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Effect of mineral feed supplement on serum calcium, magnesium and phosphorus profile during pre and post-parturient period

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Abstract
The present investigation was carried out on 36 Crossbred cows from Research Cum Development Project cattle farm, Mahatma Phule Krishi Vidyapeeth, Rahuri and Dept. of Animal Reproduction, Gynaecology and Obstetrics, K.N.P. college of Veterinary Science, Shirwal, Maharashtra. Group I (n= 12, Treatment Group I), Group II (n= 12, Treatment Group II) and Group III (n=12, Control Group). Group I were given orally 50 gm of mineral + vitamin feed supplement 20 days before and 40 days after parturition. Group II were given orally 50 gm of mineral + vitamin feed supplement 20 days before and 40 days after parturition and 100 gm of vitamin supplement 10 days prior to calving. All 3 groups included those animals which were advance pregnant (8 month).

The serum calcium (mg/dl) level before 20 days of parturition, at the time of parturition and after 40 days of parturition were (10.65+0.11, 9.68±0.15, 10.92±0.14), (10.74±0.01, 10.51±0.12, 10.71±0.15), and (11.08+0.01, 11.48±0.16, 10.41±0.1) from Group-I, Group-II and control group, respectively.

The serum magnesium (mg/dl) levels before 20 days of parturition, at the time of parturition and after 40 days of parturition were (2.26±0.09, 2.15±0.32, 2.24±0.11), (2.84±0.02, 2.81±0.04, 2.73±0.04) and (2.70±0.05, 2.46±0.05, 2.38±0.04) from Group-I, Group-II and control group, respectively.

The serum phosphorus (mg/dl) levels before 20 days, at the time of parturition and after 20 days of parturition were (5.60+0.08, 5.47+0.10, 5.60±0.08), (5.78+0.15, 5.86±0.14, 5.72±0.014) and (6.02+0.07, 6.22+0.06, 5.83± 0.13) from group-I, group-II and control group respectively.

The results revealed that serum calcium levels were increased after 40 days of parturition than previous values in both Treatment groups, but in Treatment group II it was higher than Treatment group I. While in Control group serum calcium levels were decreased after 40 days of parturition.

Keywords: Transition cow, postpartum fertility, mineral estimation

Introduction
Transition period is a crucial stage in the production cycle of a dairy cow; no other period can affect subsequent production health and reproduction performance so greatly. The success of transition period effectively determines the profitability of cow during that lactation. Nutritional or managemental limitations during this time may impede the ability of a cow to reach a maximum milk production abnormalities of blood level of four micro elements calcium, phosphorus, magnesium, potassium in the cow during transitional period are involved in the subclinical hypoplasia, clinical milk fever, hypomagnesaemia and acute hypocalcaemia. The factors responsible for the calving interval are the normal process of parturition, involution of uterus, appearance and recurrence of postpartum estrus and service period. Parturition, involution of uterus, manifestation and detection of post-partum estrus are thus basic problems vitally linked with milk production. These are the essential pre-requisite for manifestation of normal breeding efficiency and optimum lactation performance in dairy cows. To maintain a calving interval of 13–14 months in cattle, successful breeding must take place within 85–115 days after calving. Disturbances during this period due to delay of uterine involution or resumption of estrus activity are likely to prolong the calving interval and reduce the lifetime reproductive and productive efficiency (El-Wishy, 2006) [1]. Thus, the future fertility of the postpartum cattle depends upon the rate of uterine involution and resumption of ovarian cyclicity. To produce a calf every year a cow has to become pregnant within 75 to 85 days after calving. Therefore, postpartum anestrus has to be shorter than 54 days for the cow to have at least two chances to breed within 85 days post-partum. For early exhibition of first

postpartum estrus the involution of post-partum uterus has to be completed as early as possible. In dairy cows a transient period of hypocalcaemia regularly develops at the onset of lactation. This hypocalcaemia is caused by an imbalance between Calcium output in colostrum and influx of Ca to the extracellular pool from gut and bone. Hypocalcaemia develops in spite of apparently normal function of parathyroid, Vit. D and endocrine system and leads to Paresis in 5 to 20% of cows in many highly selected dairy breeds. The endocrine adjustments triggered by this hypocalcaemia are thought to secure a sufficient inflow of calcium to the extracellular pool from gut and allow for the maintenance of plasma calcium within narrow range throughout the early part of lactation. First lactation animals had greater levels of glucose, Ca, and P post calving than all other lactations; while third lactation and greater cows had higher BHBA levels than second lactation animals and also had the lowest levels of Ca in the week postpartum. (Kevin Lager, M.S. and Ellen J., 2012) [2]. Calcium and phosphorus directly or indirectly related to reproduction in cows. Several workers had observed impaired fertility with an increase in level of blood calcium and deficiency of same had retarded reproduction in cows. Even marginal deficiency of Phosphorus is considered sufficient to impaired the pituitary ovarian axis, without manifesting clinical systemic symptom and deficiency.

Materials and Methods

Selection of crossbred cattle was based on the records available on the farm and Gynaeco-clinical examinations of all pregnant Crossbred cattle were carried out for the confirmation of advance pregnancy (8 months). The crossbred cattle in advance pregnant phase were selected for the present studies. A total of 36 animals were selected randomly irrespective of their age and parity. The selected crossbred cattle have good pedigree records.

The 36 cows were divided into three groups. Group I (n= 12, Treatment Group I), Group II (n= 12, Treatment Group II) and Group III (n=12, Control Group). Group I were given orally 50 gm of mineral + vitamin feed supplement 20 days before and 40 days after parturition. Group II were given orally 50 gm of mineral + vitamin feed supplement 20 days before and 40 days after parturition and 100 gm of vitamin supplement 10 days prior to calving. All 3 groups included those animals which were advance pregnant (8 month).

For haemoglobin estimation blood samples were collected from all three groups before 20 days of parturition and after 40 days of parturition. LAB Life Noble-III automated hematology analyzer (DIRGNOUR). Blood glucose was analyzed from all three groups before 20 days, at the time and after 40 days of parturition. ACUCHEK was used to estimate the blood glucose.

Estimation of serum calcium, magnesium and phosphorus were done by using auto analyzer SEAC radium group Star 21. Reagents were supplied by Pathozyme diagnostics for calcium, magnesium and by Coral Clinical System for Phosphorus.

Results and Discussion

The hypocalcemia at the calving is also age related at their 3rd to 7 th parturition. It is infrequent at 1st parturition. A transition period of subclinical hypocalcaemia occurs at onset of lactation caused by imbalance between calcium output in the colostrum and influx of calcium to the extra cellular pool from intestine from bone. The onset of lactation results in sudden large demand of calcium haemostasis. The episodes of subclinical hypocalcaemia occur in up to 50% of adult cows during 1st few weeks of lactation.

The serum calcium (mg/dl) level before 20 days of parturition, at the time of parturition and after 40 days of parturition were (10.65+0.11, 9.68±0.15, 10.92±0.14), (10.74±0.01, 10.51±0.12, 10.71±0.15), and (11.08+0.01, 11.48±0.16, 10.41±0.1) from Group-I, Group-II and control group, respectively. In the present investigation, it was found that serum calcium levels have increased after 40 days of parturition than previous value in both treatment groups of cows. But in Treatment group - II it was higher than Treatment group – I. Serum calcium level is decrease at 40 days of parturition in control group than the previous values. Control group shown less serum calcium level than Treatment group I and Treatment group II.

Table 1: Mean serum calcium levels (mg/dl)

Group	T1	T2	T0
20 days before	10.6±0.1	9.6±0.1	10.9±0.1
At the time	10.7±0.0	10.5±0.1	10.7±0.1
40 days after	11.0±0.0	11.4±0.1	10.4±0.1

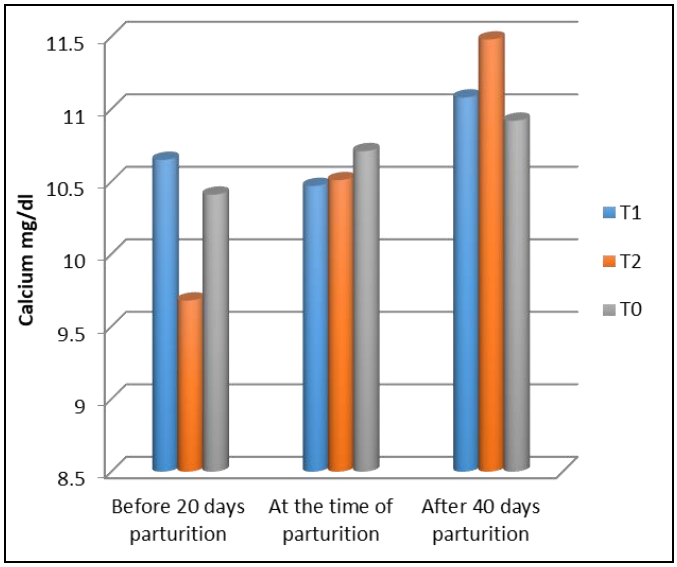

Fig 1: Serum Calcium level in transition crossbred cows

Increased in serum calcium level during postpartum period has also been reported by Rowlands *et al*. (1975) [3] and Shrikhande *et al*. (1999) [4] which is in accordance with the present results as presented in table no 1. Post-parturient hypocalcaemia was related to sudden demand for calcium to synthesize colostrums and recorded significant ($P<0.01$) rise in serum calcium level after seven days of parturition, (Nale, 2003) [5]. Kirchner *et al*. (1977) [6] also reported decreased value of calcium and phosphorus after parturition and calcium values resumed towards normalcy after seven days of parturition. Similar results obtained by Mohanty *et al*. (1994) [7] who reported lower calcium level in cows with retained placenta than in non-retaining cases.

Table 2: Mean serum magnesium levels (mg/dl)

Group	T1	T2	T0
20 days before	2.2±0.0	2.1±0.3	2.2±0.1
At the time	2.8±0.0	2.8±0.0	2.7±0.0
40 days after	2.7±0.0	2.4±0.0	2.3±0.0

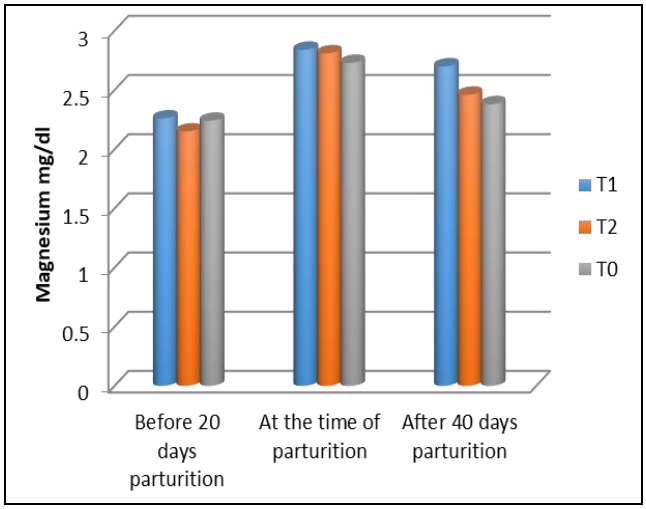

Fig 2: Serum Magnesium level in transition crossbred cows

The serum magnesium (mg/dl) levels before 20 days of parturition, at the time of parturition and after 40 days of parturition were (2.26±0.09, 2.15±0.32, 2.24±0.11), (2.84±0.02, 2.81±0.04, 2.73±0.04) and (2.70±0.05, 2.46±0.05, 2.38±0.04) from Group-I, Group-II and control group, respectively. These results are statistically highly significant at $P<0.05$ level. Present observations are in accordance with earlier observations of Zamet *et al.* (1979) [8], and Hussain *et al.* (2001) who reported higher concentration of magnesium 24 hours before parturition and 30 days after parturition. Larson *et al.* (1980) [9], also reported normal range of magnesium levels during postpartum periods [10]. The findings of the study are congruent with the observations reported by Nazifi and Sami (1997) [11], and observed the same trend in magnesium levels from 7 month of pregnancy till 2 months following parturition.

Table 3: Mean serum phosphorus levels (mg/dl)

Group	T1	T2	T0
20 days before	5.6±0.0	5.4±0.1	5.6±0.0
At the time	5.7±0.1	5.8±0.1	5.7±0.0
40 days after	6.0±0.0	6.2±0.6	5.8±0.1

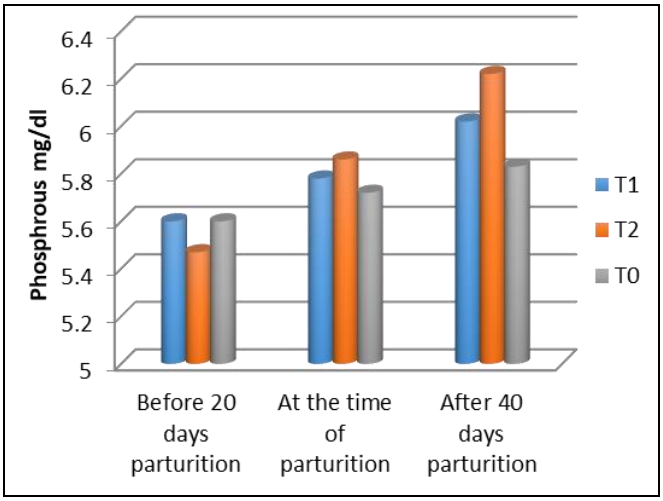

Fig 3: Serum Phosphorus level in transition crossbred cows.

The serum phosphorus (mg/dl) levels before 20 days, at the time of parturition and after 20 days of parturition were (5.60+0.08, 5.47+0.10, 5.60±0.08), (5.78+0.15, 5.86±0.14, 5.72±0.014) and (6.02+0.07, 6.22+0.06, 5.83± 0.13) from group-I, group-II and control group respectively. These results are statistically highly significant at ($P<0.05$) level.

In the present investigation, it was found that serum phosphorus levels were increases after 40 days of parturition than previous value in the Treatment group I, Treatment group II and Control group of cows but in group-II it was higher than group-I and Control group. Similar results were obtained by, Shrikande *et al.* (1989) [4] and Nale (2003) [5] who reported maternal phosphorus declined about the time of birth and remained depressed for the next 7-8 days. Bari *et al.* (1996) [12] reported mean serum calcium and phosphorus in cows with retention of placenta were lower as compared to cows with non-retention.

The variation of present finding with those reported by various authors may be due to different feeding practices, post-partum period, age and breed of cows.

In the present investigation it was observed that serum calcium levels were increased after 40 days of parturition than previous values in both Treatment groups, but in Treatment group II it was higher than Treatment group I. While in Control group serum calcium levels were decreased after 40 days of parturition.

Conclusion

Beneficial effect of mineral and vitamin supplement feeding was observed on blood Hb content of treatment groups (T1 & T2) as compared to control group. Peak blood glucose level was observed at the time of parturition in all three groups as compared to 20 days prepartum and 40 days postpartum.

Maintenance of Ca, Mg, & P levels in transition period through mineral and vitamin supplementation is useful in postpartum fertility management.

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