



## DHA (DOCOSAHEXAENOIC ACID)

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**See also:** [Breast Feeding](#)  
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**Books:** [The DHA Story: How Nature's Super Nutrient Can Save Your Life by Robert Abel](#)  
[Smart Fats by Michael A. Schmidt](#)  
[Fats that Heal, Fats that Kill by Udo Erasmus](#)

**Articles:**

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<http://www.iherb.com/neuromins.html>

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## **VEGANS HAVE LOW DHA (Docosahexaenoic Acid): INFO FOR PREGNANT WOMEN AND CHILDREN**

Source: "The China Study: More Vegan Nonsense" by Anthony Colpo,  
<http://anthonycolpo.com/?p=129>

**Numerous studies have shown that vegetarians consume far lower levels of long-chain omega-3 fats—not surprising considering their avoidance of meat and fish [Rosell MR, et al].**

**Studies of pregnant women show that, compared to omnivores, vegetarians have significantly lower levels of DHA in their breast milk, with vegans displaying the lowest levels of all.**

**These negative fatty acid profiles are reflected in infants, with vegan newborns displaying significantly lower red blood cell levels of DHA.**

**This is an ominous finding, given the critical role that omega-3 fats play in healthy immune function and cognitive development [Williams C] [O'Connor DL] [Helland IB] [Moriguchi T] [Dunstan JA].**

### **Clinical Studies / Resources**

Rosell MR, et al. Long-chain n-3 polyunsaturated fatty acids in plasma in British meat-eating, vegetarian, and vegan men. *American Journal of Clinical Nutrition*, 2005; 82: 327-334.

Williams C, et al. Stereoacuity at age 3.5 y in children born full-term is associated with prenatal and postnatal dietary factors: a report from a population-based cohort study. *American Journal of Clinical Nutrition*, Vol. 73, No. 2, 316-322, February 2001.

Helland IB, et al. Maternal Supplementation With Very-Long-Chain n-3 Fatty Acids During Pregnancy and Lactation Augments Children's IQ at 4 Years of Age. *Pediatrics*, January 2003; 111 (1): e39-e44.

Moriguchi T, et al. Behavioral deficits associated with dietary induction of decreased brain docosahexaenoic acid concentration. *Journal of Neurochemistry*, 2000; 75: 2563-2573.

Dunstan JA, et al. Fish oil supplementation in pregnancy modifies neonatal allergen-specific immune responses and clinical outcomes in infants at high risk of atopy: a randomized, controlled trial. *Journal of Allergy and Clinical Immunology*, Dec, 2003; 112 (6): 1178-1184.

## HEALTH BENEFITS OF DHA

Source: Horrocks LA, Yeo YK, Docosa Foods Ltd, 1275 Kinnear Raod, Columbus, OH, 43212-1155, USA, *Pharmacol Res* 1999 Sep; 40(3):211-225

### ABSTRACT

Docosahexaenoic acid (DHA) is essential for the growth and functional development of the brain in infants. DHA is also required for maintenance of normal brain function in adults. The inclusion of plentiful DHA in the diet improves learning ability, whereas deficiencies of DHA are associated with deficits in learning. DHA is taken up by the brain in preference to other fatty acids. The turnover of DHA in the brain is very fast, more so than is generally realized. The visual acuity of healthy, full-term, formula-fed infants is increased when their formula includes DHA. During the last 50 years, many infants have been fed formula diets lacking DHA and other omega-3 fatty acids. DHA deficiencies are associated with foetal alcohol syndrome, attention deficit hyperactivity disorder,

cystic fibrosis, phenylketonuria, unipolar depression, aggressive hostility, and adrenoleukodystrophy. Decreases in DHA in the brain are associated with cognitive decline during aging and with onset of sporadic Alzheimer disease. The leading cause of death in western nations is cardiovascular disease. Epidemiological studies have shown a strong correlation between fish consumption and reduction in sudden death from myocardial infarction. The reduction is approximately 50% with 200 mg day<sup>(-1)</sup> of DHA. DHA reduces triglycerides in the blood and decrease thrombosis, but it also prevents cardiac arrhythmias. The association of DHA deficiency with depression is the reason for the robust positive correlation between depression and myocardial infarction. Patients with cardiovascular disease or Type II diabetes are often advised to adopt a low-fat diet with a high proportion of carbohydrate. A study with women shows that this type of diet increases plasma triglycerides and the severity of Type II diabetes and coronary heart disease. DHA is present in mother's milk. **DHA is present at low levels in meat and eggs [DWR: but is destroyed by the cooking process]**, but is not usually present in infant formulas. EPA, another long-chain n-3 fatty acid, is also present in fatty fish. The shorter chain n-3 fatty acid, alpha-linolenic acid, is not converted very well to DHA in man. These long-chain n-3 fatty acids (also known as omega-3 fatty acids) are now becoming available in some foods, especially infant formula and eggs in Europe and Japan. DHA decreases the proliferation of tumour cells, whereas arachidonic acid, a long chain n-6 fatty acid, increases their proliferation. These opposite effects are also seen with inflammation, particularly with rheumatoid arthritis, and with asthma. DHA has a positive effect on diseases such as hypertension, arthritis, atherosclerosis, depression, adult-onset diabetes mellitus, myocardial infarction, thrombosis, and some cancers.

## DHA (Docosahexaenoic Acid)

Source: [www.askdrsears.com](http://www.askdrsears.com)

Topics you will find:

[DHA as a Brain Food](#)

[DHA Supplements: Pregnancy/Lactation](#)

[DHA Food Sources](#)

[DHA and A.D.D.](#)

[DHA for Students](#)



### DHA AS A BRAIN FOOD

Fats make up sixty percent of the brain and the nerves that run every system in the body. So, it stands to reason that the better the fat in the diet, the better the brain. So, with all the fat eaten by the average American, why don't we have more geniuses in this country? The average American brain is getting enough fat, but it's not getting the right kind of fat.

Think of your brain as the master gland that sends chemical messengers throughout the body, telling each organ how to work. An important group of these chemical messengers are the prostaglandins (so-called because they were originally discovered in the prostate gland). Prostaglandins initiate the body's self-repair system. The body needs two kinds of fat to manufacture healthy brain cells (the message senders) and prostaglandins (the messengers). These are omega 6 fatty acids (found in many oils, such as safflower, sunflower, corn, and sesame oils) and omega 3 fatty acids (found

in flax, pumpkin seeds and walnuts, and coldwater fish, such as salmon and tuna). The foods from which oil can be extracted are generally the foods highest in essential fatty acids.

**Most important to brain function are the two essential fatty acids, linoleic (or omega 6) and alpha linolenic (or omega 3).** These are the prime structural components of brain cell membranes and are also an important part of the enzymes within cell membranes that allow the membranes to transport valuable nutrients in and out of the cells.

When the cells of the human body - and the human brain - are deprived of the essential fatty acids they need to grow and function, the cells will try to build replacement fatty acids that are similar, but may actually be harmful. Higher blood levels of "replacement fatty acids" are associated with diets that are high in hydrogenated fats and diets that contain excessive amounts of omega 6 fatty acids. Levels of replacement fatty acids have been found to be elevated in persons suffering from depression or

Attention Deficit Disorder. A diet rich in omega 3 fatty acids (such as the LNA from flax oil or the EPA and DHA from fish oils) not only provides the body with healthy fats, but it also lowers the blood level of potentially harmful ones, such as cholesterol and, possibly, even reversing the effects of excess trans fatty acids.

Using the lock and key analogy will help you understand how the brain communication system works. Neurotransmitters are biochemical messengers that carry information from one brain cell to another, sort of like sparks flying across the gap between nerve cells. Each cell membrane contains a series of locks. The various message carriers (prostaglandins and neurotransmitters) are like keys. The keys and the locks must match. When the cell membrane is unhealthy because it is made of the wrong kind of replacement fatty acids, the keys won't fit, and brain function suffers. Nutrients may also fail to fit in a mismade lock.

The eye is a perfect example of the importance of getting the right kind of fat. The retina of the eye contains a high concentration of the fatty acid DHA, which the body forms from nutritious fats in the diet. The more nutritious the fat, the better the eye can function. And since most people are visual learners, better eyes mean better brains.

Western diets contain too much of the omega 6 fatty acids and too little of the omega 3's. Omega 3 fatty acids are found in ground flax seeds and flaxseed oil, coldwater fish (primarily salmon and tuna), canola oil, soybeans, walnuts, wheatgerm, pumpkin seeds, and eggs.

**Smart fats for growing brains\*.** Fats can also influence brain development and performance, especially at either end of life -- growing infants and elderly people. In fact, there are two windows of time in which the brain is especially sensitive to nutrition: the first two years of life for a growing baby and the last couple decades of life for a senior citizen. Both growing and aging brains need nutritious fats.

The most rapid brain growth occurs during the first year of life, with the infant's brain tripling in size by the first birthday. During this stage of rapid central nervous system growth, the brain uses sixty percent of the total energy consumed by the infant. Fats are a major component of the brain cell membrane and the myelin sheath around each nerve. So, it makes sense that getting enough fat, and the right kinds of fat, can greatly affect brain development and performance. In fact, during the first year, around fifty percent of an infant's daily calories come from fat. Mother Nature knows how important fat is for babies; fifty percent of the calories in mother's milk is fat.

Different species provide different types of fat in their milk, fine-tuned to the needs of that particular animal. For example, mother cows provide milk that is high in saturated fats and low in brain-building fats, such as DHA. This helps their calves grow rapidly, though it may not do much for their brains. In adult cows, the brain is small compared with the body. Cows don't have to do a lot of thinking to survive. In human infants, the brain grows faster than the body. Highly developed brains are important to human beings, so human milk is low in body- building saturated fats and rich in brain-building fats, such as the fatty acid DHA (docosahexaenoic acid), an omega 3 fatty acid.

DHA is the primary structural component of brain tissue, so it stands to reason that a deficiency of DHA in the diet could translate into a deficiency in brain function. In fact, research is increasingly recognizing the possibility that DHA has a crucial influence on neurotransmitters in the brain, helping brain cells better communicate with each other. Asian cultures have long appreciated the brain-building effects of DHA. In Japan, DHA is considered such an important "health food" that it is used as

a nutritional supplement to enrich some foods, and students frequently take DHA pills before examinations.

## **Just how important is DHA for brain development?**

### **Consider these research findings:**

- Infants who have low amounts of DHA in their diet have reduced brain development and diminished visual acuity.
- The increased intelligence and academic performance of breastfed compared with formula-fed infants has been attributed in part to the increased DHA content of human milk.
- Cultures whose diet is high in omega 3 fatty acids (such as the Eskimos who eat a lot of fish) have a lower incidence of degenerative diseases of the central nervous system, such as multiple sclerosis.
- Experimental animals whose diets are low in DHA have been found to have smaller brains and delayed central nervous system development.
- Some children with poor school performance because of ADD, have been shown to have insufficient essential fatty acids in their diet. (See [A.D.D. - A Nutritional Deficiency?](#))

### **DUMB FATS**

Just as there are fats that improve how the brain functions, there are fats that hinder the brain's work. The dumbest fats are those that are man-made through the process of hydrogenation. These fats are referred to on package labels as "hydrogenated" or "partially hydrogenated." A diet rich in these fats not only deprives the eater of the smart fats, but they can actually interfere with the action of smart fats on brain function.

### **NOURISHING TEEN BRAINS**

Even though the brain has completed most of its growth by adolescence, it continues to make vital connections. This is another window of opportunity for brain growth when a healthy diet is important. However, adolescence may be a period when there is a lack of essential fatty acids in the diet. There are several reasons for this deficiency: adolescents tend to eat a lot of saturated fat foods and foods that contain hydrogenated fats. Young athletes often restrict their fat intake in order to keep fit and trim. When they cut out fat, in general, they also cut out healthy fats. Teen brains need more fish and fewer fries.

### **NUTRITIP:** Fat Food for Growing Brains

While a baby is in the womb, the brain grows more rapidly than in any other stage of infant or child development. And during the first year after birth, the brain continues to grow rapidly, tripling in size



by an infant's first birthday. So, it would make sense for a pregnant and lactating mother to supplement her diet with brain-building nutrients, primarily the omega 3 fatty acids found in fish and flax oil (one tablespoon of flax oil daily, four ounces of tuna or salmon three times a week). **In fact, some nutritionists recommend that pregnant and lactating women take 200 milligrams of DHA supplements a day.**

## DHA SUPPLEMENTS

The DHA supplement we recommend is Neuromins<sup>®</sup>, a pure form of DHA derived from seaweed. This is the exact source fish get their DHA from. Martek's Neuromins<sup>®</sup> DHA, is an Omega-3 supplement derived from an all-natural plant source, which makes it a very pure and safe form of DHA. Neuromins<sup>®</sup> DHA has been evaluated by an independent panel of experts and found to be Generally Recognized As Safe (GRAS) for use by adults (including pregnant and lactating women). In fact, unlike DHA from fish oil, Neuromins<sup>®</sup> DHA is considered so safe and so important for brain and eye development, it is added to infant formulas in over 60 countries but not yet in the U.S.

The recommended dosage of Neuromins<sup>®</sup> DHA is 100mg per day. Those who eat little or no DHA rich foods should take 200mg of Neuromins<sup>®</sup> DHA per day. Today, the average Americans daily intake of DHA is significantly lower than it was 50 years ago. Similarly, the level of DHA in breast milk of American women is significantly lower than it was 50 years ago. An additional 200mg of DHA a day increases the benefits of the average American mother's breastmilk to near historic levels.

To learn more about Neuromins<sup>®</sup> DHA and chat with Dr. Sears, or visit our website at [www.DHAdoc.com](http://www.DHAdoc.com). To order Neuromins<sup>®</sup> DHA or to receive a free information packet, please call 1-888-OK-BRAIN or email Martek at [customerservice@dhadepot.com](mailto:customerservice@dhadepot.com). It's a great way to give your baby a healthy head start.

## DHA FOOD SOURCES

The best sources of DHA are: seafood, algae, and especially coldwater fish. Omega-3 fatty acids are nature's antifreeze. In general, the colder the water, the higher the omega-3 content in the fish oil. Popular sources of DHA are: salmon, sardines, and tuna. Eggs and organ meats have a small amount of DHA in them, but the healthiest source of dietary DHA is seafood. Two 4-ounce servings of omega-3-rich fish per week should yield a sufficient amount of omega-3 fatty acids, especially DHA. Besides fish oils, vegetable oils (primarily flaxseed, soy, and canola) are also rich sources of omega 3 fatty acids, with flaxseed oil being the best. The two F's, fish and flax, are the top brain-building foods for growing children, and adults.

I shoot for 1,500 milligrams a week. To insure this amount, I eat at least four 4-ounce servings of fresh or frozen salmon or tuna each week.

For more information visit [www.dhadoc.com](http://www.dhadoc.com)

## Breast Feeding and DHA

From: <http://www.enotalone.com/article/3603.html>

**Smarter fats.** What are these smart nutrients that are in mommy-made milk but not in milk from cows or the factory-made milk on the shelf at the store? One key ingredient is a brain-boosting fat called DHA (docosahexaenoic acid), an omega-3 fatty acid. DHA is one of several fats that have recently gotten a lot of attention as true health foods. DHA is considered a vital nutrient for the growth, development, and maintenance of brain tissue. Autopsy analysis of brain tissue from breastfed and formula-fed infants shows that the brains of breastfed babies have a higher concentration of DHA, and DHA levels are highest in babies who are breastfed the longest. This discovery is sending American formula manufacturers back to the drawing board, since at this writing *infant formulas made in the United States do not contain DHA*.

DHA and other fats in the breast milk contribute directly to brain growth by providing the right substances for manufacturing myelin, the fatty sheath that surrounds nerve fibers, insulating them so that these pathways can carry information. (As you will learn in chapter 4, a mother should supplement her diet with DHA-rich foods such as salmon and tuna or take DHA supplements daily in the form of capsules.)

Breast milk's role in the development of high-quality myelin and brain cells may play a role in the prevention of multiple sclerosis in adulthood. Research has shown that breastfeeding has a dose-related effect on the risk of multiple sclerosis. The longer the duration of breastfeeding, the lower the risk. The symptoms of multiple sclerosis are caused by myelin breakdown, and researchers speculate that a deficiency of omega-3 fatty acids in the myelin sheath makes the sheath more vulnerable to premature degeneration. Another explanation for breastfeeding's protective effect against degenerative nervous-system diseases is that the lower concentration of DHA in the brain-cell membranes of formula-fed infants could over a long period of time lead to defective brain-cell membranes, which allow easier entry of infectious or toxic substances into the brain cells.

Also, breast milk is rich in cholesterol; formula contains none. Cholesterol provides basic components for building the brain and manufacturing hormones and vitamin D. (Higher dietary cholesterol at the stage of fastest brain growth - what a smart idea!) Studies show that during the first year, exclusively breastfed infants have higher blood-cholesterol levels than formula-fed babies do. Depriving infants of sufficient amounts of this brain nutrient at a critical stage, as happens with formula, seems like a dumb idea.



**Brighter Brains** - (pages 3 to 4) Smarter fats. What are these smart nutrients that are in mommy-made milk but not in milk from cows or the factory-made milk on the shelf at the store? One key ingredient is a brain-boosting fat called DHA (docosahexaenoic acid), an omega-3 fatty acid. DHA is one of several fats that have recently gotten a lot of attention as true health foods. DHA is considered a vital nutrient for the growth, development, and maintenance of brain tissue. Autopsy analysis of brain tissue from breastfed and formula-fed infants shows that the brains of breastfed babies have a higher concentration of DHA, and DHA levels are highest in babies who are breastfed the longest. This discovery is sending American formula manufacturers back to the drawing board, since at this writing, *infant formula made in the United States does not contain DHA.*

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**Better Eyes** - (page 6) Not only does breast milk build brighter brains and healthier bodies, it's valuable to baby's vision, too. Studies comparing breastfed and formula-fed infants show that visual development (in particular visual acuity) is better in breastfed babies. This finding is particularly noticeable in premature infants. Again, the smart fat DHA may be one of the reasons. DHA is one of the prime structural components of the retina of the eye. As with all tissues, the better you feed it, the better it grows and functions. So the better you feed the retina, the better the vision - another reason why breastfed babies have a healthier "outlook" on life.

**Healthier Skin** - (page 9) Many pediatricians who have developed a sharp eye and keen sense of touch over years of examining babies report that they can often tell by the look and feel of an infant's skin whether or not the baby is breastfed or formula fed. The skin of a breastfed baby often has a softer, smoother feel. There is also less delineation between where the fat under the skin ends and the underlying muscle begins. The skin of formula-fed babies tends to be rougher, with dry, often sandpaper-like patches. Breastfed babies feel more solid. Researchers report that the subcutaneous fat in breastfed and formula-fed infants actually has a different composition.

Since skin is primarily made of fat, these "fat feel" differences may be the result of the healthier fats in human milk, especially DHA. The higher concentrations of healthy omega-3 fatty acids in breast milk may give the skin a healthier structure. In our pediatrics practice, we often prescribe for older children a diet high in omega-3 fatty acids (such as flaxseed oil, salmon, and tuna) for treatment of eczema and dry, scaly skin conditions. Human milk provides this naturally for babies...

**Vegetarian Diet** - (page 79) ...Our biggest concern is with the "smart fat" DHA...Some studies have shown that the breastfed babies of vegan mothers have lower levels of DHA than the breastfed infants

of nonvegetarian mothers. While other studies have found no differences in milk levels of DHA between vegetarian and nonvegetarian women, we think it would be prudent for vegetarian mothers to add fish to their diets. Four ounces of fish two or three times a week should ensure that there is no deficiency of this important fatty acid in mother's milk. We have noticed several instances in our pediatrics practice in which an infant's dry skin and eczema markedly improved following supplementation of the mother's diet with omega-3 fatty acids, namely from fish and flaxseed or flax oil.

**Smart Fats** - (page 80) Fat is the most valuable nutrient in your milk. This may surprise you, since dietary advice for adults emphasizes low-fat foods and makes fat seem almost evil. But the right fats are needed to feed growing brains. Your baby's brain triples in size by her first birthday, and fats make up 60 percent of her brain tissue. Fats are the major component of brain cell membranes and myelin, the insulating sheath around each nerve that facilitates the speedy transmission of nerve impulses. Because growing brains need fat, 50 percent of the calories in breast milk are in the form of fat.

Not only is the amount of fat important for growing brains, but so is the type of fat. Specifically, human milk contains high levels of the omega-3 fatty acids DHA and ARA (arachidonic acid), which are important to brain development. These smart fats may explain, in part, the intellectual advantage enjoyed by breastfed infants. However, recent studies of how the Standard American Diet (SAD) influences the quality of breast milk have revealed worrisome findings: the breast milk of American mothers is low in smart fats when compared to milk from mothers in countries where the standard diet contains more seafood, such as Malaysia.

Studies have shown that not only are American babies deficient in these fats but that American mothers could also use a boost in these smart omega 3s. Fortunately, you can increase the amount of DHA in your milk and in your baby by eating fish more often, particularly cold-water fish such as salmon and tuna, or by adding to your diet 100 to 200 milligrams of DHA supplements daily in the form of Neuromins capsules. You can also help your body manufacture DHA by using oils that contain nutrients needed for this process, primarily flax oil, canola oil, and soy oil. Here's our "rule of Fs" for getting enough DHA in your diet: "4 ounces of fish and 1 tablespoon of flax oil eaten by mother every day builds a brighter brain, they say."

**Premature Babies** - (page 199) ...Research has shown that premature babies who receive mother's milk have better visual development and a higher IQ later in childhood. This visual and intellectual advantage is thought to be due to the special brain-building fats, especially DHA, in breast milk. Formulas made in the United States as of this writing do not contain DHA. Also, many researchers believe that preterm infants lack the biochemical ability to make their own DHA from the nutrients in formula.

## **HUMANS TURN ALA (UDO OIL) TO EPA/DHA (FISH OIL)**

Source: [http://www.udoerasmus.com/articles/udo/fish\\_oil.htm](http://www.udoerasmus.com/articles/udo/fish_oil.htm)

Proponents of fish oils have claimed for decades that the body cannot convert the basic n-3 essential fatty acid, ALA, into the n-3 derivatives, EPA and DHA, found in fish oils. Is this true? If so, what is the

evidence? When questioned, many fish oil promoters modify themselves and say that too little conversion takes place. When pushed further on the issue, they add "in some people", and pushed even further, they'll reluctantly admit that only "a small percentage of the population may not be able to adequately convert".

The question of n-3 conversion is important, because EPA is needed to make health-protecting 'eicosanoid' hormones that keep cell metabolism on an even keel, and DHA is required for brain development, brain function, vision, and sperm formation, and has heart-protective and anti-inflammatory functions as well. If the body converts ALA into fish oil n-3, then fish or its oil is not required in the diet. If the body cannot convert, then we must all look to fatty fish or fish oils (ugh!) for these important n-3 derivatives.

## **Untrue Claims**

The claim that the body cannot convert ALA to EPA and DHA was not true 20 years ago, and is not true today. This claim does, however, serve to protect the fish oil market. You see, if people knew that the body converts the plant n-3, ALA, to the long-chain n-3 derivatives found in fish, they would stop using rancid, contaminated, or partially damaged fish oils and would use n-3 rich vegetable oils made with health in mind instead.

The truth is that most people do not get enough ALA in their diet.

Our n-3 intake is only 1/6th of the amount eaten by people 150 years ago, and intake was far from optimal in 1850. Without sufficient starting material, not much conversion can take place. Zero ALA gets you zero conversion to EPA and DHA. Lots of ALA gets you lots of conversion. Even today, 95 to 99% of the population gets too little n-3 in their diet, making conversion inadequate in the majority of the population. Instead of forcing them to take fish oils, shouldn't we encourage them to increase their intake of ALA?

## **ALA Re-Introduction to the Diet Changes the Story**

That's what began to happen in 1986. Optimum intake of ALA became possible to consumers through the introduction of n-3 rich oils made with health in mind. In 1983, the author of this article developed methods for making oils with health in mind by protecting them from light, air (oxygen), and heat during processing, filtering, packaging, and storing. He then introduced the oil richest in n-3 (and therefore most sensitive to destruction by light, air, and heat), and subsequently developed a blend of several oils to obtain an optimum ratio of the n-3 and n-6 fatty acids essential to health.

Given optimum amounts of ALA, can the body then make all of the EPA and DHA it needs? The answer to this question becomes clear from research findings reported below. Udo's Oil Blend contains about 50% ALA. Fish oils contain about 30% EPA + DHA. The questions about conversion that need to be answered are:

**Can the body convert ALA from Udo's Oil Blend into the n-3 derivatives EPA + DHA contained in fish oils?**

**If so, how much conversion takes place?**

**Is conversion sufficient for health needs?**

## Research Hot off the Press

All three of these questions were answered in October 2002, by two studies published in the *British Journal of Nutrition* (BJN) which measured the conversion of alpha-linolenic acid (ALA), the short chain n-3 essential fatty acid, into the long chain n-3 derivatives EPA, DPA, and DHA. The first study<sup>1</sup>, carried out with six women, showed that these women converted an average of 36% of the ALA they were given into long chain n-3 derivatives (21% EPA, 6%DPA, 9%DHA).

The second study<sup>2</sup>, done with six men, showed that the men converted an average of 16% of the ALA they received into long-chain n-3 derivatives (8%EPA, 8%DPA). In this study, the men produced no DHA. However, another study showed that men convert ALA to DHA as well<sup>3</sup>.

Udo's Comment: Women must be able to convert enough ALA to long chain n-3 to feed two brains, theirs and that of the child growing within them. Men have only one brain to feed, and therefore require less conversion to DHA than women do.

## Estrogen Effect

In the study of conversion, 3 women using birth control pills (estrogen) converted more efficiently than did 3 women not taking 'the pill' who relied only on the estrogen produced by their body. The researchers suggest that estrogen may speed conversion.<sup>1</sup> If the researchers are right, increased estrogen intake will help women after menopause, as well as men throughout their life (because men produce only small amounts of estrogen compared to women), to improve the efficiency of ALA conversion.

An easy, natural, and convenient way to do this is to use Wholesome Fast Food Blend, which is the richest source of beneficial plant estrogens called lignans. Lignans decrease high estrogen in women before menopause, and increase estrogen in women after the 'change of life'. Besides their mild estrogen benefits, lignans have anti-viral, anti-fungal, anti-bacterial, anti-cancer, anti-diabetic, anti-oxidant, anti-inflammatory, anti-lupus, and anti-cholesterol benefits. They are therefore highly beneficial to health. Wholesome Fast Food Blend is the richest source of these lignans.

Conversion enhancement by estrogen has biological importance. It optimizes the conversion of ALA into the long chain n-3 fatty acid, DHA, in women up during their childbearing years. Efficient conversion is needed, both during pregnancy and while breast-feeding, to build the child's nerves, brain, and vision (retina).

## Rate of Conversion

How much conversion to long chain n-3 derivatives (EPA + DHA) can a woman accomplish from the ALA in Udo's Choice Oil Blend? A 100-pound woman taking the recommended 2 tablespoons of Udo's Oil per day (1 tablespoon/50 pounds of body weight per day) will get about 14grams (14,000mg) of ALA. At the 36% conversion rate found in the study with young women, 14,000mg of ALA produces a total of 5,040mg of long chain n-3 (2,940mg of EPA, 840mg of DPA, and 1,260mg of DHA). 36% conversion of the oil blend produces the equivalent of about 17 large (1,000mg) capsules of fish oil (each containing 300mg of EPA + DHA), which is close to twice as much as the highest recommended therapeutic dose of fish oil.

Using rate of conversion measured in the study with men, how much ALA is converted? A 150-pound man converting 16% of the recommended 3 tablespoons/day (again, 1 tablespoon/50 pounds of body weight/day of Udo's Choice Oil Blend) ends up with 3,360mg of long chain n-3 (EPA + DPA), the equivalent of 11 large capsules of fish oil. This again is more than the highest recommended therapeutic dose of fish oil. The fact that no DHA was produced in the study with men prompted the researchers to speculate that men may need to eat fish or take fish oil supplements, but other studies find that men do make DHA.

### **Practical Conversion Confirmation**

The conversion numbers given above confirm what health practitioners see in their practice. Patients readily switch from fish oils to Udo's Oil Blend because they prefer its taste. Used at the optimum dose of one tablespoon/50 pounds of body weight/day, practitioners tell us that the oil blend gives the same kinds but also a wider range of benefits than fish oils. These benefits include lower cardiovascular risk, smoother skin, higher energy levels, stamina, performance and recovery, better insulin sensitivity, lowered cancer risk, lowered inflammation, greater heat production, and improved mood, learning, IQ and calmness, and better ability to handle stress. abbreviations references back to top

### **Conversion Safety and Control**

When the body has as much DHA as it needs, feedback inhibition stops further conversion. Without this inhibition, toxicity could result from excess DHA production. Let me give an example. An analysis of fish oil studies showed that too much fish oil increases inflammation due to the extreme sensitivity of DHA to damage caused by oxidative stress<sup>4</sup>. Giving n-3 in the more stable form of ALA is safer because it gives the body better metabolic control and prevents DHA overdosing. Some prominent Canadian health researchers have stated for more than 10 years that they prefer the basic n-3 ALA to fish oils because of this better metabolic control that ALA affords the body.

#### **Fish Oil Contamination**

There is another, very serious, problem with fish oils. Many fish oils, especially those derived from fish livers, are contaminated with mercury, PCBs, organo-chlorine pesticides, and dioxins. These toxins can be largely removed by processing, but the processing results in fish oil molecules being damaged and becoming toxic.

According to a test carried out in by Central Science Labs in the UK ([www.csl.gov.uk](http://www.csl.gov.uk)) Udo's Oil Blend is cleaner than even the cleanest of 15 commercial fish oils tested by that laboratory.<sup>5</sup> This is because Udo's Oil Blend is pressed from organically grown (pesticide-free and mercury-free) oil seeds. It is also free of any contaminants that might leach from plastic packaging, because the oil is always packaged in glass.

### **Udo's Oil Blend Compared to Cooking Oils**

Since we are making oil comparisons, let's take a minute to compare Udo's Oil Blend, which is made with health in mind, to cooking oils that are made with shelf life in mind. All oils-from vegetable and fish-are delicate. Light, oxygen (air), and heat easily destroy the delicate oil molecules. To make cooking oils, these delicate oils, which should be treated with care, are subjected to destructive commercial processing methods using harsh, damaging chemicals. The purpose of the destructive

processing is to increase the shelf stability of oils. The damaging chemicals used in the creation of 'cooking oils' include:

Sodium hydroxide (to degum),

Phosphoric acid (to refine {R}),

Bleaching clays (to bleach {B}).

Treatment with these chemicals creates malodorous rancidity. To blow off the bad odor, one further process must be used. That process is:

Steam or molecular distillation (to de-odorize {D}).

The finished product is called an RBD (Refined, Bleached, De-odorized) oil<sup>6</sup>. All commercial 'cooking oils' except extra virgin olive oil are RBD oils. Similar destructive processing is used to 'clean up' fish oils.

Caution: If health is the goal, oils should never be overheated during processing or cooking! Far too much destruction and toxicity results when oils are overheated. Increased incidence of cancer, cardiovascular problems, and inflammation are associated with overheated foods, including oils.

### **Toxic Molecules**

RBD oils contain 0.5 to 1.0% damaged, highly toxic molecules. A single tablespoon of RBD cooking oil made by the above processes can deliver as many as one million toxic molecules to each of the body's 60 trillion cells—a much higher toxic load than our cells can handle. The use of n-6 RBD oils like corn and safflower oil has been associated with increased cancer, and overheated oils also correlate with cardiovascular disease and inflammation.

Even worse processing damage can occur in fish oils, because EPA + DHA are 5 times more sensitive to destruction by light, oxygen, and heat than seed oils' ALA. And ALA is about 5 times more sensitive to these destructive factors than is the n-6 essential fatty acid linoleic acid (LA).

For better health, avoid destructively processed (RBD) cooking oils and fish oils. Instead, eat fresh fatty fish from clean waters, and use good oils 'made with health in mind' in foods. These good oils come from organically grown seeds that are pressed, filtered, filled, packaged, and stored under protection from the destructive influences of light, oxygen (air), and heat. Made in this protected and careful way by Flora, the manufacturer, the molecules in Udo's Oil Blend remain in their natural state.

Flora does not degum, refine, bleach, or deodorize the oil blend, so the oil molecules remain naturally intact. Damage and toxicity are thereby avoided.

### **Research Conversion Confirmation**

Every year, more research confirms that n-3 conversion takes place effectively, provided that enough ALA is present in the diet and interfering factors are avoided. One of the main factors that interferes with n-3 conversion is too much n-6 in the diet, which is the case in the diets commonly eaten by people living in developed nations. N-6 slows down the conversion of n-3.

While researchers still disagree on the exact rate of conversion (because the rate is affected by many nutritional and hormonal factors) and the optimum n-3/n-6 ratio, they agree that substantial conversion does take place. Here are some of their estimates (the first three estimates below were given to Udo by Sam Graci from discussions Sam said he had with Holub, Sears, and Schmidt):



Dr. Bruce Holub (U. of Guelph): 10-15%;  
Dr. Barry Sears (The Zone Diet): up to 18%;  
Dr. Michael Schmidt (Smart Fats): 10%;  
Dr. EA Emken et al<sup>3</sup> (research): 17%;  
Dr. GC Burdge et al<sup>1,2</sup> (research): 16%-men; 36%-women;  
Dr. SM Innis<sup>7</sup> (research): infants convert;  
Dr. JT Brenna<sup>8</sup> (research): all ages convert;  
VP Carnielli et al<sup>9</sup>; C Billeaud et al<sup>10</sup> 'prematures' convert;

A few writers still claim that conversion is less than 5%, but more and more studies report much higher rates of conversion.

The fact of conversion is just common sense. The brains, eyes, and nervous systems of all animals, from insects up are rich in long chain n-3s. Many of these animals are vegetarian, including rabbits, horses, and gorillas. They must be converting the basic n-3 in their own body, because their foods supply provides only ALA, the basic n-3. The long-chain n-3 are important, so nature equipped creatures to make what they need, and to turn up production if long-chain n-3 are not present in the diet.

### **Optimum n-3/n-6 Ratio and Optimum Conversion**

Low conversion results from too little ALA intake, a whopping high (interfering) n-6 intake, lack of the vitamins (B3, B6, C) and minerals (zinc, magnesium) necessary for conversion, other nutritional factors, and toxic influences. There is evidence that high carbohydrate diets slow down conversion, and diets higher in proteins enhance conversion. The ratio of twice more n-3 than n-6 found in Udo's Choice Oil blend ensures effective n-3 conversion. Too high a ratio of n-3 to n-6, such as 3.5 or 4 to 1 found in flax and flax oil, can lead to n-6 deficiency, with symptoms of deterioration that can harm all cells, tissues, glands, and organs.

Too low a ratio, such as 1 to 10 (the average found in Western diets) can lead to symptoms of n-3 deficiency. N-3 deficiency increases the risk of increasing cardiovascular, immune, autoimmune, diabetic, and inflammatory disease, and leads to sub-optimal intelligence, concentration, mood, and performance. In the two conversion studies published in the BNJ, the diet contained only 1/7th as much n-3 as n-6. A better ratio would consist of more n-3 and less n-6. Udo's Choice Oil Blend contains an optimum ratio of 2 times more n-3 than n-6. Why is this important?

The higher the n-6 intake, the slower is n-3 conversion<sup>3</sup>. The more n-3 and the less n-6, the faster the conversion of ALA to long chain n-3 (EPA + DHA) will be. But conversion takes place only as long as the body needs more EPA + DHA, and until optimum content has been achieved.

### **Genetic Variation**

There is genetic variation in any population. Different people have different forms of the same gene. That's why some people have blue eyes, and others have brown or green eyes. Genes also govern the conversion of essential fats to their long chain derivatives. Some people convert more slowly; others convert more rapidly. However, adequate conversion is required for health and for life, and any creature completely unable to convert dies, because DHA and EPA have absolutely necessary vital functions in the body.

With inadequate conversion, a baby would die soon after it was cut off from the mother's intra-uterine or breast supply of DHA. Adults would expire from lack of fish in their diet. In the real world, this is not the case. Many inland populations, especially those roaming the flatlands, did not eat fish or seaweed. They survived because their body was genetically equipped to do the conversion of ALA from greens, seeds, and nuts into the EPA required for making health-protecting eicosanoid hormones and the DHA required for the brain, retina, and sperm.

For thousands of years, people got along without rancid, over-processed encapsulated fish oils. They are not a necessity for health. Today, people can still get along without these damaged, fishy 'fish oil pills'. Eating clean, wild catch fish two to five times a week provides the health benefits that are attributable to long chain n-3 fats, including lowered risk of cardio, cancer, diabetes, inflammation, and even osteoporosis.

I hope this helps to clear up the conversion confusion. Eat clean, organically grown foods, optimize your intake Udo's Oil Blend and the other 13 components of health-greens, minerals, vitamins, proteins, enzymes, probiotics, fiber, antioxidants, phytonutrients, fuel, water, air, and light. Enjoy your life. Be grateful for everything God, nature, and nurture gives you, and you're good to go.

## **APPENDIX I: Abbreviations, & basic facts about 'essential' fats**

**EFA**s = **Essential Fatty Acids** are substances from fats that must be provided by foods because the body cannot make them, and yet must have them for health. EFAs exist in two families: omega-3 (n-3) and omega-6 (n-6). From these two, the body can make several derivatives, as well as eicosanoid 'hormones', and other active substances. N-3s never turn into n-6s in our body, and n-6s cannot turn into n-3s. N-3 and n-6 EFAs do, however, have some overlapping functions.

As a result of overlap in functions, n-6 can cover some symptoms of n-3 deficiency. But, as a quirk of nature, n-3 cannot cover most symptoms of n-6 deficiency. This leads to a situation where, although n-3 deficiency is far more widespread, n-6 deficiency symptoms are easier to identify. For many years, this nature's quirk led to the now known to be mistaken notion that n-6 are more important than n-3 (or that n-3 are not essential at all). As a result, instead of focusing on bringing the missing n-3 EFA back into the diet, much work has been done with oils rich in the n-6 derivative GLA. (Essential) N-3 = omega-3 fatty acids include:

**ALA** (alpha-linolenic acid; abundant in flax, and present in small quantities in hemp, walnut, soybean, and canola); given enough ALA to start with, the body converts ALA into SDA, EPA, and **DHA** in various tissues, according to need; conversion varies, depending on several factors, and ranges from less than 5% to 36% per day of the amount of ALA consumed;

**SDA** (stearidonic acid; present in a few exotic seeds);

**EPA** (eicosapentaenoic acid; parent of Series 1 eicosanoid hormones; found in fish oils);

**DPA** (docosapentaenoic acid);

**DHA** (docosahexaenoic acid; the major brain n-3; also found in eyeball (retina), red-brown algae, and fish oils).

**ALA** = Alpha-Linolenic Acid is the omega 3 (n-3) EFA. It is sometimes shortened to LNA. ALA is very fragile to destruction by light, oxygen (air), and heat, and must therefore be protected from these influences. If this is not done, ALA molecules change from natural and beneficial to unnatural and toxic. ALA is destroyed about 5 times faster than LA, the n-6 EFA. ALA is deficient in the diets of most

people in affluent societies. Due to processing damage, shelf life considerations, and changes in food choices, average intake of n-3 has decreased to less than 20% of what was present in common diets 150 years ago.

Even back then, n-3 intake was less than optimal because few foods are rich in n-3. About 95-99% of the population gets less n-3 than required for good health (making n-3 the essential nutrient most often lacking in people's foods) and n-3 is therefore the most therapeutic of all of the essential nutrients (20 minerals, 14 vitamins, 8-11 amino acids, 2 fatty acids). N-3s improve more than twice as many health problems as do n-6. N-3s are more effective for:

- Raising energy levels, stamina, and performance;
- Improving concentration, learning, calmness, behavior, and IQ;
- Lowering cardiovascular risk factors;
- Inhibiting cancer growth and metastasis;
- Increasing insulin sensitivity;
- Speeding the healing of wounds due to accidental injury, physical exertion, and surgery;
- Decreasing inflammation and joint pain;
- Dampening the symptoms of auto-immune diseases;
- Improving bone mineral metabolism;
- Improving weight management; and
- Increasing fat burning, decreasing fat production, and increasing fat burn-off as heat (thermogenesis).

However, too much n-3 (e.g. the use of flax and flax oil as the only source of EFAs in the diet) can lead to n-6 deficiency and thereby work against the health of cells, tissues, glands, and organs. Thus the ratio of n-3 to n-6 in the diet is a highly important consideration. (Essential) N-6 = omega-6 fatty acids include:

**LA** (linoleic acid; abundant in safflower, sunflower, and corn; present in medium quantities in soybean, sesame, pumpkin seed, and almond; present in small quantities in canola, peanut, and olive); given enough LA to start with, the body converts LA into GLA, DGLA, and AA in various tissues, according to need;

**GLA** (gamma-linolenic acid; present in evening primrose oil); GLA can partially cover n-3 deficiency; a main reason for its benefits comes from being used in an n-3 deficient population; in people consuming an n-3-rich, n-6-balanced diet, GLA is not nearly as impressive as it is in treating n-3 deficient people;

**DGLA** (dihomogamma-linolenic acid; parent of Series 1 eicosanoid hormones);

**AA** (Arachidonic acid; the major brain n-6; parent of Series 2 eicosanoid hormones; found in meat, eggs, and dairy products).

**LA** = Linoleic Acid is the omega-6 (n-6) EFA. LA is abundant in the diets of most people in affluent societies, its intake having doubled during the past 100 years due to increased use of corn and safflower oils. Diets too high in LA (and too low in n-3) are associated with increased cancer. Damaged n-6 molecules due to processing, removal of antioxidants and phytosterols, and concomitant lack of n-3 are likely responsible for this problem. LA is essential to life and to health, and must be present in the diet.

LA is sensitive to destruction by light, oxygen (air), and heat (but 5 times less sensitive than n-3), and should be protected from these destructive influences. If this is not done, LA molecules can change from natural and beneficial, to unnatural and toxic. People on low fat or no fat diets are likely to get

insufficient n-3 and n-6. N-3: N-6 Ratio: Both n-3 and n-6 are essential to health and must come from the diet because the body cannot make them.

However, too much n-3 can crowd out the n-6 (as can happen with flax and flax oil used exclusively as the source of EFAs in the diet), and lead to n-6 deficiency. Too much n-6 can crowd out n-3 (as is the case in 'normal' Western diets), and lead to n-3 deficiency. The ratio of n-3 to n-6 is important and must be carefully considered. I have seen the best results for health using an n-3: n-6 ratio of 2: 1. (Non-essential) N-9 = omega-9 = OA (oleic acid) The body can itself make this monounsaturated fatty acid, and OA is therefore not essential. Essential means that the body cannot make it, cannot live without it, and must therefore obtain it from an outside source, i.e. food or supplement.

## **APPENDIX II - References**

1 *British Journal of Nutrition* 2002 Oct;88(4):411-20. Conversion of alpha-linolenic acid to eicosapentaenoic, docosapenta-enoic and docosahexaenoic acids in young women. Burdge GC, Wootton SA. Institute of Human Nutrition, University of Southampton, Southampton, UK. g.c.burdge@soton.ac.uk

Estimated net fractional ALA inter-conversion was EPA 21%, DPA 6% and DHA 9%. (Udo's Comment: That is a superb conversion rate!) Approximately 22% of administered [13C]ALA was recovered as 13CO<sub>2</sub> on breath over the first 24 h of the study. (Udo's Comment: That means that women burned 22% of the ALA for energy.) Comparison with previous studies suggests that women may possess a greater capacity for ALA conversion than men. (Udo's Comment: Does that mean that women are smarter than men? Smart men have always known that!) Such metabolic capacity may be important for meeting the demands of the fetus and neonate for DHA during pregnancy and lactation. (Udo's Comment: In the paper, the authors suggest that estrogen may increase conversion of ALA to long chain n-3.) Differences in DHA status between women both in the non-pregnant state and in pregnancy may reflect variations in metabolic capacity for DHA synthesis. (Udo's Comment: Rate of conversion is also affected by n-3/n-6 ratio, and by many nutritional and hormonal factors.)

2 *British Journal of Nutrition* 2002 Oct;88(4):355-63 Eicosapentaenoic and docosapentaenoic acids are the principal products of alpha-linolenic acid metabolism in young men\*. Burdge GC, Jones AE, Wootton SA. Institute of Human Nutrition, Level C, West Wing, Southampton General Hospital, Tremona Road, Southampton, SO16 6YD, UK. gcb@soton.ac.uk

Approximately 33% of administered [13C]ALA was recovered as 13CO<sub>2</sub> on breath over the first 24 h. (Udo's Comment: That means that the men burned more (33%) ALA for energy than the women (22%.) The time scale of conversion of [13C]ALA to eicosapentaenoic acid (EPA) and docosapentaenoic acid (DPA) suggested that the liver was the principal site of ALA desaturation and elongation, although there was some indication of EPA and DPA synthesis by enterocytes. There was no apparent 13C enrichment of docosahexaenoic acid (DHA) in plasma PC, TAG or non-esterified fatty acids at any time point measured up to 21 d. This pattern of 13C n-3 fatty acid labelling suggests inhibition or restriction of DHA synthesis downstream of DPA. (Udo's Comment: Other researchers find that conversion to DHA does take place in humans. The reason for inhibition in this study was not identified.) Since the capacity of adult males to convert ALA to DHA was either very low or absent, uptake of pre-formed DHA from the diet may be critical for maintaining adequate membrane DHA concentrations in these individuals. (Udo's Comment: That conclusion is doubtful. Other studies show DHA production from ALA in men. Also, many other factors affect conversion rate. For instance, if the

brain has enough DHA, conversion is unnecessary and is shut down by feedback, until DHA is used up and more DHA needs to be made to replenish brain DHA supply.)

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