

Hong Kong Sports Institute

Effect of oxygen therapy on performance during repeated bouts of intense exercise and recovery

Limits in oxygen availability in exercising tissues may slow down recovery from intense exercise. During repeated bouts of intense exercise, recovery from the previous exercise bouts will affect performance in the subsequent exercise bouts. Increase oxygen availability may also improve recovery on repeated days of exercise training. The present study examines the effect of oxygen therapy on performance during repeated bouts of 1500m run and on daily recovery index of a group of middle distance runners.

Subjects and methods

Eight middle distance runners (4 male and 4 female) were recruited for the study. After the baseline measurement for 1 week, subjects were randomly assigned to receive oxygen therapy for 4 weeks or as control. At the end of the 4 weeks time, the two groups changed over for another 4 weeks. Therefore, each subject becomes control of himself or herself. The table below summarized the arrangement.

	Group A	Group B
Week 1	No oxygen therapy	No oxygen therapy
Week 2-5	Oxygen therapy – 20 min/day before training or testing – + on testing day, during the 10 min rest between bouts of 1500 run	No oxygen therapy
Week 6-9	No oxygen therapy	Oxygen therapy – 20 min/day before training or testing – + on testing day, during the 10 min rest between bouts of 1500 run

Oxygen therapy was achieved by using a portal unit from Oxyvital. Subjects will be required to wear a mask which attached to the machine. The machine is able to convert composition of the inspiring air by increasing the oxygen content from 21% to 60-80%.

The following recovery parameters were measured 3 times per week before training/testing on the day.

- Creatine kinase
- Urea
- Complete Blood Count
- Cortisol

All subjects were required to fill in a questionnaire daily to monitor their subjective feeling on:

- Sleep quality
- Sleep duration
- Muscle bulging
- Muscle stiffness
- Training stress
- Appetite

Testing were performed on Week 1, Week 5, and Week 9. Testing consists of 3 bouts of 1500m run on treadmill. 10 minutes rest was allowed between bouts. The speed for the run was individually assigned by their coach according to each individual's personal best in 1500m. Performance was measured as the number of bouts that can be completed in each testing session.

Data analysis

All data from each individual was first converted to percentile. This eliminates the large individual difference in various parameters and allows the data to be pooled for analysis. Paired t-test was used to determine if there is any difference ($p < 0.05$) between oxygen therapy and control. In case if there is large departure of the data from normality or the p-value is close to the (0.05, 0.1) region, then Wilcoxon rank test was used instead.

Results

Significant difference ($p < 0.05$) in creatine kinase, muscle stiffness and performance (number of bouts completed) were found between oxygen therapy and control. No significant difference can be found in haemoglobin, RBC count, WBC counts, urea, cortisol, sleep quality, sleep duration, muscle bulging, subjective training stress, and appetite.

Discussion

Oxygen therapy was able to improve number of completed bouts of 1500m run in a testing session. As both creatine kinase (a biochemical marker for muscle fatigue) and muscle stiffness (subjective feeling of athletes) were improved at the same time when oxygen therapy was applied, it is possible that the oxygen therapy improved exercise performance by increasing rate of recovery of muscles. The exact mechanism of the observed improvement needs to be confirmed with biopsy study.

Oxygen therapy was found to be not able to change haemoglobin and other parameters in the complete blood count. Extra oxygen available to the body is not able to induce any change in this aspect. Similarly, urea is not changed by oxygen therapy. Protein breakdown and recovery of the energy system are not affected by oxygen therapy.

Oxygen therapy can improve muscle recovery and performance during repeated bouts of intense exercise. Further study is suggested to refine the oxygen therapy protocol and to confirm the mechanism of so.