The effects of caffeine consumption on memory retention

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Abstract

Caffeine consumption has become a prominent part of most college students' lives (Mahoney et al., 2019). Caffeine benefits include reversed memory decline experienced by adults in the afternoon (Ryan et al., 2002), increased alertness and improved performance on simple and choice reactive tasks (Brice and Smith 2002), and higher arousal level in individuals who are tired (McLellana & Caldwell & Liebermanc 2016). This study examined the effects of caffeine consumption on memory retention. All participants were recruited from the LaGrange College Research and Experiment Participation System operated by Sona System and were asked to study a list of 12 short-term memory task words. Three minutes later, participants were given a survey on memory performance in relation to caffeine consumption. After completing the survey, participants were asked to write down as many words they could remember from the list earlier. Results concluded that there was no significant difference in caffeine and memory retention.

Introduction

- Caffeine is a bitter substance, that can be found in natural based plants such as coffee beans, tea leaves, kola nuts, and cacao pods (Medline Plus, 2019)
- "Caffeine is the most widely used stimulant and is consumed daily by 80% of the world's population and 90% of the North American population." (Heckman et al., 2010)
- Prior research indicates that when caffeine is consumed, benefits include:
  - Reversed memory decline experienced by adults in the afternoon (Ryan et al., 2002)
  - Increased alertness and improved performance on simple and choice reactive tasks (Brice & Smith, 2002)
  - Higher arousal level in individuals who are tired (McLellana & Caldwell & Liebermanc 2016)
- Further research shows that when caffeine is consumed in moderate doses of 200mg, it is more effective (University of Michigan Health Services)
- Hypotheses
  - I hypothesized that self-reported caffeine consumption would be positively correlated with memory recall
  - I hypothesized that, for participants that are not regular users of caffeine, a 200 mg dose of caffeine would lead to increased memory recall compared to when they had no caffeine.

Materials & Methods

Participants

- A total of 26 undergraduate students participated for course credit using the Psychological science REPS system
- Average age = 18.77 (range 18 – 21)
- 15 were female and 11 were male
- 9 were African American/Black and 17 were European American/White

Methods

PART 1

- Participants completed a survey assessing caffeine intake and memory retention
- Before the survey was administered, participants were asked to study a list of 12 words for 3 minutes., The list of words include:

Vase	Spade
Teapot	Cushion
Tiger	House
Camera	Piano
Ice-cream	Orange
Book	Hat

- Participants then completed the survey
- After the survey, the participants were given a blank piece of paper and were asked to write down as many words as they could remember

PART 2

- Participants from Part 1 who reported they did not regularly use caffeine were invited to participate in Part 2.
- Upon arriving, participants were given a 200 mg caffeine pill and were asked to wait 15 minutes to allow the pill to take effect.
- Participants were then given a new list of 12 words to study for 3 minutes. The list of words included:

Eggs	Apple
Favor	Trial
Drawing	Focus
Brain	Partner
Rock	Mission
Flag	House

- Participants then filled out the same survey from Time 1
- Participants were then given a blank sheet of paper and were asked to recall the list of words
- After completion, participants were debriefed and were rewarded with $5 Chick-fil-a gift card

Results

- Due to COVID-19, only 2 participants were gathered for Part 2 of this study. Thus, results for that part are not discussed.
- The main hypothesis was not supported
  - There was no significant relationship between amount of caffeine consumed and performance on the Time 1 memory task.
- There was a significant correlation between age of first caffeine consumption and amount of caffeine consumed per day, $r(22) = .41$, $p = .05$
- There was a significant correlation between amount of caffeine consumed and self-reported caffeine dependence, $r(22) = .43$, $p = .03$

	Age of 1st consumption	Caffeine per day	Depend on caffeine	Age	Memory Task 1	Memory Task 2
Age of 1st consumption	1.00					
Caffeine per day	.41^	1.00				
Depend on caffeine	.17	.43*	1.00			
Age	-.30	-.10	.23	1.00		
Memory Task 1	.00	-.10	-.07	-.18	1.00	
Memory Task 2	.00	-.17	.04	.27	.47	1.00

^$p < .10$ *$p < .05$ **$p < .01$

- The most common time to consume caffeine was morning (n=10).
- The most common number of caffeine-based products consumed in a day was 2-3 (n-12).
- The average age participants reported they started consuming caffeine was 10.70 years of age.
- 13 participants reported their caffeine consumption has increased since entering post-secondary while 11 reported that it has not.
- The average self-reported dependence on caffeine was low, X= 1.92 (scale of 1 "do not depend at all" to 5 "depend on caffeine a lot .

Reasons to Consume Caffeine

Reason	Participants Reporting Reason
To feel more awake	13
To be more alert	9
To be more productive	7
To help with focus and concentration	7
No specific purpose	7
To stay up late	5
To have more physical performance	2

N = 24

Types of Caffeine Consumed

Type of Caffeine	Participants Reporting Consumption
Coffee or Coffee Specialty	18
Soft Drink	16
Tea (Iced or Hot)	14
Energy Drink	8
PreWorkout	3
Other	1
Caffeine Pills	0

N = 24

Conclusion

- There was no significant difference in caffeine consumption and memory retention.
- The results indicate that there is no correlation between caffeine intake and memory retention on short term memory tasks.
- However there was a marginally significant correlation between how earlier participants started to consume caffeine the later they consumed more caffeine
- Another significant correlation is that the more the participants consume caffeine the more they think they depend on it.

Limitations

- Due to COVID-19 closures, we were unable to recruit enough participants to complete Part 2 study and our sample size was very small for Part 1.

Future Research

- The next step for this project would be to continue recruiting participants and add to our sample.