The Impacts of Resveratrol and Escherichia coli Dietary Restriction on the Behavioral and Pathological Aspects of Alzheimer's Disease Using Caenorhabditis elegans as a Model

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Alzheimer’s disease (AD) is projected to affect 150 million people by 2050 and is characterized by the accumulation of neurotoxic beta-amyloid (Aß) plaques in the brain, leading to severe memory and motor decline. Recent advances in AMP-activated protein kinase (AMPK) research suggest that AMPK activation reduces Aß accumulation by inhibiting the mTOR pathway to restore autophagy. To investigate this relationship, the current study examined the individual and complementary effects of two AMPK modulators—resveratrol and dietary restriction (DR)—on paralytic behavior and Aß pathology in CL2006 C. elegans (unc-54/human Aß1-42 minigene). Done in a high school laboratory, the experimental procedure followed the NGM-Dead method, which ensures consistent drug concentration and treatment uptake throughout the study. A paralysis assay was used to model the behavioral symptoms of Alzheimer’s disease (AD). To assess pathological changes, nematodes were stained with Thioflavin T and analyzed using fluorescent microscopy. Total corrected cell fluorescence (CTCF) and change in CTCF were measured to quantify amyloid accumulation. Data was analyzed with a chi-squared test, ranked-ANOVA, and post hoc Tukey's HSD, revealing significant differences between groups and interesting results. Notably, the resveratrol/DR group exhibited significant improvements in both paralytic behavior and reductions in cell fluorescence relative to all other groups, achieving a 98.7% decrease in CTCF over time. In contrast, the single-modulator treatments were less effective, potentially reflecting limitations in mTORC2-regulated actin cytoskeleton dynamics. These findings highlight the viability of complementary AMPK modulation as a promising therapeutic strategy for AD and other neurodegenerative diseases.

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