Effect of Pre-Workout Supplementation on Aerobic Endurance

Author: Mary-Catherine Wilson, KINE 4400
Faculty Sponsor: Judy Wilson, Ph.D
Cardiovascular Research Laboratory, The University of Texas at Arlington, Arlington, TX;

Abstract

INTRODUCTION: Pre-workout supplements are meant to improve exercise performance by increasing power, focus, endurance, and reaction time. Cellucor C4 Extreme is a popular pre-workout supplement containing multiple ingredients that are meant to improve exercise performance by working synergistically. Product claims for C4 include more energy, improved strength, and improved endurance.

PURPOSE: The purpose of this study was to evaluate the effectiveness of Cellucor C4 Extreme on submaximal cycle endurance by comparing five variables (distance, RPE, heart rate (HR), minute ventilation (V_E), and oxygen consumption (VO_2))

METHODS: Six female (22.5 year olds ± 1.0, 59.47 kg $\pm$ 5.52, 1.61 cm $\pm$ 0.45) recreationally active UTA students voluntarily participated in this study. Each subject completed three exercise sessions, one maximal exercise test to determine VO_2 max and two submaximal exercise tests. Subjects rode a Monark 828 E Ergomedics cycle ergometer and were fitted with headgear and a mouthpiece that connected to a Senorsmedics metabolic cart where expired air was collected and analyzed continuously. A Polar FT1 heart rate monitor was worn to monitor heart rate throughout the tests and blood pressure was also measured throughout testing. For the submaximal tests each subjects consumed either Gatorade (Drink A) or C4 supplement (Drink B) and waited for 30 minutes before beginning exercise. In order to avoid order-effect bias testing was randomized for each subject. Each subject then cycled for 30 minutes at the resistance corresponding to 70% of her VO_{2max}. Heart rate, blood pressure, RPE, and distance were measured and recorded every 10 minutes. The same procedures were followed for the second submaximal exercise test and each subject consumed the other drink.

RESULTS: The mean distances for Drink A were 1.61 cm $\pm$ 0.45, 6.5 km $\pm$ 0.93, and 10 $\pm$ 0.9 km for 10, 20, and 30 minutes respectively. Mean distances for Drink B were 3.2 km $\pm$ 0.59 km, 6.6 lm ± 1.1, and 10 ± 1.8 (p = 0.42). Mean RPE was 12 $\pm$ 0.84, 13 $\pm$ 1.1, and 15 $\pm$ 1.76 for Drink A, and 11 ± 1.33, 14 $\pm$ 1.76, and 15 $\pm$ 3.08 for Drink B (p = 1.0). Mean HR for Drink A was 145 bpm $\pm$ 15 bpm, 155 bpm ± 17, and 160 bpm $\pm$ 22; mean HR for Drink B was 144 bpm $\pm$ 20 bpm, 156 bpm $\pm$ 22 bpm, and 160 bpm $\pm$ 23 (p = 1.0). Mean V_E was 30.2 L/min $\pm$ 4.9, 30 L/min $\pm$ 2.6, and 29.7 L/min $\pm$ 9.9 for Drink A over 30 minutes and 32.1 $\pm$ 2.1, 35.5 L/min $\pm$ 10.5, and 32.3 L/min $\pm$ 16.4 for Drink B (p = 0.09). Lastly, VO_2 was 21.4-ml/kg/min $\pm$ 2.8, 21.8 ml/kg/min $\pm$ 3.9, and 20.1 ml/kg/min $\pm$ 5.3 for Drink A, and 22.6 ml/kg/min $\pm$ 3.5, 24.3 ml/kg/min $\pm$ 5.1 and 25.9 ml/kg/min $\pm$ 5.3 for Drink B (p = 0.15). There were no significant differences between the variables across time points or between supplements.

CONCLUSION: The results for this study indicated that C4 Cellucor Extreme pre-workout supplementation did not influence aerobic exercise endurance when cycling. Existing data on the effectiveness of pre-work supplementation on endurance is mainly related to local muscular endurance anaerobic endurance, and speed, and the effectiveness seems to vary with different supplement brands. There is very little data about the effectiveness of pre-workout supplementation for aerobic endurance, and much of the existing research is centered on resistance-trained men. The short duration and small sample size in this study also may have limited the effectiveness of the supplement.

Purpose

The purpose of this study was to evaluate the effectiveness of Cellucor C4 Extreme on submaximal cycle endurance by comparing five variables (distance, RPE, heart rate (HR), minute ventilation (V_E), and oxygen consumption (VO_2))

Methods

Subjects

There were six female University of Texas at Arlington (UTA) kinesiology students that voluntarily participated in this study, and were recreationally active. All subjects were 21-24 years old, had no contraindicated health conditions to exercise. All subjects agreed to the following criteria: (a) subjects were not categorized as obese (b) subjects have no known medical problems including but not limited to cardiovascular disease, diabetes, etc. (c) subjects are able to execute exercise from moderate to high intensity exercise (d) subjects must not be taking any pre-workout supplementation. Before onset of the study each participant was informed of procedures and their consent was acquired. All subjects were able to view a full ingredient list of the pre-workout supplement prior to consumption.

Methods (cont'd)

Procedures

Each subject completed three exercise sessions, one maximal exercise test to determine VO_2 max and two submaximal exercise tests. Subjects rode a Monark 828 E Ergomedics cycle ergometer and were fitted with headgear and a mouthpiece that connected to a Senorsmedics metabolic cart where expired air was collected and analyzed continuously. A Polar FT1 heart rate monitor was worn to monitor heart rate throughout the tests and blood pressure was also measured throughout testing. For the submaximal tests each subjects consumed either Gatorade (Drink A) or C4 supplement (Drink B) and waited for 30 minutes before beginning exercise. In order to avoid order-effect bias testing was randomized for each subject. Each subject then cycled for 30 minutes at the resistance corresponding to 70% of her VO_{2max}. Heart rate, blood pressure, RPE, and distance were measured and recorded every 10 minutes. The same procedures were followed for the second submaximal exercise test and each subject consumed the other drink.

Statistical Analysis

The alpha level was set at 0.05 to test for significance. A Two-tailed repeated measure t-test was evaluated using Microsoft Excel.

Results

Demographic Variables

	Mean	SD	Max	Min
Height (m)	1.61	0.45	1.65	1.57
Weight (kg)	59.47	5.52	65.9	51.4
Age (yrs)	22.5	1.0	24	21

There were no significant differences between the variables across time points or between supplements.
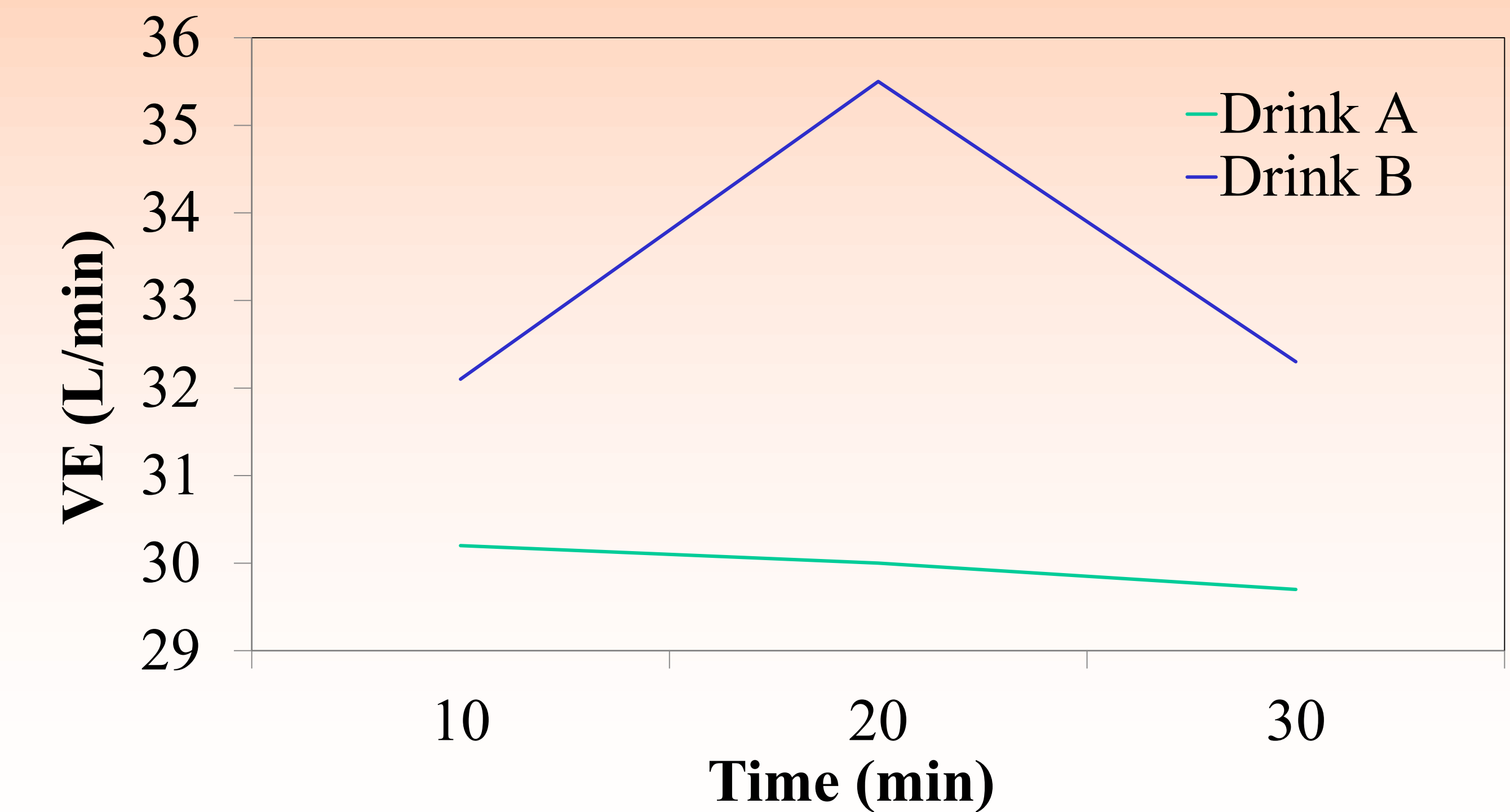
Results (cont'd)

Figure 1: Minute Ventilation During 30 Minute Submaximal Exercise With Consumption Of Control And Pre-Workout Supplement
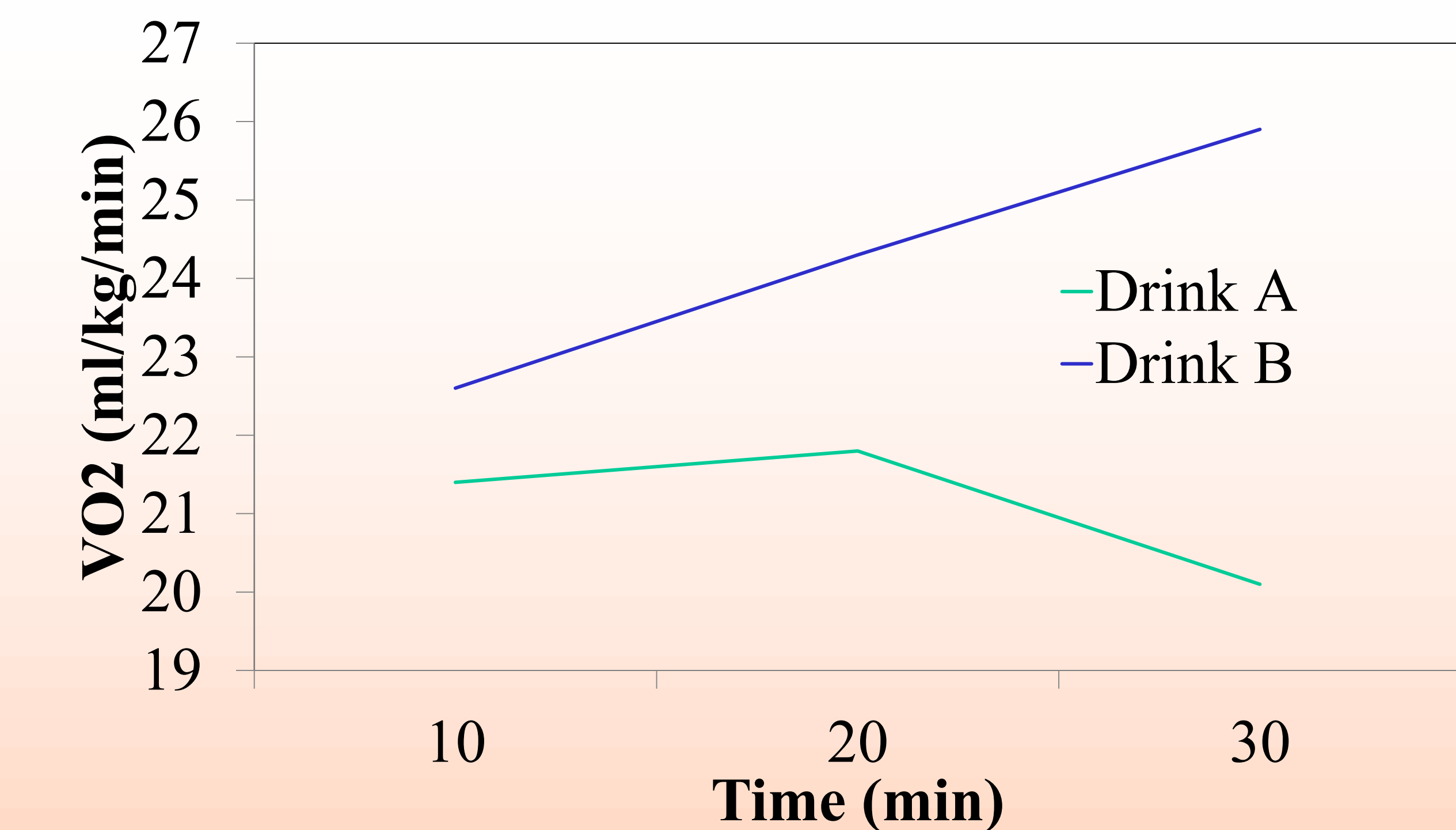

Figure 2: Oxygen Consumption During 30 Minute Submaximal Exercise With Consumption Of Control And Pre-Workout Supplement

Conclusions

The results for this study conveyed that C4 Cellucor Extreme pre-workout supplementation does not influence aerobic exercise endurance when cycling. Existing data on the effectiveness of pre-work supplementation on endurance is mainly related to local muscular endurance anaerobic endurance, and speed, and the effectiveness seems to vary with different supplement brands. There is very little data about the effectiveness of pre-workout supplementation for aerobic endurance, and much of the existing research is centered around resistance-trained men.