The purpose of this study was to examine the effects of 3 hr intensive cycling over 3 successive days on cycling economy (CE) and gross efficiency (GE) under quercetin and placebo supplementation conditions. Forty trained cyclists were randomized into quercetin and placebo groups and took either V02max in elite cyclists. Body fat (%), age, height, and peak power output were measured during cycling. Efficiency does not appear to be significantly different between untrained and trained cyclists and has been reported to be inversely related to V02max in elite cyclists. Body position, level or uphill riding and standing or sitting positions have all been shown to influence gross efficiency. However, changes in gross efficiency during long-duration cycling exercise or following successive bouts of exercise has not been studied. There have been investigations that have implied that prolonged cycling decreases gross efficiency; however cycling for longer than one hour has never been examined. Typically, VO2 max tends to decrease slightly during prolonged cycling at a fixed exercise intensity (at intensities >70% of V02max) due to increases in body temperature and sympathomimetic levels. This implies that gross efficiency would decrease. Recently there has been some evidence that the flavonoid quercetin is capable of stimulating mitochondrial biogenesis in mice. There is no evidence currently on the effects of quercetin on exercising humans. Therefore, the purpose of this study was to examine the effects of quercetin and placebo supplementation on gross efficiency of long-duration cycling (at fixed gross efficiency and cycling economy).

Methods

Research design: Forty trained male cyclists were recruited through local and collegiate cycling clubs. Two to three weeks prior to the first test session, subjects reported to the ASU Human Performance Lab for orientation and measurement of body composition and cardiorespiratory fitness. VO2max was determined using a graded maximal protocol (20-watt increase every two minutes starting at 138-watts) with the subject using a self-selected saddle on CompuTrainer™ Pro Model 8011 trainers. All exercise testing was performed in a controlled environment with a neutral stage background. Basic demographic and training data were obtained through self-administered questionnaires. During orientation, subjects were provided with the protocols and instructions for the trials. During the last two mins prior to test during the 3-day test sessions and record taken in a local record.

Experimental: Subjects were randomized to either quercetin (HCl) or placebo (V02max) groups and under double blind procedures received three weeks quercetin (150 mg/ml) or placebo supplements prior to, during, and for two weeks after the three-day period of intensified exercise. Subjects came to the lab for three consecutive days following the three-day period of intensified exercise. Subjects reported to the lab at 2:00 pm for each of the three test sessions between 12:00 pm and 6:00 pm. Subjects were instructed to fast 6-hr prior and immediate post the first and third test. Experimental subjects reported either to the lab or CompuTrainer™ Pro Model 8011 trainers for 3-hr cycling bout. All pre-test procedures or tests were repeated during the test sessions. During the test sessions, experimental subjects cycled on their own bicycles on CompuTrainer™ Pro Model 8011 trainers. Metabolic measurements were made every 30 minutes of cycling using the CompuTrainer™ metabolic system to verify workload. Current workload, average relative, overall rating of perceived exertion (RPE) were also collected every 30 minutes. Fingertip capillary blood samples were taken with Jamshidi bone marrow needles for analysis of blood lactate and glucose. Blood samples were obtained using a YSI 2300 STAT Plus. Cycling was performed at 57% Watts max in elite cyclists. Body fat (%), age, height, and peak power output were measured during cycling. Efficiency does not appear to be significantly different between untrained and trained cyclists and has been reported to be inversely related to V02max in elite cyclists. Body position, level or uphill riding and standing or sitting positions have all been shown to influence gross efficiency. However, changes in gross efficiency during long-duration cycling exercise or following successive bouts of exercise has not been studied. There have been investigations that have implied that prolonged cycling decreases gross efficiency; however cycling for longer than one hour has never been examined. Typically, VO2 max tends to decrease slightly during prolonged cycling at a fixed exercise intensity (at intensities >70% of V02max) due to increases in body temperature and sympathomimetic levels. This implies that gross efficiency would decrease. Recently there has been some evidence that the flavonoid quercetin is capable of stimulating mitochondrial biogenesis in mice. There is no evidence currently on the effects of quercetin on exercising humans. Therefore, the purpose of this study was to examine the effects of quercetin and placebo supplementation on gross efficiency of long-duration cycling (at fixed gross efficiency and cycling economy).

Results

Body composition data. Blood samples taken during the rides were analyzed using a YSI 2000 STAT Plus (Yellow Springs, OH). Body composition data were analyzed using a YSI 2000 STAT Plus (Yellow Springs, OH). Body fat (%), age, height, and peak power output were measured during cycling. Efficiency does not appear to be significantly different between untrained and trained cyclists and has been reported to be inversely related to V02max in elite cyclists. Body position, level or uphill riding and standing or sitting positions have all been shown to influence gross efficiency. However, changes in gross efficiency during long-duration cycling exercise or following successive bouts of exercise has not been studied. There have been investigations that have implied that prolonged cycling decreases gross efficiency; however cycling for longer than one hour has never been examined. Typically, VO2 max tends to decrease slightly during prolonged cycling at a fixed exercise intensity (at intensities >70% of V02max) due to increases in body temperature and sympathomimetic levels. This implies that gross efficiency would decrease. Recently there has been some evidence that the flavonoid quercetin is capable of stimulating mitochondrial biogenesis in mice. There is no evidence currently on the effects of quercetin on exercising humans. Therefore, the purpose of this study was to examine the effects of quercetin and placebo supplementation on gross efficiency of long-duration cycling (at fixed gross efficiency and cycling economy).

Conclusions

Both Cycling Efficiency and Gross Economy were found to decrease significantly during each of the 3 successive days of 3 hr bouts of cycling at ~57% max. A significant decrease in cadence, glucose, RER and muscle glycogen levels were found along with a significant increases in HR, lactate and VO2 during each 3 hr bout. A significant day effect was found for GE and CE from day 1 to day 2 indicating that GE and CE could be diminished during successive days of prolonged cycling. Quercetin supplementation did not cause any significant changes in GE, CE, HR, lactate, RER, glucose, cadence, VO2, or muscle glycogen levels.