

The Horse's Heart

Exercise, Training and Recovery

Part I

Why do we spend hours and hours training our horses? The answer of course, is to get them fitter so that they are better able to handle the endurance competition and its associated stresses. Some of the great responses to a good aerobic or endurance-training program are:

1. The horse's heart rate at any sub maximal speed will be lower. An example of this would be if your horse cantered for 20 minutes at 20 kph it might have an exercise heart rate of approximately 130 bpm. If after 6 weeks of aerobic training it repeated this run at the same speed, it would not be unrealistic to see an exercise heart rate of 120 bpm. If the horse's maximum heart rate is 230 bpm, these two exercise heart rates equate to approximately 56 and 52% of maximum heart rate respectively. Would you prefer you horse to be working at 56% or 52% of its maximum during an endurance (assuming no loss in speed)?
2. The horse's recovery heart is faster. This of course has implications to the endurance rider and horse, as horses failing to meet the official cut off recovery heart rate limit are eliminated from the event.

So what actually happens to the horse's heart during training after a prolonged period of training – what changes occur to make it more efficient? First of all, let's look at some basic physiology and terminology in relation to the horse's heart.

Basic Physiology and Terminology

1. The function of the horses heart is to pump sufficient blood to maintain blood pressure and oxygen supply to the working muscles.
2. The heart consists of four chambers, the left and right atria and the left and right ventricles. Usually, the heart is considered to be two pumps, the left heart consisting of the left atrium and ventricle and the right heart consisting of the right atrium and ventricle.
3. The left heart pumps blood through to the body tissues, such as the muscles, while the right heart pumps blood to the lungs.
4. According to equine researchers, the heart mass in Thoroughbred horses is about 4-5 kg, or approximately 1% of their body weight. It seems that trained horses have a slightly higher relative masses than untrained horses, suggesting that training can cause the heart muscle to increase in size. It also seems that heart mass to body weight ratio is a function of breed.

Racing horses have a relative heart mass of 0.86, compared with 0.76 in Arabian horses and 0.62 in draft horses^a.

5. *Heart rate* is the number of times the heart beats per minute. At rest, when the horse is relaxed and standing quietly, the heart rate is usually in the range 25-40 bpm. In the untrained human, this heart rate is normally 70-75 bpm.
6. Every time the heart beats, it pumps out or ejects a certain amount of blood. The amount of blood pumped by the heart per beat is called the *stroke volume*. The stroke volume in the resting horse is approximately 800-900 ml whilst in trained male endurance athletes it is about 100 ml!!
7. *Cardiac output* is the combination of heart rate and stroke volume. Cardiac output is therefore the volume of blood ejected from the heart per minute, expressed as litres per minute. Hence $\text{Cardiac Output} = \text{Heart Rate} \times \text{Stroke Volume}$. If we use the values above, a resting cardiac output for a horse would be approximately $30 \times 900 = 27000$ ml or 27 litres per minute.
8. In fit Thoroughbreds, cardiac outputs of between 270-350 litres per minute have been reported during maximum efforts on a treadmill. An elite athlete's heart might pump 40 litres per minute!!
9. The heart receives a rich supply of nerve fibres, which play a role in increasing and decreasing the heart rate.

Part II What happens during exercise and what happens to the heart after it 'becomes trained'

^a Hodgson, D.R., Rose, R.J. *Principles and Practice of Equine Sports Medicine: The Athletic Horse*. W.B. Saunders Company, 1994.