Name(s)	**Project Number**
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Project Title

Diabetes, A Bloody Mess: Non-Invasive Glucose Testing

Abstract

Objectives/Goals

The objective of this study is to determine the most effective, non-invasive method to measure glucose for diabetics by comparing the concentration of glucose in saliva and tears to blood. Most diabetics measure their glucose levels 2-6 times daily using a glucometer, lancing device, and test strips, but this method is painful and irritating. A non-invasive glucose testing method is needed to make it more convenient for diabetics to measure their glucose levels.

Methods/Materials

To measure the glucose concentration in the participant's blood, a glucometer, a drop of blood produced by a lancing device, and test strips were used. However, the glucometer could not measure the glucose concentrations in tears and saliva because the meter said the levels were too low to read.

Benedict's Solution, a blue reagent that changes color based on the presence of reducing sugars, was used to determine the concentration of glucose in the control solutions, tears, and saliva. When combined in a 5:1 ratio of Benedict's solution to the controls, saliva, or tears and placed in a boiling water bath, the Benedict's solution reacts and changes color from blue to red based on the concentration of sugar. As a result, a copper oxide precipitate forms, and is filtered out of the solution.

Controls of 0 (negative control), 50, 100, 250, 500, 750, and 1000 mg/dl (positive control) of glucose and 1ml of saliva and tears were used.

A colorimeter measured the intensity of the solutions' color by calculating how much of a red wavelength was absorbed by the blue solutions. (A lower absorbance indicates a higher glucose concentration because more of the copper oxide was filtered out and vice versa for solutions with a lower glucose concentration.)

Results

Three replicate trials were conducted, and a linear equation was used to calculate the glucose concentrations in tears and saliva. The data shows that blood had an average of 102mg/dl, tears had 132mg/dl of glucose, and saliva did not have any glucose.

Conclusions/Discussion

Tears proved to be an effective alternative method for glucose testing, while saliva did not. However, more precise methods are required to find a definitive correlation between the glucose concentrations in tears, saliva, or blood. Laboratories across the U.S. are currently creating innovative, non-invasive methods and devices to measure glucose using tears and saliva.

Summary Statement

Tears proved to be an effective alternative method for diabetes glucose testing while saliva did not contain any glucose and proved ineffective.

Help Received

I did not receive any help for this experiment and researched and conducted it independently.