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Effect of exercise and suspensory on scrotal surface temperature in the stallion

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Abstract

In this study, the effect of exercise (treadmill, riding) on scrotal surface temperature (SST) in the stallion with and without suspensory was evaluated. Experiments were carried out between September and November 2004 using 12 Franches-Montagnes stallions from the National Stud in Avenches (Switzerland). Each stallion performed a standardized incremental treadmill and a ridden test with and without suspensory. The intensity of exercise was monitored by heart rate and blood lactate concentration. For SST measurements, special thermistors were developed and affixed to the most ventral part of the scrotum over each testis. SST was recorded telemetrically at 1 min intervals. Our results show that type of exercise (treadmill/ridden) and suspensory (with/without) significantly influenced SST. The mean SST level was higher during treadmill (32.2 ± 0.02 °C) than during ridden exercise (30.4 ± 0.03 °C) and mean SST differences between stallions with and without suspensory were smaller in treadmill (0.4 °C) than in ridden (2 °C) exercise. These findings clearly demonstrate that ambient airflow, which was higher during ridden exercise, is important and effective in SST regulation. In order to prevent possible thermal damage to spermatogenic cells we recommend removing the suspensory immediately after exercise.
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Keywords: Stallion; Exercise; Scrotal surface temperature; Suspensory

1. Introduction

Maintenance of testes at a temperature lower than body temperature is critical for normal spermatogenesis. When testicular temperature is elevated as a result of inflammation, fever or high ambient temperature, metabolism increases at a greater rate than blood flow and hence the testes become hypoxic. Testicular thermoregulation in most mammals is accomplished by relaxation of scrotal muscles, scrotal sweat glands, heat loss from the scrotal surface and the arterio-venous countercurrent heat exchange mechanism at the pampiniform plexus [1–3]. An experimentally induced increase in scrotal and testicular temperature is known to affect spermatogenesis and has been investigated in bulls [4–8], rams [9–13], boars [14–16], rabbits [17–19] and stallions [20,21].

In the horse, intense exercise has been shown to dramatically increase core body temperature above 41 °C [22,23]. Impairment of testicular heat exchange may be caused by scrotal suspensories, the use of which has become popular in show-jumping and trotting stallions to prevent excessive testicular movement during training

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and competition. As yet, the influence of increased body temperature and the wearing of a scrotal suspensory on SST has never been shown. The aim of this study was to investigate the effect of intense treadmill and ridden exercise on SST in the stallion with and without suspensory.

2. Material and methods

2.1. Animals

Experiments were performed between September and November 2004 using 12 Franches-Montagnes stallions aged between 7 and 14 years from the National Stud in Avenches (Switzerland). All animals were kept in individual boxes bedded with straw. They were in good training condition and were fed hay, oats and pellets supplemented with minerals. Water was available ad libitum.

2.2. Experimental design

To increase core body temperature, each stallion was exercised on a treadmill and by riding at various intensities during six consecutive periods of 18 min each. Exercise was performed with and without suspensory (Stallion Support, Wahlsten OY, Lahti, Finland). A picture of the suspensory in place is shown in Fig. 1.

2.3. Treadmill exercise

Before starting the treadmill experiment all stallions were habituated to exercise on the high speed treadmill (Mustang 2200, Kagra AG, Fahrwangen, Switzerland). The exercise program shown in detail in Table 1 consisted of a warm up period (I), two periods (II and III) of increasing workload and three recovery periods (walking IV and V, resting VI). The indoor ambient temperature and humidity were measured by a wireless 433 MHz weather station (TFA, Reichholzheim, Germany) and ranged between 12.1 and 23.2 °C at a relative humidity between 56 and 74%. A ventilator (Isler Bioengineering AG, Zürich, Switzerland) placed 4 m in front of the treadmill directed an airflow (4500 m^3/h) towards the head of the animal.

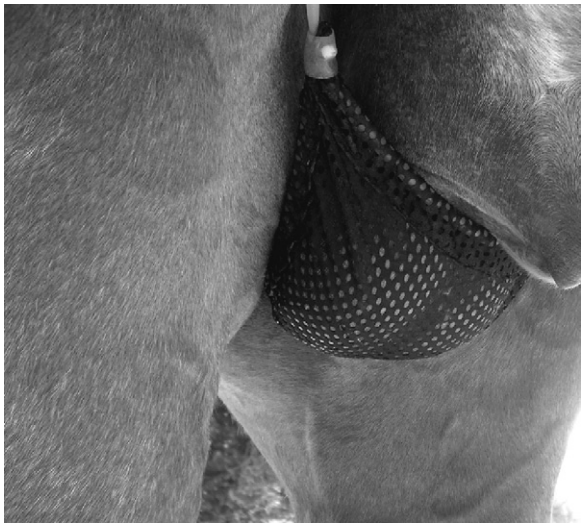

Fig. 1. Stallion wearing the netlike suspensory.

2.4. Ridden exercise

The ridden exercise (Table 2) was performed in an indoor riding arena and consisted of a warm up period (I), two periods of trotting and cantering (II and III) and three recovery periods (walking IV and V, resting VI). The ambient temperature and humidity in the arena varied from 5.3 to 16.6 °C and 59 to 77%, respectively.

2.5. Measurements

2.5.1. Heart rate and blood lactate

Heart rate was determined by two electrodes (Polar Horse Transmitter, Polar Europe, Fleurier, Switzerland) placed under the girth and the values transmitted telemetrically (HT-434-T-7 and HT-434-R-4, Polar Europe, Fleurier, Switzerland) at 1 min intervals to a portable computer (Software, Polar Equine 4.0, Polar Inc., Kempele, Finland) for further evaluation. Blood samples for measuring lactate concentrations (Lactate Pro™ Test Strip, KDK, Kyoto, Japan) were obtained by jugular venipuncture immediately after period III of treadmill and ridden exercise. The detection range of the lactate test is 0.8–23.3 mmol/L.

2.5.2. Scrotal surface temperature

The scrotal surface temperature (SST) was measured using specific thermistors (NTC BetaTHERM Thermistor100K6A1W2, BetaTHERM Ireland Limited, Ballybrit, Ireland) in a polyurethane tube (CCP, Clinical Plastics Products SA, La-Chaux-de-Fonds, Switzerland) sealed with Biresin U 1419 (Global Tool Trading AG, Kriens, Switzerland) and showing a high accuracy with an interchangeability of ±0.05 °C. Prior to each exercise session, two thermistors were fixed with silicon spray (Medical Adhesive B, Ulrich AG, St. Gallen, Switzerland) to the most ventral part of the scrotum over the left and right testis (Fig. 2). SST was transmitted by

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