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Effect of Load on Biochemical Parameters in Mules

Veterinary Science

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ABSTRACT

The investigation was carried out to study the effects of load on biochemical parameters (glucose, cholesterol, urea and lactate) in mules. Five healthy mule 5 to 6 years of age were subjected to loading exercise (i.e. 10% draft load for 1 to 5 days and 20% draft load from 6th to 10th day). ANOVA revealed a highly significant (p≤0.01) increase in blood lactate and urea at 10% and 20% draft load. Cholesterol showed non- significant (p≤0.05) effect at 10% and showed highly significant (p≤0.01) effect at 20% draft load. Glucose indicated highly significant decrease at 10% and 20% draft load.

Introduction

The mule (*Equus mulus mulus*) is a domestic animal that results from the breeding of a male donkey (*Equus asinus*) to a female horse (*Equus caballus*).. Equids particularly mules have spent long time being used by man, even though little attempts have been made to study their different aspect. They are the most important draught animal playing key role in the agriculture sectors in the developing countries in the form of pack transportation, carting, threshing, farm cultivation, riding and meat production for human (Simenew, *et al*., 2011) .The blood biochemical indices may be influenced by multiple factors including environmental factors, load carrying capacity and veterinary care availability (Sow *et al*., 2012).

Materials and Methods

Five apparently healthy adult medium-size mules of 5-6 years of age were selected for study. Their body weight ranged between 320 to 380 kg. A Central Institute of Agricultural Engineering (CIAE) loading car was used to set the desire draught load for work. These animals were procured from the project scheme in National Research Centre on Equine, Jorbeer and Bikaner. For biochemical studies, blood was collected in sterile tubes having no anticoagulant. The blood slants were made and incubated for 1 hour at 37°C. Blood clots were broken and tubes were centrifuged at 2,500 rpm for 30 min. The serum was pipette out in small Pyrex tubes and was kept immediately in the deep freeze at -20°C till analysis.

Experimental schedule

Two trials were conducted, one with 10% draft load and second with 20 % draft load. The blood samples were collected from these animals after 2 hours of work or till the fatigue symptoms appear whichever is earlier. Samples were also collected after 2 hrs of rest.

Biochemical analysis

All the serum enzymes and metabolites were estimated spectrophotometrically by using spectrophotometer-169 of systronics.

Results and Discussion

The mean ± SE concentration of Glucose, Cholesterol, Urea and Lactate with 10% and 20% draft load have been presented in table 1 and 2.

Table 1: Mean ± S.E. value of Glucose, Cholesterol, Urea and Lactate according to the effect of 10% draft load in mule.

Phases	No. of Ob.	Glucose **(mmol/L)		Cholesterol^{NS} (mmol/L)		Urea** (mmol/L)		Lactate** (mmol/L)	
		Mean ± S.E.	% Inc.	Mean ± S.E.	% Inc.	Mean ± S.E.	% Inc.	Mean ± S.E.	% Inc.
Control or Pre Exercise Condition(C)	5	**5.417^{b}**± 0.070 (4.698-5.842)	-	2.570^{a} ± 0.090 (2.245-3.766)	-	9.981^{a} ± 0.414 (5.9-13.0)	-	**0.129^{a}**± 0.008 (0.10-0.39)	-
After 2 hrs. Exercise (T_1)	5	**4.917^{a}**± 0.065 (4.185-5.594)	-9.23	2.239^{a} ±0.0140 (1.116-3.674)	-12.87	**12.830^{b}**± 0.539 (6.9-15.4)	28.54	**0.215^{b}**± 0.016 (0.18-0.52)	66.66
2 hour after rest (T_2)	5	**5.405^{b}**± 0.064 (4.705-5.841)	-0.22	2.379^{a} ± 0.122 (1.386-3.735)	-7.43	**11.940^{b}**± 0.389 (6.0-14.9)	19.62	**0.149^{a}**± 0.010 (0.13-0.45)	15.50

Note: Mean comparison have been made within different phases.

Mean superscripted with different letters differ significantly (P≤ 0.05) from each other.

Data shown in parenthesis are representing respective range.

1. Glucose

A means value of glucose showed a highly significant (p<0.01) effect at 10% and 20% draft load. The pre exercise values of glucose 5.41±0.07 and 5.029 ± 0.09 at 10% and 20% draft load. During exercise, the glucose value decreased to 4.91±0.06 and 4.265 ± 0.09. At the end of the two hours rest the values showed almost similar trend to the pre exercise level. During loaded draught exercise, the utilization of glucose in the muscle depends on the draught load and as a result of exercise stress blood glucose concentration is decreased. (Gottlieb *et al.,* 1989). Further at T2 level (i.e. 2 hours after rest) in both the phases of experiment (at 10% and 20% draft load) the blood concentration of glucose increased close to the control values suggesting acti-

vation of the sympathetic-adrenal axis and hence that continuous loaded draught exercise may constitute a stressful stimulus for the draught animals (Perez *et al.,* 1992). The fall in glucose was due to the increased energy demand by active muscles and indirectly the metabolic pathways operative. Similar findings were observed by Lekeux *et al.,* (1991) and Perez *et al.,* (1992) estimated biochemical parameters in horses.

Table 2: Mean ± S.E. value of Glucose, Cholesterol, Urea and Lactate according to the effect of 20% draft load in mule.

Phases	No. of Obs.	**Glucose** (mmol/L)**		**Cholesterol** (mmol/L)**		**Urea** (mmol/L)**		Lactate** (mmol/L)	
		Mean ± S.E.	% inc.	Mean ± S.E.	% Inc.	Mean ± S.E.	% inc.	Mean ± S.E.	% Inc.
Control or Pre Exercise Condition(C)	5	**5.029**^{b}±0.095 (3.953-5.843)	-	**2.517**^{a}±0.070 (1.746-3.646)	-	**8.711**^{a}±0.402 (5.644-14.501)		**0.158**^{a}±0.019 (0.10-0.32)	-
After 2 hrs. Exercise (T_1)	5	**4.265**^{a}±0.095 (3.828-4.931)	-15.19	**2.114**^{b}±0.056 (1.697-2.688)	-16.01	**12.834**^{c}±0.453 (9.280-15.790)	47.33	**0.422**^{b}±0.037 **(0.20-0.92)**	167.08
2 hour after rest (T_2)	5	**4.993**^{b}±0.087 (3.945-5.769)	-0.71	**2.326**^{b}± 0.072 (1.630-3.028)	-7.58	**10.386**^{b}±0.4117 (6.250-14.392)	19.22	**0.204**^{a}±0.016 (0.13-0.32)	29.11

Note: Mean comparison have been made within different phases.

Mean superscripted with different letters differ significantly (P≤ 0.05) from each other.

Data shown in parenthesis are representing respective range.

2. Cholesterol

In present study non-significant effect was observed on cholesterol concentration in response to the 10% draft load. At the 20% draft load the cholesterol concentrations showed a highly significant ($p<0.01$) effect. The pre exercise values of cholesterol 2.517 ± 0.07 at 20% draft load. During exercise, the cholesterol value decreased to 2.114 ± 0.05. The decreasing trend of cholesterol during exercise can be explained due to the effect of exercise induced increase in oxidation of cholesterol (Malinow *et al.,* 1969) secondly, there may be also some effect of endochrinological changes, taking place during the course of exercise. The cholesterol concentrations may be decreased due to increased adrenals and thyroid activities. Thyroid hormone have negative correlation with cholesterol concentrations (Lehninger *et al.,* 2000; Vasudevan, 2001 and Satyanarayana, 2002).The study also revealed at the end of two hours rest (T2 level), the cholesterol values were more or less similar to the control level (Yadav *et al.,* 2001).

3. Urea

The mean ± SE values of urea as per the ANOVA indicated a highly significant ($p<0.01$) effect at 10% and 20% draft load. The pre exercise values of urea 9.981 ± 0.41 and 8.711 ± 0.40 at 10% and 20% draft load. During exercise, the urea value increased to 12.830 ± 0.53 and 12.834 ± 0.453 at 10% and 20% draft load. The urea concentration values didn't come to normal after end of two hours rest (T2). The urea levels significantly rose after the draught. The increase in urea metabolites was associated with the higher rate of protein break down to muscular activity on draught performance. Rise in urea level in the blood due to exercise and load pulling has been reported in buffalo bullocks (Agarwal *et al.,* 1983a). Any process inducing protein catabolism can result in increased BUN (Kaneko, 1997).

4. Lactate

A means value of lactate concentration showed a highly significant ($p<0.01$) effect at 10% and 20% draft load. The pre exercise values of lactate 0.129 ± 0.08 and 0.158 ± 0.01 at 10% and 20% draft load. During exercise, the glucose value increased to 0.215 ± 0.01 and 0.422 ± 0.03 at 10% and 20% draft load. At the end of two hours rest (T2) the value was sufficient to restore the basal values. Increase in lactic acid content is natural as the demand of oxygen increased for ATP formation by oxidation of carbohydrates. Usually, the maximum possible increase in O_2 consumption during exercise is not more than 200 to 300 percent whereas the rate of ATP utilization is almost 1000 times the basal rates. Therefore, it is apparent that the process of anaerobic mechanism for rapid generation of ATP is activated. Percent increase in blood lactic acid was with higher draft level, and it was in agreement with the study of Gattewar (1983) in buffaloes. Similar findings were observed by the findings of Codazza *et al.,* (1974); Judson *et al.,* (1983) and Perez *et al.,* (1992).

CONCLUSION

On the basis of results obtained in the present study, it can be concluded that loading exercise (i.e. 10% and 20% draft load) affected the following parameters:

1. Increased lactate and urea concentrations, decreased glucose and cholesterol concentrations were found. The fall of glucose due to the energy demands and indirectly the operative metabolic pathways. Rise of lactic acid might be due to increased demand of oxygen for ATP formation by oxidation of CHO. The decrease in cholesterol concentration may be due to increased adrenals and thyroid activities. Thyroid hormone has negative correlation with cholesterol concentration. Urea increase was perhaps associated with the higher rate of protein break down due to muscular activity on draught performance.
2. Blood constituents are good indicators of biochemical and physiological status of the animals. Exercise induces major biochemical adaptation in skeletal muscles. The nutritional status, intensity and duration of exercise and degree of physical fitness are all factors that qualitatively and quantitatively affect the metabolic path way used in generation on energy for muscular contraction.
3. It is suggested that measurement biological parameters like lactate concentration can be useful markers for monitoring the effect of general condition of exercising, transporting animals with draft load-over long distances.

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