RESEARCH ARTICLE

Effect of Milk Replacer on Growth Performance and Economics of Raising Preweaned HF Crossbred Calves

Prabhatsinh V. Jadav* and Vinay Gaur

Abstract

As compared to whole milk feeding, milk replacer is an excellent cheaper source of nutrition for calves prior to weaning. For this study, 20 newborn HF crossbred calves were divided into two equal groups each of 10 animals and were put under 8 weeks feeding trial. The calves of control group (T1) were fed cow's whole milk as per owner's practice in the field, while those of treatment group (T2) were fed whole milk @ 2.5 ltr during 1st week and then milk replacer (Amul brand) was fed @ 50 gm and 150 gm along with 2.0 L and 1.0 L whole milk during 2nd and 3rd week, respectively, and then only the milk replacer @ 250, 350, 450, 500 and 400 gm was used during 4th, 5th, 6th, 7th and 8th week, respectively. Weekly body weight was calculated based on measurements of heart girth and body length using Shaffer's formula. The average body weight during 1st week of age was statistically similar in both groups. The overall mean values of gain in body weight and daily gain in weight in control and treatment groups were 20.40±0.51 vs. 24.67±0.41 kg, and 364.29±9.04 vs. 440.54±7.32 g (20.09% and 20.92% increase in T2 over T1), respectively. The weekly growth rate and overall daily gain in body weight in calves of T2 group were significantly ($p<0.001$) higher than in T1 group. There was 21.08 % reduction ($p<0.001$) in cost of feeding with milk replacer over whole milk (Rs. 3454.5 vs 4377.2) for first 8 weeks of life. In general, the crossbred calves can be raised economically on commercial milk replacer without adverse effect on their health and growth rate.

Keywords: Body Weight, Gain in body weight, HF crossbred calves, Milk replacer, Whole milk.

Ind J Vet Sci and Biotech (2022): 10.48165/ijvsbt.18.5.11

Introduction

Milk and milk products play a pivotal role as a source of animal protein in vegetarian diet. Milk is rich source of nutrients having good quantity of amino acids, minerals, vitamins and energy. The cost of rearing calves from birth to 90 days is always very high as they need milk as food. However, with scientific feeding management of these calves, cost of rearing during this period can significantly be reduced. Milk, almost a complete food for human, can be spared provided good quality cheap substitute is available for calves. Rearing the pre-weaned calf is one of the most challenging tasks on the dairy farm to achieve optimum reproductive weight (Kennedy *et al.,* 2015) to enhance future milk production. Calf feeding methods can influence labour input and calf performance (Gleeson *et al.,* 2008; Hu *et al.,* 2020).

Efficient growth of young dairy calves is important to profitability of the dairy enterprise. Before weaning, limiting nutrients intake from liquid feeds stimulate dry feed intake early in life that allow rumen development and early weaning (Huzzey *et al.,* 2006). Effects of feeding additional milk or milk replacer to calves will reduce intake of solid feed like calf starter and forage intake (Diaz *et al.,* 2001), increases body weight gain (Brown *et al.,* 2005, Hu *et al.,* 2020), and greater deposition of fat and protein in the body (Baldwin *et al.,* 2004). The higher feeding of milk or milk replacer increase cost of rearing of calf. Quantity, composition, and feeding method of milk replacer to neonatal calves have also shown effects on their growth, behaviour, health, and welfare traits (Diaz *et al.,* 2001; Brown *et al.,* 2005; Khan *et al.,* 2007; Hu *et al.,* 2020). Thus the study was conducted to compare the effect of feeding whole milk and commercial milk replacer on daily gain in body weight and cost of feeding of Holstein crossbred calves.

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How to cite this article: Jadav, P.V., & Gaur, V. (2022). Effect of Milk Replacer on Growth Performance and Economics of Raising Preweaned HF Crossbred Calves. Ind J Vet Sci and Biotech. 18(5), 56-58.

Source of support: Nil

Conflict of interest: None

Submitted: 18/07/2022 **Accepted:** 03/11/2022 **Published:** 10/11/2022

Materials And Methods

Twenty new borne HF crossbred calves were selected at farmers' doorstep from village Chekhalarani of Gandhinagar district, Gujarat (India) during the year 2018-19. Calves were divided into two equal groups of 10 calves each in control and treatment group. The calves of control group (T1) were fed whole milk as per farmer's routine rearing practices, *i.e.* @ 9-10% of their body weight (2.5 to 3.0 L) per day for first three weeks and then @ 2.0 L per day fixed till 2.0-2.5 months of age, whereas the calves of treatment group (T2) were fed whole milk daily @ 2.5 L during 1st week and then milk replacer (Amul Brand) was fed @ 50 gm and 150 gm along

with 2.0 L and 1.0 L of whole milk daily during 2nd and 3rd week, respectively. After that only the milk replacer was fed @ 250, 350, 450, 500 and 400 gm per day during 4th, 5th, 6th, 7th and 8th week of life, respectively, as per the instructions of manufacturer. The calves were fed milk and/or milk replacer thrice daily in three divided doses at 06:00 AM, 12:00 PM and 06:00 PM using nipple bottles from 2nd to 8th weeks of age. The powdered milk replacer was mixed in hot water (approx. 50 °C) to disperse fat. Cool water was then added to bring temperature around 39 °C and appropriate dry matter 93.75% prior to feeding.

The heart girth and body length were measured at weekly interval right from birth throughout the study period, and body weight in kg was calculated using Shaffer's formula ($G^2xL/660$). The average daily gain in body weight was calculated based on weekly gain in body weight over previous week. The cost of feeding of whole milk and milk replacer was calculated based on total amount of both the products used over 8 weeks period and the prevailing market rates of cow milk (Rs. 35/L) and milk replacer (Rs. 140/kg). The data generated were statistically analyzed using completely randomized design and paired 't' test (Snedecor and Cochran, 2002).

Results and Discussion

The effect of feeding whole milk and milk replacer on calves' growth performance during the first 8 weeks of infancy is showed in Table 1. The average weekly body weight from 3rd week onwards differed highly significantly ($p<0.01$) between two groups. The overall b. wt. gain at the end of 8th week (20.40±0.51 and 24.67±0.41 kg) and the overall daily gain in body weight (364.29±9.04 and 440.54±7.32 g) were significantly ($P<0.001$) higher in T2 group fed milk replacer than the control T1 group (Table 1). The milk replacer fed group showed 20.09 % higher overall body weight gain and 20.92 % higher daily average gain in body weight than that raised on control whole milk feeding.

Optimal amount of protein in milk replacer for calves is a function of the amount of food consumed, so the increase in food intake and increased amount of protein in milk substitute improves the growth efficiency (Huzzey *et al.,* 2006). Restricted milk or milk replacer feeding to calves generally depresses their growth (Khan *et al.,* 2007; Shukla *et al.,* 2016), health and behaviour (Diaz *et al.,* 2001), because of poor nutrients supply (Khan *et al.,* 2007; Hu *et al*., 2020), whereas, *ad libitum* supply of liquid feed to calves delays the initiation of ruminal fermentation and development (Jasper and Weary, 2002; Baldwin *et al.,* 2004; Hu *et al;.,* 2020) due to depressed solid feed intake (Jensen, 2006). In earlier studies, the growth rate of HF x Kankrej crossbred calves fed commercial and farm made milk replacer was reported to be significantly lower ($p<0.05$) than the whole milk fed calves (Shukla *et al*., 2016). Feeding of milk replacer also resulted in significantly lower final body weight, body weight gain and average daily body weight gain in HF crossbred and Sahiwal calves (Bhatti *et al.,* 2011, 2012). In contrast, a linear increase in average daily gain, final body weight and growth performance in Holstein-Gyr crossbred heifers has been documented with increasing concentrations of total solid in the liquid feed-whole milk from 12.5% to 20.0% (Azevedo *et al*., 2016).

We found that treatment group calves had higher body dimensions and body weight gain than those of control group. Furthermore, the control group calves were not weaned until 60 day of age, because they were not getting the required quantity of starter. For the first 60 days of life, the milk replacer group T2 calves had lower cost per kilogram body weight gain than the control T1 group calves. The reduction in cost of feeding with milk replacer over whole milk for first 8 weeks of life was 21.08 % (Rs. 3454.5 vs 4377.2, ($p<0.001$, Table 2). Based on the results of this study, it was observed that the dairy farmers can achieve economically higher body weight gain of pre-weaned HF crossbred calves on milk replacer than the conventional rearing practice on whole milk feeding, and can save whole milk (86.56 L) for human consumption.

Table 1: Weekly body weight and daily gain in body weight in pre-weaned crossbred calves raised on whole milk and milk replacer (n=10 each, Mean ± SE)

Age (in week)	Body weight (kg)			Av. daily gain in weight (g)		
	Whole milk (T1)	Milk replace (T2)	't' test	Whole milk (T1)	Milk replace (T2)	't' test
At birth	21.12±0.31	21.14±0.34	0.897	-	-	-
1st week	24.00±0.41	23.78±0.45	0.080	411.43±27.91	377.14±21.00	0.140
2nd week	25.57±0.40	26.87±0.46**	0.000	224.29±26.09	441.43±27.06**	0.000
3rd week	28.09±0.47	29.72±0.35**	0.000	360.00±35.62	407.14±21.85	0.205
4th week	31.84±0.44	34.02±0.27**	0.000	535.71±27.46	614.29±31.87	0.136
5th week	35.11±0.34	37.34±0.25**	0.000	467.14±28.42	474.29±10.61	0.806
6th week	37.92±0.26	41.52±0.35**	0.000	401.43±36.73	597.14±24.63**	0.004
7th week	39.79±0.33	43.63±0.36**	0.000	267.14±25.11	301.43±11.75	0.293
8th week	41.52±0.41	45.81±0.39**	0.000	247.14±21.09	311.43±21.06	0.074
Overall gain	**20.40±0.51**	**24.67±0.41****	0.000	**364.29±09.04**	**440.54±07.32****	0.000

** $p<0.001$ between groups.

Table 2: Cost of feeding whole milk and milk replacer to a crossbred calf during first eight weeks of life

Age	Control Group (T1)			Treatment Group (T2)						
	Whole milk fed		Total cost of milk consumed (Rs)*	Milk fed		MR fed		Total cost of		
	Litres per day	Litres / week		Litres / day	Litres / week	Gm / day	Kg / week	Whole milk (Rs)*	MR (Rs)#	MR + Milk (Rs)
1st week	2.50	17.50	612.50	2.50	17.50	0	0	612.50	0	612.50
2nd week	2.56	17.90	626.47	2.00	14.00	50	0.35	490.00	49	539.00
3rd week	2.81	19.66	688.21	1.00	7.00	150	1.05	245.00	147	392.00
4th week	2.00	14.00	490.00	0.00	--	250	1.75	0.00	245	245.00
5th week	2.00	14.00	490.00	0.00	--	350	2.45	0.00	343	343.00
6th week	2.00	14.00	490.00	0.00	--	450	3.15	0.00	441	441.00
7th week	2.00	14.00	490.00	0.00	--	500	3.50	0.00	490	490.00
8th week	2.00	14.00	490.00	0.00	--	400	2.80	0.00	392	392.00
Total	**--**	**125.06**	**4377.2****	**--**	**38.50**	**--**	**15.05**	**1347.5**	**2107**	**3454.5****

*Whole milk price, Rs. 35/L; #Milk replacer (MR) price, Rs. 140/kg, ** p<0.001.

Conclusion

Rearing dairy calves on milk replacer gave better calf performance than on whole milk in terms of calf growth and economic feasibility. The milk replacer was found beneficial for feeding calves in comparison to whole milk for saving milk for human consumption. The benefits of good performance of calves and economic feasibility of usage of milk replacer need to be disseminated to dairy farmers by extension services.

Acknowledgement

The financial support by the authorities of Krishi Vigyan Kendra, Randheja, Gujarat Vidyapeeth, Ahmedabad and the cooperation extended by the farmers for this field study is highly appreciated and acknowledged.

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