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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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 advantages over one that only allows oral breathing. It has been suggested that a breathing apparatus that allows both nasal and oral breathing may provide advantages over one that only allows oral breathing.

METHODS: Sixteen subjects (MSK: mean ± SD age: 20.3 ± 1.3 yrs; body mass: 72.5 ± 7.2 kg; height: 177.3 ± 5.4 cm; MP: mean ± SD age: 20.7 ± 0.9 yrs; body mass: 63.2 ± 7.6 kg; height: 173.5 ± 6.4 cm) ran an incremental treadmill running test to exhaustion for the determination of maximal oxygen consumption (VO2peak) and peak values for heart rate (HRpeak), breathing frequency (Fbpeak), and respiratory exchange ratio (RERpeak). Moderately trained females were allocated to the MP or MSK groups. All submaximal values from the incremental treadmill test were normalized as a percent of their peak value (corresponding to VO2peak, Fbpeak, and RERpeak) and data points were normalized across subjects and expressed as a percent of time to exhaustion (Tlim, 20, 30, 40, 50, 60,...100% Tlim). The first three minutes of exercise were eliminated for the initial physiological adjustment to exercise, so percent Tlim begins at 20% for all subjects. Statistical analysis included polynomial regression analysis to determine the pattern of responses for the physiological variables during runs in MP and MSK conditions. RESULTS: There were significant positive, quadratic relationships for maximum oxygen consumption (c) and peak HR (b) and RER (a) during the incremental tests to exhaustion. Conclusions: VO2peak and HR peak followed the same pattern of response (linear, while Fb and RER exhibited quadratic patterns for both MP and MSK conditions. These findings indicate that there are differences in the pattern of responses among physiological variables, but that there is no effect of breathing apparatus on the patterns of responses for VO2peak, HRpeak, and RER during an incremental test to exhaustion.

PRACTICAL APPLICATIONS: Previous studies have indicated that breathing apparatus does not affect peak values during an incremental test, the results of this project add to those findings in that breathing apparatus does not affect the patterns of responses for VO2peak, HRpeak, and RER during a maximal treadmill running test. Furthermore, the findings of the present study support that the MP which obstructs nasal breathing, does not affect variables typically measured during clinical running tests, and therefore, MP or MSKs may be used for testing purposes.

RESULTS: There were significant, positive, linear relationships for mean, normalized VO2 (r2=MP-0.99 and r2=MSK-0.98; p < 0.01) and RER (r2=MP-0.97 and r2=MSK-0.99; p < 0.01) versus Tlim during the incremental tests to exhaustion. There were significant positive, quadratic relationships for maximum oxygen consumption (c) and peak HR (b) and RER (a) during the incremental tests to exhaustion.

Conclusions and Practical Applications

VO2peak and HRpeak followed the same linear pattern of response vs. Tlim, while Fbpeak and RER exhibited quadratic patterns for both MP and MSK conditions. These findings indicate that there are differences in the pattern of responses among physiological variables, but that there is no effect of breathing apparatus on the patterns of responses for VO2peak, HRpeak, and RER during a maximal treadmill running test. Furthermore, the findings of the present study suggest that the MP which obstructs nasal breathing, does not affect variables typically measured during clinical running tests, and therefore, MP or MSKs may be used for testing purposes. Thus, in sick individuals or people for whom the mask or nose clip cause discomfort or aggravation, an individual has the flexibility to choose which breathing apparatus they prefer.

References


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