Consumption of Fish and n-3 Fatty Acids and Risk of Incident Alzheimer Disease

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FROM ABSTRACT

Background: Dietary n-3 polyunsaturated fatty acids improve brain functioning in animal studies, but there is limited study of whether this type of fat protects against Alzheimer disease.

Objective: To examine whether fish consumption and intake of different types of n-3 fatty acids protect against Alzheimer disease.

Design: Prospective study conducted from 1993 through 2000, of a stratified random sample from a geographically defined community. Participants were followed up for an average of 3.9 years for the development of Alzheimer disease.

Patients: A total of 815 residents, aged 65 to 94 years, who were initially unaffected by Alzheimer disease and completed a dietary questionnaire on average 2.3 years before clinical evaluation of incident disease.

Main Outcome Measure: Incident Alzheimer disease diagnosed in a structured neurologic examination by means of standardized criteria.

Results: A total of 131 sample participants developed Alzheimer disease.

Participants who consumed fish once per week or more had 60% less risk of Alzheimer disease compared with those who rarely or never ate fish in a model adjusted for age and other risk factors.

Total intake of n-3 polyunsaturated fatty acids was associated with reduced risk of Alzheimer disease, as was intake of docosahexaenoic acid (22:6n-3).

Eicosapentaenoic acid (20:5n-3) was not associated with Alzheimer disease.

The associations remained unchanged with additional adjustment for intakes of other dietary fats and of vitamin E and for cardiovascular conditions.

Conclusion: Dietary intake of n-3 fatty acids and weekly consumption of fish may reduce the risk of incident Alzheimer disease.
THESE AUTHORS ALSO NOTE:

“A primary component of membrane phospholipids in the brain is the n-3 polyunsaturated fatty acid, docosahexaenoic acid (DHA; 22:6n-3).”

“High levels of DHA are found in the more metabolically active areas of the brain, including the cerebral cortex, mitochondria, synaptosomes, and synaptic vesicles.”

“Fish is a direct dietary source of preformed DHA.”

Animals with diets high in n-3 polyunsaturated fatty acids have the following:
1) Better regulation of neuronal membrane excitability.
2) Increased levels of neurotransmitters.
3) Higher density of neurotransmitter membrane receptors.
4) Increased hippocampal [the primary region for both long-term and short-term memory] nerve growth.
5) Greater fluidity of synaptic membranes.
6) Higher levels of antioxidant enzymes.
7) Decreased levels of lipid peroxides. [This means the less free radical damage to membrane fatty acid double bonds].
8) Reduced ischemic damage to neurons. [This means the neurons can better withstand injury from stroke, etc.].
9) Increased cerebral blood flow.
10) Superior learning and memory.

In this study, “fish consumption was inversely associated with the risk of incident Alzheimer disease.”

“Persons who consumed 1 fish meal per week or more than 1 fish meal per week had 60% less risk of Alzheimer disease than did persons who reported eating fish rarely or never.”

“Total intake of the n-3 polyunsaturated fatty acids was inversely and linearly associated with risk of incident Alzheimer disease in both the age- and multivariable-adjusted models.”

Persons in the top fifth of n-3 intake had a statistically significant 70% reduction in Alzheimer disease risk compared with persons in the lowest fifth of intake.

DHA (22:6n-3) intake was most protective against Alzheimer disease, “with statistically significant 60% to 80% reductions in risk for the upper 3 quintiles in the multivariable model.”

The intake of EPA (20:5n-3) and alpha-linolenic acid (18:3n-3) [omega-3 flaxseed oil] did not alter the risk of Alzheimer disease.
COMMENT FROM AUTHORS:

“Consumption of the n-3 polyunsaturated fatty acids and fish was associated with reduced risk of incident Alzheimer disease in this large prospective study.”

“Persons who consumed at least 1 fish meal per week had 60% less risk of Alzheimer disease than did persons who rarely or never ate fish.”

“Of the marine n-3 fatty acids, only DHA (22:6n-3) was protective against the development of Alzheimer disease.”

“Protective associations were observed for DHA, a major component of brain phospholipids, with fish, its primary food source.”

“We did not observe a protective benefit from EPA (20:5n-3).”

Omega-3 fatty acids have extensive anti-atherosclerotic properties.

DHA has the strongest protective effect against Alzheimer disease. [IMPORTANT]

Docosahexaenoic acid is the most abundant fatty acid in the phospholipids of the cerebral gray matter and represents 45% to 65% of total phosphatidylserine in the mitochondria, which plays a role in neuronal signaling.”

“Docosahexaenoic acid is selectively accumulated in the brain during fetal and infant brain growth.” [IMPORTANT]

“There is a high turnover of phospholipid fatty acids in the brain.” [IMPORTANT]

In one study, consumption of preformed DHA was 7 times more likely to result in uptake by the brain than DHA derived through consumption of linolenic acid. [IMPORTANT for strict vegetarians]

“Several prospective studies found decreased risk of stroke with increased fish consumption and intake of n-3 fatty acids.”

“The n-3 polyunsaturated fatty acids have been shown to have profound effects on membrane functions, leading to change in nerve conduction, neurotransmitter release, neurotransmitter reuptake, and postsynaptic transmitter effects.”

Dietary n-3 fatty acids increased learning acquisition and memory performance.

The consumption of fish (at least weekly) and n-3 fatty acids is associated with reduced risk of Alzheimer disease.
KEY POINTS FROM DAN MURPHY

1) Eating omega-3 fish once per week or more reduces the incidence of Alzheimer disease by 60%.

2) Those taking the highest levels of docosahexaenoic acid (22:6n-3) had up to an 80% reduction of Alzheimer disease.

3) The most important omega-3 to reduce risk of Alzheimer disease is docosahexaenoic acid (22:6n-3).

4) Eicosapentaenoic acid (20:5n-3) did not reduce the risk of Alzheimer disease.

5) Docosahexaenoic acid (DHA; 22:6n-3) is the primary component of membrane phospholipids in the brain.

6) Docosahexaenoic acid (DHA; 22:6n-3) does the following:
   A) Better regulation of neuronal membrane excitability.
   B) Increased levels of neurotransmitters.
   C) Higher density of neurotransmitter membrane receptors.
   D) Increased hippocampal [the primary region for both long-term and short-term memory] nerve growth.
   E) Greater fluidity of synaptic membranes.
   F) Higher levels of antioxidant enzymes.
   G) Decreased levels of lipid peroxides. [This means the less free radical damage to membrane fatty acid double bonds].
   H) Reduced ischemic damage to neurons. [This means the neurons can better withstand injury from stroke, etc.].
   I) Increase cerebral blood flow.
   J) Superior learning and memory.
   K) Improves neuronal signaling.
   L) Improve nerve conduction.
   M) Improve neurotransmitter release reuptake.
   N) Improve learning and memory.
   O) Reduces incidences of atherosclerosis.
   P) Decreases the risk of stroke.

7) Docosahexaenoic acid is abundantly found in the mitochondria [which produce ATP energy].

8) Docosahexaenoic acid is extensively accumulated in the brain during fetal and infant brain growth.

9) There is a high turnover of phospholipid fatty acids in the brain, so they must be constantly replenished.