STUDIES ON THE EFFECT OF SUPPLEMENTATION OF AREA SPECIFIC MINERAL MIXTURE ON MICRO MINERAL STATUS AND CYCLICITY IN POST-PARTUM ANESTROUS COWS

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ABSTRACT

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The present study was conducted to identify possible trace mineral deficiencies causing anestrus and prolonged post-partum anestrus and evaluate the effect of strategic supplementation of Area Specific Mineral Mixture (ASMM) in these cases. The animals selected for study were categorized under three groups Group I- Control animals (anestrous cows of 90 days and above), Group II- Anestrous animals (anestrous of 90 days and above) and Group III- Pleuriparous animals (8 to 9 months of gestation) from Livestock Farm of CSKHPKV, Palampur consisting of 10 animals in each group. Parallel study was also conducted on animals from nearby villages of Panchrukhi block of District Kangra in the state of Himachal Pradesh consisting of 4, 11 and 6 cows in Group I, II and III respectively. The animals of Group II and Group III were supplemented with specially formulated Area Specific Mineral Mixture @ 50 gm/animal/day until the animals attained estrus whereas animals of Group I were kept as control. Anestrous group of cows from field showed a significant ($p<0.05$) increase in average plasma iron concentration on day 90 (2.94 Ø0.19 ppm) in comparison to control group (2.13 Ø 0.18 ppm). Significant ($p<0.05$) increase in average plasma copper concentration was observed in anestrous group of cows from day 30 (0.71 Ø 0.10 ppm) and day 60 (0.84 Ø 0.13 ppm) in comparison to control group on day 30 (0.25 Ø 0.04 ppm) and day 60 (0.29 Ø 0.11 ppm) respectively. Anestrous group of cows from field also showed significant ($p<0.05$) increase in average plasma copper concentration on day 60 (0.94 Ø 0.11ppm) in comparison to control group (0.28 Ø 0.06 ppm). Group II farm animals showed significant increase in average plasma zinc and cobalt concentration on day 30 and day 90 after strategic mineral mixture supplementation as compared to control group. In Group II farm animals, 7 out of 10 cows (70%) exhibited estrus and on an average animals came into heat after 35 days of mineral supplementation. In Group III of farm also 7 out of 10 cows (70%) came into heat and on an average animals came into heat 60 days of mineral supplementation. In Group II of field, 8 out of 11 cows (72.72%) came into heat,whereas in Group III of field only 2 out of 6 cows (33.33%) came into heat following strategic mineral supplementation. No animals from control group in farm as well as field came into heat during the period of study.

Key words: Anestrous, Post-partum anestrous, mineral mixture supplementation, trace minerals

INTRODUCTION

Trace minerals are known to have direct or indirect role in animal reproduction.In India, livestock production is mainly dependent on crop residues and agricultural byproducts as major component of animal feed, as a result, mineral deficiency widely exists in livestock due to exclusive dependence upon fodder and forages for their mineral requirement. To promote normal tissue growth, homeostasis, enzyme function, cell regulation, and immune function, it is imperative that trace minerals be maintained within narrow concentrations within the body (Underwood and Suttle, 1999).In grazing animals a marginal zinc deficiency results in subnormal growth, fertility, low serum zinc values, decreased resistance to infection and stress. Anestrus and prolonged post-partum anestrus has been reported as an important factor causing economic loss to the dairy farmers in the state of Himachal Pradesh. One of the important etiological factors of anestrous and prolonged post-partum anestrus is mineral deficiency. Wide ranging diversity of climate, topography, terrain and precipitation in different agro-climatic zones of Himachal Pradesh may lead to mineral imbalances. Keeping this in view the present study was conducted with the objectives of identification of possible trace mineral deficiencies causing anestrus and prolonged post-partum anestrus and study the effect of strategic supplementation of Area Specific Mineral Mixture (ASMM) in cases of anestrus and prolonged post-partum anestrus.

MATERIALS AND METHODS

The animals selected for study were categorized under three groups Group I- Control animals (anestrous cows of 90 days and above), Group II- Anestrous animals (90 days and above) and Group III- Pleuriparous animals (8 to 9 months of gestation) from Livestock Farm of CSKHPKV, Palampur consisting of 10 animals under each group. Parallel study was also conducted on animals from nearby villages of Panchrukhi block of District Kangra in the state of Himachal Pradesh consisting of 4, 11 and 6 cows in group I, II and III respectively. Analysis of minerals from plasma of animals as well as in feed, fodder samples were done initially to identify the deficient minerals.

Determination of minerals in forages/grass and feed samples wasdone by wet digestion technique as per method given by Johnson and Ulrich (1959). Approximately 6-8 ml of blood after collection from animals was centrifuged at 3000 rpm for 10 minutes for separation of plasma which was further stored at -20°C for analysis of minerals. The micro minerals in forage/grass and feed samples as well as in plasma of animals were analyzed with the help of Atomic Absorption Spectrophotometer (AAS), Model 400, Perkin Elmer (USA) as described in Perkin Elmer analytical methods manual. The initial analysis of minerals from plasma of animals and in feed/forage and grass samples revealed the deficiency of one or more minerals, so Area Specific Mineral Mixture was formulated as per the general deficiency status observed to provide 100 per cent of daily requirements of trace minerals in a 50 gm mineral mixture as suggested by McDowell *et al.* (1983). The animals of Group II and Group III of both Livestock Farm and from villages of Panchrukhi block were supplemented with the specially formulated Area Specific Mineral Mixture @ 50 gm/animal/day until the animals attained estrus, whereas animals of Group I were kept as control. Assessment of mineral status from plasma was done on day 0 i.e. before supplementation and at intervals of 30 days post supplementation. The results obtained in the above study were analyzed using computer software ΔGraphpadInstat« (Russel 1990). The data were analyzed by using ƒANOVA≈ andΔt«-test at 5% level of significance and Dunnett multiplecomparison test.

RESULTS AND DISCUSSION

The micro minerals analyzed from plasma were iron, zinc, copper, cobalt and manganese. Analysis of feed, fodder and concentrate mixture revealed a deficiency of copper and cobalt in all feedstuff which were offered to the animals of livestock farm of the University. Initial analysis of plasma showed that the

average plasma iron concentration was within the physiological level in all the three groups of cow in farm as well as in field. Iron concentration in feed/fodder was also high and therefore high concentration of iron in plasma may possibly be due to high amount of iron in diet. A non-significant increase in average plasma iron concentration was observed in anestrous and gestation group of cows from farm and in gestation group from field after strategic mineral mixture supplementation. The present findings are in line with the results of Vhora *et al.* (1995) who reported non-significant differences in plasma iron concentration between anestrous and normal cyclic crossbred rural cows. Anestrous group of cows from field showed a significant ($p<0.05$) increase in average plasma iron concentration on day 90 (2.94 Ø0.19 ppm) in comparison to control group on day 90 (2.13 Ø 0.18 ppm).The present findings are in accordance with the results of Prasad and Rao (1997), Biswas *et al.* (2005), Samanta *et al.* (1995) as these authors also reported significantly lower plasma iron in anestrous cows as compared to normal cyclic cows.

Dietary deficiency of copper both primary and secondary (induced by high molybdenum and/or sulphur) is known to induce infertility in dairy cows. Strategic mineral mixture supplementation improved the plasma concentration of copper in cows of both farm and field. Significant ($p<0.05$) increase in average plasma copper concentration was observed in anestrous group of cows from farm on day 30 (0.71 Ø 0.10 ppm) and day 60 (0.84 Ø 0.13 ppm) in comparison to control group on day 30 (0.25 Ø 0.04 ppm) and day 60 (0.29 Ø 0.11 ppm) respectively. Anestrous group of cows from field also showed significant ($p<0.05$) increase in average plasma copper concentration on day 60 (0.94 Ø 0.11ppm) in comparison to control group on day 60 (0.28 Ø 0.06 ppm). These findings are in agreement with the results of Dutta *et al.* (2001), Samanta *et al.* (1995) and Rojas *et al.* (1994) who reported lower plasma copper concentration in anestrous cows as compared to normal cyclic cows. Similar reports in buffalo were given by Biswas *et al.* (2005).Group III from farm showed an increasing trend in average plasma copper concentration from day 30 which remained stable up to day 60 and then decreasing trend was observed on day 90 however the decrease was non-significant. This decrease in plasma copper concentration may be due to dietary changes with change in season which may be due to high content of iron in feed/fodder which depresses copper bioavailability in the body (Bremner and Price 1985). Gestation group of cows from field showed non-significant increase in average plasma copper concentration after strategic mineral mixture supplementation from day 30 onwards.

Zinc is involved in a number of enzymatic reactions associated with carbohydrate metabolism, protein synthesis and nucleic acid metabolism. It is therefore essential in cells like the gonads, where active growth and division are taking place. Zinc deficiency can affect all phases of the reproductive process in the female, from estrous to parturition and lactation (Miller 1979).Group II farm animals showed significant ($p<0.05$) increase in average plasma zinc concentration on day 30 (0.86 Ø 0.05 ppm) and day 90 (0.96 Ø 0.04 ppm) as compared to control group on the respective days after strategic mineral mixture supplementation.Group III farm animals showed a non-significant increase in average plasma zinc concentration from day 30 till day 90 of study.Group II field animals showed a significant ($p<0.05$) increase in average plasma zinc concentration on day 90 (0.97 Ø0.03 ppm) in comparison to control group on day 90 (0.70 Ø 0.05 ppm). Group III field animals showed a non-significant increase in average plasma zinc concentration after mineral supplementation, whereas control group of cows from farm showed a non-significant decrease in average plasma zinc concentration without any specific trend from day 0 to day 90. The findings of the present study are in agreement with the results given by Prasad and Rao (1997). Similar findings in buffaloes were reported by Biswas *et al.* (2005) and Lall *et al.* (2004) as these authors reported significant increase in plasma zinc level after mineral supplementation.

Group II farm animals showed a significant ($p<0.01$) increase in average plasma cobalt

concentration on day 30 and day 90 after strategic mineral mixture supplementation, whereas the control group of cows from farm showed a non-significant decrease in average plasma cobalt concentration without any specific trend. The results are in agreement with the reports of Biswas *et al.* (2005) who observed significant ($p<0.01$) increase in trace mineral profile during estrous as compared to anestrous condition. Gestation group from farm showed a significant ($p<0.01$) increase in average plasma cobalt concentration on day 30 (0.16 Ø0.00 ppm) after mineral mixture supplementation.Anestrous group of cows from field showed a decreasing trend in average plasma cobalt concentration with a significant ($p<0.01$) decrease on day 60 (0.09Ø0.01 ppm) after mineral mixture supplementation. Control group of cows also showed a non-significant decrease in average plasma cobalt concentration from day 0 to day 90 without any specific trend. Gestation group from field also showed similar decreasing trend in average plasma cobalt concentration with a very significant ($p< 0.01$) decrease on day 90 (0.08 Ø 0.00 ppm)

The average plasma manganese concentration showed an increasing trend from day 30 onwards after strategic mineral mixture supplementation in group II farm animals. On the other hand control group of cows from farm showed a decreasing trend in average plasma manganese level with a significant ($p<0.05$) decrease on day 60 (0.01 Ø 0.00 ppm) as compared to day 0 (0.03Ø0.00 ppm). Gestation group of cows showed a significant ($p< 0.05$) increase in average plasma manganese concentrationon day 90 after mineral mixture supplementation. Group II cows from field showed a significant ($p<0.01$) increase in average plasma manganese concentration on day 30 (0.09 Ø 0.01 ppm), day 90 (0.10 Ø 0.01 ppm) in comparison to control group on the respective days. Gestation group of cows from field also showed a significant ($p<0.05$) increase in average plasma manganese concentration on day 30 (0.11 Ø 0.00 ppm) and day 90 (0.11 Ø 0.00 ppm) as compared to day 0 (0.01Ø0.01 ppm).Similar findings were reported by Prasad and Rao (1997), Samanta *et al.* (1995) as these authors reported significant increase in plasma manganese in normal cyclic cows as compared to anestrous cows. Similar results in buffaloes were reported by Biswas *et al.* (2005).

Results indicated that in anestrous group from livestock farm 7 out of 10 cows (70%) exhibited estrus after strategic mineral mixture supplementation. On an average the animals came into heat after 35 days of mineral supplementation. In gestation group also 7 out of 10 cows (70%) came into heat and on an average the animals came into heat 60 days after strategic mineral mixture supplementation. In anestrous group from field 8 out of 11 cows (72.72%) came into heat during the period of study. However in gestation group of cows from field only 2 out of 6 cows (33.33%) came into heat during the period of study. No animals from control group in farm as well as field came into heat during the period of study.

REFERENCES

Bremner, I, and Price, J. (1985) Effect of dietary iron supplements on copper metabolism in rats. In: Trace elements in Man and Animals. TEMA 6 (Mills, C.F., Bremner, I. and Chesters, J.K. eds.). Commonwealth Agricultural Bureaux Royal, United Kingdom. P 374¬376.

Biswas, J., Ray, S.K. and Chattaraj, S. (2005) Studies on trace mineral profile in the serum of murrah buffaloes in estrus and anestrous conditions. *Journal of Interacademicia*, **9(2)**: 278-280.

Dutta, A., Baruah, B., Sarmah, B.C., Baruah, K.K. and Goswami, R.N. (2001) Macro mineral levels in cyclic, post-partum anestrous and repeat breeding local cows in lower Brahmaputra Valley of Assam. *Indian J. of Anim.Reprod.*, **22(1)**: 41-44.

Johnson, C.M. and Ulrich, A. (1959) Analytical methods for use in plant analysis. University of California Agricultural experiment station, Berkeley. Bulletin, 766: 54.

Lall, D., Sikka, P., Khanna, S. and Chauhan, T.R. (2004) Effect of high plane of nutrition and

mineral supplementation on blood mineral profile, thyroid hormones and fertility status of anoestrus buffaloes. *Anim. N. and Feed Technol.*, **4(1)**: 71-76.

Miller, W.J. (1979) In: Dairy cattle feeding and nutrition. Academic press, New York.

McDowell, L.R, Conrad, J.H., Ellis, G.L. and Loosli, J.K. (1983) Minerals for grazing ruminants in tropical regions. Bull. Univ. Fl. Coop. Ext. Serv. Univ. of Florida, Gainesville, Florida.

Perkin Elmer. (1982) Analytical Methods Manual. Philadelphia, USA.

Prasad, K.S.N. and Rao, S.V.N. (1997) Blood mineral profile of anoestrous and repeat breeder crossbred cows; a field study. *Indian J. of Anim. Nutrition.*,**14(2)**: 135-137.

Russel, P. (1990)GraphPadInstat. GraphPad software V 2.05a. Royal Veterinary College. London.

Rojas, L.X., Moya, A., McDowell, L.R., Martin, F.G. and Conrad, J.H. (1994) Mineral status on a farm on the southwest of the llanos in Venezuela. *Zootecnia Tropical*, **12(2)**: 161-185.

Samanta, A.K., Sarkar, S., Bose, S., Duttagupta, R., Senapati, P.K. and Bhowmik, M.K. (1995) Influence of macro and micro minerals on anaemia related to production and reproduction of grazing cattle. *I. Vet. J.*, **72(10)**: 1031-1034.

Underwood, E. J. and Suttle, N. F. (1999) In: The Mineral Nutrition of Livestock 3rd Ed. CABI Publishing, CAB International, Wallingford, Oxon, UK.

Vhora, S.C., Dindorkar, C.V. and Kaikini, A.S. (1995) Studies on blood serum levels of certain biochemical constituents in normal cycling and anestrous crossbred cows. *Indian J. of Anim. Reprod.*,**16(2)**: 85-87.