Red blood cell omega-3 fatty acid levels and markers of accelerated brain aging

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This study was done at Boston University School of Medicine.

FROM ABSTRACT

Objective: Higher dietary intake and circulating levels of docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA) have been related to a reduced risk for dementia.

We examined the relation of red blood cell (RBC) fatty acid levels to subclinical imaging and cognitive markers of dementia risk in a middle-aged to elderly community-based cohort.

Methods: We related RBC DHA and EPA levels in dementia-free Framingham Study participants (n = 1,575; 854 women, age 67 years) to performance on cognitive tests and to volumetric brain MRI, with serial adjustments for age, sex, and education, additionally for APOEe4 and plasma homocysteine, and also for physical activity and body mass index, or for traditional vascular risk factors.

Results:
Participants with RBC DHA levels in the lowest quartile (Q1) when compared to others (Q2–4) had lower total brain and greater [greater is not good, it is bad] white matter hyperintensity volumes.

Participants with lower DHA and omega-3 index (RBC DHA+EPA) levels (Q1 vs Q2–4) also had lower scores on tests of visual memory, executive function, and abstract thinking; the results were significant in all models.

Conclusion: Lower RBC DHA levels are associated with smaller brain volumes and a “vascular” pattern of cognitive impairment even in persons free of clinical dementia.

KEY POINTS FROM THIS STUDY:

1) “Higher fish intake has been associated with a reduced risk of cardiovascular mortality and stroke.”

2) In an earlier Framingham cohort study, participants in the top quartile of plasma docosahexaenoic acid (DHA) levels had 47% lower risks of Alzheimer’s disease (AD) and all-cause dementia.
3) Red blood cell (RBC) fatty acid composition is the most accurate assessment because they reflect dietary fatty acid intake averaged over the RBC lifespan of up to 120 days; in contrast, plasma fatty acid composition concentrations reflect intake over only the last few days. “RBC membrane omega-3 fatty acid composition is more biologically stable than plasma concentrations, and has been shown to be highly correlated with omega-3 fatty acid concentrations in tissues such as the heart.”

4) “Measurement of RBC fatty acid composition is a reliable biological indicator of dietary intake of omega-3 PUFAs.”

5) The omega-3 index is the RBC EPA + DHA, expressed as weight percentage of total fatty acids.

6) This study related RBC fatty acid composition to subclinical markers of future dementia. “We related RBC omega-3 fatty acid levels to recognized MRI and cognitive markers of subclinical AD and vascular pathology and of risk for dementia in a large, community-based sample.”

A) The brain MRI assessment included:
   • brain volume
   • white matter hyperintensity volume

B) The cognitive evaluation included:
   • neuropsychological assessment, including recall time, verbal memory, visuospatial memory, abstract reasoning skills, etc.

7) “We found that lower levels of RBC DHA and EPA in late middle age were associated with markers of accelerated structural and cognitive aging.”

[Key Point]

8) “Fatty acids are integral components of biological membranes, and influence membrane fluidity, ion transport, and other functions. The neuronal cell membrane is no exception; the CNS has the highest concentration of phospholipids in the body.”

9) The omega-3 PUFA DHA is “very inefficiently synthesized from shorter-chain dietary precursor alpha-linolenic acid” and therefore is best obtained preformed from the diet. [Important for strict vegetarians]

10) “The biosynthesis of EPA and DHA from their precursor alpha-linolenic acid appears to decrease with age.”

11) Dietary intake of fatty fish is the main source of the omega-3s DHA and EPA.

12) Omega-3 PUFAs exert beneficial effects on the brain through both vascular and nonvascular biological mechanisms.
13) “DHA and EPA exert several favorable effects on the vasculature, including blood pressure reduction, lowering the risk of thrombosis, reducing inflammation, and lowering serum triglyceride levels. Since vascular risk factors, cerebral atherosclerosis, and stroke have been associated with a higher risk of incident dementia, omega-3 PUFAs may delay cognitive and structural brain aging by some combination of these mechanisms.”

14) The omega-3 PUFAs influence membrane function and the activities of membrane-bound proteins. [Very Important]

15) Omega-3 PUFAs may be “directly linked to the neurodegenerative pathogenesis of AD, including reduction of amyloid-B production, synaptic protection by reducing neuroinflammation and oxidative damage, by increasing levels of brain derived neurotrophic factor, and through reduction of potentially excitotoxic arachidonic acid (omega-6) levels.”

COMMENTS FROM DAN MURPHY

This study adds to the evidence that preformed long-chain EPA and DHA omega-3 fatty acids are crucial for brain function. For years myself and many colleagues have routinely tested patient RBC levels of EPA and DHA, and our findings are very concerning: our average patients are critically low in these essential fatty acids.

Healthcare costs are threatening to bankrupt our nation. It is projected that my generation, the Baby Boomers (born 1946-1964), will give our nation nearly 14 million cases of Alzheimer’s Disease; the cost of managing Alzheimer’s alone is projected to exceed $1 trillion per year, creating an unconceivable burden on our citizens. It is imperative for ourselves, our families, our patients and our nation for each of us to consume adequate levels of long-chain preformed EPA and DHA omega-3 fatty acids, and it is easy to do; supplement.

The omega-3 oils I take are from Nutri-West; I believe their ratios of ALA, EPA, DHA, and GLA are optimal: (800) 443-3333.

Nutri-West has a children’s formula, and both capsules and a liquid for adults:

*Complete Children’s EPA/DHA (8 per day)*

*Complete Omega-3 Essentials (6 per day), or*

*Complete Hi-Potency Omega-3 Liquid (1 teaspoon per day) for adults*

To achieve the “target ratio” most adults need to consume 3,000 mg/d of EPA+DHA; this dose can always be adjusted periodically after testing EPA and DHA levels in the RBCs.