Effects of Mint Gum and Physical Activity on Cognitive Performance

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Background Information

• Gum with glucose while studying has been shown to increase scores during standardized testing, and increased alertness in separate studies

(Allen & Smith 2012.) and (Ginns, Kim & Zervos 2018.)

• Acute exercise has been shown to improve test scores in experiments

(Chang et al. 2012) and (Bresseau et al. 2016)

• No studies have been done comparing the two

Project Purpose

- Academic performance is important to students, educators and parents. This study aims to find what gives students the best advantage before a scholastic test

- Comparing effects of rest, chewing gum and exercise on cognitive function

- To determine ideal pre-cognitive test activity
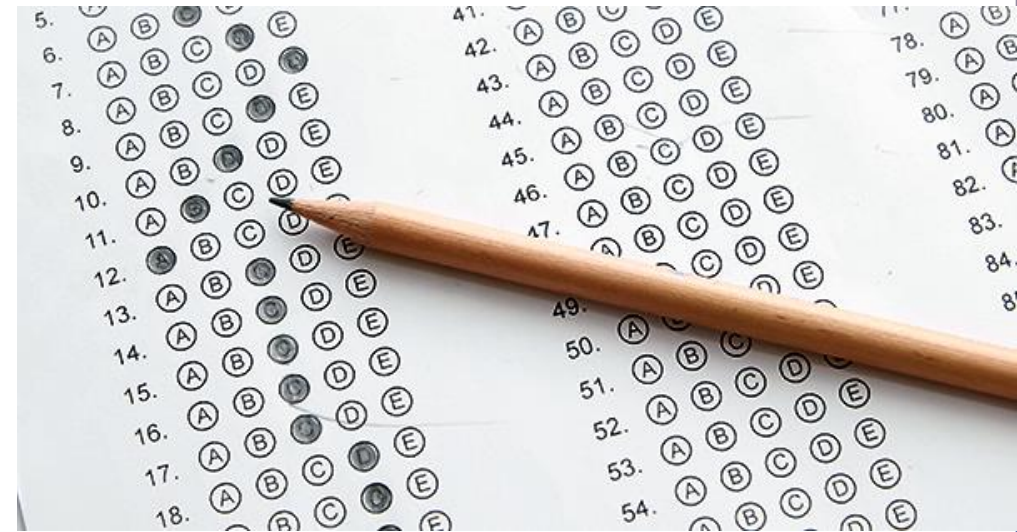
Study Population

- Male and Female ages 18-30

- Participants were of any educational and physical background

- Fluent in English, not colorblind, and not allergic to the ingredients in sugared mint gum

Total	13
% Female	85%
% Male	15%
Avg. Age	20.31
Age Mode	21

Cross-Sectional Study

Question
- Does chewing sugared mint gum or performing 10 minutes of moderate aerobic exercise improve cognition based on STROOP testing?

Stroop test results collected
- Baseline
- Gum
- Exercise

Test conducted for three months
- Each participant took three weeks for data collection
- Minimum of five days in between each test

Data Analysis
- Ran paired t-tests
- Compared accuracy, speed, heart rate, and mental health factors

Methods

Week 1: Control testing
-Participant sat for 15 minutes prior to taking the Stroop test. No gum or exercise involved.

Week 2 & 3: Gum or exercise testing (randomized)
-Participant chewed 1 piece of sugared mint gum for 10 minutes, then sat without gum for additional 5 minutes prior to Stroop.
-Participant did 10 minutes of aerobic exercise, then sat for 5 minutes prior to Stroop.
• Participants were aiming to reach and maintain 60% of max heart rate which was found using the Karvonen formula.
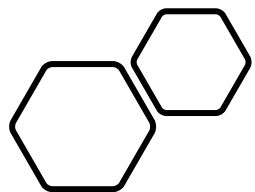
Methods continued...

- **Equipment**

-Gum, electronic device(s), Stroop Test for Research app, Heart Rate monitors, Scosche Rhythm Sync HR app, and surveys created with REDCap.

- **Assessments**

-Based on number of questions and accuracy of answered questions during Stroop in the given amount of time (180s).
-Qualitative data was assessed through pre and post-test surveys.
-Quantitative data was assessed through statistical tests using the data from Stroop app and HR app.
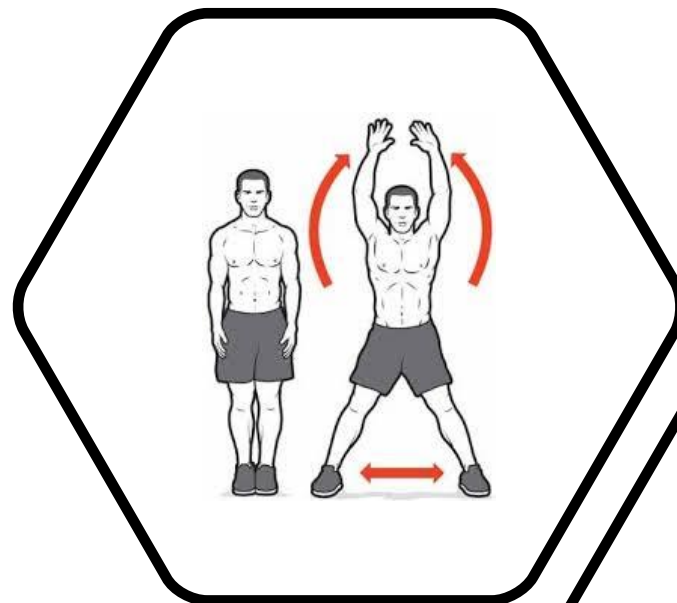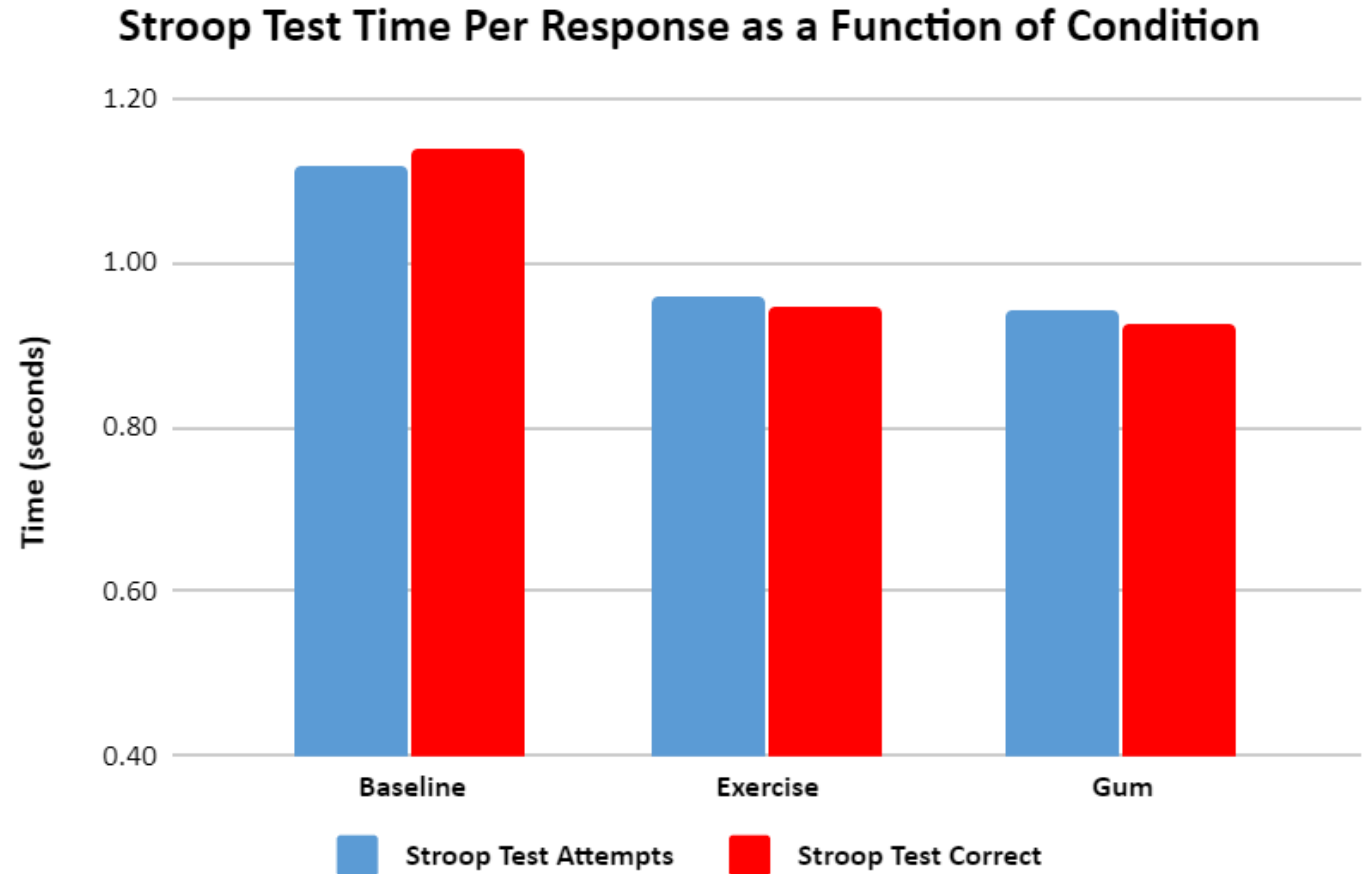
Results: Charts and Graphs

Average Percent of Correct Responses vs Trial Type

legend: baseline (blue), exercise (red), gum (black)
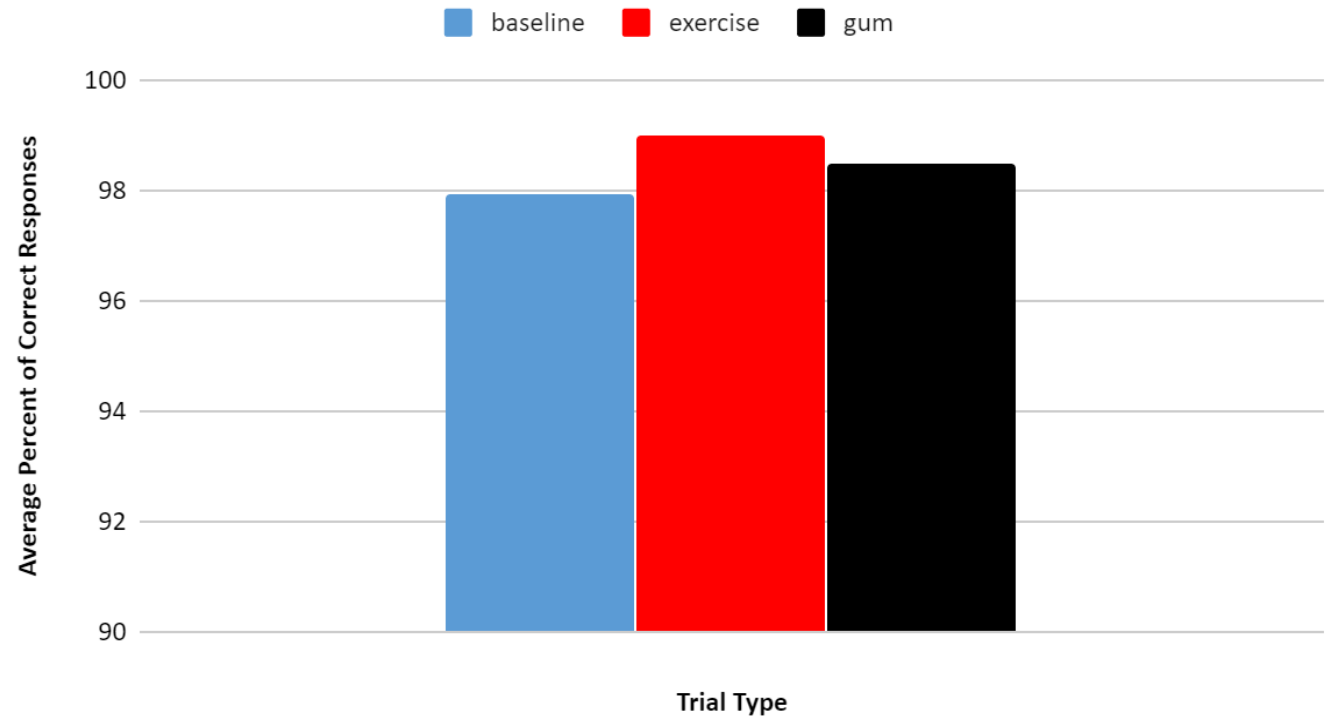
- Paired t-tests were run on the percent correct responses for the baseline, exercise, and gum trial groups.

- Baseline vs Exercise
  - P value = .004
- Baseline vs Gum
  - P value = .018
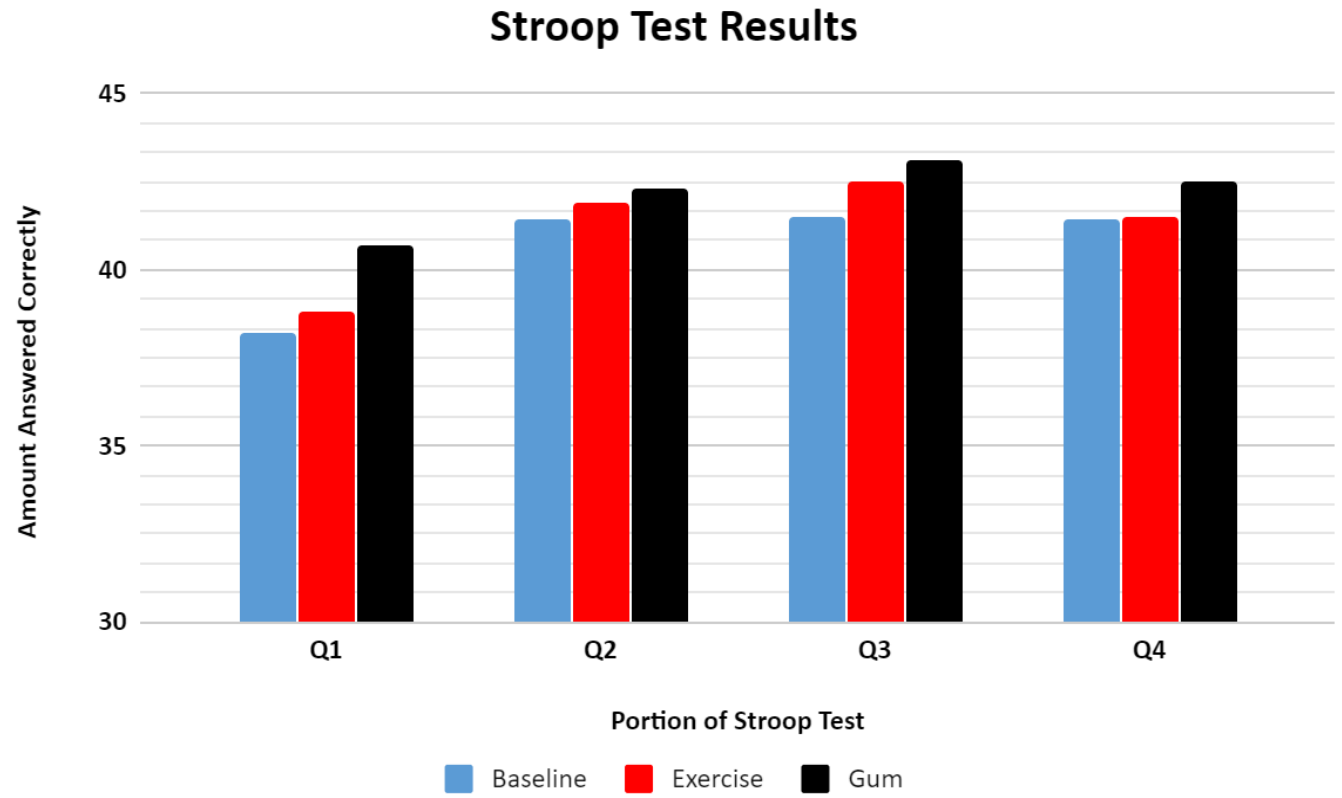- Exercise vs Gum
  - P value = .002

Results: Charts and Graphs

## Stroop Test Time Per Response as a Function of Condition

There are significant differences between the time to answer a correct response for baseline vs gum and exercise vs gum.

Results: Charts and Graphs

Stroop Test Results

- For each trial group, the number of correctly answered responses were statistically significant between Q1 and Q2 as well as between Q1 and Q3.
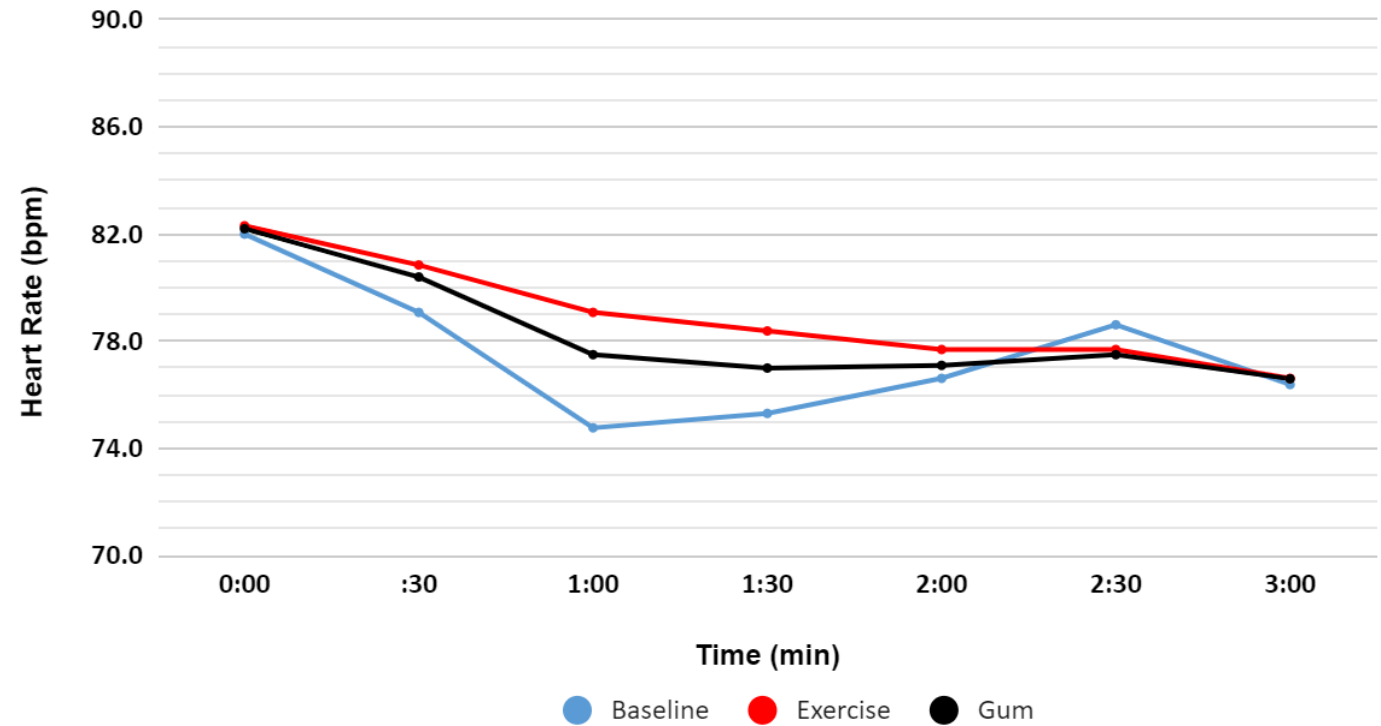
Results: Charts and Graphs

Average Heart Rates at Rest, During and After the Trial
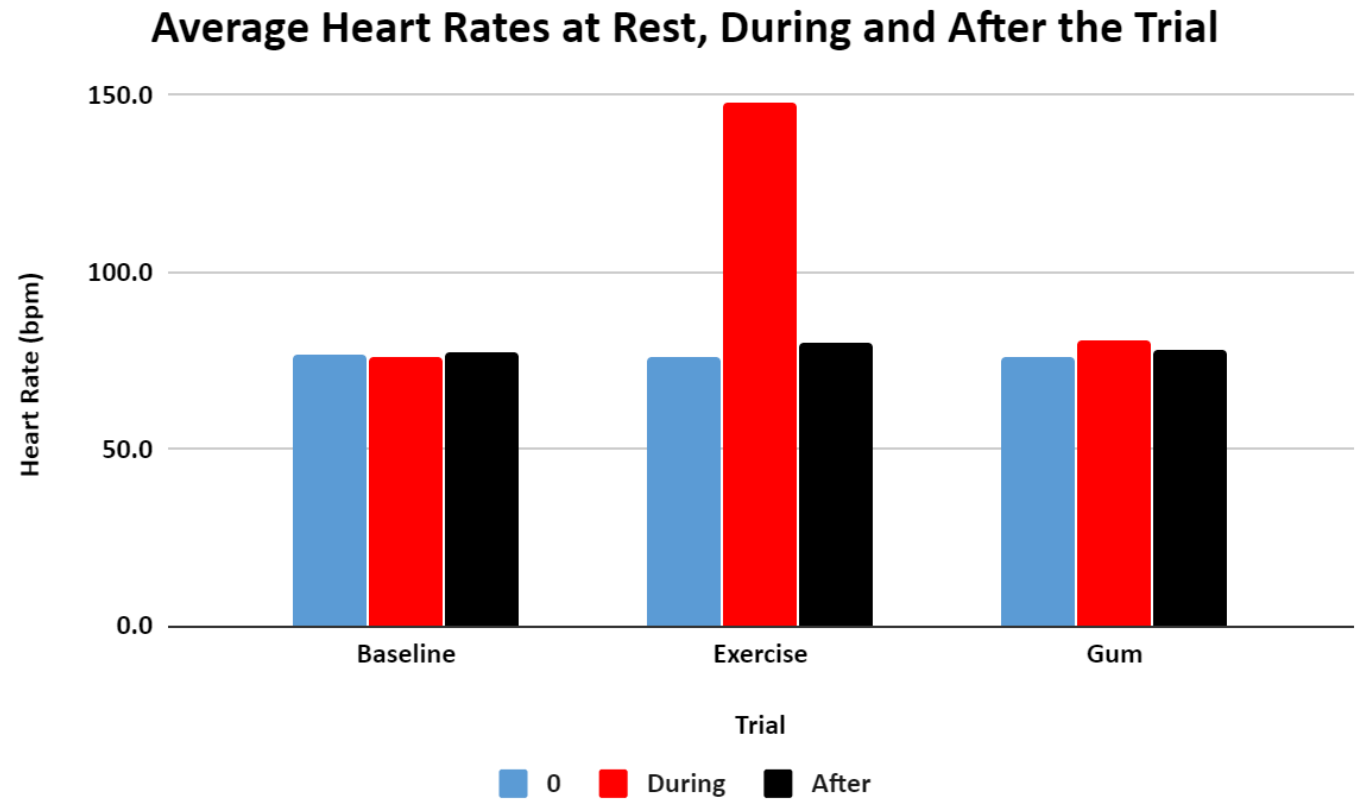
- Paired t-tests were run on the heart rates within and between each trial group.
- Exercise P-value: 0.0000000554...

Results: Charts and Graphs

Average Heart Rate During the Stroop Test

Heart Rate (bpm) vs Time (min)

Legend: Baseline, Exercise, Gum

Anxiety and Stress Correlations

- Paired t-test for anxiety and stress before and after Stroop test
  - Exercise (anxiety): p-value= 0.01
  - All other data found insignificant

Participants ranked their anxiety and stress on a scale of extremely, moderately, slightly, and not anxious/stressed which we then converted to a number scale

Average Anxiety Level with Exercise

1.31   0.77
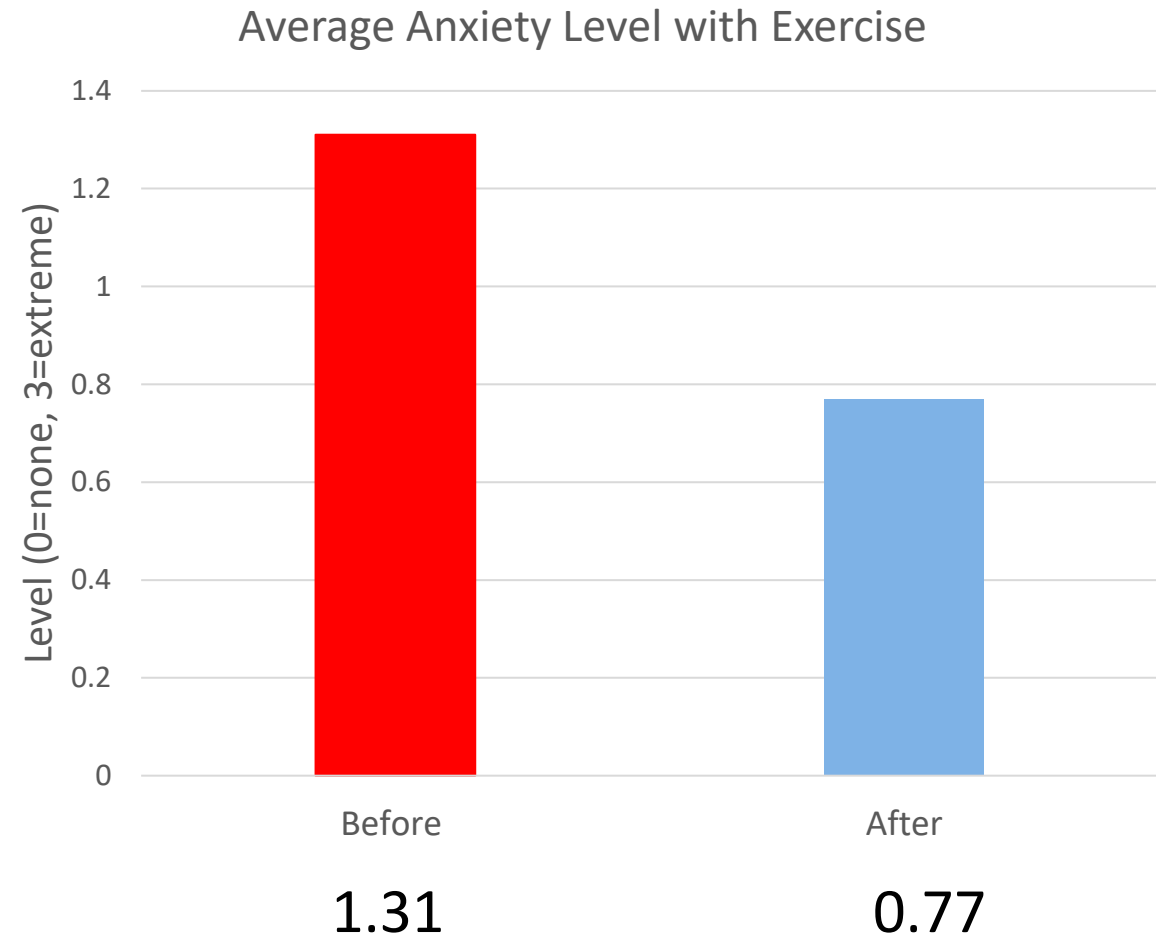
Discussion: Stress and Anxiety

- Higher percentage of questions correct

- Decreasing heart rate

- Exercise is a known anxiety reliever (Blumenthal et. al. 2015).

Discussion

- Our findings of significant difference between % correct responses in the exercise group when compared to the control group are similar to the results of Chang et al and Bresseau et al.

- Our findings of a significant difference between % correct responses in the exercise group when compared to the gum group is something that was not found in previous literature.

Red
Blue
How Fast Is Your Brain?
Purple
Orange

Discussion continued...

Strengths

- Easily performed protocol
- Few exclusion criteria
- Simple and accurate data collection through app

Weaknesses

- Small sample size and demographic
- Having participants chew gum before the test as opposed to during; hard to control

Challenges

- Lack of ability to finish collecting data due to pandemic
- Limited space and availability of heart rate monitors
- Needed 2 people to conduct a trial

What did you learn?

- Activity **prior to a cognitive assessment is better than** no activity
- Balancing communication and teamwork is key **to a** successful study

Conclusions

Difficult to draw any big conclusions with the minimal tests conducted and results gathered

Data analysis comparing control vs exercise, control vs gum, and exercise vs gum all show significant statistical differences

Both exercise and gum improve cognitive performance based on our data

Exercise showed more improvement in cognitive performance than chewing gum

Cognitive functioning is complex, and more research needs to be done to provide further evidence of activities that improve performance

Future Direction

- First, go back and collect more data for this study and re-run all statistical tests to be sure original findings are accurate and can be duplicated.

- Next, we would conduct trials on what effects caffeine vs. physical activity may have on cognitive performance.

- Use different types of cognitive tests and various age groups.

- Test different durations of exercise to see which was the most effective for cognitive testing.

- Exercise testing looking at percent max of heart rate and its effect on cognitive testing.

Questions/Comments