



# INTRODUCTION TO OMEGA-3 FATTY ACIDS

## DIETARY LIPIDS: THE GOOD, THE BAD, AND THE ESSENTIAL

In our eternal quest for thinness, we have turned fat into a villain. And in our attempts to eat low-fat diets and shun saturated fats and cholesterol, we often make the mistake of avoiding all fats. But all fats are not bad. Indeed, fat can be good, even essential. We absolutely require certain fats for health — lipids, sterols, and essential fatty acids. Some types of “good” fats make up the bulk of the membranes surrounding every cell in your body. Other types are critical components of the fatty tissues of the brain, eyes, and nerves, and play important roles in bodily defenses.

## A BALANCE OF OMEGA-3 AND OMEGA-6 FATTY ACIDS IS ESSENTIAL FOR HEALTH

Of the many “good” fats that play important roles in the body, two types — omega-6 and omega-3 polyunsaturated fatty acids — have gotten a lot of attention in the scientific community in the last three decades for their beneficial effects. Scientists worldwide have recommended that government agencies officially recognize the crucial differences between omega-3 and omega-6 fatty acids.

In the United States, the National Academy of Sciences is considering establishing Recommended Dietary Allowances (RDAs) for omega-6 and omega-3 fatty acids, following the lead of Canada, the first nation to provide separate dietary recommendations for these fatty acids

Requirements for omega-6 fatty acids, found in vegetable oils and many other foods, are more than met by the diets of developed nations. In contrast, omega-3 fatty acids, specifically the long-chain variety, are harder to come by. Fatty fish, especially salmon, tuna, herring, mackerel, and sardines are the only viable dietary sources of the often deficient long-chain omega-3 fatty acids. Therefore, the emphasis on omega-3 fatty acid intake should increase.

If you aren't eating two to three servings of fatty fish each and every week, you may not be getting enough omega-3 fatty acids. Omega-3 fatty acids are required for normal growth and development and optimal function of the heart, blood, arteries and veins, brain, nerves, eyes, joints, skin, and sex organs. Omega-3 fatty acids have been the subject of thousands of scientific studies and their importance to health is undeniable. For instance, a great deal is known about their favorable effects on cardiovascular health, as they “thin” blood and decrease the risk of blood clots and heart arrhythmias. In addition, omega-3 fatty acids have been recently shown to play important roles in inhibiting inflammation and even cancer.

## THERE ARE ACTUALLY EIGHT (8) MEMBERS OF THE OMEGA-3 FATTY ACID FAMILY FOUND IN HUMAN NUTRITION.

Starting with alpha linolenic acid (ALA) and ending at docosahexaenoic acid (DHA) there are a total of eight omega-3 fatty acids involved in human nutrition. Some play important individual roles while others play supporting or synergistic roles. All are involved in and members of the body's natural fatty acid biochemistry, including cell and tissue structure and function, the formation of other powerful biochemicals and the expression or inhibition of basic systems and balances.

The 8 members include (arranged in order of occurrence);

1. ALA - alpha-linolenic acid
2. SDA – stearadonic acid
3. ETrA - eicosatrienoic acid
4. ETA – eicosatetraenoic acid
5. EPA – eicosapentaenoic acid
6. HPA – heneicosapentaenoic acid
7. DPA – docosapentaenoic acid
8. DHA – docosahexaenoic acid

ALA and one omega-6 fatty acid (linoleic acid) are considered essential because the human body cannot produce them, so they must be supplied in the diet.

Other omega-3 fatty acids are called “conditionally essential” because the body simply cannot make them fast enough to keep up with demand. For instance, the body can make EPA and DHA from a “parent” fatty acid (ALA) and immediate precursors (ETA and DPA), but this synthesis is slow, unreliable, and cannot supply the needed amounts for optimal health. For this reason it is more efficient to obtain them directly from the diet.

## FISH OILS BENEFIT THE HEART

Populations that eat large quantities of fish tend to have lower rates of heart disease than those that do not.<sup>1</sup> For instance, despite their high-fat diets, Greenland Eskimos, who eat a lot of fatty fish (5 to 10 grams of omega-3 fatty acids per day), have few deaths due to heart attack — one-tenth the rate of Danes or North Americans!<sup>2</sup> Japan's death rate from cardiovascular disease has traditionally been the lowest among 34 developed nations for men and the second-lowest (after France) for women, according to the World Health Organization. By way of comparison, the United States ranks in the middle among the 34 nations. What is the reason for Japan's heart health? The Japanese eat 3 to 9 ounces of fish per day, whereas Americans



eat less than an ounce a day. Further, Japanese consuming the most fish have a much lower risk of heart disease than Japanese consuming the least fish.

How does fish oil support the health of the heart and blood vessels? Basically, it changes the chemistry of the blood. First, it consistently lowers blood levels of triglycerides. Second, by decreasing platelet “stickiness” and blood viscosity and by making red blood cells less rigid, it may lower the risk of artery-plugging blood clots. Third, it can lower blood pressure. And fourth, it may reduce the risk of arrhythmia, a common cause of sudden cardiac arrest. Additionally fish oil omega-3’s have been shown to help keep blood vessels soft and flexible.

Most scientists agree that omega-3 fatty acids, taken as part of a low-fat diet, can lower the risk of cardiovascular disease. Evidence suggests that fish oils may be of particular benefit during stress or exercise. A National Heart, Lung and Blood Institute study suggested that a daily intake of 0.5 to 1.0 grams of long-chain omega-3 fatty acids, such as EPA and DHA, may reduce the risk of cardiovascular death in middle aged American men by about 40%.<sup>1</sup> In people who had previously suffered heart attacks, a modest intake of fatty fish two to three times per week reduced death from all causes by 29% over a two-year period.

Dietary intake of omega-3 fatty acids from seafood is especially associated with a reduced risk of cardiac arrest. Unlike a heart attack — the result of a blocked artery to part of the heart — cardiac arrest shuts down the entire heart and is more likely to be fatal. One study reported in the Journal of the American Medical Association found that people consuming one fatty fish meal per week had a 50% lower risk of cardiac arrest compared to those with no dietary intake of fish! Those consuming the greatest amounts of omega-3-rich fish experienced an even bigger reduction in risk (70%).<sup>3</sup>

### FISH OIL HELPS CONTROL INFLAMMATION

Omega-3 fatty acids widely influence defensive and inflammatory responses throughout the body. For this reason, they may affect tissues as diverse as blood vessels, immune cells, skin, lungs, joints, kidneys, pancreas, and blood cells. By preventing overproduction of inflammatory substances, omega-3 fatty acids may lessen arthritis, menstrual pain, psoriasis, inflamed bowel, and other conditions. Moreover, they may lessen the dosages of prescribed medications required to treat these conditions.

### FISH OIL BENEFITS JOINTS

About 165 million people worldwide have rheumatoid arthritis, an inflammation of the joints. Peer-reviewed scientific studies conducted around the world have demonstrated the benefits of omega-3-rich fish oil supplements in alleviating some of the tender joints and morning stiffness that make arthritis so painful and debilitating.<sup>4,5</sup> Some people taking fish oil supplements have even been able to discontinue the use of nonsteroidal anti-inflammatory drugs without experiencing flare-ups.<sup>6</sup>

\*\*\*\*Combining fish oil with glucosamine is a powerful combination with both anti-inflammatory and anti-arthritis properties. Unlike powerful anti-inflammatory drugs, fish oil has no unwanted or dangerous side effects.\*\*\*\*

### OTHER INFLAMMATORY CONDITIONS

Omega-3 fatty acids may be useful in preventing and/or treating other serious inflammatory conditions such as psoriasis and inflamed bowel.<sup>7</sup>

### FISH IS CALLED “BRAIN FOOD” FOR A GOOD REASON

Fish has been called “brain food” for generations. The reason may be that fish’s omega-3 fatty acids support the structure and function of the brain, nerves, and eyes.<sup>8</sup> The cells of the nervous system have particularly “fluid” membranes, and omega-3 fatty acids contribute to this fluidity.

Throughout the body, cells prefer omega-3 fatty acids. When omega-3 fatty acids are available from the diet, they partially replace the omega-6 fatty acids in practically all cells, especially blood and brain cells.<sup>1</sup> In most tissues and organs, if omega-3 fatty acids are in short supply, however, cells can use omega-6 fatty acids instead. This is not the case in the nervous system, where omega-3 fatty acids are absolutely required for normal function of rhodopsin, a protein in the retina that is necessary for sharp vision.

In research published in the October 1, 2005 edition of the Journal of Clinical Investigation (JCI)<sup>12</sup> scientists investigating the relationship between omega-3 fatty acids and brain structure discovered that omega-3’s in general and DHA in particular are critical as building blocks of not just cells, but biochemical made only in the brain. “DHA is an essential building block for the structure of brain cells” stated Dr. Nicholas Bazan, Director of the Neuroscience Center of Excellence at Louisiana State University (LSU). Their findings show for the first time the direct involvement of DHA in the preservation of brain neurons and thus long-term cognitive function.

### OMEGA-3 AND BRAIN FUNCTION

In a December 2004 study published in the American Journal of Clinical Nutrition<sup>13</sup> researcher investigating the long term effect of omega-3 consumption reported finding a direct benefit. In an observational study following a group of 64 year old patients they determined that, when tested and compared to similar tests they had taken in 1947, those with the highest omega-3 intake had the highest IQ and greatest cognitive retention.

An “Evidence Report” published by the US Agency for Healthcare Research and Quality (AHRQ) in 2005<sup>14</sup> found that fish, total omega-3 fatty acid consumption and specifically DHA were associated with a reduction in risk of both Alzheimer’s and non-Alzheimer’s dementia.



Another study has shown that Omega-3 fatty acids may benefit by slowing the ageing of the brain. Older adults who supplement their diets with EPA and DHA have demonstrated greater cognitive function when compared to those who don't. A recent study in *American Journal of Clinical Nutrition* the researchers reported that study participants who eat oily fish or take fish oil supplements score 13 per cent higher in IQ tests and are less likely to show early signs of Alzheimer's disease when compared to those that didn't.<sup>13</sup>

Results of yet another trial published in the December 2005 issue of the *Archives of Neurology* showed that those who ate omega-3 rich fish at least once a week had what amounted to a 10% slower rate of brain aging.<sup>15</sup>

## OMEGA-3 AND BEHAVIOR

As goes the brain, so goes the person. The brain houses many areas and activities that affect everything about us—from alertness and mental clarity to sleep, memory, physical dexterity and even mood. Because both the structure and function of the brain are so directly related to dietary omega-3 status, researchers began looking for a relationship to behavior.

Researchers in Australia conducted a study on 145 children with ADHD and found that taking fish oil supplements can improve attention span and calm children with ADHD. Lead researcher, Natalie Sinn, from the University of Adelaide stated “There is a growing body of research to suggest that some children with developmental problems, including ADHD and dyslexia, can benefit from omega-3 supplements.”

In a double-blind study conducted by the Veteran's Administration and published in the December 2005 issue of *Neuropsychopharmacology* 16 researchers showed that patients being supplemented with 3 grams of omega-3 rich fish oil per day showed a “clinically significant and progressive decrease in their anger scores.”

## SPECIAL NEEDS DURING PREGNANCY AND LACTATION

At no time in life is the need for long-chain omega-3 fatty acids more important than during pregnancy, breast-feeding, and infancy, when infant eyes, nerves, and brain are developing.<sup>8</sup> Omega-3 fatty acids present in mother's milk influence the structure and function of the retina and central nervous system. For instance, researchers found that infants fed formulas without the omega-3 fatty acid DHA had vision that was not as sharp as that of breast-fed infants.<sup>9</sup>

Despite the importance of omega-3 fatty acids, many infant formulas still lack them. At an international scientific conference held in 1990, health experts recommended that all infant formulas include omega-3 fatty acids, and that steps be taken to stop marketing formulas that fail to include omega-3 fatty acids. Most nutritionists now advocate adding omega-3 fatty acids at least to formulas for premature infants, who tend to have lower omega-3 stores than full-term babies.

## OMEGA-3 FATTY ACIDS MAY HELP INHIBIT CANCER

In numerous animal studies, omega-3 fatty acids decreased the number, size, and growth rate of tumors and increased the time interval before tumors appeared.<sup>1</sup> Tumor inhibition was even more pronounced when animals were fed low-calorie diets. Research indicates that omega-3 fatty acids may be especially beneficial in inhibiting cancers of the colon, pancreas, breast, and prostate. In a large human study, people who consumed a higher ratio of omega-3 fatty acids compared to omega-6 fatty acids had lower risks of developing cancer. Those with the highest omega-3 intakes had 33% fewer cancer deaths compared to those with the lowest intakes.

## RESPIRATORY HEALTH

Approximately 15 million people in the United States have asthma—nearly 5 million of them are children. Recent studies show asthmatic women with diets rich in EPA and DHA during pregnancy dramatically reduced the risk of their children developing asthma by more than 70%.<sup>10</sup>

Additionally, a separate study demonstrated a reduced risk of exercise-induced asthma attacks in athletes.<sup>11</sup> The asthmatic-induced decline in lung function that occurs after exercise was reduced by almost 80% in the athletes who were taking fish oil supplements.<sup>4</sup>

## THE OMEGA-3 FATTY ACID GAP

Getting enough omega-6 fatty acids is not a problem in developed nations. Getting enough omega-3 fatty acids, however, is another story: Eating enough fish — by far the richest source of long-chain omega-3 fatty acids — is an upstream battle for most people. While many health experts recommend two to three servings of fatty fish per week for optimal health, most of us eat only one serving per week! Studies conducted by researchers at the United States Department of Agriculture and the National Heart, Lung and Blood Institute confirm that the modern diet is deficient in omega-3 fatty acids. While scientists recommend an optimal omega-3 intake of 800 to 1,100 mg per day, including 300-400 mg of DHA and EPA, the average daily consumption in the U.S. is 50 mg EPA and 80 mg DHA — a far cry from the recommended intake.<sup>1</sup>

While our low intake of omega-3 fatty acids is cause for alarm, our high intake of omega-6 fatty acids worsens the situation. For every pound of fish we eat, we consume five pounds of poultry and 10 pounds of red meat! Diets rich in red meat, full-fat dairy products, and other sources of saturated fat often feature unbalanced ratios of omega-6 fatty acids relative to omega-3 fatty acids. Evidence suggests that our hunter-gatherer ancestors consumed a diet with roughly equal amounts of omega-6 and omega-3 fatty acids. Today we consume 10 to 25 times more omega-6 fatty acids than omega-3 fatty acids!<sup>1</sup> This imbalance may set the stage for inflammation and disease. Because omega-3 fatty acids are necessary for normal growth, development, and metabolism throughout life, they should be abundant in the diets of all



humans. The only viable way to boost the omega-3 fatty acid content in the diet is to consume more fatty fish or fish oil supplements rich in omega-3 fatty acids.

## WHO HAS GREATER OMEGA-3 NEEDS!

The following groups may benefit from greater intakes of omega-3 fatty acids<sup>1</sup>:

- pregnant women
- children
- breast-feeding women
- young adults
- premature infants
- elderly adults
- full-term infants
- athletes

Amounts beyond those needed to prevent deficiency may be necessary for those with a family history of<sup>1</sup>:

- heart disease
- psoriasis
- hypertension
- cancer
- arthritis

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