

Omega-3 fatty acids upregulate adult neurogenesis

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FROM ABSTRACT:

Omega-3 fatty acids play crucial roles in the development and function of the central nervous system.

These components, which must be obtained from dietary sources, have been implicated in a variety of neurodevelopmental and psychiatric disorders.

The presence of omega-6 fatty acids may interfere with omega-3 fatty acid metabolism.

The present study investigated whether changes in dietary ratios of omega-3:omega-6 fatty acids influence neurogenesis.

A quantitative analysis in the brain shows that short-term augmentation of dietary omega-3 relative to omega-6 fatty acids results in significant increases in neurogenesis.

It is proposed that the ratio of omega-3:omega-6 fatty acids may alter neurogenesis via modulatory influences on membrane proteins, cytokines and/or neurotrophins.

THESE AUTHORS ALSO NOTE:

“Long chain polyunsaturated fatty acids (LC-PUFAs), which make up 20% of the brain’s dry weight, are critical for healthy brain development and function because of their roles in membrane structure and cytokine regulation.”

“The omega-3 fatty acids EPA (eicosapentaenoic acid, 20:5n3) and DHA (docosahexaenoic acid, 22:6n3) are of particular importance in the nervous system.” **[these are from fish oil]**

"Some fish and crustacean species can convert ALA into DHA and EPA, although this mechanism does not appear to contribute significantly to DHA and EPA levels in humans." **[Important, especially for vegetarians]**

Abnormalities in fatty acid metabolism may play a part in a range of neurodevelopmental and psychiatric disorders, including the prevalence of depressive illnesses.

"Recently, EPA supplementation has even emerged as a potential treatment for depression."

Recent research has established an association between omega-3 fatty acids and major depressive disorders.

DISCUSSION

Our experiments indicate that even a few weeks of dietary increase of long chain omega-3s can increase the numbers of new neurons.

The ratio of omega-3:omega-6 fatty acids is important because undesirable ratios can inhibit the conversion of ALA [found in flax oil] to EPA and DHA.

These authors believe that the observed increased neurogenesis is a result of a favorable omega-3:omega-6 ratio as a consequence of dietary supplementation with omega-3s.

The increases in neuronal proliferation seen with long chain omega-3 enrichment imply that the nervous system benefits from this nutritional enhancement.

Aquatic animals, grown in captivity for eventual release to the wild (enhancement programs), are often fed less nutritious, low-cost food. Unfortunately, feeding low-quality diets unenriched with long chain omega-3s produce animals that are neurologically and physiologically weaker.

Omega-3 fatty acids influence neurogenesis through at least these mechanisms:

- 1) Omega-3 fatty acids are incorporated into neuronal membranes, where they influence the structure of membrane proteins. Some of these membrane proteins act as transporters and receptors.

2) Omega-3 fatty acids alter membrane fluidity, which is important for neurotransmitter binding. For instance, as serotonin binds better to neuronal membranes, it stimulates neurogenesis in both vertebrate and the levels of neuronal proliferation.

“Omega-3 fatty acids alter the rate of neurogenesis via their contributions to the dynamic structure and function of neuronal membranes.”
[Important]

3) Omega-3 fatty acids modulate cytokine levels, “which in turn regulate immune function.” **[Important]**

“The same molecules that are of importance in regulating neurogenesis, also are implicated in major depressive illness, indicating there is a pathway by which omega-3 fatty acids may simultaneously influence neurogenesis and depressive illnesses.”

KEY POINTS FROM DAN MURPHY

1) “Omega-3 fatty acids play crucial roles in the development and function of the central nervous system.”

2) Omega-3 fatty acids “must be obtained from dietary sources.”

3) Omega-3 fatty acids are implicated in a variety of neurodevelopmental and psychiatric disorders.

4) The presence of omega-6 fatty acids interferes with omega-3 fatty acid metabolism.

5) Short-term augmentation of dietary omega-3 relative to omega-6 fatty acids results in significant increases in neurogenesis.

6) “Long chain polyunsaturated fatty acids are critical for healthy brain development and function because of their roles in membrane structure and cytokine regulation.”

7) “The omega-3 fatty acids EPA (eicosapentaenoic acid, 20:5n3) and DHA (docosahexaenoic acid, 22:6n3) are of particular importance in the nervous system.” **[these are from fish oil]**

- 8) "Some fish and crustacean species can convert ALA into DHA and EPA, although this mechanism does not appear to contribute significantly to DHA and EPA levels in humans." **[Important, especially for vegetarians]**
- 9) Abnormalities in fatty acid metabolism may play a part in a range of neurodevelopmental and psychiatric disorders, including the prevalence of depressive illnesses.
- 10) "Recently, EPA supplementation has even emerged as a potential treatment for depression."
- 11) There is an association between omega-3 fatty acids and major depressive disorders.
- 12) Just a few weeks of dietary increase of long chain omega-3s can increase the numbers of new neurons in the brain.
- 13) The ratio of omega-3:omega-6 fatty acids is important because undesirable ratios can inhibit the conversion of ALA [found in flax oil] to EPA and DHA.
- 14) Aquatic animals, grown in captivity for eventual release to the wild, are often fed less nutritious, low-cost food. Unfortunately, feeding low-quality diets unenriched with long chain omega-3s produce animals that are neurologically and physiologically weaker.
[Farmed fish is nutritionally poor]
- 15) Omega-3 fatty acids are incorporated into neuronal membranes where they influence the structure of membrane protein receptors.
- 16) Omega-3 fatty acids alter membrane fluidity, which is important for neurotransmitter binding, including serotonin.
- 17) Omega-3 fatty acids modulate cytokine levels, "which in turn regulate immune function." **[Important]**
- 18) "Omega-3 fatty acids alter the rate of neurogenesis via their contributions to the dynamic structure and function of neuronal membranes."
[Important]