RESEARCH ARTICLE

Growth Performance of Crossbred Calves (HF X K) under Different Milk Feeding Methods

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Abstract

The present study was conducted to assess performance of crossbred calves on different milk feeding methods. Total 36 crossbred calves were selected and allotted in two treatments, *viz.,* T1: Pail method and T2: Bucket with nipple method. Each treatment had 18 calves for a period of 126 days, in which first 91 days consider as pre-weaning period and 91-126 days as post-weaning period. All the new born calves were immediately separated from their dams and fed fix quantity of milk in a day, half morning, half evening. Afterward, the calves were offered 16, 8 and 4 % BW of milk for the age of 42, 63 and 91 days, respectively, in both milk feeding methods. Concentrate, dry and green fodders were offered *ad libitum* on first, eighth and forty two days' of age. There were no treatment differences in body weight, total gain and average daily gain in b. wt. in pre- and post-weaning periods. However, the calves under bucket with nipple method in pre-weaning period gained higher body weight (96.63 ± 3.34 *vs.* 93.55 ± 3.81 kg), total gain (34.58 ± 1.21 *vs*. 32.45 ± 1.58 kg) and average daily gain (752.77 ± 34.37 *vs.* 730.95 ± 36.94 g) as compared to pail milk feeding method. The body measurements of crossbred calves, *viz.,* body length, height at wither and heart girth at initial and final stage were numerically higher in calves under bucket with nipple milk feeding method. The calves with birth weight less than 30 kg grew slower than above 30 kg birth weight throughout the experiment. The male calves had numerically higher body weight than female calves. The study revealed non-significantly improved performance under bucket with nipple method as compared to pail milk feeding and that calves birth weight has influence on their subsequent growth performance also.

Keywords: Crossbred calves, Growth, Milk feeding method, Pre- and post-weaning period.

Ind J Vet Sci and Biotech (2023): 10.48165/ijvsbt.19.6.04

Introduction

Raising healthy and productive calves is the key for long-term success of dairy farm because calves are the future replacement stock (Fischer *et al.,* 2019). Generally, crossbred calves are separated from their dams immediately after the parturition and offered restricted amount of milk until weaning (Khan *et al.,* 2011). Calves management are important to optimise growth, maintain health and reduce mortality (Sahu, 2018). Initially calves are acting as a monogastric animal and abomasum is only functional compartment, so calves require more milk as a source of nutrients. Traditional calf feeding practices provide daily milk allowances of approximately 10 % of calf body weight by using milk pail (De passille *et al.* 2011). Milk feeding methods, frequency and level of milk feeding to dairy calves could influence development, immunology, physiology, health status and cost of feeding (Khan *et al.,* 2007). There are various milk feeding methods used for pre-weaning calves, *viz.,* bucket or pail feeding, bucket with nipple or bottle with nipple feeding and automized milk feeders. When calf suckles milk from pail, its head is down and esophageal groove remains open and milk passes on rumen instead of abomasum (Smijisha and Kamboj, 2007). While, if a calf suckles milk from udder or bottle or bucket with nipple kept at suitable height, oesophageal groove becomes strait and milk passes into the abomasum by-passing the rumen, reticulum and omasum compartments. Nipple feeding increases saliva secretion approximately three times higher and resulted into more salivary lipase mixing with milk, which is helpful for fat digestion in abomasum, and more abomasal enzymes secreted (Costello, 2017) lead to improved milk digestibility with reduced diarrhea and fulfill the hunger of milk (Nuwagaba and Kayongo-male, 1983). This experiment

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How to cite this article: Patel, J. H., Wadhwani, K. N., Trivedi, M. M., Lunagariya, P. M., & Patel, A. C. (2023). Growth Performance of Crossbred Calves (HF X K) under Different Milk Feeding Methods.. Ind J Vet Sci and Biotech. 19(6), 17-20.

Source of support: Nil

Conflict of interest: None

Submitted 04/08/2023 **Accepted** 07/09/2023 **Published** 10/11/2023

was planned to study the effect of milk feeding method (bucket with nipple and pail) on growth performance of crossbred calves.

Materials and Method

The experiment was conducted at the Livestock Research Station, Anand Agricultural University, Anand. Total thirty six (n = 36) new born crossbred calves were selected and divided into two treatments, *viz.,* T_1 – Pail method and T_2 – Bucket with nipple method. The experimental calves were allotted in treatments by zick-zack pattern taking care to maintain male:female ratio. Birth weight of calves under pail and bucket with nipple feeding was similar (31.08 ± 1.10 and 32.06 ± 1.17, kg respectively; p>0.54). All the new born calves were offered 4 L fix milk in two equal halves daily up to 7 days in the morning 6.00 h and evening 18.00 h. Afterward, all the calves were offered whole milk in step down method during pre-weaning period in three different phases (Phase-I, 16 % of b.wt for 8-42 days of age, Phase-II, 8 % of b.wt for 43-63 days and Phase-III, 4 % of b.wt for 64-91 days). All the experimental calves were offered *ad libitum* calf starter (CP-24 % and TDN-70 %) from 8th day and Jowar hay as a dry fodder from 14th days of age onward. Fixed 500 gm green fodder (NB-21, Napier Hybrid) was offered from 42nd day of age and *ad lib* water from pail and bucket methods in respective treatments.

Calves were weighed at weekly interval and milk weight to be offered was adjusted individually according to calf's weight. Calves under bucket with nipple were offered milk by soft, orange color rubber nipple attached to bucket and fixed at suitable height from the floor. Weighed quantities of fresh milk, calf starter and fodder were offered individually at tying place. The leftover was removed in the morning and weighed to record daily calf starter and fodder consumption and the manger was cleaned. All calves were kept loose for two hours daily for exercise. Diarrhea, if any, was noted daily and calves were treated with symptomatic medicine. Body weight (kg) and body measurements, *viz.,* body lengthy, height at withers and heart girth (cm) were recorded every week. Birth weight, body weight, average daily gain, and total gain in body weight were calculated from the data for birth weight-wise (<25, 25.1-30.0, 30.1-35.0, 35.1-40.0 and >40.1 kg) and sex-wise growth rates. During the experiment period, first 91 days were considered as a pre-weaning period, and 92-126 days as a post-weaning period. The data were analysed in completely randomized design (CRD) using online software OPSTAT and expressed as Mean ± SE values (Sheoran *et al.,* 1998).

Results and Discussion

Body Weight

The body weight, total gain and average daily gain of crossbred calves in pre-weaning and post-weaning period are presented in Table 1. The initial body weight (kg) of experimental calves in pail and bucket with nipple was found 32.15 ± 0.97 and 33.40 ± 1.05, respectively, and did not differ significantly. The body weight (kg), total gain (kg) and average daily gain (g) in calves under bucket with nipple method were higher as compared to pail method, although they did not differ significantly between two milk feeding methods. However, the body weight of calves was observed 3.18 and 4.06 % higher in bucket with nipple method as compared to pail milk feeding methods in pre and post-weaning period, respectively.

Smijisha and Kamboj (2007) reported that buffalo calves fed using bottle with nipple had significantly (P< 0.05) higher growth rate than pail feeding. This might have happened in bucket nipple suckled calves due to more milk ingestion time which resulted in to more saliva secretion and better mixing of the milk with digestive enzymes. Fallon and Harte *(*1980) did not find significant difference in pail vs. bucket milk feeding method. However, Nuwagaba and Kayongo-Male (1983) observed open pail method better than bottle method in HF calves, which contradicted with the present findings.

Body Measurements

The data on body measurements (cm), *viz.,* body length, heart girth and height at wither (Table 2) at initial and post-treatment did not differ significantly between two milk

Table 1: Body weight, total gain and average body weight gain of pre-weaned crossbred calves under different milk feeding methods

Parameter	Stage	Pail feeding	Bucket with Nipple feeding	*p*-Value
Body weight (kg)	Birth weight	31.08 ± 1.10	32.06 ± 1.17	0.54
	Initial b.wt.	32.15 ± 0.97	33.40 ± 1.05	0.39
	Pre-weaning b.wt.	93.55 ± 3.81	96.63 ± 3.34	0.54
	Post-weaning b.wt.	120.16 ± 4.96	125.28 ± 4.02	0.42
Average daily gain (g)	Pre-weaning	730.95 ± 36.94	752.77 ± 34.37	0.53
	Post-weaning	760.31 ± 42.90	818.73 ± 28.89	0.267
	Overall	739.58 ± 35.51	772.17 ± 29.86	0.487
Total gain (kg)	Pre-weaning	61.40 ± 3.10	63.23 ± 2.88	0.668
	Post-weaning	32.45 ± 1.58	34.58 ± 1.21	0.293
	Overall	93.85 ± 4.29	97.82 ± 3.66	0.487

Table 2: Body measurements (cm) of crossbred calves under different milk feeding methods

Parameter	Stage	Pail feeding	Bucket with Nipple	*p*-Value
Body length (cm)	Initial	68.00 ± 0.68	68.25 ± 1.02	0.840
	Final	105.05 ± 1.32	105.77 ± 0.91	0.657
	Gain	37.05 ± 1.17	37.52 ± 1.02	0.764
Height at wither (cm)	Initial	72.05 ± 0.69	74.00 ± 0.84	0.083
	Final	100.69 ± 1.02	102.13 ± 1.18	0.362
	Gain	28.63 ± 0.67	28.13 ± 0.85	0.649
Heart girth (cm)	Initial	72.27 ± 0.65	73.61 ± 0.88	0.236
	Final	112.5 ± 1.39	114.05 ± 1.18	0.402
	Gain	40.22 ± 1.26	40.44 ± 0.96	0.890

Table 3: Birth body weight (kg) wise growth performance of pre-weaned crossbred calves

Particulars	Birth body weight (kg) categories				
	Below 25.0	25.1 to 30.0	30.1 to 35.0	35.1 to 40.0	Above 40.1
No. of calves	02	11	13	08	02
Birth weight (kg)	22.4^{a} ± 0.79	27.55^{b} ± 0.38	31.6^{c} ± 0.31	37.08^{d} ±0.53	40.6^{e} ±0.39
Final weight (kg)	86.5^{a} ± 12.50	111.16^{b} ± 5.02	129.41^{bc}±2.58	130.45^{bc}±6.11	148.2^{c} ±4.20
Gain at weaning (kg)	42.9^{a} ± 7.29	57.54^{ab} ± 3.89	66.56^{b} ±1.90	63.9^{b} ± 5.40	74.00^{b} ±3.40
Gain at post-weaning (kg)	19.3^{a} ± 5.50	24.4^{ab} ± 1.61	29.8^{bc} ±1.11	29.1^{bc} ± 1.23	33.8^{c} ± 1.20
Overall gain (kg)	62.2^{a} ± 12.80	81.94^{ab} ± 4.78	96.36^{bc} ±2.43	93.00^{bc} ±6.25	107.8^{c} ± 2.20
ADG at weaning (g)	510.71^{a}±86.90	685.06^{ab}±46.36	792.49^{b}±22.62	760.71^{b}±64.30	880.95^{b}±40.47
ADG at post-weaning (g)	551.42^{a}±157.14	697.14^{ab}±46.25	851.42^{bc}±31.96	831.42^{bc}±35.34	965.71^{c}±34.28
Overall ADG (g)	522.68^{a}±107.56	688.61^{ab}±40.22	809.82^{bc}±20.45	781.51^{bc}±52.55	905.88^{c}±18.48

Mean values with different superscripts (a, b, c, d, e) within row differ significantly ($p< 0.05$, $p<0.01$).

Table 4: Sex wise growth performance of pre-weaned crossbred calves under different milk feeding methods

Particulars	Female	Male	*P value*
No. of calves	24	12	-
Birth weight (kg)	31.20 ± 0.99	32.30 ± 1.35	0.527
Final weight (kg)	121.06 ± 4.19	126.05 ± 4.62	0.468
Gain at weaning (kg)	61.22 ± 2.69	64.50 ± 3.29	0.469
Gain at post-weaning (kg)	27.66 ± 1.13	27.56 ± 1.57	0.960
Overall gain (kg)	88.89 ± 3.55	92.06 ± 4.26	0.592
ADG at weaning (g)	728.86 ± 32.06	767.85 ± 39.28	0.469
ADG at post-weaning (g)	790.47 ± 32.50	787.61 ± 44.92	0.960
Overall ADG (g)	746.98 ± 29.89	773.66 ± 35.81	0.592

feeding methods. The present findings were in accordance with Yavuz *et al.* (2015). However, Senevirathne *et al.* (2019), Jafari *et al.* (2021) and Rashad *et al.* (2022) reported that high milk feeding practices had a greater tendency to increase heart girth, body length, and height at wither, and that milk feeding methods and frequency also influenced the growth performance of experimental calves.

Effect of Birth Weight on Gain

The experimental pre-weaned crossbred calves were categorised in five different groups, *viz.,* below 25.0, 25.1 to 30.0, 30.1 to 35.0, 35.1 to 40.0 and above 40.1 kg based on their birth weight. The mean birth weight, final body weight, gain at weaning, post-weaning gain, overall gain, ADG at weaning, ADG at post-weaning and overall ADG in experimental crossbred calves are showed in Table 3. The calves of respective birth weight group attained overall gain in body weight of 62.2 ± 12.80, 81.94 ± 4.78, 96.36 ± 2.43, 93.00 ± 6.25 and 107.8 ± 2.20 kg, at end of experiment. All the characters were significantly ($p<0.05$) influenced by birth weight. The calves with birth weight more than 25 kg showed significantly ($p<0.05$) improved growth performance as compared to less than 25 kg birth weight calves throughout the study period. The result showed that birth weight of calves also matters the future growth performance of calves even with same feeding and managemental practices given to calves.

The sex-wise growth performance of pre-weaned crossbred calves is depicted in Table 4. The average birth weight of male calves (32.30 ± 1.35, kg) was observed 3.53 % higher as compared to female calves (31.20 ± 0.99, kg) and at the end of experiment, male calves gain 4.12 % higher body weight as compared to female calves. The overall gain and average daily gain of pre-weaned crossbred calves did not differ in both the gender. However, male calves

attained 3.44 % higher overall gain and average daily gain as compared to female calves.

Conclusion

The methods of milk feeding in pre-weaned crossbred calves did not influence the body weight (kg), average daily gain (g), total gain (kg) and body measurements (cm) of calves, although these were numerically higher in bucket with nipple method of feeding. More than 30 kg birth weight calves grew well even offering after same quantity of milk and *ad libitum* feed with equal care. The male calves grew higher as compared to female calves during the experiment.

Acknowledgements

We thankfully acknowledge the fund and facility provided by Director of Research, Anand Agricultural University, Anand for this research. We also thank the farm crew at the LRS for their assistance with care of the calves.

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