Protein transports nutrients believed to protect against eye disease

July 17 2008

Scientists have identified the protein responsible for transporting nutrients to the eye that are believed to protect against the development of age-related macular degeneration, a leading cause of vision loss in elderly Americans.

The research sought to illuminate the process by which compounds called lutein and zeaxanthin move from the bloodstream to the eye. Various studies have suggested that high concentrations of these two dietary compounds in particular, known as xanthophylls, have properties that can prevent macular degeneration.

These two nutrients are not made by the body and must be obtained through the diet. They are commonly found in green, leafy vegetables, such as kale, spinach, broccoli, zucchini and peas, and in yellow or orange fruits and vegetables, such as carrots, papaya, squash and peaches.

According to the study, the protein SR-B1, or scavenger receptor class B, type 1, plays a central role in transporting these nutrients from the bloodstream to cells in the eye.

"Our research to understand this mechanism might provide a greater appreciation for how one could intervene to possibly slow macular degeneration," said senior study author Earl Harrison, Dean's Distinguished Professor and chair of human nutrition at Ohio State University.

An estimated 10 million Americans have age-related macular degeneration, which gradually destroys sharp, central vision. The macula is located in the center of the retina, the light-sensitive tissue at the back of the eye that sends nerve signals to the brain. Deterioration of the macula blurs the central field of vision needed to drive and read. Treatment can slow vision loss, but does not restore vision, according to the National Eye Institute.

The research appears in the August issue of the *Journal of Lipid Research*.

Xanthophylls are a class of carotenoids, naturally occurring pigments that absorb blue light and sometimes function as antioxidants. Several studies have suggested that the ability of lutein and zeaxanthin to filter out damaging blue light, combined with their antioxidant properties, might protect against macular degeneration. The xanthophylls are known to accumulate in the macula region of the retina to form a yellow spot, and are referred to as macular pigment.

Though this xanthophyll concentration in the retina has been observed and associated with a lower risk for the disease, the cause of macular degeneration and the precise role these compounds play in protecting against vision loss remain a mystery.

But Harrison and colleagues had observed in their previous work that SR-B1 was involved when intestinal cells absorb these nutrients from the diet, and believed that the same transporter would be needed to help the nutrients travel to cells in the eye as well.

Lutein and zeaxanthin typically represent about 80 percent of the total carotenoid content of the retina, while beta-carotene, a major dietary carotenoid, is found in only trace amounts. That high concentration of one type of carotenoid over another also suggested that a specific

binding protein would be involved in the absorption process, Harrison said.

The scientists worked with a line of human retinal pigment epithelial cells from the lining of the retina, which served as a model for how macula cells function. The researchers introduced to these cells three types of carotenoids typically found in eye cells – the xanthophylls lutein and zeaxanthin, as well as beta carotene.

As expected, the retinal pigment epithelial cells absorbed much more of the xanthophylls than the beta carotene. To test the role of the SR-B1 transporter, the researchers used two different methods to block the protein's action. Under both experimental circumstances, blocking the SR-B1 protein also blocked the cells' absorption of the two xanthophylls by between 41 percent and 87 percent compared to absorption when SR-B1 activity was not inhibited.

"It's fairly safe to say that if you inhibit this transporter, you inhibit the uptake of xanthophylls. So that certainly suggests that this transporter is involved in that process," Harrison said.

Source: Ohio State University