Comparing Power and Endurance Athletes in the Wingate Test

By: Micah Balltzglier, Antwann McCray, Jacob Wall, and Megan Wortman

GARDNER-WEBB UNIVERSITY

This project makes no effort to suggest generalizability. Instead, it was designed to demonstrate competency using lab equipment, capacity to integrate knowledge with application, and understand the scientific method.

INTRODUCTION

The Wingate Anaerobic Test is a supramaximal test when maximal oxygen consumption serves as a maximal reference point (Beam, Adams, 2014). The physiological basis of the Wingate Test is focused on the contributions of the anaerobic pathway to the major components of the Wingate Test (Beam, Adams, 2014). The mean anaerobic power reflects the transfer of energy from the anaerobic glycolytic pathway.

Specificity of training, in the discussion between power trained athletes and endurance trained athletes, is paramount if one is to produce physiological adaptations aimed at improving overall performance. Adaptations typically include increases in mitochondrial density, capillary bed density, efficiency in clearing lactate, and hemoglobin content. The physiological adaptations that accompany anaerobic training lend themselves to higher power output while adaptations that accompany aerobic training contribute to longer sustainment of exercise. The perceived exertion scale (RPE) speaks mainly to the tolerance of an individual to the accumulating of excess hydrogen during anaerobic work. The restitution heart rate of an individual is a good indicator of aerobic fitness (Zajac, Ryszard, & Waskiewics, 1999). Power values and fatigue rates as indicated by the Wingate test assist in assessing an athlete's ability to sustain high power outputs during exercise (Miller, Kieffer, Kemp, & Torres, 2011).

The outcome of the Wingate test will be investigated for both power and endurance athletes In regards to physiological adaptations as a response to power and endurance training, . It is hypothesized that throughout the Wingate testing, endurance athletes will display greater recovery heart rates and lower blood pressure values due to their superior aerobic capacity. However, power athletes will maintain a lower overall percent of maximum heart rate reached, as well as lower RPE values due to superior adaptations in the creatine-phosphate, lactate clearing, and anaerobic energy systems.

METHODS

4 subjects, 2 power trained athletes and 2 endurance athletes

-Collect age, gender, height, weight, hip circumference, and individual quadriceps circumference

-Put a blood pressure cuff and heart rate monitor on the subject and adjust the seat, handles and pedals for the subject.

-The rest phase starts after steps 1 and 2 which is 5 minutes. Blood pressure and heart rate will be collected at 2 and 4 minutes within the phase.

-The subject then enters the warm-up phase on the bike which lasts 5 minutes. Heart rate and blood pressure is taken at 3 and 4.5 minutes. Male subject need to peddle with 90W resistances and female subject at 60W resistances.

-The subject enters the 10 second built up phase which, then lead into the 30 second test phase. Heart rate and blood pressure is taken after the 30 second test phase.

-The cool-down phase is 3 minutes with no resistance at 60 rpm. Heart rate and blood pressure will be taken every 30 seconds in this phase.

-The rest phase is 6 minutes sitting in a chair. Heart rate and blood pressure is taken every 45 seconds in this phase.

Table 1. *Data Collection*

	Power Subject 1	Power Subject 2	Endurance Subject 1	Endurance Subject 2
Peak Power (Watt)	780	702	402	661
Mean power (Watt)	614.75	516.59	362.67	516.03
Minimum power (Watt)	268	360	139	273
Rate of Fatigue (%)	65%	49%	65%	59%
Fatigue slope (Watt/s)	24.64	15.28	13.14	17.48
Peak power/body mass (Watt/kg)	7.82	5.46	5.88	8.89
Mean power/body mass (Watt/kg)	6.16	4.02	5.30	6.94

Table 2. *Hip Circumference to Peak Power Ratio*

Subjects	Hips (Inches)	Peak Power (Watt)
P1	110	780
P2	124.5	702
E1	93	402
E2	104	661

R= 0.74204

RESULTS

-Power athletes displayed higher peak power and mean power in relation to endurance athletes as shown in table 1.

-For figures 1and 2, the pink and blue lines represent power athletes. The pink line represents subject 1 for power and the blue line represents subject 2 in the power category. The green and red lines represent the endurance athletes in figures 1 and 2. The green line is subject 1 for endurance and the red line is subject 2 in the endurance category.

-Figure 3 displays the rate heart rate increase during the test and the recovery time after the expiration of the test. The endurance subject 2 had the highest heart rate during the test. The endurance athlete 1 had the fastest recovery heart rate when compared to all the subjects in the study.

-The mean RPE for power athletes was 12.5 and the mean RPE for endurance athletes was 17.5.

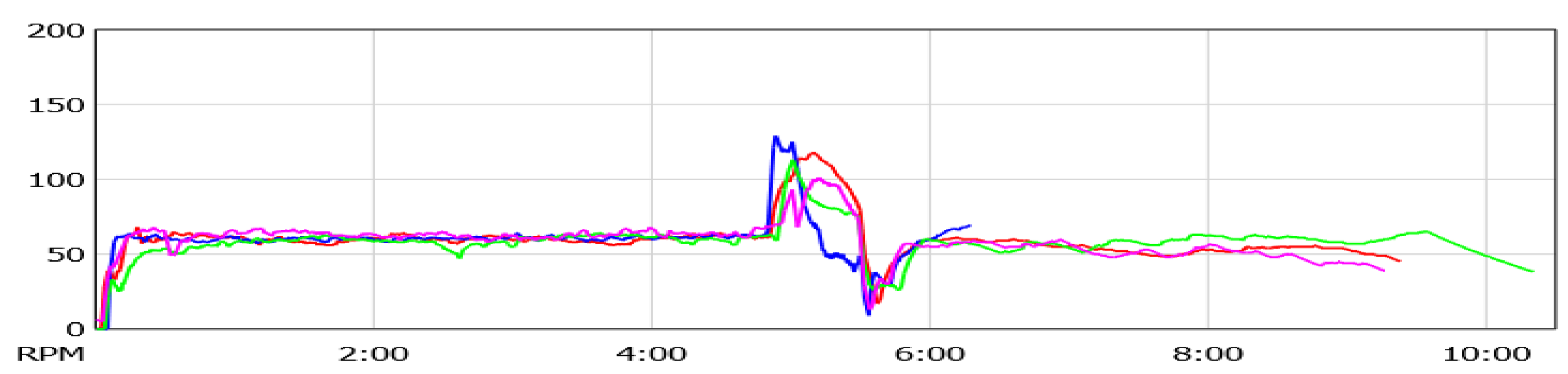

Figure 1. *Amount of RPM produced*

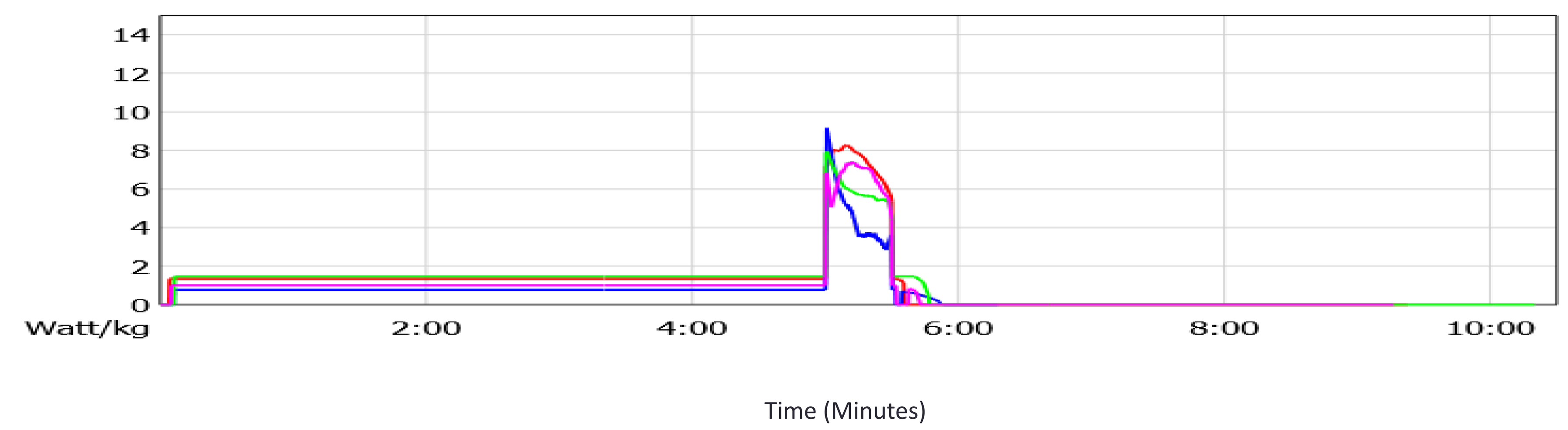

Figure 2. *Amount of Watts produced related to weight*

CONCLUSION

While all the subjects displayed a significant increase in heart rate during the test, power athletes had a higher peak power and mean power when compared to endurance athletes. However, one of the endurance subjects produced nearly the same mean power as one of the power subjects. Furthermore, an endurance athlete had the highest heart rate while the other had the fastest heart rate recovery. Overall, the initial hypothesis was largely supported by the results gathered from the Wingate test. The endurance athletes were able to restore heart rate and blood pressure faster than the power athletes due to their superior aerobic capacity, although; not by as significant of a margin as anticipated. The power athletes proved to maintain a lower overall percentage of heart rate maximum throughout the test as well as a lower RPE value due to superior adaptations in the creatine-phosphate, lactate clearing, and anaerobic energy systems. In effort to produce more reliable results and a definite answer to the targeted proposition, more than four endurance and power athletes should be tested. In conclusion, the hypothesis proved to be supported by the data collected from the test as the endurance athletes were able to restore heart rate and blood pressure at a faster rate and the power athletes maintained a lower overall percentage of heart rate maximum with a lower RPE value.

DISCUSSION

- The Wingate Test is a test designed to investigate anaerobic power. Anaerobic energy contribution ratio is 72% and highly dependent on skeletal muscle, which explains why it is directly affected by fat free mass and muscle mass (Kim, Cho, Jung, & Yoon, 2011).Despite contributing as much as 45-49% of all the ATP, the glycolytic capacity is not fully utilized during the Wingate test due to its short duration. According to Nikolaidis et al., long-term adaptations to power training would be adequate for increased performance results in Wingate Test (Nikolaidis et al., 2018). Adaptations to mitochondrial density, capillary bed density, lactate clearing, and cardiac output are responsible for improvements in anaerobic sport performance as a result of resistance and power training (Shiau, Tsao, Yang, 2018). These adaptations are indicated in our results when comparing the findings from the power athletes and that of the endurance athletes in this study. Power athletes are active for short, intense bouts, which may call for an increase in anaerobic capacity (Kim, Cho, Jung, & Yoon, 2011). Although adaptations in energy systems also occur through aerobic training, they do not necessarily lend themselves to high performance values in the Wingate test. Although the oxidative metabolic pathway is utilized during short, intense bouts of exercise, they are secondary to that of the anaerobic pathways. The correlation between Type 1 muscle fibers and mean aerobic power is significant (Beam & Adams, 2014). The training of these fibers, as seen in power athletes, could result in adaptations that ultimately lead to greater results during testing.

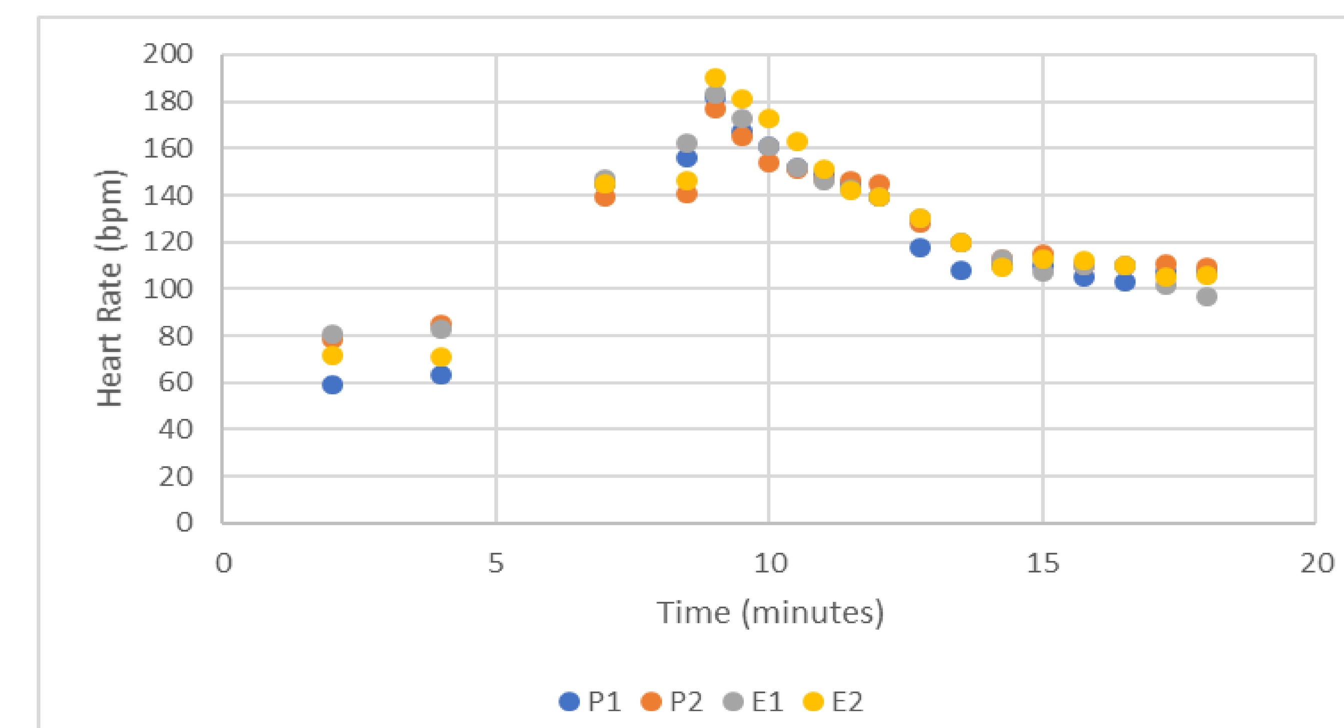

Figure 3. *Heart Rate Recovery*

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