Omega-3 Fats May Reduce Risk of Age-Related Cognitive Decline, Dementia and Alzheimer’s Disease

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The Neuroprotective Effects of Omega-3 Fats: Biological Mechanisms

Several recent studies suggest higher intake and blood levels of omega-3 fatty acids may help to reduce the risk of age-related cognitive decline, dementia and Alzheimer’s disease.1-5 Three of four epidemiological studies suggest a protective effect for omega-3 fatty acids in this regard.6 The major dietary sources of these fatty acids are fish and shellfish from both salt water and fresh water. EPA and DHA also can be synthesized from the elongation and desaturation of alpha-linolenic acid, which is present in some vegetable oils.7 Flaxseed oil is an especially rich source of alpha-linolenic acid, an omega-3 fatty acid.

DHA is 22 carbons long and has six double bonds, the first of which occurs between carbons three and four, from the omega end (the methyl end) of the fatty acid chain. It is the most prominent fatty acid in the brain, retina and spermatozoa and is necessary for vision, cognition and sperm motility. The neurons and synaptosomes of the cerebral cortex are especially rich in DHA, where it is incorporated into the membrane phospholipid structure. The brains of Alzheimer’s patients have been shown to contain a lower content of DHA in the gray matter of the frontal lobe and the hippocampus than do the brains of patients without Alzheimer’s disease. The brains of Alzheimer’s patients also demonstrate a build up of amyloid-protein complex and an inflammatory component.7

The Framingham Heart Study showed that people with plasma phosphatidylcholine DHA in the top quartile of values had a significantly lower risk (47 percent) of developing all-cause dementia than did those in the bottom quartile. Also found was a significantly greater protection obtained from consuming 2.9 servings of fish per week than from consuming only 1.3 servings of fish per week, on average.7

Several mechanisms have been proposed to explain how omega-3 fats can reduce nerve cell degeneration associated with these conditions. Omega-3 fatty acids are known to provide anti-inflammatory effects due to their conversion to anti-inflammatory eicosanoids within the body. The eicosanoids formed from omega-3
fatty acids also improve blood flow by dilating vessels and decreasing platelet stickiness (anti-thrombotic),
and provide other benefits associated with cardiovascular health, such as improving endothelial function and
lowering triglyceride blood levels. All of these effects also are associated with prevention of cognitive
decline, largely via preserved blood flow circulation to brain tissue (lower risk of cerebrovascular disease).

However, omega-3 fatty acids also play a direct role in nerve cell structure and function. Eicosapentaenoic
acid (EPA) and docosahexaenoic acid (DHA) have been shown to improve the composition of nerve cell
membranes, and stimulate the development, regeneration and function of nerve cells by stimulating synaptic
plasticity and increasing neurotransmission, as well as increasing memory abilities. In short, long-chain
omega-3 fatty acids are structural components of neuronal and other cell membranes, affecting membrane
fluidity, nerve transmission and nerve cell function in a positive way. They also modulate the production of
eicosanoids and inflammatory cytokines, and help preserve blood flow to the brain.

There is also the suggestion that oxidative stress (from oxygen and other free radicals), significantly
contributes to neuronal damage seen in cases of cognitive impairment and Alzheimer’s disease, by depleting
the brain of vulnerable highly unsaturated fatty acids (e.g., EPA and DHA). Some researchers suggest that
by replenishing brain cells with EPA and DHA via higher intake levels, individuals may help protect
themselves against cognitive decline to a significant degree.8-11

The epidemiological and experimental studies suggest omega-3 fatty acids can reduce the risk of cognitive
decline. The April 2007 issue of the American Journal of Clinical Nutrition featured the findings of two
large prospective studies that evaluated intake of omega-3 fatty acids and subsequent risk of cognitive
decline, dementia and Alzheimer’s disease in older human subjects. Taken together, the findings of
Beydoun, et al., and van Gelder, et al., indicate that a moderate intake of EPA and DHA is strongly
associated with reduced risk of cognitive decline.9,10

The ARIC Study

The ARIC Study analyzed plasma fatty acids in cholesterol esters and phospholipids in Caucasians residing
tests were administered. Effectively, this study examined the association between plasma fatty acids and
cognitive decline in adults ages 50 to 65 at baseline, and conducted a subgroup analysis. A striking finding
among the 2,251 subjects was that higher levels of omega-3 fatty acids were associated with reduced risk of
decline in verbal fluency, particularly in hypertensive and dyslipidemic subjects, whose tissues are exposed
to greater oxidative stress from these conditions. In contrast, the risk of global cognitive decline increased with elevated palmitic acid (a saturated fat) and in subjects with higher levels of arachidonic acid (an omega-6 fatty acid found in meat and dairy products). It should be noted that palmitic acid is a saturated fat that is highly associated with thrombosis and the elevation of LDL cholesterol, both of which can lead to atherosclerosis obstruction, increasing the tendency to develop dementia.

The Zutphen Elderly Study

The Zutphen Elderly Study collected data on fish consumption of 210 male participants, ages 70 to 89 in 1990, and analyzed data on cognitive functioning collected in 1990 and 1995. Intake of EPA and DHA was calculated for each participant. Results showed that fish consumers had significantly less five-year subsequent cognitive decline than did non-fish consumers, and a linear trend (dose-dependent trend) was observed for the relation between the intake of EPA/DHA and cognitive decline. More specifically, the results showed that elderly men who consumed an average of approximately 400 mg per day of omega-3 fatty acids from EPA and DHA had significantly less cognitive decline over the five-year period than did those consuming an average of approximately 20 mg per day of omega-3 fatty acids.

At present, the American Heart Association recommends the consumption of fish (preferably fatty fish) at least twice per week, a recommendation that is compatible with the results of the Zutphen Elderly Study. To achieve 400 mg per day of EPA and DHA, one would have to consume six servings per week of lean fish (average serving size 140 gm or about 5 ounces) or one serving per week of fatty fish, such as mackerel or herring. One also can achieve this level of intake by consuming a mere 20 gm of Chinook salmon (less than 1 ounce) or 100 gm of cod (a little more than 3.5 ounces). As such, two to three servings of fish per week would supply approximately 380 mg of EPA/DHA per day, on average.

Summary

A number of epidemiological studies and experimental studies suggest higher intake levels, brain levels and blood levels of EPA and DHA may help preserve cognitive function as we age, and reduce risk of dementia and Alzheimer’s disease. A number of biological mechanisms have been proposed to explain the protective effects of EPA and DHA in regard to these neurodegenerative conditions.

More recently, two prospective studies involving older and elderly humans (the ARIC and Zutphen Elderly Studies) have shown a strong correlation between higher plasma and intake levels of EPA and DHA, and
subsequent decreased cognitive decline. The Zutphen Elderly Study highlighted the fact that an average daily intake of 400 mg of EPA and DHA appears to be a significant threshold level at which a marked protective effect is observed. Some experts suggest that people who are allergic to fish and/or shellfish, and those who cannot or will not obtain sufficient intake of fish, should consume 1,000 mg per day of fish oil from supplementation.⁷ A supplement containing fish oil and flaxseed oil also may be a consideration, providing the total amount of EPA and DHA reaches a minimum threshold intake value of 400 mg per day.

Health practitioners should keep this information and dosage levels in mind when making recommendations about specific essential fatty-acid supplement products to their patients.

References

11. Scientific Advisory Committee on Nutrition, Committee on Toxicity. "Advice on Fish Consumption:

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