



Relative bioavailability of lutein and zeaxanthin in the presence of Omega-3- supplements and oxidative stress levels in humans

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Lutein and zeaxanthin (LZ) are the major constituents of macular pigment (MP), helping to protect the human retina from blue light and oxidative damage⁽¹⁾. Many studies have suggested that higher concentrations of retina LZ may reduce the risk of age-related macular degeneration (AMD) and improve retinal health^(1–3). MP and serum L have shown positive linear response with L dose⁽⁴⁾ but the combined effect (LZ + omega-3 suppl) has not been fully explored in healthy Australian adults. Understanding their bioavailability in relation to the effect of omega-3 fatty acid intakes along with LZ supplements could provide a useful indication of the potential to reduce the risk of AMD, preserve vision, and improve retinal health. LZ uptake and the associated oxidative stress levels were evaluated in two groups fed with commercially sourced supplements. The control group was given only LZ, while the intervention group was given LZ combined with omega-3 supplements containing Eicosapentaenoic acid (EPA) and Docosahexaenoic acid (DHA). 10 men and 6 women with an average age of 31.4 ± 1.3 yrs participated in this randomised, non-blinded controlled study for a total of 19-d. The control group (9) consumed the LZ supplement (12mg/d) only, while the intervention group (7) consumed the LZ supplement along with 900mg/d of an omega-3 supplement (540mg EPA + DHA 360mg). Each group adhered to a comprehensive low-carotenoid and omega-3 diet list for the 12-d intervention period and the 7-d washout period. Participants reported daily foods consumed in their diet logbooks, and Automated Self-Administered 24 diet assessment log over the study period. The body composition of each subject from the two groups was assessed before and after the study using a SECA body composition analyser and blood samples (2-time point) collected over a 12-d test period. Mean \pm SEM for serum LZ ranged from $2.23 \pm 0.24 - 2.98 \pm 0.24 \mu\text{g/ml}$ for the control group and $1.10 \pm 0.21 - 3.02 \pm 0.73 \mu\text{g/ml}$ for the intervention group. Percentage change in serum LZ concentration from ($T_0 - T_{312h}$) and ($T_{312h} - T_{456h}$) were 26% and 34% (control) and 139% and 175% for (intervention), respectively. The Area Under the Curve (AUC_{0-456h}) differed significantly ($P < 0.0469$) during the entire study period (between groups) and related to the cumulative effect of intakes at various times of blood draw. LZ from the intervention group was 68% more bioavailable than the control group. The highest peak relative response in subjects in the control group was $\approx 33\%$ (a 9.1-fold increase from baseline) at $AUC_{(168-312h)}$ and $\approx 46\%$ (a 6.6-fold increase from baseline) at $AUC_{(312-456h)}$ for the intervention group. No significant ($p > 0.05$) effect of omega-3-supplement addition on oxidative stress levels was observed. Omega-3- addition to intakes of supplement LZ was responsible for the increased absorption (intervention) observed but did not affect oxidative stress levels and the Red Blood Cell omega-3-status.

Keywords: lutein; zeaxanthin, bioavailability; Omega-3-fatty acid

Ethics Declaration

Yes

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