



# CALIFORNIA STATE SCIENCE FAIR 2016 PROJECT SUMMARY

<b>Name(s)</b> <b>Kimberly A. Stahovich</b>	<b>Project Number</b> <b>S0624</b>
<b>Project Title</b> <b>What Are the Effects of External Carbohydrate Contaminants on Blood Glucose Measurements Made with a Glucometer?</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> The objective of this study is to determine if, and to what extent, carbohydrate contaminants on the skin raise blood glucose measurements made with a glucometer.</p> <p><b>Methods/Materials</b> Carbohydrates (e.g., syrup and jelly), glucometer, syringes for measurement, and simulated blood (glucometer control solution). Experiment 1 simulates a typical life event: a finger is dipped in a carbohydrate and is quickly wiped off, a drop of simulated blood is applied, and the glucose level is measured with a glucometer. Experiment 2 is similar to Experiment 1, but the finger is wiped thoroughly. Experiment 3 examines tiny, quantified amounts of contaminants. Dilute carbohydrate solutions are created by dissolving small amounts of carbohydrates in water. Using a syringe, 0.01 mL samples are placed on a glass plate and allowed to dry. Using another syringe, 0.005 ml of simulated blood is applied to each sample and the glucose level is measured with a glucometer.</p> <p><b>Results</b> In Experiment 1, the contaminants substantially raised the glucose measurement compared to the 125 mg/dL of uncontaminated simulated blood. For syrup the average was 298.3 mg/dL, for honey the average was 232.3 mg/dL, and for jelly the average was 279.3 mg/dL. Experiment 2 showed that even careful wiping was insufficient to prevent contamination. Here the average glucose level for syrup was 189.6 mg/dL. In Experiment 3, tiny, precisely-measured amounts of dried syrup solution produced an average measurement of 199.8 mg/dL, while dried glucose tablet solution produced an average of 455.4 mg/dL. These values quantify the amount of contaminant needed to cause measurement errors.</p> <p><b>Conclusions/Discussion</b> Experiment 1 shows that small amounts of contaminant can even double the blood glucose measurement. Experiment 2 shows that even careful wiping is insufficient to eliminate the error in glucose measurements. Experiment 3 shows that a spherical speck of glucose tablet with a diameter of 0.77 mm increases the glucose by 260%, and a 0.8 mm diameter speck of syrup can increase it by 60%. The main lesson that can be gained from these experiments is that washing hands to remove contaminants is extremely important. Small amounts of contaminants can cause significant errors. The consequences of having a false glucose measurement can be disastrous for diabetics and physicians. An incorrect glucose measurement can result in the wrong treatment or diagnosis.</p>	
<b>Summary Statement</b> I showed that even tiny amounts of carbohydrates, such as honey and jelly, can cause substantial errors in blood glucose measurements made with a glucometer.	
<b>Help Received</b> I developed the idea for the project and designed and conducted the experiments. I got help in measurement methods from Professor Stahovich in the Department of Mechanical Engineering at the University of California, Riverside. He also provided guidance on technical writing.	