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Omega-3-fatty acids: Essential nutrients for infants and children

SANJAY AGRAWAL

INTRODUCTION

There is considerable interest in the role of certain long chain polyunsaturated fatty acids (LCPUFA), in visual and cognitive development throughout childhood. The omega-3 fatty acid, docosahexaenoic acid (DHA) and the omega-6 fatty acid, arachidonic acid (AA) are the major LCPUFA in the brain. DHA and AA are rapidly incorporated in the nervous tissue of retina and brain during the last trimester of pregnancy up to 2 years of age. DHA, in particular, is especially high in the retina, brain, and sperm (Ref¹). DHA is incorporated into retinal cell membranes and is required for the normal development and function of the retina, suggesting its key role in vision. The phospholipids in the gray matter of the brain contain high proportions of DHA and arachidonic acid, which are crucial for the functioning of central nervous system. (Ref²).

Beyond development of the central nervous system, omega-3 and omega-6 fatty acids may influence brain function throughout life by modifications of neuronal membrane fluidity, flexibility, permeability, activity of membrane-bound enzymes, number and affinity of receptors,

function of neuronal membrane ionic channels, and production of neurotransmitters and brain peptides (Ref.³).

Sub-optimal cognitive function and vision have been associated with poor DHA status during foetal development.(Ref.⁴). One study showed that supplementation with omega-3 fatty acids during pregnancy and lactation improved intelligence quotient (IQ) at four years of age, but no improvement was found at seven years of age (Ref.⁵). Further research into the potential benefit of prenatal omega-3 fatty acid supplementation for child mental development is needed.

The World Health Organisation recommends the following amounts of combined EPA and DHA per day

- 6 to 24 months of age: 10 to 12 mg of DHA per kg of bodyweight
- 2 to 4 years of age: 100 to 150 mg of combined EPA and DHA per day
- 4 to 6 years of age: 150 to 200 mg of combined EPA and DHA per day
- 6 to 10 years of age: 200 to 250 mg of combined EPA and DHA per day
- 10 to 18 years of age: 250 to 2000 mg of combined EPA and DHA per day

OMEGA- 3 FATTY ACIDS : ROLE IN NEURO-PSYCHIATRIC DISORDERS

In recent years, there has been considerable amount of research

assessing the health benefits of omega-3 fatty acids, docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA) in different neuro-psychiatric disorders. There is increasing evidence that suggests that deficiencies or imbalances of omega-3 and omega-6 essential fatty acids, may play an important role in development of adult psychiatric disorders (depression, schizophrenia) as well as in development of dyslexia, attention deficit hyperactivity disorder (ADHD), developmental coordination disorder (DCD) and autism spectrum disorder (ASD).

OMEGA-3 FATTY ACIDS AND ADHD

Attention deficit hyperactivity disorder (ADHD) is a common child-onset neurodevelopmental disorder occurring in children, adolescents, and adults, with an estimated prevalence of 5 to 7 per cent across cultures (Ref.⁶).

Children with ADHD, who have lower serum levels of omega-3 fatty acids, have been shown to have more behavioural problems. (Ref.⁷). A number of studies have shown positive benefits to omega-3 fatty acid supplementation, with improvements seen in behaviour and reading ability. (Ref.⁸). An analysis of 10 studies, involving 699 children, reported that omega-3 fatty acid supplementation was associated with a small but significant effect in improving ADD/ADHD symptoms. EPA dose within supplements was significantly correlated with supplement efficacy.

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They concluded that omega-3 fatty acid supplementation, particularly with higher doses of EPA, was modestly effective in the treatment of ADD/ADHD (Ref.⁹). A 2017 review of 16 studies found that omega-3 fatty acids improved impulsivity, hyperactivity, attention, visual learning, and working/short-term memory. These are all symptoms often associated with ADD/ADHD (Ref.¹⁰).

It is still unclear whether supplementation can be used as an alternative to conventional ADHD treatment, but as omega-3 fatty acids are considered relatively safe and are deemed beneficial to general health, they offer a promising complementary approach to standard treatments.(Ref.¹¹). More research is needed to establish which children with ADHD are likely to have the best response to omega-3 fatty acid supplementation and the optimum dose required.

OMEGA-3 FATTY ACIDS AND ASD

Autism spectrum disorder (ASD) is defined by the American Psychiatric Association as a biologically based neurodevelopmental disorder characterized by persistent deficits in social communication and social interaction and restricted, repetitive patterns of behavior, interests, or activities, with severity based on impairments and symptoms present when social demands exceed limited capacities (Ref.¹²). A deficiency of omega-3 fatty acids may be linked to autism spectrum disorder (ASD) in children, according to a meta-analysis of 6 trials. These studies showed that supplementation with omega-3 fatty acids may improve hyperactivity, lethargy, and stereotypy (movements such as body rocking), which are common in children with autism.(Ref. ¹³).

There is a need for more large well conducted randomised controlled trials to further evaluate the role of omega-3 fatty acids in ASD.(Ref.¹⁴).

OMEGA-3 FATTY ACIDS AND BEHAVIOURAL DISORDERS

In a 3 month study involving 942 children (aged 6-12 years), with behavioral disorders, including conduct problems, inattention, nervousness, hyperactivity, trouble concentrating, and learning issues and poor school performance, were split into 2 groups—one group received supplementation with omega-3 fatty acids, while the other group did not. By the end of the study period, there was significant improvement in health status, quality of life, and scores on Strengths and Difficulties Questionnaires in children who had been taking omega-3 dietary supplements . (Ref.¹⁵).

OMEGA-3 FATTY ACIDS AND MOODS

In a study involving 20 depressed children aged 6-12 years, supplementation with omega-3 fatty acids showed significant improvements in depressive symptoms.(Ref.¹⁶). Another study conducted in 38 children aged 11-17, found significant reductions in depressive symptoms in the participants taking omega-3 fatty acids.(Ref.¹⁷).

OMEGA-3 AND COGNITIVE FUNCTIONS

Observational (cross-sectional and longitudinal) studies in healthy children suggest that there might be a positive relationship between omega-3 fatty acid or fish intake and cognitive outcomes.

Five cross-sectional studies assessing 4-16 year old children found

a significant positive association between fish or omega-3 fatty acid intake and at least some cognitive outcomes (Ref.¹⁸). Two other studies did not find any significant associations (Ref.¹⁹).

Five longitudinal studies, followed children from birth to childhood or throughout childhood ; two studies showed significant beneficial effects of DHA fortified formula during the first 6 months (Ref. ²⁰) and fish intake during adolescence (Ref.²¹) on children's overall cognitive outcome measures.

Omega-3 supplementation in normal healthy children was associated with improved DHA and EPA status, improvements in immune function, better memory and improvements in verbal learning, comprehension and vocabulary acquisition tests.(Ref.²²).

A recent review of the evidence suggests that although consistent conclusions on the treatment effects of DHA are lacking, DHA supplementation did cause improvements in either cognition or behaviour in half the studies reviewed.(Ref.²³).

Apart from the above mentioned neuro-developmental disorders, it is worth noting that there are numerous other beneficial effects of omega-3 fatty acids. They are vital for supporting heart health, reducing inflammation throughout the body, and supporting blood pressure regulation. Few studies have reported beneficial effects of omega-3s supplementation in sickle cell anaemia, rheumatoid arthritis, bronchial asthma, cystic fibrosis and childhood allergies.

CONCLUSION:

Recently, there has been a significant amount of research about role of Omega-3 fatty acids in various childhood symptoms and

conditions, particularly attention, mood, and behavior issues. Most studies show that children with these conditions experience symptom improvement, when they receive Omega-3 supplementation. Research has also demonstrated that many of these children have abnormally low levels of Omega 3's when compared to the general population, making it an appropriate target for supplementation.

An adequate intake of omega-3 fatty acids should be ensured during pregnancy, lactation and childhood for maintaining optimal health, and its supplementation should be considered when dietary intake is not sufficient.

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Triple therapy with Angiotensin converting enzyme (ACE) inhibitors, beta blockers, and aldosterone antagonists triples lifespan of patients with Heart Failure (HF). Clinicians while counseling the HF patients should emphasize on the survival benefits with the use of ACEIs, beta blockers and aldosterone antagonists rather than the perceived adverse effects. An easy way to achieve this is to convey “triple therapy triples lifespan”



Diastolic dysfunction (DD) is a pathophysiologic condition associated with impaired myocardial relaxation and/or decreased left ventricular (LV) compliance, both of which can lead to elevated filling pressures, thus presence of DD does not necessarily mean presence of HF. HF, on the other hand, is characterized by signs and symptoms of pulmonary and/or systemic venous congestion which is a result of inability of the heart to fill with and/or to eject blood proportional to the metabolic needs of the body.

DD is not unique to diastolic HF as echocardiographic evidence of DD is very common in HFpEF (systolic HF). Diastolic HF is thus a subset of HFpEF the term “huff-puff” to help patients and healthcare providers understand that HFpEF is a better, more inclusive term compared to diastolic HF, and that “huffing and puffing” (dyspnea and exercise intolerance) are the most common symptoms in patients with HFpEF.