levels over an extended period, leading to balanced, long-lasting energy.” He adds that there has been a lot of interest in and sampling of the ingredient by customers, who are now testing it out in formulations.

### Cleaner, More Natural, “Better For You”

Beverages, snacks, and supplements formulated to increase and sustain energy in the consumer are clearly following the larger industry trend of “cleaner,” more natural, better-for-you ingredients. As consumers of all ages—and particularly Millennials—become ever more adept at using Internet sources and social media to further their health education, inform themselves, and share what they’ve learned within minutes via large-scale online platforms, brand managers and suppliers should respond with products perceived as more natural, healthful, and clean.

Maureen Kingsley is a freelance writer, editor, and proofreader based in Los Angeles. She covers a variety of industries, including medical technology, food-ingredient manufacturing, and cinematography.
RAISING THE BAR in Pet Health

BY MELISSA KVIDAHL

Clean and well-researched ingredients find favor with picky pet parents.

Millennials may be putting off getting married, buying houses, and starting families, but according to AdWeek, there’s one milestone they’re not missing adopting their first pets. Not only do around 75% of Americans in their 30s own a dog, but 44% of Millennials see their furry companions as “practice” for being a parent. And this is transforming the pet health ingredient market from one that’s specialty to one that’s increasingly mainstream.

According to Packaged Facts’ most recent “Pet Supplements in the U.S.” report, published in April 2017, 38% of Millennials purchase pet health supplements, making them 41% more likely than average to do so. Thanks to their enthusiasm, sales of pet supplements have seen increases ever since the Great Recession, at a compound annual growth rate of 3.5% through 2016. Dog owners make up the most active share of the market, buying three times as much product as cat owners.

If you ask Nena Dockery, technical services manager at Stratum Nutrition (Carthage, MO), single-person families and empty-nest Baby Boomers—two groups who, like Millennials, see their pets as family—are also driving sales across the pet health market, and “pet food advertising has capitalized on this movement, focusing on nutrient-rich and more natural pet food ingredient formulations,” she says. Additionally, the veterinary community has mirrored the physician community in that it’s increasingly receptive to recommending supplements as part of a healthy-living plan. All of this has only further served to spread the word about natural solutions and supplements for pets.

“Many consumers consider their animal companions to be family members, so are equally concerned about their pets’ health and wellbeing,” says Shaheen Majeed, worldwide president of Sabinsa (East Windsor, NJ), which offers a number of ingredients for pet products under the brand name VetVitals. As a result, he explains, consumers extend their own self-care practices—which increasingly includes supplements—to their pets.

As interest in the pet health supplement market grows, so too do opportunities for brands. “As companion animals live longer lives, their health needs will continue to expand,” says Dockery. “This will provide both challenges and opportunities for those companies who commit to providing safe and effective foods and supplements for pet owners who desire to support the health of their pets.”
needs of their animal friends in the best way possible.”

Top Challenges
As in the human supplement market, clean-label trends are putting pressure on pet health supplement brands to reformulate. According to Majeed, consumers want to know exactly what goes into the supplements they feed their pets, and are looking for brands that can put that information right on the label. Specifically, Majeed sees demand to eliminate artificial colors and flavors, grains, gluten, and corn from pet products. "Suppliers need to ensure that their ingredients are free from all of these," he says.

Jon Getzinger, chief marketing officer at Puris (Minneapolis, MN), is also seeing trends from the human supplement market bleed into the pet sector, especially trends towards using less corn and soy, and beefing up formulations with more protein. He has noticed that ingredients like Puris’s pea starches, which would not have been top of mind for pet formulators in years past, are increasingly in demand as alternatives to corn starches.

But, with better ingredients comes a bigger price tag, and that’s one of the biggest challenges that Getzinger sees in the pet market today: The solution? "Talented marketers are finding ways to pass along these additional costs to purchasers by properly positioning the end products as premium," he says, which also increases margins. Another possible solution to offset rising costs is bundling ingredients from the same process—for instance, pea proteins, starches, and fibers. This helps suppliers "spread overhead across all the products, and not just the protein," says Getzinger, which results in "not only lower overall costs, but provides a great story for consumers tracing our ingredients from the U.S. farmer to their pets’ dinner bowl, while sustainably using all parts of the pea and not just the protein.”

The key for this, explains Bill Bookout, president of the association the National Animal Supplement Council, is for brands to reach out to consumers directly to tell their stories and, therefore, justify pricing. Selling products through a veterinarian’s office can build advocacy, but it adds a layer between the company and its consumer. "I’ve always been of the opinion that the company that reaches out and educates the end user will be successful at the end of the day," he says.

Another challenge still facing this sector is determining the correct dosage for animal products, says Dockery, as even within the same species of animal there can be drastic differences in size. "This is particularly true for dogs," she says, "where the weight can vary by more than 100 pounds between breeds." The only way to combat this challenge, she adds, is to be knowledgeable in the physiology of the animal and also know "how to adjust dosing to be the safest and most effective, particularly when formulating for animal species in which there is a large variation in size.”

The way forward is through animal research that not only tests for safety in lab animals, but also tests for efficacy in the companion animals that will ultimately use the product. And many brands and suppliers are beginning to do so.

Recent Research
AstaReal Inc. (Burlington, NJ) recently published a study examining whether a nutritional antioxidant supplement could improve visual function in healthy dogs¹. A total of 12 Beagles, ages six through eight with normal eyes, were randomly assigned to receive a feeding regimen for six months either with or without supplementation. What researchers found was that, compared to the control group, dogs that took the antioxidant showed improvement in retinal function and significantly less decline in refractive error. "Dogs, like humans, experience retinal and lens functional decline with age," says Karen A. Hecht, scientific affairs manager at AstaReal. "Antioxidant supplementation as demonstrated may be beneficial and effective in the long-term preservation and improvement of various functions of the canine eye.”

In 2017, new research from Lonza (Basel, Switzerland) demonstrated the positive impact of L-carnitine in the performance and recovery of working dogs². A total of 96 Labrador Retrievers were given 250 mg of Carniking L-carnitine once daily for up to 14 weeks. Along with exercise, supplementation was shown to improve activity, body composition, and recovery markers. Specifically, the dogs gained lean muscle mass, were more active during test sprint and endurance runs, and had a lower creatinine kinase level (a marker for muscle damage). According to Aouat Bellamine, senior scientific manager at Lonza, this data is promising for senior pets, in particular, among whom muscle performance is an unmet need.

Maintaining physical performance was also at the center of a canine study recently published in Veterinary Medicine: Research & Reports, which examined the efficacy of Stratum Nutrition’s NEM eggshell membrane³. Fifty-one privately owned dogs having mild to moderate persistent sub-optimal joint function (for example, difficulty in getting up from a lying position, a noticeable limp, impaired gait, difficulty in climbing stairs, etc.) received either oral NEM at a dose of 6 mg/lb or placebo once daily for six weeks.

Researchers found that supplementation with NEM significantly reduced joint pain and improved joint function rapidly, and demonstrated a lasting improvement in joint pain, leading to an improved quality of life. Moreover, a profound chondroprotective effect was demonstrated following six weeks of supplementation with NEM. There were also clinically meaningful results from a brief responder analysis, demonstrating that a significant proportion of treated dogs may benefit substantially from NEM supplementation.

Melissa Kvidahl is a freelance journalist and copywriter specializing in the health and wellness industry.

References
Astaxanthin and Heart Health

Research has shown that astaxanthin can reduce oxidative stress and inflammation, improve lipid profiles, and promote better blood flow.

By Tryggvi Stefánsson, PhD, Algalife

The worldwide prevalence of cardiovascular diseases, coupled with the proactive wellness practices increasingly adopted by consumers today, are driving demand for dietary supplements with proven benefits for cardiovascular health.

Astaxanthin is an extremely potent antioxidant, and its unique chemical properties make it an ideal ingredient for heart health supplements. There is a growing body of scientific evidence supporting the benefits of astaxanthin for heart health, including reduced oxidative stress and inflammation, improved lipid profiles, and better blood flow.

Global Burden of Cardiovascular Disease

Cardiovascular diseases (CVDs) have become one of the primary health concerns worldwide. Every year, disorders of the heart and blood vessels take the lives of 17.7 million people, accounting for a staggering 31% of all global deaths.1 This number is projected to reach 23.3 million by 20302 due to population aging and unhealthy lifestyles. CVDs are equally alarming when it comes to their financial burden. The cumulative economic losses from CVDs in low- and middle-income countries from 2011 to 2025 is estimated at $3.76 trillion.3

Given these sobering statistics, it is not surprising that cardiovascular health is an important topic for consumers of dietary supplements. In the past three consumer surveys measuring consumer attitudes towards dietary supplements conducted by the Council for Responsible Nutrition (CRN; Washington, DC), heart health ranked number six or higher among the reasons why Americans take supplements.4,5,6

Astaxanthin: A Potent Antioxidant

A powerful antioxidant that is attracting a lot of interest in the heart health category is astaxanthin, a naturally occurring carotenoid (organic pigment) sourced from the microalgae Haematococcus pluvialis. In nature, astaxanthin is produced by microalgae as a defense mechanism against harsh environmental conditions. For humans, astaxanthin is a powerful dietary supplement that can provide a superior nutritional advantage.

Due to its unique chemical properties, astaxanthin is regarded as one of the most powerful natural antioxidants known. It is 6,000 times more powerful than vitamin C, 100 times more powerful than vitamin E, and five times more...
powerful than beta-carotene in its ability to trap energy from singlet oxygen.\(^7\)

In practice, this means that a higher dosage of these other antioxidants is required per serving—around 1000 mg of vitamin C, and 20-40 mg of lutein, for example—to equal the antioxidant capacity of astaxanthin.\(^4\)

Antioxidants like astaxanthin help to counteract the damaging effects of reactive oxygen species (ROS), promoting a healthy oxidative balance. Simply put, an antioxidant is a molecule stable enough to donate an electron to a ROS and neutralize it, thus reducing its capacity for damage. Due to its ability to combat ROS, astaxanthin can play an important role in support of cardiovascular health.

**The Link Between Oxidative Stress and CVD**

The overproduction of ROS can have harmful effects on many important cells and tissues in the body. It is estimated that each cell in the body forms more than 20 trillion of ROS per day through normal metabolism, and each cell in the body is believed to be attacked by these reactive molecules 10,000 times per day.\(^5\) While the body produces its own antioxidants to keep ROS under control, this natural defense system grows weaker as we age and may also be compromised due to certain nutritional and lifestyle choices.

The damage caused by ROS is called oxidative stress and it is a key contributor to CVD.\(^2\) In particular, oxidative stress has emerged as a common mechanism in atherosclerosis,\(^10\) a disease in which plaque builds up inside blood vessels. Atherosclerotic plaque rupture is a common reason for CVDs such as stroke and myocardial infarction.\(^11\) A recent review of oxidative stress–mediated atherosclerosis concluded that avoiding elevated ROS levels or increasing antioxidant capacity are considered key strategies for the prevention and treatment of atherosclerosis.

**How Astaxanthin Supports Cardiovascular Health**

Research has shown that astaxanthin can reduce oxidative stress and inflammation, improve lipid profiles, and promote better blood flow.\(^13-16\) Supplementation with astaxanthin has been shown to support a healthy oxidative balance in groups at elevated risk of CVD. A 2014 study with postmenopausal women,\(^13\) for example, concluded that this group could benefit from supplementing with astaxanthin. Additionally, research has demonstrated the benefits of astaxanthin in fighting obesity-induced oxidative stress in overweight young adults\(^14\) and in women with an increased oxidative stress burden.\(^15\)
Like oxidation, inflammation is an established process contributing to CVD. In both in vitro and animal studies, astaxanthin has been shown to reduce markers of inflammation. A 2013 study on human vein cells found that astaxanthin inhibits the production of inflammatory biomarkers involved in endothelial dysfunction and CVD. Elevated levels of LDL ("bad") cholesterol combined with low levels of HDL ("good") cholesterol increase the risk of CVD. For instance, research shows that the oxidation of LDL in the blood has a significant role in the development of atherosclerosis.

Astaxanthin has been shown to help support a healthy lipid profile. A 2010 human study on the effect of astaxanthin on dyslipidemia (an excess of LDL and other lipids in the blood) found that supplementation decreased levels of triglycerides, a lipid that has been shown to increase the risk of CVD. The same study also demonstrated that astaxanthin significantly increased levels of HDL cholesterol.

Astaxanthin also offers additional support for cardiovascular health. For example, its antioxidative and anti-inflammatory properties can significantly shorten blood transit times. Several studies have also indicated potential to lower blood pressure, and a recent meta-analysis concluded that it has a minor glucose-lowering effect.

**Supporting Healthy Aging**

As populations continue to live longer, new strategies to support healthy aging become increasingly important. Astaxanthin’s scientifically proven benefits mean it has enormous potential in the maintenance of cardiovascular health.

There is a solid scientific foundation supporting the case for astaxanthin as an effective ingredient for heart health supplements. Studies continue to consistently indicate positive results for astaxanthin's ability to reduce oxidative damage and inflammation as well as to provide additional heart health benefits such as improved blood flow. Furthermore, it is safe, natural and can be sustainably produced, adding to its consumer appeal globally.

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Trygvi Stefánsson, PhD, is science manager for algae-ingredients supplier Algalif (Reykjanesbaer, Iceland). Stefánsson has a PhD in microbiology and genetics from ETH Zurich in Switzerland. He joined Algalif in early 2014 and, since 2015, has led the company’s R&D and scale-up department as science manager. Among other responsibilities, Stefánsson’s department oversees the continuous optimization of algae-cultivation parameters.
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A Sourcing Situation

Flavor firms discuss some of the challenges they face when sourcing natural, clean-label flavors.

BY JENNIFER PRINCE, ASSOCIATE EDITOR

Clean-label flavors are no longer a trend but a requirement of today’s discerning food and drink consumers. While consumers and manufacturers have their own ideas about what constitutes a clean-label flavor, Dave Franz, senior director, business development, Kerry Ingredients (Beloit, WI), tells Nutritional Outlook that generally, clean-label flavors are considered to be those that are all natural, or “natural WONF” (“with other natural flavors”) added for flavor complexity. While demand is growing for natural flavors, however, it can be difficult for flavor suppliers to actually get their hands on the source materials for certain natural flavors. Here’s a look at some of the biggest challenges flavor firms say they are facing now.

According to Philip Caputo, marketing and consumer insights manager, Virginia Dare (Brooklyn, NY), the raw materials for certain trendy superfruit flavors can be difficult to bring in house. “Exotic” natural flavors like mangosteen and dragon fruit (pictured), among others, are often sourced abroad, which means that they must be shipped overseas without losing their flavor. Karen Manheimer, vice president, natural products division, Kerry Ingredients, explains that “in demand” products such as...mangosteen, dragon fruit, snake skin fruit, etc., are difficult to transport from their country of origin. Often these fruits are delicious when fresh but lose their appeal when they are processed into juice or other ingredients that could be used in a natural flavor.

Another reason these exotic flavor materials are difficult to source is because of the scale of their supply, says Caputo. “In many cases, the raw ingredient supply simply doesn’t exist at the volume required to develop natural flavors with ease,” he says. For example, although blood orange is now a popular flavor, a few years ago it was difficult to find in products and on menus. As consumer desire for blood orange has grown, U.S. growers have started growing the crop to help meet the demand, he says.

Up-and-coming flavors like dragon fruit aren’t the only flavors that can be difficult to source. Take vanilla, for instance—a consumer-beloved flavor that is universally used. It is well known that monsoons have impacted slow-growing vanilla crops in recent years, causing worldwide shortages. Humans can also be as much to blame for raw material sourcing dilemmas as Mother Nature, says Cyndie Lipka, master flavorist, Prinova (Carol Stream, IL): “The shortage of [vanilla] beans makes the crop very valuable, and there have been instances where the entire crop is stolen. Some farmers get nervous and they wind up harvesting early when beans are not at their best from a flavor development standpoint.” Lipka adds that crop shortages aside, vanilla beans are also “quite finicky, and require hand pollination for a bean to grow.”

Citrus crops, meanwhile, are also facing unforeseen ecological setbacks. Lipka cites USDA data estimating that 2018’s citrus crop yield will be the smallest it’s been since the 1940s, due to various environmental impacts. “Oranges have been demolished by a vector-transmitted pathogen which causes a disease called Huanglongbing, or HLB,” she says. “This insect [transmitting this pathogen] affects trees by killing branches, causing unsellable bitter fruit and stunting growth.”

U.S. grapefruit crops have also been nearly decimated by natural disasters. Kerry Ingredients’ Manheimer states that while the “best quality” grapefruit oil is produced in Florida, recent years have seen many acres of grapefruit crops destroyed by hurricanes. This is a big concern for many in the beverage space who rely on the popular flavor in beverage formulations.

It’s worth noting that there are many trending flavor ingredients that do not come with some of the sourcing challenges that other unique flavors do. Manheimer points to turmeric extract, ginger oil, cinnamon oil, and cardamom oil, which she says are currently less difficult to source.
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