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BIOCHEMICAL AND HORMONAL RESPONSES OF *MALVI* AND *NIMARI* BULLOCKS OF MADHYA PRADESH TO WORK

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ABSTRACT

The study was conducted on six bullocks each of *Malvi* and *Nimari* breed maintained at Government cattle breeding farms located in their respective tract. For exercise bullocks were made to pull a load weight equivalent to 200 % of their body weight over a distance of 10 km on level road and ploughing of 200 meter level elliptical track was done continues for 2 hours. From each animal venous blood was collected just before and after carting and ploughing and the serum was separated out. The mean value of glucose, craetinine kinase, lactic acid, triiodothyronine (T_3), thyroxine (T_4), testosterone and cortisol before work were 61.27±0.43 mg/dl, 68.08±2.78 U/L, 98.64±3.12 mg/dl, 568.77±55.83 ng/dl, 2.28±0.89 mg/dl, 0.19±0.03 ng/ml and 10.95±2.10 mg/dl in *Malvi* bullocks and 66.95±0.96 mg/dl, 129.79±20.45 U/L, 280.21±7.74 mg/dl, 699.48±60.99 ng/dl, 12.33±2.86 mg/dl, 0.43±0.13 ng/ml and14.34±2.70 mg/dl in *Nimari* bullocks, respectively. Concentration of glucose, T_3 and testosterone in blood decreased after work whereas, concentration of creatine kinase, lactic acid, T_4 and cortisol increased after work in both breeds. The non significant changes in most of the parameters after work performance indicate that both *Malv*i and *Nimari* breeds are good draught breeds.

Key words : Biochemical parameters, hormonal parameters, Malvi, Nimari.

Draught animal power plays a substantial role in various agricultural operations and rural transportation. The bullocks of *Malvi* and *Nimari* breeds are excellent draught animals, well adapted to tropical conditions of their respective tract. The animals of both breeds are still proudly reared by the farmers[13, 17]. Limited reports are available on biochemical and hormonal changes in animals in response to work[1, 8, 19, 18]. Present communication reports the biochemical and hormonal responses of *Malvi* and *Nimari* bullocks to carting and ploughing.

MATERIALS AND METHODS

The study was conducted on six bullocks each of *Malvi* and *Nimari* breed maintained at Government cattle breeding farms located in their respective tract. For exercise a single animal pneumatic cart of specified design manufactured by Central Institute of Agricultural Engineering, Bhopal and single animal harness and plough was used Bullocks were made to pull a load weight (including weight of cart) equivalent to 200 % of their body weight over a distance of 10 km on label road and ploughing of 200 meter label elliptical track having approximately 50 % sand and 50 % clay was done continues for 2 hours. From each animal 10 ml of venous blood was collected just before and after carting and ploughing and the serum was separated out. Each sample was set in quadruplicate for each of the parameter and average was taken as observation on individual bullock. Biochemical parameters (glucose, craetinine kinase, lactic acid) and hormonal parameters (triiodothyronine (T_3), thyroxine (T_4), testosterone, cortisol) were estimated using standard kits. Blood glucose was estimated by using Glucometer (Accucheck) and lactic acid and creatine kinase were estimated by using Trinity, Biotech kit. The T_3 and T_4 were estimated through ELISA using kits supplied by Biotecx laboratories Inc., USA. The Testosterone and cortisol concentration in serum was determined by using kits supplied by Biosource,

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Europe, S.A. and United Biotech Inc. CA., respectively. Student 't" test was applied to see the significance of difference between values before and after work and difference between breeds[18]. The experiment was conducted during summer 2007. The ambient temperature during experimental period ranged between 31° C to 39°C and 35° C to 43°C in *Malwa* and *Nimar* region, respectively.

RESULTS AND DISCUSSION

Means and standard error of different biochemical and hormonal parameters obtained before and after work for *Malvi* and *Nimari* bullocks are presented in table 1.

The resting blood glucose level was found to be higher in *Nimari* bullocks than in *Malvi* bullocks. However, the difference between breeds was non significant (P> 0.05). Both *Malvi* and *Nimari* breeds showed a reduction (P> 0.05) in blood glucose level after carting and ploughing. Slight reduction in blood glucose level after work have been reported in indigenous cattle[12], cows and buffaloes[14], crossbred bullocks[19] and *Kenkatha* bullocks[18]. Slight reduction in blood glucose level indicates that the energy requirement during work is met through glucogenolysis and glucogenesis and also there is increased permeability to glucose in peripheral tissues. However, a rise in blood glucose level after haulage has been reported in *Hariana* and crossbred bullocks[5].

The creatinine kinase level was significantly higher (P<0.01) in *Nimari* bullocks (129.79±20.45) than in *Malvi* bullocks (68.08±2.78). This may be due to the difference in the breeds of bullocks and the ambient temperature, which is very high in *Nimar* tract in comparison to the *Malwa* tract. Both breeds showed a significant increase (P< 0.01) in creatine kinase level on exposure to work. The significant increase in blood creatine kinase level was also observed in stressed young bulls and in horses[7, 8]. Elevated plasma creatine kinase activity is associated with strenuous muscular exercise. During exercise an increase in muscle cell permeability occurs, which leads to enzyme leakage and accumulation in plasma[8].

The *Nimari* bullocks showed a higher level (P< 0.01) of blood lactic acid (280.21±7.74) than *Malvi* bullocks (98.64±3.12). Lactic acid values increased significantly (p<0.01) immediately after work in both *Malvi* and *Nimari* bullocks. Increased values of lactic acid content in blood have been reported in different working animals[10, 7, 16, 19]. During very intense muscular activity, the circulatory system cannot bring oxygen and glucose to the skeletal muscles fast enough. Hence, muscle glycogen is used as a reserve fuel and is broken to form lactate, generating ATP, which is the energy source for the contraction of the muscle. Since insufficient oxygen is available under these circumstances, the lactate cannot be metabolized further in the muscles and diffuses in the blood, where its concentration increases[11].

The T_3 concentration was found to be higher in *Nimari* bullocks than in *Malvi* bullocks. However, the difference was non significant. The serum T_3 level slightly decreased from pre to post-carting and post-ploughing in bullocks of both breeds but the values did not differ significantly (p>0.05). The present findings are in confirmation with earlier findings in male buffaloes[1] and in man[9]. However, pronounced rise in T3 during work in crossbred bullocks has also been reported[4].

Breed wise Nimari bullocks showed higher concentration of T_4 than *Malvi* bullocks (P<0.01). The exercise resulted in minute alterations in T_4 concentration in both breeds (P> 0.05). This is in agreement with the findings in male buffaloes[1] and crossbred bullocks[4]. The findings suggests that both Malvi and Nimari bullocks possessed efficient thyroid system.

Nimari bullocks showed significantly higher values of testosterone (0.43±0.13) than *Malvi* bullocks (0.19±0.03). Serum testosterone level reduced non-significantly (p>0.05) after work i.e. carting and ploughing in both *Malvi* and *Nimari* bullocks This fall may be due to rise in serum corticoids, as the administration of corticoid preparations drastically reduced the plasma levels of testosterone in cattle[2].

The mean value of cortisol was found to be significantly higher (P<0.05) in *Nimari* bullocks (14.34±2.70) than in *Malvi* bullocks (10.95±2.1). The cortisol content of serum increased significantly (p<0.05) in bullocks of both breeds after work. The present findings are in conformity with earlier findings in male buffaloes[3] and in cattle[6]. Metabolic changes and oxygen tension have been suggested as reasons for adrenocortical response during exercise. The rise in glucocorticoids, by virtue of their glycogenolytic and gluconeogenic properties, may be necessary

in providing sufficient energy to cope with the immediate needs of the body during muscular exercise[3].

The non significant changes in most of the parameters after work performance indicate that both *Malv*i and *Nimari* breeds are good draught breeds.

Table 1. Biochemical and hormonal responses of *Malvi* and *Nimari* bullocks to carting and ploughing.

Parameter	Breed	Carting		Ploughing		Average		
		Before work	After work	Before work	After work	Before work	After work	t value
Glucose	*Malvi*	60.97±0.59	59.10±2.07	61.57±0.84	59.20±1.52	61.27±0.43^{a}	59.15±1.38	1.67^{NS}
(mg/dL)	*Nimari*	67.62±1.14	66.16±2.21	66.28±1.12	63.72±2.37	66.95±0.96^{a}	64.94±2.18	1.43^{NS}
Creatine kinase	*Malvi*	67.33±3.41	110.08±6.35	68.83±4.76	102.00±9.36	68.08±2.78^{a}	106.04±6.40	3.70**
(U/L)	*Nimari*	97.83±9.18	194.75±8.0	161.75±25.81	280.13±38.37	129.79±20.45^{b}	225.50±15.91	4.11**
Lactic acid	*Malvi*	98.30±4.47	125.9±7.33	98.97±7.04	117.63±8.65	98.64±3.12^{a}	121.77±5.26	3.28**
(mg/dL)	*Nimari*	270.54±18.85	362.04±20.75	289.88±10.55	357.50±17.38	280.21±7.74^{b}	359.77±15.11	3.35**
Triiodotyro-	*Malvi*	559.65±61.06	530.75±76.51	577.88±81.97	54268±78.84	568.77±55.88^{a}	536.72±54.69	2.06^{NS}
-nine (ng/dL)	*Nimari*	703.94±61.98	682.33±59.60	695.01±69.85	674.29±78.84	699.48±60.99^{a}	678.31±58.37	1.96^{NS}
Thyroxine	*Malvi*	1.98±0.49	2.33±0.50	2.57±1.26	2.93±1.27	2.28±0.89^{a}	2.63±0.62	2.12^{NS}
(µg/dL)	*Nimari*	10.01±256	13.03±3.08	14.65±3.48	16.61±3.92	12.33±2.86^{b}	14.82±2.43	1.43^{NS}
Testosteron	*Malvi*	0.21±0.03	0.18±0.02	0.16±0.02	0.13±0.01	0.19±0.03^{a}	0.16±0.06	1.81^{NS}
(ng/dL)	*Nimari*	0.43±0.05	0.41±0.06	0.43±0.05	0.41±0.06	0.43±0.13^{b}	041±0.05	2.14^{NS}
Cortisol	*Malvi*	10.33±2.55	21.31±3.99	11.56±2.33	22.80±4.42	10.95±2.1^{a}	22.06±3.25	2.36*
(µg/dL)	*Nimari*	13.67±2.75	23.13±3.58	15.00±2.99	25.16±3.86	14.34±2.70^{b}	24.15±2.06	2.71*

Values with similar superscript do not differ from each other for a parameter between breeds. NS non significant; ** Significant at 1%; * Significant at 5% after work performance.

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