



SEEING CLEARLY — FISH, OMEGA-3S AND VISION

Fish and shellfish are the richest sources of two remarkable omega-3 fatty acids, EPA* and DHA.* These substances are key components of fish oil that benefit the health of the heart, brain, blood vessels and immune system. DHA is essential for healthy brain development and vision, but humans cannot make this fatty acid. They must rely on the diet to provide adequate amounts. DHA is highly concentrated in the brain and retina of the eye, where it participates in visual function and cell-to-cell communication. We are now learning that DHA is important for healthy vision from early life to old age.

Visual Development in Pregnancy and Infancy

Long before birth, the developing eye begins to accumulate DHA. After birth, the infant's brain and nervous system continue to grow and add DHA. Eventually, the retina of the eye achieves the highest concentration of DHA of any tissue in the body.

The retina is "essentially a piece of brain tissue" lining the eye, according to eye expert, Helga Kolb, professor emerita at the University of Utah. It receives energy from light, which it changes to biochemical and electrical signals, and then sends to the brain for processing as "vision." The retina uses specialized photoreceptor cells called rods and cones to process light. Cones process color and daylight vision. Rods are responsible for night vision, motion detection, and peripheral vision. They are highly enriched in DHA, which is critical for their

function. If DHA is insufficient, visual acuity—the ability to distinguish fine detail—is reduced. Visual acuity develops rapidly in the first year of life and increases slowly thereafter until about 3 years of age. Having plenty of DHA enhances the maturation of the retina.

Infants receiving too little omega-3s during fetal development (pregnancy) have less DHA in their brain and retina compared with infants who have an adequate supply of these fatty acids. They also have poorer visual acuity. After birth, infants who are breastfed, and thus receive DHA from their mother's milk, have better visual acuity than infants fed formula without DHA. However, infant formula is now available with added DHA and arachidonic acid, (another fatty acid important in fetal and infant development). These supplemented formulas are strongly preferable to formulas without these fatty acids. Infants fed DHA-supplemented formula in early infancy usually have better visual acuity than those fed unsupplemented formula. Not all studies have observed such differences, however.

Preterm infants represent a special condition. These babies are born with less DHA in their tissues than term infants, because they missed a critical period when DHA and other fatty acids are transferred from the mother to the fetus. They also have very little body fat, so do not have stores of DHA. For these reasons, preterm infants are fed special nutrient-enriched formula containing DHA and arachidonic acid. Some mothers may provide breast milk as well. Once preterm infants are ready for regular formula, they should receive the age-appropriate formula with added DHA to ensure optimum brain and retina development.

Research suggests that the longer infants receive DHA, either from breastfeeding or supplemented formula, the better visual acuity they have at one year of age. Providing weaning foods with DHA contributes to better acuity, too. Once infants begin to eat solid foods, usually at 4 to 6 months of age, there are few foods with EPA and DHA. One choice is omega-3 eggs (yolks). As infants get older, they can obtain these fatty acids from canned, frozen and fresh fish. In addition, fish is easily digested and provides other vitamins and minerals too.

Visual Function in Aging

Eating seafood regularly throughout childhood and adulthood helps reduce the chance of developing other diseases that occur later in life, especially heart disease. It may also help maintain healthy vision.

Age-related macular degeneration: One condition that develops in some older people is age-related macular degeneration or AMD. It is more common in people who smoke, are obese, have light colored eyes, and have a family history of the disease. AMD is a progressive eye condition in which the central part of the retina becomes damaged. Central vision darkens, becomes blurry and gradually enlarges. AMD can lead to severe loss of vision and eventually blindness. As the condition develops, retinal pigment cells become damaged and destroyed, and this leads to greater damage in the retina. When DHA is abundant, the retina is protected.

DHA in the retina is used to make a substance called neuroprotectin D1. This substance protects retinal pigment cells from damage and destruction. DHA itself also helps protect these cells and prevents their loss. These mechanisms help explain why people who consume fish often—more than once/week—have a significantly lower chance of developing AMD. There is a report that patients with early AMD who were treated with omega-3 fatty acids and two other nutrition-related substances had improved visual function after one year. Almost no patients had their condition worsen. Studies with omega-3s in patients with AMD are very recent, so additional research is needed to verify this promising study.

Cataracts and Glaucoma: Cataracts interfere with vision because the lens of the eye becomes clouded. The result is blurry vision. In contrast, glaucoma results from increased pressure in the eye. It reduces peripheral vision. Research linking these conditions to omega-3 fatty acid status is limited, but what is available suggests that low intake of fish is associated with greater chance of developing cataracts. Patients with primary glaucoma were reported to have low levels of EPA and DHA in their blood. These associations need to be confirmed, but they are consistent with the importance of DHA in healthy eye function.

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* EPA or eicosapentaenoic acid; DHA or docosahexaenoic acid

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