**Project Title:** The Effect of Coffee Consumption on Attention Performance

**Background Information:**

Caffeine is a natural stimulant found in coffee, tea, and some other plants.  It increases brain activity and speeds up communication between the brain and body, making people feel more awake (MedlinePlus, 2021). Many people consume caffeine to improve focus and reduce tiredness.

Research shows that caffeine can increase attention and reaction speed for a short time, but its effects vary between individuals. (Einöther & Giesbrecht, 2013). People who consume caffeine more often may not experience the same level of improvement as those who rarely consume caffeine. Other factors such as sleep, and caffeine sensitivity may also change how caffeine affects attention. Some individuals experience side effects, such as jitteriness or headaches, even at lower doses.

**Question of Interests:**

* Does caffeine intake level affect attention test performance?
* Does caffeine intake level affect reaction time?
* Does prior caffeine consumption (pre-test caffeine tablet) influence the effect of caffeine on attention?
* Does pre-test nap change how caffeine affects attention performance?

**Methodology:**

We will use ANCOVA to analyze the effect of Caffeine Intake Level on Attention Test Scores and Reaction Time, adjusting for Pre-Test Nap Duration and Memory Test Score. Participants will be randomly assigned to a Caffeine Intake Level (Decaffeinated, Regular, or Espresso).

**Experimental Unit:** an individual participant.

**Variables:**

* **Attention Test Score** – The participant’s score on a 10-minute attention test. Higher scores indicate better attention performance. (Quantitative, dependent, response.)
* **Reaction Time** – The time taken to respond during the test. Lower times indicate faster responses. (Quantitative, dependent, response.)
* **Caffeine Intake Level** – Determines the amount of caffeine consumed before the test. (Qualitative, independent, explanatory, a factor for the study. Levels: Coffee Decaffeinated 250 mL, Coffee 250 mL, Coffee Espresso 60 mL × 2.)
* **Memory Test Score** – A pretest measure of cognitive ability, using Memory Test Cards or the Stroop Test. (Quantitative, independent, explanatory.)
* **Pre-Test Nap Duration** – The length of time a participant napped before the experiment, measured in minutes. (Quantitative, independent, explanatory.)
* **Caffeine Sensitivity** – A measure of how sensitive a participant is to caffeine, based on a 100 mg caffeine tablet pre-test. (Quantitative, independent, explanatory.)

**Treatments:**

* Control group: Decaffeinated Coffee (250 mL)
* Regular Coffee (250 mL)
* Espresso (60 mL × 2)

**Total Number of Planned Observations:** 90 total observations, 30 per treatment group.

**How the experiment will be conducted:**

* **Control**:
  + Age Restriction: Participants are restricted to individuals aged 20–40 years.
  + Avoid other foods that may affect the test results: Ask participants if they consumed caffeine or alcohol in the last 24 hours before testing, if so, we will exclude them.
  + Cognitive Screening: Participants must achieve ≥60/100 on a standardized Memory Test (10 min).
  + Caffeine Sensitivity Screening: Participants must achieve ≥60/100 on a 100 mg caffeine tablet sensitivity test.
  + Testing Time Standardization: All experiments were conducted between 1:00–5:00 pm.
  + Pre-Test Nap: Participants were required to take a 30-minute nap before the experiment.

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* **Blocking:**   
  Participants will be blocked based on their caffeine sensitivity test results. Those with a strong reaction to the 100 mg caffeine tablet will be placed in one block, while those with a weaker response will be in another. This helps account for individual differences in caffeine metabolism, reducing variability in the results.

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* **Randomization**: A total of 90 participants will be randomly assigned to one of three caffeine intake levels using The Island (human population simulation). Each of the three team members will be randomly in charge of the three caffeine treatments.

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* **Replication**: Each treatment group will have 30 participants, for a total of 90 observations

* **confounding variables:**
  + Previous caffeine exposure history.
  + Caffeine clearance rate.
  + Potential mental fatigue.
  + Potential experimental environment interference.

**References**

MedlinePlus. (2021). Caffeine. *MedlinePlus*. Retrieved from<https://medlineplus.gov/caffeine.html>

Einöther, S. J., & Giesbrecht, T. (2013). Caffeine as an attention enhancer: Reviewing existing assumptions. *Psychopharmacology, 225*(2), 251–274. <https://doi.org/10.1007/s00213-012-2917-4>