TACSM Abstract

The Effect on Carbon Dioxide Production During Maximal Exercise with Distinct Breathing Mechanisms

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ABSTRACT

Nasal breathing (NB) may lead to lower maximal oxygen uptake (VO_{2max}) compared to oral breathing (OB) or nasal/oral combined breathing (CB) due to a transient increase in the systemic concentration of carbon dioxide (CO_2) that can replicate the effects of a hypoxic environment. The exercise intensity at which NB can elicit this response is poorly understood. **PURPOSE:** To examine the increase in the fractional rate of exhaled CO_2 ($FECO_2$) and FEO_2 with different breathing conditions during a graded maximal aerobic exercise test (GXT). **METHODS:** Eight healthy males (21.88 ± 0.46 years) completed 3 GXTs (separated by 48+ hours of recovery) using a different randomly assigned breathing condition (NB, OB, and CB). Participants exercised on a semi-recumbent bicycle at a pedaling speed of 70 rpm, increasing resistance every 2 minutes until volitional fatigue. Following the GXT, participants had a 2-minute recovery. Expired respiratory gases were collected via a metabolic cart. Six time points (40%, 55%, 70%, 85%, 100% VO_{2max}, and recovery) were compared between NB, OB, and CB. Data are presented as mean ± SD. **RESULTS:** $FECO_2$ was significantly higher during NB than OB at 70% [4.52 ± 0.37 vs. 4.07 ± 0.26%, p = 0.031 and 85% (4.49 ± 0.43% vs. 3.80 ± 0.32%, p = 0.009) of VO_{2max}. Additionally, $FECO_2$ at 100% of VO_{2max} was significantly higher (p = 0.001) during NB (4.33 ± 0.69%) than OB (3.47 ± 0.29%) and CB (3.55 ± 0.19%). The transient change in $FECO_2$ during exercise rapidly changed after the 2-minute recovery, where NB = 3.75 ± 0.71%, OB = 3.38 ± 0.17%, and CB = 3.30 ± 0.27%. FEO2 was significantly lower during NB than OB at 70% (16.34 ± 0.45% vs. 17.04 ± 0.3%, p = 0.011) and 85% (16.50 ± 0.53% vs. 17.32 ± 0.38%, p = 0.009) of VO_{2max}. FEO_2 was significantly lower (p = 0.003) during NB (16.66 ± 0.91%) compared to OB (17.67 ± 0.33%) and CB (17.61 ± 0.26%) at 100% VO_{2max}. The transient change in FEO_2 during exercise rapidly changed after the 2-minute recovery, where NB = 17.67 ± 1.00%, OB = 18.03 ± 0.23%, and CB = 18.20 ± 0.17%. **CONCLUSION:** NB elicits an exercised-induced increase in $FECO_2$ that is analogous to a decrease in FEO_2 starting at 70% of VO_{2max}. Given the transient increase in $FECO_2$, NB should be considered as a potential breathing method and further explored to replicate a temporary hypoxic environment that could promote a greater exercise adaptation than CB or OB might do.

TEXAS CHAPTER
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