

# Can Omega-3 Fatty Acids Prevent Blindness?

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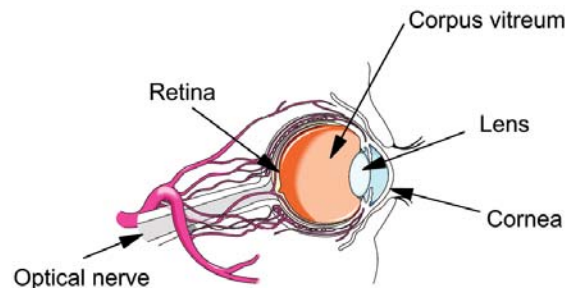
**Age-related macular degeneration is a disease of the eye in the elderly population usually leading to blindness. Besides age smoking, elevated blood lipids, hypertension and diabetes are risk factors for the development of the disease. Epidemiological studies have demonstrated that a frequent intake of seafood and antioxidants seems to prevent development of this disease. Studies are ongoing where omega-3 concentrates alone or in combination with lutein are tested in patients with early stage of age-related macular degeneration.**

More people are losing their eyesight than ever before, which is a function of the population getting older. Glaucoma, caused by chronic high intraocular pressure, used to be the most common cause of blindness. But age-related macular degeneration (ARMD) is now much more common, leading to a progressive loss of vision. The disease is rare before the age of 70, while about 10 per cent of seniors above the age of 80 have ARMD. The disease is located in the retina, which is the thin transparent layer of nerve tissue that forms the innermost coat of the eye (Fig. 1). The retina is an extension of the optic nerve, leading electrical impulses to the posterior part of the brain. In the retina, light energy is transformed into electrical impulses by conformational changes of the light-sensitive protein, rhodopsin. The omega-3 fatty acid, docosahexaenoic acid (DHA), plays a part in the generation of these impulses, which are later decoded in the visual cortex of the brain, making us perceive what we cast our eyes on.

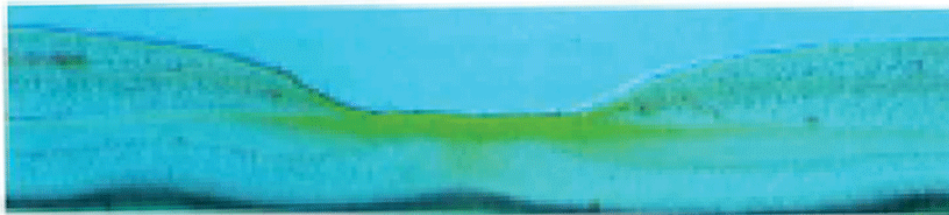
ARMD, which has two separate forms, the “dry” form and the “wet” form, starts with the loss of central vision, making it difficult to concentrate on what is in focus. The peripheral vision remains intact much longer, which means that people with ARMD can be trained to focus objects at the outer perimeters. Besides genetic disposition, it is generally accepted that smoking, elevated blood lipids, hypertension and diabetes are risk factors for the development of ARMD. These are the same risk factors as for the development of cardiovascular disease (CVD). Coincidentally, with its preventive effect on development of CVD it seems that a regular intake of fatty fish may also prevent the development of ARMD (1,2). Therefore, populations with a high intake of fish, such as the Japanese and Icelanders, have a low prevalence of the disease.

To understand the nature of this disabling disease, we have to know a little about the physiology of the eye. Functionally, the eye can be divided into two separate sections acting in sequence: the conduction of light and conversion of light energy into electrical impulses. The cornea is the window to the world, protecting the eye from dust and dirt. The lens enables us to focus on an object, projecting an image through the gel-like Corpus Vitreum to a defined area of the retina (Fig. 1). In the retina, light energy is converted into electrical impulses, which are continuously conducted through the optical nerve to the vision centre in the brain.

*Figure 1. Schematic anatomical picture of the eye. Images are focused in the eye lens and projected on the retina where the light energy of the image is transformed into electrical signals which are conducted in the optical nerve to the back of the brain.*

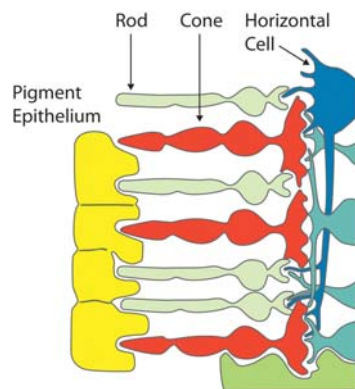


The part of the retina that provides the sharpest image is located just beside where the optic nerve diverges and is called the macula lutea, or yellow spot. Even though other parts of the retina can receive images, a proper and intact macula function is necessary for perfect vision. Fig. 2 depicts the macular part of the retina, which has a diameter of only 2-3 mm. The yellow colour is caused by the presence of so called xanthophylls, lutein and zeaxanthin, compounds with powerful antioxidant properties.



*Figure 2. An image of the macula lutea, a small spot in the retina where to the images are projected. This part of retina provides the sharpest definition of images and a normal macular function is essential for correct focusing of all visual information entering the eye.*

The photoreceptors of the retina (and fovea) are made up of so-called cones and rods (Fig. 3). In developmental terms, the cones represent a very old type of vision, and they are responsible for night vision, while the rods, which represent a highly developed type of vision, are active during the light-intense part of the day. The rods can distinguish colours which the cones cannot. The neurons and nerve fibres that conduct the visual signals for cone vision are considerably larger than for rod vision, and the signals are conducted to the brain two-to-five times as rapidly.



*Figure 3. An image of the photoreceptors of the eye with cones and rods. The rods are the most important receptors responsible for transformation of detailed information including colours. The cods are still important for night vision.*

The DHA content in the retina is the highest of any tissue in the human body, and it is located in the membranes of the photoreceptors, especially in the rods. It has been known for many years that premature babies who are given infant formula without marine omega-3 fatty acids do not have the same visual acuity as babies who are given mother's milk containing DHA (3). Later studies have demonstrated complex and very important actions of DHA in the retina: light energy generation of electrical signals by so called G-protein-coupled signalling, the prevention of cell death (apoptosis), antioxidative effects, anti-inflammatory, and anti-angiogenic effects (prevention of the formation of new pathological capillaries; 4).

The eye is at high risk of being damaged by oxidative mechanisms. One major reason for this is the intensive exposure to light throughout life. Visible blue light is believed to be a significant mechanism causing damage to the retina. Lutein and DHA have important functions in the retina, preventing damage from light, oxidation by free radicals and modern lifestyle risk factors. Lutein prevents high-energetic blue light beams from entering, while at the same time acting as an antioxidant and scavenger of free radicals. DHA, which is integrated in the membranes of rods but also in other cell membranes, also prevents cell death and damage by free radical to cell mitochondria, the energy factory of cells. There are probably also other preventive mechanisms for which DHA is responsible. Animal studies have confirmed this hypothesis, but we still lack results from clinical studies that demonstrate therapeutic effects against ARMD of giving either Lutein or DHA, or a combination of both. Several studies have been presented on the use of antioxidants to prevent oxidative damage. While vitamin E alone has not demonstrated any positive effects, the combination of antioxidants and zinc in a large controlled study slowed the progression of ARMD (5).

The results of two important clinical studies will be presented next year. In NAT 1, a high concentrate DHA product (EPAX1050TG in Reti-Nat™) will be tested against placebo. In the second study, NAT 2, the same DHA concentrate will be combined with lutein and tested against placebo. The results of these two French multi-centre studies will probably shed more light on the probable effects of DHA alone or in combination with lutein on the development of ARMD. Pending the results, people over the age of 50 should ensure they have a regular intake of fat fish and foodstuffs containing zinc. Or they should use food supplements with a high concentration of DHA in combination with zinc.



## REFERENCES AND NOTES:

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