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Effect of different milk feeding strategies on growth, feed-efficiency, blood immunoglobulin level and disease incidence of crossbred calves

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Bovine neonates are subjected to a number of severe maladies just after birth, and over 75% of deaths in calves occur during the first month of neonatal life (Sampath 1989). Sharma *et al.* (1975) observed highest mortality in calves below 1 month of age at the NDRI, Karnal. Feeding probiotic to calves increased feed intake, improve feed conversion efficiency and health status (Malik 1993, Roth *et al.* 1998, Stohlein 2003, Kamra and Pathak 2005). Fermented milk products like, *dahi* (sour whole milk) are believed to have beneficial effects for humans as well as livestock due to the high concentration of lactobacilli that they contain. Natural suckling is the desired method of colostrum intake in calves and a slow intake of milk by suckling stimulates the secretion of saliva in the young calf. The present experiment was conducted to evaluate a number of different milk feeding strategies in young crossbred calves.

Crossbred calves (25) maintained at the Livestock Research Farm of National Dairy Research Institute, Karnal (Haryana), were randomly allotted to one of five treatment groups with 5 calves in each group. Control was the prevailing feeding practice followed in the institute dairy farm which involved hand feeding of respective dam's colostrum for 5 days followed by whole milk @ 1/10th of their body weight up to 1 month and a combination of whole and skimmed milk supplemented with concentrate mixture thereafter. Experimental treatments included, feeding probiotic (Lactobacillus @ 20 million cfu) supplemented whole milk (T_1); feeding of sour milk (*dahi*) diluted with milk (1:1) (T_2); feeding of pooled diluted surplus colostrum (T_3); and suckling their dams for first 5 days followed by control feeding (T_4). However, dam's colostrum was fed manually for first 5 days to calves in treatments T_1 to T_3.

During the 84 day experiment, the body weights of all the calves were recorded weekly in the morning before offering feed to the calves. Birth weight was also taken just after birth prior to feeding colostrum. The samples of whole milk, diluted colostrum and skim milk were collected at weekly interval and the pooled samples were subjected to tests for their protein, fat, SNF, total solids and lactose content. On the basis of these readings, the energy content, TDN content, DCP content, and DM content were calculated as described by Brody (1945). The DM, DCP and TDN content of concentrate and green fodder was also estimated.

Blood samples were drawn from the calves 4 times (on 7th, 26th 36th and 56th day of age) during the experimental period to assess the immunological status of the calves. Zinc sulphate turbidity test (McEwan *et al.* 1970) was used for the estimation of immunoglobulin status in the serum. The occurrence of diarrhoea and other health disorders along with their duration was also recorded for each group.

The trends in body weight gain during different periods as well as for the overall experimental period indicated that during the initial 4 weeks of experiment, the weight gain (kg) was highest in T_2 (5.10±0.93), followed by T_4 (4.10±1.76), T_1 (3.70±3.27), control (3.00±1.55) and T_3 (2.700±1.18). However, the feeding treatments did not have significant effect on the live weight gain. The lack of initial progressive growth in T_3 group, in which the calves were fed supplemental colostrum, may be, due to the fact that some calves from this group were initially prone to diarrhoea, which affected their growth during the early adaptation period. The growth rate picked up later on as the calves recovered quickly and the favourable residual effects of the colostrum supplementation continued in the calves. The growth rate under colostrum supplemented group (T_3) was very good in the subsequent period as also for the overall experimental period as compared to other treatment groups as reflected in higher average daily gain obtained in this group (0.38±0.027g/d). The average daily gains (g/d) in the other four treatment groups being: 0.25±2.602 (Control), 0.371±0.032 (T_1), 0.37±0.032 (T_2) and 0.329±0.047 (T_4). Evidently, the favourable effect of the colostrum supplementation during early period (initial 4 weeks) continued till the end of the experimental period. A higher body wt gain in calves fed surplus colostrum was also

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reported by many workers (Keys *et al.* 1980. Nagpaul 1982, Daniele *et al.* 1994).

The calves in treatment group T_1, which were given probiotics supplementation also registered higher growth rate *vis-à-vis*, control group. These calves also grew slowly during the initial weeks but gained an average of 0.371 g/d over the experimental period. These results suggest that the probiotics may have had residual effects on performance that extended throughout the feeding period. Reports are available regarding the advantageous effect of feeding probiotic in calves (Cole *et al.* 1992, Malik 1993, Pandey and Agrawal 2001, Stohlein 2003, Kamra and Pathak 2005). Sour milk (*dahi*) supplemented calves (T_2) also registered average daily gains (0.370 g/d) similar to the calves supplemented with probiotics and appreciably better than the control. The growth rate of calves in limited suckling groups (T_4) was also appreciably better than control (0.329 v/s 0.250 g/d). Available literature also suggests advantages of feeding soured milk and whole milk feeding (Keith *et al.* 1983) as well as suckling for limited period (Skvruk *et al.* 1984, Ferreira *et al. 1996*)

Feed conversion Efficiency

The average gross efficiency of energy conversion for the overall treatment period was lowest in control and highest in T_3 (Table 1). The DM required per kg gain in live weight during the same period averaged 2.888±0.421, 2.080±0.117, 2.252±0.173, 2.096±0.119 and 2.482±0.336 in C, T_1, T_2, T_3 and T_4 groups, respectively. The TDN intake per kg gain in live body weight in corresponding treatment averaged 2.524±0.152, 1.968±0.133, 2.184±0.045, 1.742±0.087 and 2.192±0.185, respectively. Intakes of average DCP per kg gain in body weight was highest in control and lowest in T_3. However, treatment effect did not reach the significant proportions. Several workers reported higher average daily gain and better feed conversion efficiency in calves fed acidified colostrum than milk replacer fed calves (Habunchong 1978, Nagpaul 1982). Feeding of probiotic is another means to improve feed conversion efficiency which is reported by many workers and corresponds to the result of the present investigation (Roth *et al.* 1998, Smekalov and Anisova, 1995 and Malik *et al.* 1998, Stohlein 2003.

Blood immunoglobulin profile

A wide variation of Ig concentration in sera of calves was observed. The comparison of average concentration of Ig (mg/ml) in sera of calves under different treatments revealed that the maximum Ig concentration of 97.17 mg/ml and 105.00 mg/ml was obtained on 7th and 56th day respectively in treatment group T_4, wherein calves were allowed limited suckling for first 5 days of life, whereas on 21st and 36th day, mean Ig concentration was highest (92.23 mg/ml and

Table 1. Mean and standard errors of gross efficiency, DM, DCP and TDN intake per kg gain in live weight of crossbred calves under different feeding schedule

Treatments	Gross Efficiency (%) Live Weight (kg)	DM Intake/kg Gain in Live Weight (kg)	DCP Intake/kg Gain in Live Weight (kg)	TDN Intake/kg Gain in
C	22.038±1.308	2.888±0.421	0.616±0.091	2.524±0.152
T_1	28.420±1.895	2.080±0.117	0.442±0.027	1.968±0.133
T_2	25.104±0.555	2.252±0.173	0.460±0.027	2.184±0.045
T_3	31.812±1.552	2.096±0.119	0.430±0.025	1.742±0.087
T_4	25.032±2.401	2.482±0.336	0.514±0.056	2.192±0.185

Table 2. Range and average Ig level (mg/ml) in serum of calves at different ages under treatment groups. (Figures in parentheses indicate average Ig level)

Treatments	No. of Calves	Ig Level (mg/ml)			
		Day 7	Day 21	Day 36	Day 56
C	5	37.92–114.16 (75.76)	39.59–74.06 (66.14)	51.25–83.38 (60.96)	47.23–113.71 (74.93)
T_1	5	57.99–133.99 (92.88)	79.3–100.42 (89.98)	66.52–123.03 (84.58)	84.64–121.95 (92.86)
T_2	5	64.53–119.05 (90.97)	64.11–122.35 (84.44)	46.15–79.73 (70.03)	63.67–128.37 (86.91)
T_3	5	46.49–157.20 (93.90)	66.84–126.75 (92.23)	83.32–107.79 (92.40)	68.58–105.72 (82.22)
T_4	5	42.34–128.76 (97.17)	30.68–133.59 (82.40)	45.38–126.76 (89.44)	77.53–137.64 (105.00)

92.40 mg/ml) in T^3 (fresh surplus colostrum supplemented group) respectively. The results also indicate that Ig concentration in calf sera was higher in all the four treatment groups when compared to control group for all the age categories (7th, 21, 36th and 56th day). The results of the ANOVA indicate a nonsignificant variation between treatment groups for the serum Ig concentration. However, the treatments T_4 followed by T_3 and T_1 were slightly more effective. Skvruk *et al.* (1984) and Georgina *et al.* (1987) also reported that natural way of colostral supply of suckling seemed to increase absorption of Igs.

D Disease Incidence

The results pertaining to the incidence of diseases indicate that the calves mostly suffered from diarrhoea. In the control-feeding group, three calves suffered a total of 5 episodes of disease (diarrhoea and pneumonia) for 23 days. The corresponding number of calves suffered, disease episodes and the duration of disease episodes and the duration of disease in treatment groups T_1, T_2 T_3 and T_4 were 2,2, 12; 2, 3, 15,;3,3,20 and 3, 4, 20, respectively. The results of the analysis revealed no significant variation between treatments for the disease incidence.

SUMMARY

A study was undertaken to evaluate the 5 different feeding strategies during the first month of their life followed by control feeding till 84-days of age on the growth, feed efficiency, blood imunoglobulin level and incidence of diseases of crossbred calves. The growth trends favoured the calves reared on fresh surplus and diluted colostrum till one month (T_3), followed by probiotics supplemented group (T_1), calves fed sour milk (*dahi*) diluted with fresh milk (1:1) (T_2) and group of calves allowed limited suckling for 5 days of colostrum feeding period (T_4) all performed better than control group (NDRI feeding practice). Feed conversion efficiency followed the trends of body weight gain. Average concentration of immunoglobulins was maximum in T_4 followed by T_3, T_1 and T_2. The incidence of the disease was lowest in T_1 followed by T_2 T_3 and T_4 respectively in increasing order. None of the variations, however, were statistically significant.

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