The Effects of Caffeine on a Time-Trial Cycling Performance

Author: Chris Tucker

Faculty Sponsor: Dr. Judy Wilson

Cardiovascular Research Laboratory, The University of Texas at Arlington, Arlington, TX

Introduction

Caffeine is one of the most widely consumed drugs in the world. Its mechanism of action has given it credibility as an ergogenic aid. It has been shown to stimulate the mobilization and oxidation of free fatty acids (FFA), thus sparing muscle glycogen. Caffeine is also well documented as a central nervous stimulant and its direct effect on the central nervous system is found in its role as an adenosine antagonist. It is thought to inhibit adenosine from blocking neuronal transmission thus increasing pain tolerance and reducing fatigue.

Purpose

The purpose of this study was to investigate the effects of caffeine supplementation on a one-hour cycling performance.

Methods

Nine volunteers participated in this study. They were asked to refrain from endurance exercise and caffeine ingestion for a 24-hour period prior to testing. The participants were randomized into two groups. One group received caffeine for their first trial, while the other group received a placebo for their first trial. This was to avoid an ordering effect. Participants arrived at the lab 60 minutes prior to testing, at which point a relative dose (6 mg/kg of bodyweight) of either supplement was distributed and ingested in a single blind fashion. During that 60 minutes prior to testing, all subjects were asked to rest. At the end of the 60 minute rest period, a resting heart rate and blood pressure were taken. Immediately after these measurements were taken, each subject began a cycling protocol including a 5-minute warm-up, 60 minutes of exercise, and a 5-minute cool-down. During the warm-up phase, subjects were asked to maintain a pace of < 70 rpm. At the end of the 5-minute warm-up, subjects were allowed to increase the intensity to a level that they could comfortably pace themselves at for an hour, as long as they chose the same level of intensity for their second ride.

Methods (cont'd)

Participants were instructed to increase from their warm-up rpm range to a minimum of 70 rpm and to remain above 70 rpm for the duration of the exercise phase. Participants were encouraged to ride as far as possible. Heart rate, as measured continuously by a Polar monitor, was recorded every third minute, from the last minute of warm-up through the last minute of the exercise phase. Blood pressure was measured manually and recorded during the last minute of warm-up and every 5 minutes during exercise, Rating of Perceived Exertion (RPE), using Borg's 6 - 20 scale, was recorded during the last minute of warm-up and every 5 minutes during exercise. Distance was tracked and recorded (in miles) from the beginning of the exercise phase to the end of the exercise phase (60 minutes). Participants were unable to see the distance reading on the ergometer in order to control their effort. All participants returned at least 48 hours later to repeat the protocol. For their second trial, however, each subject was given the supplement that they did not ingest during the first trial (again, 6 mg/kg of bodyweight). Dependent, paired *t*-tests were conducted for HR, BP, RPE, and distance traveled. Significance was set to $p \leq 0.05$.

Results

Nine volunteers (age: 24.67 ± 2.69 yrs., height: 169.33 ± 9.99 cm, weight: 79.65 ± 20.22 kg) participated in this study (see Table 1). End stage (60 min) values were collected for HR, RPE, and total distance traveled (see Table 2). As shown in Fig. 1, there was a slight difference in total distance traveled between trials, but not a significant difference ($p > 0.05$). The differences in RPE (Fig. 2) and HR (Fig. 3) across time between trials were also found to be not significant ($p > 0.05$).

Subjects (n=9)	Mean	SD
Height (cm)	169.33	9.99
Weight (kg)	79.65	20.22
Age (yrs)	24.67	2.69

Table 1. Subject demographics

Results (cont'd)

	Mean		SD	
End-Stage values (60 min)	w/ caffeine	w/o caffeine	w/ caffeine	w/o caffeine
Distance covered (mi)	15.83	15.26	± 2.01	± 3.06
Heart rate (bpm)	152.11	150.11	± 20.98	± 30.23
Rating of Perceived Exertion	14.0	14.0	± 2.6	± 3.0

Table 2. End stage values

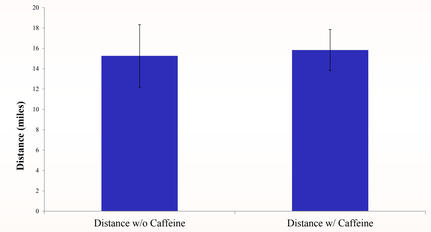

Fig. 1: Total distance traveled with and without caffeine

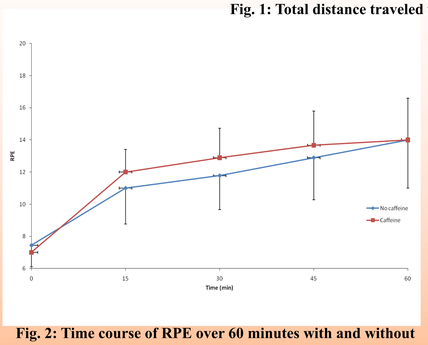

Fig. 2: Time course of RPE over 60 minutes with and without caffeine

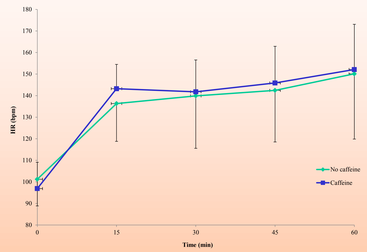

Fig. 3: Time course of heart rate over 60 minutes with and without caffeine

Conclusions

Based on the results of this study, caffeine demonstrated no beneficial effects on performance. Though other research has shown caffeine to have a positive impact on cycling performances, further modifications should be made to this protocol. Accounting for individual tolerances of caffeine may also be necessary, thus the inclusion criteria should be adjusted.