J Pediatr. 2003 Oct; 143 (4 Suppl): pp.1-8.

Perinatal biochemistry and physiology of long-chain polyunsaturated fatty acids.

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Docosahexaenoic acid (DHA) and arachidonic acid (ARA) are important structural components of the central nervous system. These fatty acids are transferred across the placenta, are present in human milk, and are accumulated in the brain and retina during fetal and infant development. The high concentrations of DHA in the retina and of DHA and ARA in brain gray matter suggests that these fatty acids have important roles in retinal and neural function. Animal studies have shown that depletion of DHA from the retina and brain results in reduced visual function and learning deficits. The latter effects may be explained by changes in the membrane bilayer that alter membrane-associated receptors and signal transduction systems, ion channel activity, or direct effects on gene expression. DHA can be formed in the liver from alpha linolenic acid, but it is unclear if the rate of DHA synthesis in humans is sufficient to support optimal brain and retinal development. Although there is no evidence that the ability to form ARA from linoleic acid is limiting, supplementation with DHA reduces tissue ARA, possibly creating a conditional need for ARA in infants with a dietary intake of DHA. The amount of DHA in human milk varies widely and is positively correlated with visual and language development in breast-fed infants. Advances in understanding essential fatty acid requirements will benefit from intervention studies that use functionally relevant tests to probe the deficiency or adequacy of physiologically important pools of DHA and ARA in developing infants.