CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

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Project Number

36885

Project Title

Effects of Curcumin and Tannic Acid on Amyloid Beta Aggregation: A Novel Potential Therapy for Alzheimer's Disease

Abstract

Objectives/Goals

Alzheimer's disease (AD) is characterized by the accumulation of amyloid beta peptides, which aggregate into toxic oligomers and senile plaques in the brain causing neurodegeneration. The compounds curcumin, a principle curcuminoid in the spice turmeric, and tannic acid, a natural clarifying agent found in red wine, have a broad spectrum of anti-oxidant, anti-inflammatory, and anti-amyloidogenic activities in vivo. The current study aimed to demonstrate that individual or combined doses of curcumin and tannic acid could inhibit aggregation and cause disaggregation of amyloid beta peptides in vitro.

Methods/Materials

Amyloid beta(1-42) was treated with individual and combined doses of the test compounds (curcumin and tannic acid) dissolved in 20% DMSO. Thioflavin T, a fluorescent dye which binds to amyloid beta fibrils, was used and fluorescence was monitored with a Tecan Fluorescent Microplate Reader. Samples were incubated at 37 C for 180 min and readings were taken every 5 min with 15 sec shaking between each cycle to facilitate aggregation.

Results

Tannic acid inhibited amyloid beta aggregation (IC50 = 42.0 uM) to a greater extent than curcumin (IC50 = 81.7 uM). Curcumin and tannic acid at 30 uM had an additive inhibiting effect on amyloid beta aggregation when combined. When amyloid beta was pre-fibrillated for 24 hours, curcumin disaggregated fibrillar amyloid beta approximately 23% better than tannic acid. Moreover, combined doses of curcumin and tannic acid at 30 uM had a synergistic effect on fibrillar amyloid beta disaggregation.

Conclusions/Discussion

Curcumin and tannic acid are most effective in disaggregating amyloid beta and preventing the formation of fibrils when combined. Both compounds are therefore attractive potential therapies for AD as they could reduce existing amyloid beta plaques while preventing the creation of new amyloid beta deposits.

Summary Statement

This project demonstrated that combined doses of curcumin and tannic acid could inhibit the formation of amyloid beta fibrils and disaggregate pre-formed fibrils in vitro providing a novel attractive therapy for Alzheimer's Disease.

Help Received

Dr. Nikki Malhotra provided most of the equipment and reagents needed for conducting this project while Amgen Inc. gave me access to the Tecan Microplate Reader. AnaSpec donated the amyloid beta(1-42) peptides and SensoLyte aggregation kit. Thermo Fisher Scientific donated the lab grade tannic acid.