

EICOSAPENTAENOIC ACID (EPA)

DOCOSAHEXAENOIC ACID (DHA)

General: essential fatty acid derivatives; omega-3;

- Found in cold water fish oils and certain micro-algae; 20% (EPA) found in certain snake oils;
- **History:** Eskimo consuming traditional diet high in fat & proteins found free of most degenerative conditions in 1972; EPA (& DHA, that may convert back to EPA) found to be key protective ingredient by 1978; EPA research goes wild in 1980 & continues;

Nutrition

- **Sources:** best: meat along belly, around fins & behind gills (shoulder) of cold water, high fat fish; good: cold water, high fat fish; fair: low fat, cold water fish; poor: warm water fish;
- **Supplements:** encapsulated fresh fish body oils (cold water, high fat); fish liver oils; best fish oils contain about 18% EPA& 12% DHA (omega-3s);
- **Absorption** from intestine; can also be absorbed through skin;
- **Improved by:** sufficient bile;
- **Antagonized by:** insufficient bile;
- **Stability:** destroyed by light (generates free radicals), oxygen (peroxides = rancidity) & heat (increases rate of spoilage by light & oxygen; above 160°C, twisted trans-fatty acids begin to form); frying & deep-frying is very destructive;
- **Storage:** in adipose cells; in cell membranes; in membranes surrounding intracellular organelles;
- **Excretion:** not excreted; excess is “burned” to generate energy;
- **Metabolism:** converted into series-3 prostaglandins in the body, according to need;
- **Interactions:** fish oils contain no vitamin E (in nature not necessary at low temperature in ocean); this needs to be added when oil is used in warm human body; uses up vitamin E in human body;

Functions of EPA

- Part of membranes of all cells & of membranes around intracellular organelles;
- Blocks formation of detrimental series-2 prostaglandins; decreases blood pressure, inflammation; increases sodium & water loss; enhances immune function;
- Makes platelets less sticky; increases bleeding time (by about 60%);
- May be helpful in arthritis & other inflammatory disorders;
- May be helpful in certain kinds of cancer;
- May be helpful in kidney disease;
- Lowers insulin requirements in diabetics;

Functions of DHA

- Part of membranes of all cells & of membranes around intracellular organelles;
- Needed For the regulation of all bodily functions and the breakdown of dietary fats within the body;
- Essentials for the growth and functional development of the brain in infants;
- Essential for visual and neurological in infants.
- Required for maintenance of normal brain function in adults;
- Low levels linked to Alzheimer’s disease;
- Low levels linked to learning disorders (ADD);
- Low levels linked to depression in humans;

Quantities

- **Measurement:** milligrams; grams;
- **Optimum** (SONA) average ranges not yet established; estimated requirement: perhaps 1% of calories (2 - 3 grams/day);
- **Individual** optimum needs to be determined individually;
- **Minimum** (EC RDA) not yet established;
- **Less than RDA:** no official figures; suggested: more than 95% of population is getting less Omega-3s from their foods than minimum required for health;
- **Deficiency** of EPA and DHA from lack of omega-3s in diet;
- **Symptoms** might include: skin afflictions, high blood pressure, high cholesterol, high triglycerides, joint problems, tumours, kidney malfunctions;
- **Toxicity:** not likely, except if diet lacks vitamin E & selenium;
- **Reversed by:** addition of vitamin E & selenium to diet;

Therapy with EPA/DHA

- Therapeutic dose: 2 to 4 grams of EPA/DHA per day;
 - Reduces both high blood pressure (hypertension) and platelet aggregation, reducing the risk of heart attack;
 - Reduce total cholesterol & detrimental LDL & increase beneficial HDL;
 - Reduce triglyceride levels by up to 60% or even more;
 - Transformed human cancer cells in tissue culture are killed by EPA;
 - Used in treatment of psoriasis;
 - May be helpful in kidney disease;
 - Counteracts some of detrimental effects of immunosuppressive drugs used to prevent rejection of tissue & organ transplants;
 - May be useful in diabetics; lowers insulin requirements; close monitoring of insulin requirement is important;
 - Protects against age-related macular degeneration;
 - DHA may be helpful in neurological disease and Alzheimer's disease;
 - May help to reduce the symptoms of rheumatoid arthritis;
 - High doses may help with Raynaud's phenomenon;
 - High doses (20 grams of fish oil daily) may help with lupus;
 - When taken along with calcium, EFAs may help prevent osteoporosis;
 - Regular use of fish oil may reduce the pain of menstrual cramps;
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- EPA/DHA has a positive effect on diseases such as hypertension, arthritis, atherosclerosis, depression, adult-onset diabetes, myocardial infarction, thrombosis and some cancers.
 - Randomized controlled trials in term infants given infant formula lacking DHA (as is the current North American situation) versus milk formula supplemented with 0.35% DHA, indicated that early dietary supply of DHA was a major determinant of improved performance on the mental development index for the latter group.
 - Synergists: vitamin E, selenium;

Balanced ratio of GLA - EPA / DHA

As this article illustrates, both omega-3 and omega-6 fatty acids are essential for optimal health and a lack of either one or both can lead to many disease conditions. While there is no clear-cut scientific consensus as to the correct balance between the omega-3 and omega-6 fatty acids, we can look to nature to obtain guidelines on this important question. All of the comparative data from various species show a predominance of the omega-6 fatty acids over the omega-3. Since the omega-3 fatty acids are preferentially metabolized in the body, a ratio of 4-1 in favour of the omega-6 fatty acids will insure a balanced composition at the cellular level. Such a ratio recommendation would be applicable when the parent acids, linoleic acid (w6 series) and alpha-linolenic acid (w3 series) are the predominant constituents in the diet. On the other hand, the longer chain derivatives such as gammalinolenic acid (GLA), dihomogamma-linolenic acid (DGLA), arachidonic acid (AA) and eicosapentaenoic acid (EPA) are biologically more active and are incorporated into cell structure more effectively. Also, EPA is preferentially incorporated into cell membranes at the expense of AA. In situations where these longer chain polyunsaturated fatty acids are provided in the diet as food supplements, a ratio of 1:1 between GLA and EPA\DHA would be desirable to ensure a correct balance at the cellular level.

LECITHIN

General: non-essential nutrient but contains LA & ALA, essential fatty acids.

- Made of phospholipids, whose components always include glycerol, two fatty acids & phosphate & may contain choline, inositol, serine, or ethanolamine as additional components;
- If foods contain the necessary materials, the liver can make lecithin;
- Lecithin from foods is disassembled by digestion & re-assembled in gut or liver;

Nutrition

- **Sources:** the cell membranes of all living cells are constructed mainly from phosphatides; unrefined seed oils contain about 1 - 2% lecithin; richest source is soy beans, with 2 - 4% lecithin; soy beans are usual commercial source of lecithin; egg yolks, another rich source of lecithin, have drawback of containing mostly saturated fats;
- **Supplements:** lecithin & phosphatidyl choline capsules; lecithin granules; also present in some multi-nutrient formulations, but in nutritionally insignificant amounts;
- **Absorption** of digested lecithin components from small intestine;
- **Storage:** broadly distributed in the body; concentrated in brain, nervous system & “energy factories” (mitochondria) of heart cells;
- More than 25% of lipids in brain grey matter is phosphatidyl choline;
- More than 10% of lipids in myelin sheath surrounding nerve cells is phosphatidylcholine;
- 50% of lipids in cell membranes—”envelopes” that surround & protect cells—is lecithin;
- Lecithin represents about 25% of the total lipids in blood stream;
- **Metabolism:** liver makes lecithin in amounts that correspond to the amount of cholesterol present in the body;