

Protecting Nutraceuticals With Packaging

Consumers are increasingly interested in nutraceuticals, with global product sales projected to rise at a compound annual growth rate of 8.3% from 2020 through 2027, according to Grand View Research. They see nutraceuticals as a means to enhance their ability to fight viruses such as COVID-19, maintain active lifestyles while aging, restore lost nutrients from exercise, speed recovery from surgery, and enable balanced nutrition if they're unable to consume a balanced diet.

The scope of nutraceuticals is not well-defined, due to conflicting and broad definitions from different sources. The U.S. Food and Drug Administration (FDA), for example, defines a nutraceutical as “any substance that is a food or a part of a food and can induce medical and health benefits, including the prevention and treatment of disease.” But FDA does not allow companies to suggest that these foods prevent or cure diseases, even though consumers often

link certain nutrients to specific health benefits (without substantiation). Nutraceuticals also have spawned many offshoots, including “farmaceuticals” from modified crops or animals.

The complexity of ingredients for foods and the potential health benefits of these ingredients are the subject of much analysis (Carpio et al. 2021). But in any case, the presence of nutrients in higher concentrations in foods requires unique attention to packaging.

Establishing Authenticity

The authenticity of nutraceuticals as ingredients and in finished products is essential in ensuring that the nutrients are safe and that they are what consumers need and expect. But accessing critical ingredients to meet an exponential rise in consumer nutrient trends is challenging. The situation often prompts counterfeiters to seek to profit from the short supply and sometimes limited

ability to track sources.

Obtaining ingredients to meet trend-driven desires is logistically demanding for agricultural products in particular because

Packaging that enables nutrient shelf stability facilitates access to nutrients without the need for a constrained, high-cost, and greenhouse gas-intensive refrigerated supply chain.

they require an extended growing season before harvest. For example, the high demand for European black elderberry—which is connected to reducing influenza and cold symptoms—and the low crop yields due to inclement weather have led to an elderberry shortage. This imbalance between supply and demand has prompted concerns about dilution of elderberry within packaging and replacement of entire elderberry shipments with counterfeit elderberry-like additives.

Using overt and covert intelligent packaging can deter and thwart counterfeiting in B2B nutraceuticals such as elderberry, as well as provide consumers with confidence that a product is authentic. While trusted relationships in the value chain aid in reducing counterfeiting, tracking and tracing the actual chain of custody provides continual assurance for each hand-off in the supply chain. Packaging equipped with near-field communication (NFC) and radio frequency identification (RFID) or blockchain can track ingredients at defined hand-offs in the supply chain. These technologies can be replaced or augmented with covert intelligent packaging

Using intelligent packaging can help deter and thwart counterfeiting in B2B nutraceuticals in short supply, such as the European black elderberry. © Anastasia Stihailo/iStock/Getty Images Plus





NutriCaps deliver nutrients and are compatible with Nespresso machines. Photo courtesy of HERMES

that tracks package openings from diversion of nutraceutical ingredients. For example, covert sensors can measure chemical, humidity, light, and pressure changes that indicate tampering and instances of diversion.

QR (quick response) code and NFC packaging technology allow shoppers to track products within the value chain to verify product authenticity for consumer-facing package tracking. Tamper-evident packaging also bolsters consumer confidence that a product is authentic and has

not been opened. Tamper-evident packaging includes fiber-tear on paperboard cartons, audible pops when closures are removed, specialized hologram labels, and shrink bands and sleeves. CCL Industries' *easy4opening* tamper-evident partial shrink sleeve, for example, sports a flagged portion that can be removed with two fingers to reveal a scannable QR code.

Ensuring Efficacy

As with all food packaging, barriers retard the many modes of product deterioration, extend shelf life, and expand the time and location for actual consumer use. Stalling degradative reactions brought on by the

Protecting Nutraceuticals With Packaging continued...



Multilayer or single-use packaging for nutraceutical beverages is increasingly able to be recycled conveniently, thanks to legislative and technological advances. © kotangens/iStock/Getty Images Plus

presence of oxygen or moisture is especially important due to the high concentration of nutrients in nutraceutical foods.

Nutraceuticals often need packaging that provides high moisture and oxygen protection. For example, *Emergen-C* 60 mm x 95 mm rectangular single-use packets employ a 2.7 mil thick multilayer foil laminate barrier to allow essentially no moisture and oxygen transfer to the product. The 5.5 mm wide patterned heat seals on all four sides of the packets ensure both definitive seals, so no loss of seal integrity would occur if particulate matter inadvertently ended up within the seal area. In addition, a 2 mm notch on one side seal allows a consumer to open the packet by easily tearing through the section of the packet that is parallel to and below the top seam.

Multilayer nutraceuticals require an initial barrier as well as a barrier after the container is opened. Consumers of *Benefiber Prebiotic Fiber + Probiotics Gummies*, for example, may open and close the shrink-labeled jar at least 25 times to access the gummies. The inner seal protects the product before the initial opening by the consumer, while the screw-top lid allows for a tight seal after the initial opening. Moisture-absorbent liners that remain on the underside of the lidding can be used for nutraceuticals that require a low relative humidity environment to be maintained despite intermittent use.

Championing Convenience

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a constrained, high-cost, and greenhouse gas-intensive refrigerated supply chain. Depending on product acidity and characteristics, retortable cans and pouches, aseptic, and hot-fill containers have been used to supply nutraceuticals to people without access to controlled-temperature storage, such as some consumers, refugees, displaced persons, soldiers, and astronauts.

The marriage of convenient aseptic packaging technology and nutraceuticals meets the needs of programs such as Global Alliance for Improved Nutrition and athletic groups alike. Fortified milk and *Premier Protein* nutraceuticals products packaged in Tetra Pak cartons, for example, have a shelf life of at least 12 months. The three to seven layers within cartons can include ethylene vinyl alcohol (EVOH), polyethylene (PE), copolymers of PE, aluminum, nylon, polyethylene terephthalate (PET), and paperboard.

The superior oxygen and water vapor barrier of the multilayer cartons inhibits nutrient loss and microbial growth. This allows for supply chain agility in storing products, shipping products to varied temperature environments, and distributing products to people in need. A one-step tamper-evident opening feature adds convenience without the need to remove or dispose of additional foil lidding.

Convenient disposal of single-use nutraceutical beverage packaging is also a concern. Legislation to curb littering and encourage convenient recycling has prompted introduction of tethered caps and extension of the collection and sorting infrastructure to include multilayer or single-use packaging, including packaging containing nutraceutical beverages.

Packaging technology to inhibit separation of the cap from the main package is progressing to prepare for plastic bottle design rules set by the European Union Directive on Single-Use Plastics, scheduled to go into effect in July 2024. Tetra Pak's *HeliCap 26 Pro* impedes cap littering because a hinge connects the cap to the carton. Similar technology is employed in *Pure-TwistFlip* by Elopak, *combiMaxx* and *combiSwift* by SIG Combibloc, and options from Greatview Aseptic Packaging.

Recycling of the combined tethered caps and cartons containing nutraceuticals is advancing as well. Paperboards representing 75% of the PE, aluminum foil, and paperboard multilayer carton materials can be recycled via hydropulping, and construction boards that can benefit from the strength of PE-aluminum residuals can use 100% of the used cartons (Robertson 2021). To aid in the separation of bottles and labels during PET recycling, Nestlé's high-protein, high-calorie *Clinutren* uses PET bottles labeled with CCL *EcoFloat*.

HERMES *NutriCaps* provide a convenient way to convey powdered nutrients to consumers with Nespresso machines. Cough and cold formulation products can offer fast-dissolving ingredients such as vitamin C, zinc, and bioflavonoids within the capsules, which are transformed into a hot nutraceutical drink at the push of a Nespresso *lungo* button (*lungo* is a way of preparing espresso). The sealed EVOH and aluminum recyclable capsules provide ingredient protection. **FT**

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