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A large blue graphic of a globe with silhouettes of various animals (giraffes, horses, dogs, cats) on top of it.

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## **Examination of poor performance in sports horses**

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Horses are extraordinary athletes which characteristics of speed, power and endurance have been developed and enhanced thanks to selective breeding in order to adapt them to a large variety of uses and disciplines, as racing, eventing, harnessing, etc. Whatever the equestrian discipline considered, the accomplishment of performance is the result of a combination of genetic potential, healthiness, optimal nutrition, long-term adequate physical preparation and external factors, including rider intervention, environmental conditions, injuries, etc. When considering the pure physical side of performance, factors rendering horses extraordinary athletes are mainly their high maximal aerobic capacity, their large stores of intramuscular energy substrates, their aptitude to increase oxygen carrying capacity by spleen contraction, their dramatic increase in cardiac output during exercise. In healthy horses, performance-limiting factors depend on the type of exercise, on its intensity and duration. During exercise, there is a coordinate response of all body systems involved to increase energy availability, to maintain acid-base balance and to control body temperature. As an example, if racehorses undergoing high intensity exercise are limited by oxygen transport and by high blood acidosis, eventers and endurance horses are mainly debilitated by their capacity to maintain fluid and electrolyte homeostasis and to ensure thermoregulation. The understanding of which phenomena are most likely to limit performance in healthy horses according to their discipline is important, especially in identifying a cause of poor performance. In this regard, it has to be underlined that history is an essential element to reach a precise diagnosis and it is often underestimated. Then, a thorough physical examination is mandatory, even if horses suffering from poor performance are often asymptomatic, to decide which specific exam should be privileged. As lameness is the

first recognized reason for poor performance, any gait irregularity has to be considered as a potential cause of exercise impairment. Lameness problems should be normally identified and resolved before continuing examinations; nonetheless, if the degree of lameness is acceptable and other non-orthopedic dysfunctions warrant further investigation, dynamic tests should be carried on, especially if a recovery time is going to be anyway recommended for all these issues. Resting examinations will go through hematology and blood chemistry, arterial gas assessment, cardiac and respiratory examination at rest by ECG, cardiac ultrasound if necessary, pulmonary function test if available and respiratory endoscopy. The main challenge for the clinician during resting examination is to determine whether some findings are incidental or likely to have an impact on performances. In fact, resting examination is often inconclusive and/or not necessarily correlated with dynamic findings. For this reason, an exercise test is often necessary. Clinical exercise tests allow the evaluation of athletic capacities and fitness, the follow-up of training-induced adaptations and the determination of causes of poor performance. They can be conducted either on a high-speed treadmill or in the field. Field investigations have the advantage to be realized in a more "natural" environment, thus being less stressful than a treadmill in a clinic, less time-consuming for the owner (no transport) and more demonstrative of horses' natural aptitude. In field tests, gait, surface and speed are more closely aligned to the demands of exercise in "genuine conditions" and the effect of the jockey/rider, in terms of weight bearing, head-neck flexion and reins/bit, is taken into account. Nonetheless, field tests are more difficult to standardize compared to treadmill tests, which give the opportunity to better control environmental conditions and to set a precise design of test (in terms of speed, incline and duration) in order to make the test highly repeatable. Several studies have shown that the physiologic response to treadmill exercise does not replicate responses to field exercise, so the correlation between tests realized in these two different conditions is poor and results cannot be compared. Therefore, modern technology has worked on the development of alternative techniques allowing reliable evaluations on the field, leading to the miniaturization of measuring and recording equipment. Amongst the simpler techniques there are heart-rate monitors coupled to GPS and portable lactate analyzers, some of these are commonly used by riders and trainers to monitor the physical progress of their horse. Some commercial software have been designed for the elaboration and

the integration of these data (speed, lactate and heart rate) to evaluate each horse individually, objectively and immediately after a session and to realize intra- and inter-individual comparisons. The occurrence of over-ground endoscopes (dynamic respiratory endoscopy) has also allowed the assessment of the dynamic behavior of the upper airways in the diagnosis of obstructive disorders. They are useful to determine the origin of a respiratory noise during exercise, to assign a severity score and to determine appropriate medical or surgical treatment. Several other connected devices have been put in the market in the last couple of years, with the purpose to follow up training and to allow an early detection of gait asymmetries and abnormalities or of “overtraining”. Nonetheless, they often lack of scientific validation and should not expertise of an equine veterinarian. In conclusion, during the last decade, research has contributed to the occurrence of new methods of investigation, adapted to the anatomical and physiological specificities of the horses that improve the quality and reliability of the follow-up and clinical examination of the race- and sports horses suffering from poor performance.

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