Muscle Reaction Time vs Type of Caffeine (Standard and Anhydrous)

Jun, Ari, Andrew, Nathen

Section: C02
Group: C

Research question: How does anhydrous caffeine compare to standard caffeine for muscle reaction time?

Hypothesis: Anhydrous caffeine will result in shorter muscle reaction time at 30 minutes from the start, however, normal caffeine will result in shorter muscle reaction time at 60 minutes.

Experimental Design:

Gather 75 UCSD students aged 18-25 who consume 100-250 mg caffeine daily (1-3 cups of coffee).

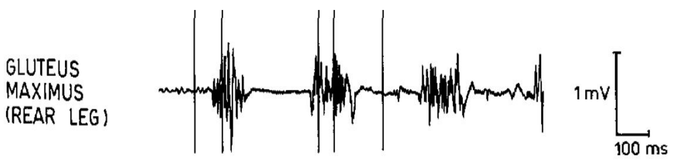
Over the course of 12 weeks, 75 individuals will undergo 12 rounds of testing.

Weeks 1,5,9 - Standard Caffeine	Weeks 3,7,11- pos. control (sugar)
Weeks 2,6,10 - Anhydrous Caffeine	Weeks 4,8,12 - neg. control, (nothing)

Attach EMG electrode on gluteus maximus (GM) of the rear leg.
Then have each participant perform 10m sprint after consuming 3mg/kg of each caffeine or sugar or nothing.

Measure the total reaction time from the gun signal until the onset of EMG activity in skeletal muscle in 30 minutes intervals.

Calculate and plot averages of the total reaction time among 75 participants comparing their averages to themselves.



(Mero 76)

Background

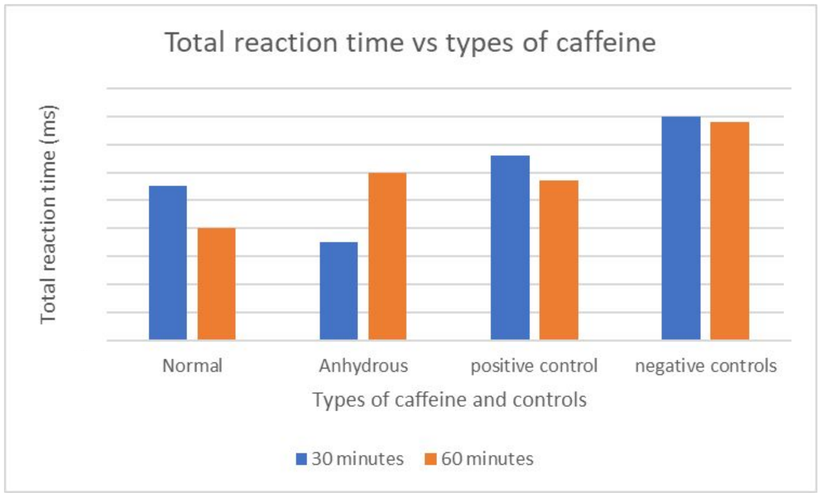
Caffeine is a psychoactive substance found naturally in coffee, cacao, and guarana plants. It operates by antagonizing the adenosine receptors located in the Central Nervous System (CNS), which increases the release of neurotransmitters such as dopamine and glutamate as well as increases motor unit firing rates and pain suppression (Guest et al.).

Caffeine use has become integral in competitive sports, where there is great interest in deepening the understanding of caffeine's impact on athletic performance. Caffeine Anhydrous is created through dehydration and further filtration process, making it more concentrated, stronger and more potent than standard caffeine.

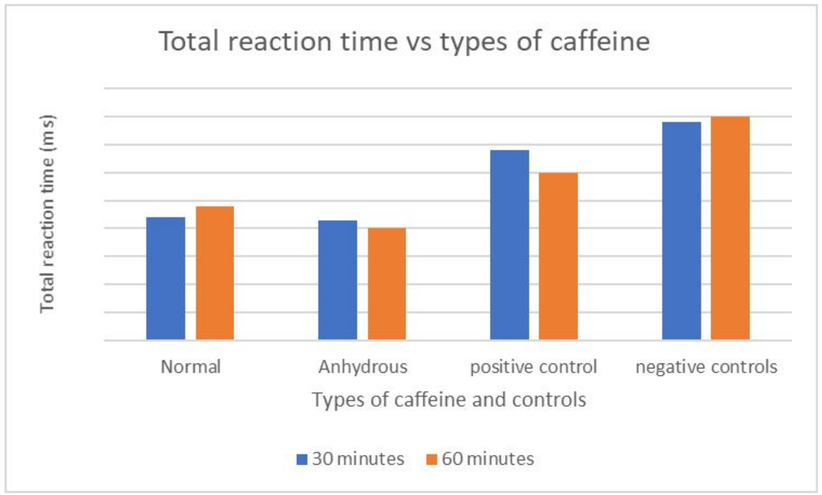
The effects of a specific type of this synthetic caffeine are measured in athletic performance, using a test known as an Electromyography (EMG), which measures muscle response time. Reaction time (RT) has been studied as the total reaction time (TRT) defined as the time from the gun signal until the production of force. The pre-motor time (PT) is defined as the time from the gun signal until the onset of electromyographic (EMG) activity in skeletal muscle. (Mero & Komi.).

Possible Outcomes

Expected



Least Expected



Explanation #1: Anhydrous caffeine will result in faster total reaction time at 30 minutes, but Normal will result in faster total reaction time at 60 minute, since anhydrous caffeine is dehydrated which results in higher concentration and faster absorbance compared to normal caffeine.

Explanation #2: There's no difference in total reaction time between two caffeine at 30 minutes and 1 hour. P-value from T-test conducted is greater than 0.05, significance level, so it proves that there is no significant difference between total reaction time of normal caffeine and anhydrous caffeine.

Future Directions:

The next logical research question would be to identify the effects of caffeine on other parts of the body to see if there is a difference in effectiveness as different sports and types of athletics depend on different muscles and their respective reaction times.

It would also be beneficial to measure different types of reaction times, such as the effect of caffeine on visually-mediated reaction time

The power output of each muscle could also be measured (Newtons) to see caffeine's effect on power output of muscles.

Works cited

1. Guest, N. S., VanDusseldorp, T. A., Nelson, M. T., Grgic, J., Schoenfeld, B. J., Jenkins, N. D. M., Arent, S. M., Antonio, J., Stout, J. R., Trexler, E. T., Smith-Ryan, A. E., Goldstein, E. R., Kalman, D. S., & Campbell, B. I. (2021, January 2). *International Society of Sports Nutrition Position Stand: Caffeine and Exercise Performance*. Journal of the International Society of Sports Nutrition. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7777221/
2. Mero, A, and P V Komi. "Reaction time and electromyographic activity during a sprint start." *European journal of applied physiology and occupational physiology* vol. 61,1-2 (1990): 73-80. doi:10.1007/BF00236697

Author Contributions
Experimental Design: Ari T., Jun L. Nathen C.
Research Question/Hypothesis: Nathen C.
Possible Outcomes: Nathen C., Jun L.
Background: Andrew D., Ari T., Jun L.
Future Directions: Andrew D., Ari T.