J. Agric. Res. Technol., 51 (2) : 182-186 (2026) https://doi.org/10.56228/JART.2026.51208

Effect of Replacing Whole Milk by Skim Milk on Body Weight of Crossbreed Dairy Calve

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(Received : 28.11.2025 Accepted : 10.03.2026)

Abstract

Raising healthy calves is essential for building a productive dairy herd, but the high cost of whole milk feeding poses economic challenges, especially in developing countries like India. This study evaluated the growth performance of 20 crossbred calves fed varying proportions of whole milk and skim milk. Calves were randomly divided into four groups: Control (100% whole milk), T_1 (25 - 100% skim milk from day 22), T_2 (50 - 100% skim milk) and T_3 (75 - 100% skim milk). All calves received colostrum for the first three days and were monitored for 10 weeks. Weekly body weights and average daily gains (ADG) were recorded. Results showed non-significant differences among groups in birth weight, weekly body weight, total weight gain or ADG. Final body weights were slightly higher in T_3 (53.31 kg) compared to control (50.62 kg), though not statistically significant. The average ADG ranged from 0.501 to 0.541 kg day^{-1}. The findings suggest that gradual replacement of whole milk with skim milk from day 22 onward supports comparable growth in calves, offering a cost-effective alternative feeding strategy without compromising performance.

Key words : Integrated nutrient management, growth contributing characters, summer sesamum.

The livestock industry is essential to the rural economy since it supports families and creates good work. Currently, the cattle industry makes up 4.11 per cent of the national GDP and provides 25.6 per cent of the agricultural GDP. Calf raising is one of the many dairy farm procedures that is crucial since calves are the foundation of the future producing herd. We can understand the significance of calf rearing from the proverb "best herds in the world are raised not brought." About 20 per cent of cows must be replaced with recently calved heifer cows in order to maintain production efficiency. Additionally, a significant portion of the dairy industry's income comes from the selling of heifers.

Neonatal calves below 3 months of age depend mainly on liquid milk in the forms of colostrum, whole milk, skim milk or calf milk replacer as their digestive systems are not ready for per cent solid feed intake. However, it is recommended to feed colostrum up to 3 to 5 days of neonatal life after birth (Sastry and Thomas, 2005). The factors considered while feeding milk replacer are quality and per cent of protein and fat, amount of solids in final mixture, environmental temperature and weight of calf before the feeding programme (Corbett 2003). When high quality milk replacers are compared with milk diets, performance are similar. The poor performance of calves on milk replacers often is attribute or underfeeding to the calves. Thus, choice of liquid feed intake can have impact upon their growth, health and profitability. In India, feeding whole milk for raising calves is the most common practice at small as well as large dairy farms, which not only accounts for high cost of rearing but also reduces the availability of marketable whole milk for public consumption (Bharti *et al*., 2005). Early milk replacers were actually milk extenders and fed in gruel form along with whole milk (Godden *et al*., 2011). The commercial milk replacers are

also fortified with the required amounts of essential minerals and vitamins in a balanced form. The dairy calves raised on these replacers are expected to perform similar to that fed on fresh milk.

First three months of life are the most dangerous for calves in terms of mortality (Kulkarni *et al*., 1993). Therefore, in order to minimize calf loss, the early stages of life require the most attention. The most crucial aspect of early calf management is feeding.

Feeding of whole milk to the calves is not economical as the butter fat is the costliest component of milk. In view of obtaining good growth performance, the whole milk can be partly or completely substituted with variety of ingredients. Among these the easiest one is skim milk which is by product of cream separation and is produced when the fat is removed from the whole milk. The fat percentage of skim milk is around 0.1-0.3 per cent (not more than 0.5 %).

Keeping the above facts in view, the present study was undertaken on young calves with the objectives: to study the growth performances of crossbred calves by replacing whole milk by skimmed milk.

Materials and Methods

For the present investigation 20 crossbreed calves were selected. Animal shed, feed and fodders, whole milk skim milk, milking equipment and cream separator machine were used for the research. The research was carried out at the Post Graduate Institute, MPKV, Rahuri, Ahmednagar District, Maharashtra. The calves were separated from the dam on the very first day of their birth. They were provided the colostrum from their respective dams for the first three days.

All calves were housed in a well-ventilated byre having concrete floor with individual feeding arrangement. Fresh and clean water was provided thrice a day i.e. morning, afternoon and evening throughout the experimentation. During the research period, health status of calves was monitored regularly.

Feeding schedule of calves

The feeding schedule of calves was as below.

Control (C)

Days	Colostrum	Whole milk
0-3	$1/10^{th}$ colostrum	-
4-56		$1/10^{th}$ of body weight
57-63		$1/10^{th}$ of body weight
64-72		$1/10^{th}$ of body weight

Treatment-1 (T_1)

Days	Colos-trum	Amount to fed	Whole milk	Skim milk
0-3	$1/10^{th}$ of BW	-	-	-
4-21	-	$1/10^{th}$ of BW	100%	Nil
22-44	-	$1/10^{th}$ of BW	75%	25%
45-63	-	$1/10^{th}$ of BW	50%	50%
64-72	-	$1/10^{th}$ of BW	Nil	100%

Treatment-1 (T_2)

Days	Colos-trum	Amount to fed	Whole milk	Skim milk
0-3	$1/10^{th}$ of BW	-	-	-
4-21	-	$1/10^{th}$ of BW	100%	Nil
22-44	-	$1/10^{th}$ of BW	50%	50%
45-63	-	$1/10^{th}$ of BW	25%	75%
64-72	-	$1/10^{th}$ of BW	Nil	100%

Treatment-1 (T_3)

Days	Colos-trum	Amount to fed	Whole milk	Skim milk
0-3	1/10th of BW	-	-	-
4-21	-	1/10th of BW	100%	Nil
22-44	-	1/10th of BW	25%	75%
45-63	-	1/10th of BW	Nil	100%
64-72	-	1/10th of BW	Nil	100%

After the colostrum feeding the calves were fed with whole milk and skim milk as per the schedule of the respective group of calves. The milk and skim milk were fed individually to all calves twice a day at morning (8.000am) and evening (5.00pm). The green fodder mainly chopped maize; berseem was provided based on availability during the season.

Observation recorded

Body weight : The body weight (kg) of calves was recorded at weekly interval from birth till the end of the experiment. The calves were weighted during morning before offering feed and water on digital balance. Based on the difference in body weights at different intervals, the weight gain and total weight gain of calves as calculated.

Result and Discussion

The effect of replacing whole milk by skim milk on the body weight in crossbreed dairy calves was studied at RCDP on cattle, MPKV Rahuri. The results obtained from experiment are discussed below.

Body weight of calves : The mean body weight (kg) of calves from birth to 10 weeks of age in different groups has been presented in Table 1. The mean birth weight of calves in control, T_1, T_2 and T_3 were 21.93 ± 0.71, 21.60 ± 0.48, 22.26 ± 031 and 22.39 ± 0.54 kg respectively. The mean birth weight of calves was non-significant from each other in different groups. Although intervention had started from 22 days of age, the calves were allotted in different groups based on their body weight. This was done to avoid any interaction of birth weight with the feeding regime since the birth weight was shown to influence the future performance of cross bred calves (Sharma, 1978: Ambatkar and Nandan, 1984). The mean body weight of calves in Control, T_1, T_2 and T_3 at three weeks of age was 25.68 ± 0.54, 26.06 ± 0.64, 26.70 ± .010 and 27.16 ± 0.89, respectively, which were also non-significant from each other. The final body weight of calves at the end of experiment was 50.62 ± 1.52, 51.09 ± 1.90, 52.06 ± 2.01 and 53.31 ± 1.48 kg for control, T_1, T_2 and T_3 groups, respectively. The final body weight was higher in T_3 followed by T_2, T_1 and Control but the difference was non-significant.

Babu (2000) recorded similar body weight in skim milk fed calves compared to whole milk fed calves when 50% of the whole milk has been replaced by skim milk after 30 days of life. However, he reported lower final weight when

Table 1. Mean ± SE for body weight (kg) of calves at weekly interval

Weeks	Control	T_1	T_2	T_3	C.D.	SE(m)	SE(d)	C.V.
At birth	21.93 ± 0.71	21.63 ± 0.48	22.26 ± 0.31	22.39 ± 0.53	N.S.	0.385	0546	3.919
1	24.10 ± 0.67	23.56 ± 0.87	24.04 ± 0.67	24.19 ± 0.55	N.S.	0.675	0.96.	6.305
2	24.20 ± 0.84	24.12 ± 0.42	25.36 ± 0.45	25.30 ± 0.86	N.S.	0.689	0.975	6.233
3	25.68 ± 0.54	26.06 ± 0.64	26.70 ± 1.10	27.16 ± 0.89	N.S.	0.681	0.963	5.772
4	28.48 ± 1.21	27.68 ± 0.80	31.70 ± 0.74	31.89 ± 0.75	N.S.	1.012	1.432	7.563
5	31.10 ± 1.30	30.56 ± 1.04	33.56 ± 0.80	33.50 ± 0.58	N.S.	1.040	1.471	7.229
6	34.08 ± 093	33.72 ± 0.76	36.64 ± 1.35	37.20 ± 0.96	N.S.	1.117	1.579	7.053
7	36.79 ± 0.31	36.93 ± 0.82	39.65 ± 1.35	41.11 ± 0.29	N.S.	0.892	1.261	5.164
8	40.76 ± 1.61	40.68 ± 1.53	42.82 ± 0.88	44.00 ± 0.60	N.S.	0.962	1.360	5.114
9	44.86 ± 1.34	45.09 ± 1.31	47.16 ± 1.12	48.27 ± 0.49	N.S.	1.022	1.446	4.956
10	50.62 ± 1.52	51.09 ± 1.90	52.06 ± 2.01	53.31 ± 1.48	N.S.	1.704	2.410	7.362

NS: Non-significant.

the whole milk was completely replaced with skim milk after 30 days of age, but the difference was not significant. Similarly, a lower body weight was observed in skim milk fed calves than the whole milk fed calves (Bharti *et al*., 2012).

Body weight gain of calves : The weekly body weight gain (kg) of calves in different group has been presented in the Table 2. The total body weight gain of calves in control, T_1, T_2 and T_3 were 24.50 ± 0.82, 25.26 ± 0.79, 26.48 ± 0.79 and 26.77 ± 0.76 kg. respectively which was non-significant from each other. The body weight gains non-significant for all the weeks during the experiment.

Present results are in conformity with the findings of Ranjhan *et al*. (1972) who fed different levels of whole milk i.e. 100, 116 and 116 kg along with 0, 30 and 55 kg skimmed milk up to 45, 60 and 90 days of age, respectively to three groups of calves. They found that average weight gain of calves fed with different levels of milk for varying period was not significantly different. Similar results were also obtained by other researchers when skim milk was supplemented with any energy source like jaggery (Sharma and Tripathy, 1978) or lard (Srivastava, 1977).

Average daily weight gain of calves : The average daily weight gain (kg) of calves in different group has been presented in the Table 3. Yunta *et al*. (2015) observed that average daily gain was better for calves received 8 litres of milk replace (MR) daily, but they were unable to compensate the lack of MR during the weaning phase which resulted in decreased ADG as compared with calves fed 4 litres daily.

Table 2. Mean ± SE for weight gain (kg) of calves at weekly interval

Weeks	Control	T_1	T_2	T_3	C.D.	SE(m)	SE(d)	C.V.
4	3.12 ± 0.14	2.24 ± 0.17	4.34 ± 0.14	3.84 ± 0.23	N.S.	0.145	0.205	9.589
5	2.28 ± 0.12	2.34 ± 0.16	2.65 ± 0.09	2.46 ± 0.10	N.S.	0.119	0.169	11.017
6	2.72 ± 0.14	3.18 ± 0.04	3.02 ± 0.05	3.27 ± 0.16	N.S.	0.121	0.171	8.880
7	2.72 ± 0.11	3.06 ± 0.06	2.81 ± 0.06	3.30 ± 0.03	N.S.	0.068	0.097	5.175
8	4.00 ± 0.10	3.88 ± 0.12	3.16 ± 0.13	4.44 ± 0.11	N.S.	0.104	0.147	6.453
9	3.96 ± 0.14	4.520.15 ±	4.56 ± 0.09	4.70 ± 0.07	N.S.	0.136	0.192	6.866
10	5.70 ± 0.07	6.04 ± 0.09	4.94 ± 0.23	4.76 ± 0.06	N.S.	0.130	0.184	5.447
Average	3.50 ± 0.15	3.60 ± 0.53	3.78 ± 0.48	3.82 ± 0.37				
Total	24.50 ± 0.82	25.26 ± 0.79	26.48 ± 0.79	26.77 ± 0.76				

NS: Non-significant.

Table 3. Mean ± SE average daily weight gain (kg) of calves at weekly interval

Weeks	Control	T_1	T_2	T_3	C.D.	SE(m)	SE(d)	C.V.
4	0.444 ± 0.024	0.318 ± 0.13	0.616 ± 0.012	0.552 ± 0.021	N.S.	0.012	0.018	5.942
5	0.366 ± 0.021	0.344 ± 0.01	0.346 ± 0.017	0.313 ± 0.032	N.S.	0.009	0.013	6.373
6	0.416 ± 0.023	0.446 ± 0.016	0.436 ± 0.028	0.516 ± 0.093	N.S.	0.015	0.021	7.545
7	0.372 ± 0.013	0.440 ± 0.01	0.426 ± 0.019	0.472 ± 0.024	N.S.	0.014	0.023	7.498
8	0.568 ± 0.021	0.554 ± 0.033	0.454 ± 0.033	0.494 ± 0.029	N.S.	0.0157	0.022	6.783
9	0.639 ± 0.014	0.640 ± 0.012	0.652 ± 0.012	0.656 ± 0.017	N.S.	0.014	0.020	5.036
10	0.756 ± 0.016	0.7670.014	0.700 ± 0.026	0.729 ± 0.032	N.S.	0.017	0.024	5.286
Total	0.508 ± 0.012	0.501 ± 0.016	0.518 ± 0.014	0.541 ± 0.017				

NS: Non-significant

Huuskonen (2017) studied that effect of skim milk and whey-based replacers on feed intake and growth of dairy calves. He reported significantly higher ($P<0.05$) live weight gain in skim milk-based milk replacer than the whey-based replacers.

Summary

The mean birth weight of calves in control, T_1, T_2 and T_3 was 21.93 ± 0.71, 21.63 ± 0.48, 22.26 ± 0.31 and 22.29 ± 0.53 kg respectively, which was non- significant from each other. The weekly weight gain of calves in control, T_1, T_2 and T_3 was 24.50 ± 0.82, 25.26 ± 0.79, 26.48 ± 0.79 and 26.77 ± 0.76 respectively, which was non-significant from each other. The overall average daily weight gain (ADG) of calves in control, T_1, T_2 and T_3 was 0.508 ± 0.012, 0.50 ± 0.016 0.518 ± 0.014 and 0.541 ± 0.0171 kg respectively. The ADG of calves was not significantly different from each other. The body length of calves was in C, T_1, T_2 and T_3 78.16 ± 0.15, 77.46 ± 0.96, 78.24 ± 0.29, 78.52 ± 0.15 Kg, respectively which was non-significant from each other.

Conclusions

Replacement of whole milk by skim milk at 22nd days of age and at 45th days of age at the rate of 25-75 per cent and 50-100 per cent, respectively had comparable performance on body weight gain with respect to whole milk feeding in crossbreed calves.

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