Astaxanthin Treatment on Iron-Sensitized Oxidative Stress

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Age-related macular degeneration (AMD) is a neurodegenerative eye disease that impacts roughly 200 million people worldwide. It occurs in the macula, which contains a dense number of photoreceptor cones and rods, essential to vision. Degeneration starts with the accumulation of iron, which contributes to the formation of drusen, a fatty protein that is an indicator of AMD, and toxic hydroxyl radicals that result in ferroptosis. The Age-Related Eye Disease Study 2 (ARDES2) supplement is the current solution for AMD, which slows its progression, and, due to its high zinc concentration, it is considered unsafe to consume consistently. This study examined the antioxidants, astaxanthin and trolox, hypothesizing that they would result in protective effects against an AMD model using 661W mouse photoreceptor cells. Cells were seeded in a 96-well plate and treated with astaxanthin and trolox after exposure to ferric ammonium citrate (FAC), which induces iron overloading. The experiment quantified cell viability, oxygen-containing free radicals, and lipid peroxidation. The results indicate that both astaxanthin and trolox prevented further cell degeneration and even showed signs of cell recovery, with astaxanthin improving metabolic health by 51% and trolox by 49% compared with the control group. Future implications of this study could integrate astaxanthin and trolox into the ARDES2 formula to potentially reduce harmful zinc concentrations by either replacing or adding to current ingredients from the same families as astaxanthin and trolox. Furthermore, the in vitro FAC model can be applied to studies of other neurodegenerative diseases, as similar oxidative processes occur in these diseases.

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