

The Truth About Omega-3:



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and DHA from fish oil ...
the best source of
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Health researchers have shown increased interest in Omega-3 for decades. First, the dietary supplement industry and, now, the food industries have caught on to the idea that food products containing Omega-3 are a significant marketplace opportunity.

Elizabeth Mannie

And what an opportunity it is, as shown by a 2004 consumer research study conducted by an independent research firm. All 100% of participants indicated that they would be inclined to purchase a product enriched with Omega-3, if there was no impact on taste or price of the product. Additionally, 100% of participants indicated an interest in educating their families about the many health benefits of Omega-3. When asked about the primary health benefits associated with Omega-3, 40% of the participants felt that it was "good for the heart," 18% felt that it was good for the skin, and 16% felt that it would help lower cholesterol. The bottom line is that consumer awareness of Omega-3, and fish oil as the primary source of Omega-3, is very high.

Omega-3 fatty acids are considered essential for normal growth and development; they are present in every cell in the human body. Important in cell membranes and human metabolism, low levels of Omega-3 in today's diet are a known risk factor for heart and inflammatory diseases. Other evidence points to fatty acid deficiencies contributing to

psychiatric and neurologic disorders and childhood neurodevelopmental disorders including Attention Deficit Hyperactivity Disorder (ADHD), dyslexia, dyspraxia/developmental coordination disorder (DCD) and autistic spectrum disorders.^{1,2} Omega-3 deficiencies are also thought to play a role in asthma, hypertriglyceridemia, high blood pressure and rheumatoid arthritis.^{3,4,5,6}

Western Diets and Health Issues

While scientists and consumers are more educated about the vital role Omega-3 plays in preventing certain diseases, the beginning of this dietary deficiency can be traced to approximately 50 years ago, when food processing technologies allowed manufacturers to offer more packaged foods, and fish was not easily available everywhere. Today, 25% of Americans don't eat fish. The physiologically essential and biologically active forms of Omega-3 are EPA (eicosapentaenoic acid or 22:6n-3) and DHA (docosahexaenoic acid or 20:5n-3). ALA (alpha-linolenic acid or 18:3n-3) is also an Omega-3, but the body needs to con-



vert it to EPA and DHA to derive the health benefits, and this conversion is very inefficient (about a 5% conversion efficiency).⁷

Therefore, it is not surprising that the World Health Organization and others have identified a serious and pervasive deficiency in the Omega-3 fatty acids EPA and DHA, which are vital for heart and brain health as well as for normal growth and development.

In another effort to address the issue, the United States Department of Agriculture changed the food pyramid in 2005, adding the recommendation that people eat at least two, four-ounce meals of fatty fish per week. The American Heart Association (AHA) recommends that adults consume plant-derived sources of Omega-3 fatty acids in addition to eating fish at least twice per week. Because of the inconvenience of preparing fish, and its higher cost, this level of fish consumption is difficult for the average American to achieve.

All Omega-3s are not Created Equal

It is important to remember that all Omega-3s are not created equal. Three common forms of Omega-3 fatty acids are found in foods. ALA is primarily from flax and a few other plant sources such as soy, walnuts, flaxseed and canola oil, while EPA and DHA are primarily from oily fish such as anchovies, sardines, salmon and mackerel. The highest sources of Omega-3 come from anchovies and sardines.

ALA is different bioactively than EPA and DHA. The Institute of Medicine states that ALA is not known to have any specific functions other than as a precursor to EPA and DHA. However, the conversion rate is very inefficient and will not produce the levels of EPA and DHA believed to offer heart health benefits.⁴ The optimal approach for heart health with Omega-3 fatty acids is to consume EPA and DHA via fish consumption and/or supplementation.⁸

Health Benefits

Over 8,000 research publications support the health claims of EPA and DHA. Only calcium has as much scientific evidence for importance in human health. Here are some of the well-researched health benefits.

• Cardiovascular Disease

The FDA reviewed clinical data supporting EPA and DHA benefits to the heart when considering evidence for



Danone Danino Yogurt, co-branded with MEG-3®, is available in Canada and targeted to children. It contains 20mg DHA per serving and carries a Biological Role Claim: "DHA, an Omega-3 fatty acid, supports the normal development of the brain, the eyes and the nerves" on the front panel.

a qualified health claim. It was noted that four trials conducted in populations with coronary heart disease or high risk factors for CHD found substantial benefits.⁸

The AHA in its 2003 recommendations stated that 2g-4g of EPA and DHA taken daily can lower triglycerides by 20% to 40%. The effects appear to be synergistic with the HMG-CoA reductase inhibitor (statin) drugs such as simvastatin (Zocor[®]), pravastatin (Pravachol[®]), and atorvastatin (Lipitor[®]). The AHA also recommended in 2003 that people with known coronary disease take approximately 1g of EPA and DHA combined each day, either by eating fish or taking fish oil supplements.³

High blood pressure also responds favorably to Omega-3 supplementation, and the effects appear to be dose sensitive. Higher doses seem to have greater effects on reducing blood pressure.³

• Rheumatoid Arthritis

Multiple randomized, controlled trials report improvements in morning stiffness and joint tenderness with regular intake of fish oil supplements over a three-month period. Clinical trials commonly have used doses of between 3g and 5g of EPA and DHA per day, but the effects beyond three months of treatment have not been well evaluated.³

• Fetal and Infant Benefits

Studies have shown that maternal intake of DHA during pregnancy and lactation may be favorable for later mental development of the child. It was also demonstrated that an early dietary supply of DHA was a major dietary determinant of improved performance on the Mental Development Index (MDI).^{9,10} Human breast milk contains both DHA and EPA in a 4:1 ratio, indicating the importance of both nutrients in infant nutrition.¹¹

• Developmental Coordination Disorder

Disturbances of perception, attention and behavior seen in DCD/dyspraxia show parallels to symptoms of Omega-3 fatty acid deficiency seen in animal studies.



Farmers Choice 1% low-fat Milk Beverage, available at Sobeys and Superstore in Canada, contains 40mg EPA and DHA per serving.

• Asthma

A study of Australian school-aged children showed that consumption of one fish meal per week reduced asthma, when compared to control groups that rarely ate fish.⁴ Another study, where children were evaluated for asthma at eight years of age and compared to healthy control groups of the same age, showed that asthmatics were more likely to have a diet with a higher ratio of Omega-6 to Omega-3 than their control counterparts.⁵

The Omega-3 to Omega-6 ratio, in fact, is so critical. In another study, involving 616 women at risk for having children with asthma, mothers who received fish oil concentrate and gave fish oil concentrate to their infants after birth had fewer doctor visits for their children for wheezing, nocturnal cough, and bronchodilator use compared with control participants at 18 months old.⁶

Considering that EPA has anti-inflammatory characteristics, it is not surprising that fish oil could lessen asthmatic symptoms. Since asthma, atopy, and atopic dermatitis are closely related, it is possible that Omega-3 could help treat all of these. Although research on Omega-3 supplementation in asthmatics is in its early stages, there are some very encouraging results.

DCD affects 5% of school-aged children to a serious degree. It is characterized by deficits in motor function, difficulties in learning, behavior, and psychosocial adjustment that remain into adulthood. DCD shows substantial overlap with ADHD, dyslexia, and autistic spectrum disorders.^{12,13}

A randomized, double-blind, placebo-controlled trial involving children aged five through 12 with suspected DCD-type difficulties featured treatment in parallel groups for three months. This was followed by a one-way crossover for an additional three months. Treatment consisted of supplements containing 80% fish oil (558mg EPA and 174mg DHA) and 20% primrose oil, along with Omega-6 (60mg γ -linoleic acid) and 9.6mg vitamin E. The placebo was olive oil.

There was significant improvement in reading, spelling, and behavior, when compared to the placebo group. Mean reading age increased by 9.5 months versus 3.3 months for the placebo group. Mean spelling age increased by 6.6 months versus 1.2 months for the placebo group. The author suggested that fatty acid supplementation might be a safe, tolerable and effective treatment for improving academic progress and behavior among children with DCD.¹⁴

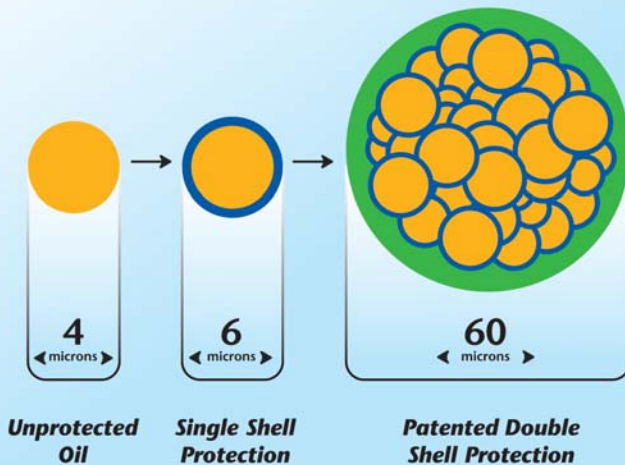
The Challenge of Providing Omega-3

Polyunsaturated fatty acids fall into two classes, Omega-3 and Omega-6. Over the past half century, a disproportionate increase in

Stonyfield Farm Organic Yo-Baby Yogurt with DHA for babies and toddlers. This is a U.S. product containing 17mg DHA per serving.



POWDERLOC™



Powder-loc™ has revolutionized the ability for food manufacturers to use fish oil as a healthy food ingredient.

Powder-loc™ uses double shell protection, which keeps the EPA/DHA locked into the microcap while keeping the smell and taste of the fish locked out of the food.

Source: Ocean Nutrition Canada

Omega-6 relative to Omega-3 consumption has occurred. Vegetable oil consumption soared while fish consumption declined, accounting for the current Omega-6 to Omega-3 intake ratio of approximately 15 to 1 in Western diets. Previously, the ratio was closer to 3 to 1.

The increased intake of Omega-6 fatty acids is due to consumption of vegetable oils containing linoleic acid such as corn, safflower, soybean and sunflower oils, as well as less ordinary oils like evening primrose, pumpkin, sesame, walnut and wheat germ. The increased Omega-6 to Omega-3 ratio creates a health issue, since the two types of lipids compete with each other to be converted to active metabolites in the body. Currently, at this reduced intake ratio, Omega-3 is not converted in the quantities needed for health. When more Omega-6 is converted, arachidonic acid is made more prevalent; this is a precursor of the inflammatory cascade and research suggests that this leads to inflammation, the first phase of many disease conditions. Thus, by either decreasing Omega-6 intake or increasing Omega-3 intake, health benefits can be achieved.¹⁵

One way to increase Omega-3 in the diet is to put fish oil into foods. Previously, many companies have tried this with limited success because the oil is prone to oxidation, causing flavor and odor issues. However, one company, Ocean Nutrition Canada Limited (ONC), has

invested in an intensive research and development program to create a solution for the problem of adding fish oil into food products.

The traditional approach to preventing oxidation was microencapsulation, where spray-dry emulsion technology was used to create a sponge-like gelatin matrix of oil. However, this provided limited protection because when the encapsulated oil was exposed to the stresses of food processing, the oil would leak into the food. Also, the older technology allowed large amounts of free oil on the outside of the microencapsulated droplet, resulting in a fishy taste or smell.

Ocean Nutrition's solution is a new, patented process of microencapsulation called Powder-loc™, which enables foods to be enhanced with Omega-3 without any fishy taste or smell. In essence, Powder-loc™ uses double shell protection, which means that each oil droplet not only has its own protective shell, but all the single shells are then grouped together and protected in a second shell. This process keeps the EPA and DHA locked into the microcap, while keeping the taste and the smell of the fish locked out of the food.

In 2005, Ocean Nutrition's MEG-3® brand food ingredient, which uses the unique Powder-loc™ micro-encapsulation technology, has become the world's leading fish oil ingredient in food products. MEG-3® is the breakthrough Omega-3 product that finally enables food companies to create nutritionally dense foods containing EPA and DHA from fish oil, without affecting the taste or smell of the foods.

Micro Spheres of Fish Oil

A cross-section of one grain of MEG-3® powdered fish oil, using Powder-loc™ technology, looks like many little balls inside one large ball. Each of these smaller balls is a mini-





microcapsule that contains fish oil and protects the oil from both oxidation and the rigorous stresses of food processing. Even if the outer shell were to break, which is unlikely, the oil still has the protection of the inner mini-microcapsules that surround it. Thus, the whole cluster of mini-microcapsules is protected by a tough outer shell, resulting in virtually no free oil on the outside.

MEG-3[®] food ingredient, made with Powder-loc™ technology, enables food companies to put fish oil in their products, without the taste or smell of fish, allowing for the development of a wide variety of new products. With the technology's superior processing tolerance characteristics, the ingredient can withstand the high stress of being kneaded in bread, for example. It can also be heated to high temperatures, surviving milk pasteurization or hot candy processing. Having double the nutritional density of Omega-3 compared with many competitive products, it is also the most cost effective form of microencapsulated fish oil on the market.

The MEG-3[®] ingredient is commercially available for a broad range of food applications around the globe. No other competitive product has demonstrated its ability to provide foods with added EPA and DHA from fish oil on this magnitude of scale. MEG-3[®] also demonstrates great flexibility in the range of foods it can be added to including bread, dairy, nutrition bars, orange juice, pizza crust and confections.

Regulatory Benefits

In the U.S., MEG-3[®] ingredients are FDA-notified Generally Recognized as Safe (GRAS) and a copy of their letter from the FDA can be found on the FDA's website

Cali Wraps with MEG-3[®] include four types: original, whole wheat, whole grain and Mediterranean Herb. A Canadian product containing 50mg EPA/DHA per serving, the front panel states: "Source of Omega-3 polyunsaturates from the sea. 0.05g EPA+DHA per tortilla." The company also uses the Biological Role Claim: "Cali-Wraps with MEG-3[®] contain DHA, an Omega-3 polyunsaturate, which supports the normal development of the brain, eyes and nerves."

(www.cfsan.fda.gov/~rdb/opa-g138.html). This letter summarizes the maximum levels and the food categories which are allowed to have MEG-3[®] added to them.

Based on a large amount of scientific evidence demonstrating the efficacy of EPA and DHA, the Food and Drug Administration has allowed a Qualified Health Claim for heart benefits in supplements and foods containing these Omega-3. This allows manufacturers of nutritional products to better position their products as healthy because EPA and DHA may play significant roles in heart health.

Recently, the U.S. has approved a prescription form of concentrated fish oil for reduction of hypertriglyceridemia, an independent risk factor for coronary artery disease. In Italy, concentrated fish oil is also prescribed by physicians to prevent secondary myocardial infarctions based on the results of a major clinical trial called the GISSI study. These examples demonstrate that there is a positive regulatory environment supporting the efficacy and value of fish oil as a food ingredient.

In Canada, Ocean Nutrition obtained Novel Food approval for the ingredient to be added to food products.

Currently, Ocean Nutrition customers are allowed to add a maximum of 50mg EPA and DHA per serving in a limited list of foods. Specifically, they are: unstandardized loaves (not including bagels, flat breads and rolls), granola and cereal bars, meal replacement bars, unstandardized frozen dairy desserts, unstandardized milk-based beverages, yogurt and nutritional supplements in liquid form and chicken nuggets.

Under U.S. labeling regulations, Omega-3, EPA or DHA cannot currently be listed as voluntary nutrients on the Nutrition Facts panel. However, the amounts per serving of Omega-3 or DHA/EPA can be listed on the front panel of a food package. An example statement would be: "A serving contains 90mg of DHA and EPA Omega-3 fats."

In Canada, Omega-3 content may be listed on nutrition facts while EPA and DHA (separately) are not allowed. However, EPA/DHA can be listed separately on the front panel. In the U.K., Omega-3 (DHA/EPA) is represented on the Nutrition Panel, expressed as mg per serving as well as % RDA (Recommended Dietary Allowances) per serving.



Consumer Awareness of Omega-3

Ocean Nutrition has been working diligently to better understand consumers and it has found that adequate access to accurate information about Omega-3 has not been available up until now. Data has shown that consumers who are well informed about Omega-3 are substantially more likely to purchase Omega-3 supplements and Omega-3-enriched foods.

Through extensive research, Ocean Nutrition has developed many insights to customize consumer messaging for specific products. Their dynamic website (www.meg-3.com) helps food manufacturers educate consumers about the benefits of Omega-3 effectively. Their Point of Purchase program helps attract and educate consumers, while highly interactive training programs help educate employees, key stakeholders and health professionals. A public awareness campaign to keep Omega-3 in the public eye is currently being rolled out by Ocean Nutrition in both the U.S. and Canada.

The MEG-3® brand creates a positive emotional relationship with consumers. The product positioning is "Trust the Source" of MEG-3® Omega-3 ingredients. The phrases, "A little fish your heart will love™," for MEG-3® and "A little fish your brain will love™," for MEG-3®DHA, educate people to appreciate the health benefits and consume products containing MEG-3® ingredients because they feel confident about the idea of consuming fish oil.

MEG-3® ingredients are available around the globe for use in dietary supplements and food ingredient applications, and many products containing the ingredients have recently been launched. Several examples appear throughout this publication. These and more product launches have been occurring in the last 12 months and many more are in development planning for 2006 and beyond. A new consumer market is converging to make

EPA and DHA from fish oil the next mass consumer ingredient, following in the success of soy and calcium.

A New Kind of Fish Market

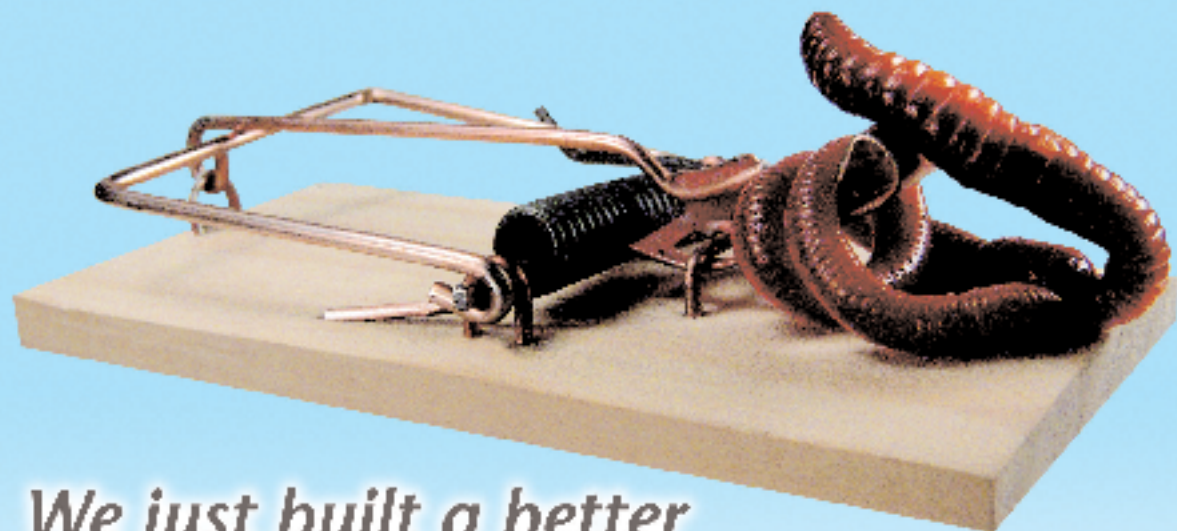
The food ingredient market for fish oil historically has been a small niche market at best. At that time, product applications were limited to foods where masking agents were used to cover up fish flavor and odor. But now, because of the large-scale ability of MEG-3® ingredients to fortify foods with Omega-3 without the fishy taste or smell, a completely new segment of the food industry (which did not exist even 18 months ago) is being created.

People can now get the essential nutrients EPA and DHA from fish oil in foods they love to eat. This improves human health by providing nutritionally dense foods and creating convenience. Now, large groups of people who have been lacking these nutrients in their diets have the opportunity to improve their nutrition by eating the foods they like in brands they love. This will have spillover effects on all levels of the value chain, creating new products, new wealth and new exciting commercialization opportunities for our industry as a whole. **PF**

A.C. LaRocco Pizza in the U.S. has added 50mg EPA/DHA per slice to its Tomato & Feta, and Greek Sesame frozen pizza crusts, which are distributed and promoted nationally.

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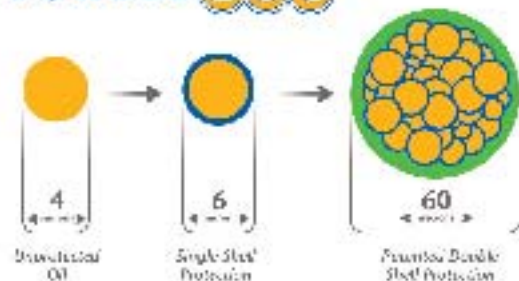


We just built a better

FISH TRAP

Everyone knows that the best source of Omega 3 is EPA and DHA from fish oil. Scientists know it. And so do increasing numbers of consumers. But using fish oil in food processes has been problematic because of well, the fish. You always noticed it. The taste. The smell. That is... until now!

POWDER LOC™



Introducing MEG-3[®], a healthy food ingredient, derived from fish oil. MEG-3[®] is manufactured using our exclusive Powder-Loc[™] technology. Powder-Loc[™] is changing the market. Its patented, double shell protection produces a free flowing, dry powder with a unique molecular construction that locks in the health benefits of Omega-3, and locks out even the slightest hint of fishiness. This new powder can be easily incorporated into any production facility without the mess or smell of working with conventional fish oil products.

MEG-3[®] is proven and versatile. It has a ready been successfully commercialized in over ten food categories, to date, including everything from milk and yogurt to breads and frozen pizza. This year, food manufacturers in over a dozen countries, will produce over two billion food servings that include MEG-3[®].

With the better fish trap there's no instability. So, there's no need to compromise your Omega-3 food products with inferior flax derived ingredients anymore. Should you beat a path to our door? Absolutely. But, it might be easier to just pick up the phone! We'll be happy to answer all of your questions about MEG-3[®] and our revolutionary Powder-Loc[™] process.

We'll go on. "Snap" to it!

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