

MeritCare Health System

**Aunt Cathy's Guide To:
All Those Lipids**

**Recommendations for Using
Different Types of Vegetable
Oils (Omega-3, Omega-6 and
Monounsaturated Oils)**
(Short No-references Version)

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Practical Applications: The Bottom Line
(Subject to change at any moment! ☺):

- 1. When buying margarine and shortening, look for some brands that are now available labeled "free of trans fatty acids."** Trans fatty acids are formed as a by-product of the process that produces "partially hydrogenated" vegetable oils – which converts the liquid oils to a more solid, spreadable texture. The trans fats seem to be as bad (or worse) for the heart as "saturated" fats like lard and coconut oil in terms of causing a person's body to produce more cholesterol. It also is a factor in whether or not the cholesterol in the blood "sticks" to the inside of arteries and clogs things up. Other health problems are being identified as well. High consumption of trans fat is associated with increased inflammation and high "oxidative stress" in humans. This could increase the risk of the development or acceleration of several diseases, such as cancer, atherosclerosis, and type 2 diabetes, and a possible increased risk of infertility.

Some new techniques for making margarine and shortening from vegetable oils do not cause trans fatty acids to be formed at all, so look for the phrase "no trans fat" on the label. Starting January 2006, a law went into effect requiring the trans fat content to appear on the label. This requirement is stimulating research by food producers to explore more ways to prepare foods without trans fat. Foods produced prior to this date will still be able to have undisclosed trans fat.

Foods may be labeled "No Trans Fat" if they contain less than a gram per serving, so the better way to be sure to minimize intake of trans fat is to also look on the ingredient list for the words "partially hydrogenated." In addition to trans fats that we might add to our foods, the ingredient list of many commercially made baked goods and other commercial foods also need to be looked at. Removing trans fat from our food supply is the goal and it is a work in progress. Until it is gone we should read ingredient lists carefully.

2. **Nuts and peanuts are generally friendly in terms of the type of fat they contain, and they also are great sources of important minerals like magnesium and other goodies.** Like other foods that contain a generous amount of fat, nuts and peanuts are high calorie foods, but the forms of fat they contain appears to be **primarily dangerous to your width and not to your heart!** In other words, the calories they contribute may be a problem for people who are aiming to take in fewer calories, but the form of fat is not as contributory to health problems as certain other forms of fat are. It now appears that besides not contributing to the risk of heart disease and cancer, **adding nuts and legumes to the diet can actually be a tool to decrease the risk.**

Nuts and legumes tend to have good proportion of the fat as **monounsaturated fat**, and of the polyunsaturated fats a reasonable ratio of omega-6 to omega-3 fat. (More on that topic will follow.) A large Harvard study of women followed for 16 years, **eating nuts or peanuts four or more times a week was associated with a 25% decreased risk of developing diabetes** compared with women who rarely ate them. A recent review of research studies found that nut consumption can actually lower bad cholesterol (LDL) more than following a diet that is “low fat” and nuts can be an excellent food in the fight against what is called “metabolic syndrome.”

Peanuts were counted separately in the study of likelihood of developing diabetes because they are really not a nut but a member of the bean (legume) family. However, both had the same apparent beneficial effect. Note that both nuts and legumes are excellent sources of fiber and important nutrients like magnesium and chromium, which also are especially important in diabetes. The fat, protein, fiber, and vitamin/mineral content are all part of that complex puzzle, but the bottom line is that it is good to include nuts and legumes in one’s diet.

(Please see “Aunt Cathy’s Guide to Nutrition: Magnesium and Chromium” and “Aunt Cathy’s Guide to OTHER Nutrition Issues in Diabetes” if you want details about their role in diabetes.)

3. **For cooking and baking, canola oil, olive oil, non-hydrogenated soy oil and walnut oil are best and they appear to be better for you than corn oil.** They all contain the same amount of calories – about 9 calories per gram, or about 100 per tablespoon. But both have better proportions of the “friendlier” oils (monounsaturated and omega-3 polyunsaturated fats); corn oil is almost all the “omega-6” kind of fat. The reason for this is explained more fully below.
4. **Adding ground flax to foods is also good for you.** It needs to be ground up, though (or purchased that way -- you can get it at most grocery stores now) because otherwise the intact flax seeds just pass right on through like a high fiber supplement, and the good stuff inside is not absorbed into the body. Use a coffee grinder if you want to grind whole flaxseeds at home – the tiny seeds just jump over the blades in a regular food processor. The generous amount of “friendly” fat in flax is an omega-3 fat called “alpha-linolenic acid.” Ground flaxseeds can be added to hot or cold cereal or granola, or used in muffins, pancakes, meatloaf, etc. Some ready-to-eat cereals are now available that have ground flaxseed in them; some have the whole intact seeds in them so they may be less helpful. Most ground flax products are best stored in the refrigerator or they can turn rancid.

It appears that the ground flaxseed is more beneficial than taking the flax oil in capsules, probably because of the micronutrients and the fiber. A fiber-like material in the seeds called “lignins” appears to have health benefits as well, including decreased risk of breast cancer. Soybeans and walnuts will also provide many additional nutrients besides “friendly” fat.

5. **Eat fish when able (avoiding the swordfish and other big fish known to contain high levels of mercury), and consider taking a fish oil supplement daily, especially if you do not eat fish.** This has to do with trying to eat more oils from the "omega-3" family and less from the "omega-6" family. **Taking in the forms of omega-3 oils in fish (EPA and DHA) has certain advantages over only eating the plant/vegetable form (linolenic acid.)** There is more on this topic later. The fish oil supplements are less likely to contribute mercury in part because the mercury tends to be distributed mostly in the flesh of the fish and not as much in the fat. Also, various treatments are used to make the capsules safer. There is a table on Page 8 that shows the amount of omega-3 fat in oils, flax and fish.

Why do we care about the amounts and the ratios of “Omega-3” to “Omega-6” fat?

The reason for the recommendations in suggestions #3-5 above is that increasing the ratio of the omega-3 family of oils relative to the omega-6 family is looking very helpful in **decreasing risk of developing a number of serious health conditions.** It may also slow the progression and/or decrease complications of many medical conditions. It also appears to be a factor in having a healthy pregnancy and in the development of the infant both before and after birth.

There will likely be a lot more fine-tuning of the recommendations coming out for specific types of fat and not just broad classes of fat. For example, new knowledge about certain special types of omega-6 fats is looking interesting as well. An example is one called gamma-linolenic (different from alpha linolenic acid) that appears to be quite promising in decreasing nerve damage (neuropathy) related to diabetes, and in decreasing inflammation. It is also being studied in critically ill patients with very encouraging results, along with other specific types of oil. The best food sources of gamma linolenic acid include nuts, and some leafy greens (like evening primrose oil.) Mother's milk is usually rich in gamma linolenic acid. Although there is still much to learn, there is a rapidly growing body of research being reported in the scientific literature exploring these issues. References of a sampling of the most recent research is shown below:

Additionally, there is a huge amount of research showing that the special forms of omega-3 fats found in **fish and fish-oil supplements (EPA and DHA)** have certain very important advantages for many people. EPA decreases inflammation in a wide range of inflammatory diseases like MS, cardiovascular disease and arthritis. I think of **EPA** (whose real name is **eicosapentaenoic acid**) should be thought of as “**Environmental Protection Agency**” instead, because it seems to be very protective against a number of health problems.

DHA in particular appears to be very important for the development of the brain and the retina of the eye, so it is critical during pregnancy and infancy. It has also been shown to be helpful in the continued good operation of the brain (e.g. in possibly helping to ward off age-related problems like alzheimers and other forms of dementia,) and for decreased risk of, or progression of, depression, blindness due to macular degeneration, attention deficit disorder and Parkinson's disease.

More research is ALWAYS needed, of course, but the cumulative results of a great many studies have been in the same direction. Assuring an adequate intake of these fats looks like a VERY good idea. **Additionally, it is now recognized that for some people it is difficult to**

efficiently convert the plant omega-3 oils (like those in canola, flax and walnuts) into the important EPA and DHA oils that are found ready-made in the fish oil. This may be a factor in a broad range of inflammatory conditions and critical in pregnancy.

The American Heart Association recommends 1000 mg of fish oil for most people with risk of heart disease. People at risk include those who smoke, who have disturbed blood lipids (too much LDL cholesterol or triglycerides, or too little HDL cholesterol,) who are overweight or sedentary, or who have high blood pressure, diabetes, or a family history of heart disease. Other factors contribute to heart disease risk as well.

Specific Health/Medical Conditions are also affected by omega-3 and omega-6 intake.:

AIDS/ HIV

Alzheimer's Disease

Arthritis

Asthma

Bone Health

Cancer, Prevention (General)

Lung Cancer

Breast Cancer

Colon Cancer

Prostate Cancer

Adjunct to Chemotherapy in Cancer Treatment

Cardiovascular Disease (Esp. Heart Disease, Hypertriglyceridemia and Stroke)

Chronic Fatigue Syndrome

Cystic Fibrosis

Diabetes

Epilepsy

Eye Health – Macular Degeneration and others

Inflammatory Bowel Disease – IBD-- Crohn's Disease & Chronic Ulcerative Colitis

Kidney Disease

Lupus

Mental Health: Attention Difficulties, Autism, Cognition, Depression, Schizophrenia.

Multiple Sclerosis – MS

Parenteral Nutrition (Feeding via an I.V.)

Polycystic Ovary Disease and Ovarian Function

Pregnancy and Infant Development Issues:

Oils rich in omega-3 fatty acids appear to have important implications in pregnancy and infant nutrition in particular. DHA (a long-chain omega-3 fatty acid) is **a major fat of the brain**, and the research is growing that suggests that providing some pre-formed DHA is advantageous. It has also been reported that maternal alcohol intake can alter fatty acid transport by the human placenta, decreasing fetal availability of polyunsaturated fats in general and of DHA especially. It may be that this decreased DHA transport is one of the (many) mechanisms of **FAS (Fetal Alcohol Syndrome.)**

Omega-3 fats are also associated with **decreased risk of premature delivery**. As premature delivery is the most common cause of low infant birth weight, and infant morbidity and mortality, this is a very important observation.

There is growing interest in the potential role of maternal supplementation of anti-inflammatory n-3 polyunsaturated fatty acids (n-3 PUFAs) in the prevention of allergic disease. For more information on this topic please see "Aunt Cathy's Guide to Nutrition: A Top Ten Nutrition Plan for Optimizing Pregnancy."

What is a Good Ratio of Omega-3 to Omega-6 Fatty Acids to Aim For?

Most Americans eat about ten grams of omega-6 fat for every one gram of omega-3. That is, the ratio is ten to one. Some estimates are even higher. **We should try to change that ratio to four-to-one, and if we have an inflammatory disease, two-to-one might even be better.** Corn oil is almost all omega-6, so it is not the best choice. Compared with omega-3 fats, the omega-6 fats tend to increase inflammatory responses. If you buy a fish oil supplement, look for the words "EPA and DHA" on the label -- these are the "good guy" omega-3 fats that you are trying to get. (I remember this by thinking of EPA as "Environmental Protection Agency" since it protects your personal internal environment.)

A report on EPA-DHA (NOT on cod-liver oil, which is different in a number of ways) supplements available in the U.S. appeared in **Consumer Reports** (2003Jul;68(7):30-2.) They evaluated the **safety** of products on the market (e.g. related to mercury concerns, etc.), the **actual content** of each product, and the **price**. The good news is that they found all to be safe, and all products contained what the label said was in there. However the **price** per 300 mg of supplemental fish oil ranged from 6 to 60 cents each! Expensive items provided no additional benefit. The cheapest are found at bulk-sales stores like Sam's Club or Costco, etc. (in BIG bottles.) Most pharmacies carry them in smaller bottles.

Alpha linolenic acid is the form of omega-3 fat found in plants. Flax, canola and walnut oil are the most generous sources. Usually we can use it to make the EPA and DHA we need, but many people clearly benefit from getting at least some EPA and DHA "ready-made," (i.e. in fish and fish oil supplements.) For example, some people may have difficulty making adequate EPA out of the omega 3 fats in plants. Another group of people at particular risk of cardiovascular disease was identified who have a different genetic trait for which providing EPA may be especially helpful. They have a variant 5-lipoxygenase genotype affecting leukotriene production and inflammation.

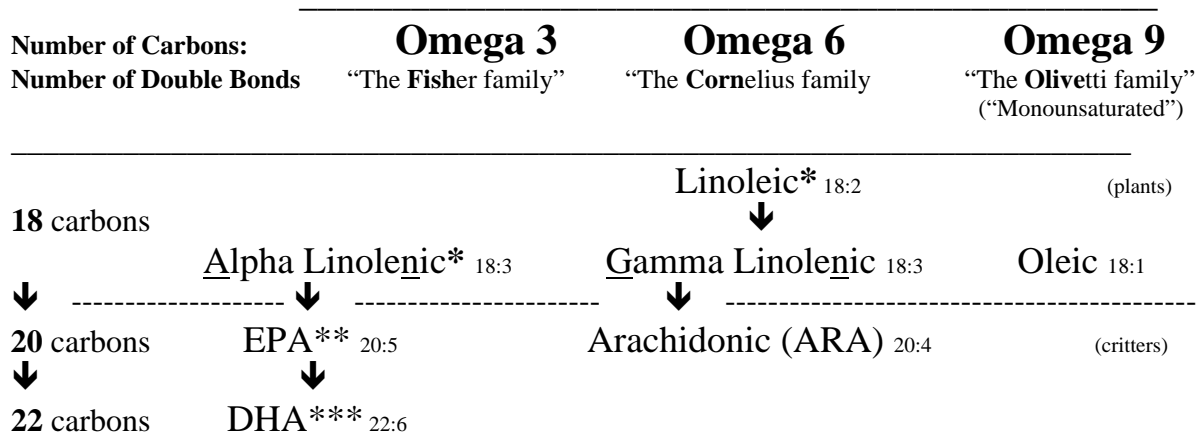
Some guidelines are now available: A qualified health claim for fish oil supplements with EPA and DHA in capsule form has been approved by the FDA. The supplements should be used with a physician's knowledge and approval, as certain aspects of the use of high doses of fish oil can increase bleeding problems among people taking certain medications to decrease risk of clots. These include anticoagulant and antiplatelet medications like Coumadin. Supplements that provide about one gram (1000 mg) of omega-3 fat daily can benefit persons with cardiovascular disease. Higher dose (2-4 grams, or 2000-4000 mg) intakes appear to greatly improve high triglyceride levels in particular. The higher doses (over 3 grams daily) should be taken only with physician approval.

The chart on the next page shows the families of oils and the names of the fats in each family. To help me remember them, I gave each “family” a last name that reminds me of some of the major food sources of each. The **omega-3 family is the “Fishers,” the omega-6 family’s last name is “Cornelius,”** and **the monounsaturated fats are the “Olivetti” family.** The dotted line is the marker of the forms of these fats found in plants, and the forms that are found only in “critters” like fish and animals, including people. The critters themselves can usually make the EPA, DHA and ARA out of the plant forms that they eat, and they also take them in by eating other critters. **But as noted earlier, some folks appear to have more difficulty making their own and so they really benefit from taking in some ready-made EPA and DHA.**

Why we care about this:

Prostaglandins, thromboxanes, prostacyclins, and leukotrienes are made from 20 carbon polyunsaturated fatty acids (EPA and ARA). Thromboxanes made from ARA are much more aggregatory (promoting of blood clots) than those made of EPA. Prostaglandins made of ARA are much more inflammatory than those made of EPA. **Decreasing the ratio of omega 6 to omega 3 fatty acids in the diet decreases the likelihood of forming blood clots, and decreases inflammation. This is particularly important in cardiovascular health, in diabetes, and in autoimmune diseases such as MS, inflammatory bowel disease, lupus and arthritis.** A typical omega 6:omega 3 ratio in the US is often as high as 10:1. A suggested ratio goal for healthy people: 4:1. A ratio of 2:1 has been suggested for people with inappropriately inflammatory or aggregatory conditions.

The Unsaturated Fat Families:



* Essential fatty acids *linoleic = 18:2 *alpha linolenic = 18:3
 ** Eicosapentaenoic acid
 Eicosa: 20 (carbons) Penta :with 5 Enoic: double bonds
 *** Docosahexaenoic acid (an important component of the brain)
 Docosa: 22 (carbons) Hexa: with 6 Enoic: double bonds

(New research issue: Is docosahexaenoic acid (DHA) essential? Lessons from DHA status regulation, our ancient diet, epidemiology and randomized controlled trials. J Nutr. 2004 Jan;134(1):183-6)

The chart on the next page shows the plant and animal food and oil sources for omega-3 fats in descending order. The animal sources (including fish) are on the right, and plant sources are on the left. It is interesting to note that olive oil and peanut oil are not very generous sources of omega-3 fat. Their contribution to heart health (for example, as a part of the “Mediterranean Diet”) appears to be due to their **displacement** of other, less-healthy fats in the diet, such as the omega-6 fats and saturated fats. Displacing some of the dietary omega-6 fats is another way to **decrease the ratio** omega-6 to omega-3 fat.

Omega 3 Fatty Acids in Foods

Plant Forms:

Linolenic Acid (18:3)

omega-3 fatty acids mg per tablespoon of food (unless otherwise noted)

Linseed oil (flax)	7300
Rapeseed (Canola) Oil	1500
Walnuts, English, chopped	1440
Walnut Oil	1400
Wheat germ	900
Soybean oil	900
Soybean Sprouts, cooked 1 oz	600
Hydrogenated Soybean Oil	300
Olive Oil	100
Safflower Oil	100
Sunflower Oil	100
Corn Oil	100
Peanut Oil	0
Palm Oil	0
Palm Kernel Oil	0
Cottonseed Oil	0
Coconut Oil	0

Source:
 Omega 3 values from "Provisional Table on Content of Omega-3 Fatty Acids and Other Fat Components in Selected Foods" USDA Human Nutrition Information Service 1986, and Agriculture Handbook No. 8-4
 US Dept. of Agriculture Science and Education Administration

New Source: DHA produced by the use of microorganisms. Biotechnological production and applications of the omega-3 polyunsaturated fatty acid docosahexaenoic acid. Appl Microbiol Biotechnol. 2004 Jan 22

Animal Forms:

EPA and DHA (20:5 and 22:6)
 (Eicosapentaenoic Acid and Docosahexaenoic Acid)

Seafood portion in ounces to provide 300 mg of omega-3 fatty acids (uncooked weight)

Fish oil 300 mg capsule	1 capsule
Mackerel, Atlantic	0.4
Trout, Lake	0.5
Herring, Atlantic	0.7
Sardines	0.7
Anchovies, European	0.8
Salmon, Pink	1.0
Tuna, white	1.3
Bass, striped	1.3
Trout, Brook	1.8
Tuna, Light	2.1
Cod	3.5
Crab, king	3.5
Shrimp	5.3
Flounder	5.3
Haddock	5.3
Lobster	5.3
Scallops	5.3
Snapper, Red	5.3
Swordfish	5.3
Sole	10.5