Investigating the relationship between prefrontal cortex oxygenation and locomotor muscle oxygenation during incremental exercise using near-infrared spectroscopy

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I. INTRODUCTIONf

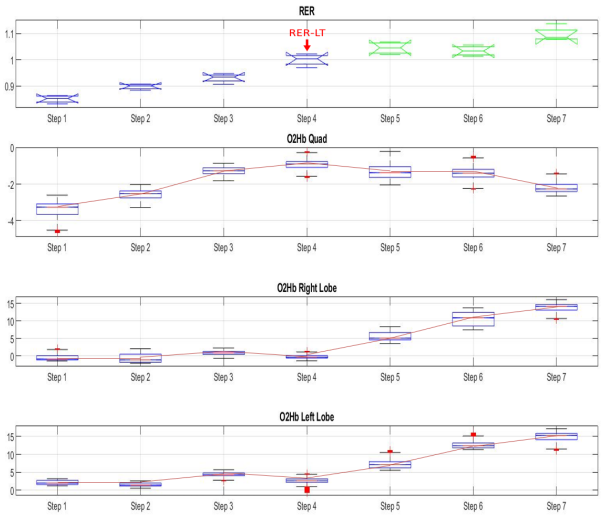
Monitoring prefrontal cortex oxygenation (PFCO) during exercise has been of paramount importance as a measure of decision-making and cognitive responsibilities. Near-infrared spectroscopy (NIRS) is an optical technique that can measure and monitor tissue oxygenation of the brain and skeletal muscles in real time.

II. STUDY OBJECTIVE & PROTOCOL

The objective of this study was to investigate the pattern of cerebral oxygenation during progressive exercise and compare it with exercising muscle oxygenation at the anaerobic threshold (AT). Healthy adults with moderate to high fitness levels participated in an incremental exercise protocol on a stationary bicycle. Two wearable NIRS sensors were used to monitor NIRS measures of tissue oxygenation from the forehead and the vastus lateralis (VL) muscle. A metabolic cart was used to monitor respiratory gas exchanges. Respiratory Exchange Ratio (RER) > 1.0 was used to estimate the AT.

III. RESULTS

After the AT was reached, the oxygenated hemoglobin (O2Hb) concentration in the VL decreased significantly ($p<0.05$). However, there was no significant change in O2Hb in the cerebral cortex after the AT ($p>0.05$). Our data demonstrated that while exercising muscle oxygenation decreased at higher intensities after the AT, cerebral oxygenation did not decline significantly.



IV. CONCLUSION

This finding suggests that the PFC may have a greater oxygen delivery and utilization capacity and may play a role in maintaining cognitive function during exercise.

This study introduced NIRS as a noninvasive optical technique to monitor the prefrontal cortex and muscle oxygenation in real-time, making it particularly well suited to exercise sciences.

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