SEASONAL VARIATIONS IN MICRO MINERAL PROFILE OF LACTATING KANKREJ COWS (*BOS INDICUS*)

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ABSTRACT

Present study reports seasonal variation in concentrations of copper (Cu), zinc (Zn), iron (Fe) and manganese (Mn) in different production groups of lactating Kankrej cows. The concentrations of Cu was significantly higher ($p<0.05$) in all the groups during summer season; while, Zn concentration was found to be significantly higher in winter as compared to rainy and summer seasons. Similarly, Fe concentrations in all the production groups were apparently lower in summer as compared to rainy and winter seasons. However, there was no definite pattern of variation in serum Mn concentration amongst the experimental groups. A comprehensive study is warranted on this aspect to evolve the correlations between blood concentrations of these microelements and productive performance of the breed.

KEYWORDS: Kankrej, Lactating, Seasons, Serum, Micro mineral

INTRODUCTION

Micro minerals (trace minerals) are essential for life. Body immunity and reproductive activities have direct relationship with micro mineral status of animals (Prasad and Gowda, 2005). They activate several enzymes responsible for various physiological functions and some are integral component of hormones and vitamins. Deficiency of these minerals impairs productivity in livestock (Shahjalal et al., 2008). However, the requirement of such minerals for livestock is dependent on level of production, physiological status and feeding system. Diets and feedstuffs deficient of these leads to deleterious effects on both productive and reproductive performances; hence, the mineral status of animals should be considered for formulation of final ration for the dairy animals (Smith and Akinbamijo, 2000). Further, assessment of micro element status of animal gives an idea whether the supplemented mineral mixture is adequate or changes in their supplementation is required to improved the productivity. Accordingly, the present study was undertaken to determine the serum level of some important micro minerals in different production groups of lactating Kankrej cows (*Bos indicus*) during different seasons of the year.

MATERIALS AND METHODS

The present study was carried out in eighteen (18) healthy lactating Kankrej cows raised at Livestock Research Station (LRS), Sardarkrushinagar, Gujarat with a minimum of four (4) lactations during the period of March, 2012 to February, 2013. The experimental animals were divided into three groups of six animals each based on consistent milk yield records in their earlier lactations: viz. group-I (low yielder), group-II (medium yielder) and group-III (high yielder).

Ten ml of blood sample was obtained in sterilized glass tubes from each animal of the experimental groups by jugular vein puncture between 8 AM to10 AM during three seasons of the year and kept

in slanting position for 45 min, followed by centrifugation at 700xg for 15 min to separate the serum. The serum samples were then frozen at -20°C till analysed.

The micro minerals viz. copper (Cu), iron (Fe), manganese (Mn) and zinc (Zn) were estimated employing atomic absorption spectrophotometer (Model AAS-4141, ECIL-INDIA). Data obtained were statically analyzed as per procedure described by Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

The main objective of this study was to investigate the possible effects of seasons and milk yield on the serum levels of some important micro minerals in Kankrej cows. To date, no reliable values of these minerals are available in veterinary literature except a few reports on the effect of physiological variations on serum chemistry. Mean ±SE values of the estimated micro mineral concentrations of the experimental groups during different seasons have been presented in Table-1.

It was observed that Cu concentrations were significantly higher in all the groups during summer season. Ogwang (1988) also recorded similar trend of variation. Copper is one of the major antioxidant arsenals involved in antioxidant mechanism via its involvement in the enzyme Cu-Zn superoxide dismutase (SOD) and ceruloplasmin (Spears and Weiss, 2008), and plays a significant role in protecting cellular constituents from oxidative assaults. The summer hike of Cu may be attributed to greater assimilation of Cu to counteract oxidative stress occurring during summer. It is reported that dairy animals are more prone to oxidative damage during summer due to heat stress (Ganaie et al., 2013). However, contrary to the current observation, Noaman et al. (2012) recorded significantly higher serum concentration of Cu during winter than summer. Erdogan *et al.* (2004) observed that serum Cu levels were not seasonally altered in cattle. The contradicting results obtained on this aspect may probably due to differences in breed, their origin and regional feeding practices (Yokus and Cakir, 2006).

Conversely, the Zn concentration was found to be significantly higher in winter as compared to rainy and summer seasons. This finding corroborates the observation of Noaman et al. (2012). Similarly, Garcia et al. (2000) also observed seasonal alteration of Zn concentration in case of human beings. Nonetheless, Yokus and Cakir (2006) found no effects of seasonal variation on serum Zn concentration of crossbred cows. In fact, Zn is an essential component of numerous enzymes including those involved in the synthesis of DNA and RNA. It may affect immunity via its important role in cell replication and proliferation (Weiss and Spears, 2006). Moreover, since Zn and Cu compete for the same binding sites on enzymes and metallo-proteins, it may be reasonable to speculate that these minerals are antagonistic to some degree (Hatfield et al., 2001). In addition to seasons, physiological status of the

Table 1 : Serum micro mineral profile of the experimental groups during the three seasons

Parameters (ppm)	Group-III			Group-I			Group-II		
	Rainy season	Winter season	Summer season	Rainy season	Winter season	Summer season	Rainy season	Winter season	Summer season
Cu	1.76 ± 0.31^{a}	2.51 ± 0.37^{a}	4.89±0.29^{b}	1.79 ± 0.26^{a}	2.56 ± 0.45^{a}	4.12±0.34^{b}	2.07 ± 0.55^{a}	2.12 ± 0.46^{a}	4.56±0.21^{b}
Zn	1.39 ± 12.15^{a}	2.53 ± 12.38^{b}	1.59± 12.38^{a}	1.43 ± 13.96^{a}	2.41 ±11.76^{b}	1.42 ±12.76^{a}	1.32 ± 13.68^{a}	2.59 ±12.49^{b}	1.51±12.49^{a}
Fe	1.98 ±0.28^{a}	1.81±13.78^{a}	1.12±0.21^{a}	1.85±23.33^{a}	1.81±18.75^{a}	1.25±0.21^{a}	1.91 ± 43.12^{a}	1.98 ± 10.12^{a}	1.15±0.18^{a}
Mn	0.62 ± 0.17^{a}	0.48 ± 0.12^{a}	0.22 ± 0.11^{a}	0.57 ± 0.15^{a}	0.43 ±0.13^{a}	0.34 ± 0.12^{a}	0.53 ± 0.14^{a}	0.45 ± 0.11^{a}	0.30 ± 0.10^{a}

Mean ± S. E. bearing similar superscripts are non-significant at 0.05 % level of probability

animals is also seemed to have a significant effect on serum Zn levels (Khan et al., 2007). Signs of Zn deficiency are non-specific. Therefore, a mixture containing Zn should be continually supplemented to dairy animals particularly during summer, when forage Zn contents are on borderline levels (Khan et al., 2005).

Table-1 further revealed that Fe concentrations in all the production groups were apparently lower in summer as compared to rainy and winter seasons. Similarly, Bhardwaj et al. (2008) also observed that plasma iron concentrations were highest during Sep-Oct and Nov-Dec (i.e. winter season) and lowest during May-June (i.e. summer season) in crossbred cattle. The lower value of Fe recorded during summer may be attributed to the high environmental temperatures and humidity of the region of the present study, since such environment is conducive for tick proliferation and their survival (Bhardwaj et al., 2008). High densities of external parasites can cause blood loss and subsequently, reduce iron concentration (Marufu et al., 2010). Moreover, it is reported that high level of copper may lead to lower absorption of Fe and vice versa, since both the cations compete for absorption and transport of the same proteins (Perucchietti and Litjens, 2010).

However, there was no definite pattern of serum Mn concentration in all the groups and varied within a limited range amongst different seasons. Manganese plays an important role in health and productivity of farm animals through their functions as a main component of many essential mettalo-enzymes. These enzymes regulate the metabolism of carbohydrate and lipids, and also functions as antioxidants (Tomlinson et al., 2004). Though there is no similar study for comparison of our findings, it is observed that seasons affect the availability of Mn to plants and animals, and its solubility increases during the rainy season (Khan et al., 2004). The apparent decrease in Mn level during summer may be ascribed to low Mn content of forages during the season (Khan et al., 2004). It is to be noted that the Mn content of forages is generally higher than the dietary requirements of animals; Mn deficiency in grazing animals is, therefore, a rare occurrence (Udiba et al., 2014). Nonetheless, in view of importance of Mn for livestock, the analysis of dietary components as well as animal fluid is important for obtaining Mn status of an area before providing Mn containing supplements to grazing animals.

It may be concluded that seasons and milk yield do alter the micro-mineral profile of lactating Kankrej cows. Therefore, such variation must be taken into consideration before supplementation of cattle with mineral mixture for proper maintenance of health and optimization of productive performance.

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