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Keely Goodgame

The Effect of 670 nm LED Photobiomodulation on the Growth of Mitochondrial Mutant Saccharomyces Cerevisiae

San Jon High School, San Jon, New Mexico

Abstract: Therapeutic light-emitting diodes (LED) are a recent form of light therapy. This so called “photobiomodulation” has been shown to accelerate wound healing and to increase cell growth in tissue cultures. Both cell division and growth require energy produced through the cellular respiration occurring in mitochondria. Cytochrome-c oxidase, the terminal enzyme complex of the mitochondrial electron transport chain, creates the electrochemical gradient which provides the force to produce ATP (Capaldi, 1990). The theorized energizing of cytochrome complexes in the electron transport systems by the photobiomodulation have not been documented (Eells, et al., 2002). The purpose of this experiment is to test the effects of a 670nm LED light on a S. cerevisiae strain deficient in mitochondrial DNA and a strain deficient in cytochrome-c oxidase subunit IV, to elucidate the theorized mode of action. S. cerevisiae is a well documented eukaryotic model with available mutant and wild-types to test specific cytochrome-c oxidase complexes. It was hypothesized that the 670nm LED light would improve the growth and longevity of both mutant strains. The wild-type and mutant yeast were photoirradiated with a 670nm LED light at 80seconds/4joules per cm2, 2X and 3X a day, using a Quantum© warp 10 light for a period of 86 hours. Colonies were counted at 12 hours, 24 hours, and 86 hours. The photobiomodulation significantly increased the growth and longevity of cytochrome-c oxidase subunit IV S. cerevisiae at both levels of irradiation, supporting the hypothesis. Further research should include a suitable model for a mitochondrial respiration deficient disease.