Measures of Power and Fatigue Index Differ Between Sitting and Standing During the Wingate Anaerobic Test in Women

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Introduction

- Cycling is a continuous task well suited for assessing the physiological response to physical activity in laboratory environments.
- Factors such as body position often influence the output measures of gross motor activities such as cycling.
- The Wingate Anaerobic Test (WAnT) has been widely used to assess power output and anaerobic capacity in a variety of populations.
- Studies show that measures of power output (W) are usually greater when cycling in a standing position rather than in a seated position.
- Yet little is known regarding how cycling position influences the characteristics of power output and fatigue in women performing the WAnT.

Methods

- Purpose
  - Thirty-two apparently healthy women (24.14±1.62 years, 167.77±7.52 cm, 64.13±8.55 kg) completed this study.
  - Inclusion criteria included individuals who exercised at least 30 minutes 3 or more days per week.
  - Individuals who regularly cycle or possess any known pathology which, by itself, might alter gross motor coordination were excluded.
  - Each participant completed a 30 second maximal intensity cycling trial (WAnT) in seated and standing positions (Figure 1) – following a standardized warm up and pacing familiarization protocol.
  - Participants rode an electronically-braked cycle ergometer (Computrainer, Racermate, Seattle, WA) mounted to Fit Cycle (Serrata, Saratoga Springs, NY)
  - The trial order (seated vs standing) was randomized
  - Participants visited the laboratory on two separate occasions
  - Riding conditions were controlled and measured by computer

Results

- The following variables were assessed continuously during each trial: speed, watts, cadence, and measures of cycling efficiency (SpinScan™), and average torque angle (ATA) throughout the 360° of pedal travel.
- Indices of peak power (PP), mean power (MP), and fatigue index (FI) were calculated using 5 second time periods:
  - PP: Maximum power Output
  - MP: Average power Output
  - FI: [(Peak Power Output – Min Power Output)/Peak Power Output] x 100
- Paired t-tests were used for statistical analysis.

Discussion

- Significant differences were found between the conditions for:
  - PP (t(31)= -2.46, p=0.02)
  - MP (t(31)= -8.66, p<0.000)
  - FI (t(31)= 2.42, p=0.021)
- Power values were significantly higher – and the fatigue index was significantly lower – during the seated condition.

Conclusions

- Subjects responded to the different riding positions by demonstrating differences in short term muscular force production as measured by MP, PP, and FI.
- Statistical analysis revealed significantly greater power values in the seated versus the standing position.
- Contrary to previous studies, the findings suggest that there is more effective power output and fatigue index in the seated cycling position.
- The lesser power output, earlier fatigue onset and decreased efficiency seen in the standing position may be due to the following:
  1) less optimal muscle length positioning
  2) altered use of available short term energy stores

References