

Brains with Alzheimer's disease have subnormal levels of important dietary antioxidants

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Alzheimer's disease is a progressive neurodegenerative disease estimated to affect 6 million Americans and 33 million people worldwide. Large

numbers of those affected have not yet been diagnosed.

A new study published in the *Journal of Alzheimer's Disease* by a Virginia Tech Carilion School of Medicine faculty member shows that brain levels of dietary [lutein](#), zeaxanthin, lycopene, and vitamin E in those with Alzheimer's disease are half those in normal brains. Higher dietary levels of lutein and zeaxanthin have been strongly linked to better cognitive functions and lower risk for dementia or Alzheimer's disease.

"This study, for the first time, demonstrates deficits in important dietary antioxidants in Alzheimer's brains. These results are consistent with large population studies that found risk for Alzheimer's disease was significantly lower in those who ate diets rich in [carotenoids](#), or had high levels of lutein and zeaxanthin in their blood, or accumulated in their retina as macular pigment," said C. Kathleen Dorey, professor in the Department of Basic Science Education at the medical school. "Not only that, but we believe eating carotenoid-rich diets will help keep brains in top condition at all ages."

Carotenoids and the healthy brain

Because normal brain functions and response to misfolded proteins constantly generate reactive oxidizing molecules, the brain is vulnerable to cumulative oxidative damage, which can be prevented by antioxidants supplied by a [healthy diet](#). Carotenoids are powerful antioxidants that are commonly found in colorful plants. Lutein is especially abundant in kale and spinach, and zeaxanthin is highest in corn and orange peppers.

Dorey and Neal E. Craft, of Craft Technologies in Wilson, North Carolina, first reported that the brain selectively accumulated carotenoids such as lutein, zeaxanthin, and beta-cryptoxanthin in 2004. Since then, researchers around the world have demonstrated better cognition in those with higher levels of lutein and zeaxanthin in their

macular pigment and lower risk for dementia in those with highest levels of lutein and zeaxanthin in their diet or accumulated in their macular pigment.

The Rush University Memory and Aging Project followed the diet and cognitive performance of more than 1,000 participants living in Chicago for more than a decade, assessing their intake of carotenoids, and found that those following the MIND diet—consuming higher levels of antioxidant-rich fruits, nuts, vegetables, and fish, and lower levels of meat and sweets—had reduced risk for Alzheimer's disease diagnosis, higher cognitive performance before death, and less Alzheimer's disease-related brain pathology. Moreover, those with the highest intake of total carotenoids or lutein/zeaxanthin over a decade had 50% lower risk for Alzheimer's disease.

Correlation between carotenoids and brain protection

Although studies had strongly implicated the possibility that carotenoids may protect the brain against damage contributing to Alzheimer's disease, there has been no evidence that brain carotenoids correlated with the disease. The Dorey-Craft report in the June issue of the *Journal of Alzheimer's Disease* has filled that gap.

In a study of carotenoids in brains with and without Alzheimer's disease brain pathology, the Dorey-Craft team demonstrated that brains with Alzheimer's neuropathology have significantly lower levels of lutein, zeaxanthin, and lycopene and tocopherols. Concentrations of lycopene, zeaxanthin, and retinol were half those found in age-matched brains with no Alzheimer's disease pathology.

Diagnosing and limiting future Alzheimer's disease

This new evidence of selective [carotenoid](#) and tocopherol deficiencies in the brains of subjects with Alzheimer's disease adds further support to the growing evidence that a greater dietary intake of carotenoids may slow cognitive decline prior to—and possibly following—a diagnosis with Alzheimer's disease.

Research also has shown that the retina selectively accumulates lutein and zeaxanthin from the diet, forming visible yellow macular pigment that enhances vision and protects photoreceptors. By noninvasively measuring patients' macular pigment optical density, researchers can estimate the concentration of lutein and [zeaxanthin](#) in the [brain](#).

"Recent advances in new therapies for Alzheimer's disease show exciting promise as an effective way to slow [disease](#) progression," Dorey said. "I'd be thrilled if our data motivated people to keep their brains in optimum condition with a colorful diet with abundant carotenoids and regular exercise. Available studies suggest this may also reduce risk for dementia."

More information: C. Kathleen Dorey et al, Low Xanthophylls, Retinol, Lycopene, and Tocopherols in Grey and White Matter of Brains with Alzheimer's Disease, *Journal of Alzheimer's Disease* (2022). [DOI: 10.3233/JAD-220460](#)

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