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Effect of molasses mixed starter ration on the growth performance of crossbred calves

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ABSTRACT

Thirty two calves consisting of 16 Holstein Friesian crossbred (G1) and 16 Jersey crossbred (G2) were divided into four different groups at one week of age keeping uniformity in breed and sex *viz.* T_1: calves fed on calf starter ration without molasses, T_2: calf starter with 20 g, T_3: calf starter with 40 g and T_4: calf starter with 60 g freshly mixed molasses per kg of feed. The average initial body weight in each group was almost similar. The calf starter ration was fed to calves twice daily *ad libitum* and soft green fodder such as Para (*Bracharia mutica*), Napier (*Pennisetum purpureum*) and Guinea (*Panicum maximum*) grasses were fed along with soft paddy straw free of choice as basal diet from second week onwards. The experimental calves were fed whole milk manually from a pail at the rate of $1/10^{th}$ of the body weight till consumption to 0.5 kg calf starter ration (CP: 21% and TDN: 75%) daily. Wholesome potable water was also accessible freely to the calves during the experimental period. The overall average body weight of calves were 47.31± 2.42, 50.56 ± 2.26, 57.63 ± 1.50 and 59.13 ± 1.71 kg at the 97 day of age and the average body weight gain were 0.232 ± 0.021, 0.267 ± 0.019, 0.347 ± 0.012 and 0.363 ± 0.013 kg during 7 to 97 days of age in T_1, T_2, T_3 and T_4 groups, respectively. There was significant ($P<0.01$) difference of average body weight at 97 days and body weight gain during 7 to 97 days of age. The overall average body length was 80.25 ± 0.67, 81.88 ± 1.43, 84.38 ± 0.34 and 87.81 ± 0.43 cm; height at wither was 83.25 ± 0.81, 85.25 ± 1.63, 88.50 ± 0.83 and 90.13 ± 0.91 cm and heart girth was 89.50 ± 1.22, 89.38 ± 1.01, 95.00 ± 0.91 and 102.00 ± 0.95 cm in T_1, T_2, T_3 and T_4 groups respectively at 97 days of age. The average body length, height at wither and heart girth were also differed significantly ($P<0.01$) among the groups. However, significant ($P<0.05$) effect of breed was observed for height at wither and highly significant ($P<0.01$) effect of breed was observed for heart girth. There was highly significant ($P<0.01$) effect of groups and breeds on average daily DM intake, but only groups have highly significant ($P<0.01$) effect on FCR during the same period. The average daily cost of feeding was lesser in T_4 group by Rs. 6.38 than the control group (T_1). There was positive correlation of body weight with body length, height at withers and heart girth. The growth performance was better in T_4 group in which the calves were fed on calf starter ration mixed with molasses at 6 percent level.

Key words: Crossbred, calves, molasses, body weight, weaning

Raising dairy calves is a challenging job owing to poor growth and higher mortality under field condition. The rate of mortality up to 30-35 percent was reported in many organized farms in India[16]. The profitability of a dairy farm depends on the various factors including the management of neonatal calves, environmental condition, housing, sanitation and health management. Growth and development of body at early stage of life determine the future production potential and performance of dairy animals. A well grown and developed heifers are the best foundation stock of a dairy farm[11]. Body measurements such as body length, height at wither and heart girths are the main indicators of bone and skeletal growth of calves. Optimum growth of body structures is very essential for a strong and healthy

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animal which can replace the old and culled livestock of a dairy farm.

MATERIALS AND METHODS

Thirty two Jersey crossbred and Holstein Friesian (HF) crossbred calves were divided into four different groups at one week of age with uniform breed, sex and average body weight in each group. The calves were subjected to four different treatments such as T_1- calves fed on calf starter ration without molasses, T_2- calf starter ration with 20 g, T_3- calf starter ration with 40 g and T_4- calf starter ration with 60 g molasses per kg of feed. The calf starter ration (CP 21% and TDN 75%) was composed of crushed maize, wheat bran, rice polish, ground nut cake, mustard oil cake, skimmed milk powder, mineral mixture and common salts @ 44, 12, 10, 25, 5, 1, 2 and 1 percent respectively and antibiotic powder Lixen[1] (Cephalexin oral powder) was also mixed with calf starter ration at the rate of 20 gm per 100 kg of feed. The experimental calves were manually fed whole milk from a pail at the rate of 1/10th of the body weight daily in two divided doses till a calf was able to consume 0.5 kg calf starter ration per day. Calf starter ration was fed to calves twice daily *ad libitum* after freshly mixed with molasses. Green fodder such as Para (*Bracharia mutica*), Napier (*Pennisetum purpureum*) and Guinea (*Panicum maximum*) grasses were fed along with soft paddy straw free of choice as basal diet. Wholesome potable water was also freely accessible to the experimental animals. Body of calves were taken with spring balance in kg, body measurements were taken by standard methods with measuring tape in cm, cost of feeding was calculated as per the prevailing market price (Calf starter @ ₹ 26.44/kg, Milk @ ₹ 50.00/liter, Paddy straw @ ₹ 1.50/kg, Grasses @ ₹ 1.00/kg and Molasses @ ₹ 20.00/kg). The calves were reared under standard management condition with individual feeding. The experimental data were analyzed as per GLM procedure of SAS Enterprise guide 4.2.

RESULTS AND DISCUSSION

Body weight of calves

The overall average body weight of crossbred calves were 47.31±2.42, 50.56±2.26, 57.63±1.50 and 59.13±1.71 kg at the end of study period in T_1, T_2, T_3 and T_4 groups, respectively (Table 1). Analysis of variance revealed significant (P<0.01) difference of body weight among the groups as well as between the breeds at the end of experimentation. It was also observed that body weight of calves under group T_4 was significantly (P< 0.01) higher than other groups. The mean body weight of HF crossbred calves (58.75±1.05 kg) were significantly higher than the Jersey crossbred (48.56±1.54) calves at 97 days of age.

Previous authors[4] were found 51.4 ± 0.34 kg mean body weight at 13 weeks of age in Jersey crossbred calves fed restricted milk along with standard calf starter ration. Some other workers[8] observed that average weight of crossbred calves fed with restricted milk and calf starter ration with 22 percent crude protein was 57.8 ± 11.7 kg and average body weight of 60.8 and 45.8 kg at sixth fortnight for HF crossbred and Jersey crossbred calves, respectively. Few workers[6] reported 56 kg average body weight of crossbred calves attained at 3 months of age with restricted milk feeding up to 60 days. Molasses included in calf feed in small amount reduced dustiness of the starter ration and add some aroma and flavor[1]. The mean body weight of the calves feeding starter ration mixed with 60 g molasses per kg was 63.50 ± 0.65 and 54.75 ± 0.66 kg for HF crossbred and Jersey crossbred, respectively at 97 days of age (Table1). Significantly more body weight of crossbred calves of in T4 groups at 97 days of age in the present study might be due to addition of higher amount of molasses in calf starter ration. This finding received a good deal of support from the comparison with the above mentioned workers.

The average daily body weight gain of crossbred caves were 0.232 ± 0.021, 0.267 ± 0.019, 0.347 ± 0.012 and 0.363 ± 0.013 kg during 7 to 97 days of age in T_1, T_2, T_3 and T_4 groups, respectively (Table 1). Analysis of variance revealed significant (P<0.05) effect of groups as well as breeds during 7-97 days of age. Some workers[3] reported 0.350±0.03 to 0.390±0.04 kg daily body weight gain of crossbred calves. The mean daily body weight gain from birth to 3 months of age was reported to be 0.321 to 0.428 kg in crossbred calves by[6] previous workers. The

average daily body weight gain of Holstein Friesian crossbred calves (0.345±0.012 kg) was significantly higher than Jersey crossbred calves (0.260±0.017 kg) during the same period. Significantly higher body weight gain in T4 group might be due to better effect of molasses in calf starter ration. Better performance in respect of mean body weight gain of the calves fed on starter with 6 percent molasses was also reported by[18] few authors. However, two other workers[7] reported better average body weight gain of calves fed with calf starter ration containing 5 percent molasses than that of 12 percent group.

Table 1. Average (mean±se) body weight and daily body weight gain (kg) of crossbred calves

Age	Breed	T_1	T_2	T_3	T_4	Overall (μ)
Initial (7 days of age)	HF CROSSBRED	27.75 ±0.52	27.88 ±0.55	27.50 ±0.54	27.75 ±0.60	27.72 ±0.25
	JERSEY CROSSBRED	25.13 ±0.52	25.25 ±0.66	25.25 0.32	25.13 ±0.43	25.19 ±0.22
	OVER ALL	26.44 ±0.60	26.56 ±0.64	26.38 ±0.52	26.44 ±0.60	-
Final (97 days of age)	HF CROSSBRED	53.63^{Aa} ±0.55	56.38^{Ab} ±0.55	61.50^{Ac} ±0.54	63.50^{Ad} ±0.65	58.75^{A} ±1.05
	JERSEY CROSSBRED	41.00^{Ba} ±0.61	44.75^{Bb} ±1.01	53.75^{Bc} ±0.43	54.75^{Bc} ±0.66	48.56^{B} ±1.54
	OVER ALL	47.31a ±2.42	50.56b ±2.26	57.63c ±1.50	59.13c ±1.71	-
Daily body weight gain	HF CROSSBRED	0.288 ±0.00	0.317 ±0.01	0.378 ±0.01	0.397 ±0.00	0.345 ±0.01
	JERSEY CROSSBRED	0.176 ±0.01	0.217 ±0.01	0.317 ±0.00	0.329 ±0.01	0.260 ±0.02
	OVER ALL	0.232 ±0.02	0.267 ±0.02	0.347 ±0.01	0.363 ±0.01	-

Means with different superscripts within a row (small letter) and within a column (capital letter) differ significantly.

Body Measurements

The overall average body length was 80.25 ± 0.67, 81.88 ± 1.43, 84.38 ± 0.34 and 87.81 ± 0.43 cm; height at wither was 83.25 ± 0.81, 85.25 ± 1.63, 88.50 ± 0.83 and 90.13 ± 0.91 cm and heart girth was 89.50 ± 1.22, 89.38 ± 1.01, 95.00 ± 0.91 and 102.00 ± 0.95 cm in T_1, T_2, T_3 and T_4 groups respectively at the end of study period. The average body length, height at wither and heart girth differed significantly ($P<0.01$) among the groups. However, significant effect of breed was observed for height at wither and highly significant ($P<0.01$) for heart girth. The effect of breed on body length was non-significant.

The average body length of HF crossbred calves were 81.00 ± 0.54, 82.50 ± 1.66, 84.00 ± 0.46 and 87.13 ± 0.52 cm at 97 days of age in T_1, T_2, T_3 and T_4 groups respectively. In case of the Jersey crossbred calves, the corresponding values were 79.50 ± 1.19, 81.25 ± 2.56, 84.75 ± 0.48 and 88.50 ± 0.54 cm. The average heights at withers of HF crossbred calves were 85.00 ± 0.71, 87.00 ± 2.27, 90.25 ± 0.78 and 91.88 ± 0.97 cm at 97 days of age in T_1, T_2, T_3 and T_4 groups, respectively. In case of the Jersey crossbred calves the corresponding value were 81.50 ± 0.71, 83.50 ± 2.27, 86.75 ± 0.78 and 88.38 ± 0.97 cm, respectively. The average heart girth of HF crossbred calves were 91.75 ± 1.33, 91.63 ± 0.83, 97.25 ± 0.48 and 104.25 ± 0.66 cm at 97 days of age in T_1, T_2, T_3 and T_4 groups, respectively. The average value for Jersey crossbred calves were 87.25 ± 1.33, 87.13 ± 0.83, 92.75 ± 0.48 and 99.75 ± 0.66 cm at 97 days of age in T_1, T_2, T_3 and T_4 groups, respectively. Previous workers[3] found that mean body length, height at wither and heart girth of crossbred calves were 74.27 ± 0.30, 75.44 ± 0.20 and 91.35 ± 0.94 cm, respectively at 13 weeks of age.

Significantly highest average height at wither and heart girth in the calves of T_4 group might be due to beneficial effect of molasses in calf starter ration

with proportion of 60 g in one kg than that of other groups. Better performance of calves fed on the starter with 6 percent molasses were also reported by[18] earlier people. There was highly significant (P<0.01) correlation of body weight with body length, height at wither and heart girth in case of both HF crossbred and Jersey crossbred calves. From the present study it has revealed that increase in body measurements leads to the increase in body weight. Similar pattern was also observed by[15] two authors. Another workers[7] reported better performance of calves fed with calf starter containing 5 percent molasses than 12 percent molasses in respect of heart girth. On the basis of above fact, it might be concluded that the freshly mixed calf starter ration with 60 g molasses in 1 kg might be the best one in comparison to 20 and 40 g of molasses per kg of feed. It was also [13]reported that non-significant differences of body measurements due to different types of calf starter ration.

Dry matter (DM) intake and Feed Conversion Ratio (FCR)

The overall DM intake were 1.402 ± 0.025, 1.486 ± 0.028, 1.533 ± 0.029 and 1.629 ± 0.030 kg in T_1, T_2, T_3 and T_4 groups, respectively (Table 2). The average daily DM intakes of the calves were significantly highest in T_4 group both in HF crossbred (1.720 ± 0.04 kg) and Jersey crossbred (1.538±0.044 kg) calves. It was observed that as soon as the consumption of whole milk reduced by the calves the intake of calf starter, green fodder and straw consumption increased in both the breeds among the treatment groups and therefore means daily DM intake was also increased. The authors[5&14] also reported significantly more DM intake in case of restricted milk feeding period. In the present study feed intake was highest in calves fed with 6 kg molasses mixed in one quintal calf starter ration than that of no molasses or 2 and 4 kg molasses per quintal of feed. It might be due to increasing palatability arising out of reduced dustiness of calf starter ration due to the sticky nature and better aroma of molasses. Subsequently the milk feeding was stopped when a calf was able to consume 0.5 kg of calf starter ration daily. A trial conducted by two workers[7] revealed that calf starter with 5 percent molasses was better. The average milk consumption of the Holstein crossbred and Jersey crossbred calves up to 90 days of age were founded to be 316.8 and 367.3 kg, respectively by[10] earlier scientists.

Table 2. Average (mean±se) daily feed (dm) intake (kg) per calf during experimental period (90 days)

Treatments	HF crossbred	Jersey crossbred	Overall
T_1	1.445^{A} ± 0.032	1.359^{A}± 0.039	1.402^{A}± 0.025
T_2	1.545^{AB}± 0.035	1.427^{AB}± 0.042	1.486^{B}± 0.028
T_3	1.592^{B}± 0.037	1.473^{B}± 0.043	1.533^{B}± 0.029
T_4	1.720^{C}± 0.040	1.538^{B}± 0.044	1.629^{C}± 0.030
Overall	1.576^{a}± 0.018	1.449^{b}± 0.021	..

Means with different superscripts within a row (small letter) and within a column (capital letter) differ significantly.

The previous workers[5] reported that average daily DM intake of Jersey crossbred calves during 14 to 90 days of age was 1.73 ± 0.04, 2.03 ± 0.03 and 2.10 ± 0.05 percent of body weight when milk was fed up to 90 days, up to 56 days and up to 42 days respectively. The average DM intake in the present study was comparatively more than the report of by few workers[5&14] which might be due to early discontinuation of milk feeding in the present study. The consumption of calf starter ration was highest in T_4 group among the treatment groups. It might be due to beneficial effect of molasses in calf starter ration at the proportion of 6 kg in one quintal than those of other groups. The use of techniques to increase starter intake by the calf was of unique significance as opined by[17] one previous worker.

The average FCR of T_1, T_2, T_3 and T_4 groups were 5.03±0.05, 4.88±0.06, 4.21±0.04 and 4.33±0.03 in HF crossbred and 7.70±0.06, 6.59±0.09,

4.65±0.04 and 4.47±0.4 in Jersey crossbred calves, respectively. The overall FCR was 6.04±0.05, 5.57±0.03, 4.42±0.03 and 4.49±0.03 in T_1, T_2, T_3 and T_4 groups, respectively.

Analysis of variance revealed highly significant difference of feed conversion ratio among the treatment groups. But it did not differ significantly due to breeds. The overall mean feed conversion ratio was significantly highest inT_4 followed by T_3, T_2 and T_1 groups, respectively. This might be due to more solid feed consumption and less milk feeding by the calves of T_4 group as they were ready to wean on to solid feed earlier. Similar trend was also observed within the breeds in the present experiment. In one report[9] it was observed that the feed conversion efficiency in crossbred calves ranged from 8.45 to 9.07 which were fed on concentrate mixture supplemented with antibiotics those were more than the present findings. Few authors[14] observed mean feed gain rate in crossbred calves as 2.13, 4.50 and 8.86 in the calves feeding whole milk up to 90, 60 and 30 with skim milk from 31 to 60 days, respectively. Some authors[5] observed that feed conversion ratio of Jersey crossbred calves was significantly more in the calves feeding milk up to 42 days (3.41) than those feeding up to 56 days (3.16) and up to 91 days (2.62) of age which were less than the present observation. Two workers[2] reported higher feed efficiency of calves fed with calf starter having 6 percent molasses than those having 9 and 12 percent.

Cost of feeding

The overall average daily feed cost was found to be ₹ 75.62, 75.00, 73.02 and 69.24 in T_1, T_2, T_3 and T_4 groups, respectively (Table 3). The overall average feed cost per kg body weight gain was Rs. 326.03, 281.25, 210.28 and 190.64 in T_1, T_2, T_3 and T_4 groups, respectively.

Table 3. Average cost of feeding (₹) per calf from 8th to 97th days of age

Breeds	Periods	T_1	T_2	T_3	T_4
HF	For 90 days	6904.92	6846.79	6585.10	6293.32
	Daily	76.72	76.08	73.17	69.93
Jersey	For 90 days	6706.51	6652.86	6557.16	6169.16
	Daily	74.52	73.92	72.86	68.55
Overall (μ)	Daily	75.62	75.00	73.02	69.24
Overall (μ)	Per kg body weight gain	326.026	281.25	210.28	190.64

Few authors[14] reported less cost per kg weight gain for crossbred calves reared on partial milk feeding or on skim milk as compared to calves reared on whole milk up to 90 days. Similar report was revealed by the study of few authors[5] in case of crossbred Jersey calves. Some authors[6] also observed that cost of feeding each crossbred calf up to 3 months of age was more in case of higher amount of milk feeding. In the present experiment calves from T_4 groups stopped milk feeding early as compared to other groups T_1, T_2 and T_3 for both the breeds. As milk feeding was stopped early the cost of feeding for remaining periods up to 90 days trial became economical in the respective groups. The cost feeding of the T_4 group was lowest which might be due to more consumption of highly palatable calf starter ration freshly mixed with molasses at the proportion of 60 g per kg as compared to calf starter ration with no molasses or with 20 and 40 g per kg molasses. The daily cost of feeding per calf in T_1, T_2, T_3 and T_4 groups for the Holstein Friesian crossbred were ₹ 76.72, 76.08, 73.17 and 69.93; and for Jersey crossbred it were ₹ 74.52, 73.92, 72.86 and 68.55 respectively up to the period of 90 days.

CONCLUSION

Addition of molasses in calf starter ration enhanced the growth performance of the dairy calves. The mixing 60 g molasses in 1 kg of calf starter ration just before feeding was found to be best in respect of body growth, FCR and cost effectiveness in feeding crossbred calves.

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