ORIGINAL RESEARCH PAPER

Veterinary Science

EFFICACY EVALUATION OF SUPPLEMENTING MINERAL MIXTURE IN IMPROVING THE METABOLIC PROFILE OF DAIRY HERD AND AUGMENTING PRODUCTIVITY

KEY WORDS: CMPT test, mineral mixture, oral supplementation, poor yielders, repeat breeders.

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ABSTRACT

A study was conducted to evaluate the efficacy of supplementing dairy special with unique vital 5 formula Ayumin V5 (M/S Ayurvet) and mineral mixture Ayumin (M/S Ayurvet) to dairy herd in improving their productive and reproductive traits. A total of 36 cows were selected for the purpose of study. Group T0 (n=12) was kept as control having 4 animals from each subgroup, i.e. lactating but poor yielders, repeat breeders and healthy subgroup. Group T1 (n=12), having allotted 4 animals from each subgroup, was treated with Ayumin V5 at the rate of 30 g/day for 60 days along with standard basal diet. Group T2 (n=12), having allotted 4 animals from each subgroup, was treated with Ayumin at the rate of 30 g/day for 60 days along with standard basal diet. Results revealed that milk yield was significantly increased in the supplemented groups as compared to control. The CMPT test (Compton metabolic profile test) revealed there was significant increase in the serum concentration of macro and micro minerals following supplementation of oral mineral supplement. Thus, it can be inferred that oral supplementation of mineral mixture can increase serum concentration of different minerals.

INTRODUCTION

Vitamins and minerals for dairy cattle and well-balanced diets can maximise profits or minimise losses in a feeding program as well cattle farming business. The importance of essential trace minerals on livestock productivity has been realized for several decades **(Arthington, 2006)**. Certain trace minerals affect immunity and may affect disease susceptibility in cattle. Selenium, copper, zinc, cobalt and iron have been shown to alter various components of the immune system **(Spears, 1995)**. The immune system is designed to provide protection from a wide range of pathogenic micro-organisms **(Bonnie *et al.*, 2014)**. The immune system has been shown to play a role in dairy cow reproduction, both indirectly, through the effects of mastitis, metritis, retained placenta, and metabolic diseases; and directly, through actions of immune cells upon the ovary **(Rowson, 2015).** Copper and zinc play an important role in regulating progesterone production by luteal cells via involvement of superoxide dismutase **(Sales *et al.*, 2011)**. Iron also plays an important role in ovarian activity (Qian et al., 2001). The Ca: P ratio plays important role and any alteration may affect ovarian function through its blocking action on pituitary gland **(Yasothai, 2014)**. In view of the importance of minerals in ameliorating stress and augmenting reproductive function, the present study has been undertaken to evaluate the effect of herbal mineral supplements in influencing the overall blood chemistry of different macro and macro minerals.

MATERIALS AND METHODS

A study was conducted in the NTR college of Veterinary college, Gannavaram, to evaluate the efficacy of supplementing Ayumin V5 and Ayumin to dairy herd in improving their productive and reproductive traits. A total of 36 cows were selected for the purpose of study, out of which 12 cows were lactating but poor yielders, another 12 of them repeat breeders, still another 12 were healthy cows. Group T0 (n=12) was kept as control having 4 animals from each subgroup, i.e. lactating but poor yielders, repeat breeders and healthy subgroup. Group T1 (n=12), having allotted 4 animals from each subgroup, was treated with Ayumin V at the rate of 30 g/day for 60 days along with standard basal diet. Group T2 (n=12), having allotted 4 animals from each subgroup, was treated with Ayumin at the rate of 30 g/day for 60 days along with standard basal diet. The CMPT test (Compton metabolic profile test) was carried out and serum levels of various macro and micro minerals were determined. Milk yield of all the three subgroups were also recorded. All the data obtained were analyzed as per standard statistical procedure **(Snedecor and Cohran, 1987).**

RESULTS AND DISCUSSION

Milk yield

The milk yield post treatment was found to be significantly higher in all the subgroups (Lactating and poor yielders, repeat breeders, healthy cows) of Ayumin V5 and Ayumin treated groups T1 and T2 as compared to the control group T0 (table 1). Deficiency of macro and micro minerals have a negative impact on milk yield. **(Bhanderi et al., 2016)**. The increase in the milk yield may be attributed to the increased availability of minerals in the diet thereby helping to meet the needs of dairy cow and improving milk yield.

Table 1. Milk yield of cows in the control and treated groups

	Milk yield (litres)					
	Lactating and poor yielders		Repeat Breeders		Healthy cows	
	Pre-Treatment	Post-Treatment	Pre-Treatment	Post Treatment	Pre-treatment	Post treatment
Group T0	2.5 ± 0.54	2.5 ± 0.57	3.17 ± 0.38	3.37 ± 0.12	6.5 ± 0.35	6.5 ± 0.20
Group T1	3.62 ± 0.23	7.12 ± 0.42	3.62 ± 0.23	7.37 ± 0.31	7.62 ± 0.23	9.12 ± 0.31
Group T2	4 ± 0.20	6.87 ± 0.23	3.5 ± 0.20	7.25 ± 0.14	7.62 ± 0.23	8.5 ± 0.35

Serum Calcium level

The serum calcium levels post treatment were found to be significantly higher in all the subgroups (Lactating and poor yielders, repeat breeders, healthy cows) of Ayumin V5 and Ayumin treated groups T1 and T2 as compared to the control group T0 (table 2). Similar reports also suggest that oral supplementation of mineral mixture help to raise serum calcium levels **(Mane *et al.*, 2014; Dawane *et al.*, 2010)** and ameliorate various signs of hypocalcemia **(Hansen *et al*, 2002)** thereby increasing milk yield **(Weiss, 2014)** and reproductive performance **(Phiri *et al.*, 2007).**

Table 2. Serum calcium level of cows in the control and treated groups

	Calcium (mg/dl)					
	Lactating and poor yielders		Repeat Breeders		Healthy cows	
	Pre-Treatment	Post-Treatment	Pre-Treatment	Post Treatment	Pre-treatment	Post treatment
Group T0	8.25 ± 0.22	8.25 ± 0.06	8.65 ± 0.18	8.55 ± 0.21	9.62 ± 0.15	9.8 ± 0.28
Group T1	8.45 ± 0.15	11.12 ± 0.31	8.65 ± 0.11	11.4 ± 0.38	9.92 ± 0.09	11.95 ± 0.20
Group T2	8.02 ± 0.08	10.17 ± 0.13	8.82 ± 0.18	10.47 ± 0.13	10.07 ± 0.19	11.15 ± 0.28

Serum Magnesium level

The serum magnesium levels post treatment were recorded to be significantly higher in all the subgroups (Lactating and poor yielders, repeat breeders, healthy cows) of AyuminV5 and Ayumin treated groups T1 and T2 in comparison to the control group T0 (table 3). The finding is in keeping with similar reports that have shown significant elevation in the serum magnesium level post supplementation with mineral mixture **(Edwards *et al.*, 2008**; **Sharma *et al.*, 2002)** thus culminating in improved reproductive performance **(Small *et al.*, 1997)** and increased milk yield **(Shimada, 1991).**

Table 3. Serum magnesium level of cows in the control and treated groups

	Magnesium (mg/dl)					
	Lactating and poor yielders		Repeat Breeders		Healthy cows	
	Pre-Treatment	Post-Treatment	Pre-Treatment	Post Treatment	Pre-treatment	Post treatment
Group T0	1.27 ± 0.14	1.25 ± 0.08	1.1 ± 0.12	1.3 ± 0.04	1.97 ± 0.08	1.85 ± 0.13
Group T1	1.02 ± 0.16	2.02 ± 0.07	0.87 ± 0.19	2.1 ± 0.17	1.9 ± 0.08	2.1 ± 0.08
Group T2	0.87 ± 0.11	1.95 ± 0.08	1.22 ± 0.16	1.95 ± 0.18	1.95 ± 0.06	2.02 ± 0.04

Serum Phosphorus Level

The serum phosphorus levels post treatment were recorded to be significantly higher in all the subgroups (Lactating and poor yielders, Repeat breeders, healthy cows) of Ayumin V5 and Ayumin treated groups T1 and T2 when compared to the control group T0 (table 4). Similar reports resembling the current study further corroborate the influence of mineral supplementation in augmenting the serum phosphorus level (Kirk and Davis, 1970; Espinoza et al., 1990) which in turn translate into better productivity (Kurek et al., 2009) and improved reproductive functions.

Table 4. Serum phosphorus level of cows in the control and treated groups

	Phosphorus (mg/dl)					
	Lactating and poor yielders		Repeat Breeders		Healthy cows	
	Pre-Treatment	Post-Treatment	Pre-Treatment	Post Treatment	Pre-treatment	Post treatment
Group T0	4.7 ± 0.24	4.42 ± 0.17	4.42 ± 0.25	4.75 ± 0.31	5.85 ± 0.06	5.77 ± 0.19
Group T1	5 ± 0.09	6.15 ± 0.13	4.75 ± 0.13	6.22 ± 0.21	5.9 ± 0.10	6.32 ± 0.17
Group T2	4.67 ± 0.22	6.32 ± 0.17	4.92 ± 0.20	6.27 ± 0.16	5.9 ± 0.08	6.45 ± 0.09

Serum Copper level

The serum copper levels post treatment were found to be significantly higher in all the subgroups (Lactating and poor yielders, Repeat breeders, healthy cows) of Ayumin V5 and Ayumin treated groups T1 and T2 when compared to the control group T0 (table 5). Perusal of reports show that that serum copper levels are elevated upon supplementation of mineral mixture **(Bagley, 1997)** and the benefits vis-à-vis production accruing thereof may be strongly attributed to proper mineral supplementation. **(Muehlenbein *et al*, 2001; Naylor et al., 1989)**.

Table 5. Serum copper level of cows in the control and treated groups

	Copper µg/dl					
	Lactating and poor yielders		Repeat Breeders		Healthy cows	
	Pre-Treatment	Post-Treatment	Pre-Treatment	Post Treatment	Pre-treatment	Post treatment
Group T0	42.75 ± 4.32	46 ± 4.14	33 ± 2.91	37 ± 1.68	62.75 ± 3.47	66.75 ± 4.26
Group T1	43.5 ± 3.66	76.25 ± 9.65	47.5 ± 4.19	88.25 ± 1.31	64.25 ± 3.32	96 ± 3.34
Group T2	49.25 ± 2.17	83.5 ± 10.85	46.25 ± 1.88	84.75 ± 5.64	65.5 ± 2.84	104.75 ± 6.27

Serum Iron level

The serum iron levels measured post treatment were significantly higher in all the subgroups (Lactating and poor yielders, repeat breeders, healthy cows) of Ayumin V5 and Ayumin treated groups T1 and T2 as compared to the control group T0 (table 6). There are reports which indicate that iron deficiency has been controlled with mineral supplementation (Gadberry et al., 2003) and serum levels brought closer to the normal range.

Table 6. Serum iron level of cows in the control and treated groups

	Iron µg/dl					
	Lactating and poor yielders		Repeat Breeders		Healthy cows	
	Pre-Treatment	Post-Treatment	Pre-Treatment	Post Treatment	Pre-treatment	Post treatment
Group T0	40.75 ± 0.62	47.25 ± 2.83	48 ± 2.27	48.75 ± 1.70	62.25 ± 2.28	67.25 ± 2.46
Group T1	41.25 ± 1.60	86.25 ± 6.57	53 ± 2.64	86.25 ± 2.28	57.5 ± 1.25	98 ± 4.77
Group T2	51 ± 2.27	82 ± 7.83	48.5 ± 1.32	85.25 ± 3.52	69.75 ± 2.49	112.25 ± 5.15

CONCLUSION

The milk yield was significantly higher in the Ayumin V5 and Ayumin treated groups post treatment as compared to the control. The Compton Metabolic profile test also showed that there was significant rise in the serum levels of various macro and micro minerals following oral supplementation with mineral mixture. Thus, it can be inferred that oral supplementation with mineral mixture can meet the requirement of minerals in dairy herd.

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REFERENCES

1. Arthington JD. Trace Mineral Nutrition and Immune Competence in Cattle. Range Cattle Research and Education Center University of Florida – Institute of Food and Agricultural Sciences, 2006.
2. Spears JW. Improving Cattle Health Through Trace Mineral Supplementation, North Carolina State University, 1995.

3. Bonnie AM, Cartwright S, Emam M, Fleming K, Gallo N, Hodgins D, Paibomesai M, Crispi KT, Lesperance LW. Genetic Selection of Cattle for Improved Immunity and Health. Advances in Dairy Technology. 2014; 26: 247 – 257.
4. Rowson A. Dairy cow immunity impacts reproductive performance. Phibro Animal Health Corporation, 2015.
5. Sales JNS, Pereira RVV, Bicalho RC, Baruselli PS. Effect of injectable copper, selenium, zinc and manganese on the pregnancy rate of crossbred heifers (Bos indicus × Bos taurus) synchronized for timed embryo transfer. Livestock Science. 2011; 142(1–3): 59–62.
6. Qian LC, Zou XT, Xu ZR, Xi S. Effect of various levels of iron on the reproductive performance and biochemical parameters of gestation cow. Chinese J. Vet. Sci. 2001; 21: 526-528.
7. Yasothai R. Importance of minerals on reproduction in dairy cattle. International Journal of Science, Environment and Technology. 2014; 3 (6) : 2051 – 2057.
8. Bhandari BM, Goswami A, Garg MR, Samanta S. Study on minerals status of dairy cows and their supplementation through area specific mineral mixture in the state of Jharkhand. J. Anim Sci. Technol. 2016; 58: 42.
9. Snedecor GW, Cochran WG. 1994. Statistical methods. 8th ed. IOWA: IOWA State University Press. 1-503.
10. Mane PM, Dhoble RL, Suryavansi PR, Gaikwad SM, Chaudhary RJ. Effect of mineral supplementation on serum calcium and phosphorus levels in pre and post- partum Marathwadi buffaloes. Intas polivet. 2014; 15 (1): 55-60.
11. Dawane SC, Mane PM, Chaudhari RJ, Nimase RG, Kadam DG. Effect of mineral supplementation on serum calcium and phosphorus level in red Kandhari cows. The Asian Journal of Animal Science. 2010; 5 (1): 74-77.
12. Hansen TT, Jorgensen RJ, Ostergaard S. Milk fever control principles: A review. Acta Vet Scand, 43(1): 1–19.
13. Weiss WP. Minerals and vitamins for dairy cows: magic bullets or just bullets? Department of Animal Sciences. Ohio Agricultural Research and Development Center. The Ohio State University.
14. Phiri EC, Nkya R, Pereka AE, Mgasa MN, Larsen T. 2007. The effects of calcium, phosphorus and zinc supplementation on reproductive performance of crossbred dairy cows in Tanzania. Trop Anim Health Prod. 2007; 39(5):317-23.
15. Edwards LJ, Clarke T, Hepworth G, Parker AJ. Physiological response to Magnesium supplementation in lactating dairy cows. Proc. Aust.Soc. Amin. Prod. 27: 64.
16. Sharma MC, Joshi C, Sarkar TK. Therapeutic efficacy of minerals supplement in macro-minerals deficient buffaloes and its effect on haematobiochemical profile and production. Asian-Aust. J. Anim. Sci. 2002; 15 (9): 1278-1287.
17. Small JA, Charmley E, Rodd AV, Fredeen AH. Serum mineral concentrations in relation to estrus and conception in beef heifers and cows fed conserved forage. Canadian Journal of Animal Science. 1997; 77: 55–62.
18. Shimada Y. Low milk fat syndrome and magnesium oxide supplementation. Magnes Res. 1991; 4(3-4):177-84.
19. Kirk WG, Davis GK. Blood Components of Range Cattle: Phosphorus, Calcium, Hemoglobin, and Hematocrit. Animal Scientist Emeritus, Range Cattle Experiment Station, Ona; and Animal Nutritionist, Animal Science Department, University of Florida, Gainesville, 1970.
20. Espinoza JE, McDowell LR, Wilkinson NS, Conrad JH, Martin FG, Williams SN. Effect of dietary phosphorus level on performance and mineral status of grazing cattle in a warm climate region of central Florida. University of Florida, Gainesville, 1990.
21. Kurek L, Lutnicki K, Banach A. Various types of hypophosphataemia in dairy cows and the clinical implications depending on the intensity of the deficiency. Bull Vet Inst Pulawy. 2010; 54: 35-41.
22. Bagley CV, Stenquist NJ, Worwood DR. Clinical trials with copper supplementation of cattle. Utah State university. Logan.
23. Muhleinbein EL, Brick DR, Duetscher GH, Carlson MP, Johnson AB. Effects of inorganic and organic copper supplemented to first-calf cows on cow reproduction and calf health and performance. J Anim Sci. 2001; 79 (7):1650-1659.
24. Naylor JM, Kasari TR, Blakley BR, Townsend HG. Diagnosis of copper deficiency and effects of supplementation in beef cows. Can J Vet Res. 1989 ; 53(3): 343–348.
25. Gadberry MS, Troxel TR, Davis GV. Blood Trace Mineral Concentrations of Cows and Heifers from Farms Enrolled in the Arkansas Beef Improvement Program. Arkansas Animal Science Department Report, University of Arkansas Cooperative Extension Service, Little Rock, 2003.