Effect of Breathing Apparatus on the Patterns of Response for Physiological Variables during an Incremental Test to Exhaustion

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Effect of Breathing Apparatus on the Patterns of Response for Physiological Variables during an Incremental Test to Exhaustion

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Abstract

During running exercise, trained runners will utilize both nasal and oral breathing mechanisms. However, during most clinical running tests, the breathing apparatus blocks the nasal pathway; therefore only allowing oral breathing. It has been suggested that a breathing apparatus that allows both nasal and oral breathing may provide an environment that is more similar to running outside of a lab setting. PURPOSE: The purpose of this study was to examine the patterns of response for physiological variables during an incremental treadmill running exercise test to exhaustion utilizing both a traditional mouth piece (MP) and breathing mask (MSK) apparatus.

METHODS: 16 subjects (MP: mean ± SD: 30.0 ± 1.3 yrs; body mass: 72.3 ± 6.2 kg; height: 173.5 ± 5.4 cm; MP: mean ± SD: 30.0 ± 0.9 yrs; body mass: 63.2 ± 7.6 kg; height: 173.3 ± 6.4 cm) performed an incremental treadmill running test to exhaustion for the determination of maximal oxygen consumption (VO2max) and peak values for heart rate (HRpeakmax), breathing frequency (BFpeakmax), and respiratory exchange ratio (RERpeakmax). All submaximal values from the incremental treadmill test were normalized as a percent of their peak value (corresponding to Tlim) and data points were normalized across subjects and represented as a percent of time to exhaustion (%Tlim). T20, 30, 40, 60, 80, and 100% Tlim. The first three minutes of exercise were eliminated for the initial physiological adjustment to exercise, so percent Tlim begins at 3% for all subjects. Statistical analysis included polynomial regression analyses to determine the patterns of responses for the physiological variables during runs in MP and MSK conditions. RESULTS: There were significant, positive, linear relationships for mean, normalized VO2 (r MP=0.99 and r MSK=0.90; p < 0.01) and HR (r MP=0.97 and r MSK=0.89; p < 0.01) versus Tlim during the incremental tests to exhaustion. There were significant, positive, quadratic relationships for mean, normalized VO2 (r MP=0.99 and r MSK=0.89; p < 0.01, respectively) and RER (r MP=0.99 and RER=0.90; p < 0.01) versus Tlim during the incremental tests to exhaustion.

Results

There were significant, positive, linear relationships for mean, normalized VO2 (r MP=0.99 and r MSK=0.89; p < 0.01) and HR (r MP=0.97 and r MSK=0.89; p < 0.01) versus Tlim during the incremental tests to exhaustion. There were significant, positive, quadratic relationships for mean, normalized VO2 (r MP=0.99 and r MSK=0.89; p < 0.01, respectively) and RER (r MP=0.99 and RER=0.90; p < 0.01) versus Tlim during the incremental tests to exhaustion.

Introduction

During running exercise, trained runners will utilize both nasal and oral breathing mechanisms. However, during most clinical running tests, the breathing apparatus blocks the nasal pathway; therefore only allowing oral breathing. It has been suggested that a breathing apparatus that allows both nasal and oral breathing may provide an environment that is more similar to running outside of a lab setting. Each breathing apparatus has its drawbacks. When the mouthpiece and nose clip are used, subjects may have difficulty breathing comfortably. When the mask is used, subjects may feel uncomfortable and lightweight around the edges. It may be a potential source of error when collecting gas measurements for VO2max. Some research has disagreed on whether not the subject’s discomfort or difficulty breathing affects the response for the next metabolic responses or terms of VO2, HR, BF, and RER

The purpose of this study was to examine the patterns of response for physiological variables during an incremental treadmill running exercise test to exhaustion utilizing both a traditional mouth piece (MP) and breathing mask (MSK) apparatus.

Methods

During the first visit, subjects completed a familiarization session on a motorized treadmill. During the second visit, the VO2max test was completed. VO2max test was run on a treadmill with calculated treadmill grade, with height, age, body mass, and running velocity set. During the VO2max test, subjects were informed that they should run as fast as possible, with the goal to reach exhaustion. This VO2max test was run for 10 minutes, with 3 minutes of warm-up prior to the test. The VO2max test was completed with the same apparatus (MP or MSK) as used during the testing. There were significant, positive, linear relationships for mean, normalized VO2 (r MP=0.99 and r MSK=0.89; p < 0.01) and HR (r MP=0.97 and r MSK=0.89; p < 0.01) versus Tlim during the incremental tests to exhaustion. There were significant, positive, quadratic relationships for mean, normalized VO2 (r MP=0.99 and r MSK=0.89; p < 0.01, respectively) and RER (r MP=0.99 and RER=0.90; p < 0.01) versus Tlim during the incremental tests to exhaustion.

There were significant, positive, linear relationships for mean, normalized VO2 (r MP=0.99 and r MSK=0.89; p < 0.01) and HR (r MP=0.97 and r MSK=0.89; p < 0.01) versus Tlim during the incremental tests to exhaustion. There were significant, positive, quadratic relationships for mean, normalized VO2 (r MP=0.99 and r MSK=0.89; p < 0.01, respectively) and RER (r MP=0.99 and RER=0.90; p < 0.01) versus Tlim during the incremental tests to exhaustion.

References


