

# Omega-3 fatty acids protect eyes against retinopathy, study finds

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Omega-3 polyunsaturated fatty acids protect against the development and progression of retinopathy, a deterioration of the retina, in mice. This is the major finding of a study that appears in the July 2007 issue of the journal *Nature Medicine*.

The study was a collaborative effort by researchers at Children's Hospital Boston, the primary pediatric teaching affiliate of Harvard Medical School, Brigham and Women's Hospital, Massachusetts General Hospital, the University of Goteborg in Sweden, and the National Eye Institute (NEI) and National Institute on Alcohol Abuse and Alcoholism (NIAAA) of the National Institutes of Health (NIH).

Paul A. Sieving, M.D., Ph.D., director of the NEI, said, "This study explores the potential benefit of dietary omega-3 fatty acids in protecting against the development and progression of retinal disease. The study gives us a better understanding of the biological processes that lead to retinopathy and how to intervene to prevent or slow disease."

The researchers studied the effect of the omega-3 fatty acids EPA and DHA, derived from fish, and the omega-6 fatty acid arachidonic acid on the loss of blood vessels, the re-growth of healthy vessels, and the growth of destructive abnormal vessels in a mouse model of oxygen-induced retinopathy. The retinopathy in the mouse shares many characteristics with retinopathy of prematurity (ROP) in humans. ROP is a disease of the eyes of prematurely born infants in which the retinal blood vessels increase in number and branch excessively, sometimes leading to

bleeding or scarring. Infants who progress to a severe form of ROP are in danger of becoming permanently blind. There are also aspects of the disease process that may apply to diabetic retinopathy, a disease in which blood vessels swell and leak fluid or grow abnormally on the surface of the retina, and age-related macular degeneration (AMD), a disease of the macula, the part of the retina responsible for central vision, and a leading cause of vision loss in Americans 60 years of age and older.

The researchers found that increasing omega-3 fatty acids and decreasing omega-6 fatty acids in the diet reduced the area of vessel loss that ultimately causes the growth of the abnormal vessels and blindness. Omega-6 fatty acid contributes to the growth of abnormal blood vessels in the retina.

To further test the apparent beneficial effect of omega-3 fatty acids, the researchers studied mice fed a diet modeled after a traditional Japanese diet (more omega-3 than omega-6 fatty acids) and mice fed a diet modeled after a traditional Western diet (lower amounts of omega-3 fatty acids). In addition, they studied mice genetically altered with a gene which mammals normally lack that converts omega-6 into omega-3 fatty acids. They found that the mice with higher amounts of omega-3 had a nearly 50 percent decrease in retinopathy.

Omega-3 fatty acids create chemical compounds known as bioactive mediators, which protect against the growth of abnormal blood vessels, a condition that characterizes some forms of retinopathy. In part, this occurs because these mediators suppress a type of inflammatory protein called tumor necrosis factor alpha (TNF-alpha). TNF-alpha is found in one type of cell, called microglia, that can be closely associated with retinal blood vessels.

“The retina has one of the highest concentrations of omega-3 fatty acids in the body,” said lead author and NEI fellowship recipient Kip M.

Connor, Ph.D., a postdoctoral research fellow at Children's Hospital Boston. "Given this, it is remarkable that with only a two percent change in dietary omega-3 intake, we observed an approximate 40-50 percent decrease in retinopathy severity."

"Our findings represent new evidence suggesting the possibility that omega-3 fatty acids act as protective factors in diseases that affect retinal blood vessels," said John Paul SanGiovanni, Sc.D., NEI staff scientist and the other lead author of the study. "This is a major conceptual advance in the effort to identify modifiable factors that may influence inflammatory processes implicated in the development of common sight-threatening retinal diseases."

These study results, SanGiovanni emphasized, are important because they provide a reasonable biological explanation for findings from a number of human studies on diet and retinal disease, and they identify low-cost and widely available nutrient-based treatment approaches that may show merit in future research on diseases that damage retinal blood vessels and nerve cells.

"The purpose of our study was to discover and describe the scientific basis for any possible protective role of omega-3 fatty acids against retinopathy," said Lois E. H. Smith, M.D., Ph.D., senior investigator of the study and associate professor of ophthalmology at Children's Hospital Boston, an affiliate of Harvard Medical School. "By identifying the fatty acids, lipids and growth factors involved in both the disease and protective processes, we hope to translate this work to influence the outcome in patients. Our study results suggest that increasing omega-3 fatty acid intake in premature infants may significantly decrease the occurrence of ROP. This changing of lipids by dietary means may also translate to AMD and diabetic retinopathy. If clinical trials find that supplementing with omega-3 fatty acids is as effective in protecting humans against retinal disease as demonstrated by the findings of this

study, this cost effective intervention could benefit millions of people."

The NEI is currently conducting the Age-Related Eye Disease Study 2 (AREDS2) that will, in part, assess the effect of omega-3 fatty acids DHA and EPA on the progression of AMD. In addition, an upcoming clinical trial at Children's Hospital Boston will test the effects of omega-3 supplements in premature infants.

Source: NIH/National Eye Institute

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