CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

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Project Number

S1524

Project Title

Novel HIV & Tuberculosis Combination Therapy: Proliposomal Formulation of Efavirenz & Glutathione for the Dual-Infected

Abstract

Objectives/Goals

With over 37 million people affected by the HIV virus globally and subjected to ineffective treatment, the current problem of low bioavailability of antiretroviral drugs must be addressed. To aid, is the antioxidant glutathione which impairs function of Mycobacterium tuberculosis. The objective is: will a proliposomal formulation of the antiretroviral efavirenz and the antioxidant glutathione confer higher bioavailability thereby aiding HIV & Tuberculosis infected individuals?

Methods/Materials

500mg of Efavirenz was used, with 500mg glutathione antioxidant. To stabilize lipid membranes, 125mg cholesterol was used. After finalizing a 1:1:2:0.25 ratio of GSH:EFZ:DMPC lipid: cholesterol, 1 gram of DMPC lipid was required for the formulation. 600mL of ethanol and 400mL nanopure water were required to dissolve constituents of the formulation in; this solution was rotated in a Rotovapor apparatus above 50C water bath to evaporate solvent from the drug-containing liposomes. 212.5mg of dried powder obtained was filled in capsules and dissolution (in vitro) testing conducted with a 6.8pH sodium-phosphate buffer at 37C. The dissolutions of three formulation capsules were conducted in parallel to those of three pure-drug capsules (control). Samples of liquid media of each of the six vessels were taken at 15,30,45, and 60 minutes. These samples were run through HP 1100 HPLC for high pressure liquid chromatography analysis. Malvern Zeta and particle sizing was also conducted to ensure drug encapsulation, and lipid membrane stability.

Results

On average, the control capsule released 30.26% of its glutathione amount, and 26.81% of efavirenz content at the end of an hour (Vessels #1-3). In dissolution Vessels #4-6, the formulation released 57.13% and 65.14% of GSH and EFZ drug respectively. Particle size of empty liposomes read 490.8 nm, whereas the formulation particle size read 728.1 nm. 11.4mV average Zeta potential was obtained for formulation membranes, indicating membrane stability and that aggregation/disintegration will not occur.

Conclusions/Discussion

My hypothesis was affirmed by results found, as a formulation of efavirenz and glutathione conferred higher bioavailability. Glutathione bioavailability of the formulation was 188 percent of the control, and efavirenz absorption 242.97 percent of the control. These results promise lesser use of antiretroviral equals affordability and effective cures for patients.

Summary Statement

Solving current underlying problem of low drug absorption in HIV patients using a novel method, while providing a Tuberculosis cure to immunocompromised AIDS patients.

Help Received

Dr. Guru Betageri of Western University of Health Sciences provided me with the lab equipment and funding required to conduct my independent experiment, thus encouraging my unique scientific pursuits.