İstanbul Üniv. Vet. Fak. Derg.
28 (1), 85 - 90, 2002

J. Fac. Vet. Med. Univ. Istanbul
28 (1), 85 - 90, 2002

THE EFFECTS OF PHYSICAL EXERCISE ON PLASMA LIPID AND PROTEIN PROFILE IN RACE HORSES*

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Yarış atı olarak yetiştirilen atlarda fiziksel egzersizin lipid ve protein profili üzerine etkileri

Özet: Dokuz adet iki yaşındaki erkek İngiliz atına yaptırılan 10 dakika 5400 m'lik koşunun plazma lipid ve protein profili üzerine etkileri incelendi. Tüm hayvanlardan koşu öncesi, koşunun 5. ve 10. dakikaları ile koşu bitiminden sonra 1/2, 6, 12 ve 24. saatlerde kan örnekleri alındı. İstirahat düzeyine oranla egzersizde plazma trigliserit, total protein, albumin, kreatin ve üre düzeylerinde bir yükselme, kolesterol ve total bilurubin düzeylerinde ise bir azalma olmasına karşın bu değişimlerin hiçbiri istatistiksel önemde bulunmadı.

Anahtar Kelimeler: Egzersiz, protein, lipit profili, at.

Summary: The effects of a 10 min, 5400 m ride, on plasma lipid and protein profile was studied in 9, two-year old male English horses. Blood samples were collected from all horses before the ride, at the 5th and 10th min of the ride and at 1/2, 6, 12 and 24 hours after the ride. Compared to the resting values, although slight increases in plasma triglyceride, total protein, albumin, creatinine and urea levels and slight decreases in cholesterol and total bilirubin levels were found during exercise, these changes were not considered significant statistically.

Keywords: Exercise, protein, lipid profile, horse.

Introduction

Race performance is closely related to the horses' genetics, its growth, feeding, its living conditions and training programme.

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* This study was supported by Gemlik Military Veterinary School and Central Training Commandership, Turkey.

Haematologic researches made during the exercise and resting periods in horses are used to develop training programmes and to get optimum condition and better performance from horses (19).

Together with many parameters used in performance profile tests, the importance of plasma cholesterol, triglyceride, total protein, albumin, creatinine, urea and total bilirubin levels were also studied (4).

It has been suggested that; the duration of the return of these changed values to their normal levels, especially during strenuous exercise, could demonstrate the adaptation of animal to exercise (9). Although there have been many research reports informing the effects of various exercise on physiological and biochemical parameters (3, 8, 9, 10, 16), little work has been done on the return of these changed values to their normal levels, in a long period of time.

The purpose of this study was to determine the changes in lipid and protein profile with a 10-minute exercise, and the return duration of these changed values to their normal levels in horses which a special beginning exercise programme had been applied at Gemlik Military Veterinary School and Central Training Commandership. However we aimed to determine if this exercise programme which applied to the animals is suitable to the condition of the horses or not.

Material and Methods

In the study, nine 2-year old male English horses bred as race-horses in Gemlik Military Veterinary School and Central Training Commandership were used. An exercise was applied to all animals on dry sand, close manage where they trotted 5400 m approximately in 10 minutes. Before the study, to increase the power and condition of the young horses, this exercise had been applied to the animals 5 days a week, for 7 weeks. The speed of the horses was 540 m/min during the exercise. When blood samples were taken, the temperature was 18°C and relative humidity was 78%. Jugular venous blood samples of 10 ml were collected from all horses immediately after the beginning training, before the exercise (0 min), on the 5^{th} min of the exercise, immediately after the exercise (10^{th} min) and at 1/2, 6, 12 and 24 hours after the exercise and placed into tubes containing lithium heparine. Blood samples were centrifugated for 10 min and the plasma removed. Plasma samples were kept at –20°C until they were analysed. Plasma cholesterol, triglyceride, total protein, albumin, creatinine, urea and total bilirubin levels were measured with Ciba Corning Express Plus Autoanalyzer by using Bio-Clinica commercial kits.

The mean values of all results and standard deviations of the mean values were calculated and the importance controls of differences between groups were determined with variance analysis (20).

Results

The mean values of plasma triglyceride, cholesterol, total protein, albumin, creatinine, urea and total bilirubin before, during and immediately after the exercise and the standard deviations of the mean values are presented in Table 1.

Table 1. The effects of exercise on some blood parameters in young horses (n=9)

Specialities	Pre-exercise O min x ± Sx	During Exercise 5 min x ± Sx	End of the exercise 10 min. x ± Sx	After-exercise			
				1/2hour x± Sx	6 hour x ± Sx	12 hour x ± Sx	24 hour x ± Sx
Triglyceride (mg/dl)	36.9±2.25	42.9±1.83	44.1±3.11	38.0 ±3.43	41.7±2.73	39.8±3.19	40.0 ±3.96
Cholesterol (mg/dl)	125.7±4.90	120.2±3.29	120.6±3.72	129.5±5.25	115.4±3.42	124.9±7.40	117.3±6.05
Total Protein (g/dl)	6.5±0.17	6.6±0.12	6.5±0.18	6.5±0.65	6.2±0.12	6.5±0.01	6.2±0.1
Albumin (g/dl)	3.5±0.05	3.7±0.12	3.5±0.09	3.4±0.14	3.5±0.08	3.4±0.09	3.3±0.1
Creatinine (mgdl)	1.1±0.07	1.2±0.08	1.3±0.10	1.1±0.05	1.1±0.06	1.1±0.06	1.0±0.0
Urea (mg/dl)	35.6±1.87	37.2±3.43	35.9±2.75	33.7±2.98	37.1±2.69	35.9±1.52	40.7±2.7
Total Bilirubin (mg/dl)	2.3±0.19	2.0±0.17	2.1±0.13	2.2±0.16	2.6±0.30	2.2±0.14	2.3±0.2

Although no statistical difference was found among these mean values, slight increases in plasma total protein, albumin, creatinine, triglyceride and urea levels and decreases in cholesterol and total bilirubin levels were noticed.

Discussion

It is known that a prolonged and attentive training programme is necessary for the adaptation of race-horses. Another point is that the haematological and biochemical values during this adaptive process could be useful in reflecting the horses' response to exercise (5).

In this study, pre-exercise plasma triglyceride and cholesterol levels in young horses that are bred as race-horses were found 36.9±2.25 mg/dl and 125.7±4.90 mg/dl respectively. And these values were similar to the triglyceride (1, 23) and cholesterol (7) values informed for horses. In the measurements which were made at the 5^{th} and 10^{th} min of the exercise, an increase in plasma triglyceride level and a decrease in cholesterol level were determined. But neither of these changes nor the changes at the 24^{th} hour after the exercise were considered significant statistically (Table 1). The meaningless increase of triglyceride during exercise can be explained by the increased synthesis of triglyceride in liver as a result of the increased free fatty acid level in the blood circulation. An

increase in triglyceride level was found in horses which various training technics were applied (7) and in Standardbreds and Finnishbreds which a short term exercise were applied (15). And our findings agree with the reports above. However, the increase of triglyceride level were found less than Pösö et al. (15) and the reason of this may be the differences between races. As a matter of fact, it is determined that the capacity of triglyceride synthesis in liver may change according to the race (15).

Findings about the decrease in cholesterol level in training horses (7, 15) are similar to our results. Beginning cholesterol levels of Standardbreds and Finnishbreds were found 2.3±0.1 and 2.5±0.1 mmol/l respectively and they didn't change after a 5100 m run (15). And these findings agree with our findings about plasma cholesterol level (Table-1). The plasma cholesterol level of the various breds which were trained at least 80 km per week during the previous 3 months and competed in a 100 km ride on the day that blood samples were taken, increased from 91.2±13.4 mmol/l to 132.9±25.8 mmol/l (18). And our findings about plasma cholesterol level disagree with these findings. The reason of this case might be a prolonged and strenuous exercise performed on the horses by Rose et al. (18). As a matter of fact, lipid mobilisation increases extremely during prolonged and strenuous exercises (6, 11, 17, 21).

Our results regarding pre-exercise total plasma protein (TPP) and albumin values are within normal ranges informed in literature (13, 14, 15, 22). Although a slight increase in these values was found at the 5^{th} min of the exercise, no significant differences were determined among the mean values of these parameters statistically before, during and after the exercise. Most studies were performed on the effects of various race, competition and training programmes on TPP (2, 3, 9, 13, 15, 16, 18, 22) and albumin (12, 13, 15, 16, 18, 22) and in all these studies it was informed that the level of these parameters increased during exercise. The increases in both TPP and albumin during exercise are explained by the loss of extracellular fluid, decrease of blood volume and haemoconcentration (2, 9, 15, 16, 22). And also Sommardabl et al. (22) stated that high molecular weight protein fractions were given from stored regions into the blood and Rose et al. (16) stated that the TPP level increases with the loss of fluid during exercise and using TPP value is crucial to find the fluid loss during the training. It was determined that the changes in plasma albumin level is not a correct indication for dehydration (12).

In this study the increases in TPP and albumin levels are less than the results of other studies and the reason of this could be the type of exercise. However, it was determined that total plasma protein levels may change according to the intensity and continuity of the exercise (9). Lucke and Hall (12) observed an increase in albumin from 36.0 g/l to 41.4 g/l during 80 km ride ($P<0.001$) and a decrease from 37.2 g/l to 36.0 g/l during the 40 km ride but this was not significant statistically. The finding of Lucke and Hall about albumin level actually support our results.

Pre-exercise creatinine level which was found 1.1±0.07 in the present study agree with literature (12). Changes, which were found not to be significant statistically, were determined in creatinine and urea level during 24 hour. It was determined in the studies in which these values were investigated (9, 16, 18) that creatinine (12, 16, 18) and

urea (12, 16) increased significantly during long-distance rides over 80-100 km. While Rose et al. (16) determined that creatinine decreased on the day after exercise or ride but post-exercise urea level was 37% higher than pre-exercise urea level, Lucke and Hall (12) found increases in both plasma urea and creatinine on the day after exercise. In another study (18) it was determined that the creatinine level went on increasing 30 mins after the exercise. In this study slightly increases of creatinine and urea levels and the determination of a decrease in urea level at 24 h after the exercise according to the pre-exercise level (Table 1) can be explained by the decrease of glomerular filtration. However, it was indicated that, blood flows through working muscles (16) and glomerular filtration rate decreases due to the decreased renal function (12, 18).

It has been declared that, erytrocyte fragility increase during strenuous exercise (24). In the present study, pre-exercise bilirubin level is within the ranges that informed 0.2-2.4 mg/dl for horses (14), and as we did not apply a strenuous exercise to the horses, no significant changes were found during and after the exercise. In many researches (7, 9, 12, 16, 18) it was determined that total bilirubin increases during exercise and the reason of this increase was explained by intravascular haemolysis during exercise (7, 16), increase of erytrocyte fragility, functional disorders of bile duct, the damage of hepatocytes (7) or some disorders in liver functions (12). The reason of the results of this study being different from other studies could be explained by the distance and term of the exercise applied on horses in this study being much shorter.

As a result, no significant change in plasma lipid and protein profile, creatinine, urea and total bilirubin values was determined. This shows us that a beginning training programme performed by young horses does not cause extreme physical stress on the adaptation of horses to the exercise and more intensive exercise can applied to these animals.

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