Caffeine Lab

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Introduction

The Go/No-go task assessed information processing and reaction time. It is definitely a good test of reaction time. The simplicity of the test (green-go/red-no-go) was not significantly complicated enough to be a good assessment of information processing.

For this test, the independent variable was the amount of caffeine consumed (0 – 3 cups). The dependent variables were the reaction time (in ms) and the percentage of correct selections.

Discussion

The graph in Figure 1 shows the reaction time for a given amount of caffeine, and Table 1 shows the raw values.

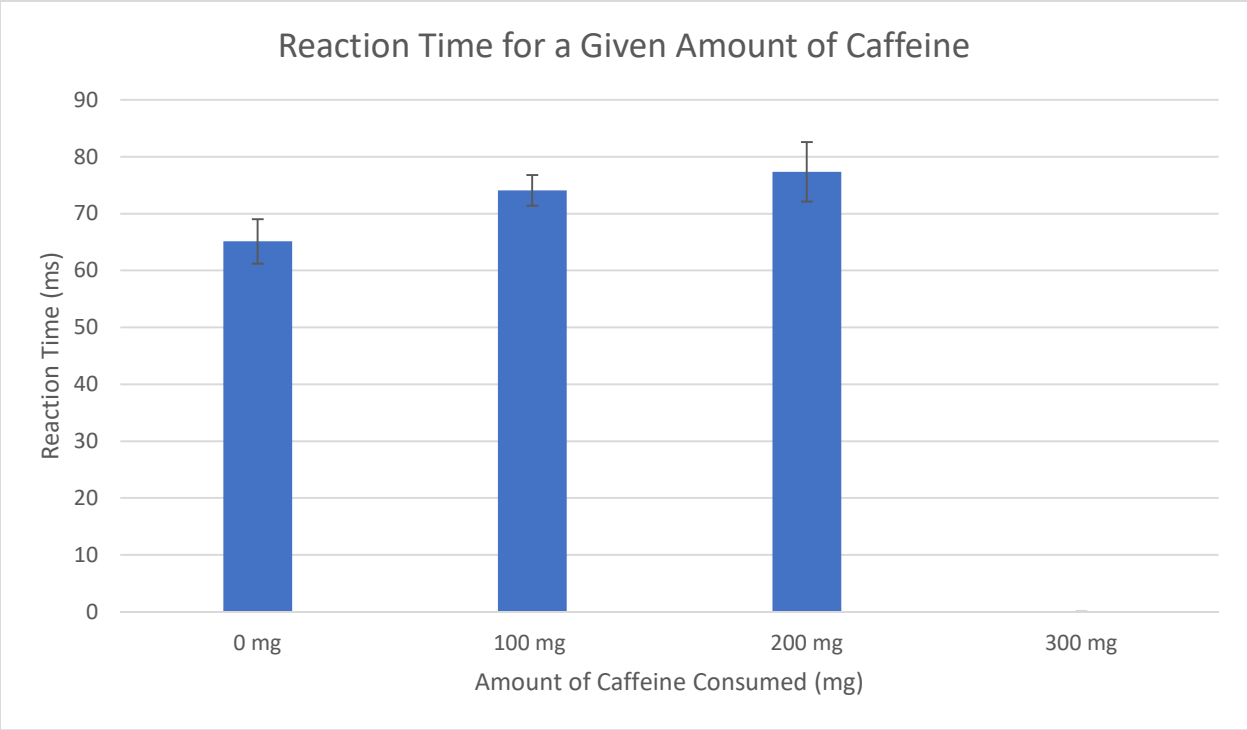


Figure 1

0 mg	100 mg	200 mg	300 mg
65	74	77	N/A

Table 1

Figure 2 shows the graph of percent correct for a given amount of caffeine and Table 2 shows its raw values.

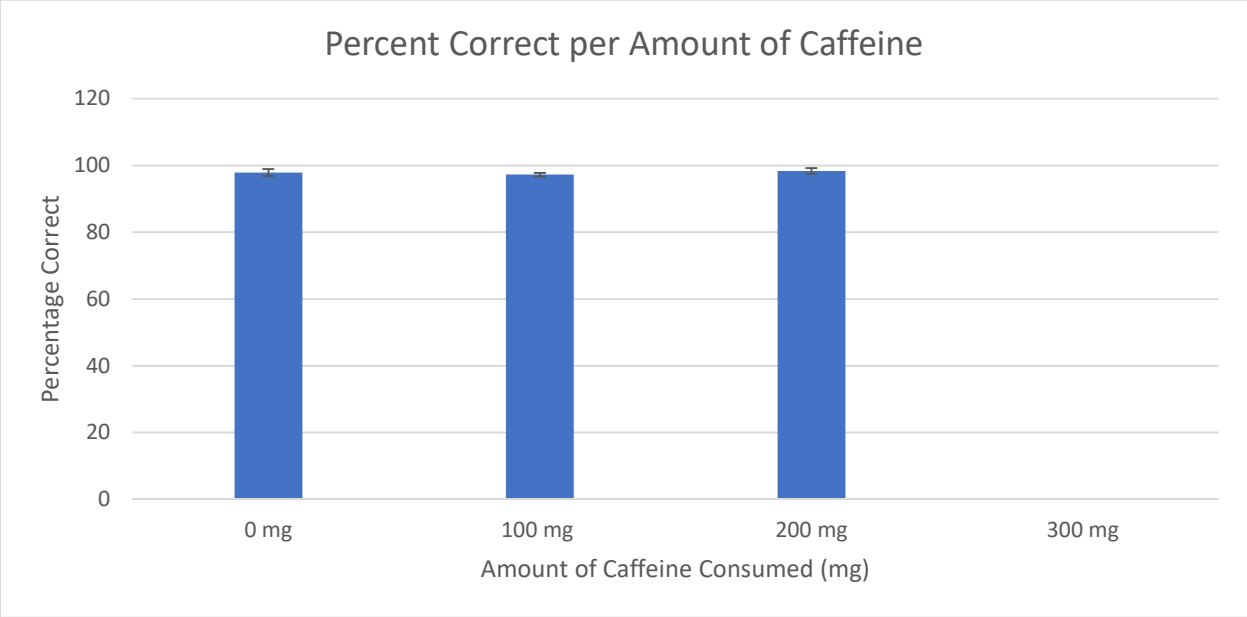


Figure 2

0 mg	100 mg	200 mg	300 mg
98	97	98	N/A

Table 2

The reaction time (RT) values do not agree with the common wisdom since they show a positive correlation between the amount of caffeine and the average reaction time. The previous research (Rogers et al., 2013; Saville et al., 2018) suggests that caffeine should have an inverse correlation with reaction time (i.e. the reaction times should be faster for the greater caffeine consumption groups). Rogers et al. suggest that caffeine is only effective at increasing reaction time and cognitive performance in medium/high consumers after a period of caffeine withdrawal of 24 hours. Low or non-consumers have this effect offset by induced jitteriness and anxiety.

Saville et al. demonstrated a statistically significant effect on RTs using a similar task. Hence, there is likely some confounding factor in the data generated for this task that is causing this effect. A likely culprit when examining the experimenter's trial is the No-Go times, which were

200ms timeouts. Excluding these from the averaged data gave an average RT more than 25ms lower than the one generated by averaging all the data. It might be useful to re-examine the data and leave out the no-go times to get a more accurate sense of the caffeine-based RT.

The percentage correct was not significantly different for any given amount of caffeine, so this can be assumed to be agnostic to caffeine's effects. This would mean that caffeine had more of an effect (albeit a negative one based purely on this data) on the motor control necessary to push the button quickly and not on the cognitive processing needed to recognize the circle's colour correctly.

Leaving aside any numerical challenges, peoples' tolerance for caffeine and the amount of caffeine consumed could be further confounding factors. Someone who routinely drinks two cups of coffee daily would see a much different effect than someone who never drank coffee but only drank it for this experiment. Sorting subjects based on their routine caffeine usage would improve this experiment's results - precise control of the dosage using measured amounts of caffeine, probably in pill/powder form. Timing is also a factor since subjects were told to wait about an hour before they did the experiments. Control of the time delay or at least measurement of it would make the data cleaner. Finally, measuring the rate of absorption of caffeine by each subject might improve the data further.

For the caffeine-similar molecules provided, we know that caffeine's quick absorption is largely due to its nitrogen-methyl bonds rendering the molecule neutral. We can assume that the closer to neutral a molecule is, the faster it will be absorbed. In that case, the example molecules will be rated C:1, A:2, and B:3 due to each having fewer methyl and more hydrogen atoms.

References

Rogers, P.J., Heatherley, S.V., Mullings, E.L. et al. “Faster but not smarter: effects of caffeine and caffeine withdrawal on alertness and performance.” *Psychopharmacology* 226, 229–240 (2013). https://doi-org/10.1007/s00213-012-2889-4

Saville, C. W. N., de Morree, H.M., Dundon, N. M., Marcora, S. M., & Klein, C. (2018). “Effects of caffeine on reaction time are mediated by attentional rather than motor processes.” *Psychopharmacology*, 235(3), 749-759. https://doi.org/10.1007/s00213-017-4790-7