CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY

Name(s)

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Project Number

S1202

Project Title

Can the Longevity Compound Rapamycin Rescue Brain Tissue in Age-Related Diseases in Old Mice?

Abstract

Objectives

Rapamycin is an immunosuppressant that inhibits mTOR (the mammalian target of rapamycin) and extends lifespan in organisms such as worms, flies, and mice. While it is known that rapamycin s effects on cardiac and skeletal muscle contribute to lifespan extension, it is unknown if rapamycin s effects on the brain contribute to lifespan extension. Some of the proteins associated with rapamycin have decreased while other proteins have increased in the brain tissue of old mice. Moreover, several of these proteins have been implicated in various age-related diseases, such as Alzheimer s disease and Huntington s disease. However, these proteins have not been jointly studied with rapamycin treatment in age-related diseases. In this experiment, I utilized wet lab techniques, including but not limited to Western blots, to investigate glial fibrillary acidic protein (GFAP), peroxisome proliferator-activated receptor gamma coactivator 1-alpha (PGC-1a), fibroblast growth factor 21 (FGF21), and zinc metallopeptidase STE24 (ZMPSTE24) in the brain tissue of old mice treated with rapamycin to see if rapamycin could rescue the proteins by affecting the protein expression.

Methods

Brain tissue samples from male old mice were obtained; six samples were from vehicle (control, untreated) mice while six samples were from mice that received 8 mg/kg of rapamycin I.P. (high dose) injections every other day. Wet laboratory techniques such as tissue cryohomogenization and Western blots (gel electrophoresis, protein transfer, chemiluminescent detection, and film development) were used to obtain data.

Results

GFAP expression in the brain tissue was not affected by the rapamycin treatment. PGC-1a had greater protein expression in the brain tissue of the mice treated with rapamycin. Rapamycin may have increased the protein expression of FGF21 in the brain tissue.

Conclusions

Rapamycin rescued PGC-1a in the brain tissue of the old mice, which suggests that rapamycin could be used in treatment for Alzheimer s disease, Huntington s disease, or ALS. Rapamycin may rescue FGF21 in the brain tissue, and this suggests that rapamycin could be used in treatment for metabolic disease. Rapamycin did not rescue GFAP in the brain tissue, which suggests that rapamycin may not be able to treat Alexander disease. Rapamycin did not rescue ZMPSTE24 in the brain tissue.

Summary Statement

The longevity compound rapamycin rescues several important proteins in the brain tissue of old mice, which suggests that it could potentially be used in treatment for various age-related diseases, including neurodegenerative diseases.

Help Received

Used lab equipment in Kennedy Lab at the Buck Institute for Research on Aging under the supervision of Dr. Chen-Yu Liao