LUTEIN STUDY 2

IMPROVED LEVELS BDNF. . .LEARNING, MEMORY, AND HIGHER COGNITIVE PROCESSES

This study was designed as a double-blind, placebo controlled, 12-month lutein supplementation trial[7] assessed the effects on visual performance, Total antioxidant potential and BDNF. 59 subjects was followed throughout the study period, with plans to recruit 80 initially (assuming some attrition). Two levels of daily lutein supplement (Lutemax 2020): 10 mg & 20 mg were used, with subject numbers as follows: 20 mg lutein group (n = 25), 10 mg lutein group (n = 25), and placebo (n = 10).
The following were specific aims for the study: 1) Characterize macular pigment (MP) levels, and 2) Assess visual performance parameters thought to be affected by ocular / brain lutein, including:

- Speed of processing
- Contrast sensitivity
- Visual discomfort
- Disability glare assessment
- Photostress

The results were that:

- Both doses of Lutemax 2020 significantly improved contrast sensitivity (CS) compared to baseline, and at 12 months both doses had a significant effect on CS over placebo.
- Lutemax2020 improved Glare performance both doses significantly changed CS from baseline. At 6 and 12 months both doses have significantly improved glare performance over placebo.
- Lutemax2020 improved better photo stress recovery both doses significantly changed CS from baseline. At 6 and 12 months , 20 mgL/4mg Zi have significantly improved better photo stress over placebo.
- Lutemax2020 improved MPOD both doses significantly changed CS from baseline. At 6 and 12 months , 10 mg L/2 mg Zi and 20 mgL/4mgZi have significantly improved MPOD over placebo.

In addition, Lutemax2020 improved levels of Brain-derived neurotrophic factor (BDNF), a neurotrophin that is particularly active in hippocampus, cortex, and basal forebrain – areas that are involved in learning, memory, and higher cognitive processes. Furthermore BDNF has been shown to support synaptic plasticity, and

is generally increased following healthy behaviors (e.g. physical exercise), and decreased during times of psychological stress. In this study, the accumulation of lutein in the retina (macular pigment) was assessed and compared to serum BDNF. Results showed that BDNF in lutein- supplemented subjects was found to significantly increase over the 6-month study period ($p = 0.0243$), whereas the placebo group did not change ($p = 0.874$). After 6 months of lutein supplementation, an analysis of the change in macular pigment optical density (MPOD) versus the change in BDNF produced a significant positive correlation ($p < 0.001$). This indicates that favorable response to lutein supplementation in the retina (and presumably the brain) leads to proportion increases in systemic levels of BDNF. Because neuro- inflammation has been shown to reduce BDNF levels, the anti-inflammatory capability of lutein is a plausible mechanism for this effect.

Lutein supplementation also enhanced antioxidant levels after 6 months compared to placebo. Both lutein/zeaxanthin treated groups had significant increase in total antioxidant level over placebo.

[7] Stringham JM, O'Brian KJ, Stringham NT. Macular carotenoid supplementation improves disability glare performance and dynamics of photostress recovery. *Eye and Vision*. 2016;3:30.

[6] Stringham J. Effects of three levels of lutein supplementation on macular pigment optical density, psychological stress levels, and overall health. Nutritional Neuroscience Laboratory, University of Georgia. Unpublished. 2016:17 pgs.