

THE EFFECT OF CAFFEINE ON SWIMMING SPEED

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How to cite this article: Alkatan, M. (December 2020). The effect of caffeine on swimming speed. Journal of Physical Education Research, Volume 7, Issue IV, 24-29.

Received: October 13, 2020

Accepted: December 22, 2020

ABSTRACT

Caffeine had also been used in sports and during training by coaches, athletes, and recreational athletes for performance to improve. Athletes, such as short-distance swimmers, who utilize the anaerobic system are interested in taking supplementation to boost their strength. Thus, the purpose of this study was to examine the effects of caffeine supplementation (250 mg) on swimming speed in college students. Eighteen college age students volunteered for the study. The study design was a randomized double-blind cross-over. This study involved two testing sessions. During the first and second testing sessions, subjects were given either coffee with caffeine or placebo. After forty-five minutes, the subjects were then asked to perform one swimming test. The results show that age mean of the participants was 22 ± 3 years, mean height of 175 ± 8 cm, mean body weight resulted to 84 ± 14.2 kg, and the body mass index concludes 27.4 ± 4.5 . Moreover, observation of further difference was not observed between placebo with a mean of 15.6 ± 5.8 sec. vs. caffeine mean of 15.3 ± 3.6 for the set $p > 0.05$. In conclusion, our present results indicate that consuming of a coffee, with 250 mg of caffeine was not effective to increase swimming speed by reducing the time needed to complete a 25 m simulated competition.

Keywords: Caffeine, swimming, speed.

1. INTRODUCTION

With various kinds of drugs in the world, caffeine is known as one of the most popular drugs. Caffeine had been consumed since ancient times by people of different races. It has been used as an ingredient in foods and beverages such as in chocolate, soda, coffee, sports drink, and black and green tea. It can also be found in some over-the-counter medications such as Excedrin, Anacin, and Midol.

Caffeine had also been used in sports and during training by coaches, athletes, and recreational athletes for performance to improve. It is said to have beneficial effects during both aerobic and anaerobic exercises. According to Forman et al. (1995), caffeine is used by approximately about 70% of young athletes globally. Studies showed an improved sports performance of around 3 mg/kg of caffeine (Jenkins et al., 2008; Ivy et al., 1979; Kovacs et al., 1998; Bridge & Jones, 2006).

The explanation for caffeine's ergogenic effect and its mechanism is still unclear. Caffeine intake is also associated with increased secretion of epinephrine (Graham et al., 1995; Greer et al., 1998). Researchers also suggested the effects of caffeine on endurance activities. Caffeine increases the use of fats while muscle glycogen is spared (Costill et al., 1978). However, this was argued by Graham et al. (2000) claiming that fat metabolism does not increase with caffeine. In another study, Kalmar and Cafarelli (1999) stated the

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mechanism of action of caffeine on strength exercises. Performance when doing strength exercises is enhanced since the firing rates of motor units are increased which would then lead to an increase in force production.

Several studies explored the ergogenic effect of caffeine supplementation when doing any physical activity or exercise in terms of sports performance. Caffeine showed beneficial effects on aerobic exercises as reported by the majority of the studies conducted. This claim was supported by Costill et al. (1978) wherein caffeine (330 mg) was found to significantly improve the cycle ergometer exercise time to exhaustion by 20%. In addition to this, a study conducted by Ivy et al. (1979) reported that the mean power output of cycling in two hours was enhanced significantly upon intake of caffeine (250mg). This result was 7.4% higher as compared with the placebo. Other findings of MacIntosh and Wright (1995) demonstrated in a 1500 m freestyle race an improved swimming time due to caffeine ingestion. Based on the results of these studies, it can be carefully concluded that caffeine enhances performance during endurance exercises.

The improvement of caffeine intake seen in sports performance is not just exclusive to aerobic exercises. Athletes, such as short-distance swimmers, who utilize the anaerobic system are interested in taking supplementation to boost their strength. Some studies indicate that caffeine can enhance performance on anaerobic exercises. Jacobson et al. (1992) found out that in highly trained males, caffeine intake (7 mg/kg) considerably improved their maximal strength. However, Bond et al. (1986) findings showed no significant difference in the muscular strength of untrained males between caffeine ingestion and placebo. A study by Beck et al. (2006) suggested that supplements that contain caffeine may be effective for increasing upper body strength but not for the lower body. Due to these varying results, a gap in the scientific literature exists regarding the effect of caffeine on anaerobic performance. There are only a few studies conducted concerning this gap. Moreover, the evidence available is inconclusive due to conflicting results. Based on this reason, this study is conducted to explore further the role of caffeine in strength enhancement particularly in swimmers. The purpose of this study was to examine the effects of caffeine supplementation (250 mg) on swimming speed in college students. It is hypothesized that there will be a significant reducing in swimming time with coffee of 250 mg of caffeine to complete the 25 m simulated swimming competition.

2. METHODS AND MATERIALS

2.1 Study Design

The study design was a randomized double-blind cross-over. This study involved an initial visit and two testing sessions. During the initial visit, investigators measured the baseline for height and body mass of the subjects. During the first and second testing sessions, subjects were given either coffee with caffeine or placebo. After forty-five minutes, the subjects were then asked to perform one swimming test. There was a wash-out period of 48 hours before each testing session which requires the participants to abstain from caffeine consumption.

2.2 Participants

A total of 18 college male students aging between 18 to 25 years old were recruited from the Department of Physical Education & Sports at the Public Authority for Applied Education and Training. All participants were classified as low risk for atherosclerotic cardiovascular disease following *ACSM's Guidelines for Exercise Testing and Prescription* (2006) in which subjects are asymptomatic and did not have more than one major coronary heart disease risk factor. Participants are excluded if they have the following conditions: 1) an ACL tear within

the last two years 2) a lower extremity injury within the last six months or 3) a neurological disorder. The inclusion criteria include the ability to swim continuously for at least 50 m. Subjects were given a Caffeine Consumption Diary to be filled up to assess their usual intake of caffeine (Sanchez-Ortuno et al., 2005). There were no nutrition supplements taken by the participants such as protein drinks, amino acids, creatine, and vitamins 48 hours before testing. The participants were informed of the purpose and potential risks or benefits of the study. A health history questionnaire (International Physical Activities Questionnaires) was completed by the participants which are a tool used in screening any pre-existing conditions that may preclude their participation in the study. Participants were then asked to sign a written informed consent document per the institutional guidelines for human research subjects at the Public Authority for Applied Education and Training.

2.3 Instrumentation

2.3.1 Twenty-five Meter Freestyle Swimming Test: The swimming test was performed in the swimming pool with a 25-m width located in the Department of Physical Education on The College of Basic Education. The water temperature of the swimming pool was held constant at 27–28°C. For uniformity, freestyle was used by all subjects. The speed at 25 m of maximum effort was recorded using a manual stopwatch (Casio, Japan). A whistle blow signaled the start of the swimming test with the participants pushing against the wall and the finish line is indicated by reaching the opposite end of the pool.

2.3.2 Body Mass and Height: Measuring height and body mass of a person were done using a balance scale – in centimeter and kilogram respectively. To calculate the Body Mass Index or BMI, mass in kilogram is divided by height in meter squared [mass (kg) / height (m²)].

2.4 Experimental Procedure

To support the experiment, a double-blind crossover design was used. To avoid bias, participants were designated randomly to a caffeine or placebo group; they were strictly told not to take caffeine which is present in products like tea, chocolate, coffee, and soda in 48 hours before the session of tests. Before the session, they were provided with a questionnaire regarding exercise and diet – to be completed in 24 hours. Diet plan and no intense exercise in the 24-hour range were also strictly followed by the participants before participating in each trial test. The swimming test was conducted only when the participants consumed the provided supplement forty-five minutes prior.

Treatment Ingestion: In one trial, swimmers ingested two shots of coffee with caffeine (250 mg; Nespresso® Ispirazione Palermo Kazaar). In another trial, swimmers ingested 2 shots of decaffeinated coffee (0 mg; Nespresso® Ispirazione Ristretto Decaffeinato) but with the same taste (placebo).

After performing the above mentioned, participants were told to warm up on a stationary bike with their choice of speed in five minutes; this was done during the second and third testing visits. Forty-five minutes before the swimming test, participants intake caffeine or placebo; sessions were conducted one week apart.

2.5 Statistical Analysis

Measurements of the experiments were validated through statistical tools. The *t*-test was used to find out the difference of mean values of the conducted swimming test with caffeine supplement and with not; using normality checks and Levene's test, assumptions were validated and therefore met. To have the significance of the data, $p < 0.05$ was set in all

analyses. Statistical analysis was finalized using Statistical Package for the Social Sciences in version 22.0.

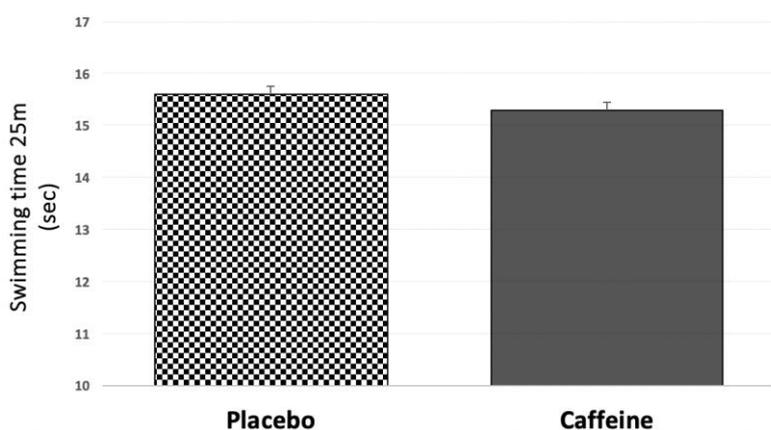
3. RESULTS

Table 1: Characteristics of study participants (n=10)

Variables	Mean \pm SD	Range
Age (years)	22 \pm 3	18 - 25
Body Mass (kg)	84 \pm 14.2	74.9 - 88.0
Height (cm)	175 \pm 8	170 - 188
BMI (kg/m ²)	27.4 \pm 4.5	21.8 - 29.4

Data are mean \pm SD and range, BMI (kg/m²) = Body Mass Index.

Figure 1: Mean swimming time (sec) in group of college age students after placebo and caffeine ingestion.



*Statistical significant differences between groups, $p < 0.05$.
Data are mean \pm SD and range.

There were 20 male college students recruited at first, but two of them withdrew their participation which resulted in a total of 18 male participants. Table 1 presented the Kuwaiti college students, whose age ranges from 18 to 25 years old, and contains the following data: age mean of 22 \pm 3 years, mean height of 175 \pm 8 cm, mean body weight resulted to 84 \pm 14.2 kg, and the body mass index concludes 27.4 \pm 4.5. Moreover, observation of further difference was not observed between placebo with a mean of 15.6 \pm 5.8 sec. vs. caffeine mean of 15.3 \pm 3.6 for the set $p > 0.05$.

4. DISCUSSION

The aim of this investigation was to determine the efficacy of a coffee with caffeine to improve swimming performance. For this purpose, 18 male college students performed 25 m swimming tests after the ingestion of the caffeinated coffee or the same drink without caffeine. Findings showed coffee with caffeine drink did not reduced the time needed to complete the 25 m simulated swimming competition.

There is tremendous amount of scientific information about the ergogenicity of caffeine products for physical performance in anaerobic prospective. However, only a few studies have been geared to determining the ergogenic effects of caffeine for swimming performance. There was an observed difference in highly trained swimmers who take caffeine at a moderate dose. Giving both trained and untrained swimmers 250 mg in both trained and

untrained, which have done 100 m freestyle swim, increase in swimming velocity of trained swimmers were only observed but not untrained swimmers (Collomp et al., 1991). Moreover, according to MacIntosh and Wright, who provided a caffeine dose of 6 mg/kg and did a 1,500-meter swim, swimming time was improved to those who take caffeine than the placebo.

In the present study, we did not see ergogenic effect of caffeine in improving swimming speed this might be due our sample are not highly trained swimmers. A study conducted by Collomp et al. 1991, stated that there is a possibility of physiological changes that occur in highly trained anaerobic athletes to have a normal ergogenic effect because of caffeine due to enhanced regulation of acid-base balance.

5. CONCLUSION

In conclusion, our present results indicate that consuming of a coffee, with 250 mg of caffeine was not effective to increase swimming speed by reducing the time needed to complete a 25 m simulated competition. Importantly, this can be taken as a positive finding, in that appetite-related hormones are not negatively influenced to impair weight.

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