

## **The Horse's Heart**

### **Exercise, Training and Recovery**

#### **Part II**

##### **What Happens During Endurance Exercise?**

Horses are creatures of habit. They know that when you start to saddle them up for training or competition, it is time to do some work! As already mentioned, a horse's resting heart rate could be as low as 25 bpm while standing quietly in the stable. As soon as the saddle goes on, it could immediately go to 60 or 70 bpm. Mechanisms from the spinal cord and brain use an early warning system to warn the horse to prepare for exercise. Hence, even at rest, the horse's heart rate and perhaps depth of breathing start to increase in anticipation of exercise.

When the horse begins to move over the ground, changing its gait from walk to trot to canter, it asks its muscles to perform work. In order for muscles to perform work, they need energy. Chemical reactions in the working muscles accelerate to meet the increasing energy demands of the exercise. For these chemical reactions to continue, they require a supply of oxygen. The heart and lungs provide the delivery service, taking the oxygen to the working muscles, which in turn use the oxygen to 'burn' carbohydrate and / or fat to provide energy for muscles to contract. Whilst how much energy the horse requires depends on the horse's speed, it is also proportional to the combined body weight of the horse and rider. Hence, an endurance horse works harder and requires more energy carrying a 100 kg rider than a 55 kg rider!

To service this increased demand for oxygen and energy, the horse's heart rate increases, beating faster and stronger with each beat to pump more blood with each stroke. In other words, its cardiac output (see Part I of this article) starts to increase.

Blood vessels in some parts of the horse's body not directly involved in the exercise (for example, some parts of the digestive system and some non-exercising muscles), squeeze shut (constrict), so the blood is diverted to working muscles where it is needed. Blood vessels in the exercising muscles expand so that more blood can be pumped to the working muscles. In addition, blood vessels close to the surface of the skin expand, so that blood warmed during exercise can be cooled as it travels close to the cooler skin surface. The horse begins to sweat, so that when the sweat evaporates from its skin, it is cooled, which in turn cools the blood as it passes close to the surface. This is one way in which the horse tries to 'stay cool' or prevent overheating while exercising.

If the horse and rider continue to increase the intensity of exercise (e.g., running faster or canter up a hill), the above changes continue to occur but at a greater rate. This is because the working muscles need more energy to service the demand of increased running speed. For example, the horse's heart beats faster (maybe going from 120 bpm to 170 bpm) to circulate the blood. In addition, the heart beats stronger to pump more blood with each stroke (stroke volume). The lungs work faster and harder to extract oxygen from incoming air and to release the 'waste product' carbon dioxide from the outgoing exhaust air. The end result of these changes is more oxygen and energy producing fuel to the working muscles.

The horse is a powerful athlete with a huge 'engine'. Huge engines produce a lot of heat when they operate. Because of the heat generated during exercise, more blood must be shunted to the skin to keep the body cool, which means less blood going to the muscles. This phenomenon can present an unsustainable position for the exercising endurance horse. On one hand, if blood is diverted from the muscles to the skin surface to prevent overheating, work output or speed may drop because energy supply to the working muscles can be compromised. On the other hand, if blood is maintained at the working muscles, speed or work output can be maintained but the horse may start to overheat. Increased sweating may cause the horse to become dehydrated. If the horse overheats and becomes dehydrated, recovery heart rate will be much slower. Overheating, running out of fuel, dehydrating and having a slow recovery heart rate are obviously great concerns to the endurance horse and rider. The good news is appropriate training can improve the workout of the muscles, the ability to control body heat and facilitate a faster recovery heart rate.

**Part III**                      **What changes occur in the horse's body to help alleviate the above problems.**