

# Advanced exercise physiology essay examples

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As incremental exercise progresses, the lower lobe of the lung exhibits an increase in alveolar  $PO_2$ , a decrease in alveolar  $PCO_2$ , and a marked increase in mixed venous  $PCO_2$ . During exercise, the ventilation rates increase gradually from resting values of around 5-6 liters per minute to over 100 liters per minute. On average, the rate of oxygen consumption is 250ml per minute but as during high intensity exercise, this can go up to 5000ml per minute. Increased pulmonary ventilation triggers a subsequent rise in the tidal volume of the lungs and respiratory rate hence more oxygen is taken into the alveoli. The rate of metabolism increases gradually thus the ventilation rate in the alveoli increases. It prevents the  $PaCO_2$  from increasing in the blood and the  $PaO_2$  from decreasing. During the initial stages of exercise, there is a rapid increase in the rate of ventilation. There are several theories that have been advanced in order to explain this phenomenon. One of the theories is that this initial increase in the rate of ventilation is as a result of motor activity afferent impulses that are sent from the proprioceptors that are located in the limbs, muscles and the joints. Another theory is that the peripheral nerves are sensitive to changes in the  $PaCO_2$  and  $PaO_2$  hence triggering changes in the ventilation although the values of  $PaCO_2$  and  $PaO_2$  remain fairly stable. It has also been postulated that the rise in body temperature may also be responsible for the changes in ventilation. In addition to this, it has also been postulated that impulses originating from the neurons from the motor cortex to active muscles and joints may stimulate the respiratory centre and the brain stem leading to hyperpnoea. The respiratory rate stays elevated for one or two hours after exercise. During intense exercise, there is an overdependence on

glycolysis due to the increased amounts of oxygen that are available. The overreliance on glycolysis results in an increase in the  $PCO_2$  initially due to the accumulation of lactic acid. The increase in  $PCO_2$  triggers hyperventilation which results in a decrease of  $PCO_2$  eventually. The venous blood will therefore be one of the mechanisms in place that eliminates the excess carbon dioxide hence the increase in venous  $PCO_2$ . These respiratory changes are positive in relation to continued exercise given that  $CO_2$  is a powerful vasodilator hence continued exercise leads to improved circulation of blood and delivery of oxygen to all body organs.

There is a linear increase in the uptake of oxygen as the work out continues. At 20% max  $\dot{V}O_2$ , the changes in ventilation are as a result of the neural messages sent from the brain to the respiratory centers. This happens at the start of exercise right after the start of exercise. At this point,  $PO_2$ ,  $PCO_2$ ,  $H^+$  remain at stable values hence the changes in ventilation are not a consequence of changes in any of their values. At 90% max  $\dot{V}O_2$ , the changes in ventilation take place as a result of the changes in the partial pressure of  $CO_2$ . At such a time, the concentration of carbon dioxide is at its peak as a result of the high metabolic activity which is necessary for the production of ATP molecules. This takes place through glycolysis. The concentration of  $CO_2$  exceeds that  $H^+$  concentration. The chemo receptors not only detect the changes in  $PCO_2$  but also the changes in  $H^+$  and the decreasing levels of oxygen. However, it must be noted that the membrane solubility of carbon dioxide is 20% greater than that of oxygen. In response to the rise in the concentration of carbon dioxide at 90% max  $\dot{V}O_2$ , the chemo receptors trigger an increase in the respiratory rate. Due the rise in the concentration of  $H^+$

ions, the chemo receptors trigger an increase in the uptake of oxygen that is being rapidly consumed. PCO<sub>2</sub> is the most important control mechanism at 90% max VO since its concentration is at its peak, it has a quick diffusion rate as compared to the rest hence initiates the chain of events in the ventilation triggered in response to detection by the chemo receptors. Pulmonary diffusion capacity is the rate of gaseous exchange between the capillaries of the lungs and the alveoli. During exercise, there is an increase in the demand for oxygen due to an increased need for ATP derived from glycolysis which is dependent on oxygen. As a result, there is an increase in the pulmonary diffusion rate for oxygen during exercise.

## **Bibliography**

Burton, Deborah Anne, Keith Stokes and George M. Hall. " Physiological effects of exercise." Continuing Education in Anaesthesia, Pain and Critical Care (2004 ): 185-88 .

McArdle, WD, FI Katch and VL Katch. Exercise Physiology: Energy, Nutrition and Human Performance. Lippincott : William and Wilkins, 2001 .

Powers, SK and ET Howley. Exercise Physiology,. New York : Mc Graw Hill, 2004 .