

Authenticity of the Ratio of Inorganic Phosphate to Phosphocreatine as a Marker for Respiratory Stress During a Maximal Aerobic Exercise

CHRISTIAN J. CHANG, JOSE M. MORIS, RYAN CURTIS, KYLIE ALLEN, VINEET K. PAIDISETTY

Mooney Lab of Exercise, Nutrition, & Biochemistry; Health Science Studies; Baylor University; Waco, TX

Category: Undergraduate

Advisor / Mentor: Koh, Yunsuk (Yunsuk_koh@baylor.edu)

ABSTRACT

Under the context of assessing the effects of mitochondrial stress on skeletal muscles, consideration for the ratio of inorganic phosphate to phosphocreatine (Pi:PCr) may be used as a surrogate marker. Furthermore, assessing the systemic Pi:PCr, under states of high metabolic and respiratory demands with reduced oxygen supply (VO_2), such as strenuous exercise while only using nasal breathing (NB), might provide valuable information regarding respiratory strain to a given exercise bout. **PURPOSE:** To determine if the systemic assessment of the Pi:PCr ratio can serve as an indicator of respiratory stress. **METHODS:** Fourteen young males (age = 20.57 ± 1.22 yrs) completed a graded maximal exercise test (GXT) on a recumbent bike using either NB (n = 8) or combined (CB, n = 6) breathing. Plasma Pi and PCr were measured pre- and immediately post-GXT. Pi was analyzed using the malachite green colorimetric method, and PCr was quantified via sandwich enzyme-linked immunosorbent assay. The Pi:PCr was calculated by $Pi \div PCr$. A paired-sample t-test examined the Pi:PCr change following a GXT. A Pearson correlational analysis examined the relationship between the Pi:PCr and the respiratory performance during preset intensities (40%, 55%, 70%, 85%, and 100% VO_{2max}). Data are presented as mean \pm SD. **RESULTS:** The Pi:PCr ratio significantly decreased in the NB group (0.589 ± 0.313 to 0.530 ± 0.304 , $p = 0.034$) mainly due to the elevated PCr (601.68 ± 318.88 mmol/L to 689.40 ± 410.60 mmol/L, $p = 0.033$). The Pi:PCr ratio was negatively correlated with VO_2 only in the NB group throughout all preset intensities of the GXT. After controlling for the pre-GXT Pi:PCr as a covariate, the NB group showed a non-significant ($p = 0.340$) but higher mean concentration for post-exercise Pi:PCr compared to the CB group [NB: 0.451 ± 0.027 mmol/L versus CB: 0.407 ± 0.320 mmol/L]. **CONCLUSION:** The results from the present study suggest that the assessment of the Pi:PCr ratio could serve as a valuable marker of physical strain pertaining to high respiratory demands. Moreover, the assignment of NB during exercise is becoming a novel method due to its postulated benefits towards respiratory function, which may induce a more significant cellular stress as denoted by an increase in the post-exercise Pi:PCr ratio.