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Introduction into performance evaluation in the equine

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Any alteration in normal physiology or anatomy can compromise athletic function. The challenge is to identify this abnormality. Additionally, performance evaluation can provide an index of fitness level to help assess a particular training program. Regardless of whether you are interested in identifying limits to performance or to measure the degree of fitness, performance evaluation requires standardized conditions.

The track can be used without additional costs. Velocity measurements and heart rates can be used to assess performance prior to going to the actual race event. In human athletic performance, self assessment is standard and inexpensive heart rate monitors are available in variety stores. However all serious athletes will avail themselves of a treadmill.

Treadmills provide a highly reproducible environment for performance evaluations. They also allow animals to work at speeds that equal those they do in real life. The actual protocols for clinical exercise testing vary from laboratory to laboratory, but some aspects of the test should be noted. One protocol is to increase the speed continually but gradually until the animal fatigues. Another technique is to do an incremental step test. This test may start at 4 m/s for 3 minutes followed by 60 second increments at 6, 8, 10, 11, 12 and 13 m/s. Race horses will fatigue at higher speeds while endurance horses will fatigue at lower speeds. These are high speed treadmills (up to 14 m/s or higher) and are capable of increasing their slopes. This incline increases the workload so that animals will be working at maximal intensities even though 14 m/s may not be their maximal speed on the flat (world class Thoroughbreds will be racing at 19 m/s).

Physiological measurements during the exercise test are a function of the information that is sought. Oxygen consumption using open flow systems provide an integrated view of all physiological systems. Oxygen consumption increases linearly with exercise intensity up to a maximum. In human athletes, maximal oxygen consumption is correlated with athletic potential. The sophistication of oxygen consumption measurements make this a cumbersome evaluation. Heart rate also increases with exercise linearly up to a maximum. The availability of heart rate monitors for the horse permit assessment of athletic intensity without oxygen consumption.

Some individuals measure heart rate at submaximal speeds. With a treadmill, one can increase the speed until a particular heart rate is obtained. This may be a heart rate of 200 or 180 bpm. The speeds are then referred to as V_{200} or V_{180}. These numbers can then be used as a measure of performance. As an animal becomes conditioned, V_{180} should increase. If there is a record on the horse, then V_{180} can be used for baseline purposes. If V_{180} is reduced, then one can look at the training program or look for organic causes (diseases).

Another measure of exercise intensity is blood lactates. Lactate increases in curvilinear fashion with exercise intensity. At around 4 mmol/L, blood lactate begins to increase exponentially. For this reason, the 4 mmol/L value is referred to as the OBLA (onset of blood lactate—a misnomer, but used none the less). If blood lactate is measured at three speeds (say 6, 8, and 10 m/s), one can construct a regression of blood lactate vs speed. Extrapolation will permit determination of the speed at which blood lactate reaches 4 mmol/L. This then is the V_{LA4}. A poorly conditioned animal will have a reduced V_{LA4}.

Some laboratories will measure blood gases. This is particularly helpful in dissecting out problems with the lungs. Inadequate ventilation or gas exchange will lead to decrease in PaO_2.

Videoendoscopy is another means of evaluating air exchange (obviously for upper airways). In some instances upper airway problems may only arise with high airflow and the attendant turbulence—airflow that may only be achieved at near maximal speeds. The use of a videoendoscope permits not only visualizing abnormalities but also recording.

Hematology provides insights on the cardiovascular adaptations. Hematocrits and total blood volumes: Blood volume is correlated with performance and can be determined with the appropriate equipment. However, blood volume is a function of exercise intensity, so animals must be exercised maximally for accurate values. Hematocrits are also a function of splenic contraction. Unless you know you've produced full contraction of the spleen, comparative values can not provide much insight onto performance ability. However, low hematocrits can indicate potential organic problems that might limit performance. Serological measurements of CK can provide information on the amount of muscle damage.

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