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Biochemical profile in buffaloes with periparturient reproductive and metabolic disorders

G.C. MANDALI[1], P.R. PATEL[2], A.J. DHAMI[3], S.K. RAVAL[4] AND K.S. CHRISTI[5]

Department of Medicine, College of Veterinary Science and Animal Husbandry
Gujarat Agricultural University, Anand Campus, Anand-388 001

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ABSTRACT

The relevant blood biochemical profile in cases of retention of fetal membranes-RFM (53), pre-partum (7) and post-partum (32) prolapse of genitalia, milk fever (25) and clinical ketosis (14) were studied and compared with those of normal (10 each) buffaloes of similar physiological status with a view to characterize the same and suggest some suitable control measures. The mean blood glucose level was significantly lower in buffaloes with RFM (53.42 ± 0.73 Vs 57.73 ± 1.42 mg%). Similarly, ketotic buffaloes also had significantly lower blood glucose (40.93 ± 0.85 Vs 58.25 ± 1.33 mg%) and higher ketone bodies (15.43 ± 0.33 Vs 3.29 ± 0.20 mg%). The serum calcium level was significantly lower in cases of RFM (5.52 ± 0.12 mg%), pre and post-partum genital prolapse (6.27 ± 0.13 and 6.03 ± 0.13 mg%) and milk fever (4.30 ± 0.08 mg%) as compared to normal ones (8.07 ± 0.21 mg%). The inorganic phosphorus level was also significantly lower in pre-partum (3.80 ± 0.08 Vs 5.22 ± 0.15 mg%) and post-partum (3.29 ± 0.08 Vs 5.57 ± 0.12 mg%) genital prolapse and milk fever (3.28 ± 1.0 Vs 5.57 ± 0.12 mg%). Although magnesium levels in milk fever and total proteins and AKP levels in RFM cases did not differ from those in normal buffaloes. The serum GOT and LDH activities on the contrary were significantly higher in RFM and milk fever cases as compared to normal ones. The findings suggest that the altered metabolic profile could be the cause of most periparturient disorders in buffaloes and these could probably be prevented by proper care, balanced feeding and mineral supplements during advanced pregnancy and early post-partum period.

Key words : Buffalo, reproductive and metabolic disorders.

Periparturient disorders in dairy animals are of great concern to the growth of dairy industry as they seriously jeopardize the reproductive and productive efficiency of these animals. Several extrinsic and intrinsic factors are known to influence the occurrence of these disorders. Deficiencies or low levels of certain blood metabolites and minerals especially blood glucose, calcium and phosphorus, and elevation of serum enzymes GOT, AKP & LDH have been documented in some specific periparturient disorders in bovines (Dutta and Dugwekar, 1983a,b; Dabas *et al.*, 1987; Choudhury *et al.*, 1993; Mohanty *et al.*, 1994; Patel *et al.*, 1999). The present paper deals with the biochemical profiles of buffaloes with peripartum reproductive and metabolic disorders so as to suggest their preventive measures.

[1-4] Asstt. Prof., Dept. of Medicine
[2]Professor & Head. Deptt. of Medicine
[3]Corresponding author - Assoc. Professor, Dept. of Animal Science.
[5]Asstt. Professor. Dept. of Physiology

MATERIALS AND METHODS

This study was undertaken during the year 1997-98 on 131 rural buffaloes affected with retention of fetal membranes-RFM (53), pre-partum (7) and post-partum (32) prolapse of genitalia, milk fever (25) and clinical ketosis (14) to know and compare their biochemical profiles with normal healthy buffaloes (10 each) of identical peripartum stage. Blood samples were collected once from the ketotic as well as normal healthy buffaloes using sodium citrate and sodium fluoride as anticoagulant for the study of blood glucose and ketone bodies levels. Moreover, 117 sera samples were obtained from buffaloes with other periparturient disorders, viz. RFM, pre and postpartum genital prolapse and milk fever by collecting jugular blood samples just before attempting any treatment. These along with other 20 samples from healthy buffaloes were then stored at –20°C in sterilized vials until analysed.

The blood glucose, blood ketone bodies as well as serum calcium, inorganic phosphorus and magnesium levels were quantified according to standard procedures described by Oser (1979). The activities of enzymes serum glutamic oxaloacetic transaminase (SGOT), alkaline phosphatase (AKP) and lactic dehydrogenase (LDH) in sera samples of only RFM and milk fever cases were determined by colorimetric methods of Wootten (1980) using Span Diagnostic Kits (Udhna, Surat, Gujarat). The data were anaysed statistically using unpaired 't' test to compare the profiles of various constituents between healthy and affected buffaloes.

RESULTS AND DISCUSSION

The relevant biochemical profiles of buffaloes affected with retention of fetal membranes, pre- and post-partum prolapse of genitalia, milk fever and clinical ketosis in comparison to those of healthy buffaloes of same physiological stage are presented in Tables 1 to 4, respectively.

Biochemical profile in retention of fetal membranes : The buffaloes affected with RFM had significantly ($P<0.01$) lower levels of blood glucose and serum calcium than those calved normally, but total protein did not vary between them (Table 1). This was in accordance with the findings of Dutta and Dugwekar (1983b), Dabas *et al.* (1987), Choudhury *et al.* (1993) and Mohanty *et al.* (1994). The present findings suggest that the low energy and calcium concentration in blood may be responsible for the causation of retention of fetal membranes. Patel *et al.* (1999) also reported significantly lower blood glucose and serum total protein, calcium and inorganic phosphorus levels on day 1st and 30th postpartum in buffaloes retaining their fetal membranes as compared to control ones. The disturbance in the calcium metabolism and its utilization by the tissue results in the atony of the internal organs. During advanced stage of pregnancy, there is excessive mobilization of calcium. It is therefore suggested that probably less availability of glucose and calcium to the uterine tissues results in atony of uterus, with decrease contraction and retention of fetal membranes (Mohanty *et al.*, 1994).

The level of LDH was observed to be significantly ($P<0.01$) higher in RFM buffaloes as compared to normal ones, but AKP levels did not vary between them (Table 1). Similar findings for LDH were reported by Dutta and Dugwekar (1983a). Further, AKP levels were also reported to be non-significantly higher in RFM buffaloes over control ones by Sharma *et al.* (1991) and Mohanty *et al.* (1994). The increased levels of these enzymes in the serum might result from leakage from necrotic or damaged cells (Wootten, 1980). Retention of fetal membranes is commonly associated with small portion of necrotic epithelium between the chorionic villi and the cryptal walls. The degree of placentitis that may develop as a complication secondary to retained fetal membranes could vary from a mild peripheral type of necrosis involving only the villi to a severe necrosis involving the entire cotyledons and a part or all of the caruncles (Roberts, 1971). This might explain the reasons for elevated levels of AKP in buffaloes with RFM.

Biochemical parameters in genital prolapse : The average serum calcium (8.30±0.06 vs 6.27±0.13 mg%) and inorganic phosphorus (5.22±0.15 vs 3.80±0.08 mg%) levels in normal buffaloes were significantly higher than those with prepartum prolapse of genitalia (Table 2).

Table 1. Levels of certain biochemical parameters in buffaloes with and without retained fetal membranes (Mean±SE)

Sr. No.	Parameters	Normal Parturition (n=10)	Retained Fetal Membranes (n=53)	't' value
1	Calcium (mg%)	8.07±0.21	5.52±0.12	8.5^{**}
2	Blood glucose (mg%)	57.73±1.42	53.42±0.73	2.4^{*}
3	Total proteins (g%)	6.64±0.09	6.78±0.05	1.7^{NS}
4	AKP (KA Units)	17.06±0.39	18.51±0.28	0.61^{NS}
5	LDH (IU/L)	324.45±7.77	425.40±1.84	3.61^{**}

* Significant at 5% level ($P<0.05$), ** Significant at 1% level ($P<0.01$).

Table 2. Mean levels of serum calcium and inorganic phosphorus in buffaloes with pre-partum and post-partum prolapse of genitalia

Sr. No.	Condition	No. of animals	Calcium (mg %)	Phosphorus (mg %)
1	Pre-partum prolapsed buffaloes	07	6.27±0.13	3.80±0.08
2	Normal Advanced pregnant buffaloes	10	8.30±0.06	5.22±0.15
	't' test	-	5.2**	2.68*
3	Post-partum prolapsed Buffaloes	32	6.03±0.13	3.29±0.08
4	Normal post-partum buffaloes	10	8.07±0.21	5.57±0.12
	't' test	-	7.86**	14.32**

* Significant at 5% level (P<0.05), ** Significant at 1% level (P<0.01).

Table 3. Mean ± SE levels of certain biochemical parameters in control and milk fever affected buffaloes

Sr.No.	Parameters	Control (n=10)	Milk fever (n=25)	't' value
1	Calcium (mg%)	8.07±0.21	4.30±0.08	20.48**
2	Magnesium (mg%)	1.85±0.09	2.04±0.07	1.63^{NS}
3	Phosphorus (mg%)	5.57±0.12	3.28±0.10	12.8**
4	SGOT (unit/ml)	9.98±0.25	24.60±0.29	8.75**
5	LDH (IU/L)	324.45±7.77	421.59±2.17	3.62**

** Significant at 1% level (P<0.01)

Table 4. Biochemical profiles (mean±SE) in buffaloes affected with clinical ketosis

Sr. No.	Parameters	Normal (n=10)	Clinical ketosis (n=14)	't' value
1	Blood glucose (mg%)	58.25±1.33	40.93±0.85	10.8**
2	Blood ketone bodies (mg%)	3.29±0.20	15.43±0.33	8.82**

** Significant at 1% level (P<0.01).

Pandit *et al.* (1982) and Nanda and Sharma (1982) reported similar findings, whereas Choudhary *et al.* (1987) observed non-significantly lower level of phosphorus in prolapse cases. This could be due to some metabolic disturbances causing poor absorption of calcium and phosphorus from the gut. The role of calcium in prepartum prolapse is not clearly understood. Further, the functions of inorganic phosphorus being synergistic to calcium, the simultaneous deficiency of both these minerals either causes lack of tone of muscles of genitalia and/or weakness and excessive relaxation of pelvic ligaments, thus making the animals more prone to the prolapse of genitalia (Nanda and Sharma, 1982).

The buffaloes affected with postpartum prolapse of genitalia also had significantly (P<0.01) lower levels of serum calcium (6.03±0.13 Vs 8.07±0.21 mg%) and inorganic phosphorus (3.29±0.08 Vs 5.57±0.12 mg%) than those of normal ones (Table 2). These values are comparable with those reported by Pandit *et al.* (1982) and Dabas *et al.* (1987) in buffaloes. whereas Choudhary *et al.* (1987) observed significantly lower level of only calcium, but not of phosphorus. A decline in postpartum

serum calcium may be attributed to sudden drain of calcium to the colostrum at the onset of lactation apart from greater need/use in muscle contractions (Dabas *et al.*, 1987; Risco *et al.*, 1984). The decreased serum calcium content is accentuated greatly in buffaloes in which paresis also develops. It is suggested that hypocalcaemia in relation to phosphorus altering calcium-phosphorus ratio might interfere with the normal position of genital organs resulting in prolapse.

Biochemical profiles in milk fever : The concentrations of serum calcium and inorganic phosphorus decreased significantly ($P<0.01$) in cases of milk fever as compared to normal ones, but magnesium levels were identical in them (Table 3). These observations are in agreement with the reports of Bhoop Singh *et al.* (1974), Patel (1990) and Mandali *et al.* (1993). However, Hejlasz (1985) reported higher levels of magnesium in milk fever cases. Lack of available dietary calcium and phosphorus during advanced pregnancy and subsequent excessive drainage of same in colostrum and milk at the onset of lactation could be the predisposing factors for hypocalcaemia and hypophosphataemia as postulated by Bhoop Singh *et al.* (1974).

The concentration of SGOT and LDH also increased significantly ($P<0.01$) in milk fever cases as compared to normally calved buffaloes (Table 3). These findings are in agreement with the reports of Church *et al.* (1978) and Mandali *et al.* (1993). This increase in the serum enzyme concentrations in milk fever may be due to stress and injury sustained during calving and the effect of recumbency after parturition.

Blood biochemical profiles in clinical ketosis : A significant ($P<0.01$) decrease in blood glucose level and increase in blood ketone bodies was observed in buffaloes having clinical ketosis as compared to normal ones (Table 4). Similar findings were also observed by Anantwar and Bhoop Singh (1993). Moreover, Bhuin *et al.* (1993) and Rautmare and Anantwar (1993) recorded significant decrease in blood glucose level in ketotic cows and buffaloes, respectively. This could be due to rapid utilization and conversion of glucose to lactose by mammary gland coupled with insufficient feed intake to replenish glucose supply. Similarly, highly significant increase in blood ketone might be due to lipolysis occurring in adipose tissues (Anantwar and Bhoop Singh, 1993).

The findings of this study, in general, suggest that the altered metabolic profile could be the cause of most periparturient disorders in buffaloes and these could probably be prevented by proper care, balanced feeding and mineral supplements during advanced pregnancy and early post-partum period, where the animals are highly prone to stress of heavy nutrients demand and drain making them more susceptible to periparturient disorders and uterine/udder infection.

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