The Journal of Animal and Plant Sciences, 22(3 Suppl.): 2012, Page: 315-318
ISSN: 1018-7081

MAPPING OF CALCIUM AND PHOSPHORUS STATUS OF BUFFALOES IN DIFFERENT CROPPING ZONE OF PUNJAB PROVINCE

M. Z. Khan, T. N. Pasha, U. Farooq, Y. A. Ditta, M. Ilyas and H. Ahmad

Department of Food and Nutrition, University of Veterinary and Animal Sciences, Lahore
Corresponding Author e-mail: tnpasha@uvas.edu.pk

ABSTRACT

The study was conducted to ascertain the calcium and phosphorus imbalances in buffaloes of different cropping zones of Punjab province on the basis of mineral concentrations in blood plasma, feedstuffs, soil and water. Zones selected for studies were central mixed cropping zone (Lahore, Kasur and Okara Districts), Thal irrigated canal zone (Khushab district) and D.G. Khan irrigated zone (Muzaffargarh district). Five sub-locations were selected randomly from each district of the study area. From each sub-location, 10 blood samples were collected each from lactating buffaloes, dry buffaloes and buffalo calves, both in winter and summer season (5 districts x 5 sub-locations x 10 blood samples x 3 physiological stage x 2 seasons = 1500). In addition, a total of 27 feedstuffs (5 districts x 5 sub-locations x 9 feedstuff types x 3 samples for each type x 2 seasons = 1350), 6 soil (5 districts x 5 sub-locations x 6 soil samples x 2 seasons = 300) and 6 water samples (5 districts x 5 sub-locations x 6 water samples x 2 seasons = 300) were collected form each sub-location in both the seasons. Plasma calcium values were found slightly lower in Khushab district, whereas adequate levels were found in Muzaffargarh district. Significant ($P>0.05$) effects of cropping zones and physiological stages were observed on both calcium and phosphorus concentrations in blood plasma. Whereas, affect of seasons on plasma minerals was found non-significant ($P<0.05$). Water calcium and phosphorus values were significantly ($P<0.05$) different among different sites of the districts, whereas difference between the districts was found non-significant ($P>0.05$). Feedstuffs of all districts were found variable in calcium and phosphorus content.

Key words: Calcium, phosphorus, buffaloes, feedstuffs, soil and water.

INTRODUCTION

Minerals are the critical nutrients bearing significant effect in animal nutrition because both their excess and deficiency produce detrimental effects on the health and production of livestock. Mineral imbalances of soil and forage have long been held responsible for impaired reproduction (Kadzere, 1997) bone abnormalities; tetany, infertility and pica are some of the clinical signs often suggestive for mineral deficiencies in livestock. Minerals are interrelated and balanced against each other, and most often cannot be considered as single elements with independent and self-sufficient roles in the organized bodily processes. The definite relationship of calcium and phosphorus is an example (McDowell, 1992). Mineral contents of plants vary with the soil chemical composition and is affected by the climatic influences like temperature, rain fall and water drainag.

Calcium (Ca) and phosphorus (P) are considered together because they constitute the major part of the mineral content of bone. They are very closely related; a deficiency or an excess of one will interfere with the proper utilization of the other. In young animals and humans, shortage of Ca, P, or vitamin D results in rickets, and in the adult or more mature animal, osteomalacia. Ca and P are two most abundant mineral elements in the animal body. They are frequently found in insufficient quantities in common feedstuffs to meet requirements of livestock. Phosphorus deficiency is predominantly a condition of grazing ruminants, especially cattle, whereas Ca deficiency is more a problem of animal fed mostly on concentrates (McDowell, 1992).

The quality and quantity of nutrients of feed and forages mainly depend on factors like type of soil, level of fertilization, source of irrigation, etc. More and extensive research is required to identify the areas and extents of these mineral imbalances. There is need to ascertain the status of Calcium, Phosphorous in different canal irrigated districts of Punjab having highest population density of livestock.

MATERIALS AND METHODS

Investigation Area: This study was conducted in 3 different cropping zones of Punjab province. Zones selected for study were central mixed cropping zone (Lahore, Kasur and Okara Districts), Thal irrigated canal zone (Khushab district) and D.G. Khan irrigated zone (Muzaffargarh district).

Five different sub-locations were selected from each district under study. This selection was on the basis of topography, soil type and livestock availability. Samples were taken once in summer and once in winter and analyzed for Calcium (Ca) P, Calcium (Ca).

Feed and Forage Samples Collection: A total of 9 feedstuff samples were taken from each sub-location in both the seasons a total of 27 feedstuffs (5 districts x 5 sub-locations x 9 feedstuff types x 3 samples for each type x 2 seasons = 1350). The representative sample of 1-2 kg was taken and dried in a hot air oven at 100 ^{0}C for 24 hrs, ground in a Willey mill through 1-mm screen and kept in tightly stoppard bottles. The sample of 0.5g was digested, then filtered and diluted up to 100 ml.

Soil and Water Sampling: From each sub-location, 6 soil (5 districts x 5 sub-locations x 6 soil samples x 2 seasons = 300) and 6 water samples (5 districts x 5 sub-locations x 6 water samples x 2 seasons = 300) were collected in both the seasons. Soil representative samples of 1 kg at 15-18 cm depth were collected using soil auger, then dried at 100^{0}C, ground in a Willey mill through 2mm screen and wet digestion was done for further analysis. For water analyses, 500 ml water sample was filtered and preserved (Singh *et al.*, 2005).

Blood Sampling: From each sub-location, 10 blood samples were collected each from lactating buffaloes, dry buffaloes and buffaloes calves, both in winter and summer season (5 districts x 5 sub-locations x 10 blood samples x 3 physiological stage x 2 seasons = 1500). Blood samples of 8-10 ml were taken by jugular puncture in sterilized vacutainer containing heparin, then treated with 10% TCA, centrifuged at 3000 r.p.m. for 15 minutes and filtered. For Calcium and Phosphorus, the analyses were conducted by Atomic Absorption Spectrophotometer and Spectrophotometer (Singh *et al*., 2005).

Statistical Analysis: The data thus obtained was statistically analyzed using one way ANOVA for differences among mean mineral concentrations of different districts and different sub-locations and t-test for comparison between seasons. Regression model was used for interactions among different variables. The significant differences between means were tested by Duncan's Multiple Range test (Steel *et al.,* 1997).

RESULTS AND DISCUSSION

In lactating and dry buffaloes, plasma calcium and phosphorus values were found slightly lower in Khushab district, whereas adequate levels were found in Lahore, Kasur, Okara and Muzffargarh districts. Calves of districts Lahore, Kasur and and Khushab were found deficient in plasma calcium concentration. Whereas, calves of district Khushab and Muzaffargarh were found deficient in plasma phosphorus.

Lower plasma calcium values were observed in district Khushab as compared to district Muzaffargarh. Plasma phosphorus values were found higher in district Muzaffargarh than district Khushab. Water calcium and phosphorus values were significantly ($P<0.05$) different among different cropping zones. Feedstuffs of both districts were found variable in calcium and phosphorus content. Plasma Ca concentration in lactating buffaloes in all the districts were within the critical limits except district Kasur where Ca concentration was found slightly lower than the critical limit. In dry buffaloes, plasma Ca concentration were found lower in district Lahore (9.20$\pm$0.33 mg/dl) and district Kasur (9.48$\pm$0.43 mg/dl) whereas in districts Okara normal plasma Ca concentration (10.29$\pm$0.38 mg/dl) was observed. The Ca concentration in calves of Lahore and Kasur districts were found deficient. In plasma Ca concentrations, effects of district, season and physiological stage of the buffaloes were observed in the study area ($P<0.05$). Whereas, effect of seasons on plasma minerals was found non-significant ($P<0.05$).However, plasma concentration of P was within the critical limits in all physiological stages of buffaloes. Variable Ca and P concentrations were found in soil, feedstuffs and water in all the cropping zones. Significant ($P<0.05$) effects of cropping zones and physiological stages were observed on both calcium and phosphorus concentrations in blood plasma (Table 01).

Findings of the present study are in agreement with those of Shukla *et al* (1980), Hanif (1983), Neto *et al* (1988), Oba *et al* (1988), and Khan *et al* (2007) who reported serum calcium levels ranging from 9.25 to 11.9mg/dl. However findings did not agree with that of Iqbal *et al* 1990 who studied minerals imbalances in buffalo of Punjab province. He reported plasma calcium values ranging from 7.09 to 8.05 mg/dl in different districts of the area. Our findings are also not in agreement with those of Ashraf (2006) and Dhoble abd Gupta (1986) who reported lower plasma calcium levels ranging from 6.70 to 7.68 mg/dl.

Mtimuni *et al.* (1990) observed that assessment of mineral status of animals involved the influence of forage consumed and the soil upon which the forage was grown. Thus, soil-plant-animal system as well as other dietary antagonistic showed significant influence on mineral concentration of blood. These findings were in accordance with the Khan *et al*. (2003) who observed that excretion of Ca and Mg through the feaces was maximum during winter than summer, thus less absorption through the gastro-intestinal tract. It might be due to certain interactions and antagonistic role of certain minerals as well as controlling mechanism under the action of hormones. In another study, Khan *et al*. (2003) observed that livestock fulfilled majority of their minerals requirements from the forages which uptake these essential nutrients from the soil. From these analyses, we concluded that plasma Ca and P levels were significantly different ($P<0.05$) in blood plasma of different physiological stages of buffaloes. For optimum production and health status, minerals supplementation is

needed according to the physiological stages of buffalo and cropping zone of the province.

Table 01: Concentrations of calcium and phosphorus in blood plasma of different buffaloes in different physiological stages in relation to season, soil, physiological stages and cropping zone

Variables	Significance of season, physiological stage and cropping zone	Interaction of soil with different physiological stages	Interaction of season with different physiological stages	Seasons	Physiological stages of buffalo		
					Lactating	Dry	Calves
P^{+}, C.L: 3.35-8.58mg /100ml	A*, S:ns, Z*	SiA*	SA:ns	Winter	4.32±0.32	5.77±0.0.41	3.40±0.51
				Summer	3.90±0.20	554.06±0.73	3.33±0.44
Ca^{2+}, C.L: 9.76-12.45/100ml	S*, A:ns, Z*	SiA**	SA:ns	Winter	9.55±1.22	10.01±2.01	8.37±2.12
				Summer	10.40±1.06	11.09±1.31	8.93±1.66

S: season, Si: Soil, Z: cropping zone, A: Physiological stage, SA: season x Physiological stage, SiA: Soil x Physiological stage, ns: non-significant, ±: S.E,
C.L. critical limits: Radostits *et al.,* (2000)
*: Significant at 0.05 level., **: Significant at 0.01 level.

Acknowledgement: Pakistan Agriculture Research Council for funding to conduct this study

REFERENCES

Ashraf, M. Y., A. Khan, M. Ashraf, and S. Zafar (2006). Studies on the transfer of mineral nutrients from feed, water, soil and plants to buffaloes under arid environments. J. Arid Env. 65 (4):632-643.

Dhoble, R. L and S. K. Gupta (1986). Serum calcium and inorganic phosphorus levels duringpostpartum anoestrus in buffaloes. Ind. J. Anim. Heath. 25(2):123-126.

Engle, T. E. (2001). Trace minerals, vitamins and preventative nutrition. *Feedstuffs.* 73:1-18.

Hanif, M. (1983). Influence of pregnancy stress on blood mineral profile in Buffaloes. *M. Sc. Thesis,* Department of Animal reproduction, University of Agriculture Faisalabad. pp. 31-49.

Kadzere, C. T. (1997). Emergent feedlotters in South Africa: Potential-Problems- Possibilities. Farmer's Weekly, May., pp. 24-27.

Khan, M. Z. U. (2007). Studies on imbalances of macro-minerals in Hafizabad and Okara districts. M.Sc. thesis, Dept. of Animal Nutrition, University of Veterinary Sciences, Lahore. pp. 57-63

Khan, G. S., M. Ikram, and M. Z. Gondal, (1999). Evaluation of water quality of Ravi and Chenab rivers and their sediments. J. of Drainage and Water manage., 3(1 &2): 48-55.

Khan, Z. I., A. Hussain, M. Ashraf, M. Y. Ashraf, and L. R. Mcdowell (2005). Macromineral status of grazing sheep in a semi-arid region of Pakistan. Small Rumin. Res. 68: pp. 279-284.

Martin, S. and F. C. Bryant (1989). Nutrition of domestic South American llamas and alpacas, Small Rumin. Res. 2: pp. 191-216.

Masters, D. G., D. B. Purser, S. X. Yu, Z. S. Wang, R. Z. Yang, N. Liu, D. X. Lu, L. H. Wu, J. K. Ren and G. H. Li. (1993). Mineral nutrition of grazing sheep in Northern China. Macro-minerals on pasture feed supplement and sheep. Asian-Aust. J. Anim. Sci. 6: pp. 99-105.

Mcdowell L. R. (1992). Minerals in animals and livestock nutrition. Academic press Inc., San Diego, California, USA.

Mcdowell, J. K. (1997). Minerals for grazing ruminants in tropical regions. *Extension Bulletin, third ed. Department of Animal Sciences, Center for Tropical Agriculture, University of Florida, Gainesville, FL.* pp.1-81.

Mcdowell, L. R. (2003). Minerals in animals and human nutrition. 2nd ed. Elsevier Science, Amsterdam. pp. 644.

Mcdowell, L. R., J. H. Conrad and G. L. Ellis (1986). Mineral deficiencies and toxicities of tropical forages for grazing livestock. *In: International Rangeland Development Symposium, Orlando, FL.* pp. 139-146.

Mtimuni, J. P., M. W. Mfitilodze and L.R. Mcdowell, (1990). Interrelationships of minerals in soil-plant-animal system at Kuti Branch, Malawi. Commun. Soil Sci. Plant Anal., 21: pp. 415-427.

Neto, R. F., M. A. Zanetti, D. Ocampos, V. R. Herling and C. A. Gomide (1988). Serum major minerals and total protein levels in buffalo calves weaned on Brachiaria Brizantha CV maandu grazing. *2nd World* Buffalo Congress, Dec. 1988. pp. 91-102.

Oba, E. and A. A. Ramos (1988). Qualitative and quantitative aspects of the crossbred Murrah buffalo blood in feedlot during the service period. 2nd World Buffalo Congress, pp. 62.

Orden, E. A., A. B. Serra, S. D. Serra, C. P. Aganon, L. C. Cruz, and T. Fujihara (1999). Mineral concentration in blood of grazing goats and some forage in Lahar-Laden area of Central Luzon, Philippines. Asian-Aust. J. Anim. Sci, 12: pp. 422-428.

Shukla, P. C., M. B. Pande, H.B. Desai and M. C. Oesa, (1980). Hematological and chemical status of blood of local cattle and Buffaloes of Panch mahal districts of Gujrat state. Ind. J. Ani. Res. 15: pp.103-106.

Singh, D., P. K. Chhonkar and B. S. Dwivedi (2005). Manual for soil, water, plant and fertilizer analysis. Westville Pub., New Delhi, India. pp. 117-142.

Steel, R. G. D., J. H. Torrie and D. A. Dickey (1997). Principles and Procedures of Statistics, 3rd ed. McGraw-Hill Book Co Inc., New York, USA.

Tiffany, M. E., L. R. Mcdowell, G. A. O'connor, H. Nguyen, F. G. Martin, N. S. Wilkinson, and E. C. Cardoso (2000). Effects of pasture-applied bio- solids on forage and soil concentrations over a grazing season in North Florida. I. Macrominerals, crude protein and in-vitro digestibility. Commun. Soil. Sci. Plant Ani., 31:201-213.