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Effect of Exercise on Biochemical Factors in Healthy and Diseased Horses

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ABSTRACT

A clinical study was conducted with an aim to determine the extent of changes in biochemical parameters in healthy horses and those with upper respiratory tract affection both at rest and after exertion. There was a significant change in the level of creatinine kinase in horses with exercise intolerance, poor performance and healthy horses before and after exercise. A significant decrease in the creatinine kinase level was noticed in clinical group (122.8±8.52 IU/L) when compared to that of control group (187.93±14.72 IU/L) before exercise and also there was a significant decrease in the creatinine kinase in clinical group (158.12±15.13 IU/L) when compared to that control group (187.93±14.72 IU/L) after exercise.

Key words: Exercise intolerance, Horses, Poor performance, Serum biochemistry, Upper respiratory tract.

INTRODUCTION

Clinical pathology is frequently used in horses for assessing fitness to race and to screen for diseases that may affect performance. The performance or output of an equine athlete is determined by many complicated interdependent biological and physiological processes. Understanding how these process function and relate to each other is mandatory if the horse is to be effectively trained and managed during its working or competitive life (Warwick, 2004). On the basis of such considerations, the purpose of this study was to investigate changes of some biochemical parameters: aspartate amino transferase (AST), alanine amino transferase (ALT), alkaline phosphatase (ALP), gammaglutamyl transferase (GGT), lactate dehydrogenase (LDH), creatinine kinase (CK), total protein (TP) and glucose in healthy and horses suffering from upper respiratory tract infection, before and after exercise.

MATERIALS AND METHODS

To study the effect of exercise on the serum biochemical parameters in ten clinically normal Thoroughbred (6 geldings, 4 mares) of similar age group (6-9 years) were selected as control (Group I) and were compared with ten Thoroughbred (7 geldings, 3 mares) those affected with upper respiratory tract affections (5 Left Laryngeal hemiplegia, one Dorsal displacement of the soft palate, one Epiglottic entrapment, one Pharyngeal lymphoid hyperplasia, one Guttural pouch empyema, one Rostral displacement of palatal arch) with similar age group (6-9 years) were selected as clinical group (Group II).

Blood samples (10 ml in a vacutainer without anicoagulant) were collected from each horse at rest and after exertion (which was fifteen minutes) induced by lunging, canter, trotting or hand rolling. Serum was separated and used for estimation of the biochemical parameters. The value of the alanine amino transferase and asparate amino transferase was estimated as per the technique described by Varley *et al.* (1980). The alkaline phosphatase was estimated by IFCC method (Tietz *et al*., 1983). Modified Biuret and Dumas method (Varley *et al*., 1980) was followed for estimating serum total protein. The glucose was estimated by orthotoludine method (Bauer, 1982). The lactate dehydrogenase and Gamma glutamyl transferase was estimated by Szasz method (Szasz *et al*., 1976). Creatinine kinase was estimated by Wroblewsk and La Due method (Wroblewsk and La Due, 1995). The data were analyzed by paired and unpaired t-Test.

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RESULTS AND DISCUSSION

In this study, a significant increase in AST, GGT, LDH, CK and TP values and there was a significant decrease in Glucose value were observed after exercise in group I (Table 1a). A significant increase in AST, GGT, CK and TP values and there was a significant decrease in ALT, ALP and Glucose values were observed after exercise in group II (Table 1a). The increased values (after exercise) for AST, GGT, CK, LDH and TP were well within the physiological limit. This could possibly due to short sampling interval for the collection of pre and post exercise blood sample, (which was fifteen minutes) and no major metabolic changes associated with liver and bone alterations can be expected, with in the short sampling period. Snow and Harris (1988)

Table 1a: Effect of exercise on biochemical parameters in control and clinical groups.

Parameters	Control		t-Test	Clinical		t-Test
	Before exercise	Afterexercise		Before exercise	After exercise	
AST (IU/L)	286.13±26.82	303.90±28.58	2.62*	262.78±27.28	276.62±26.82	7.47**
ALT (IU/L)	27.62±10.10	23.65±7.8	1.71^{NS}	25.25±4.19	21.82±4.11	7.37**
ALP (IU/L)	233.73±21.3	229.52±23.3	1.16^{NS}	244.91±17.09	235.76±16.12	3.57**
GGT (IU/L)	13.44±0.48	14.50±0.65	3.66**	11.72±0.98	13.46±0.91	5.93**
LDH (IU/L)	311.78±19.88	328.88±20.18	4.23**	342.71±44.2	393.53±63.97	2.15^{NS}
CK (IU/L)	187.93±14.72	229.61±16.3	5.43**	122.82±8.52	158.12±15.13	2.60*
TP (g/dl)	5.84±0.23	6.59±0.29	3.42**	6.40±0.32	7.19±0.24	4.44**
Glucose (mg/dl)	87.14±3.78	83.78±4.22	5.78**	111.6±9.20	97.21±6.13	2.28*

**- Highly significant (P≤0.01) *- Significant (P<0.05) NS- Not significant (P>0.05).

Table 1b: Comparative effect of exercise on biochemical parameters in control and clinical groups.

Parameters	Before exercise		t-Test	After exercise		t-Test
	Control group	Clinical group		Control group	Clinical group	
AST (IU/L)	286.13±26.82	262.78±26.01	0.62^{NS}	303.90±28.58	276.62±26.82	1.07^{NS}
ALT (IU/L)	27.62±10.10	25.25±4.19	0.22^{NS}	23.65±7.8	21.82±4.11	0.21^{NS}
ALP (IU/L)	233.73±21.3	244.91±17.09	0.40^{NS}	229.52±23.3	235.76±16.12	0.22^{NS}
GGT (IU/L)	13.44±0.48	11.72±0.98	1.68^{NS}	14.50±0.65	13.46±0.91	0.92^{NS}
LDH (IU/L)	311.78±19.88	342.7±44.20	0.68^{NS}	328.88±20.18	393.53±63.97	0.96^{NS}
CK (IU/L)	187.93±14.72	122.8±8.52	3.63**	229.61±16.3	158.12±15.13	3.21*
TP (g/dl)	5.84±0.23	6.40±0.32	1.43^{NS}	6.59±0.29	7.19±0.24	1.56^{NS}
Glucose (mg/dl)	87.14±3.78	111.67±9.20	2.63*	83.78±4.22	97.21±6.13	1.80^{NS}

**- Highly significant (P≤0.01) *- Significant (P<0.05) NS- Not significant (P>0.05).

reported that though there were increase in serum biochemical parameters, the value remained within the reference limits. Similar findings were observed in the present study also. The values observed in the control group horses (Table 1a) were in agreement with standard reference values observed by Sribhen *et al*. (2007).

The reduction in glucose level was due to the energy expenditure associated with the exercise. Rose (1982) stated that reduced glucose values reflected utilization of glucose in excess of replacement by glucogenolysis in horses after exercise. Though there was significant reduction in the ALT and ALP levels after exercise, they were within the physiological normal range. Since the sampling interval is too short, no major metabolic changes associated with liver and muscle metabolism.

No significant differences were observed in the levels of AST, ALT, ALP, GGT, LDH and TP between the groups before and after exercise (Table 1b). However decrease in the creatinine kinase was found to be significant in group II when compared to that group I before and after exercise (Table 1b). The decreased value of CK in clinical group, before and after exercise was within the normal range. A significant increase in glucose value was found in group II when compared to that group I before exercise (Table 1b). The increased value of glucose before exercise was within the normal range. The values observed in the clinical group horses (Table 1b) were in agreement with standard reference values observed by Sribhen *et al*. (2007).

Conflict of interest: None.

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