Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2020; 8(1): 1380-1383

Received: 24-11-2019
Accepted: 28-12-2019

Vivek Berwal
M.V.Sc Scholar, Department of Veterinary Pharmacology and Toxicology, LUVAS, Hisar, Haryana, India

Vasan Palaniswamy
Professor, Department of Animal Nutrition, Veterinary College and Research Institute, Namakkal, Tamil Nadu, India

Madhur
M.V.Sc Scholar, Department of Livestock Production Management, College of Veterinary Sciences, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar, Haryana, India

Sandeep Dhillod
Assistant Professor, Department of Livestock Production Management, College of Veterinary Sciences, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar, Haryana, India

Man Singh
Assistant Professor, Department of Livestock Production Management, College of Veterinary Sciences, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar, Haryana, India

Vishal Sharma
Assistant Professor, Department of Livestock Production Management, College of Veterinary Sciences, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar, Haryana, India

Narender Singh
Assistant Professor, Department of Livestock Production Management, College of Veterinary Sciences, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar, Haryana, India

Corresponding Author:
Vivek Berwal
M.V.Sc Scholar, Department of Veterinary Pharmacology and Toxicology, LUVAS, Hisar, Haryana, India

Study of the effect of anionic salt mixture to augment postpartum performance of dairy cows

Vivek Berwal, Vasan Palaniswamy, Madhur, Sandeep Dhillod, Man Singh, Vishal Sharma and Narender Singh

Abstract
The present investigation was undertaken to study the impact of anionic supplements on postpartum performance of dairy cows. Forty numbers of cross-bred dairy cows in their third lactation period were selected for the present study (control - 20 cows; Anionic salt supplementation – 20 cows). Reducing DCAD by increasing dietary acidity or employing anionic salts has been efficacious and cost effective in the prophylaxis of hypocalcaemia. The results of this study, based on the data available, suggest that DCAD has a significant effect on a variety of performance indicators including milk production, health status and reproductive performance. A sharp reduction in urinary pH was found after introduction of anionic mineral mix in trial group up to 21 days. A positive role for anionic mineral mixture intake between groups for reducing the risk of retained placenta was identified. A positive role for anionic mineral mixture intake between groups for increased milk yield was identified. Findings of this experiment suggest that feeding of anionic mineral mixture in prefresh period improves the performance of dairy cows with respect to their production and reproductive performance.

Keywords: anionic salt mixture, augment postpartum, dairy cows

Introduction
The art of feeding dairy cattle is rapidly becoming the basic and applied science of dairy cattle nutrition. Milk fever, a metabolic disease, and retention of placenta affects high producing dairy animals usually within one or two days after calving, resulting in a huge reduction in milk production and thus becomes economically most important. It is estimated that these diseases affect 3% to 8% of cows with some herds having prevalence as high as 25% to 30%. One of the major reasons for these diseases is low blood calcium. Incidence of milk fever and retention of placenta (ROP) is estimated to be between 4-5% in second lactation cows and increases with cow age. Economic losses due to medicines, veterinary services and reduced production exceed Rs. 400 per cow. Losses are also associated with increased incidence of secondary diseases, such as ketosis, mastitis, placenta, displacement of abomasum, uterine prolapse, limb injuries and pneumonia which can further inflate losses. Milk fever occurs in dairy cattle after calving because of low blood calcium levels as a result of calcium moving into milk. There are about 23 grams of calcium in 10 liters of colostrum and when this is added to the normal amount of calcium needed, the demand for calcium becomes greater than the supply in the blood. This causes the problem of milk fever, unless the cow can rapidly mobilize stored calcium in her body (e.g. in bones) to offset the situation. The transition from late gestation to lactation requires enormous physiological adaptations by the dairy cow, which can significantly affect the following lactation and subsequent reproduction. Nutrition management during the transition period is challenged by reduced DMI during the late gestation period coupled with a drastic increase in nutrient requirements following calving. One of the most significant challenges involves Ca homeostasis and can result in clinical or subclinical hypocalcaemia. Block (1984) [2] reported that cows experiencing clinical hypocalcaemia during the immediate periparturient period produced 14% less milk than cows with normal serum Ca concentrations. In addition to decreased milk yield, cows that experienced clinical or subclinical hypocalcaemia are at greater risk for developing other metabolic disorders (Curtis *et al*., 1985) [3]. Feeding negative DCAD diets prepartum stimulated Ca absorption and mobilization, thus preventing hypocalcaemia and maintained DMI and improved the post partum milk yield (Block, 1984) [2].

Roche (2003) [9] indicated that factors other than a high DCAD are probably more important in controlling milk fever because low levels of clinical cases of milk fever occurred in cows grazing pastures containing excess K (>4%). Once animal nutritionists began to test this hypothesis, mineral inter-relationships were found to affect numerous metabolic processes. Leach (1979) reviewed the related literatures and concluded that mineral inter-relationships had profound influences. They theorized that for an animal to maintain its acid-base homeostasis, input and output of acidity had to be maintained. It was shown that net acid intake was related to the difference between dietary cations and anions. The monovalent macromineral ions, Sodium (Na), Potassium (K) and Chlorine (Cl) were found to be the most influential elements in the expression for poultry and Na, K, Cl and Sulphur (S) were found to be the most influential elements in the expression for dairy cattle (Dishington, 1975) [4]. Since that time, several other minerals have been tested in various equations to verify that acid-base status is the major physiological event controlled by these minerals, or more specifically, acid-base status is regulated by hydrogen ion concentration in blood and affects the buffering capacity of blood or tissue.
Horst *et al*. (1994) reported that the addition of >300 mEq of anions/kg diet may reduce DMI. Joyce *et al*. (1997) reported depressed DMI in multiparous cows supplemented with 471 mEq anions/kg DM, whereas Moore *et al*. (2000) showed no decline in DMI for multiparous cows supplemented with 329 mEq anions/kg DM; however, prepartum DMI was lower for heifers supplemented 329 mEq anions/kg DM. In their meta-analysis
In this pretext, the present study was designed to alleviate the postpartum complications. Broad outline of this study is as following:

1. Calculation of DCAD Value of 100 grams of anionic mineral mixture (60% of $MgCl_2$& 40% $CaCl_2$) and the TMR to be given to the prefresh cattle group (21 days before calving).
2. Calculation of number of retention of placenta cases in control and treatment cows.
3. Total milk production for 1 month after calving in both control and treatment groups will be recorded.
4. Calculation of number of days open in both control and treatment group.

Materials and Methods

- Forty numbers of advance pregnant cross-bred dairy cows whose third lactation period yet to be started after calving were selected for the present study (control - 20 cows; Anionic salt supplementation – 20 cows) in Diya Farms, Rourkela.

Chemicals used were Magnesium Chloride hexahydrate ($MgCl_2.6H_20$) and Calcium Chloride dehydrate ($CaCl_2.2H_2O$). They were procured from Saife Vet med private limited. For analysis of Sodium, Potassium, Chlorine &Sulphur in mass percentage, samples of Compound feed, Silage and Straw were sent to Alpha Test House. Method Reference used for Sodium and Potassium Analysis was by Flame photometry, for Chlorine IS:7874(P-2)-1975 RA 2014 and for Sulphur IS:1664-2002 RA 2013. For Urine pH analysis, calibrated Urine pH meter was procured. For measuring of milk, calibrated jars were taken. Calculation of DCAD Value of 100 grams of anionic mineral mixture (60% of $MgCl_2$&40% $CaCl_2$) and the TMR to be given to the prefresh cattle group (21 days before calving).

Statistical analysis

Data were expressed as mean ± SE. Statistical analysis of data were performed using SPSS v16 software. Independent t-test was used.

Results and Discussion

DCAD value of TMR and anionic mineral mixture

Our objectives were to explore the effects of postpartum DCAD intake on metabolism, production and health as well as the potential for differences in intake of other macro minerals to influence responses to differences in DCAD intake. We hypothesized that reducing DCAD intake would improve Ca metabolism and postpartum performance. Dietary cation-anion difference has a role in animal productivity and health via its influence on the acid-base balance and calcium metabolism in the animal that often become 'broken' in dairy cows. Reducing DCAD by increasing dietary acidity or employing anionic salts has been efficacious and cost effective in the prophylaxis of hypocalcemia. High concentrations of dietary anionic salts cause an influx of negatively charged ions systemically, leading to increased hydrogen ion concentration to maintain electro neutrality. Increased hydrogen ion concentration induces a mild metabolic acidosis.
Dietary cation-anion difference (DCAD) typically includes two cations [potassium (K) and sodium (Na)] and two anions [chlorine (Cl) and sulfur (S)]. The DCAD equation most often applied in the field equals: milli equivalents (mEq) [(%K divided by 0.039) + (%Na divided by 0.023)] – [(% Cl divided by 0.0355) + (%S divided by 0.016)]/100 grams of dietary dry matter (DM). Considerable research and field application of the DCAD concept have occurred in the last two decades (NRC, 2001). Physiologically, DCAD influences the animal's acid-base homeostasis, Ca status around calving and mineral element utilization. Much of the early work addressed the effects of DCAD on Ca status and metabolic health of late pregnant, transition cows (NRC, 2001; Goff and Horst, 1997) [5].
The primary goal in late pregnancy is to provide a ration with a low (less than +5 mEq/100 grams of dietary DM) or negative DCAD to reduce the risk of hypocalcemia (low blood Ca) and clinical milk fever around the time of calving. Minimizing the incidence of hypocalcemia and milk fever reduces the incidence of other associated metabolic disorders such as retained fetal membrane, abomasal displacement and metritis. In many cases, simply using feedstuffs with lower concentrations of K and Na will lower DCAD enough to improve transition cow performance. This also may reduce udder oedema. When it is not possible to reduce dietary K and Na significantly, supplementation with anions (chlorides and sulfate) will reduce DCAD. A target DCAD of -5 to -10 mEq may improve transition cow health and performance.

Table 1: Calculation of DCAD value of TMR

S. No.	Ingredients	Prefresh cow ration-kg/day	Sodium (%)	Potassium (%)	Chlorine (%)	Sulphur (%)	DCAD value (mEq/100g)	Total DCAD (mEq)
1.	Concentrate feed	4	0.04	1.24	0.05	0.11	25.25	1010
2.	Silage	22	0.02	1.15	0.31	0.14	12.87	2831.4
3.	Wheat straw	1	0.03	1.88	0.16	0.24	30.0	300
4.	Total TMR DCAD value/cow	27						4141.4

Table 2: Calculation of DCAD value of Anionic mineral mix

S. No.	Salt	Molecular weight	Sodium (%)	Potassium (%)	Chlorine (%)	Sulphur (%)	DCAD value (mEq/100g)
1.	$MgCl_2$.6H20	203.3			30.47		-858.31
2.	$CaCl_2$.2H2O	147.0146			48.28		-1360.0
3.	Anionic mineral mixture of 60% $MgCl_2$.6 H20 and 40% $CaCl_2$.2H2O				37.594		**-1058.986**

N = Number; Significant ($p \leq 0.05$) = *; Significant ($p \leq 0.01$) = **

Phase 2 (After Calving)

Table 3: No. of ROP cases

Groups	No. of ROP cases
Anionic mineral mixture	**1**
Control Group	**4**

Retention of placenta cases in control and treatment cows

More cases of retention of placenta were found in control group as compared to treatment group. Retained placenta (RP) creates a number of problems following pulling of microorganisms into the uterus causing its inflammation, decreased milk yield, longer calving intervals, reduction of fertility, longer calving interval and reduced conception rate. RP causes great economic losses, mainly due to decreased milk yield and infertility. Vitamin and mineral deficiencies such as selenium, vitamin E, vitamin A, B-carotene and disturbed Ca/P ratio can impair general immunity and may alter the competence of cellular self-defense mechanism and can increase the risk for placental retention and metritis. Supplementation with balanced vitamin and anionic mineral mixture in pre-partum period is considered a prophylactic step to avoid fetal membrane retention. A positive role for anionic mineral mixture intake between groups for reducing the risk of retained placenta was identified (Lean *et al*., 2019).

Table 4: Total milk production in both the groups

	Anionic mineral mixture (Mean± SE) (N = 30)	Control Group (Mean± SE) (N = 30)	p value
Milk Production	654.23 ± 11.79**	586.95 ± 9.82	0.000045

N = Number; Significant ($p \leq 0.05$) = *; Significant ($p \leq 0.01$) = **

Total milk production for 1 month after calving in both control and treatment groups

More milk yield was recorded in first 30 days in the treatment group as compared to control group. A significant ($p \leq 0.01$) increase in milk production was found in treatment group as compared to control group. Prepartum diets influence the performance of cow for weeks to months postpartum. This observation leads to questions about milk yield and physiological and health responses to diets with negative dietary cation-anion difference (DCAD). A positive role for anionic mineral mixture intake between groups for increased milk yield was identified (Lean *et al*., 2019). The result of this study suggests that DCAD has significant effects on milk production in lactating dairy cows. Results indicated that feeding of anionic mineral mixture could improve milk production potential of dairy cows due to its impact on the milk producing cells in the udder. Their micro and macro element contribute to the working of mammary cell to enhance their production.

Table 5: No. of days open in both the groups

	Anionic mineral mixture (Mean± SE) (N = 20)	Control Group (Mean± SE) (N = 20)	P value
No. of days open	55.95 ± 2.94^{NS}	59.15 ± 3.43	0.327

No. of days open in both control and treatment group

No. of open days in treatment group was less as compared to the control group. Mineral mixture fed group had edge on control group with respect to reproductive efficiency. Findings of this experiment suggest that continuous feeding of anionic mineral mixture improved the performance of dairy cows with respect to their production and reproductive performance.

Acknowledgement

The author is greatly indebted to Department of Animal Nutrition, Veterinary College and Research Institute, Namakkal for his expert guidance, valuable suggestions, constructive criticism and support for the successful completion of this study

Conclusion

The results of this study clearly showed the role of DCAD in regulating milk production and acid-base balance. Supplementation of diets in the prepartum with anionic salt mixture at a sufficient rate to decrease DCAD may benefit the blood calcium homeostasis and increased the total milk yield, improved the reproductive performance and also improved the health status. In conclusion, feeding negative DCAD in late gestation period improved the performance and productivity of dairy cows.

References

1. Block E. Anion-cation balance and its effect on the performance of ruminants. Recent Advances in Animal Nutrition. 1991, 163-176.
2. Block E. Manipulating dietary anions and cations for prepartum dairy cows to reduce incidence of milk fever. Journal of Dairy Science. 1984; 67:2939-2948.
3. Curtis CR, HN Erb, Sniffen CJ, Smith RD. Epidemiology of parturient paresis: predisposing factors with emphasis on dry cow feeding and management. Journal of Dairy

Science. 1984; 67:817-825.
4. Dishington IW. Prevention of milk fever (hypocalcemic paresis puerperalis) by dietary salt supplements. Acta Veterinaria Scandinavia. 1975; 16:503-512.
5. Goff JP, Horst RL. Effects of the addition of potassium or sodium, but not calcium, to prepartum rations on milk fever in dairy cows. Journal of Dairy Science. 1997; 80:176-186.
6. Goff JP, Horst RL. Role of acid-base physiology on the pathogenesis of parturient hypocalcaemia (milk fever) - the DCAD theory in principal and practice. Acta Veterinaria Scandinavia Suppl. 2003; 97:51-56.
7. Horst RL, Goff JP, Reinhardt TA, DR. Buxton. Strategies for preventing milk fever in dairy cattle. Journal of Dairy Science. 1997; 80:1269-1280.
8. Lunn DP, McGuirk SM. Renal regulation of electrolyte and acid-base balance in ruminants. Veterinary Clinics of North America, Food Animal Practice. 1990; 6:1-28.
9. Roche JR. The incidence and control of hypocalcaemia in pasture-based systems. Acta Veterinaria Scandinavia Suppl. 2003; 97:141-144.