

# The Effects Of Caffeine On The Agility T-Test and Heart Rate

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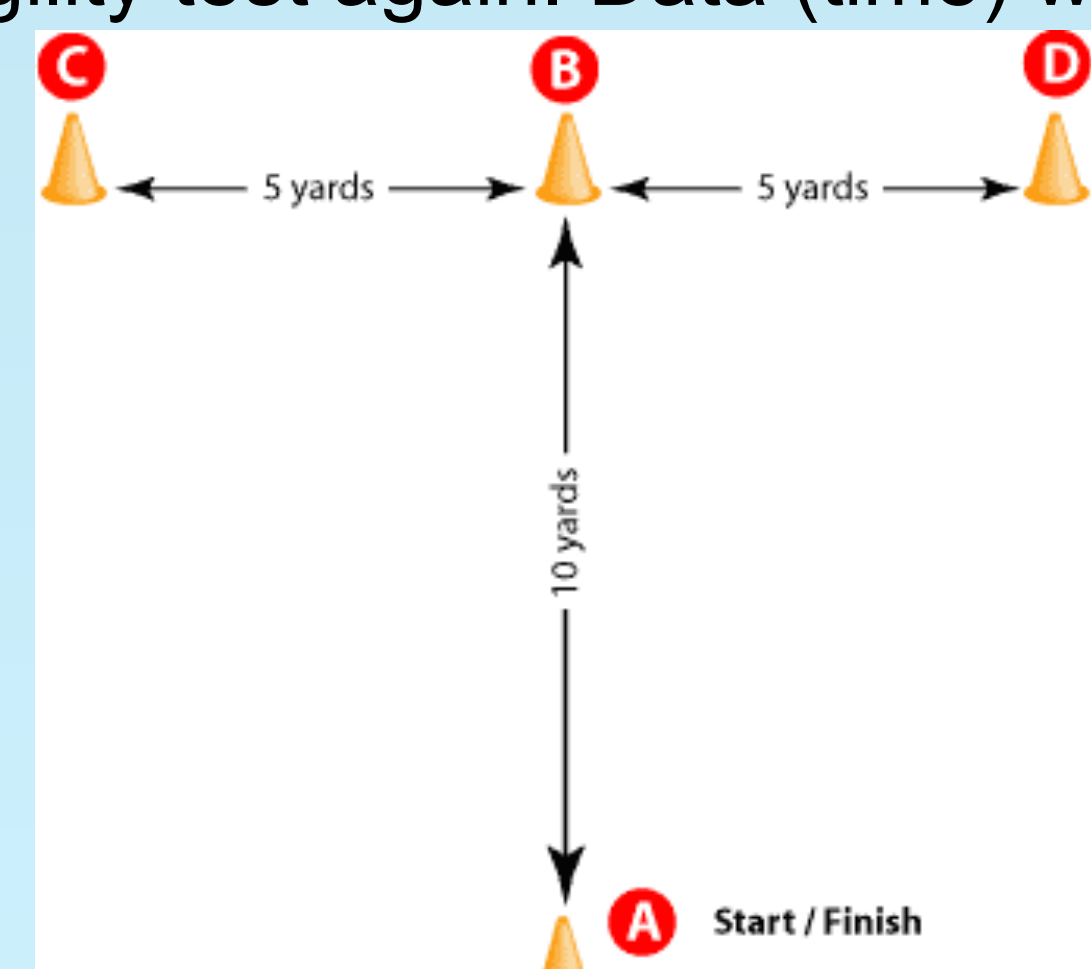
This project makes no effort to suggest generalizability. Instead, it was designed to demonstrate competency using lab equipment, capacity to integrate knowledge with application, and understanding of the scientific method.

## Introduction

According to Graham (2001), caffeine is a common substance in the diets of most athletes. It has been shown to increase speed and power output as well as increase training time at a greater power. It has been shown that the effects of caffeine is the same for women and men, both the time course and absolute plasma concentrations. The mechanism for which caffeine elicits its effects is unknown but popular theory suggests that it enhances fat oxidation and spares muscle glycogen (Graham, 2001). There is some literature to suggest that a moderate amount of caffeine (~3 mg/kg<sup>-1</sup>) has the greatest effect on sports performance (Burke, 2008). According to Pauole, Madole, Garhammer, Lacourse, & Rozenek (2000), the T-test is described as a measure of 4-directional agility and body control that evaluates the ability to change directions rapidly while maintaining balance without loss of speed. It is relatively simple to administer, because it requires minimal equipment and preparation. The t-test has been shown to be a reliable and valid measure of leg speed, power and agility (Pauole et. al, 2000). It was hypothesized that caffeine will increase speed and agility, and increase resting heart rate.

## Methods

4 college students, ages 20-22, were asked to participate in this test. There were two separate days of testing. Day one of testing consisted of the non-caffeinated test and day two consisted of the caffeinated test. On day one, subjects rested for 15 minutes. After the 15 minutes, the heart rate was measured for each participant. The subject then completed a warm-up on the walking track. The warm-up consisted of jogging a lap, high knees for 20 yards, arm circles, 10 forward and 10 backward, shuffles, 10 yards down and back, and forward/side leg swings, 10 each way. Subjects were then given a walkthrough of the agility test after warm-up prior to completing the test. The agility T-test (sprint to middle cone, then sprint to the right cone and then the left cone, then back to the middle cone, and then back to the starting cone. Subjects were instructed to touch every cone, except when ending the test) was to be completed as quickly as possible. Figure 1 below expresses the basic set up of the T-test. The time began on the subjects' initial movement and ended when the subject ran through the black start line. The data collected (time) was entered into an excel document. Subjects then rest for 3 minutes while a researcher monitored them to make sure no injuries occurred. On day two, subjects met with the researchers one hour prior to the test to ingest 2 mg/kg of caffeine. Subjects then came back after the hour passed and rested for 15 minutes. After the 15 minutes, the heart rate was measured for each participant. Subjects then completed the warm-up and agility test again. Data (time) was recorded in the excel sheet.



1,3,7-Trimethylxanthine  
<https://en.wikipedia.org/wiki/Caffeine>

## Results

Table 1: Heart rate and agility performance.

Subject	Heart Rate		Agility Performance	
	Non-caffeinated	Caffeinated	Non-caffeinated	Caffeinated
Subject 1	77 bpm	80 bpm	12.06 sec	9.59 sec
Subject 2	82 bpm	85 bpm	9.65 sec	9.62 sec
Subject 3	74 bpm	81 bpm	9.69 sec	8.82 sec
Subject 4	82 bpm	90 bpm	9.62 sec	8.40 sec

In Table 1, the heart rates are displayed with and without the ingestion of caffeine for each subject. Based on the table, the ingestion of caffeine caused an increase in heart rate for all subjects. For example, subject 1 had a heart rate of 77 bpm without the ingestion of caffeine and 80 bpm with it. The agility performance that each player exhibited for both trials is also shown. All subjects displayed a decrease in time after the ingestion of caffeine, however not all decreases in time were significant. For example, subject 2 had a 0.03 sec decrease in time, while subject 4 had a 1.22 sec decrease in time.

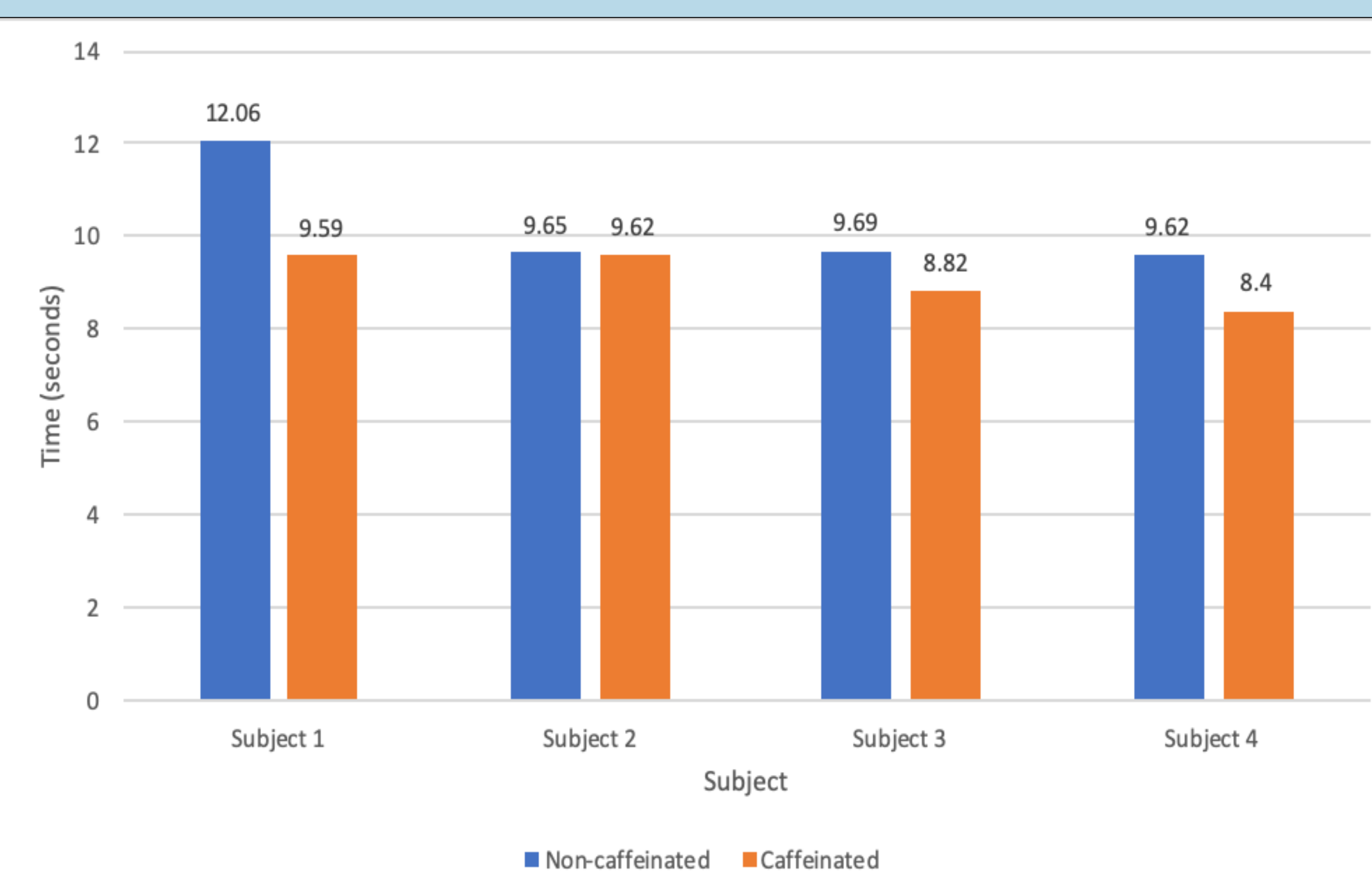


Figure 1. Agility performance with and without caffeine.

In Figure 1, the results for the agility T-test with and without caffeine are shown. All caffeinated trials resulted in a shorter test completion time. Subject 1 had the greatest improvement in time, with a non-caffeinated trial of 12.06 seconds and a caffeinated trail of 9.59 seconds.

Table 2: Correlation of heart rate.

		Non_Caffeinated	Caffeinated
Non_Caffeinated	Pearson Correlation	1	.817
	Sig. (2-tailed)		.183
	N	4	4
Caffeinated	Pearson Correlation	.817	1
	Sig. (2-tailed)	.183	
	N	4	4

In Table 2 above, the heart rates for each subject are shown in an SPSS correlation. The non-caffeinated and caffeinated trials results to have a correlation of 0.817 between all subjects.

## Discussion

According to Lorino, Lloyd, Crixell & Walker (2006), there are no significant improvements on agility when caffeine is consumed. However, when the subjects consumed caffeine, their test results did improve. All four of the subjects test results after their consumption of caffeine improved by at least 0.03 seconds. According to Hoffman (2006), female athletes between the ages of 18-22 tend to score between 10.5 and 12.50 seconds on the T-test. The subjects completed the T-test with an average of 10.25 seconds.

The normative value for resting heart rate is 68-72 beats per minute for women between the ages of 18 and 65 years old. The subjects' non-caffeinated resting heart rate averaged to be approximately 79 bpm. According to Geethavani, Rameswara and Rameshwari Reddy (2014), as the caffeine enters the bloodstream, the heart rate increases. All four subjects experienced an increase in their resting heart rates after the caffeine was consumed.

According to Bitar, et al. (2015), cardiac output increases after caffeine consumption. The physiology behind cardiac output is the inotropic and chronotropic response, which is the force of the heart beat and the heart rate, respectively (McArdle, Katch & Katch, 2015). Therefore, as the cardiac output increases, so does the heart rate. This means that when caffeine is consumed, the heart rate will increase.

Familiarity with the agility test may have altered results. Due to the subjects being new to the T-test, their unfamiliarity may have caused them to be slower initially. The familiarity of the test for trial 2 may explain why there was an improvement in the test results when course literature suggests that there should not have been improvement.

Testing an ergogenic aid such as caffeine is important in a performance environment. Once a subject consumes more than 9 mg/kg of caffeine, they can experience negative effects, such as tachycardia, which is a resting heart rate above 100 bpm (Beam & Adams, 2014). This ergogenic aid improves performance, making it important to determine whether or not an athlete should use it in order to create a proper training program.

## Conclusion

The results of this study showed that there was a slight improvement in the subjects test result after the consumption of caffeine. Based off of the results, it can be concluded that consuming an ergogenic aid will enhance performance slightly. It can also be concluded that heart rate during exercise will increase after the consumption of caffeine when compared to exercise without caffeine. It was hypothesized that the ingestion of caffeine would increase speed, agility, and increase heart rate. Based on the results, this hypothesis was correct, however it is unsure whether the improvements were due to the ingestion of caffeine or specific limitations, such as the familiarity of the test.

## References

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Figure 1. T- Test (Hachana et al.)