SERUM ELECTROLYTES IN BUFFALOES DURING LATE PREGNANCY, PARTURITION AND POST PARTUM PERIODS

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ABSTRACT

This study was executed on 30 pregnant Nili-Ravi buffaloes. Serum was harvested for the estimation of calcium, magnesium, phosphorus, sodium, potassium and iron in the late pregnancy (at 8th and 9th month of gestation), at parturition and in the postpartum periods (at Ist and 2nd month postpartum). The concentrations of Ca and P were significantly ($P< 0.05$) lower and Mg was significantly ($P<0.05$) higher at the time of parturition. The concentrations of Na and K did not show much variation. The values of Fe also decreased significantly ($P<0.05$) near parturition (at 9th month of gestation) and at parturition. No puerperal disorder was observed in any of the experimental animals.

Key Words: Buffalo, Serum Electrolytes, Gestation, Parturition, Postpartum

INTRODUCTION

Minerals are important constituent of feed and may play a significant role in the reproductive efficacy of livestock. Essential minerals are required for reproduction due to their effective cellular roles in the metabolism, maintenance and growth of animal body. Minerals affect estrus, ovulation and conception. Minerals are also necessary for maintenance of fertilized fetus in the uterus and for successful pregnancy. Deficiency of minerals has been associated with reduced fertility rate due to irregular estrus cycle, delayed ovulation and silent estrus. Ovarian activity of buffalo is mostly prone to minerals and their deficiency (Irshad-ul-Haq *et al.*, 1999) though the exact mechanism by which the deficiency reduces fertility is not clear (Laing, 1988).

Electrolyte profiles have been used in an effort to predict periparturition problems and fertility, diagnosis of metabolic diseases and assessment of nutritional status (Ingraham and Kappel, 1988). Changes in the levels of various serum electrolytes of cows in pregnancy, parturition and lactation have been investigated earlier (Murtaza *et al.*, 1979; Gibasiewiez 1985; Pathak and Janakiraman, 1989). In most of these studies, serum electrolytes and the duration of research were limited. The purpose of the present study was to find variation of serum electrolytes (Ca^{++}, P, Mg^{++}, Na^{+}, K^{+}, Fe^{++}) of Nili– Ravi buffaloes at two months prepartum, parturition and two months postpartum and to know the relationship between blood mineral values and puerperal disorders.

MATERIALS AND METHODS

This study was conducted on 30 pregnant Nili-Ravi buffaloes kept at Livestock Production Research Institute, Bahadarnagar, Okara during the months from May to December, 1999. Blood samples were collected by jugular veinepuncture. Approximately 8-10 ml of blood was drawn from each animal. Five blood samples i.e. at 8th and 9th month of pregnancy, at parturition and at Ist and 2nd month postpartum were taken from each animal. Serum was harvested by centrifugation at 3000 rpm for 10 minutes and stored frozen at -20°C until analysis (Nazifi and Sami, 1997).

Calcium, magnesium and iron were estimated by atomic absorption spectrophotometer (Varian A.A. 1475) according to Singh *et al.* (1998). The sodium and potassium were estimated by flame photometer (Jenway PFP 7 digital) according to Nazifi and Sami (1997). Phosphorus was measured by double beam spectrophotometer (Cecil CE 1021 Series 1000). The data was analyzed according to analysis of variance using LSD to know the significant difference at 5% probability level (Steel and Torrie, 1982).

RESULTS

The blood samples taken from 30 buffaloes at 8th and 9th month of pregnancy, at parturition and Ist and 2nd month postpartum were analyzed for calcium, phosphorus, magnesium, sodium, potassium and iron and the results are described below:

Calcium (Ca) Concentration

The highest mean concentration of calcium was observed in prepartum stage i.e., at 8th month of pregnancy, which was 9.30 ±0.12 mg/dl. On the other hand, the lowest mean value of calcium was observed at parturition, which was 6.90 ± 0.20 mg/dl (Table 1). Statistical analysis revealed a non-significant difference among means values of calcium at 8th and 9th month of pregnancy and Ist month after parturition. Whereas, the mean values of calcium at parturition and at 2nd month after parturition differ non significantly from each other but differ significantly (P<0.05) with other stages (Table 1).

Findings of the present study are in accordance with the observations of Jaskowski and Lachowski (1985) who reported low level of Ca during the final month of pregnancy in cows. Similarly, Ciani *et al.* (1994) showed that in buffaloes, plasma levels of Ca were minimum at parturition. Our findings are in close conformity with the observation of Nazifi and Sami (1997) who reported same pattern of Ca level from 7th months of pregnancy till the 2nd month following parturition. Our findings are also supported by the observations of Muller *et al.* (1983) who observed low level of Ca at parturition which started to increase after parturition. However, Larson *et al.* (1980) and Shukla *et al.* (1983) had slightly different observations than the present findings. They found an increasing trend in Ca concentration following parturition (8.24 mg/100ml at 14-21 days postpartum and 8.33 mg/100ml at 38-45 days postpartum). Whereas, in the present study the Ca value did rise significantly after 30 days following parturition (8.43 ± 0.17 mg/dl as compared to 6.90 ± 0.20 mg/dl at parturition) but after next 30 days (2nd month postpartum) again a decrease in Ca value was observed. However, this decreased value was significantly higher than Ca value at parturition.

Phosphorus (P) Concentration

The highest mean concentration of phosphorus was observed in prepartum stage i.e., at 8th month which was 6.98 ± 0.12 mg/dl. On the other hand, the lowest mean value of phosphorus was observed at parturition which was 3.77 ± 0.08 mg/dl (Table 1). Statistical analysis revealed non significant difference among means values of phosphorus at 9th month of pregnancy, at parturition and Ist month after parturition. However, the mean values of phosphorus at 8th month of pregnancy and 2nd month after parturition differ significantly (P<0.05) from each other and also from the mean values of phosphorus at 9th month of pregnancy, at parturition and Ist month after parturition (Table 1). Our findings are in close conformity with the observations of Husnain *et al.* (1981) who reported significantly higher phosphorus concentration in buffaloes 60 – 90 days postpartum. Similar observations were recorded by Jaskowski and Lachowski (1986) during the final months of pregnancy as in our study. Our findings are also well supported by the findings of Bari *et al.* (1996) who found lower phosphorus levels in cows with retained placenta. The findings of present study are in complete agreement with the findings of Nazifi and Sami (1997), however, they reported wider range (4.35 ± 0.20 to 7.37 ± 0.12 mg/dl) of serum phosphorus as compared to the serum phosphorus range in present study (3.77 ± 0.08 to 6.98 ± 0.12 mg/dl). Manju *et al.* (1985) reported much higher value of phosphorus (5.95 ± 0.20 mg/dl) at normal parturition in buffaloes.

Table 1: Mean ± S.E. Values Of Different Serum Electrolytes At Different Stages

Serum electrolytes	Prepartum		At parturition	Postpartum	
	8th month	9th month		Ist month	2nd month
Ca (mg/dl)	9.30^{b}±0.12	7.95^{b}±0.15	6.90^{c}± 0.20	8.43^{b}±0.17	7.33^{c}±0.16
P (mg/dl)	6.98^{a}±0.12	4.15^{c}±0.08	3.77^{c}±0.08	4.76^{c}±0.09	5.38^{b}±0.15
Mg (mg/dl)	2.38^{c}±0.10	2.18^{c}±0.10	2.81^{c}±0.07	2.61^{b}±0.07	2.50^{b}±0.07
Na (mmol/l)	147.14^{a}±2.62	145.71^{a}±2.58	146.50^{a}±2.68	141.37^{b}±2.55	137.69^{b}±2.44
K (mmol/l)	4.90^{a}±0.21	4.53^{b}±0.14	4.31^{b}±0.12	4.53^{b}±0.12	4.33^{b}±0.11
Fe (µg/dl)	269.36^{b}± 12.07	225.58^{c}± 9.23	212.82^{c}± 8.75	260.77^{b}± 8.60	282.31^{a}± 8.97

A, b, c any two means in a row carrying the same superscript are non significant from each other at 5% probability level using LSD test.

Magnesium (Mg) Concentration

The highest mean concentration of Mg was observed at parturition (2.81 ± 0.07 mg/dl) and the lowest mean value of Mg was observed at 9th month of pregnancy. Statistical analysis revealed a non significant difference between mean values of Mg at 8th and 9th month of pregnancy. Similarly, the mean values of Mg at 1st and 2nd month postpartum also differed non significantly from each other but differed significantly (P<0.05) with mean values in prepartum stage and at parturition (Table 1). Our findings are in accordance with the earlier observations of Zamet *et al.* (1979) who reported higher Mg concentration 24 hrs before calving and 30 days after calving. Larson *et al.* (1980) also reported normal range of Mg levels during postpartum periods. The findings of Riond *et al* (1995) and Bari *et al.* (1996) also favour the observations of present study. The findings of our study are congruent with the observations of Nazifi and Sami (1997). They observed the same trend in the level of Mg from 7th month of pregnancy till the 2nd month following parturition. However, they reported a wider range (2.40 ± 0.08 to 3.01 ± 0.10 mg/dl) of serum Mg as compared to the serum Mg range in present study (2.18 ± 0.10 to 2.81 ± 0.07 mg/dl).

Sodium (Na) Concentration

The highest mean concentration of Na was observed at 8th month of pregnancy (147.14±2.62 mmol/l) and the lowest mean value of sodium was observed at 2nd month after parturition (137.69 ±2.441 mmol/l) . Statistical analysis revealed a non significant difference among mean values of Na before parturition (at 8th and 9th month of pregnancy) and at parturition. However, significant (P<0.05) difference was observed among mean values of Na postpartum and mean values in the prepartum period and at parturition (Table 1). Our findings are fully in accordance with the findings of Nazifi and Sami (1997) and Small (1997) who reported non significant change in serum Na during final month of pregnancy, at parturition and in the postpartum period and the Na levels remained in normal range. A wider range (137.69 ± 2.44 to 147.14 ± 2.62 mmol/l) of serum Na was observed as compared to a range of 151.26 ± 0.98 to 152.67 ± 0.97 mmol/l (Nazifi and Sami, 1997). In contrast to our findings, Manju *et al.* (1985) reported quite low value (117.66 ± 0.61 mmol/l) of Na at normal parturition in buffaloes.

Potassium (K) Concentration

The highest mean concentration of K was observed at 8th month of pregnancy, which was 4.90 ±0.21 mmol/l. On the other hand, the lowest mean value of K was observed at parturition, which was 4.31 ±0.12 mmol/l (Table 1). Statistical analysis revealed a non significant difference among the mean values of K at various stages except 8th month of pregnancy, which differs significantly (P<0.05) from all other values.

The findings of present study are in agreement with the observation of Sen *et al.* (1989) and Mulei and Daniel (1990) who reported increased K concentration after calving. The findings of Nazifi and Sami (1997) also showed similar trend in the K values starting from 7th month of pregnancy till 2nd month following parturition. They also reported a similar range (4.72 ± 0.08 to 4.81 ± 0.07 mmol/l) of serum K as in our study i.e., 4.31 ± 0.12 mmol/l to 4.90 ± 0.21 mmol/l of serum. In contrast to our findings, Manju *et al.* (1985) reported quite low value (2.60 ± 0.02 mmol/l) of K at normal parturition in buffaloes.

Iron (Fe) Concentration

The highest mean concentration of Fe was observed at 2nd month postpartum, which was 282.31 ± 8.97µg/dl. On the other hand, the lowest mean value of Fe was observed at parturition, which was 212.82 ± 8.75µg/dl (Table 1). Statistical analysis revealed a non significant difference between mean values of Fe at 9th month of pregnancy and at parturition. Similarly, the mean values of Fe differ non significantly at 8th month of pregnancy and 1st month after parturition. However, the mean value of Fe differ significantly (P<0.05) between 8th and 9th month of pregnancy and Ist and 2nd months postpartum (Table 1). The findings of present study are in accordance with the observations of Zhang et *al.* (1992), Selia *et al.* (1994) and Nazifi and Sami (1997). They reported same trend in the Fe values. The Fe concentration start decreasing towards the parturition and then again start rising following parturition. However, in this study much wider range (212.82 ± 8.75 to 282.31 ± 8.97 µg/dl) of serum Fe was observed as compared to Nazifi and Sami (1997) who found a range of 151.85 ± 3.36 to 209.76 ± 4.20 µg/dl.

The lowest concentration of Ca and P (Table 1) has been observed at parturition time. It has been attributed by an inadequate response of the parathyroid gland to the substantial demands for Ca imposed by the mineralization of fetal bones and the initiation of lactation (Kaneko, 1989). Moreover, a large amount of maternal P is transferred to fetus during pregnancy and secreted in milk during lactation (Husnain *et al.*, 1981).

Unlike Ca and P, Mg concentration was increased during parturition time (Table 1). Serum Mg may increase reciprocally as calcium declines (Kaneko, 1989). Singh *et al.* (1995) reported that in buffalo, the

concentration of Mg increased, preceded by a continuous decline in early, mid and late pregnancy.

No significant change was observed in serum Na at 2 months prepartum and at parturition. Similarly no significant change was observed in serum K at one month prepartum, at parturition and at 2 months postpartum. (Table 1). Murtaza *et al.* (1979) reported non significant difference in serum Na of late pregnant and early lactating cows. Gibasiewiez (1985) also reported that the concentration of serum K in recently calved cows was normal and was not different from that of healthy non pregnant cows.

Serum iron concentration was also the lowest during parturition (Table 1). This probably is due to increase demand of fetus for this stage of development (Pathak and Janakiraman, 1989).

Infact, problem of mineral deficiency is a complex one and while concluding, it is important that feed mineral contents and blood profiles should be correlated. Moreover, inter relationship of minerals and their proper ratio with one another also should be given due attention. Concentration in blood serum alone may not assess adequately the status of the animal. Perhaps the ratio of the blood components is as critical as concentration. Another possibility is that there is an optimal concentration for each blood component and that above or below this concentration would be detrimental.

The concentration of the blood constituents in the present study was within the normal range, as no puerperal disorder was observed. However, in the present study we observed much wider range of serum electrolytes than the other workers. This difference may be attributed to the dietary condition of the animals in this study and concentration of certain elements in the soil. Moreover, the species difference can not be ruled out. It can be concluded from the results that the most important changes in serum electrolytes observed are at parturition. Prevention of these changes, mainly by dietary means, can reduce the incidence of clinical and sub clinical periparturient diseases.

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