


Issue 3 2013

For Eventers &  
Show Jumpers

# Talking Performance



## From the editor...

Welcome to Talking Performance 3 - the newsletter dedicated to upper level sport horse training and competition.

Show jumping is a sport which requires power, speed, stamina and precision. For eventing, a horse also requires versatility and endurance for the cross country phase, as well as agility and obedience for jumping. Courses in cross country are more complicated and demanding as the level of competition increases. The degree of difficulty of the dressage and jumping phases correspond to the level of technical skill required of both the horse and rider.

In this issue, we discuss the important principles of **cardiovascular conditioning** to withstand the demands of a show jumping course, combining fitness and speed with acceleration and ability to turn and decelerate. It is also a very important part of training for eventing with the added need for endurance. Horses must be selected for athletic prowess and aerobic capacity, with high energy efficiency in movement.

All the best with your horse's sport training and competition.

*Dr John Kohnke* BVSc, RDA

## Did You Know That...

Both show jumping and eventing require a special type of horse. Traditionally, the cardiovascular prowess of a retired Thoroughbred racehorse formed the nucleus of these demanding horse sports in many countries where the sports were developing into specialised equine disciplines. Over the last two decades, the mental stability and precision of Warmbloods to create a horse with a steadier temperament, a stronger constitution and physique and stamina for endurance, has been recognised. In breeding programs, the characteristics of Warmbloods combined with the athleticism of the Thoroughbred, has resulted in a cross-breed hybrid for upper level sport horse competition. Soundness for training over an extended career is an important criterion in upper level horses. It is essential to start with a sound, strong, sensible and agile horse. In some cases, a Warmblood-Thoroughbred cross inherits the thin limbs of the Thoroughbred with a Warmblood body proportion and appetite. The extra weight bearing demand on the thin limbs may increase the risk of breakdown injury as the horse ages. A horse which has soundness issues is not a long term prospect for either of these sports where long term training and progression through increasing grades and physical demand is paramount for developing the skills required in both these disciplines.

## In this issue...

- \* Cardio-vascular Fitness - the foundation for performance

**Plus handy hints and lots more!**

### Handy Hint 1

#### Examination for Soundness

'Soundness for Purpose' is related to the degree of intensity and skill required in a competitive horse. It is not only an assessment of musculoskeletal soundness, which is a primary need, but also combines respiratory with cardiovascular health as part of the evaluation criteria when selecting or purchasing a horse for long term training. If you arrange a vet check, it is important to ensure a full physical examination, including X-rays of lower limb joints, a sacroiliac check in the lower back, scoping the upper respiratory tract and lower windpipe for structural abnormalities or excess mucus, as well as electrocardiogram to evaluate heart health. A scope for stomach ulcers is also worthwhile and an eye examination for uveitis and associated retinal degeneration is mandatory in an upper level qualified horse with a high purchase price. A blood test for sedative and pain-killing drugs should also be considered. Consult your vet for advice.

### Handy Hint 2

#### Check for Sacroiliac Pain

Show jumpers and eventers are at a high risk of developing lower back injuries, including lumbo-sacral and sacroiliac sprain, due to the weight loading and landing stresses imposed on these lower back structures. Sacroiliac sprain is a common cause of lower back pain and discomfort, causing a horse to develop a shortened stride, usually more noticeable in one hind limb; resistance to turning to one side and jumping with a flat, low action. One 'give away' sign is the swinging in of the affected hind limb under the body as the horse walks. Simply have the horse led away on a loose lead and carefully watch the movement path of the hind limb stride on each side as it follows through. If one limb is 'swinging in' under the body compared to the other, then this is the side most likely to have a sacroiliac injury. Consult your vet for advice.

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Upper level sport horses require a well planned conditioning program over at least a 3-4 month period to establish overall fitness of the heart and vascular system. Musculoskeletal and respiratory adaptation will help to ensure soundness to enable them to perform at their physical limitation in competition. The success, or otherwise, of a training program is dependent on a horse's natural performance ability, its relative fitness, the environmental conditions, skill of the rider and the horse's willingness to meet the physical and mental challenges during competition. All sporting horses should be trained specifically to achieve full fitness for the discipline of competition.

In Parts 1 and 2 of **Talking Performance**, we discussed conditioning and adaptation during training to achieve optimum strength, stamina and speed. We also reviewed the soundness aspects for upper level performance, including cardio-vascular soundness and problems associated with impaired cardio-vascular function. To obtain back copies of Talking Performance 1 and 2, please contact Gary at [newsletters@kohnkesown.com](mailto:newsletters@kohnkesown.com). You can also ask Gary to add your name to our free subscription list for ongoing issues of Talking Performance or our other popular newsletters.

Cardio-vascular fitness has an important influence on overall metabolic fitness related to the delivery of oxygen to rapidly contracting muscles. This is also influenced by nutrition to maintain normal red and white blood cell numbers, metabolic function with co-nutrients, parasite control and the overall health of the individual horse. In racing horses, fitness for racing is often assessed by blood counts to measure red blood cell parameters, including red cell counts, haemoglobin content (H g/L) and Mean Cell Volume (MCV or relative size of red blood cells), as a way of evaluating the adaptation to training and likely ability to perform. It can also be evaluated by heart rate response to exercise speed and heart rate recovery as a measure of cardio-vascular efficiency and fitness for strenuous exercise.

However, heart rate recovery can be influenced not only by cardio-vascular fitness, but also by the efficiency of heat loss, the effects of dehydration and the efficiency of system re-oxygenation during recovery. The individual horse's nervous disposition and other environmental influences, such as wind movement, interaction with other horses or animals and ambient temperature and humidity under which the heart rate recovery is being monitored. These can all affect the resting heart rate and speed of heart rate recovery after near maximal exercise effort.

### Handy Hint 3

#### Worm-Out Horses 3-4 Days After Arrival

It is important to quarantine all new arrivals for 5-7 days to ensure that they are not carrying the EHV-1/EHV-4 respiratory virus which could spread to other horses in adjacent stables. However, avoid worming them 'straight off the float', as it can lead to an increased risk of gastric pain and even colic due to stomach irritation from gastric acid on a relatively empty stomach when travelling and dehydration during transport. Aim to worm horses 3-4 days after arrival after they have recovered and rehydrated. New recommendations suggest that a 5 day course of Panacur 100®, (fenbendazole 100g/L) or equivalent generic wormer, given at 10mL/100kg bodyweight for 5 days (re: 50mL daily for 5 days for a 500kg horse) is highly efficient at removing Small Redworm burdens from the hind gut lining. It is recommended especially for horses returning from a long spell at pasture and is less likely to precipitate a colic reaction. However, it is not recommended to worm a horse with fenbendazole within 10 days of a race or competition as metabolites may be detected in a urinary swab. Consult your vet for advice. **A detailed 6 page review of the latest Worm Control Strategies can be obtained by emailing Gary at [newsletters@kohnkesown.com](mailto:newsletters@kohnkesown.com) or from the website [www.kohnkesown.com](http://www.kohnkesown.com) under the title 'Articles'.**

### Did You Know that...

- The resting heart rate of a healthy, mature horse is between 30-40 beats/minute. It does not normally reduce by more than 5-7 beats/minute at peak fitness in an otherwise healthy, calm horse.
- At the start of exercise, the heart rate will increase to 80% of maximal levels due to adrenaline release for 1-2 minutes before it reduces to a lower, steady rate. Therefore, heart rate measurement during the first 2 minutes of exercise is not an accurate means of monitoring fitness or work effort.
- The majority of the energy used during medium exercise at a slow to medium canter at between 4-8 metres/second (240-480 metres/minute), is metabolised aerobically using oxygen up to heart rates between 170-200 beats/minute. Aerobic exercise primarily uses blood glucose, some muscle glycogen and fats as sources of energy to fuel muscle contraction.
- A horse's speed increases at a given heart rate as it becomes physically fit and reaches the anaerobic threshold of 150-170 beats/minute. At speeds above the 'anaerobic threshold', a fit horse still primarily uses oxygen during aerobic metabolism for the primary generation of 80% of the muscle energy. As speed increases, 'oxygen debt' phases in anaerobic metabolism in higher proportions, which rapidly uses up blood sugar and muscle glycogen stores. Adenosine triphosphate (ATP) is the energy used for muscle contraction. Aerobic metabolism produces 36 units of ATP per unit of glycogen, whereas under 'oxygen debt', anaerobic metabolism produces only 12 units of ATP, with the by-product of lactic acid accumulating in muscle cells and as lactate in the blood. Therefore, at sustained speed exercise, muscle energy stores are more rapidly depleted and blood lactate increases, resulting in the onset of fatigue.
- The heart rate at a given speed does not change significantly as fitness increases in response to training, although aerobic phase heart rates can decrease as oxygen uptake efficiency is increased with training. The 'anaerobic threshold' in an exercising horse is increased towards 170-180 beats/minute with training. Muscles performing above the 'anaerobic threshold' use glucose and muscle glycogen as energy sources under conditions of 'oxygen debt'. Muscle lactic acid production due to rapid anaerobic energy depletion and the accumulation of high blood lactate, limits performance.
- The maximal heart rate is between 200-250 beats/minute, peaking at full all-out galloping speed of 16 metres/second for most fit, upper level sport horses. It does not lower with increasing fitness, but if it reaches the highest limit early before maximal exercise demand (as measured by a heart rate meter), it may indicate cardiovascular disease, low red cell parameters (anaemia), airway abnormalities with reduced oxygen uptake, stress or excess fatigue.

### Handy Hint 4

#### Heart Rate - GPS Measurements

New equipment which links heart rate to velocity using a GPS navigation link to measure speed (velocity) of exercise in metres/second is useful to monitor increase in fitness and reduction in heart rate (HR) at a given speed. It can also be used to compare speed of heart rate recovery after a standard workout. This equipment is also useful to accurately monitor the speed at which a horse is to be exercised by a jockey, harness driver, or upper level event rider, such as  $\frac{3}{4}$  pace, and even time. Memory cards in HR meters can be downloaded onto a laptop or telemetrically transmitted to a remote computer for analysis.



## Assessing Cardio-vascular Fitness

**1. Blood Parameters** Many trainers of racing horses place great importance on testing blood parameters as a means of assessing 'fitness to race'. Red cell parameters, white cell numbers and the relative numbers of individual types of white cells (termed 'differential' count) and changes in blood biochemical values, are often used to confirm or diagnose anaemia, underlying disease or metabolic conditions such as 'tying up', gastric ulcers and airway disease. Many blood testing laboratories offer a 'race fitness' profile as part of their blood screening process. Changes in values outside those considered normal for a horse likely to perform at its optimum, can be a useful guide to evaluate adaptation to training and underlying diseases which are possible reasons for a poor performance.

Blood parameters are only one of the ways to evaluate overall fitness of a horse in training. If a horse is not performing to expectation, a blood profile can be helpful to check for a possible underlying red cell synthesis problem, referred to as non-regenerative anaemia; red cell loss (i.e. a bleeding gastric ulcer in a horse with a very 'picky' appetite in full training); worm burdens (high Small Strongyle worm burdens are a common cause of ill-thrift and related poor overall performance and recovery in a horse) or an underlying infection or inflammatory condition. Worm burdens should always be considered as a possible reason for less than optimum performance, although a horse may have been regularly wormed out. A very low, or elevated white cell count, in an otherwise 'fit' horse is more likely to indicate an underlying infective disease process. A low white cell and lymphocyte count can be associated with long term stress of training, or over-training, all which could affect its performance potential. Further tests and diagnostic procedures may be required, such as lower airway scoping to check for excess mucus, or a Bronchoalveolar Lavage (BAL) to pinpoint underlying airway disease as a cause for the altered blood readings.

### Handy Hint 5

#### Early Morning Blood Sampling

If you are concerned that a horse in training is recovering poorly and lacks stamina, then a blood test may help reveal an underlying cause. When collecting a blood sample, it is best to do so early in the morning before the horse is exercised or given feed. If you cannot arrange with your vet to collect an early morning sample, or are not skilled to collect blood yourself, then arrange to have a sample taken at least 4 hours after the day's training or the last feed. Ensure that the horse is as relaxed as possible and don't 'spook' the horse by handling other horses, or allowing an unfamiliar or growly dog in the area where the blood sample is being taken. Ensure that you use the correct collection tubes as supplied by your vet and fill the serum (white cap) tube to over ¾ full. **More information on blood collection and interpretation is provided in a 6 page guideline 'Blood Counts', available by emailing Gary at newsletters@kohnkesown.com or from the website www.kohnkesown.com under the title 'Articles'.**

**2. Heart Rate Recovery** The resting heart rate is normally between 30-40 beats/minute in a mature, healthy horse. The resting heart rate in horses does not significantly decrease as a result of exercise conditioning, as it does in human athletes.

Heart rate recovery is becoming a popular and practical means of evaluating fitness for purpose in racing and sport horses. It is most useful in assessing fitness in horses performing at speeds nearing VO<sub>2</sub> max, and heart rates exceeding 180-200 beats/minute during exercise or competition.

Cardiovascular fitness is important to enable an exercising horse to efficiently deliver oxygen to working muscles to use aerobic metabolism to produce maximal energy and remove by-products such as carbon dioxide and lactate from the muscles. The heart rate is driven by oxygen and carbon dioxide levels in the blood. However, retained heat after exercise, pain and excitement, can influence the heart rate prior to, during and especially after exercise as a horse recovers.

There are a number of methods which can be used to evaluate heart rate recovery relative to the speed of exercise and during the recovery time following exercise. Many professional riders now invest in electronic heart rate monitoring equipment which measures electrical or depolarisation changes within the chest cavity and converts them to a digital heart rate count number. It provides an accurate record of maximal heart rates relative to speed and intensity of exercise. They can be used to monitor heart rate recovery at a set time, usually 3 minutes, after maximal exercise, to evaluate relative fitness in a healthy horse.

New technology enables heart rate and exercise speed to be monitored using an accurate GPS combination with ECG readings to count heart beats.

**An Australian designed heart rate monitor/GPS system is one of the most accurate. It is available from Prof. David Evans PhD who pioneered the development of the combined GPS/heart rate meter system. Professor Evans can be contacted on 0411 289 212 or by email Equine Health and Fitness on equinehealthfitness@gmail.com for further details and purchase of the equipment. Dr David Evans also provides advice on the interpretation of heart rate records.**

Most upper level trainers and riders have a simple stethoscope to monitor heart rate recovery. It is impossible to accurately count maximal heart rates of 100 beats/minute using a stethoscope. A heart beat count taken at a standard 3 minutes after exercise can provide a guide to the relative fitness and speed of recovery of a horse after exercise.

#### Heart Rates at Varying Exercise Speeds in a Fit Horse

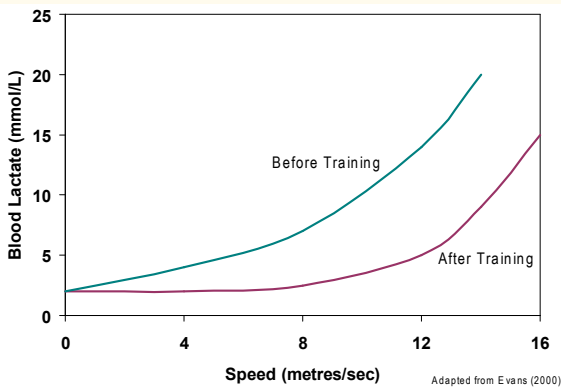
Exercise Type/Speed	Heart Rate Beat/Min
Slow Cantering - 6 m/sec (360 m/min)	160
All-out cantering - 8.5 m/sec (510 m/min)	190-200
Medium Gallop - 11 m/sec (66 m/min)	200-220
All-out Gallop - 16 m/sec (1000 m/min)	220-240

### Handy Hint 6

#### Sprint-Ups to Stimulate Oxygen Uptake and Reduce Physical Stress

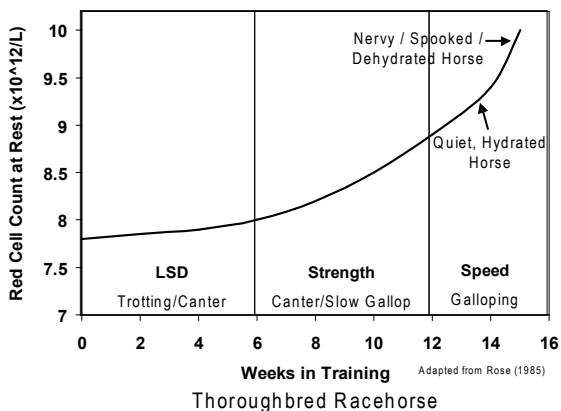
A regular program of sprint-ups at 10-14 day intervals will help to maintain fitness and reduce the stress of hard, repetitive alternate days of slow and long fast workouts. Once a horse develops fitness, excessive hard workouts tend to tire the horse and it may lose its willingness to run, especially in upper level sport horses. After warming the horse up for 5-10 minutes at a trot and canter (which will help to initiate more efficient oxygen uptake), give the horse an all-out sprint-up over 400 metres in a straight line gallop. Then slow back to a trot/light canter for 600-800 metres and then sprint-up again in straight line on a flat area over another 300-400 metres. Then exercise to cool down for 5 minutes. On return to the stables after the wash bay and a cool-off, give a scoopful (30g) of **Kohnke's Own® Cell-Iron® Supplets®** in the feed to maintain iron and co-factor vitamin levels in the blood and muscle cells. If the horse is 'slabby' and weak in the top-line and croup, give it 60g **Kohnke's Own® Muscle XL™**, either as a water slurry over the tongue in the wash bay within 15 minutes of the sprint-ups, or in a small feed (eg a double handful of its after work meal) before giving the full feed. This will help to ensure optimum uptake of the glutamine and other amino acids and Vitamin E, which have roles in muscle recovery and protein synthesis. A similar sprint-up and supplementation 48 hours before an event will help to taper the training and keep the horse more willing to compete. An additional 3-4 cups of raw, cracked corn given in the feed on the last 3 nights before the competition will help top-up muscle energy stores, particularly in horses which fatigue before the completion of a competition that runs over 2-3 days.

**Graph 1 Blood Lactate accumulation in response to training**



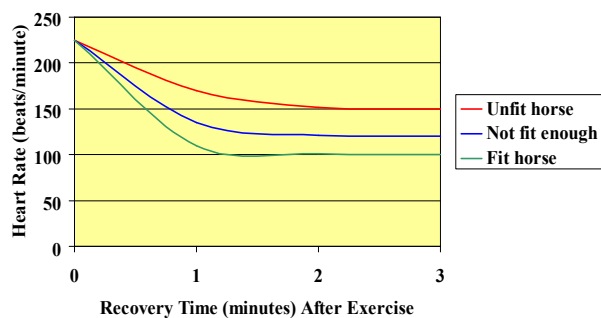
This graph illustrates that as a horse develops muscle fitness in training, the muscles produce less lactic acid from anaerobic metabolism for a given speed. This is related to the cardiovascular fitness and delivery of oxygen to the rapidly contracting muscles.

**Graph 2 Red Cell Count response to training speed**



Red Cell numbers (and haemoglobin content) do not increase significantly during LSD training. However, once faster speeds over 6-8 metres per second are introduced, the demand for oxygen to fuel aerobic metabolism, stimulates red blood cell (and haemoglobin content) to carry more oxygen. Splenic reserves of red cells also increase as speed of exercise reaches VO<sub>2</sub> max.

**Graph 3 Heart rate recovery after maximum speed**



Heart Rate recovery relative to time improves as a horse develops cardiovascular fitness in training. A horse which is not fit enough for the speed or distance of exercise will not be able to recover to less than 150beats/minute within a standard 3 minute recovery

period. A horse which is not quite fit enough, will need more speed work, such as sprint-ups, to enable it to recover below 100 beats/minute within 3 minutes of exercise. If a horse is challenged by a sprint-up over 400 metres and fails to recover below 120 beats/minute in 3 minutes, the horse is not fit enough.

**Handy Hint 7**

**Loss of Performance in a Group of Horses**

In some cases, a number of horses in a larger equestrian sport training stable may exhibit a poor performance record. In these cases, although evaluation of individual horses may be carried out without any untoward signs, the underlying cause is likely to be infectious disease (most commonly a respiratory virus), a dietary deficiency, particularly of energy in the ration being fed and any excess of nutrients in the ration. Changes to the energy source in the feed can have a direct influence on performance ability of a horse in training. Even subtle changes in the brand of a prepared feed, or sudden introduction of high levels of fat in a feed or added as vegetable oil, both of which initially provide less digestible energy, can cause a loss of performance in a group of horses over a period of time. Horses which gain excess weight during training, those with gastric ulcers and a poor appetite, may also perform well below their optimum within a group in a stable.

**Handy Hint 8**

**Counting Heart Rates with a Stethoscope**

It is important that you position the stethoscope 'head' just above the elbow and under the shoulder muscles on the left side. When counting, listen carefully to pick up the sound of the heart beat and then count the beats over a ten second period (multiply by 6 to a full 60 seconds) or preferably 15 seconds (multiply by 4 to a full 60 seconds). Counting the pulse rates and heart beat sound becomes less accurate over 100 beats/minute. Heart rate recovery in a fit horse at 3 minutes after exercise can be counted using this simple technique.

**Handy Hint 9**

**Keep Accurate Records of Heart Rates**

If heart rate recovery is used to evaluate fitness relative to work effort, then accurate records must be kept for comparison to obtain an estimate of the degree of fitness achieved during a training preparation. If heart rate recovery levels are monitored and they appear to increase, it may be an indication of pain or injury, or that the horse is over-heating during exercise due to dehydration or poor heat dissipation. The horse may also be showing signs of long term fatigue and over-training. If over-training is suspected, then the horse may have to be rested for 1-2 months to allow it to recover. Consult your vet for advice.

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