# CALIFORNIA STATE SCIENCE FAIR
# 2015 PROJECT SUMMARY

**Name(s)**

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**Project Number**

35634

**Project Title**

## Can We Measure the Concentration of Glucose in Our Eye Tears by Simple Means?

**Abstract**

**Objectives/Goals**

About 347 million people worldwide have diabetes. More than 80% of diabetes deaths in the world occur in low income countries because of lack of awareness. Current testing methods of measuring glucose are complex, expensive and invasive. The objective of this project is to find out if we can measure the concentration of glucose in tears by simple, non-invasive and affordable means. If so, we also would like to determine if there is a measurable difference between diabetic/non-diabetic participants. Our study tests the idea of glucose in tears as an alternative.

**Methods/Materials**

The two methods we used to measure the glucose are Brix Refractometer and Diastix Reagent Urine Strips.

We researched that a simple optical device (Refractometer) can measure sugar percentage in fluids on a brix scale.

We then used a Refractometer to base line if fluid samples (water, sugar solution, soda, wine etc.,) have sugar content and if yes, how much on the brix scale. The data showed fluid samples had sugar to various degrees on scale. Next we tested tears from participants of various ages ranging from age 2 to 75 years, who are non-diabetic/diabetic.

We dropped the second method since the urine strips didn#t work as they react only to Ketone acid which is not present in eye tears.

**Results**

From the base line data we gathered on various fluids, we conclude that the Refractometer does fairly and consistently detect the varying sugar content. Now for the second and important part of our project based on the limited sample set of 16 participants across various ages who are non-diabetic/diabetic. We can say that tears have glucose content in the range of 2.5% to 5.0% on the Brix scale. 9 (56%) participants who are identified as non-diabetic had the reading less than 3% on the brix scale. The remaining 7 (44%) who are diabetic had reading above 3.2% on the brix scale.

**Conclusions/Discussion**

From the gathered data we concluded that tears have glucose and can be measured by simple, non-invasive and affordable means. The data also tells us that diabetic participants have a higher percentage of glucose as compared with non-diabetic participants when measured on brix scale.

We would like to continue this study with large population of participants and also correlate our brix scale

**Summary Statement**

To measure the concentration of glucose in human eye tears by simple means.

**Help Received**

Thanks to our teacher for mentoring us and our parents for driving us around to gather data.

Preliminary