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Standardized Exercise Test on a Track to Evaluate Exercise Capacity in Different Breeds of Horses

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ABSTRACT. A standardized stepwise exercise test based on radiotelemetrically measured heart rate and speed was used to calculate V 170 in 756 3 year old horses of 9 different breeds, i.e. 449 Czech Warmbloods, 103 Slovak Warmbloods, 105 Kladrubians, 16 Lipizans, 31 Thoroughbreds, 15 Half-thoroughbreds, 15 Anglo-Arabs, 6 Arabs and 16 small riding horses. All horses had undergone 9 months training for cross country competition. Each horse was exercised on a racetrack for 5×800 m at constant speeds of 220, 270, 360, 450 and 540 m min^{-1}. The Thoroughbreds, Halfthoroughbreds, Anglo-Arabs and Arabs were found to have a significantly higher mean V 170 (10 35; 7 76; 7 70; and 8.15 m s^{-1}, respectively) than Czech and Slovak Warmbloods (7.30 and 7.25 m s^{-1}, respectively). All these groups had significantly higher mean V 170 than the Kladrubians, Lipizans and small riding horses (7 02; 6.84 and 6.44 m s^{-1}, respectively). No correlation was found between V 170 and the subjectively evaluated cross country performance of the Czech Warmbloods.

Key words. Horse breed; heart rate; performance; horses

INTRODUCTION

Radiotelemetry for the measurement of heart rate (HR) as an indication of the work load in sport horses has been widely used[1,2,4,9] when studying aerobic capacity[12–14] as well as providing the basis for an objective comparison of horses. An objective evaluation of the capacity for performance requires a standardized test which may indicate the fitness of the horse. Several investigators have assessed the horses response to stepwise loading and have observed a linear regression of HR against speed at submaximal intensities, where HRs were between 120 and 210 bpm.[3,7,9,14,15] Determinations of exercise capacity have been assessed calculating the speed at which steady state is attained. Heart rates of 140,[5,16] 150,[5,11,12] and 200[12] have been used. Whether the heart rate at a submaximal work load is decreased with training is controversial, with decreases[6,10] and no change[8] being reported.

The purpose of this study was to investigate, using a standardised exercise test, 1) whether the mean V 170 varied between breeds and the variation within a large group of animals of similar age and training and 2) whether a relationship existed between V 170 and cross country performance.

MATERIALS AND METHODS

756 healthy 3 year old horses that were normal on cardiac auscultation and had no arrhythmias or murmurs were examined. All horses had been in 9 months of training for cross country competition. The horses were divided into groups according to breeding. There were 449 Czech Warmbloods, 103 Slovak Warmbloods, 105 Kladrubians, 16 Lipizans, 31 Thoroughbreds, 15 Half-thoroughbreds, 15 Anglo-Arabs, 6 Arabs and 16 small riding horses.

Heart rate determination

Heart rates were recorded telemetrically using either a device MPC-IT (Chirana Brno,

Table 1. *Results of the standardized exercise stepwise test of 756 horses in 9 different breeds*
n = number of horses, x(V170) = arithmetical mean of values V170, SD = standard deviation, CV = coefficient of variation

Horse	n	x(V170)	SD	CV
Thoroughbreds	15	10.355	1.811	17.488
Arabs	6	8.147	1.856	22.782
Halfthoroughbreds	31	7.762	1.171	15.089
Anglo-Arabs	15	7.705	1.207	16.522
Czech Warmbloods	449	7.309	1.152	15.757
Slovak Warmbloods	103	7.253	1.265	17.436
Kladrubians	105	7.025	1.230	17.502
Lipizans	16	6.842	0.946	13.830
Small Riding Horses	16	6.441	0.697	10.816

The stepwise exercise test is on the base of the variance analysis statistically conclusive ($p<0.01$) in dependence of V170 on a breed.

Czechoslovakia) or commercial telemetric equipment (Meditel MT, Hellige GMBH, Germany). The electrodes (Danica, Denmark) were fixed mechanically under the saddle girth in the region of the withers and sternum. The transmitter was located in a bag attached behind the saddle of the horse. Heart rates were determined from the paper recording of the ECG at a speed of 25 mm s^{-1}.

Standardised stepwise exercise test

The test was carried out on a grass race track during sunny weather (18–26°C). Each horse was exercised on a track over 800 m at constant speeds of 220, 270, 360, 450 and 540 m min^{-1}. Along the 800 m track were markers every 50 m and the speed of each step was controlled by communicating pacing signal via earphones to the rider. V170 was determined by interpolation from data recorded at the 5 workloads. An analysis of variance was used to determine differences between breeds. Cross country performance was subjectively assessed by a commission of experts using a point scale of 1–10 points in 339 Czech Warmbloods. The relationship of V170 to cross country performance was assessed by comparison of the physiological and subjective point score.

Reproducibility of test

Six horses were given the same test on three occasions on 0, 13 and 22 days and 3 horses on 2 occasions (at least 9 days apart).

RESULTS

The coefficient of reproducibility of stepwise test was 0.927. Table 1 shows the V170 values in 756 horses of 9 different breeds irrespective of their sex. Analysis of variance demonstrated a statistical difference ($p<0.01$) for V170 between breeds. The Thoroughbreds had a much higher V170 than all other breeds. The Thoroughbreds, Half-thoroughbreds, Anglo-Arabs and Arabs were found to have significantly higher V170 (10.35; 7.76; 7.70 and 8.15 ms^{-1}, respectively) and those were significantly higher than the Kladrubians, Lipizans and small riding horses (7.02; 6.84 and 6.44 ms^{-1}, respectively). Within the Czech Warmblood group no sex difference was found $p>0.05$). Subjective evaluation by the commission of 339 Czech Warmbloods scored 79% of the horses within the band 6 to 9 and only 4% below 5. The relationship between V170 and the commission score for individual horses is shown in Fig. 1. No significant correlation ($r=0.048$) was found between V170 and the subjective point score.

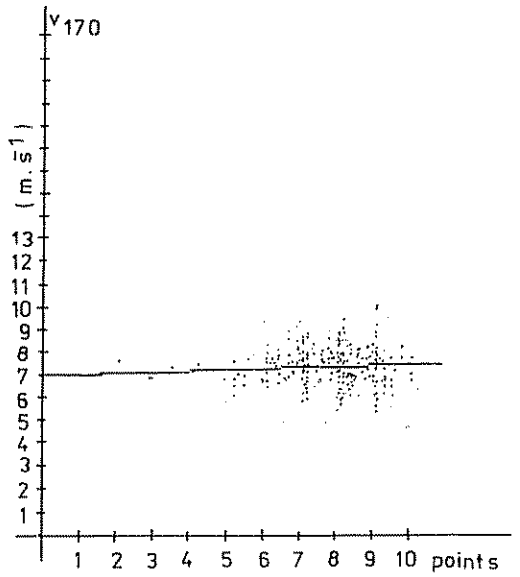

Fig. 1 Scatter plot of V_{170} (*y*-axis) versus subjective point score for cross country ability of 339 Czech Warmbloods.

DISCUSSION

In agreement with previous reports[3,7,9,14,15] linearity of HR of 170 bpm was selected as it was considered that such a speed could be determined for all breeds and that this was of psychological significance for horses performing cross country endurance activity. Differences in V170 may be an index of aerobic capacity as it would be around the onset of blood lactate accumulation. This could reflect either genetic variations or differences in response to training programmes and thus fitness. It was also assumed that any variations in performance may be reflected in differences in V170. The high reproducibility of this stepwise test together with its ease of application indicated the possibility of this test being of practical application.

A significant difference between breeds existed and the Thoroughbreds had the highest V170 values. This is not surprising, as the hotblooded breeds (Thoroughbreds and Arabs) have been selected for speed. It is of interest that there was no significant difference between colts and fillies of a breed. In racing, fillies are given less weight to carry in order to try and make the workload similar between colts and fillies. Perhaps the sensitivity of determining V170 was not sufficient to detect the small variations in performance when altering weight carried by a few kilograms.

One of the purposes of this study was to evaluate the relationship between V170 and the horse's ability to perform in cross country competition. Perhaps it is not surprising that no relationship existed. First, speed and aerobic capacity are not the only criterion for a successful cross country horse. Secondly, the narrow band width classification of the majority of the horses by the commission makes establishment of a relationship more difficult than it would be if a wider distribution existed.

It was concluded that the standardised stepwise test based on V170 was reproducible, but had no value in differentiating the cross country performance ability of similarly trained horses. Whether this same test could be of use in evaluating the training response within an individual horse needs examination.

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