Natural versus Artificial Sugar and the Effect on Cognitive Performance

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ORGANIC PHYSIOLOGICAL CHEMISTRY
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The two of us are both currently in or looking to work in a medical field. We wanted to know if certain energy sources could impact our decision making skills. We both, along with popular culture, are concerned with healthy food choices. Does consuming sugar actually help with memory, attention and reasoning? Is natural sugar a better alternative to artificial for improving brain performance?
Background research for this project supplied much research in the form of effects of sugar on memory.

Several studies focused on hyperactivity in children, while others studied enhancing memory in elderly.

There has been previous research in the specific ways that molecules are broken down and used for energy in the body.

Artificial sugar and sucrose in the body has been related to hyperactivity and increased memory among children and the elderly.
Importance of project

- Simple sugars are one of the body’s primary energy sources.
- The brain uses up to 20% of the energy we produce.
- This study was important to examine possible differences between natural and artificial sugars and cognitive performance.
- Research was not readily available comparing the two in direct relation to cognitive performance; instead most research grouped natural and artificial sugars and compared it to no sugars.
- Given that the majority of research did not focus on an age group of 25-40, and did not distinguish between natural and artificial, the need for this research arose.
Community Aspect

- This research is beneficial to the majority of the population.
- Many people use sugars of some sort daily.
- Could a small change in diet have measurable effects on our work and our studies?
- From students to professionals, enhancing attention, memory and reasoning by a simple dietary change would prove very important.
• Sugar is the sole source of energy for our brains. Our body digests foods into simple sugars. These sugars are digested into the blood stream to then provide the energy necessary for cellular functions.

• Glucose is the most important carbohydrate, it is a monosaccharide that almost all known organisms metabolize.

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Hypothesis

- Natural sugar will have an increased effect on cognitive performance over no sugar and artificial sugar.

- Could energy derived from naturally forming sugars result in different cognitive function levels than energy from artificial sweeteners?
Explanation of Project

- This project will use a test to examine function of the brain after consuming natural, artificial or no sugar.
- Participants will, on 3 separate mornings, consume lemonade with either no sugar, natural sugar or artificial sugar.
- After consuming lemonade, participants will complete cognitive performance games on an application.
- Accuracy scores from each game will be recorded and analyzed.
- Scores will be used to examine:
  - 1) the relation between scores with no sugar versus scores with artificial or natural sugar.
  - 2) Is there a difference in scores between artificial sugar and natural sugar?

- Expected Outcome: Consumption of natural sugars will increase brain performance.
- 41 participants ranging in age between 25-40
- Participants received a bag containing:
  - 2 packets of Sugar in the Raw
  - 2 packets of Sweet ‘N Low
  - 3 individual sugar free packets of Country Time Lemonade
  - Detailed instruction sheet for each day and for downloading the application.
  - Results sheet with place to record accuracy percentage.
- Participants tested for 3 consecutive days, before breakfast, while consuming no other products prior to the test.
- Results sheets were turned into the Dayan or Ruby where accuracy would be analyzed.
Responsibilities

- **Dayan Mazariegos**
  - Responsible for taking group discussions and finalizing what methods and technology would be used.
  - Research scholarly articles to develop the background for the study.
  - Present the test to 13 participants.
  - Discuss the results and conclusion post experiment.

- **Ruby Tollison**
  - Responsible for discussing with the group and finalizing the time scale and division of the project. Also responsible for developing written, oral and visual presentations and project abstract.
  - Research scholarly articles to develop the background for the study.
  - Present the test to 28 participants, examine results, and prepare conclusions.
  - Analyze data, develop table, chart and graphs.
  - Develop community education poster, connect with community contact and display results.
  - Formulate the conclusion of the research post experiment.
  - Responsible for writing: written EMPACTS report and creating EMPACTS presentation.
Participant Instructions

- Download Clockwork Brain application.
- Day 1:
  - Before breakfast, mix one packet of lemonade in 8 oz of water.
  - Do not add any sugar to the lemonade.
  - Drink lemonade and wait 30 minutes, then open application Clockwork Brain.
  - Proceed to game Point of View (Reasoning) play game.
  - Record accuracy number (%) on results sheet.
- Day 2:
  - Before breakfast, mix one packet of lemonade in 8 oz of water.
  - Add 2 packets of Sugar in the Raw, stir.
  - Drink lemonade and wait 30 minutes, then open application Clockwork Brain.
  - Proceed to game Solo (Attention), play game.
  - Record accuracy number (%) on results sheet.
- Day 3:
  - Before breakfast, mix one packet of lemonade in 8 oz of water.
  - Add 2 packets of Sweet ‘N Low, stir.
  - Drink lemonade and wait 30 minutes, then open application Clockwork Brain.
  - Proceed to game Chase the Numbers (Memory) play game.
  - Record accuracy number (%) on results sheet.
Methods and Technology

Materials used:
- Sugar in the Raw
- Sweet ‘N Low
- Country Time Sugar Free Lemonade (single serve packets)
- Water

Technology used is the Clockwork Brain application.
- Application that uses a series of fun and cognitively challenging games to test memory, attention and reasoning.
Methods

- Each member of the group is responsible for recruiting six people who will commit to the experiment.
- We are going to have the participants consume three cups of lemonade with different types of sugar: Non-Nutritive Sweeteners (artificial sugar) and natural sugars.
  - Sugar in the Raw
  - Sweet ‘N Low
  - Without sugar
- Participants will then play an application called Clockwork Brain, to see how the performance of the brain is affected or if there is an affect
- We will have the same participants test all three options over a three-day period.
- We will measure the success and speed from the application to formulate the results of all participants.
Results

- **Data collection**
  - Participants recorded the accuracy % that was displayed after each game on to the results sheet provided.
  - At the end of the 3 days, participants returned the results sheet to either Dayan or Ruby.
  - Results were sent to Ruby where tables, graphs and charts were created to examine trends in the raw data.
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Results, continued

- **Day #1, no sugar added:**
  - Scores ranged from 81-100%
  - 4 of the participants on the first day scored a 100%

- **Day #2, Sugar in the Raw added:**
  - Scores ranged from 91-100%
  - 24 of the participants scored a 100% on day #2

- **Day #3, Sweet ‘N Low added**
  - Scores ranged from 88-100%
  - 13 of the participants scored a 100%
Basic conclusion from the resulting data
- There was an increased cognitive performance when sugar is consumed, whether natural or artificial.
- Secondly, there is an increased level of cognitive performance when natural sugar is consumed rather than artificial sugar.

Outcome of this project was consistent with the hypothesis the researchers posed, that natural sugar will have an increased effect on cognitive performance over no sugar and artificial sugar.
Justification of Conclusion

- Data displays a higher range of scores for the Sugar in the Raw as well as an increased number of 100% scores over the Sweet ‘N Low and no sugar options.

- The highest level of success was for the Sugar in the Raw, second was for the Sweet ‘N Low. Lowest level of success was for the lemonade without sugar added.

- Sugar in the Raw added:
  - Scores ranged from 91-100%
  - 24 of the participants scored a 100% on day #2

- Sweet ‘N Low added
  - Scores ranged from 88-100%
  - 13 of the participants scored a 100%

- No sugar added:
  - Scores ranged from 81-100%
  - 4 of the participants on the first day scored a 100%
These results support the conclusion made by showing that the majority of success with the Clockwork Brain application was in the game played on the day when Sugar in the Raw was mixed with the lemonade.

The conclusion that participants scored higher with sugar, either artificial or natural, than without is clearly justified by reviewing the results showing the lowest level of scores for the lemonade without sugar added.
There were four 100% scores for the lemonade without sugar.

- The participant’s usual diet could have an effect on sugar or the absence of effects cognitive performance.
- A diet well balanced with healthy metabolism and glucose control can regulate glucose and prevent drops.
- Also, can be related to the cognitive strengths of the individual. If the participant is usually strong in the area that was tested, a successful score might have been ensued regardless of glucose intake.
Future Development

- Participants tested, who would consume a diet with greater intake of natural versus artificial sugar over the course of a longer period of time, would be helpful data.
- It would be advantageous to follow participants through a longer course of time, and multiple tests.
- Also could advance this project by using more in depth tests of cognitive performance such as more advanced testing.
- There is room to continue this research further than cognitive performance as well. Both physical and emotional reactions/tests associated with diets high in sugars compared to those with no sugar in their diet would be very interesting as well.
Community Contact

- Leslie Wilcher, MSN- Employee Health Nurse- Mercy Hospital Rogers, AR
  - 2710 Rife Medical Lane Rogers, Arkansas 72758
  - Poster discussing research and findings was displayed at Mercy Hospital for employees.


Swithers, S. E. (2013). Artificial sweeteners produce the counterintuitive effect of inducing metabolic derangements. Trends in Endocrinology & Metabolism, 24(9), 431-441. doi:10.1016/j.tem.2013.05.005


