CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

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Project Number

S1403

Project Title

What Is the Optimal Ratio of Glucose to Fructose that Prevents Fructose Malabsorption?

Abstract

Objectives/Goals

Chronic abdominal pain occurs in 30% of children (ref. 1). A symptom of fructose malabsorption is abdominal pain (AP). Fructose is commonly used as a sweetener. Initial studies for this project showed that 70% of human subjects malabsorbed 50g of fructose dissolved in 8oz of water and that none of the same subjects malabsorbed 50g of fructose and 40g of glucose in 8oz of water. This proved that the presence of glucose facilitates fructose absorption in humans. The objective of this project was to find the optimal ratio of fructose to glucose that prevents fructose malabsorption and AP.

Methods/Materials

10 subjects, 9 years or older were used. All subjects were fructose intolerant. 3 different ratios of fructose to glucose in 8oz water were tested. 50g fructose/0g glucose, 50g fructose/12.5g glucose, 50g fructose/25g glucose, 50g fructose/40g glucose and 0g fructose/0g glucose (as control). Fructose malabsorption was assessed by breath hydrogen analysis and gas chromatography following established procedures (ref. 2).

Results

100% of subjects malabsorbed 50g fructose/0g glucose. 90% of malabsorbers had AP.
50% of subjects malabsorbed 50g fructose/12.5g glucose. 80% of malabsorbers had AP.
20% of subjects malabsorbed 50g fructose/25g glucose. 50% of malabsorbers had AP.
0% of subjects malabsorbed 50g fructose/40g glucose. 0% had AP.
Subjects served as their own controls. 0% of subjects demonstrated malabsorption or AP with water.

Conclusions/Discussion

Results showed that a 55% fructose to 45% glucose mixture eliminated malabsorption of fructose and AP in all subjects. Adding smaller amounts of glucose improved the absorption of 50 g of fructose, but did not eliminate malabsorption and AP in all subjects. The presence of glucose clearly improves the absorption of fructose by the human intestine in a dose dependent fashion. This would be consistent with fructose, in the presence of glucose, being absorbed by a different mechanism then when fructose is absorbed in the absence of glucose. This study suggests that adding glucose to high fructose foods could have therapeutic benefits in people with chronic AP, as fructose malabsorption may be an important factor in people with AP.

Summary Statement

This project showed that the addition of glucose to fructose improved or eliminated fructose malabsorption and associated gastrointestinal symptom of abdominal pain in humans.

Help Received

Dad showed me how type data into Excel; California Digestive Disease Center provided the gas chromatograph and breath hydrogen analysis supplies under the direction of Dr. Judy Davis; mom helped with the application; Mrs. Coburn, chemistry teacher, reviewed my project.