

# FATS OF LIFE newsletter

Quarterly News for Consumers About Healthy Fats

## HEART HEALTH

### Japanese Frequent Fish-Eaters Avoid Heart Disease

Heart disease claims more lives in the U.S. and western countries than any other cause. People know that, but until a heart attack strikes, many give the condition little thought. It doesn't have to be that way, of course. Preventing heart disease calls for healthy habits—wise food choices, regular exercise, healthy body weight—and knowing your personal risks, such as high blood pressure, diabetes, and high cholesterol levels. For many people, eating healthfully is a challenge.

*... people who ate fish at least 8 times a week had less than half the heart disease found in people eating fish just once a week.*

Making wise food choices to keep your heart healthy might become a little easier, thanks to findings from Japan. In a study published in the January 2006 issue of the journal *Circulation*, a publication of the American Heart Association (AHA), Dr. Hiroyasu Iso and colleagues at the University of Tsukuba, reported that people who ate

fish at least 8 times a week had less than half the heart disease found in people eating fish just once a week. All types of heart disease were nearly 60% lower in Japanese men and women eating fish 8 times a week or more compared with people eating fish just once a week. Chances of a heart attack were half among the highest fish eaters compared to people eating the least amount.

The investigators monitored the health of 41,578 Japanese men and women 40 to 59 years of age for 10 years. All were free of heart disease at the beginning of the study. Over the 10 years of monitoring, there were only 62 deaths attributable to heart disease. This astonishing low death rate was so low, the researchers could not calculate the statistics on mortality. People simply weren't dying from heart disease! Not only that, they weren't developing the condition in the first place.

Several studies in western populations have reported that regular fish consumption, even small amounts, reduces the chance of dying from sudden death or

heart disease by about half. That is why the AHA recommends eating fish at least twice a week. However, these studies have been unable to show that fish consumption has any effect on developing the disease itself. The likely reason one doesn't see effects on heart disease in most western countries is that fish consumption is too low for such an effect.



*"Give it to me straight, Doc.  
How long do I have to ignore your advice?"*

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To put these observations in perspective, American adults eat about 12 gm of fish a day according to surveys by the US Department of Agriculture, whereas these Japanese adults ate at least twice that amount, 23 gm/day. People eating the most fish consumed 15 times as much fish as Americans do. Unfortunately, we have high mortality rates from heart disease to show for it. US men die from ischemic heart disease at a rate of 176.6 per 100,000 men, whereas mortality of Japanese men is 44.8 per 100,000—one-quarter the US rate. To see heart disease mortality rates in other countries, click [here](#).

To be fair, there are many other differences between Japanese and western lifestyles and fish consumption is just one of them. This study suggests that the heart-protecting effects of regular fish consumption take place earlier in life, before heart disease becomes well established. Viewed in the light of our growing understanding of how fish oils benefit heart health, this study adds to the case for eating fish much more often than Americans do.

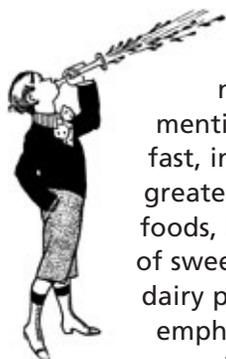


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## American Heart Association Says Children Should Eat Fish

Two leading professional organizations support new nutrition guidelines for children. The American Heart Association (AHA) and the American Academy of Pediatrics recognize that the health problems of today's children—overweight and obesity, increasing occurrence of diabetes, poor food habits, too little exercise—begin in childhood. These groups urge physicians to acquaint their patients with the recently revised AHA dietary recommendations for children. Improving children's eating habits helps establish long-lasting food habits that discourage the development of heart disease, high blood pressure, diabetes, and obesity. Tips for parents to keep in mind are reprinted here.



The AHA noted the large gap between the way children eat now and what is recommended. It mentioned the decline in eating breakfast, increased calories from snacks, greater intake of fried and nutrient-poor foods, larger portions, high consumption of sweetened drinks, and lower use of dairy products. The AHA guidelines emphasize eating whole grains, fruits and vegetables, low-fat dairy products, fish, poultry, and lean meats. New emphasis in these guidelines is more liberal consumption of unsaturated fats, including omega-3 fatty acids.

**Omega-3s** are a type of **unsaturated fat** found mainly in fish. The plant form of omega-3 occurs in flax seed, walnuts, and canola oil and a limited amount of this type can be converted to the same omega-3s found in fish. Because the oils in fish are associated with better health throughout the body, it is wise to include these regularly. Consumption of fish in the U.S. is among the lowest in the world.

These new guidelines would go a long way to improving child and adolescent health if taken to heart by parents. Parents and youngsters alike could gain better appreciation of the importance of sound eating habits by following these suggestions. They won't do anything about eating too much or lack of exercise, but they are an excellent start for building better health.

## TIPS FOR PARENTS

- ♥ Reduce added sugars, including sugar-sweetened drinks and juices.
- ♥ Use canola, soybean, corn, safflower, or other unsaturated oils in place of solid fats during food preparation.
- ♥ Use recommended portion sizes on food labels when preparing and serving food.
- ♥ Use fresh, frozen, and canned vegetables and fruits and serve at every meal; be careful with added sauces and sugar.
- ♥ Introduce and regularly serve fish as an entrée.
- ♥ Remove the skin from poultry before eating.
- ♥ Use only lean cuts of meat and reduced-fat meat products.
- ♥ Limit high-calorie sauces such as Alfredo, cream sauces, cheese sauces, and hollandaise.
- ♥ Eat whole-grain breads and cereals rather than refined products; read labels and ensure that "whole grain" is the first ingredient on the food label of these products.
- ♥ Eat more legumes (beans) and tofu in place of meat for some entrées.
- ♥ Breads, breakfast cereals, and prepared foods, including soups, may be high in salt and/or sugar; read food labels for content and choose high-fiber, low-salt/low-sugar alternatives.

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## MOTHERS & INFANTS

### Can a Shortage of Omega-3s in Pregnancy be Overcome?

Good nutrition during pregnancy is vital for a mother and her developing baby. For this reason, vitamin and mineral supplements are often recommended. Until recently, doctors paid little attention to dietary fats. That situation is changing now as the importance of certain types of fats has been recognized.

*The two most important essential fatty acids for the brain are AA and DHA, known by their abbreviations.*

Besides providing energy and fat-soluble vitamins, food fats provide **essential fatty acids**—substances the body can't make from other fats. These are particularly important for brain development and function in the developing fetus. The two most

important essential fatty acids for the brain are known by their abbreviations AA and DHA because of their cumbersome technical names, **arachidonic acid** and **docosahexaenoic acid**. AA and DHA represent two **families of fatty acids**, omega-6 and omega-3.

In pregnancy, the content of AA and DHA increases in the mother's blood by 23% and 52%, respectively. These come from the mother's diet and from her own tissues and are passed on to the fetus during the course of pregnancy. Transfer to the fetus is greatest in the last 3 months of pregnancy. For this reason, babies born before term may not have enough of these fatty acids to meet their developmental needs. To make up for it, they are fed special preterm formula that contains them.

It appears that the supply of AA reaching a fetus is less dependent on a mother's levels than for DHA. That means that dietary provision of DHA is of prime importance in pregnancy. A small amount of DHA can be made from a precursor fatty acid, alpha-linolenic acid. However, the body performs this conversion very poorly, so even if plenty of precursor is available, very little DHA is made. In addition, the placenta takes up preformed DHA from a mother more readily than its precursor. For that reason, it is important during

pregnancy to consume foods that already have DHA. The main foods with DHA are fish, especially fatty fish, omega-3 eggs, and fish oil supplements.

*A small amount of DHA can be made from a precursor fatty acid, alpha-linolenic acid. However, the body performs this conversion very poorly.*

What happens when a mother consumes too little DHA in pregnancy? We know that preterm infants are born with significantly lower levels of DHA than term infants. Further, infants fed formula not having AA or DHA have less DHA in their brains

and other tissues compared with breast-fed infants. The reason is because breast milk contains AA and DHA, but until recently, infant formula did not. Now, infant formula supplemented with AA and DHA is available in the U.S. and Europe.

The question of having too little DHA in pregnancy was explored by researchers at Oregon Health and Science University in Portland, Oregon, USA. Using rhesus monkeys—for ethical reasons, you can't do these experiments in people—the researchers fed pregnant rhesus monkeys a diet nearly completely free of omega-3 fatty acids for 2 months before conception and throughout pregnancy. After birth, the infants were fed the same diet containing omega-3s as the control monkeys.



At birth, the infants of omega-3-deficient mothers had significantly less DHA in all their tissues compared to the control infants. However, after 2 to 3 years of consuming omega-3 fatty acids, all tissues except the retina of the eye had DHA levels comparable to the control infants. In retina, DHA was still significantly lower



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than in control infants. Most tests of visual function were equivalent in the two groups, but there was a significant difference in one test of the cells that process light adaptation. The authors also observed that recovery of brain DHA was slower when the precursor alpha-linolenic acid was fed, compared to feeding DHA.

This study, which looked at what happens when omega-3s are deficient only during pregnancy, but are consumed after birth, found long-lasting effects in the retina. It is not clear whether visual function would be below optimal in the long-term, but the study does suggest that in some cases, deficits in omega-3s during pregnancy may not be repaired after birth. Although this study was carried out in monkeys, there are many developmental similarities between monkeys and humans, especially in the retina and some parts of the brain. It seems prudent for mothers to consume adequate DHA during pregnancy. Putting fish on the menu is a good place to start.

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## IMMUNITY & INFLAMMATION

### Immune Responses to Omega-3s in Men at Different Ages

The immune system is responsible for defending the body against outside invaders such as bacteria, viruses, and allergens and for responding to injuries and diseased cells. To carry out these functions many organs, tissues, and cells must work together. Specialized cells produced in bone marrow and the thymus gland regulate the immune and inflammatory systems, using a variety of chemicals to communicate amongst each other. One category of chemical mediators, the **cytokines**, has

*The content of the omega-3s, EPA and DHA in certain cells was significantly higher in older men compared with younger ones.*

both pro-inflammatory and anti-inflammatory activities, depending on the type of cytokine. Various cytokines may be measured to assess immune responses in different health conditions and treatments.

Fatty acids, particularly the highly **polyunsaturated** ones in the **omega-6** and **omega-3** families, help regulate immune and inflammatory responses. They may act directly, or indirectly as precursors to the synthesis of highly active substances. In general, the omega-6 polyunsaturated fatty acid arachidonic acid is mainly pro-inflammatory and the marine omega-3s, EPA and DHA, are anti-inflammatory. Some have worried that increasing the consumption of fish or omega-3s might impair immune function. On the other hand, overactive immune responses make inflammatory defenses worse.

A detailed study in younger and older men who for 12 weeks consumed increasing amounts of EPA, a marine omega-3, provides some answers to this conundrum. To the researchers' surprise, the content of EPA and DHA in certain cells of older men was significantly higher than in younger men. This observation was unlikely related to dietary differences, as men consuming oily fish weekly or more were excluded from the study.

Older men were also more responsive to consuming EPA than younger men, taking up more of it in their cells. Older men also had a greater production of pro-inflammatory cytokines at the beginning of the study, but neither age group responded to increased consumption of EPA. This finding suggests that it takes larger amounts of EPA than tested here to reduce pro-inflammatory mediators in healthy men, regardless of age. In addition, the study indicates that consuming considerable amounts of marine omega-3 fatty acids does not compromise immune function in either young or older men. Because marine omega-3s have significant benefits in heart health and other conditions, worries about impaired immunity should not discourage greater consumption of them, as is now recommended by several health organizations.

*In the study . . . consuming considerable amounts of marine omega-3 fatty acids did not compromise immune function in either young or older men.*

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## MENTAL HEALTH

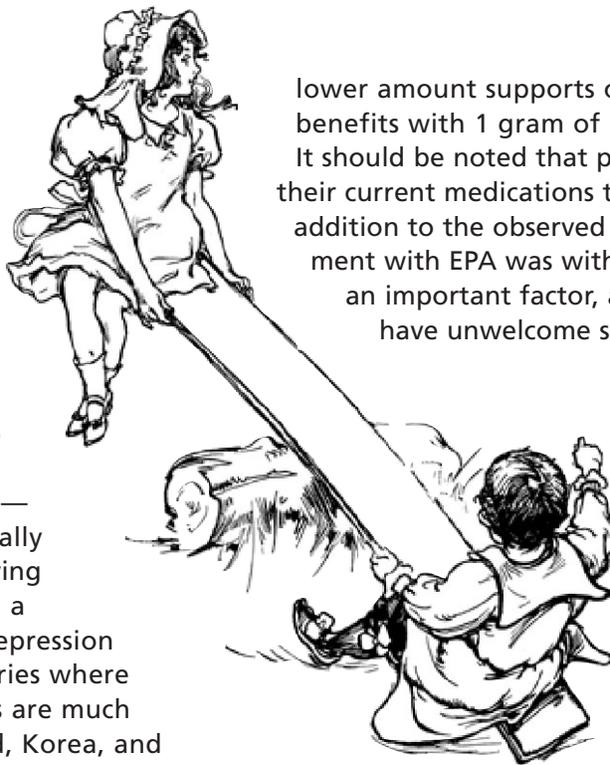
### Bipolar Disorder

#### EPA Improves Symptoms in Patients with Bipolar Disorder

Mental illness in the U.S. and worldwide is common, affecting 30% of people 18 to 54 years of age in the U.S., according to recent figures from the National Institute of Mental Health. The conditions seen most frequently are depression—both mild and severe forms—and **bipolar disorder**. The latter typically includes disabling mood swings, see-sawing from depression to mania repeatedly. On a worldwide basis, bipolar disorder and depression are significantly more common in countries where fish consumption is low. Both conditions are much less common in countries such as Iceland, Korea, and Taiwan, where seafood consumption is more than double that in the U.S.

A number of small studies in people with bipolar disorder have reported significant improvements in mood with the consumption of fish oil or supplements of EPA, a marine **omega-3 fatty acid**. These studies indicate that EPA rather than DHA, another marine omega-3, appears to be the most effective. Even better, the amounts associated with clinical improvements are relatively low (1 to 2 grams/day). However these studies were not randomized controlled trials, which have a stronger study design and are, therefore, more credible.

A new study from the Institute of Psychiatry in London reported encouraging results from a randomized controlled trial of EPA in 75 patients with bipolar disorder. Published in the *British Journal of Psychiatry*, the study found that the consumption of 1 or 2 grams of EPA daily for 3 months resulted in significant clinical improvements, notably in reduced depression. It is usually the gloomy depression phase of the illness that is most difficult to manage. Hence, improvement in this condition offers considerable hope to people afflicted by it. There was no difference between taking 1 or 2 grams of EPA, so the



lower amount supports other reports of benefits with 1 gram of EPA daily. It should be noted that patients continued with their current medications throughout the study. In addition to the observed improvements, treatment with EPA was without serious side effects, an important factor, as most drug therapies have unwelcome side effects.

These findings have plausible explanations, based on current understanding of marine omega-3s in brain function. These fatty acids, especially DHA, are components of brain cell membranes, are

involved in the transmission of chemical signals and are associated with brain function. Clinical studies such as this will encourage the search for details of how omega-3s affect brain function.

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## CLINICAL CONDITIONS

### Parkinson's Disease

#### DHA Eases Side Effects of Treating Parkinson's Disease

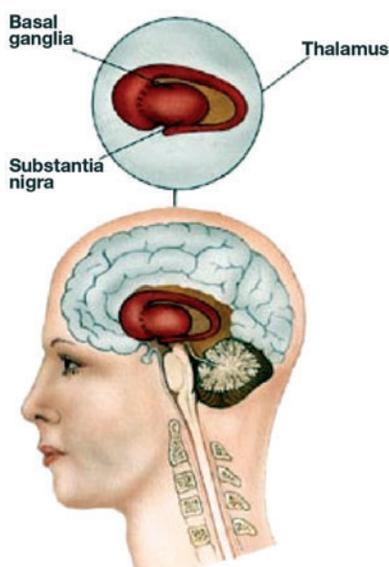
Sometimes living to a "ripe old age" brings with it impaired brain function. One disorder that may develop after the age of 65 is Parkinson's disease, a brain condition characterized by tremors or shaking, slow movements, stiffness, and poor balance. The disease occurs when cells in the substantia nigra (Figure 1), deep inside the brain, start dying. This leads to a loss of dopamine, a chemical messenger that relays information from one cell to another. As dopamine levels fall, the symptoms of Parkinson's disease develop.



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Parkinson's disease is treated by providing L-dopa, a substance the brain converts to dopamine. However, the downside of L-dopa treatment is the onset of involuntary distorted movements known as dyskinesia. Once established, these symptoms are almost impossible eliminate. New findings from the University of Laval in Quebec, Canada, published in the *Annals of Neurology* may offer new hope to reduce these side effects.



**Figure 1. Human brain showing location of the substantia nigra. Reproduced with permission from Family Doctor Books, [www.familydoctor.co.uk](http://www.familydoctor.co.uk).**

Using monkeys treated with a substance that mimics the conditions of Parkinson's disease, the scientists paired L-dopa with DHA, an omega-3 fatty acid found mainly in fish. The animals given DHA with L-dopa exhibited a significant improvement in their dyskinesia scores, a reduction of 35% compared to monkeys given only L-dopa. When the investigators gave the monkeys DHA for 3 days before the L-dopa treatment and followed that with both substances, the improvement in scores was even better—about 40% to 46%. The condition worsened when DHA was removed from the treatment.

*While DHA did not improve the disease itself, it eased the side effects of the main treatment for the condition.*

When the investigators gave the monkeys DHA for 3 days before the L-dopa treatment and followed that with both substances, the improvement in scores was even better—about 40% to 46%. The condition worsened when DHA was removed from the treatment.

Even though the monkeys' symptoms improved, the Parkinson condition was unaffected by DHA. While DHA did not improve the disease itself, it eased the side effects of the main treatment for the condition.

The next step is to see whether smaller amounts of DHA would have similar effects and whether these improvements are long-lasting. It would also be important to know whether DHA would benefit people being treated with L-dopa. The amount used in these animal studies was much larger than what a person would consume by eating fish often, but could be achieved with dietary supplements.

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## ALZHEIMER'S DISEASE

### DHA Derivative Protects Brain Cells in Model of Alzheimer's Disease

Alzheimer's disease is a much-dreaded cause of mental dysfunction in aging. The condition has been well described, but what causes it remains a mystery. Brain function becomes impaired from deposits of amyloid plaque outside the brain's neurons, as shown in the illustration. Inside these neurons deposits of disordered proteins or tangles accumulate. Together, plaques and tangles erode memory, cognition, and function.

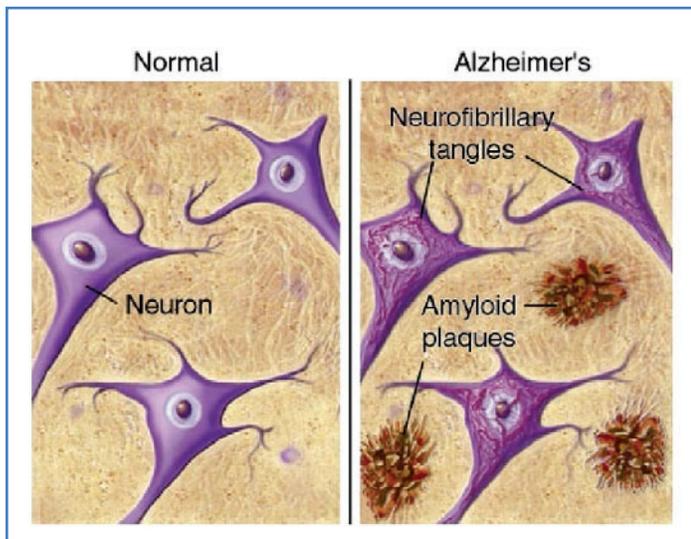
Recent research has shown that when DHA a marine omega-3 fatty acid is plentiful in brain, it reduces the production of amyloid and counteracts some of its harmful effects. Studies have shown that people who regularly consume fish, the food richest in DHA, are less likely to develop Alzheimer's disease. However, it has not been shown that DHA can prevent the condition from developing.

How DHA might be involved in protecting against Alzheimer's disease is being studied intensively. In 2004, a research team at Louisiana State University described a substance called neuroprotectin D1 that protected cells in the retina from oxidative damage. Neuroprotectin D1 was derived from DHA. Since then,



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Normal and Alzheimer's brain showing amyloid plaque outside and tangles inside the neurons. Reproduced with kind permission of the Alzheimer's Disease Research program of the American Health Assistance Foundation, [www.ahaf.org/alzdis/about/adabout.htm](http://www.ahaf.org/alzdis/about/adabout.htm)

Nicholas Bazan and colleagues have shown that neuroprotectin is involved in the communication between neurons. It protects cells from injurious conditions and prolongs cell survival. Recently, they found that DHA-derived neuroprotectin was protective in aged neurons. When old, these cells secrete amyloid proteins similar to what happens in Alzheimer's disease.

Bazan's team found that aged brain cells secreted significantly less amyloid when DHA was present. Moreover, adding DHA increased the production of neuroprotectin and reduced the death rate of brain cells. When they examined the brain tissue of Alzheimer's patients, they found greatly reduced levels of DHA and neuroprotectin compared to amounts in healthy patients. These findings all point to the involvement of DHA and its derivatives in protecting brain health in aging.

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## EXERCISE-INDUCED ASTHMA

### Fish Oil Improves Lung Function in Asthmatics During Exercise

Most people with asthma experience breathing difficulties in the cold or during exercise. These environmental conditions trigger inflammatory responses and narrowing of the air passages along with wheezing, cough, and chest tightness. People with asthma usually control the difficulty with inhaled medications or bronchodilators which relieve the tightened airways and reduce inflammatory responses.

Omega-3 fatty acids from marine sources such as fish and shellfish have anti-inflammatory effects in respiratory tissues in people with asthma, but do not affect breathing in people without the condition. Whether they might be effective in asthmatics under the stress of cold or exercise is not known. Recently, marine omega-3s were found to ease breathing in elite athletes with exercise-induced airway narrowing. Now, they appear to help asthmatics during exercise, too.

Researchers at the Indiana University School of Medicine, USA, compared the effect of 3 weeks of fish or olive oil supplementation on lung function in asthmatic patients. Participants were tested by treadmill exercise and had their lung function and use of bronchodilators measured before, during, and after exercise. When the patients consumed the fish oil





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supplements, they reduced their use of bronchodilators by nearly a third and experienced significantly improved lung function compared to their performance when consuming olive oil or a normal diet. The usual decline in lung function with exercise and a normal diet was reduced by 64% during the period of fish oil consumption. These responses were accompanied by corresponding changes in immune responses in white blood cells, and reduced production of pro-inflammatory chemical mediators.

These findings suggest an additional strategy to ease the breathing difficulties associated with exercise, particularly in cold conditions. The study deserves repeating in a larger number of people with varying severity of asthma. These results also support current understanding of how fish oils suppress inflammatory responses in asthma and other clinical conditions with exaggerated immune responses.

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## CHRONIC OBSTRUCTIVE LUNG DISEASE

### Alpha-Linolenic Acid Improves Lung Function

One of the consequences of smoking is the development of chronic obstructive pulmonary disease. In this condition tissues in the airways and lungs deteriorate and breathing becomes more difficult. The disease can lead to respiratory failure.

*At the end of the 2-year study, patients taking the omega-3 mixture had significantly improved lung function and lower levels of inflammatory mediators, but those taking the omega-6 fatty acids had no improvements their condition.*

Like other forms of respiratory disease, obstructive pulmonary disease includes inflammation and heightened immune responses. Chemical substances that stimulate these responses are produced in lung

tissues from the omega-6 polyunsaturated fatty acid, arachidonic acid. This fatty acid is abundantly available in cell membranes. Reduction in these inflammatory mediators occurs if the marine omega-3 polyunsaturated fatty acids, EPA and DHA, are available to compete with arachidonic acid. Omega-3s produce less potent inflammatory mediators, and with the reduction in mediators made from arachidonic acid, reduce the symptoms of airway inflammation.

Interestingly, it has been known that the prevalence of chronic obstructive pulmonary disease is less frequent in current or past smokers who have higher levels of DHA in their plasma. That observation suggests that DHA might be protective in this condition. A report from Japan has found this to be the case. Sixty-four former smokers were given a nutritional mixture enriched with linoleic acid, an omega-6 fatty acid, or alpha-linolenic acid, an omega-3 fatty acid the body can convert to EPA. They consumed these mixtures for 2 years and had clinical check-ups every 3 months. At the end of the study, patients taking the omega-3 mixture had significantly improved lung function and lower levels of inflammatory mediators, but those taking the omega-6s had no improvements their condition. Those consuming alpha-linolenic acid also had significantly higher levels of EPA, an indication that the alpha-linolenic acid was likely converted to EPA. However, the clinical benefits were not observed until 21 months after the study began. The improvements observed in chronic obstructive pulmonary disease indicate that long-term consumption of omega-3s can improve clinical outcomes and quality of life.

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## ECZEMA

### Puzzling Fatty Acid Changes in Eczema

Eczema is an inflammatory skin condition characterized by dry itchy skin. The inherited form of the condition is called atopic eczema and is linked to various environmental allergens that trigger inflammatory and immune responses. This type is distinguished



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from the non-atopic form by a positive skin test in response to common allergens.

*As expected, infants with atopic eczema had higher levels of linoleic acid in their cheek cells, but the higher level of EPA, a marine omega-3 fatty acid, in serum was unexpected.*

Infants and children with eczema often have altered fatty acid metabolism, but the changes are not always consistent. Several studies have

found higher levels of the omega-6 fatty acid, linoleic acid in patients with atopic eczema, but its product, arachidonic acid, is not increased.

A new report from Finland describes some expected and surprising differences in the fatty acids of infants with atopic and non-atopic eczema. As expected, infants with atopic eczema had higher levels of linoleic acid in their cheek cells than non-atopic and control infants. This observation did not hold for fatty acids in the blood, however. What was unexpected was the higher level of EPA, a marine omega-3 fatty acid, in the blood of atopic infants. Higher EPA would be expected to weaken the inflammation of eczema.

These puzzling observations seem at odds with the present understanding of inflammatory disease. It may be that the conflicting fatty acid observations reported in various studies are telling us that these changes have a relatively small part in the larger environment of allergic disease. Although it may not be comforting or clear, studies such as this one reflect the complexity of the condition scientists are trying to understand and treat. It's a long-term quest.

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## BLOOD PRESSURE

### Fish Oil Does Not Lower Blood Pressure in Healthy Adults Eating High Fat Diets

High blood pressure affects nearly one in three or

about 20 million American adults. Its occurrence increases with age and makes heart disease and stroke much more likely. Fewer than half of those with the condition are being treated for it. According to the American Heart Association, high blood pressure claimed over 52,000 American lives in 2003. As high blood pressure can usually be controlled, this condition is well worth heeding.



Healthy food choices are important in preventing and controlling high blood pressure. Weight loss to achieve desirable body weight, moderation of alcohol consumption, increased potassium intake, and the "DASH" diet high in fruits, vegetables, and low-fat dairy products help keep blood pressure in check. For people sensitive to sodium, limiting sodium intake is critical. Regular consumption of fish or marine omega-3 fatty acids EPA and DHA also has a modest blood pressure-lowering effect in people with high blood pressure. It is thought that DHA rather than EPA is responsible for these effects.

It is uncertain whether marine omega-3 fatty acids affect blood pressure in healthy people who do not have high blood pressure. According to a study published in the American Journal of Clinical Nutrition, people in five western countries who ate high fat diets—37% or more of their calories from fat—did not experience lower blood pressure when they consumed omega-3 supplements for 3 months. However, people who consumed a diet relatively high in monounsaturated fat, the kind found predominantly in olive oil, had significantly lower blood pressure at the end of the study. Those people whose diet was high in saturated fat, found in dairy and animal fats, had no change in blood pressure.

These findings suggest that marine omega-3s have little effect on blood pressure in people who do not have hypertension. However, they were of some benefit in people consuming monounsaturated fats and more than 37% of their energy from fat.

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## FRONTIERS IN RESEARCH

### Links Between Folic Acid and DHA

It is not uncommon in nutrition that the effects of one nutrient depend on another. The need for vitamin D in the uptake and utilization of calcium is one example. Now, it seems that the B vitamin folic acid may be linked to the metabolism of DHA, a marine omega-3 fatty acid. Many years ago it was noted that folic acid deficiency was accompanied by the loss of DHA from the myelin that covers nerves. DHA is abundant in nervous tissue and brain cells and is important in the communication between nerve cells. Feeding folic acid to animals deficient in the vitamin restores both folic acid and DHA in their red blood cells.

Not much attention was given to these observations until it was noticed that in several health conditions, notably depression, bipolar disorder, Alzheimer's disease, and cardiovascular disease, low levels of folic acid and marine omega-3 fatty acids go hand in hand. A new study from the National Institutes of Health,

USA, reported a significant association between folic acid and DHA in the red blood cells of aggressive men. In this study, levels of the vitamin and various fatty acids were compared in men with a history of violent behavior and those with no history of violence. Low DHA was the only fatty acid related to folic acid in aggressive men. In nonviolent men, there was no relationship between the two nutrients. Low levels of marine omega-3s have been observed in other studies of people with hostile behavior.

Associations such as this one are intriguing, but they do not establish cause. We cannot say that either low folic acid or low DHA causes aggressive behavior, but the study suggests that it could be worth looking at both nutrients when examining nutrient status in different health conditions. It would also be useful to see whether recent food fortification programs, which have added folic acid to the food supply, as in the U.S., affect DHA as well as folic acid status.

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