

Do animal derived long-chain polyunsaturated fatty acids (LC PUFAs) improve brain development or protect against mental illness?

Brain development

This is a very complex area and overall the results investigations are not clear cut. Where the intake of long chain poly-unsaturated fatty acids (LC-PUFAs) is higher because of breast feeding or supplementation of formula enriched with LC-PUFAs, some studies suggest a better short term development of vision and mental development. However, an almost equal number of studies show no difference. Longer term studies tend to show no difference (Simmer 04).

Human milk contents of 18:2 ω 6 (linoleic acid) and 18:3 ω 3 (a linoleic acid) are more variable than the contents in formulas. On average, 18:2 ω 6 comprises <16% of the total fatty acid content of the milk of U.S. women and 18:3 ω 3 comprises about 1%. Human milk also contains small amounts of a number of longer chain, more unsaturated metabolites of both 18:2 ω 6 and 18:3 ω 3, including 20:5 ω 6 and 22:6 ω 3.

Some studies are suggestive that infants who are fed formula not enriched with arachidonic acid or DHA have lower levels of brain DHA than infants raised on breast milk. However, when attempts are made to control for the obvious confounding variables such as the mother's level of education, socioeconomic status and the like, these differences tend to disappear. Further, infants given formula with higher concentrations of a linoleic acid, the substrate for the production of DHA, the level of DHA is correspondingly higher.

Both term and preterm infants can convert linoleic acid to arachidonic acid and linoleic acid to DHA (docosahexanoic acid). This has been established by administering the precursor fatty acids labelled with stable isotopes of either carbon(¹³C) or hydrogen (²H) and serially measuring blood levels of the labelled precursors as well as labelled metabolites of each by gas chromatography/mass spectrometry. However, the argument is whether this is adequate or not. The answer is that this is really not known.

A recent Cochrane review (a very prestigious medical reviewing body) concluded that there was no advantage in supplemental DHA in relation to brain development or eyesight (Simmer 04).

Many have taken the point of view in that since there appears to be no harm from adding LC-PUFAs to infant formulas, then this is what should be done. However, this should not be taken as proof that such actions have been conclusively established.

Hence the evidence that there is a continuing need to have a source of LC-PUFAs in the diet in addition to the supply of the two precursor essential fatty acids, linoleic and alpha linoleic acid is lacking.

Protection against mental illness.

There have been fairly extensive studies in the use of omega 3 LC-PUFAs such as DHA, EPA and similar compounds for the treatment or prevention of such mental illnesses as schizophrenia and depression (Vaddadi 06). While there have some suggestive results, when more carefully done double blinded placebo controlled studies are done, the positive findings are less impressive or completely disappear. Many limitations of these studies are also noted (Berger 06). Supplementation has been shown in uncontrolled studies to prevent the onset of schizophrenia in at-risk groups, but wider community based studies show no effect (Vaddadi).

An area that seems not to have been explored is whether correcting the current imbalance of omega 6 linoleic and omega 3 alpha linoleic essential fatty acids (EFA) has any role in these disorders. These two EFAs compete for the same set of enzymes to produce longer chain metabolites and the current excess of omega 6 linoleic acid, aggravated by the grain feeding of cattle, may lead to a relative shortage of the omega 3 LC-PUFAs such as EPA and DHA. We really need fairly firm evidence that this approach is effective since the major source of these LC-PUFAs is from fish which is already vastly over-exploited resource or comes from environmentally damaging fish farms.

References:

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- (Simmer 04)** Simmer K, Patole S. Long-chain polyunsaturated fatty acid supplementation in preterm infants. *Cochrane Database of Systematic Reviews*. 2004, DOI: 10.1002/14651858.CD000375.pub2.