The Effect of Increased Hip Rotation on Lower Body Anaerobic Power and Fatigue Index During the Wingate Anaerobic Power Test

Andrea Foster, Keisha Crum, Luke Humphreys, Dylan Rich

Mentors: **Dr. Manuel Probst, Dr. Gina Gonzalez, Carl Pickering**

The Department of Kinesiology, Health and Imaging Sciences College of Science

Introduction

The Wingate Anaerobic Power Test (AnPT) has been used for decades to measure lower body peak and average anaerobic power, components critical to athletic performance such as in running and cycling events. The test is typically performed on a cycle ergometer with minimal hip rotation in the sagittal plane, as in "traditional" cycling. However, the hips can move in multiple planes and therefore the hip musculature may additionally contribute to overall anaerobic power.

Purpose

Due to the potential contribution of the hip musculature in generating anaerobic power, the purpose of this study was to determine the effect of increased hip rotation on anaerobic power and fatigue.We hypothesized that increased rotation would have an impact on anaerobic power even if the subject transitions from the traditional Wingate Power Test to the hip swivel Wingate test during all-out cycling while decreasing fatigue index.

Methods

Subjects. Sixteen (male (10) and female (6)) students, between the ages 19 and 27 from Morehead State University, volunteered for the study

instruments. The instruments that were used for the test include: Monark 874E Ergometer, SMI computer program, and scale to gather weight.

Procedures: This study required each participating to complete to different test using the Wingate. Subjects performed this test twice on nonconsecutive days in order to ensure full recovery. A counter-balanced design was used to avoid an order effect. If incorrect form was utilized then the test was stopped. Each subject was weighed prior to testing in order to determine the proper resistance (load applied to the bike) added. The load is 7.5% of the subjects weight in kg. Following a seat height adjustment each subject performed a two minute non load bearing warm-up before each portion of the tests.

Traditional Cycling: Each subject then performed a 10-second, no-load period of increased cycling speed. Once the 10 second countdown was complete, a weight tray with the proper load was dropped, applying tension to the flywheel making the bike harder to pedal. Each subject pedaled all out for 30 seconds against the weighted flywheel, followed by a 2-5 minute no-load, cool down.

Rotation Cycling. Subjects were instructed to perform the first 15 seconds like the traditional test, then at 15 seconds were given an indicator to over-rotate their hips by aiming their knees at the handlebar stem of the bike. Subjects were initially allowed to practice this technique during their warm-up period. Technique

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Peak Traditional-Peak Swivel	21.813	63.704	15.926	-12.133	55.758	1.370	15	.191
Pair 2	Mean Traditional – Mean Swivel	-.625	27.232	6.808	-15.136	13.886	-.092	15	.928
Pair 3	Min Traditional – Min Swivel	-6.750	40.151	10.038	-28.145	14.645	-.672	15	.512
Pair 4	Traditional Fatigue – Swivel Fatigue	6.000	5.741	1.435	2.941	9.059	4.180	15	.001

Methods

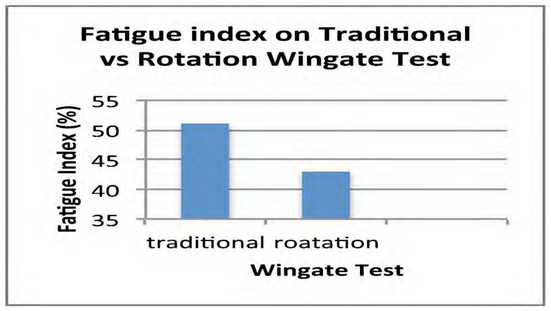
The statistical analysis was a paired samples t-test that was performed on the peak power, minimum power, mean power, and the fatigue index (% decrease in power) of each subject using IBM's SPSS software.

Results

The results in Table 1 indicate that the mean power for the traditional and rotation Wingate tests are both 475 W (Traditional: 475 +/- 171, Rotation:475 +/- 165). The results also display that the fatigue index for the traditional Wingate test was 51% +/- 11%, while the Rotation Wingate test was 45% +/- 11% This is a 6% decrease in fatigue loss. This means that transitioning to the hip rotation technique does not directly cause the over all power to decrease but illustrates a decrease in the fatigue index by approximately 6%.

Table 1: Comparison of Average Data Between Traditional Wingate Test and Hip Rotation Wingate Test

	Traditional	Std.Deviation	Rotation	Std. Deviation
Peak (W)	668	267	646	235
Minimum Power(W)	334	133	341	130
Mean Power (W)	475	171	475	165
Fatigue Index (%)	51	11	43	165



Discussion

The results from this study indicate that our hypothesis was correct. Participants were able to keep the same mean power while lowering their fatigue index in this study. This gives credibility to our hypothesis. These results could benefit cyclists by incorporating the hip swivel (rotation of the hips) after the cyclist begins to fatigue or during the of the middle of a race therefore they will be less fatigued and in turn exert more power toward the end of the race.

Sample Trends for Power (Traditional vs. Hip Rotation)