



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) Anubhav Sarkar	Project Number S0420
Project Title An Innovative Approach to Combat Stress: Using Glucose as an Ego-Depletion Compensator to Enhance System 2 Thinking	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals According to Nobel laureate Daniel Kahneman, there are two methods of thinking: System 1 (intuitive) and System 2 (rational). When an individual is stressed, they are less able to exert self-control when challenged - a phenomenon known as ego-depletion. Under conditions of ego depletion, their blood glucose level drops, and they are therefore unable to perform to the best of their ability under stress. In this experiment, I tried to determine whether or not ego-depletion could be compensated for by ingesting glucose, in an attempt to improve critical thinking.</p> <p>Methods/Materials 32 students from a Biology Honors class were selected as students. In this blind study, they were divided into two groups. The students were tasked to cross out as many instances of a vowel as possible in 5 minutes from an article published in a scientific paper. This act would require the students to exert self-control, and has been proven to cause ego-depletion. Then, the students in Group 1 were given 3 oz. of lemonade containing glucose, and the students in Group 2 were given 3 oz. of lemonade containing Splenda. After waiting 10 minutes for the glucose to be ingested, every student was given a 10 minute test which tested System II thinking. The entire process was repeated in two more tests: in the second test, fonts for Group 1 test papers were smaller and less legible, as harder to read fonts have been proven to exert System 2 thinking and in the third test, the amount of sugar was doubled in the lemonade but the fonts were kept the same.</p> <p>Results Data was analyzed using 3 statistical methods # comparison of mean scaled scores, chi square tests and Euclidean distances. The students with glucose scored higher, and the chi square test results established with 97.5% to 99.9% certainty, that chance was not the factor causing the differences in scores. The Euclidean distance computations established that more glucose yielded better results, and glucose plus smaller fonts was better than glucose alone.</p> <p>Conclusions/Discussion Based on my study, ego-depletion can indeed be compensated for by ingesting glucose or by activating System 2 thinking by using smaller fonts. This will result in higher test scores for tests that rely on System 2 critical thinking. Higher concentrations of glucose, aided by smaller fonts, can overcome ego depletion to greater extents and thus increase critical thinking ability even more.</p>	
Summary Statement Supplementing the brain with glucose in times of stress to enhance System 2 critical thinking.	
Help Received My biology teacher (also my mother) helped me with the setup at school, and my father helped me with my presentation	