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PRELIMINARY OBSERVATIONS ON CHANGES IN BLOOD METABOLITE CONCENTRATIONS IN EARLY LACTATION IN LACTATING BUFFALOES COMPARED WITH OPEN BUFFALOES

A CASE STUDY

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ABSTRACT

The Metabolic Blood Profiling is a herd test designed to correct errors in management and nutrition, which show up as abnormal levels in blood chemistry of energy, protein, mineral and diagnostic enzyme concentrations. The purpose of this study was to investigate changes that may have occurred for at 60, 90 and 120 days post parturition in buffaloes, in comparison to open buffaloes in certain serum energy, protein and enzyme concentrations. At 90 days both glucose and cholesterol levels were higher in lactating animals compared with open animals. Similarly, only at 90 days were serum protein, albumin and globulin higher in lactating animals compared with open animals but not with 60 and 120 days into lactation. Aspartate amino transferase (AST) activity was higher in lactating than in open buffaloes at 90 and 120 days, with a reversal occurring at 60 days, respectively. There were no difference in ceruloplasmin activity ($P>0.05$) between lactating and open buffaloes for the three sampling periods, but all levels were extremely low. Ceruloplasmin is a metalloenzyme with oxidase activity composing of eight to 10 atoms of copper and highly correlated with serum copper levels in cattle. Hence a copper dietary insufficiency may be associated with the prolonged calving interval in our local buffaloes.

Keywords: Blood Metabolite Concentrations, Lactation, Lactating Buffaloes.

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INTRODUCTION

Water buffaloes (*Bubalusbubalis*) were imported into Trinidad from India in 1905 to work as beasts of burden, primarily on the sugar cane plantations. Increased mechanization of the sugar cane industry resulted in the selection of beef type bulls in the herds owned by Caroni Limited. Interbreeding between the Murrah, Badawari, Surti, Jaffarabadi and Nelli breed types over 25 years by Dr. Steve Bennett resulted in the development of the buffalypso (Bennett 1964; Bennett 1972; Bennett and Porteus 1974).

To date preliminary studies in buffaloes from Trinidad have been carried out milk yield, average daily gains of buffalo calves and bulls on sugar cane by-product feeding systems including birth weights, weaning weights and weight of yearlings on forage based diets (Garcia et al; 1987; Rastogi et al; 1978; Rastogi and Rastogi, 2004; Danille et al, 2013).

The Metabolic Blood Profiling is a herd test designed to correct errors in management and nutrition, which show up as abnormal levels in blood chemistry of energy, protein, mineral and diagnostic enzyme concentrations. Changes in blood metabolite concentrations are often related to problems associated with subclinical metabolic disorders at parturition and stage of lactation.

The purpose of this study was to investigate changes that may have occurred for at 60, 90 and 120 days post parturition in buffaloes, in comparison to open buffaloes in blood glucose, cholesterol, total protein, albumin, globulin, iron, calcium, phosphorus and AST (Aspartate aminotransferase) and ceruloplasmin (EC 1.16.3.1) (Copper oxidase) enzyme concentrations.

MATERIALS AND METHODS

The ARIPO livestock station manages a brucella disease free buffalo herd size of about 160 animals. Ten (10) lactating buffaloes and fifteen (15) open buffaloes were blood sampled from the station at 60 d, 90 d and 120 d post parturition of lactation. Open female adult buffaloes were non-lactating and not served either by natural mating or by Artificial Insemination (AI).

Fifteen millilitres of blood was drawn by venipuncture (16 gauge needle) and allowed to clot for 3 hrs before serum was separated by centrifugation (3000 x rpm) and stored at minus 80 degrees. Serum glucose (mmol/L), cholesterol (mmol/L), total protein (g/L), albumin g/L), globulin g/L), iron (µmol/L), calcium (mmol/L), AST Aspartate aminotransferase (U/L) concentrations were measured using a Daytona Autoanalyser (Randox laboratories) using respective controls and standards. Serum P concentrations were determined calorimetrically from the formation of the yellow phosphorus-vanado-molybdate complex (Fick et al; 1979). Ceruloplasmin concentration as a change in optical density units was determined using *p* – paraphenylene-diamine-dihydro-

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chloride as substrate (Varley, Gowenlock, and Bell, 1980). All samples were analyzed in duplicates.

RESULTS AND DISCUSSION

Tables 1, 2 and 3 show the comparison of energy, protein, mineral, and enzyme concentrations of lactating buffaloes with open buffaloes with days into lactation. Glucose and cholesterol level were not different (P> 0.05) between lactating and open buffaloes at 60 and 120 days of the former.

Table (1): Biochemical parameters as influenced by the physiological state of Buffaloes

[ab]Means in separate columns within a parameter with different superscripts differ significantly; P<0.05

		Physiological State			
Parameters	**Days Lact**	**Lactating**	**Open**	**Normal range**	**SEM**
Glupap (mmol/l)	60	3.29[a]	3.37[a]	2.0 - 3.0	0.065
Cholesterol (mmol/l)	60	2.2[a]	2.1[a]	1.0 - 3.1	0.068
Total protein (g/l)	60	69.9[a]	74.5[a]	59 - 73	3.58
Albumin (g/l)	60	35.3[a]	36.8[a]	28 - 36	0.415
Globulin (g/L	60	34.6	37.7	27-50	
Calcium (mmol/l)	60	2.33[a]	2.42[a]	2.0 - 3.0	0.09
Phosphorus (mg/L)	60	35.65[a]	35.79[a]	20-40	0.118
Iron (umol/l)	60	14.9[a]	18.9[b]	4.0 – 25.0	0.535
AST (U/L)	60	77.7[a]	90.4[b]	53 - 105	2.68
Ceruloplasmin OD	60	0.06[a]	0.05[a]		0.061
Mean		0.06205	0.051		
± SD		0.023	0.033		

SEM: Standard Error of Mean, AST: Aspartate aminotransferase, OD: Optical Density Units

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Table (2): Biochemical parameters as influenced by the physiological state of Buffaloes

[ab]Means in separate columns within a parameter with different superscripts differ significantly; P<0.05

	Physiological State				
Parameters	**Days Lact**	**Lactating**	**Open**	**Normal range**	**SEM**
Glupap (mmol/l)	90	3.89[a]	3.33[b]	2.0-3.0	0.05
Cholesterol (mmol/l)	90	3.4[a]	2.04[b]	1.0-3.1	0.115
Total protein (g/l)	90	90.4[a]	72.1[b]	59-73	0.954
Albumin (g/l)	90	40[a]	36.7[b]	28-36	0.162
Globulin (g/L	90	50.4	35.4	27-50	
Calcium (mmol/l)	90	2.56[a]	2.38[b]	2.0 – 3.0	0.03
Phosphorus (mg/L)	90	36.02[a]	36.34[a]	20-40	0.269
Iron (umol/l)	90	17.3[a]	18.4[a]	4.0-25.0	0.735
AST (U/L)	90	94.9[a]	63.2[b]	53-105	4.17
Ceruloplasmin OD	90	0.02[a]	0.04[a]		0.049
Mean		0.02038	0.051		
± SD		0.02	0.04		

SEM: Standard Error of Mean, AST: Aspartate aminotransferase, OD: Optical Density Units

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Table (3): Biochemical parameters as influenced by the physiological state of Buffaloes

[ab]Means in separate columns within a parameter with different superscripts differ significantly; P<0.05

	Physiological State				
Parameters	**Days Lact**	**Lactating**	**Open**	**Normal range**	**SEM**
Glupap (mmol/l)	120	3.17[a]	3.28[a]	2.0 – 3.0	3.02
Cholesterol (mmol/l)	120	2.63[a]	2.12[a]	1.0-3.1	0.495
Total protein (g/l)	120	75.3[a]	71.7[a]	59-73	5.54
Albumin (g/l)	120	36.7[a]	36.7[a]	28-36	0.351
Globulin (g/L	120	38.6	35	27-50	
Calcium (mmol/l)	120	2.33[a]	2.35[a]	2.0-3.0	0.02
Phosphorus (mg/L)	120	35.18[a]	35.6[a]	20-40	0.515
Iron (umol/l)	120	16.9[a]	18.1[a]	4.0 – 25.0	2.75
AST (U/L)	120	72.1[a]	60.8[b]	53-105	2.67
Ceruloplasmin OD	120	0.02	0.01		0.011
Mean		0.021	0.014		
± SD		0.017	0.0155		

SEM: Standard Error of Mean, AST: Aspartate aminotransferase, OD: Optical Density Units

At 90 days, however, both glucose and cholesterol levels were higher in lactating animals compared with open animals. Glucose and cholesterol levels were within reference ranges expected for cattle. Similarly, only at 90 days were serum protein, albumin and globulin higher in lactating animals compared with open animals but not with 60 and 120 days into lactation.

Highest serum protein and highest globulin levels were observed at 90 days in lactating animals. Highest protein and globulin levels may have been due to an inflammatory response as suggested by Whittaker et al (1998) and Hagawane et al (2009) from their studies on metabolic blood profiling of tropical cattle.

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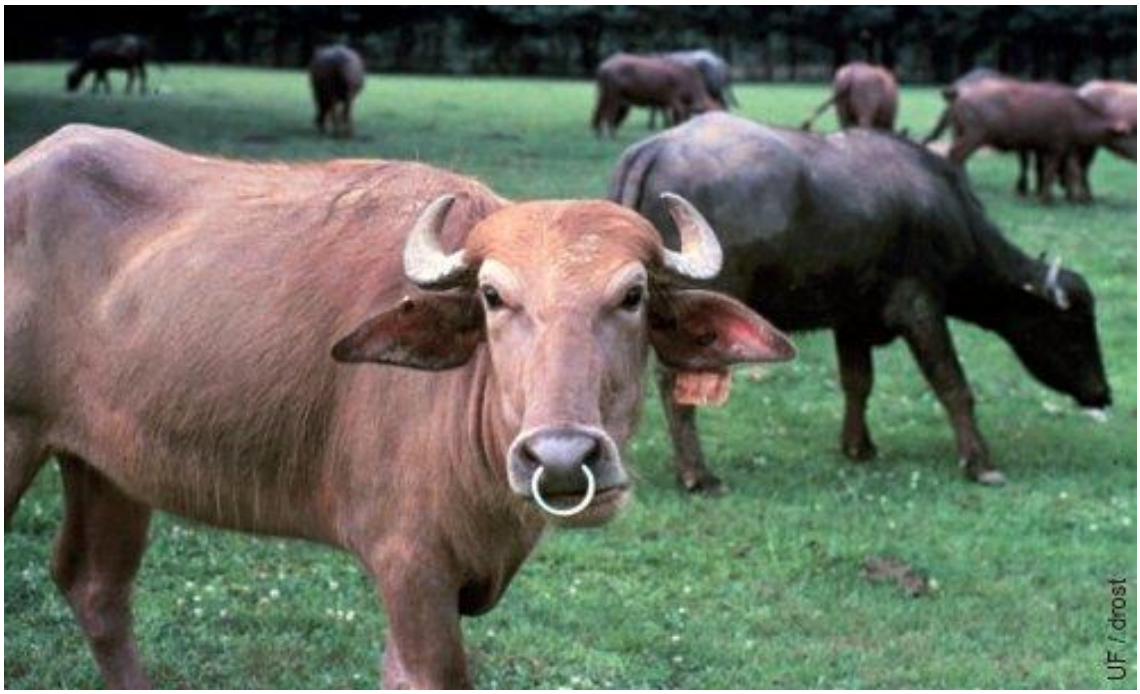
Aspartate amino transferase (AST) activity was higher in lactating than in open buffaloes at 90 and 120 days, with a reversal occurring at 60 days, respectively. Higher AST activity is activity is reported for cycling and repeat breeder buffaloes compared with anoestrus buffaloes (Chaurasia et al; 2016).

Serum iron levels were higher in open buffaloes at 60 days only than levels found in lactating buffaloes which is similar to the findings in Nili- Ravi buffaloes (Shahzadi et al; 2014).

There were no differences in ceruloplasmin activity ($P>0.05$) between lactating and open buffaloes for the three sampling periods, but all levels were extremely low. Low ceruloplasmin and copper concentrations have been associated with low progesterone in the luteal phase of reproductive activity in Egyptian buffaloes suggesting causing cessation of cyclical activity(Ahmed et al. 2009).

Ceruloplasminis a metalloenzyme with oxidase activity composing of eight to 10 atoms of copper and highly correlated with serum copper levels in cattle (Blakey and Hamilton, 1985).Dunn et al (2013) noted that the Trinidad buffalo calving interval was over two years with most calves being born towards at the end (March to May) of the dry season. Hence a copper dietary insufficiency may be associated with the prolonged calving intervaland time of conception mainly May to July of the previous year, in our local buffaloes.

Figure 1 Buffaloes of the Aripo Livestock station Trinidad



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