Journal of Equine Veterinary Science 39 (2016) 7–11

Contents lists available at ScienceDirect

Journal of Equine Veterinary Science

journal homepage: www.j-evs.com

Original Research

Effect of a 130-km Endurance Ride on the Serum Biochemical Profile of Mangalarga Marchador Horses

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ARTICLE INFO

Article history:
Received 18 March 2015
Received in revised form 6 August 2015
Accepted 6 August 2015
Available online 17 August 2015

Keywords:
Endurance ride
Mangalarga Marchador horse
Muscle enzyme
Cholesterol

ABSTRACT

Laboratory tests have become essential in the evaluation of horses that participate in equestrian sports. The purpose of this work, therefore, was to evaluate the serum levels of total protein, albumin, globulin, several metabolites, electrolytes, and enzymes of horses participating in an endurance ride. Blood samples were drawn from 31 Mangalarga Marchador horses during a 130-km South Minas Endurance Ride in the municipalities of Lavras and São João del Rey, state of Minas Gerais, Brazil. Sampling was performed on the first, third, and fifth day of the event to determine the serum levels of proteins, metabolites, minerals, and enzymes in each sample. Significant differences were found in the serum levels of total proteins, globulins, and cholesterol at the three time points. Albumin, creatine kinase, creatinine, uric acid, chloride, total protein, and globulin levels increased from the first time point (TP-1) to the second (TP-2) and decreased in the third (TP-3). Cholesterol levels decreased significantly from TP-1 to TP-3. The 130-km 5-day endurance ride caused changes in most of the serum biochemical parameters of the horses, particularly in total proteins, globulins, and cholesterol.

1. Introduction

Endurance riding is one of the world's emerging equestrian sports, in which horses are subjected to exertion over long distances, and this type of prolonged exercise requires a well-prepared body [1].

Studies on the exercise physiology of horses have expanded due to the growing popularity of, and interest in, equestrian sports. However, horses are subjected to stress through rigorous and often incorrect training, which does not always produce the desired results but often leads to pathologies and injuries that prevent them from engaging in sports activities. The main pathologies involve the cardiorespiratory and locomotor systems, which require the use of clinical laboratory markers to diagnose, prevent, and evaluate lesion treatments [2,3].

The biochemical composition of blood accurately reflects the metabolic state of animal tissues, enabling the assessment of lesions and functional disorders of organs, and the animal's adaptation to nutritional and physiological challenges and to specific metabolic imbalances [4]. It is important to understand the biochemical disorders associated with various types of exercise because they reflect changes in the function of different systems and in the type of energy used [5].

Laboratory tests have become essential in the evaluation of horses used in competitions, making them decisive tools for monitoring the animal [6]. The objective of this work was therefore to evaluate the serum profiles of proteins, metabolites, minerals, and enzyme of horses subjected to a 130-km 5-day endurance ride, comparing their values at the three analyzed time points.

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http://dx.doi.org/10.1016/j.jevs.2015.08.010

2. Material and Methods

Blood samples were collected from 31 Mangalarga Marchador horses with an average age of seven years, of both sexes, during the South Minas Endurance Ride on 130 km of dirt roads with rough and rocky stretches in the municipalities of Lavras and São João del Rey, state of Minas Gerais, Brazil. The animals had participated in four other qualifying rounds before this endurance ride, which was the final phase. As the endurance ride was not a competition itself, we evaluated the effort of the animals during the ride. Only one horse was not able to finish the ride and was eliminated from this study. The horses started the ride in pairs with an interval of fewer than 2 minutes between them. Eventually, all horses were being ridden at the same time and were classed into the same group. On the route between the overnight points, the animals had access to water and at the end of each day, during the overnight stay in paddocks, they had ad libitum access to hay and water. Each day before departing and after arriving at the next overnight location, the horses underwent a Vet Check by the veterinary team to evaluate their physical fitness.

Three blood samples were collected during the 5 days of the event: on the first day in the morning before beginning the ride, time point one (TP-1); on the third day in the afternoon on arrival at the overnight site, after covering 67 km, time point two (TP-2); and on the fifth day at the end of the endurance ride, time point three (TP-3), 30 minutes and 5 seconds after the arrival of the pairs in São João Del Rey, where the endurance ride ended, before the horses were given access to water and food, after covering another 63 km.

At each time point, five milliliters (mL) of blood was drawn from each animal by venipuncture of the external jugular vein into a tube without anticoagulant containing separator gel (BD Vacutainer). The tubes were placed in an isothermal box with recyclable ice cubes and transported to the Clinical Laboratory of the Veterinary Hospital of the Federal University of Uberlândia, where they were centrifuged for 10 minutes at 720*g*. The resulting serum was aliquoted into microtubes (Eppendorf) and chilled for a maximum period of 72 hours before analysis. The serum concentrations of total protein (Biuret method), albumin (bromocresol green method), uric acid (Trinder enzymatic method), creatinine (alkaline picrate method), urea (UV kinetic enzymatic method), total cholesterol (Trinder enzymatic method), triglycerides (Trinder enzymatic method), gamma glutamyl transferase (GGT) (modified Szasz method), aspartate aminotransferase (AST) (International Federation of Clinical Chemistry - Ultraviolet [IFCC UV] kinetic method), alanine aminotransferase (ALT) (IFCC UV kinetic method), and creatine kinase (CK) (IFCC UV method) of each sample were determined in a ChemWell automated multichannel chemistry analyzer (Awareness Technology Inc, Palm City, USA), using commercial kits supplied by Labtest Diagnóstica (Brazil). The analyzer was calibrated with an H gauge and checked with Qualitrol H universal negative control serum, both produced by Labtest Diagnóstica (Brazil).

The globulin levels were calculated based on the difference between total proteins and albumin. The sodium, potassium, and chloride levels were determined by the ion selective electrode method, in an Easylyte Plus electrolyte analyzer (Medica Corp., Bedford, USA).

The results were subjected to an analysis of variance for completely randomized design with the application of the Tukey test at 5% significance to compare the values of the three analyzed time points.

3. Results

Table 1 lists the average values of each biochemical parameter analyzed at the three different time points. A comparison of the values of the parameters found for the

Table 1
Mean values and standard deviations of the blood biochemical parameters of Mangalarga Marchador horses subjected to an endurance ride, analyzed at three time points.

Biochemical Parameters	Analyzed Time Points		
	TP-1	TP-2	TP-3
	Mean ± SD	Mean ± SD	Mean ± SD
Total proteins g/dL	6.53 ± 1.39[b]	7.32 ± 1.45[a]	5.15 ± 0.75[c]
Albumin g/dL	2.27 ± 0.68[a]	2.51 ± 0.56[a]	2.05 ± 0.48[a]
Globulins g/dL	4.25 ± 1.01[b]	4.81 ± 1.04[a]	3.14 ± 0.57[c]
A/G ratio	0.55 ± 0.18[b]	0.53 ± 0.10[b]	0.67 ± 0.19[a]
Uric acid mg/dL	0.88 ± 0.64[a]	0.86 ± 0.43[a]	0.64 ± 0.39[a]
Creatinine mg/dL	1.15 ± 0.26[a]	1.22 ± 0.34[a]	1.07 ± 0.27[a]
Urea mg/dL	38.85 ± 8.66[a]	37.38 ± 14.39[a]	27.34 ± 10.48[b]
Cholesterol mg/dL	123.67 ± 31.72[a]	82.89 ± 18.58[b]	52.38 ± 14.21[c]
Triglycerides mg/dL	31.03 ± 14.87[a]	20.92 ± 9.85[b]	22.79 ± 10.72[b]
Sodium mEq/L	143.53 ± 11.29[b]	140.44 ± 10.20[b]	151.44 ± 9.67[a]
Potassium mEq/L	4.06 ± 0.50[a]	3.27 ± 0.55[b]	3.55 ± 0.56[b]
Chloride mEq/L	103.16 ± 9.25[a]	97.98 ± 9.71[a]	106.12 ± 10.52[a]
GGT U/L	12.85 ± 11.88[b]	34.39 ± 26.23[a]	13.50 ± 11.57[b]
ALT U/L	21.78 ± 12.36[a]	25.91 ± 10.90[a]	28.94 ± 19.75[a]
AST U/L	283.09 ± 78.00[a]	266.38 ± 44.02[a]	180.91 ± 38.06[b]
CK U/L	412.27 ± 341.74[a]	612.96 ± 467.00[a]	386.64 ± 302.81[a]

Abbreviations: ALT, alanine aminotransferase; AST, aspartate aminotransferase; CK, creatine kinase; GGT, gamma glutamyl transferase; SD, standard deviation; TP-1, first day, before beginning the endurance ride; TP-2, third day of the endurance ride; TP-3, fifth day, at the end of the endurance ride.
[a,b,c]Mean values on the lines, followed by different letters, indicate statistical differences ($P < .05$).