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Part 1 of 2: Omega-3 Fatty Acids 101

What are Omega-3 fatty acids?

Fatty acids consist of carbon chains of varying length, with a carboxyl group (COOH) on one end. The numbers “3”, “6”, and “9” indicate the placement of the first double bond relative to the last carbon of the chain (the carbon at the opposite end of the carboxyl group); this last carbon is termed omega (the last letter in the Greek alphabet).¹

Nutritionally important omega-3 fatty acids include α -linolenic acid (ALA), eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA). The human body cannot synthesize ALA, but ALA can be converted into the longer chain omega-3 fatty acids (EPA and DHA).² However, this conversion occurs competitively with omega-6 fatty acids so accumulation of EPA and DHA is more effective when obtained directly from food sources or when competing amounts of omega-6 analogs do not greatly exceed amounts of omega-3.^{3,4} EPA and arachidonic acid (AA)(an omega-6 fatty acid) are further broken down into eicosanoids, including prostaglandins, thromboxanes, and leukotrienes. Eicosanoids made from omega-3 fats often have opposing functions to those made from omega-6 fats (ie, anti-inflammatory and decreased blood clotting rather than inflammatory and increased blood clotting). If both omega-3 and omega-6 fatty acids are present, they will compete for transformation to their active forms; therefore, the ratio of omega-6:omega-3 directly affects the type of eicosanoids that are produced.⁵

The ideal ratio of omega-6 to omega-3 fatty acid intake is unclear. Researchers believe the ideal omega-6 intake should be no more than four to five times that of our omega-3 intake. The National Institutes of Health recently published recommendations of daily fatty acids intakes. Specific recommendations include 1.1 to 1.6 g/day of ALA and 11 to 17 g/day of linoleic acid (omega-6) in adults.⁵ The World Health Organization suggests an optimal balance between the intake of omega-6 fatty acids and omega-3 fatty acids with the recommendation being 5-8% and 1-2 %

of daily energy intake respectively.⁶ Health Canada's recommendations suggest an intake of 5-10% of total energy from omega-6 sources and 0.6-1.2% from omega-3 sources.⁷ Since current North American intake of omega-6 in the diet is ten to thirty times greater than that of omega-3, it is recommended to consume less omega-6 fatty acids and more omega-3 fatty acids to promote good health.⁵

The best source of EPA and DHA is fatty fish, such as mackerel, halibut, salmon, bluefish, mullet, sablefish, menhaden, anchovy, herring, lake trout, coho, and sardines. Each of these provides 1 g or more of omega-3 per 100 g serving. ALA is found in fats and oils (such as flaxseed, canola, soybean, walnut and wheat germ), nuts, seeds, and vegetables.^{4,5} Omega-6 fatty acids are found in vegetable and nut oils such as sunflower, safflower, corn, soy and peanut oil.⁸

Why are omega-3 fatty acids important?

EPA and DHA, are important for the production of nerve tissue, hormones, and cellular membranes. EPA is converted into prostaglandins, which have anti-inflammatory activity. These fats also help lower high blood pressure, reduce elevated cholesterol and triglycerides, prevent atherosclerotic plaque formation, and improve skin conditions such as eczema and psoriasis.³ Deficiency of omega-3 fatty acids has been associated with growth retardation, reproductive failure, skin lesions, renal and hepatic disorders, neurological disturbances (eg. incoordination, learning disability, paresthesias, weakness), diarrhea, and visual problems.⁴

Safety

Fish oil consumption is likely safe when used orally and appropriately in adults. Doses of 3 grams per day and less can be safely used by most people. Doses greater than 3 grams per day have been associated with increased risk of bleeding and suppression of the immune system, thereby justifying physician consultation.⁹

It is possible that fish oils may contain potentially harmful contaminants such as dioxins, methylmercury, and polychlorinated biphenyls (PCBs). However, mercury accumulates in fish meat more than fish oil, and fish oil supplements appear to contain almost no mercury.² It is recommended to avoid frequent consumption of shark, swordfish, king mackerel, tilefish (also called golden bass or golden snapper), and farm-raised salmon due to the potential of higher amounts of contaminants.²

Omega-3 supplementation is likely safe when used orally and appropriately in children. However, dietary consumption of large amounts of fish oil may be unsafe in children. Frequent consumption of

contaminated fish can cause brain damage, mental retardation, blindness and seizures in children. Lower levels can cause more subtle problems such as learning disabilities. Fish consumption should be limited in young children to no more than two ounces per week.²

Adverse Effects

The most commonly reported adverse effects involve mild gastrointestinal discomfort such as nausea, diarrhea, heartburn, indigestion, burping, and abdominal bloating and pain. Gastrointestinal discomfort can be reduced by taking fish oils with food and

gradually increasing the amount consumed. Other adverse effects include a fishy aftertaste, inhibition of platelet aggregation, occasional increased LDL levels, skin rash, hypoglycemia and decreased immune system function. Most of these adverse effects were noted at doses greater than 3 g per day.^{2,4}

Drug Interactions

Caution may be required in individuals taking antiplatelet drugs and antihypertensives as fish oils can decrease both platelet aggregation and blood pressure. Oral contraceptives may decrease the lipid lowering effects of omega-3 fatty acids and orlistat may decrease the absorption of omega-3.²

Use in Pregnancy

Supplementation with omega-3 fatty acids is likely safe and does not appear to adversely affect the fetus. However, consumption of large amounts of dietary omega-3 fatty acids may be unsafe due to the possibility of toxic contaminants. Women who are pregnant (or who may become pregnant) and nursing mothers should avoid shark, swordfish, king mackerel, and tilefish, which may contain high levels of methylmercury. They should also limit consumption of other fatty fish to 12 ounces per week or about 3-4 servings/week.²

Supplementation: Should I buy an Omega-3 Supplement that also contains Omega-6 and 9?

Since current Western diets contain much higher omega-6:omega-3 ratios than what is thought to provide optimal health, the current recommendation is to decrease omega-6 consumption and increase

omega-3 consumption.⁵ This makes supplementation with omega-6 fatty acids irrational.

Omega-9 fatty acids can be synthesized in the body from unsaturated fats and are therefore not essential in the diet. Oleic acid is an omega-9 fatty acid found in olive oil. Limited information suggests metabolites of oleic acid may competitively inhibit the production of omega-6 fatty acid prostaglandins and leukotrienes.¹⁰ Until more conclusive information is available, regular supplementation is not justified.

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References posted with the newsletter on the SDIS website or available upon request.

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