



Effects of C4 on Maximum Testing During Bruce Protocol

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Abstract

INTRODUCTION: The Bruce Protocol is a commonly used test for determining maximal oxygen consumption (VO_{2max}). The VO_{2max} value is a measure of an athlete's aerobic endurance. VO_{2max} can be reported in absolute terms (L/min) or it can be reported in relative terms (mL/kg/min). C4 is one of the most popular pre-workout supplements on the market. Research has showed that C4 can improve an athletes' anaerobic power and endurance, but not much research has been done on how C4 can affect aerobic endurance.

PURPOSE: The purpose of this study was to evaluate the effects that C4 had on subjects during maximal exercise testing using the Bruce Protocol.

METHODS: Five men (age 23.4 ± 3.71 yrs) from UTA volunteered to participate in this study. All five men were active and participated in some type of sport during and through the 6 months prior to this study. Each subject completed the Bruce Protocol, which is a graded exercise test on a treadmill, which increases speed and elevation every 3 minutes until they could not run anymore. Each subject completed this test twice: once after drinking a placebo and the other after drinking C4. During each test heart rate (HR), rate of perceived exertion (RPE), relative maximal oxygen consumption (mL/kg/min), and time of exercise were all recorded.

RESULTS: The maximum HR for the placebo trial was 191.6 ± 9.0 bpm compared to 191.4 ± 5.8 bpm with the C4 trial. This difference was not significant ($p = 0.14$). The average relative VO_{2max} for the placebo trial was 42.12 ± 6.9 mL/kg/min compared to 44.16 ± 6.8 mL/kg/min for the C4 trial which was also not significantly different ($p = 0.43$). The average time of exercise for the subjects during the placebo trial was 11 min \pm 6 sec compared to an average time of 11 min \pm 8.4 sec on the C4 trial ($p = 0.43$) which was also not significantly different. Finally, the average RPE for the placebo trial was 17.4 ± 1.5 compared to 18.2 ± 1.3 on the C4 trial resulted in no significant difference between the two conditions ($p = 0.19$).

CONCLUSION: The results of this experiment do not support the claims that C4, when consumed prior to exercise, will improve performance. However, this study evaluated maximal exercise only. Further studies are need to determine if C4 will improve performance during submaximal exercise, such as the type generally involved in a "workout".

Introduction

The Bruce Protocol is a commonly used test used for recording VO_2 max. The VO_{2max} value is a measure of an athlete's aerobic endurance. VO_{2max} can be reported in absolute terms (L/min) or it can be reported in relative terms (mL/kg/min). C4 is one of the most popular pre-workout supplements on the market. One of the reasons that C4 is so popular is because of the ingredient of Creatine Nitrate. The Creatine Nitrate allows the body to absorb more creatine which in turn allows the body to do more work. Research has showed that C4 can improve an athletes' anaerobic power and endurance, but not much research has been done on how C4 can affect aerobic endurance.

Purpose

The purpose of this study was to describe the effects that C4 had on subjects during maximal testing on the Bruce Protocol.

Methods

Five men (age 23.4 ± 3.71 yrs) from UTA volunteered to participate in this study. All 5 men were active and participated in some type of sport during and through 6 months prior of this study being conducted.

Methods (cont'd)

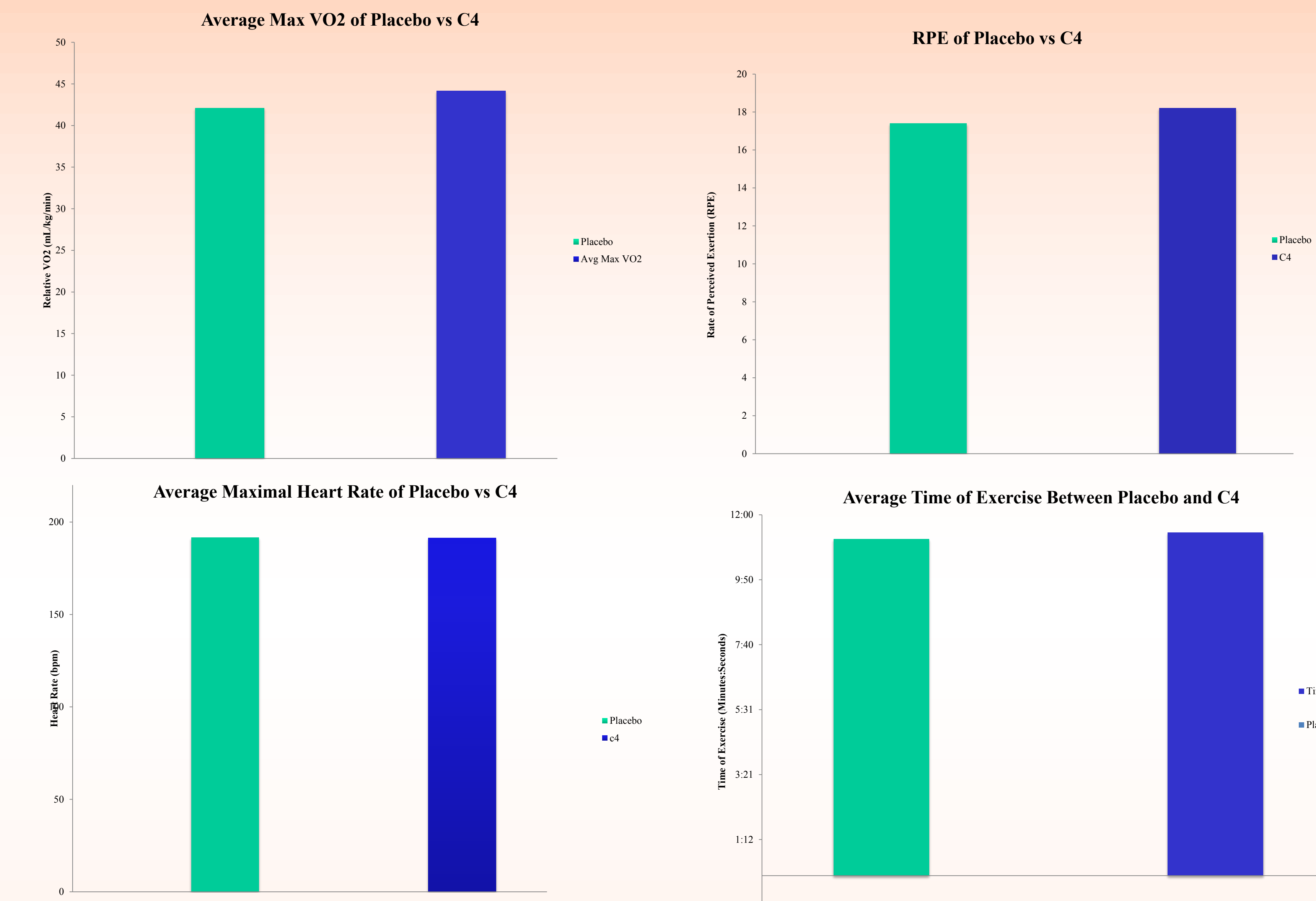
Each subject completed the Bruce Protocol, which is a graded exercise test on a treadmill, which increases speed and elevation every 3 minutes until the subject cannot run anymore, on two separate days. On one day, 30 minutes prior to the exercise the subjects ingested 6.5 grams of a placebo mixed in water, and on the other day the subjects ingested 6.5 grams of C4 mixed in water. The order in which they took the placebo and C4 was randomized. After drinking the fluid the subjects age, height, and weight were put into the computer system and then a heart rate monitor was attached to them. They would then step onto the treadmill. Once the heart rate monitor was on the subjects were given a head piece and a mouth piece that was attached to the metabolic cart. Subjects were also given a nose clip to ensure that they would only breath through their mouths. Once all equipment was set up the test began at a speed of 1.7 miles per hour (mph) and a 10% incline. Every 3 minutes the speed and incline increased by 10%. After each stage the subject was asked if they were good to continue and a thumbs up indicated they would continue while a thumbs down indicated to stop the test. When the subjects felt like they could only go for 10-15 seconds they would give a wiggle of the hand and once again a thumb down to terminate the test. After the test was completed they stayed on the treadmill for enough time to bring their blood pressure and heart rate to near resting values. During each test heart rate (HR), rate of perceived exertion (RPE), relative maximal oxygen consumption (mL/kg/min), and time of exercise were all recorded. Blood pressure was also monitored as a safety precaution. Once all data was recorded, the data was analyzed using a 2 tailed, 1 paired t-test. The alpha level for significance was set at $p \leq 0.05$.

Results

Table 1. Subject Characteristics

Age, yr	23.4 ± 3.7
Height, in	67.4 ± 1.5
Weight, lbs	163.4 ± 21.7

Results



The average max heart rate for the placebo trial was 191.6 ± 9.0 bpm compared to 191.4 ± 5.8 bpm with the C4 trial resulted in no significant difference ($p = 0.14$). The average relative max VO_2 for the placebo trial was 42.12 ± 6.9 mL/kg/min compared to 44.16 ± 6.8 mL/kg/min for the C4 trial, which was also not significant ($p = 0.43$). The average time of exercise for the subjects during the placebo trial was 11 minutes and 11 seconds \pm 6 seconds compared to an average time of 11 minutes and 24 seconds \pm 8.4 seconds on the C4 trial ($p = 0.43$) and the average RPE for the placebo trial which was 17.4 ± 1.5 compared to 18.2 ± 1.3 on the C4 trial ($p = 0.19$) were also not significantly different.

Conclusions

The results of this experiment support the evidence that C4 and pre-workout supplements similar to C4 have no effect on maximal aerobic endurance. However, further research should be done to determine the effect on submaximal work.