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Assessment of seasonal changes in magnesium in soil, feed fodder and serum of livestock from Sangli district of Maharashtra

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Abstract

This study was undertaken to assess the Magnesium content of soil, feed, fodder and serum in Sangli district of Maharashtra, during different seasons of the year. Atomic absorption spectrophotometry (AAS) was used to evaluation the mineral contents of samples. Overall mean levels of Mg in soil and serum sample were above the critical value whereas in feed, and fodder samples from all the tehsils were lower the critical value. In all tehsil the overall average values of soil magnesium reliable of highest value in rainy followed by winter and then by summer except for tehsil Jat in which highest value in rainy followed by summer and then by winter with a significant difference between summer and winter as well as winter and rainy without significant difference between summer and rainy. However, for Tasgaon and Palus Tahsil the values of the three seasons differ significantly among the seasons. The Percent Deficient Samples (PDS) for Mg in soil, feed and fodder were nil and in serum samples were 0.79%. However, the PDS for Mg in serum was observed (2.38%) only in Jat tehsil. In conclusion, it is necessary to supplement these minerals in ration by formulating area specific mineral mixture in order to sustain normal levels and maximize production of cattle.

Keywords: Magnesium, cattle, mineral, Sangli

Introduction

India has 18 percent of the world bovine population and the leading with respects to milk production. But individual animal milk productivity has been mentioned to be low which clouding be due to malnourishment and mineral deficiency^[1]. The average content of Mg in the body of most animals is ~0.4 g Mg per kilogram of body weight^[2]. Supplementary magnesium may reduce stress, and subsequent harmful and aggressive behaviors, that occur during stressful events, such as recovering^[3,4].

A large quantity of Indian livestock suffers from deficiency or imbalances in minerals because they are mainly maintained on crop residue-based rations and grazing deprived of access to mineral supplement^[5,6]. Deficiency of single or multiple minerals results in enzymatic dysfunction and hormonal imbalance related with fertility of animals^[7]. Usually, these animals do not receive mineral mixture supplementation in their basal diet^[8]. Minerals are crucial for animal fitness and manufacturing the production^[6]. Additionally, minerals play great position in number of digestives, physiological and biosynthetic approaches of animal body^[9,10]. mineral deficiencies can end result in suboptimal presentation and reproductive inefficiencies^[9]. The mineral magnesium is the second most abundant intracellular cation, even though, as with calcium, the majority of the magnesium in the body is bound in the bones. Intracellular magnesium is important for several enzymes that regulate the metabolism. Also plays an important role as an extracellular ion for nerve transmission. Mg supplement in pigs rises meat quality and sows' fertility; in poultry, it helps to avoid deficiency-related health conditions and to improve meat quality and egg production by laying hens; in dairy cows, it serves to avoid grass tetany and milk fever, two conditions related to hypomagnesaemia, and to support their growth^[11].

The repetition of supplementing feedstuffs with Mg is broadly used, with the main aim to avoid Mg deficiency and then to progress animal performance (fertility and yield) and sometimes products' quality^[12-13]. However, in dairy and beef cows' diets, Mg is generally recommended at 1.2 to 3 g/kg DM^[14]. Due to pasture and forage consumption by ruminants, Mg in soil is important in defining Mg availability for these animals.

Mg content in soil differs between the various soil types and its availability to plants is influenced by several factors such as soil pH, organic matter content and fertilization [15]. This latter is an important feature on which depends the availability of minerals, including Mg. It has been observed that fertilization of soil with MgO provided and increased Mg content in grass, but it was considered insufficient to prevent Mg deficiency. Instead of this approach, direct Mg supplementation in cows' diets is considered the best practice to prevent grass tetany and milk fever [16, 17, 18]. The mineral content of soil, feeds and forage is area specific. Thus it is essential to access mineral levels from serum soil feed and forages in different seasons to estimate the year-round mineral requirements of livestock of a particular area. Current investigation was undertaken to estimate the Mg in content in soil, feed, fodder and serum of sangli district through different seasons.

Materials and Methods

Sample collection

The present study was carried out in Sangli district Maharashtra. Representative samples of soil, fodder and animal serum were collected randomly from Jat, Tasgaon and Palus tehsils of Sangli district. Soil, samples were collected with the help of pickaxe and trowel and processed

for analysis of Mg as described previously [19, 20]. Samples of concentrate mixture or ingredients and roughages were collected once during each season by visiting individual families. Feed and fodder samples were processed for analysis of Mg as described previously [19, 20]. Serum sample were collected from animal (cattle and buffalo) of each visited farmer family under study, once in each season. The serum sample were stored at -20 °C unit analysis.

Sample processing, mineral estimation and data analysis-

The samples (soil feed/fodder and serum) were digested using the method described by Franek (1992) [21]. Trolson, (1969) [22] and Kolmer *et al.*, 1951 [23] respectively. Simultaneous digestions of reagent blanks were also undertaken. Estimation of Mg in the samples was done using atomic absorption spectrophotometer (AAS) (ELICO, Ltd, Hyderabad, India). The present prevalence was calculated using reported critical values of corresponding minerals in soils, feed, fodder and animal (cattle). Statistical analysis was carried out as per Snedecor and Cochran, 1994 [24] using Web Agricultural Statistical Package (WASP) of ICAR, Goa. Assessment of Seasonal Changes in Magnesium Content in Soil, feed, Fodder and Serum of Livestock from Sangli district of Maharashtra.

Table 1: Mean \pm SE levels of Magnesium (Mg) in soil, feed, fodder and serum of Sangli district during different seasons

Soil (in ppm)					Feed (in ppm)				
Tehsils	Sum	Winter	Rainy	Overall	Tehsils	Sum	Winter	Rainy	Overall
Jat	412 \pm 0.67a	315 \pm 1.08b	414 \pm 0.83a	380 \pm 0.21a	Jat	0.37 \pm 0.08 a	0.43 \pm 0.05 a	0.43 \pm 0.03 a	0.40 \pm 0.05 a
Tasgaon	302 \pm 1.25a	385 \pm 0.88b	462 \pm 2.15c	383 \pm 0.98a	Tasgaon	0.35 \pm 0.02 a	0.39 \pm 0.02 a	0.39 \pm 0.06 a	0.38 \pm 0.03 a
Palus	288 \pm 0.12a	355 \pm 1.22b	491 \pm 2.58c	378 \pm 1.98a	Palus	0.37 \pm 0.05 a	0.41 \pm 0.05 a	0.50 \pm 0.06 b	0.43 \pm 0.05 a
Fodder (in ppm)					Serum (in mg %)				
Tehsils	Sum	Winter	Rainy	Overall	Tehsils	Sum	Winter	Rainy	Overall
Jat	032 \pm 0.04 a	034 \pm 0.03 a	0.38 \pm 0.04 a	0.30 \pm 0.04 a	Jat	4.05 \pm 0.09a	4.57 \pm 0.52b	5.06 \pm 0.14c	4.53 \pm 0.21 a
Tasgaon	0.23 \pm 0.04 a	0.38 \pm 0.03 b	0.50 \pm 0.05 c	0.37 \pm 0.04 a	Tasgaon	4.06 \pm 0.12a	4.81 \pm 0.098 b	5.16 \pm 0.11c	4.59 \pm 0.12 a
Palus	0.27 \pm 0.05 a	0.31 \pm 0.07 a	0.48 \pm 0.07 b	0.35 \pm 0.04 a	Palus	2.35 \pm 0.076 a	4.91 \pm 0.097 b	5.01 \pm 0.079 b	3.97 \pm 0.29 a

Similar superscripts in rows indicate non-significant differences whereas, dissimilar superscripts indicate significant differences among the seasons at 5% or 1% level

Table 2: Percent Deficient Samples (PDS) found in different tehsils of Sangli district

Tahsil	Critical value	Jat	Tasgaon	Palus	Overall
Soil	22ppm	--	--	--	--
Feed	40ppm	--	--	--	--
Fodder	40ppm	--	--	--	--
Serum	0.2ppm	2.38	0.00	0.00	0.79

*McDowell *et al.*, 1984; †McDowell *et al.*, 1985, Figures shown in parenthesis represent the number of samples.

Results and discussion Soil status

Values (mean \pm S.E.) of Mg in different samples (soil, feed, fodder and animal serum) are offered in Table- 1. In present study, the statistical analysis was carried out using Completely randomized Design (CRD) for evaluating the impact of season. The average Mg levels of soil samples from all the tehsil of Sangli district were the critical level of 22 ppm, as suggested by McDowell *et al.*, [25]. The comparison open that overall mean soil Mg values of all tehsils were above the critical level. In this study, overall soil Mg levels of Tasgaon tehsil were higher compared to the tehsil. For soil Mg values non-significant differences were observed in different seasons. In all tehsils, highest soil Mg values were seen in rainy, followed by winter and then by summer season.

The results are in agreement with previous report from Rajasthan, Odisha and Andhra Pradesh [26-28]. The mean soil Mg level of all tehsils in summer, winter and rainy season was above critical value. Over all PDS (Percentage Deficient Samples) (Table -2) of Mg in soil from Sangli district was nil indicating absence of deficiency in soil Mg.

Feed minerals

The average Mg content (Table-1) of animal feed samples from different tehsils of sangli district were compared with the critical level (40 ppm) suggested by McDowell *et al.* [25]. Findings of this study revealed that overall mean Mg values in feeds of all tehsils were below the critical level.

Highest mean Mg value was observed in rainy samples of Palus tehsil whereas the lowest mean Mg value was observed in summer season samples of Tasgaon tehsil. Highest feed Mg values were seen in rainy, followed by winter and then by summer season. This observation is in agreement with previous report from Maharashtra (...). Overall PDS (Table-2) of Mg in feed from Sangli district was 0.40. in this study, Mg PDS from Jat, Tasgaon and Palus was nil.

Fodder minerals

The average Mg content (Table-1) of animal fodder samples

from different tehsils of Sangali district were analyzed in comparison with the critical level (40 ppm) suggested by McDowell *et al.* [29]. Result of this study revealed that overall mean Mg values in fodder of all tehsils were above the critical level. These findings are in agreement with previous report from Maharashtra.

Highest mean Mg content was observed in rainy fodder samples of Tasgaon tehsil whereas the lowest mean Mg was observed in summer season fodder of Tasgaon tehsil. With regards to the mean Mg levels in fodder samples from all tehsils from all tehsils, non-significant differences were seen in different seasons. Overall prevalence of both Mg PDS in fodder of Sangli district was nil. The Mg content of the sorghum green, hybrid Napier, wheat bran, groundnut cake and compounded cattle feed were comparable to the reported values of Ramana *et al.* [30] in Southern transition zone of Karnataka.

Serum mineral

Overall average Mg content (Table-1 and 2) of serum samples of different seasons from different tehsil of Sangli district were above the critical level (0.2 ppm) suggested by McDowell *et al.*, (25). Highest mean Mg content were present in rainy samples of Tasgaon tehsil: whereas the lowest mean Mg was observed in summer season serum of Palus tehsil. For all tehsils, highest mean Mg values were seen in rainy, followed by winter and then by summer season. These results agree with previous findings published from Maharashtra [30]. With regards to the mean Mg levels in serum samples from all tehsils, significant difference were seen in different seasons. Overall PDS (Table -2) of Mg serum from Sangli district was 0.79%. Highest PDS for Mg in serum was seen in Jat tehsil (2.38%).

Conflict of Interest

Authors do not have any conflict of interest with any other institute or with the authors who are doing similar work.

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