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Analysis of Mineral Content of Serum and Hair Samples of Buffaloes in Gurgaon District of Haryana

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ABSTRACT

A survey was conducted to study the mineral composition of serum samples in milch buffaloes in Gurgaon district of Haryana state. From each of the four blocks, three villages were randomly selected. To have a systematic and planned study, all the blocks were included in the survey. From each block, three villages were randomly selected to have a fairly representative sample. From each village, four categories of farmers i.e. landless, small (having up to five acres of irrigated land), medium (five to ten acres of irrigated land) and large (more than ten acres of irrigated land) and having dairy animals were purposefully selected. In each village, five families under each category were interrogated on the prescribed Performa for this study, thus, making a total of 240 families. Result of the study depicted that the average value was highest (0.95 ppm) in block Farrukhnagar and lowest (0.74 ppm) in block Pataudi. Some samples were deficient in Zn as their level was below normal range i.e. 0.8 to 2 ppm. Some of the samples of serum were deficient in Zn and Mn . Nearly 65% and 10% buffalo serum samples were deficient in Ca and P respectively and nearly 40% serum samples were deficient in Cu. The normal level of Zn in hair was 115-135 ppm (O,Mary et al., 1969). Some values obtained under the present investigation were below 115 ppm which was found to be associated with Zn deficiency in buffaloes. Nearly 90 percent of animals had Cu concentration in hair below 8 ppm and Cu level in hair below this was associated with deficiency in cattle. None of the hair samples were deficient in Fe and Mn. So from present study we can conclude that mineral mixture should be added to the animal feed for better production, reproduction and health.

Key words: *Survey, Farmers, Minerals, Serum, Hair*

INTRODUCTION

Serum mineral content plays a significant role in any livestock development programme and the optimum expression of genetic potential for milk production in dairy buffalo depend on adequate supply of nutrients, particularly minerals. Micronutrients, particularly the mineral elements are considered to be inevitable for the normal metabolic and physiological processes of animal systems.

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The importance of minerals in regulating biological systems, growth, production and reproduction is well documented; however, livestock in India do not receive mineral/vitamin supplements except for common salt and calcite powder. Hence, dairy cows depend on forages for their mineral requirements. Garg *et al.*[4] and Bhanderi *et al.*[1] reported high incidences of forage and blood serum samples below the critical levels for Cu and Zn. Soils from all over country have been being depleted for Cu, Zn, P and S in soil, plants and dairy buffaloes. The quantity of minerals, thus, present in forages may not be adequate for optimum growth, milk yield and reproduction when those were fed to dairy buffalo. So a study was carried out to know the actual availability of minerals in serum because there is difference in intake and bioavailability of the minerals. In Haryana state farmers generally do not supplement mineral mixture and common salt in animal ration which leads to many reproductive and health problems due to deficiency of important minerals. Studies conducted on mineral status of buffaloes in Mohindergarh[8] and Rewari[14] districts of the state revealed that over fifty percent buffaloes show calcium, phosphorus and copper level below normal values. Therefore, there is an urgent need for determining mineral status of feed, fodder and animals; and advocating suitable corrective measures for optimal health and increased animal production.

MATERIAL AND METHODS

Fully automated Random Access Clinical Chemistry Analyzer (EM 200^{TM} Erba Mannheim – Germany) was employed for estimation of biochemical parameters using kits produced from Transasia Biomedical Limited, Germany.

1. Calcium was estimated by Arsenazo method.
2. Phosphorus was measured by UV phosphomolybdate method.

The biological samples were digested with nitric and perchloric acid (4:1) mixture. For wet digestion, 1 ml serum sample was taken in 50 ml conical flask and added 10 ml digestion mixture of acids. Thereafter, it was left overnight and in the next morning, heated the sample over hot plate until color of fumes changed. Then after cooling 15 ml final volume was made by adding distilled water into conical flask slowly, mixed properly and stored into 30 ml capped tubes until analysis. The hair samples were dusted off for extraneous contamination, cut it into 1 cm length and washed with acetone again before digestion following standard procedure. For digestion, the amount of samples taken was 1ml for serum 0.2g for hair. The concentration of Zn, Cu, Mn, and Fe in samples was estimated using Perkin Elmer Atomic Absorption Spectrometer (PinAAcle 900T).

RESULTS AND DISCUSSION

Mineral status of biological sample

Besides composition of minerals in feed ingredients and intake of different minerals, status of different minerals was also assessed through their analysis in blood (serum) and hair. The status of minerals in these biological samples are presented and discussed below.

Table 1: composition of serum in different sites of Gurgaon district

Site No.	Name of Block	N	Ca(mg%)	P(mg%)	Zn(ppm)	Cu(ppm)	Fe(ppm)	Mn(ppm)
1.	Gurgaon	60	7.62±0.07	3.76±0.05	0.80±0.08	0.62±0.04	1.79±0.06	0.20±0.01
2.	Pataudi	60	7.83±0.09	4.15±0.10	0.74±0.04	0.76±0.02	1.95±0.07	0.22±0.03
3.	Farrukhnagar	60	7.16±0.19	4.80±0.16	0.95±0.14	0.63±0.08	1.64±0.06	0.18±0.01
4.	Sohna	60	6.40±0.15	3.51±0.21	0.78±0.02	0.59±0.01	1.60±0.09	0.18±0.01
Mean			7.25±0.17	4.06±0.16	0.82±0.04	0.65±0.03	1.75±0.05	0.20±0.01
Range			4.62-11.50	2.56-6.17	0.45-1.29	0.34-0.96	1.38-2.21	0.10-0.37

± Standard error of mean

Serum mineral status

The average values in a block of Gurgaon district for mineral concentration in serum of buffaloes surveyed under study are presented in Table 1. The concentration of Zn in serum ranged from 0.45-1.29 ppm and the mean value was 0.82 ppm. The average value was highest (0.95 ppm) in block Farrukhnagar and lowest (0.74 ppm) in block Pataudi (Table 1). Some samples were deficient in Zn as their level was below normal range i.e. 0.8 to 2 ppm[12]. But as a whole data, average value was within normal range. The Zn concentration in serum or plasma was the most widely used indicator of deficiency but also lacks certainty and sensitivity as a diagnostic criterion[12]. Though, all the animals received less Zn than the required level yet the blood Zn levels were maintained. This indicates the ability of the animal to adjust with the available dietary habits. Yadav *et al.,*[15] reported that the average value of Zn content was 2.76 mg/kg in blood serum of buffaloes in Rewari district. According to Mandal *et al.,*[8] the average Zn content in blood serum of milch buffaloes was 2.80 mg/kg in Mohindergarh district. The values under the present investigation were lower than the ranges reported earlier.Copper status in serum ranged from 0.34-0.96 ppm and the mean value was 0.65 ppm. The lower critical value of Cu in serum has been reported as 0.6 ppm[12]. Accordingly, 40 percent of the serum samples were deficient in Cu when 0.6 ppm was taken as lower critical level. Therefore, the results of serum Cu status coincided with its status in feed and fodders as well. Yadav *et al.,*[15] reported that the average value of Cu content was 0.47 mg/kg in blood serum of buffaloes in Rewari district. According to Mandal *et al.,*[8] the average Cu content in blood serum of milch buffaloes was 0.67 mg/kg in Mohindergarh district. Chauhan and Nderingo[2] reported the Cu content ranged from 0.64 to 0.75 mg/kg in Tanzama. Under the present investigation figures of Cu Content in blood serum were found in line with the ranges reported earlier.The concentration of Fe ranged from 1.38 to 2.21 ppm and the mean value was 1.75 ppm. Intake of Fe was very high due to high content in feed and fodders but its level in serum was within the reported range of 1.1 to 2.5 ppm[5]. Yadav *et al.,*[15] reported that the average value of Fe content was 1.45 mg/kg in blood serum of buffaloes in Rewari district. According to Mandal *et al.,*[8] the average Fe content in blood serum of milch buffaloes was 2.18 mg/kg in Mohindergarh district. Sharma[11] observed Fe content in serum under different levels of mineral feeding were 1.47, 1.64 and 1.69 mg/kg in three different treatments, respectively. The values under the present investigation were also in line with the ranges reported earlier.Mn concentration in serum ranged from 0.10 to 0.37 ppm and the average value was 0.20 ppm. The lower critical value of Mn in serum has been reported as 0.20 ppm[13]. Accordingly, some samples were deficient in Mn. However, such level is generally non detectable by Atomic Absorption Spectrophotometer used for experiments. Yadav *et al.,*[15] reported that the average value of Mn content was 0.39 mg/kg in blood serum of buffaloes in Rewari district. According to Mandal *et al.,*[8] the average Mn content in blood serum of milch buffaloes was 0.43 mg/kg in Mohindergarh district. Sharma[11] observed Mn content in serum under different levels of mineral feeding were 0.59, 0.65 and 0.65 mg/kg in three different treatments, respectively. The values under the present investigation were lower than the ranges reported earlier. Serum Ca levels ranged from 4.62 to 11.50 mg% while the mean value was 7.25 mg% (Table 1). Below 8 mg% has been considered as indicative of Ca deficiency [10]. Nearly 65 percent of buffaloes had serum Ca below the critical level. The deficiency of Ca was also indicative from its intake data.The values of P ranged from 2.56 to 6.17 mg% and the mean value was 4.06 mg%. The lower critical level of P in serum has been reported as 3.8 mg%[10]. Nearly 10 percent of buffaloes had serum P below critical level. The marginal deficiency of P may not be significant while the animals were receiving green or cotton seed but may occur during scarcity of green fodder or when milk production is reduced to a level that farmers do not offer concentrates. Indira *et al*., (2014) reported that about 10 and 35% of the total animals showed lower levels of serum Ca (6.11 mg %) and P (3.23mg %),

respectively in West Godavari District of Andhra Pradesh.

Hair mineral status

Mineral levels in hair must reflect the concentration and (or) activity of the certain minerals in other parts of the body and reflect dietary mineral status of animals[3]. The mean values in a block of Gurgaon district for mineral concentration in hair of buffaloes surveyed under study are presented in Table2. The average values of Zn content in hair of different blocks were 115.62, 118.59, 113.61 and 119.45 mg/kg. Concentration of Zn ranged from 105.12-135.06 mg/kg. The normal level of Zn in hair was 115-135 ppm [9]. Some values obtained under the present investigation were below 115 ppm which was found to be associated with Zn deficiency in buffaloes. The present investigation indicated that Zn content of hair is indicative of general deficiency of Zn in animal feeds. Mandal *et al*.,[8] reported that the average Zn contents in buffalo hair were 150.87 mg/kg in Mohindergarh district of Haryana state. Bhanderi *et al*.,[1] while surveying the Sabarkantha District of Gujarat reported that the average level of Zn in hair was 73.51 ppm. The values under the present investigation are at par with the ranges reported earlier.The concentration of Cu in hair ranged from 5.23-9.45 mg/kg and the mean value was 7.14 mg/kg. Nearly 90 percent of animals had Cu concentration in hair below 8 ppm and Cu level in hair below this was associated with deficiency in cattle[12]. Cu deficiency was also indicated from its concentration in blood, feeds and fodders, and dietary intake. Mandal *et al*.,[8] reported that the average copper contents in buffalo hair were 10.55 mg/kg in Mohindergarh district of Haryana state. Bhanderi *et al*.,[1] while surveying the Sabarkantha District of Gujarat reported that the average level of Cu in hair was 6.28 ppm.Iron contents of hair ranged from 82.55-101.34 mg/kg and the mean value was 91.52 mg/kg (Table 2). The lower critical value of Fe in hair is 40 ppm[13]. Therefore, none of the hair samples were deficient in Fe, as also indicated from data of feed and serum composition. According to Gupta and Chaudhari[6] the cattle poll hail iron content ranged from 5.25 to 248.81 mg/kg in the hilly tracts of Darjeeling. Mandal *et al*.,[6] reported that the average Fe contents in buffalo hair were 82.55 mg/kg in Mohindergarh district. The values under the present investigation corroborate with the ranges reported earlier.The concentration of Mn ranged from 12.63-17.09 mg/kg with mean value of 14.28 mg/kg. Underwood[13] stated that hair apparently reflects the dietary status of animals and 8 ppm was the lower critical level in adult cattle[13]. The values obtained under present investigation were also in the normal physiological range. According to Gupta and Chaudhari[6] the cattle poll hail Mn content ranged from 1.70 to 40.76 mg/kg in the hilly tracts of Darjeeling. Mandal *et al*.,[8] reported that the average Mn contents in buffalo hair were 13.72 mg/kg in Mohindergarh district. The values under the present investigation were also in line with the ranges reported earlier.

Table 2: Mineral Composition of Hair in different sites of Gurgaon district

Site No.	Name of block	n	Zn(mg/kg)	Cu(mg/kg)	Fe(mg/kg)	Mn(mg/kg)
1.	Gurgaon	60	115.62±2.96	6.76±0.11	94.70±2.32	14.10±0.29
2.	Pataudi	60	118.59±3.76	7.79±0.16	95.32±1.78	14.94±0.64
3.	Farrukhnagar	60	113.61±4.03	7.05±0.05	86.72±1.62	13.93±0.18
4.	Sohna	60	119.45±2.52	6.97±0.06	89.34±1.42	14.12±0.64
Mean			116.82±1.60	7.14±0.13	91.52±1.34	14.28±0.24
Range			105.12-135.06	5.23-9.45	82.55-101.34	12.63-17.09

± Standard error of mean

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