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Boosting bioavailability of omega-3s

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phospholipid technology for fish oil



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Boosting bioavailability of omega-3s

Ruby-O™ features advanced phospholipid technology for fish oil



The ability of the new mRNA-based vaccines to prevent infection from SARS-CoV-2 is a major medical scientific breakthrough. The crucial ingredient is the strands of genetic material that teach cells to make virus proteins that help the immune system develop antibodies. Yet these fragile and awkward molecules could never reach a human cell without assistance. Tiny balls of fat called liquid nanoparticles shield the mRNA on its journey, with phospholipids among the four ingredients that make up the protective glob that has helped save millions of lives.¹

A type of fat, phospholipids are vital components to the cell membranes of both animals and plants, providing structure and protection to each cell.² Phospholipids also support the absorption of fats and fat-soluble nutrients, like omega-3 fatty acids, by forming a shell of sorts that helps them slip more easily into the body's cells³—not unlike how the mRNA liquid nanoparticle formula works—and be absorbed.

Indeed, phospholipids and other lipid molecules are becoming increasingly attractive drug delivery platforms.⁴ But it's not just big pharma leveraging these lipid-based delivery systems. Nutraceutical companies are also discovering the power of phospholipids to improve the absorption and bioavailability of different nutrients, leading to better health outcomes.^{5,6,7}

Now it's possible to leverage this phospholipid technology across a wide swath of health categories with just one ingredient. Read on to learn about the world's most advanced omega-3 fish oil.

Phospholipids boost bioavailability

Marine sources including fish, algae and shellfish such as krill naturally contain phospholipids, which a growing body of research suggests can increase the health outcomes derived from the omega-3 fats docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA). These benefits include improved cardiovascular, cognitive, joint, eye and skin health, among others.

Most of the current research on the benefits of phospholipids on omega-3 bioavailability and function are based on krill oil, which typically contains 40% phospholipids versus about 1.5% for most fish species.⁸ The basic premise is that



phospholipid-based oils, which disperse in water thanks to a hydrophilic “head,” are more effective in incorporating different fatty acids in the cell membrane than triglyceride-based oils, which generally contain higher concentrations of EPA and DHA.

A small, double-blinded crossover trial in 2012, for example, compared the bioavailability of krill oil versus fish oil. The study found that samples of krill oil had much higher free EPA and DHA, which the authors concluded “might have a significant influence on the availability of EPA+DHA from krill oil.”⁹ In a 2013 clinical study, 24 healthy volunteers received similar amounts of EPA/DHA from either fish or krill sources over the course of four weeks. At the end of the study, participants who took the krill oil had twice the levels of omega-3 fatty acids in their blood compared to those who took a fish oil supplement.¹⁰ An even earlier study on overweight and obese individuals also found that phospholipid-bound omega-3 oil results in higher plasma concentrations of EPA and DHA.¹¹

A 2015 paper that reviewed results from 14 previous studies comparing bioavailability between krill and fish oils found that there seems to be a difference in bioavailability of EPA and DHA in the phospholipid-bound omega-3s versus triglyceride-bound omega-3s.¹²



The idea is that better bioavailability leads to improved efficacy, potentially lower doses and a better user experience. Consumer surveys consistently show that they want more scientific rigor from their brands. In one survey, for example, between 70% and 78% of consumers, depending on the demographic, would like more clinical proof that the nutrients in their supplements are fully absorbed by their bodies.¹³

Ruby-O™: advanced omega-3 Phospholipid

That’s where patent pending Ruby-O™ from Naturmega comes in. The Colombian company begins with its high-quality EPA/DHA omega-3 oil concentrates, sustainably sourced from Peruvian anchovy fisheries that carry the seal of the Friends of the Sea, an environmental certification for sustainability of marine resources. Scientists then used an enzymatic reaction to attach its omega-3 fish oil to a phospholipid head. In this case, they use a vegetable source, lecithin, for the phospholipid delivery system.

Ruby-O™ represents a shift in how manufacturers can formulate innovative products with omega-3 fish oils. The current paradigm is to chase after ever higher concentrations of EPA or DHA, depending on the desired function—the former for heart health, the latter for brain health, for example.

“If you don’t change the delivery form of omega-3 fish oil, you could take as much EPA and DHA as you want, but your bioavailability is going

“Because the starting material is our fish oil concentrates, we can produce high EPA, high DHA, or other grades. As an example, we can make a triple strength phospholipid by using our 5020EE, or a double strength by using our 3322EE. Imagine using a lower concentration of Omega 3, and be on par with industry leading phospholipids,” Tang noted.



to be limited because it lacks that phospholipid head,” noted Tom Tang, vice president of sales and marketing for Originates, which is bringing Ruby-O™ to the North American market.

“We are able to deliver 40% more total omega-3s,” he emphasized. That puts Ruby-O™ on par with phospholipid krill oils, while also still packing higher concentrations of EPA/DHA. In fact, one distinct advantage of Ruby-O™ is that it is highly customizable based on a customer’s EPA/DHA requirements.

Ruby-O™ also features glycolipids, another integral component of the cell membrane capable of facilitating a variety of intra- and intercellular interactions, including immune response and tissue formation. Glycolipids may also help provide better bio-absorption of omega-3s. Studies have suggested that functional algae oils containing both phospholipids and glycolipids work synergistically to enhance the bioavailability of omega-3s to plasma and tissues.¹⁴



The innovative ingredient also contains choline and astaxanthin. The former is a water-soluble compound that contributes to healthy brain function, heart health and liver function, among other benefits.¹⁵ The latter is a carotenoid pigment that acts as an antioxidant, with its own bevy of benefits, supporting heart health, joint health, skin health and more.¹⁶

World population suffers from low omega-3 intake

The need for more efficacious omega-3 products has never been greater from a health standpoint.

Study after study has shown that most people have low blood serum levels of omega-3s, including a 2016 global study that reported 97% of the world population has sub-optimal levels.¹⁷ A more recent study published in 2021 analyzed U.S. population data and found that more than 88% of adults scored in the high cardiovascular risk category on the Omega-3 Index.¹⁸ While more than half of adults surveyed in another study believed that omega-3 fatty acids are beneficial for heart and brain health, few participants had Omega-3 Index concentrations in the range for cardiovascular disease protection.¹⁹

In addition, the economic toll of chronic illnesses such as heart disease and Alzheimer’s are growing. The former costs the U.S. healthcare system \$214 billion per year and causes \$138 billion in lost productivity on the job.²⁰ Meanwhile, costs associated with dementia



are expected to fall between \$379 billion and \$511 billion in 20 years.²¹ Conversely, a study in Europe that analyzed the potential cost benefits of supplementation with 1000mg of omega-3 EPA+DHA fish oil among individuals aged 55-plus reported that there could be 1.5 million fewer visits to the hospital over a five-year period, generating savings of \$72.5 billion.²²

The emerging phospholipid market

The omega-3 market is primed for something new.

In 2020, the U.S. fish/plant oils market was valued at about \$1.2 billion, according to Nutrition Business Journal, with growth relatively flat—compared to a jump of 14.5% in the overall \$55.7 billion U.S. supplement market. Omega-3 oils continued to beat steady and strong in the heart health category, with growth of more than 8% last year to \$517 million. However, while

omega-3 oils remain the foundation of the brain health category, sales remained relatively flat at \$286 million.

The lackluster performance in brain health and other categories—down more than 10% in joint health, negative a percentage point in pre-/post-natal health, up just 3.9% in eye health—led NBJ to quip: “Fish oil has hit a dull spot ... It may still benefit from some tweaks for bioavailability and perhaps a formulation boost ...”

“Ruby-O™ represents a new way to reboot and rethink the functional oils market”, according to Tang.

“The current choices for consumers are made from either Krill Oil or Herring Roe. The source of our phospholipid is our very own Omega 3 fish oil. This will enrich the category of phospholipids and offer additional choices” he said, while pointing out that some brands may be drawn more strongly to a non-shellfish ingredient with a similar pharmacokinetic profile to krill, including no fishy aftertaste.

Naturmega is in the process of establishing its own foundation of scientific evidence for Ruby-O™, as most of the scientific literature today focuses on phospholipid-bound krill oil. In vitro studies will characterize the modes of action and pharmacokinetics, with follow-on clinical studies to investigate the bioavailability by 2022.

“We believe that this is a very competitive and affordable option for brand owners who want to sell a phospholipid to their customers,” Tang said. “There’s a new option in town.”





Phospholipids and the health benefits of better bioavailability

Consumers use omega-3 supplements to tap into many different health benefits, particularly to promote cardiovascular wellness and improve cognition.

Numerous studies have been conducted on omega-3s and heart health, in particular, with several systematic reviews and meta-analyses showing that higher consumption of omega-3s are associated with a lower risk of cardiovascular disease and other heart health conditions.^{23,24}

Fewer studies have directly investigated the potential benefits of phospholipid-bound omega-3 fatty acids on heart health. However, a 2014 study involving 300 subjects with high triglyceride levels, a biomarker of heart disease risk, found that phospholipid omega-3 supplementation using krill oil was associated with a 10% reduction in triglyceride levels. The authors concluded that

oral supplementation with phospholipid-bound omega-3s is “effective in reducing a cardiovascular risk factor.”²⁵

Similarly, a large body of research has been dedicated to the effects of omega-3 fatty acids on reducing cognitive decline, dementia and even Alzheimer’s disease.^{26,27} In particular, DHA is an essential component of cellular membrane phospholipids in the brain, so one hypothesis is that omega-3s might support cognitive health by maintaining neuronal function and cell-membrane integrity.²⁸

Again, while evidence is far more scarce regarding how phospholipid-bound omega-3 fatty acids may directly benefit brain health, early results are exciting. Studies involving animal models, for example, have shown that DHA delivered with phospholipids can raise levels of omega-3 in the brain.^{29,30} In addition, a review of the available scientific literature of omega-3 DHA and EPA for cognition, behavior and mood had an especially encouraging conclusion: “Omega-3 phospholipid supplements that combine DHA/EPA and phospholipids into the same molecule have shown marked promise in early clinical trials.”³¹

As more companies in the natural products industry adopt phospholipids and related lipid-based delivery technologies, more research will follow, bolstering the case for ingredients that feature high bioavailability.



Endnotes

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