DHA and Cognitive Function: Early Development Through Aging

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Omega-3 polyunsaturated fatty acids (n-3 PUFA), including eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), play important roles in the body as components of the phospholipids that form the structures of cell membranes. Required for neuronal membrane synthesis and optimal cognitive function, DHA is particularly dense in the brain. It is also important in a wide range of physiologic states and cognitive functions including signal transduction, neurotransmission, neurogenesis, myelination, membrane receptor function, synaptic plasticity, neuroinflammation, membrane integrity, and membrane organization.[1] How the brain develops and functions, from early embryonic development through end of life, is highly influenced by the amount of DHA in neural tissue. This article will review the role of DHA in cognition, from early development through end of life, including recommended intake levels of EPA/DHA.

DHA in Early Cognitive Development

DHA is essential for neurologic development, particularly in the third trimester of gestation through the second year of life, during which time deposition of DHA into brain tissue peaks.[2] Many observational studies have investigated the impact of varying levels of maternal DHA intake on fetal and neonatal brain development as a way to understand the role of DHA in cognitive function. These studies illustrate that increased DHA intake correlates with a range of functional cognitive benefits in infants and very young children, including improved visual recognition memory, higher scores of verbal intelligence, higher IQ, and improved fine motor, social, and communication skills.†[3,4]

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In school-aged children, the frontal lobe of the brain, responsible for higher functions such as problem-solving and emotional expression, continues to develop with spurts of growth at seven to nine years of age and again mid-adolescence. The body of clinical research describing the influence of DHA on cognitive development and function in this age group demonstrates a range of compelling benefits. In a clinical trial involving elementary school-aged boys, McNamara and colleagues elucidated a direct link between DHA supplementation and frontal lobe activation.[5] In this study, one or two doses of DHA (400 or 1,200 mg/d) for eight weeks resulted in significant sustained attention improvements with greater changes from baseline in activation of the dorsolateral prefrontal cortex.† Other studies in this age group have shown that supplementation with DHA correlates with improvements in reading, spelling, memory, attention and executive function, processing speed, and non-verbal cognitive development.†[6] These benefits were especially evident in malnourished populations supplemented with omega-3.

DHA in Aging and Later Life

Robust cognitive function is directly associated with productivity and quality of life throughout the life cycle. Unfortunately, normal aging is accompanied by a gradual loss of neuronal synapses, and a parallel decrease in DHA composition, manifesting in cognitive decline.[7,8] Fortunately, DHA supplementation is positively correlated with gray matter volume and cognition in normal, elderly adults with many observational studies and clinical trials linking dietary DHA supplementation with cognitive support in healthy, aging populations.†[9]

In the landmark MIDAS (Memory Improvement after DHA) Study, 485 healthy elderly subjects (mean age of 70 years) with mild, subjective memory complaints (assessed and quantified using the Logical Memory subtest of the Wechsler Memory Scale and the Mini-Mental State Examination) were evaluated in a randomized, controlled clinical trial.[10] The groups received either 900 mg of algal DHA or corn/soy placebo over a 24-week period. At the end of the study period, those who received DHA demonstrated significantly improved Paired Associate Learning (PAL) testing as compared with placebo.† There were also significant differences in measures of verbal recognition and memory, including immediate and delayed recall.†

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Clinical Pearls

- Recommended intakes for adults, as established by the National Institutes of Health, is 650 mg of omega-3 as EPA/DHA per day (minimum 220 mg of both DHA and EPA).[11]
- To minimize environmental risk, look for omega-3 marine-based supplements that source small species of wild fish (sardine, anchovy, and mackerel) which naturally contain reduced levels of harmful environmental contaminants such as heavy metals, pesticides, PCBs, and dioxins.
- Use of molecular distillation and ultra-filtration processing methods may further purify supplemental oils and help ensure a safe, high-qualit product.

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