



FOOD TECHNOLOGY FACT SHEET

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Foods, Health, and Omega-3 Oils

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Fats and oils are part of a healthful and balanced diet. The type and amount of fat/oil consumed are very important for maintenance of health and disease prevention. The Dietary Guidelines prepared by the U.S. Food and Drug Administration recommends “20 to 35 percent of the daily calories should come from dietary fats.” FDA Dietary Guidelines for 2005 suggest less than 10 percent of calories should come from saturated fatty acids and less than 300 milligrams per day of cholesterol should be consumed for healthy living. It is also emphasized in the Dietary Guidelines that most of the dietary fats/oils should come from sources of polyunsaturated and monounsaturated fatty acids, such as fish, nuts, and vegetable oils.

Polyunsaturated fatty acids, or PUFAs, are fatty acids with more than one double bond in their chemical structure. The importance of PUFAs in human nutrition and disease prevention was scientifically recognized several decades ago. Systematic nomenclature for fatty acids is based on the number of carbon atoms and number and position of unsaturated bonds. They are usually named in abbreviated form as X:Y_n [or ω (omega)] Z, where X refers to the number of carbon atoms of the chain, Y is the number of double bonds, and Z is the position of the first double bond. The ‘ω’ system relates the position of the first double/triple bond from the methyl terminal carbon. As an example, 18:3n₃ refers to a fatty acid (omega-3) that consists of an 18 carbon chain with 3 double bonds; the first double bond being between the third and fourth carbon from the methyl end.

Eicosapentaenoic acid, or EPA (20:5n-3), Docosahexaenoic acid, or DHA (22:6n-3), and Alpha-Linolenic Acid, or ALA (18:3n₃), are three important omega-3 fatty

acids that are studied and advertised extensively to well-informed consumers. Fats and oils rich in omega-3 fatty acids have been shown to possess various health benefits, such as preventing coronary heart disease, hypertension, type 2 diabetes, renal disease, rheumatoid arthritis, ulcerative colitis, and chronic obstructive pulmonary disease. These fatty acids also aid brain development and growth. In September 2004, the FDA approved a “qualified health claim” for reduced risk of coronary heart disease, or CHD, for conventional foods containing EPA and DHA. A qualified health claim for a conventional food must be supported by credible scientific evidence. Although these fatty acids are not essential to the diet, they help to maintain health and prevent disease. The 2005 FDA announcement states “*evidence suggests that consuming approximately two servings of fish per week (approximately 8 ounces total) may reduce the risk of mortality from CHD and that consuming EPA and DHA may reduce the risk of mortality from cardiovascular disease in people who have already experienced a cardiac event.*” In 2000, FDA announced a similar qualified health claim for dietary supplements containing EPA and DHA fatty acids and the reduced risk of CHD. FDA recommends consumers not exceed more than a total of 3 grams per day of EPA and DHA omega-3 fatty acids, with no more than 2 grams per day from dietary supplements.

In the United States, intake of omega-3 fatty acid is about 1.6 grams per day (approximately 0.7 percent of energy). DHA and EPA consist about 0.1 to 0.2 grams per day of the total omega-3 consumption. It is recommended that EPA and DHA consumption should be increased four fold to 0.65 grams per day. A main reason for omega-3 supplementation in adults is due to an imbal-

ance; many consume excess amounts of omega-6. It is believed human beings evolved on a diet with a ratio of omega-6/omega-3 fatty acids of about 1. Today the same ratio is in the range of 15/1 to 17/1 in the Western diet. Enlargement of the modern vegetable oil industry, and increased use of cereal grains for domestic livestock are some of reasons for the increased ratio of omega-6 fatty acids in the human diet. Foods from edible wild plants contain a good balance of omega-3 and omega-6 fatty acids. Wild animals and birds who feed on wild plants have very lean meat (3.9 percent fat), which contains 5-fold more PUFA per grams than found in domestic livestock. Even domestic green leafy vegetables, eggs, and fish contain less omega-3 fatty acids than in their wild counterparts.

Fish, specifically halibut, mackerel, herring, and salmon are the major source of EPA and DHA. For example salmon and mackerel contain 1.0 to 1.4 grams and 2.5 grams omega-3 fatty acids per 100 grams edible portion (raw), respectively. Many of the dietary supplements available to consumers are derived from marine oils and contain approximately 180 milligrams EPA and 120 milligrams DHA. BASF, Merck, and Hoffmann-La Roche market fish oil-based products, often packaged with proprietary microencapsulation technology. Martek markets DHA-rich oils produced by a fermentation process. In May 2001, the FDA issued a Generally Recognized As Safe notification regarding the use of Martek's DHA oil (DHASCO®), in infant formula. This favorable review opened the door for U.S. infant formula manufacturers to add microalgae-derived DHA to domestic infant formula.

ALA cannot be synthesized by humans; hence its deficiency can lead to health problems including impaired growth, skin lesions, and neurological abnormalities. ALA is found in many foods including flaxseed oil, borage oil, walnuts, and leafy vegetables. Purslane, a vegetable used in soups and salads along the Mediterranean basin and in the Middle East, is unique because it is the richest source of ALA and one of the few plants known to contain EPA. Perilla seed oil is the richest ALA source among vegetable oils and is widely used in Asian countries for cooking and traditional medicine.

Enteric coated soft gel perilla oil capsules are available in the market.

The addition of omega-3 to infant formulas has extended to their addition to fluid milk and other products around the world. Nestle markets its Omega Plus line in South America and the Far East. The following commercial products have also been introduced into the world market; cheese (130 milligrams EPA+DHA per 100 grams), bread (29 milligrams long-chain omega-3 PUFA per 100 grams) and eggs (more than 200 milligrams per 100 grams). Mayonnaise, sweet flavored nutrition bars, cream cheese, and drinkable, as well as cup yogurt are also marketed in omega-3 enriched forms. Recently, it was announced that Kellogg Co. signed a 15-year supply agreement with an omega-3 producer and is working on adding omega-3 to its products.

As consumers continue to demand more nutritious products, food manufacturers are seeking many more opportunities to include omega-3 in their formulations. However, flavor is the major obstacle tempering progress on the enrichment and fortification of food products with omega-3 oils. These oils can be highly susceptible to oxidation, which deteriorates flavor, increases the risk of rancidity, and reduces shelf-life of the product. For example, in a case study of omega-3 fatty acids in mayonnaise, it was shown that low pH combined with high iron content (caused by egg yolks) accelerated oxidation and reduced the shelf life of the product. Presence of copper and peroxides in foods can also be a problem in causing oxidation of omega-3 fatty acids. Fortunately, there are solutions to these problems. Oils high in omega-3 fatty acids may be spray-dried and oil encapsulated in a dry matrix with very low exposure to surface oxidation. Omega-3 fatty acids oxidation can also be controlled by pH adjustment in emulsions or by producing low-viscosity emulsions for ease of handling and incorporation into water based foods. Addition of mixed tocopherols (antioxidants) and EDTA (metal chelating agent) has been proven effective to improve oxidative stability of omega-3 fatty acids. Some products that are emerging as the best for omega-3 fortification include frozen food entrees, soups, refrigerated foods, salad dressing, yogurt, spreads, juices, egg products, and cheeses.