ABSTRACT

Two groups of 15 Murrah buffaloes each, expected to calve in winter and summer season were selected for monitoring during peripartum period to have an overview of the herd micro-mineral status. There was significant difference in plasma concentration of the Zn on day 30 prepartum, calving day and day 60 postpartum (P<0.05); Cu on day 60 prepartum (P<0.05) and Mn at all the stages (P<0.01). The summer season calvers had higher levels at all the stages. After evaluating the herd status, it was clear that buffaloes were either deficient or had imbalance in nutrients in winter season calvers resulting into wide variation in reproductive performance. Herd status regarding mineral status need to be evaluated from time to time in different seasons to achieve set targets in terms of reproduction and production performance by adjusting feeding schedule.

Keywords: Murrah buffalo, Zn, Cu, Mn, season

INTRODUCTION

Micro minerals are critical functional components of various enzymatic systems and important for good health and requirements vary with the physiological status of the animal (Borghese, 2005). In buffaloes minimum but long-term deficiencies during dry period have been known to cause impaired health during lactation (Campanile et al., 1997). Mineral status of animals is a direct reflection of their presence, absence, deficiency or excess in soil and fodder. Under tropical Indian conditions, mineral deficiency problems have been recognized to be very common causing production and reproduction problems unless proper dietary supplementations are provided to save economic losses (Sharma et al., 2003). The Cu and Zn deficiencies have been incriminated for loss of production and reproduction, irregular cycles, cycle extension, subestrus, difficult delivery, retained placenta, abortions, estrus prevention, congenital abnormalities/disorders, repeat breeding and early embryonic deaths (McDowell, 1992; Balakrishnan and Balagopal, 1994; Dutta et al., 2001; Sharma et al., 2005; Prajapati et al., 2005). The normal blood values of Mn in cattle have been established to be 18-19 μg/dl (Sharma et al., 2005). Mn deficiencies have been found to suppress conception rates, delay estrus, cause abortions, deformed calves at birth and increase occurrence of cystic ovaries.
A lower level of manganese and copper has been reported in anestrus buffaloes when compared with those exhibiting estrus (Patil and Deshpande, 1979; Naidu and Rao, 1982; Agarwal et al., 1985; Singh and Vadnere, 1987). Thus such disorders could probably be prevented by addressing to the basic etiology through balanced feeding and mineral supplementation during advanced pregnancy and early post-partum period, when the animals are highly prone to stress of heavy nutrient demand and drain (Mandali et al., 2002). Satisfactory conception rates have been attributed to combined effect of mineral and vitamin supplementation because of their positive effect on steroid synthesis, release, follicular growth and symptoms of ovulatory oestrus (Srivastava, 2008). During different seasons availability of feed and fodder changes thereby changing the availability of certain nutrients which may have direct or indirect effect on productive and reproductive performance of the buffaloes. Therefore envisages evaluation of herd status in terms of micro-mineral profiling of buffaloes during peripartum from time to time for further decisions for improving the herd performance.

**MATERIALS AND METHODS**

The present study was conducted on 30 pregnant dry Murrah buffaloes maintained at Cattle Yard of National Dairy Research Institute (NDRI), Karnal and divided into 15 animals each as per expected day of calving in winter (January to March) and summer (April to July) season. The herd was kept under loose housing and group management system following standard managemental practices. The nutrient requirements of all the animals were mostly met through limited concentrates (1.5 kg per day for body maintenance) and *ad libitum* green fodder (berseem, oat, mustard and maize). All the experimental buffaloes were monitored regularly for estrus by visual observation and by parading of vasectomized bull in morning and evening hours. Animal were confirmed for heat by rectal palpation and inseminated with frozen semen by two inseminations at 12 h intervals. Buffaloes not returning to estrus after 21 days of insemination were examined per rectum on 45th day for pregnancy confirmation.

**Plasma Biochemical Assay**

The blood samples were collected from jugular vein into heparinized (20 IU heparin/ml blood) tubes from all experimental animals at fortnightly interval from 60 days prepartum to 60 days postpartum. Immediately after sampling the blood was centrifuged at 3000 rpm for 15 to 20 minutes and the plasma was separated and stored frozen (-20°C) until analyzed. Following micronutrients in control as well as in experimental groups were estimated with the help of Atomic absorption Spectrophotometer (Model PU9100X Atomic absorption Spectrophotometer, Philips). The procedure described in AAS (1988) manual for preparation of stock and standard solutions and choice of instrumental conditions were followed. Effect of season of calving on micro-mineral status was calculated by t test, using Systat 6 software package.

**RESULTS AND DISCUSSION**

In the present investigation 15 buffaloes each expected to calve in winter and summer season were randomly selected during prepartum period to have an overview of micro-mineral status of the
herd. Mineral status of plasma is a direct reflection of their presence, absence, deficiency or excess in soil and fodder. Under tropical Indian conditions mineral deficiency and imbalance problems have been recognized to be very common causing production and reproduction problems unless proper dietary supplemnetations are provided. Correction of deficiencies and imbalance by balanced mineral supplementation has been shown to produce a marked response saving huge economic losses due to production and reproduction losses (Sharma et al., 2003).

Plasma Zn, Cu and Mn were estimated at monthly interval in both the groups. The results obtained are presented in the Table 1 for interpretation from 60 days prepartum to 60 days postpartum taking 0 day as the day of calving.

**Plasma Zn**

Plasma Zn concentration was lowest on the day of calving in winter season. The Zn concentration dropped on day 30 prepartum and day of calving and showed an increasing trend thereafter in winter season, whereas it showed an increasing trend at day 30 prepartum and then decreased upto day 30 postpartum in summer season. There was significant difference in plasma concentration of the Zn on day 30 prepartum, calving day and day 60 postpartum (P<0.05). The differences in concentration at all other stages was non significant but summer season had higher levels than the winter season at all the stages reflecting better availability of fodders having sufficient nutrients required for optimum performance.

Decrease in plasma Zn concentration in buffaloes during late gestation and parturition has also been reported by House and Bell (1993) and Panda (2003). Zn accretion rate in the conceptus in late pregnancy is 11.7 mg/day which may be reason for lower level of Zn before parturition. Zn deficiency has been incriminated for impaired reproductive performance, decreased fertility and abnormal estrus in cows and decreases cell mediated immunity (Sharma et al., 2005). Zinc is a critical nutrient of immunity, being involved in so many immune mechanisms including cell-mediated and antibody-mediated immunity, thymus gland function and thymus hormone action. When zinc levels are low, the number of T cells is reduced and many white blood functions critical to the immune

<table>
<thead>
<tr>
<th>Micro Mineral</th>
<th>Season</th>
<th>Prepartum</th>
<th>Postpartum</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>-60d</td>
<td>-30d</td>
</tr>
<tr>
<td>Zn†</td>
<td>Winter</td>
<td>1.46±0.27</td>
<td>1.13±0.17*</td>
</tr>
<tr>
<td></td>
<td>Summer</td>
<td>1.88±0.29</td>
<td>2.01±0.36*</td>
</tr>
<tr>
<td>Mn†</td>
<td>Winter</td>
<td>0.26±0.04**</td>
<td>0.25±0.03**</td>
</tr>
<tr>
<td></td>
<td>Summer</td>
<td>0.60±0.05**</td>
<td>0.45±0.05**</td>
</tr>
<tr>
<td>Cu†</td>
<td>Winter</td>
<td>0.90±0.10*</td>
<td>0.809±0.072</td>
</tr>
<tr>
<td></td>
<td>Summer</td>
<td>1.45±0.18*</td>
<td>1.006±0.224</td>
</tr>
</tbody>
</table>

† – ppm; * - Significant (P<0.05); ** - Significant (P<0.01)
response are severely lacking. Like vitamin C, zinc also possesses direct antiviral activity, including activity against several viruses. It is also present in members of a class of proteins called the metallothioneins that are believed to provide antioxidant protection by scavenging free radicals (Borghese, 2005).

**Plasma Cu**

Plasma Cu levels followed a particular trend in both the groups. It started declining upto calving and thereafter there was an increase in its concentration. The extent of decrease in Cu concentration at parturition was more in comparison to other minerals due to more accretion rate of Cu in the conceptus (House and Bell, 1993). There was significant statistical difference in plasma concentration of the Cu on day 60 prepartum (P<0.05), however, the differences in concentration at all other stages was non significant but summer season had higher levels than the winter season at all the stages reflecting better availability of fodders having sufficient nutrients required for optimum performance.

Panda (2003) also found the similar trend in Cu concentration but reported higher levels than the present findings. Cu deficiency has been incriminated for poor performance, reduced fertility in animals attributed to poor conception rates, anoestrus and foetal resorption. It has also been associated with impaired immune response and failure to respond to treatment (Sharma et al., 2005). The Cu and Zn deficiencies have been incriminated for loss of production and reproduction, irregular cycles, cycle extension, subestru, difficult delivery, retained placenta, abortions, estrus prevention, congenital abnormalities/disorders and early embryonic deaths (McDowell, 1992; Dutta et al., 2001) and repeat breeding (Dhami et al., 2003).

**Plasma Mn**

Plasma Mn levels followed a decreasing trend upto parturition and followed increasing trend following parturition in both seasons. The drop in the Mn concentration during prepartum due to increasing demands of growing fetus (House and Bell, 1993) and utilization for improving antioxidant status. There was highly significant difference (P<0.01) in plasma concentration of the Mn at all the stages and summer season had higher levels than the winter season at all the stages reflecting better availability of feeds and fodders having sufficient nutrients required for optimum performance. This is in agreement with the findings of Panda (2003), who has reported similar trend in Mn concentration but reported higher levels than the present findings. Mn deficiency has been found to suppress conception rates, delay estrus, cause abortions, deformed calves at birth and increase occurrence of cystic ovaries (Sharma et al., 2005).

The deficiency or imbalance of critical factors has either immediate effects on health, productive and reproductive processes or the effects may be covert and recognized after a prolonged period. The effects depend on the nature of the factor, extent of deficiency or imbalance, duration and physiological status of the animal. In buffaloes minimum but long-term deficiencies during dry period have been known to cause impaired health during following lactation (Campanile et al., 1997). Various workers have revealed a direct correlation of mineral status of the animals with their physiological status and observed disorders and incriminated altered levels of minerals and enzymes for loss of production and reproduction (Patil and Deshpande, 1979; Naidu and Rao, 1982; Agarwal et al., 1985; Singh and Vadnere, 1987). Inactive ovaries, anestrus and poor conception rates have been recognized as the most common
expressions consequent upon the deficiency of Cu, Zn and Mn (Khasatiya et al., 2005). Also, imbalance between minerals has been incriminated as a possible cause for repeat breeding (Balakrishnan and Balagopal, 1994; Prajapati et al., 2005; Kalita and Sarmah, 2006). Requirements that are based on measures of immune function have been reported to be higher than those that are based on production or reproduction (Weiss, 1998). The amount of minerals required for optimal immune function may exceed that amount which will prevent more classical deficiency signs.

CONCLUSION

There was significant difference in plasma concentration of the Zn on day 30 prepartum, calving day and day 60 postpartum (P<0.05); Cu on day 60 prepartum (P<0.05) and Mn at all the stages (P<0.01). The summer season calvers had higher levels at all the stages.

REFERENCES


Dairy Research Institute, Karnal, India.


