Journal of Animal Research: v.6 n.5, p. 915-919. October 2016

DOI: 10.5958/2277-940X.2016.00119.4

Effect of Free Choice Salt and Mineral Licks Supplementation on Milk Production and Blood Biochemical Parameters in Crossbred Cows

R.S. Grewal[1], J.S. Lamba[1], C.S. Ahuja[2], Sushma Chhabra[3], Simarjit Kaur[4] and Jasmine Kaur[1]*

[1]*Department of Animal Nutrition, College of Veterinary Sciences, GADVASU, Ludhiana, INDIA*
[2]*Department of Veterinary Physiology and Biochemistry, GADVASU, Ludhiana, INDIA*
[3]*Department of Veterinary Medicine, GADVASU, Ludhiana, INDIA*
[4]*Department of Animal Genetics & Breeding, GADVASU., Ludhiana, INDIA*

**Corresponding author: J Kaur; Email: sachdeva_jasmine@rediffmail.com*

Received: 19 May, 2016 **Accepted:** 08 August, 2016

ABSTRACT

The present study was conducted to determine the effect of free choice salt and mineral licks on dry matter intake, milk yield, milk composition, blood biochemical parameters and micromineral profile in crossbred cows. Twenty four lactating Holstein Friesian crossbred cows were randomly distributed in 3 groups of 8 animals each based on milk yield. The cows in control group were fed basal ration to meet their nutrient requirements while tradition universal multi blocks and tradition fertility blocks/licks provided by Akzo Nobel were supplemented free choice in multi and fertility groups, respectively in addition to basal diet. The duration of the study was 120 days. The mean dry matter (DM) intake was similar in all the groups. The free choice multi and fertility licks increased the milk yield by 2 kg per cow per day as compared to control group where as multi lick also improved the milk fat and protein content. The control group had a lower persistency of milk yield during the experimental period as compared to multi and fertility groups. Supplementation of free choice multi and fertility licks did not affect levels of blood biochemical profile and monitored plasma micromineral content of crossbred cows.

Keywords: Blood parameters, Holstein Friesian, micromineral content, milk yield, salt, mineral licks

Dairy producers require salt and trace mineral products that are palatable and canefficiently deliver consistent nutrition to their cattle. A salt lick is a deposit of mineral salts used by animals to supplement their nutrition, ensuring that they get enough minerals in their diets. Salt licks can help increase feed intake, resulting in improved milk production. Requirements for specific nutrients such as Na, K and Mg increases during thermal stress compared to thermo neutral conditions. Requirements for specific nutrients such as Na, K and Mg increases during thermal stress compared to ther moneutral conditions. At environmental temperature of 40°C, there is a 28-fold increase in the urinary excretion of potassium compared to cows maintained at 15°C (Flamenbaum *et al.*, 1995). Therefore, in tropical conditions the microelement deficiencies in dairy cattle are quite common and frequent. Therefore, in tropical conditions the microelement deficiencies in dairy cattle are quite common and frequent. Ruminant nutrition uses several methods and forms to supplement microelements. As scanty information is available on offering salt licks to dairy cows under tropical conditions, a study was conducted with the objective to explore the potential of commercial salt and mineral licks as dietary supplement on the dry matter intake, production performance and health of dairy cows.

MATERIALS AND METHODS

Experimental animals and treatments

Twenty four lactating Holstein Friesian crossbred cows between 0-60 days in milk were selected from Livestock Farm of College of Veterinary Sciences, Guru Angad Dev Veterinary and Animal Sciences, Ludhiana, India and randomly distributed into three groups of 8 animals each namely control, multi and fertility, respectively. The average milk yield measured between day 7 and 21 after parturition was taken as basis while allocating the animals to the above mentioned treatment groups. The duration of the study was 120 days. The nutrient requirements of cows in all the groups were met by feeding a total mixed ration (TMR) composed of oat silage and concentrate mixture (NRC, 2001). The concentrate mixture fed to the cows contained 30 percent maize, 25 per cent mustard cake, 10 per cent soybean meal, 15 per cent wheat bran, 4 per cent cotton seed, 13 per cent deoiled rice bran, 2 per cent mineral mixture and 1 per cent common salt. The basic diet fed to all the groups was similar as described above with the difference in the type of blocks offered *viz.*no block (control group), tradition universal multi block (multi group) containing common salt fortified with trace elements like zinc, iodine, magnesium and iron and tradition fertility block (fertility group) containing iodine, organic selenium and vitamin Eprovided by Akzo Nobel. The cows were housed in a loose housing system and offered TMR in the morning and evening. Clean and fresh water was available free choice to all the cows. For the multi and fertility treatment groups, the respective licks of 10 kg each were hanged above the manger at 4' from ground.

DM intake of each group was recorded daily and salt lick intake of treatment groups *viz.* multi and fertility groups was measured at weekly intervals. Body weight of the cows of all the groups was recorded at monthly interval and feed offered was adjusted accordingly. The feedstuffs were analyzed for proximate constituents (AOAC, 2005) and fibre fractions (Van Soest *et al.*, 1991). The metabolizable energy of the diet was estimated by *in-vitro* gas production technique (Menke and Steingass, 1988). Milk yield was recorded twice daily in the milking parlour with auto milk recording system and milk composition *viz.* fat, SNF, protein and lactose was recorded monthly using Lactoscan. Blood samples were collected at 0 day (before start of experiment) and at 120 day (at the end) in heparinised vacutainer tubes from jugular vein before feeding and watering in the morning. Immediately after collection, blood samples were centrifuged at 1200xg for 20 min to separate plasma. Alanine amino-transferase (ALT), Aspartate amino-transferase (AST), gamma-glutamyltransferase (GGT) activity, glucose, total protein, cholesterol, blood urea nitrogen (BUN), creatinine and bilirubin were determined using Siemens Autopak kit (Siemens Healthcare Diagnostics Ltd.) on semi-automatic chemistry analyser (RA 50). For micro minerals estimation in blood samples, the modified method of EPA (2001) was followed for digestion of sample using 10 ml of tri acid mixture (HNO_3: $HClO_4$: H_2SO_4 in 3:2:1) followed by atomic absorption spectrophotometer (Hitachi Model Z-5000 Series) for estimation of minerals (AAS, 1988).

Statistical analysis

Data were subjected to analysis of variance (Snedecor and Cochran, 1994) and the differences in means were tested by Tukey's honestly significant difference test (Tukey, 1949), using statistical software package (SPSS version 20, 2012).

RESULTS AND DISCUSSION

The chemical composition of concentrate mixture, oat silage and TMR's offered to cows of all the groups is shown in Table 1.

Table 1: Chemical composition (% DM basis) of experimental feeds

Parameter	TMR	Concentrate mixture	Oat silage
CP	12.6	18.57	8.1
Total ash	10.0	13.4	9.45
EE	4.35	4.60	3.24
NDF	55.1	38.4	64.7
ADF	30.8	13.8	25.8
ME, MJ/kg DM	7.29	9.34	8.7

CP-crude protein, EE- ether extract, NDF-neutral detergent fibre, ADF-acid detergent fibre, ME-metabolizable energy

In all three groups, the DM intake was lowest during second and third month of the experiment which might be due to hot and humid climate during this period (Table 2). However, the DM intake was similar among the three groups over the experimental period. The average intake of lick over entire period was 4.59 g/cow/d in multi and 4.15 g/cow/d in fertility group and the difference was non-significant.

Table 2: Monthly average DM intake and lick intake of experimental cows

Month	Control	Multi	Fertility	SEM
M-1	16.34	16.94	16.61	0.30
M-2	11.78	12.04	11.24	0.31
M-3	10.65	9.88	9.47	0.30
M-4	13.71	13.04	13.47	0.22
Mean DM intake (kg/d)	13.12	13.00	12.70	0.25
Mean lick intake (g/d)	—	4.59	4.15	0.35

The data on body weight change revealed that during first and second month of the trial, the cows lost body weight which might be due to mobilization of body reserves during early lactation (Table 3). During third month of the trial, the cows in all the groups started gaining body weight. The DM intake from third month through fourth month was on an ascending trend,that is why, the animals started gaining weight. In fourth month, the body weight gain was higher (P<0.05) in multi group followed by that in fertility and control groups. Similar findings were obtained by Hossain *et al.* (1995) on supplementing urea molasses blocks to sheep that resulted in significantly higher average daily live weight gain in sheep.

Table 3: Effect of block supplementation on the monthly average body weight change (kg)

Month	Control	Multi	Fertility	SEM
M-1	-38.33	-39.33	-20.0	5.05
M-2	-20.83	1.00	-10.83	5.66
M-3	27.50	23.00	32.50	4.61
M-4	1.67^{a}	20.00^{c}	6.67^{b}	3.48
Initial body weight	493	504	489	6.57
Final body weight	495^{a}	523^{c}	503^{b}	5.88

Means with different superscripts in a row differ significantly (P<0.05); M=Month

The weekly milk production of cows in the three groups is given in table 4. The milk yield was similar among the three groups over 120 days experimental period except during 8th week of the study, when the milk production was significantly (P<0.05) higher in multi and fertility groups as compared to control group. Righi *et al.* (2016) also reported that the use of free choice energetic mineral vitamin licks during dry and transition cows can improve early lactation cows performance. Onjoro *et al.* (2006) investigated the effects of mineral supplementation on the milk yield of free-ranging Somali camels and found that mineral supplementation (high cobalt and phosphorus) resulted in significantly higher milk yield in camels. The feed efficiency is statistically similar in all the groups. The control group had a lower persistency of milk yield during the experimental period as compared to multi and fertility groups (Fig. 1). The trend line in Fig. 1 is the indicator of persistency. The lactation curve (Fig. 1) showed a little upward trend, especially for the multi and fertility groups, towards the end of the experiment which might be due to fall in environmental temperature towards the end of the experiment. Environmental temperature could be one reason for this.

Table 4: Effect of block supplementation on the weekly milk production (kg/d)

Week	Control	Multi	Fertility	SEM
0	15.6	15.72	16.02	1.15
1	15.5	15.98	16.10	1.11
2	16.88	16.36	18.82	0.802
3	15.80	16.96	18.56	0.66
4	15.58	17.37	17.02	0.73
5	16.50	18.33	19.85	0.697
6	16.12	17.35	17.66	0.730
7	15.91	17.15	17.30	0.62
8	13.86^{a}	16.27^{b}	17.03^{b}	0.64
9	14.01	16.22	16.87	0.67
10	14.23	14.28	16.64	0.80
11	14.03	16.06	16.55	0.76
12	14.56	14.80	15.70	0.76
13	14.58	15.95	15.97	0.75
14	14.06	15.46	15.97	0.75
15	13.03	15.88	16.52	0.80
16	12.22	15.52	16.18	0.82
17	13.25	15.92	16.28	0.90
Feed efficiency (kg milk/kg DMI)	1.25	1.33	1.39	0.029

Means with different superscripts in a row differ significantly (P<0.05)

The average milk yield in multi and fertility groups was significantly (P<0.05) higher than control group. On an average, cows in control group produced 2 kg less milk than cows in the multi and fertility groups. The effect of block supplementation on the milk composition revealed that multi group had significantly (P<0.05) higher fat and protein content as compared to control and fertility groups (Table 5). The reason may be the supplementation of limiting nutrients in the form of block. The SNF content of multi group was significantly (P<0.05) higher than fertility group, however, it was similar to that of control group. There was no difference in lactose content among the three groups.

Table 5: Effect of block supplementation on milk yield*and milk composition

Parameters	Control	Multi	Fertility	SEM
Milk yield (kg/d)	14.70[a]	16.62[b]	16.88[b]	1.17
Fat (%)	3.91[a]	4.07[b]	3.69[a]	0.036
SNF (%)	8.34 [b]	8.56 [b]	8.27 [a]	0.031
Protein (%)	3.07 [a]	3.16 [b]	3.05[a]	0.013
Lactose (%)	4.82	4.87	4.80	0.026

Means with different superscripts in a row differ significantly (P<0.05); *120 days experimental period

The blood biochemical constituents of cows in the beginning and at the end of the experiment were similar in all the groups (Table 6) except the ALT levels which were significantly (P<0.05) low in multi group. This might be due to availability of micro mineral for metabolism. Glucose level was significantly higher (P<0.05) in fertility group as compared to multi group but it was similar to that of control group. The higher glucose level might be due to better liver function in fertility group as indicated by the level of liver function enzymes. However, the values of all the blood metabolites were within the normal physiological range.

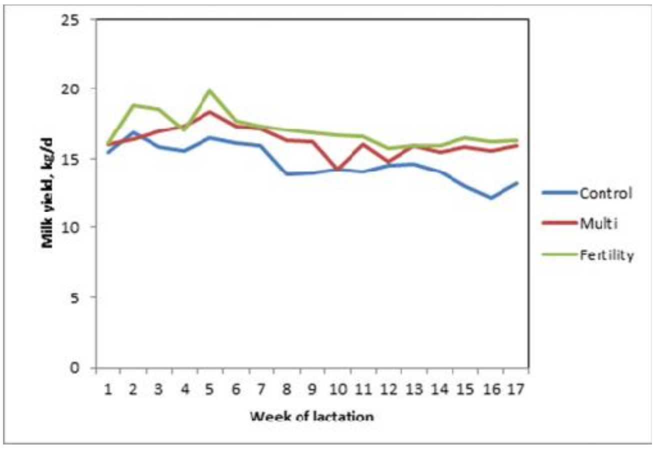

Fig. 1. Milk production (kg/d) of experimental groups over the trial period

The plasma micro mineral levels were similar in all the groups before start of experiment (Table 7). Post treatment data showed no significant difference in plasma copper, zinc, and manganese content except the cobalt content which was significantly higher (P<0.05) in multi group as compared to control and fertility group. The levels of

Table 6: Effect of block supplementation on blood biochemical parameters

Parameter	0 day				120 day			
	Control	Multi	Fertility	SEM	Control	Multi	Fertility	SEM
Glucose, mg/dl	51.82	49.68	51.76	1.06	49.96[ab]	47.17[a]	59.46[b]	2.23
Total protein, mg/dl	7.02	7.28	7.08	0.14	7.00	6.47	7.10	0.18
Cholesterol, mg/dl	122.17	139.98	135.73	3.14	115.06	123.25	129.16	3.37
BUN, mg/dl	15.77	16.50	15.25	0.67	18.93	17.15	20.20	0.87
Creatinine, mg/dl	0.86	0.89	0.93	0.032	0.88	0.83	0.98	0.039
Bilirubin, mg/dl	0.78	0.75	0.77	0.037	0.77	0.77	0.85	0.057
AST, IU/l	52.50	55.20	53.50	2.17	57.33	52.25	44.67	2.29
ALT, IU/l	21.50	25.20	22.00	1.21	27.00[b]	19.50[a]	24.67[b]	1.23
GGT, IU/l	12.75	16.80	18.00	1.09	18.67	21.25	14.67	1.46

Means with different superscripts in a row differ significantly (P<0.05)

Table 7: Effect of block supplementation on plasma mineral profile

Parameters	0 day				120 day			
	Control	Multi	Fertility	SEM	Control	Multi	Fertility	SEM
Cu (ppm)	0.227	0.195	0.0814	0.053	0.223	0.602	0.186	0.083
Zn (ppm)	1.38	1.77	1.02	0.168	1.75	1.958	1.99	0.257
Co (ppm)	0.0204	0.0403	0.0538	0.0086	0.0256[a]	0.089[b]	0.029[a]	0.0149
Mn (ppm)	0.791	1.076	0.838	0.113	0.817	1.45	1.468	0.2087

Means with different superscripts in a row differ significantly ($P<0.05$)

minerals did not vary significantly post treatment due to homeostatic mechanisms in the body which do not allow appreciable increase in mineral content if the animals are not in mineral deficient state. The present results are in agreement with those of Krys *et al.* (2009) who concluded that mineral lick feeding did not result in evidential increase in concentration of micro-elements in the cows' blood.

CONCLUSION

In this study, it was seen that free choicemulti and fertilitylicks boosted the milk yield by 2 kg per cow per day where as multi lick also improved the milk fat and protein content. The blood micromineral content did not vary among different groups and blood biochemical profile was also within the normal physiological range on lick supplementation. The salt licks, both multi and fertility, were useful in crossbred cows under hot humid climate to maintain their milk production resulting in better persistency.

ACKNOWLEDGEMENTS

Funding provided by AkzoNobel, India Ltd. is duly acknowledged.

REFERENCES

AAS, 1988. Philips Scientific Atomic absorption Data Book. 5th ed. Philips Scientific, York Street, Cambridge CBI 2PX, England.

AOAC, 2005. Official Methods of Analysis. Association of Official Analytical Chemists. 18th ed. Washington, D.C, USA.

E.P.A. (U.S.), 2001. Method-1631, Development of digestion procedures for determination of mercury in solid and semisolid samples, Frontier Geosciences, available from EPA sample control centre DYN Crop I & ET, Alexandria, VA 22304 (703-461-2100., scc@dyncorp.com).

Flamenbaum, I., Wolfenson, D., Kunz, P.L., Maman, M. and Berman, A. 1995. Interactions between body condition at calving and cooling of dairy cows during lactation in summer. *J. Dairy Sci.*,**78:** 2221-2229.

Hossain, K.B., Sarker, N.R., Saadullah, M., Beg, MA.H. and Khan, T.M. 1995. Effect of feeding straw supplementing with urea molasses block lick on the performance of sheep. *Asian-Australas. J. Anim. Sci*., **8(3)**: 289–293.

Krys, S., Lokajova, E., Podhorsky, A. and Pavlata, L. 2009. Microelement supplementation in dairy cows by mineral lick. *Acta Veterinaria Brno.*,**78(1):** 29-36.

Menke, K.H. and Steingass, H. 1988. Estimation of the energetic feed value obtained from chemical analysis and *in-vitro* gas production using rumen fluid. *Anim. Res. Dev.,* **28**: 7−55.

NRC, 2001. Nutrient requirements of dairy cattle, seventh revised ed. National Research Council, National Academy press, Washington, DC.

Onjoro, P.A., Njoka-Njiru, E.N., Ottaro, J.M., Simon, A. and Schwartz, H. J. 2006. Effects of mineral supplementation on milk yield of free-ranging camels (Camelusdromedarius) in Northern Kenya. *Asian-Australas. J. Anim. Sci*., **19(11):** 1597 – 1602.

Righi, F., Simoni, M., Malacarne, M., Summer, A., Constantini, E. and Quarantelli, A. 2016. Feeding a free choice energetic mineral-vitamin supplement to dry and transition cows: effects on health and early lactation performance. *Large Anim. Rev.,* **22:** 1-10.

Snedecor, G.W. and Cochran, W.G. 1994. Statistical Methods. 7th ed. The Iowa State University Press, Ames, Iowa, USA.

SPSS, 2012. Statistical Packages for Social Sciences. IBM SPSS 20 Statistics.

Tukey, J.W. 1949. Comparing individual means in the analysis of variance. *Biometrics*., **5 (2):** 99-114.

Van Soest, P.J., Robertson, J.B. and Lewis, B.A. 1991. Methods for dietary fiber, neutral detergent fiber andnon starch polysaccharides in relation to animal nutrition. *J. Dairy Sci.*, **74:** 3583-3597.