

Review of “A Field Study of Oxygen Consumption and Estimated Energy Expenditure in the Exercising Horse”

by J. Hanak, P. Hahn, R. Kabes, M. Sedlinska, Z. Zert, J. Mezerova, O. Chvatal

Equine Clinic, University of Veterinary and Pharmaceutical Sciences, Brno, Czech Republic

Why was this study done? The goal of the study, according to the authors, was to **estimate the roles of both aerobic and anaerobic energy consumption** in the exercising horse. This knowledge could potentially be a **tool to help assess cardiovascular fitness and to predict performance**.

How was the study conducted? The researchers used 12 warmblood horses in the study. On the first day, the horses were ridden 400 meters at a gallop to **establish each animal’s maximum speed**. On the second day each horse was ridden 3000 meters at a **walk**, the same distance at a **trot**, and then the same distance at a **canter**. Speeds for these gaits were set for individual horses so that they corresponded to **15, 30, and 50% of the animal’s maximum speed**. On the third day, six of the horses were ridden 1500 meters at a **gallop at 70% of maximum speed**.

During exercise and for 10 minutes before and 10 minutes after exercise, the researchers monitored **heart rate, respiratory rate, and respiratory volume** for each horse. The horses were fitted with face masks that allowed the collection of samples of **exhaled air**. **The samples were used to calculate oxygen consumption, production of carbon dioxide, respiratory quotient, and oxygen debt** throughout the trial. Calculations were also made for **exercise energy expenditure and post-exercise energy expenditure** for each workout by using respiratory quotient values and oxygen caloric equivalents.

What results were found? The researchers found a **linear relation between speed and aerobic energy expenditure, and a quadratic relation between speed and anaerobic energy expenditure and total energy expenditure**. At speeds up to 30% of maximum, metabolism was mainly aerobic. At higher speeds total energy demands of exercise increased sharply. While aerobic metabolism continued, anaerobic metabolism contributed a greater share as exercise intensity rose. The authors stated that aerobic energy utilization was 27 times greater at 70% of maximum speed than while standing still, but only 5.5 times greater than when the horse was walking. Anaerobic energy utilization was more than 200 times greater at 70% of maximum speed than at the walk.

What can be concluded from this research? Although blood lactate accumulation has been used as an indicator of released anaerobic energy, this study looked at **post-exercise oxygen uptake as another measuring tool**. While complete replenishment of the oxygen debt takes longer than 10 minutes after strenuous exercise, it was felt that the measurements taken during this immediate post-exercise period could be used to find a reasonable approximation of absolute values. The authors stated that **post-exercise oxygen consumption seems a suitable measure of oxygen debt, is an indicator of anaerobically released energy, and therefore may also be an indicator of the horse’s anaerobic capacity at standard or maximal exercise**.

–This article was originally published in *Acta Vet. Brno* 2001, 70:133-139.