



CALIFORNIA STATE SCIENCE FAIR 2014 PROJECT SUMMARY

Name(s) Rajiv Movva	Project Number 34756
Project Title Preventing Excessive Blood Sugar Levels in Diabetes Patients: An Inhibition Mechanism of Alpha-Amylase with Flavonoids	
Abstract Objectives/Goals Diabetes mellitus, a disease affecting carbohydrate metabolism, is characterized by an inability of the endocrine system to properly regulate the amount of glucose in the bloodstream. In 2011, 90-95% of the 26 million cases of diabetes in US were type 2. Type 2 diabetes is distinguished by the cells being partially desensitized to insulin. An enzyme known as alpha amylase is responsible for breaking up large starch molecules to their glucose monomers. FDA approved amylase inhibitors are available to help reduce sudden increases in blood glucose after carb-filled meals, however 50% of patients report side effects such as abdominal pain and nausea/vomiting. This project aims at finding the value of naturally occurring plant-based inhibitors of amylase that could be used in the place of prescription agents. I decided to focus on three flavonoids hesperidin, naringin, and quercetin that are widely present in fruits, vegetables, and spices. Methods/Materials For each of the trials, a starch solution at the concentration of 50mg/ml and amylase at a concentration of 1.25mg/ml were used. For each flavonoid, concentrations of 1.25, 2.5, and 5mg/ml were tested. The amylase activity was tested quantitatively using a titration with Benedict's reagent. The amount of solution required to form a precipitate in the Benedict's solution after 5 minutes was compared to the positive control group to determine inhibitory indices. For each group, tests were run in triplicates to assure reproducibility, with 36 tests in total. Results The hesperidin inhibited the enzyme by 30%, 51%, and 64% at the concentrations of 1.25, 2.5, and 5 mg/ml respectively. Similarly, the naringin inhibited the enzyme by 25%, 48%, and 61% respectively. Finally, the quercetin inhibited amylase by 32%, 53%, and 68% respectively. Conclusions/Discussion My results suggest that all three flavonoids are practicable inhibitors of alpha amylase, and quercetin and hesperidin worked the best. Based on my results, I have determined that around 2-3 servings of fruits/vegetables containing the flavonoids should be consumed (or equivalent amounts in spices) to attain 50% inhibition of amylase. Moving forward, these findings could help lead to the development of a rational treatment of type 2 diabetes and prediabetes in which flavonoid-rich fruits and vegetables are incorporated into one's diet.	
Summary Statement My project proved that flavonoids, compounds found in fruits, vegetables, and spices, are viable inhibitors of alpha amylase, and therefore they could be used to assist Type 2 Diabetes patients in controlling their blood glucose levels.	
Help Received I would like to thank my mother for helping make my board, Mrs. Kristen Morgensen of The Harker School for helping me attain my materials, and Mr. Akhil Mehta for providing guidance and support.	