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IMPACT OF FEEDING MILK REPLACER ON GROWTH RATE AND BLOOD PARAMETERS IN HOLSTEIN X KANKREJ CROSSBRED CALVES

R. Shukla, S.V. Shah, P.R. Pandya, P.M. Lunagariya, Monika Parmar and B.S. Divekar
Livestock Research Station, College of Veterinary Science and Animal Husbandry,
Anand Agricultural University, Anand-388 001, India
E-mail: drpravinml@gmail.com (**Corresponding Author*)

Abstract: An experiment was conducted on 18 Holstein x Kankrej crossbred calves of either sex to study the effect of formulated milk replacer on growth, body measurements and blood biochemical parameters. The new born calves were fed colostrum @ 10% for first 3 days and whole milk @ 12.5% of body weight up to 9th day of age. From tenth day calves were randomly distributed in to three treatment group. T1 group received whole milk as per routine farm practice; T2 group was fed whole milk and commercial milk replacer as per instruction of manufacturer, whereas T3 calves were fed formulated milk replacer @ 12.5 % of body weight with upper limit of 4 kg. The average weight and body measurements at 10th day of age in all groups were statistically similar. The overall mean values of body weight, daily growth rate, body length, height at wither and heart girth were 33.90±0.89 kg, 205.92±13.44 g, 69.47±0.58 cm, 73.65±0.47 cm and 73.51±1.53 cm, respectively. The growth rates of T3 and T2 calves were significantly lower ($p<0.05$) than the T1 calves; the difference between T2 and T3 was non-significant. The measurements for body length, height at wither and heart girth at the end of experiment (94th day of age) were significantly ($p<0.05$) higher under T1 than T3 and T2 groups, the values for T2 were also significantly lower than T3 group. Blood serum biochemical parameters like total protein, albumin, creatinine, calcium and phosphorus of calves fed milk or milk replacer were within normal range. The serum calcium and phosphorus were higher for calves fed whole milk. In general, the crossbred calves can be raised on milk replacer without adverse effect on growth and blood biochemical parameters, and it provides better option for commercial dairy farmer to spare whole milk for human consumption and get more income.

Keywords: Crossbred calves, Growth, Biochemical parameters, Milk replacer, Whole milk.

INTRODUCTION

An important relationship exists between man and cow. 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 and they are highly susceptible to diseases also. However, with scientific feeding management of these calves,

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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.

Usage of milk replacers has increased tremendously during past 60 years. Milk replacer is used to replace or substitute in part or whole the milk for calves. The first true milk replacer was developed by about 1950 (Schugel 1974). Previously milk replacers were really milk extenders and consisted of linseed oil meal, wheat middlings and oat flour. During late 1950`s and early 1960`s, milk replacers were formulated from dried skim milk, dried butter milk, dried whey, and animal fat. Dried skim milk was the principal source of protein and carbohydrate because of its low cost. Soy protein in concentrates form and soy isolates have been used in milk replacers with good results and are used in large amounts in present day formulations (Otterby and Linn 1981). At least 50% of milk protein can be replaced by soy protein concentrates in milk replacer without adverse effect (Ghorbani *et al*. 2007). Other good protein sources for milk replacers are rapeseed and alfalfa protein concentrates used up to 30 to 50% for acceptable calf performance (Gorrill *et al,* 1976; Alpan *et al.* 1979). If good quality milk replacer is used, there will not be any need for feeding whole milk. A milk replacer almost always will be cheaper than saleable whole milk for calf raising (Heinrichs *et al.* 1995). Other advantages of milk replacer feeding are flexibility of storage, day to day constancy of product, easy to carry over and control of diseases in the calves. The present study was intended to evaluate the effect of milk replacer by utilizing locally available feed ingredients for raising crossbred cows in terms of growth rate and blood biochemical profile.

MATERIALS AND METHODS

The experiment was conducted on 18 HF x Kankrej crossbred calves from 10 to 94 days of age at Livestock Research Station, College of Veterinary Science & Animal Husbandry, Anand Agricultural University, Anand, Gujarat after permission from local Institutional Animal Ethical Committee. All calves were cared and managed as per standard procedure followed at research station. Males and females were equal in numbers. All the calves were weaned at birth and fed colostrum within 40 minute of birth @10% b.wt. for first 3 days and milk @ 12.5% of b. wt. from 4^{th} to 9^{th} day. The calves were individually fed at tying place and let loose for exercise after feeding in open paddock for two hours every day. The faecal samples were tested for parasitic infestation before and at the end of experimental period. The calves were dewormed using broad spectrum dewormer as per routine farm practice at 21 days and 3 months age.

From 10th day of age calves were equally distributed in different treatments according to sex, age and body weight. The calves were fed whole milk (T1), commercial milk replacer and milk (T2); and formulated milk replacer (T3, Table 1) as shown in Table 2 in two equal parts in the morning and evening hrs. Liquid milk replacer was prepared by mixing 100 g milk replacer powder in 1 kg boiled water (1:10) at 40-41^{0}C and fed at 38-40^{0}C temperature.

Table 1: Composition of formulated milk replacer

Ingredients	Proportion	Cost per kg (Rs/ kg)	Total Cost (Rs)	CP (%)
Milk	15.00	24.70	370.50	3.00
Casein	11.00	499.50	5494.50	75.00
Maize	18.00	15.70	282.60	10.00
Soy meal	18.00	31.60	568.80	38.00
Soy seed	15.00	58.00	870.00	25.00
Molasses	8.00	12.00	096.00	-
Pam oil	12.00	68.00	816.00	-
Minerals & Vitamin	2.00	100.00	200.00	-
Salt	1.00	6.00	6.00	-
Total	100.00		8704.40	
Processing cost for items Maize (18 kg), Soymeal (kg) and soy seed (18 kg) i.e. 51 kg @ 3 Rs/kg			153.00	
Total cost of 100 kg (Rs)			8857.40	
Cost per kg of milk replacer (Rs)			88.57	

Table 2: Feeding schedule of calves under different treatments

Age in days	Treatment-1 (Farm Practice)	Treatment-2 (Commercial MR)	Treatment-3 (Formulated MR)
10-16	Milk 4 kg feeding in equal half morning and evening	3.0 kg Milk plus 500 gm Milk replacer (As recommended by manufacturer)	Milk replacer @ 12.5 % of body weight with upper limit of 4 kg reconstituted
17-30		1.0 kg Milk plus 1.5 kg Milk replacer	
31-37		3.5 kg Milk replacer	
38 -44		4.5 kg Milk replacer	
45 -51		5.0 kg Milk replacer	
52- 94		4.0 kg Milk replacer	

Measured quantity of commercial concentrate (Amul Dan) was offered from 15th day of age of calves in clean and dry plastic bowl starting from 50 g/day between 1000 and 1400 hrs and increased by 50 g/day after complete intake of offered quantity with the upper limit as 300

g/head/day. Similarly, the measured quantity of good quality lucerne hay was offered from 20th day of age between 1500 and 1700 hrs with care not to cause diarrhoea due to over feeding. The offered quantity of milk/ milk replacers were consumed without leftover. Left over of concentrate and lucerne hay were measured daily at 1400 hrs and 1700 hrs, respectively.

The calves were weighed at birth, 10th day of age and their after at weekly intervals in the morning between 0700 and 0800 hrs on weigh-bridge before feeding and watering. An average of weight of two consecutive days was taken as final. The body measurements were taken at 10th day and after that at biweekly intervals till 94th day of age after taking body weight. Fortnightly blood samples were also collected aseptically for serum from jugular vein before feeding, watering and after taking body weight. The serum was stored at -20^{0}C till analysis. Serum biochemical parameters, viz., total protein, albumin, creatinine, calcium and phosphorus were analyzed using standard procedures and assay kits of Crest Biosystems, Goa, India. The data generated were statistically analysed using completely randomized design (Snedecor and Cochran 2002).

RESULTS AND DISCUSSION

The proximate composition of different feeds used and the values on growth performance parameters like body weight, growth rate and body measurements of crossbred calves generated during experiment are presented in Table 3 and 4, respectively.

Table 3: Proximate composition of different feeds (Dry Matter basis)

Feed	DM (%)	CP (%)	EE (%)	CF (%)	NFE (%)	Ash (%)
Milk	12.85	26.85	29.49	0.00	38.21	5.45
Commercial MR	93.75	19.70	18.62	0.41	53.42	7.85
Formulated MR	90.62	25.25	25.58	1.42	41.46	7.29
Amul Dan	87.42	19.37	4.79	9.43	51.07	15.34
Lucerne Hay	87.82	15.90	2.36	36.37	36.65	8.72

Table 4: Body growth and measurements of crossbred calves under different treatments

Parameters	Treatments		
Body weight (kg)	T1	T2	T3
At birth	25.87±2.20	24.87±2.50	25.60±1.71
At 10th day of age	28.17±2.20	27.12±2.71	27.83±1.76

At 94 day of age	52.72^{a}±4.45	38.87^{c}±3.53	43.30^{b}±3.07
Mean	37.21^{a}± 1.57	31.44^{b}± 1.16	33.04^{b}± 1.11
Overall ADG (g/day)	294.15^{a}±26.96	139.58^{b} ±11.93	184.03^{b}±20.64
Body measurements (cm)			
Body length (10^{th} day, cm)	62.50±2.36	63.17±1.74	64.00±1.90
Body length (94^{th} day, cm)	80.50^{a}±2.06	72.50^{c}±2.11	74.83^{b}±1.99
Mean Body length (cm)	71.14^{a}±2.51	68.05^{b}±1.40	69.21^{ab}±1.41
Wither height (10^{th} day, cm)	68.67±1.33	68.33±1.94	69.67±1.09
Wither height (94^{th} day, cm)	82.00^{a}±1.93	75.50^{c}±2.06	78.83^{b}±1.92
Mean Wither height (cm)	75.05^{a}±0.92	72.12^{b}±0.80	73.79^{ab}±0.67
Heart girth (10^{th} day, cm)	65.83±2.27	67.50±2.03	68.00±0.86
Heart girth (94^{th} day, cm)	84.50^{a}±2.57	76.50^{c}±2.74	80.50^{b}±1.86
Mean Heart girth (cm)	75.43^{a}±1.20	72.10^{b}±0.96	73.00^{b}±0.86

^{abc} Mean value with different superscripts in a row differ significantly ($p< 0.05$).

Body weight and growth rate:

The average weight at birth and at start of experiment (10^{th} days of age) of calves under T1, T2 and T3 groups were statically similar. The differences in final body weight of calves amongst treatments T1, T2 and T3 were significant ($p<0.05$) with values of 52.72, 38.87 and 43.30 kg, respectively, being highest in T1 and lowest in T2. The body weights of T2 calves remained lower throughout the experiment. The mean body weight of calves was higher ($p<0.05$) in milk fed T1 (37.21 kg) than commercial T2 (31.44 kg) or farm formulated T3 (33.04 kg) milk replacer groups. Feeding of farm formulated milk replacer resulted in numerical higher body weight. The daily growth rate of T3 calves was also significantly lower ($p<0.05$) than T1 calves due to lower TDN and dry matter intake. Further, T2 calves had lower growth than T3, but the difference was non-significant (Table 4).

A linear increase in average daily gain, final body weight and growth performance in Holstein-Gyr crossbred heifers has been documented (Azevedo *et al*. 2016) with increasing concentrations of total solid in the liquid feed-whole milk from 12.5% (only milk) to 20.0% (added dry). Feeding of milk replacer resulted in significantly lower final body weight, body weight gain and average daily body weight gain in Holstein crossbred calves in comparison to feeding whole milk for three months (Bharti *et al.* 2011, 2012). The Sahiwal calves grew slower (162 vs. 357 g/day), and had lower weaning weight (35.2 vs. 51.6 kg) and total weight

gain (13.6 vs. 30.0 kg) on feeding milk replacer than whole milk (Bhatti *et al.* 2012). The higher values of body weight (79.4 kg), live weight gain (40.9 kg) and daily gain (584 g/day) was also reported in Black and White breed calves on daily feeding 6 litre colostrum for first two day, 4 litre milk from 3-35 day and 2 litre milk from 36-49 days of age than complete weaning (Yavuz *et al.* 2015).

Body measurements:

The measurements for body length, height at wither and heart girth at start of experiment (10^{th} day of age) were statically similar in all three treatments (Table 4). The measurements for body length, height at wither and heart girth at the end of experiment (94^{th} day) were significantly ($p<0.05$) higher under T1 than T2 and T3 groups of calves, and the values were also significantly higher under T3 than T2. Lower body measurements under milk replacer feeding may be due to lower intake of dry matter and TDN than control (Azevedo *et al.* 2016). Higher body measurement in male Holstein calves (Blome *et al.* 2003; Hill *et al.* 2007; Lee *et al,* 2009) and lower body length in crossbred calves (Masum *et al.* 2009) were reported on feeding milk replacer than present experiment. Greater increase in body length of T1 calves might be because of higher dry matter and TDN consumption due to intrinsic milk properties resulted in better skeletal growth.

Milk replacer with different protein concentration (Blome *et al.* 2003) and use of dried skim milk and whey protein concentrate in milk replacer (Lammers *et al,* 1998) in Holstein calves increase daily wither height in the range of 0.113 to 0.168 cm and 0.11 to 0.13 cm, respectively, which is in accordance with current findings. Lee *et al.* (2009) used milk and milk replacer and observed 85.8 and 90.0 cm wither height, respectively. The present observations recorded on heart girth are in accordance with the results of earlier studies (Lammers *et al.* 1998). However greater increase in heart girth than present finding has been reported in Holstein calves by others (Lee *et al.* 2009; Masum *et al.* 2009; Kmicikewycz *et al.* 2013).

Blood biochemical parameters:

The values for serum total protein, albumin and creatinine differed non-significantly amongst treatments (Table 5). The serum calcium of calves fed milk (T1) was higher ($p<0.05$) than calves fed commercial milk replacer (T2), whereas calves fed farm formulated milk replacer (T3) were intermediate to both. The serum phosphorus of calves in T1 and T3 was higher ($p<0.05$) than calves in T2, while difference between T1 and T3 was non-significant. All values of blood biochemical parameters were within normal range (Radostits *et al*. 2009).

The higher value of serum calcium and phosphorus may be due to higher intake of dry matter and TDN. The values were in agreement with value found in Japanese black calves (Keiko *et al.* 2012) and in Holstein calves (Kmicikewycz *et al.* 2013) on feeding milk replacer. These values indicate that the formulated milk replacer can be used for calves without any adverse effect on health.

Table 5: Blood metabolites of crossbred calves under different treatments

Parameters	Treatments		
	T1	**T2**	**T3**
Serum total protein (mg/dl)	6.23±0.22	5.97±0.20	6.01±0.27
Serum albumin (mg/dl)	3.36±0.08	3.23±0.12	3.47±0.11
Serum calcium (mg/dl)	10.40^{a}±0.27	9.28^{b}±0.35	9.87^{ab}±0.19
Serum phosphorus (mg/dl)	6.76^{a}±0.23	6.16^{b}±0.20	6.90^{a}±0.21
Serum creatinine (mg/dl)	0.85±0.03	0.90±0.03	0.86±0.03

^{ab} Mean value with different superscripts in a row differ significantly ($p< 0.05$).

Conclusion

The observations on body weight, body measurements and blood biochemical parameters indicated that farm formulated milk replacer can be used for feeding dairy calves without any adverse effect on health of calves. The feeding farm formulated milk replacer was found beneficial for feeding calves in comparison to feeding commercial milk replacer for saving milk for human consumption.

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