

The relationships between macular pigment optical density and its constituent carotenoids in diet and serum.

Nolan JM, Stack J, O'connell E, Beatty S.

Macular Pigment Research Group, Department of Chemical and Life Sciences, Waterford Institute of Technology, Cork Road, Waterford, Ireland.

PURPOSE: Lutein (L) and zeaxanthin (Z) are two dietary carotenoids that accumulate at the macula, where they are collectively known as macular pigment (MP). There is a biologically plausible rationale, with some supporting evidence, that MP may protect against age-related maculopathy (ARM). This study was undertaken to investigate the relationship between dietary intake of L and Z, serum concentrations of these carotenoids, and MP optical density in 828 healthy Irish subjects. **METHODS:** Dietary intake of L and Z was assessed with a validated food-frequency questionnaire, and serum concentrations of these carotenoids were quantified by high-performance liquid chromatography. MP optical density was measured psychophysically, using heterochromatic flicker photometry. Demographic data, lifestyle data, and general health status, were also recorded by questionnaire, with particular attention directed toward risk-factors (established and putative) for ARM.

RESULTS: The relationships between MP optical density, serum concentrations of L (and Z), and dietary intake of L (and Z) were positive and statistically significant when analyzed for the entire study group ($r = 0.136-0.303$; $P < 0.01$ for all). Subjects with a clinically confirmed family history of ARM, current heavy cigarette smokers, subjects aged more than 53 years, and subjects with a body mass index (BMI) >27 , did not demonstrate a positive and significant relationship between MP optical density and serum concentrations of Z ($r = 0.041$, $r = 0.001$, $r = 0.074$ and $r = 0.082$, respectively; $P > 0.05$ for all). However, there was a positive and significant relationship between MP optical density and serum concentrations of L in the presence of all these risk factors ($r = 0.165$ to 0.257), except for current heavy smokers ($r = 0.042$; $P > 0.05$). **CONCLUSIONS:** For subjects at increased risk of ARM (e.g., subjects with a clinically confirmed family history of ARM, current heavy cigarette smokers, subjects aged > 53 years and subjects with a BMI > 27) retinal capture and/or retinal stabilization of Z appears to be compromised, whereas retinal uptake and/or stabilization of L appears to be compromised in current heavy smokers only. Given the lack of MP in association with risk for ARM, the findings indicate that a retina predisposed to this condition may have an impaired ability to accumulate circulating Z.