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Comparative effect of feeding commercial milk replacer and whole milk on growth performance and feed conversion efficiency for Indian dairy calves

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ABSTRACT

Newly born crossbred dairy calves (24) of either sex were selected and equally distributed into 3 treatment groups, viz. control, treatment-1 and treatment-2, for evaluating the effect of feeding different liquid diets on their growth performances. Control group received whole milk and skim milk as per institute feeding schedule, whereas the T1 and T2 groups were fed on whole milk and milk replacer, respectively, at the constant rate 1/10th of their body weight. The birth weights of calves in control, T1 and T2 groups were 29.83±3.12, 29.66±2.47 and 30.83±3.07 kg and the final body weights were 64.00±3.39, 73.43±3.40 and 58.16±3.68 kg, respectively. The overall average daily gain (ADG) in control, T1 and T2 were 406.74±17.50, 521.03±17.00 and 325.39±13.23 g, respectively, where T1 showed significantly higher ADG than control and T2. The average daily dry matter intake in control, T1 and T2 was 0.86±0.04, 0.91±0.05 and 0.83±0.05 kg, respectively, which were nonsignificant from each other. The feed conversion efficiency in control, T1 and T2 were 2.08±1.14, 1.68±0.06 and 2.491.14, respectively, in which T1 was significantly higher than T2. The growth rate in milk replacer group was comparatively lower than whole milk and control group. The milk replacer used in the present study was more economical than feeding whole milk and skim milk. Therefore, raising crossbred calves on milk replacer could be better option for commercial dairy farms to save the saleable whole milk for human consumption.

Key words: Crossbred calves, Growth, Health, Milk replacer, Whole milk

Colostrum feeding must be followed up to 3 to 5 days of neonatal life whether milk substitute or whole milk feeding will be followed or not after colostrum feeding (Sastry 2005). Milk replacer is cheaper and easily available for calf rearing (Heinrichs 1993). The factors to be considered while feeding milk replacer are quality and percent of protein and fat, amount of solids in the final mixture, environmental temperature, and weight of calf before the feeding program (Corbett 2003). Whole milk, a high quality feed on which calves grow well, is the most expensive liquid feed (Drackley 1999). The poor performances of calves on milk replacers often are attributable to selection of an inappropriate or poor quality milk replacer, or to underfeeding the calf (Drackley 1999). Earlier milk replacers are milk extenders consisting of linseed meal, coconut oil, oat flour, molasses etc., which were fed in gruel form along with whole milk (Roy 1980). These milk replacers were costlier and not available in a ready-to-serve form on commercial scale. However, now-a-days many such commercial calf milk replacers (CMR) are available in the market. The dairy calves raised on these replacers are expected to perform similar to that fed on fresh milk. Therefore the present study was aimed to compare the effect of different liquid milks, viz. commercial milk replacer, whole milk and skim milk on growth performances and feed conversion efficiency of Indian dairy calves.

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MATERIALS AND METHODS

Indian dairy crossbred (Holstein Friesian×Tharparkar) calves (24) of either sex were selected at birth, which were randomly but equally distributed into 3 groups, viz. control (C), treatment 1 (T 1) and treatment 2 (T 2). All calves were housed individually under similar managemental conditions in well-ventilated stalls of dimension 1 m × 1.2 m with facilities of feeding mangers and water troughs. The calves were protected from cold during winter with provision of gunny bags and paddy straws as bedding materials. Fresh, clean and wholesome drinking water was made available all the times.

All calves received colostrum from their respective mothers for first 5 days of life. The whole milk and skim milk were boiled and fed after cooling down to the equivalent body temperature (39°C) of the calves. The commercial milk

replacer powder was mixed with lukewarm water (1: 7) at 60°C and fed after cooling down at equivalent body temperature.

The amounts of liquid milk (whole milk, skim milk and CMR) were adjusted weekly as per their body weight gain and given into 2 equal doses, daily at 8.00 AM in morning and 4.00 PM in afternoon. The concentrate mixture and green fodder were given simultaneously from 31st day onwards till the end of experiment. The green fodder was given *ad lib.*, whereas the concentrate feed was given @ 120g, 200g, and 200g to C, T 1, and T 2 group, respectively, in second month and @ 250g to each group in third month. Apart from these, utmost hygienic conditions with regards to cleanliness of pens, feeding utensils, water containers and the surroundings were maintained throughout the experimental period to check the incidence of diseases. All calves were dewormed with piperazine @ 100 mg / kg body weight on seventh day of age and regularly monitored under the supervision of veterinarian.

Recording of growth parameters: Growth parameters of calves like weekly body weight (kg), average daily gain (ADG) in gram, total weight gain (TWG) in kg, and other parameters like body length (BL), heart girth (HG) and height at wither (WH) were recorded every week in morning hours before offering feed and water.

Dry matter intake and feed conversion efficiency: Dry matter intake (DMI) from all feed components (liquid feeds concentrate and green fodder) was calculated after estimation of dry matter of each component separately. Average daily DMI (kg) was calculated at 0 to 4 weeks, 4 to 8 weeks, and 8 to 12 weeks intervals. Feed conversion efficiency (FCE) was calculated at monthly interval as average daily dry matter intake (kg) per unit kg average daily weight gain (ADG).

The data were analyzed as per Snedecor and Cochran (1994). Analysis of variance (ANOVA) and completely randomized design (CRD) were applied for analyzing the data.

RESULTS AND DISCUSSION

Growth performance: The initial body weight (birth weight) of calves in control, T 1 and T 2 were nonsignificant from each other. The final body weight T1 showed significantly higher body weight over T2 ($P<0.01$). However, control group was nonsignificant either from T1 or T2.

The present study revealed that the weekly body weights of calves in all the groups from birth to ninth week of age were nonsignificant however, from 10th week onwards T1 showed significantly higher body weight than T2 ($P<0.01$) but not with the control. There was no significant difference observed between control and T2 group. The total body weight gains in T1 (Fig. 1) showed significantly higher weight gain than control ($P<0.05$) and T2 ($P<0.01$). The overall ADG (Fig. 1) in T1 showed significantly higher ADG than control ($P<0.05$) and T2 ($P<0.01$).

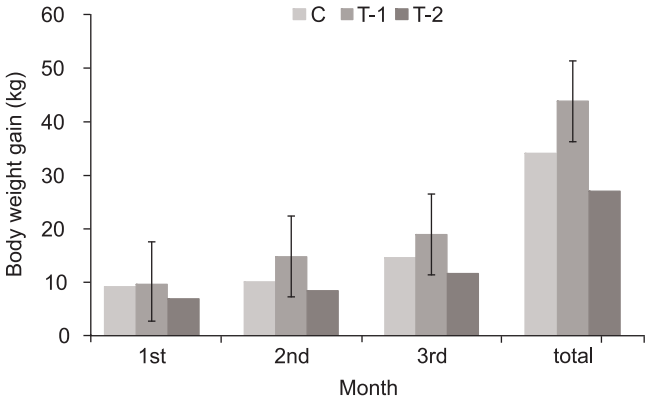

Fig. 1. Body weight gain (kg) of calves at monthly interval

Significantly higher weekly body weight from 10th week onwards in T1 group might be due to higher DMI (Silva and Huber 1986). However, no significant difference was observed between control and T2 group (Blome *et al.* 2003). The total body weight gain during first month was highest in T1 group followed by control and T2. Similarly Nagpaul (1982) reported lesser body weight gain in Danish Red calves fed on milk replacer as compared with surplus colostrums. The higher ADG recorded in T1 group might be due to the higher nutritive value and better utilization of available nutrients in whole milk. Similarly, a significantly lower body weight gain in milk replacer group was reported by Lynch *et al.* (1978) indicating its poor protein quality in milk replacer than whole milk.

Body measurements: The body measurements (Figs 2,3) of calves at birth were nonsignificant for all the groups. However, the final body length was significantly higher in T1 than control and T2 ($P<0.05$), which could be due to significantly higher body weight gain in the respective group. The final heart girth was significantly higher in control than T2 ($P<0.05$) but it was nonsignificant from T1. The difference in final height at wither among various treatment groups was nonsignificant.

Table 1. Composition of calf milk replacer

Ingredients	Percentage (DM basis)
Crude protein	22%
Fat	20%
Crude fiber	1%
Ash	7.5%
Moisture	4.5%
Vitamin A	25,000 IU/ kg
Vitamin D_3	10,000 IU/kg
Vitamin B_1	2.60 mg/kg
Vitamin K_3	1.60 mg/kg
Vitamin C	150 mg/kg
Copper	5 mg/kg
Butyl hydroxyl toluene	Trace amount

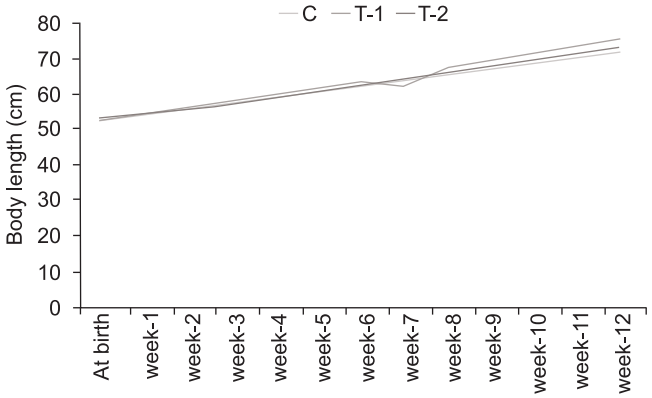

Fig. 2. Body length of calves (cm) at weekly interval.

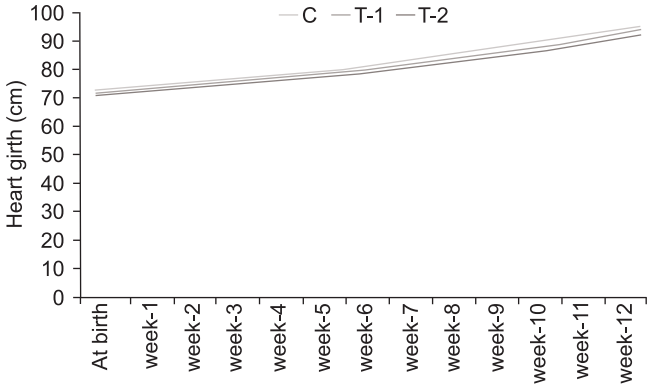

Fig. 3. Height at wither (cm) of calves at weekly interval.

Significantly higher body length in T1 group might be due to their higher body weight gain. Bartlett (2001) and Blome *et al.* (2003) showed that measurements of stature increased as the content of dietary crude protein is increased in iso-caloric diets. However, Drackley (1999) found a nonsignificant effect of feeding milk replacer with higher crude protein content on body length. The control group showed significantly higher value (P<0.05) of the final heart girth than T2. However, T1 was not significantly different either from control or T2 (Lammers *et al.* 1998). The present study showed nonsignificant effects of different treatments on height at wither. This is in agreement with the findings of Arora *et al.* (1973).

Dry matter intake and feed conversion efficiency: The average daily dry matter intake of calves are presented in Table 2. The overall average daily DMI was significantly higher (P<0.05) in T1 than T2 (P<0.05) however; control group was not significant from T1 and T2.

The feed conversion efficiencies (FCE) of calves fed on different liquid diets are presented in Table 2. The overall means of FCE in control, T1 and T2 were significantly different (P<0.01) from each other. The study revealed that the T1 group requires less DMI for every unit gain in body weight as compared to control and T2.

The significantly higher DMI in T1 group might be due to better palatability, higher total solid contents, better nutrient profiles of whole milk than milk replacer or skim milk based diet (Silva and Huber 1986). The palatability of diet should be considered as an important factor in increasing the feed intake and growth response of acidified milk replacer diet (Jester *et al.* 1990). However, Blome *et al.* (2003) reported that the overall DMI in calves fed on milk replacer was slightly more than control group because of the semi liquid form of milk replacer. The overall FCE in T1 group was significantly lower (P < 0.05) than control and T2 group which suggested that the growth performance was better in whole milk fed calves as compared to control and milk replacer fed calves (Terosky *et al*. 1997). Simultaneously it is equally supported by lesser incidence of diarrhoea in whole milk fed calves than milk replacer fed calves (Fisher 1976). While comparing growth and health performance of calves it is important to compare results on the basis of nutrient intake because fat and protein content of milk and milk

Table 2. ADG (g/day), average DMI and feed conversion efficiency (FCE) of calves under different treatment groups

	Treatment			
	1 month	2 month	3 month	Overall
		ADG (g/day)		
Control	330.35^{a}±21.18	369.04^{b}±25.51	520.88$^{a\pm}$23.69	406.74^{a*}±17.50
T1	347.02^{a}±25.92	530.95$^{a\pm}$26.27	685.11^{b} 27.20	521.03^{b}±17.00
T2	251.19^{b}±20.13	305.35^{b}±30.70	419.64^{c} 19.42	325.39$^{c\pm}$13.28
		Dry matter intake (kg/day)		
Control	0.43±0.04	0.83±0.05	1.31±0.05	0.86±0.04 ^{ab}
T1	0.43 0.03	0.89±0.06	1.40±0.06	0.91$^{\pm}$0.05^{a}
T2	0.410.04	0.80±0.06	1.28±0.06	0.83±0.05^{b}
		Feed conversion efficiency		
Control	1.348±0.152	2.354$^{a\pm}$0.176	2.553^{a}±0.164	2.08$^{a\pm}$1.14
T1	1.282±0.127	1.695^{a}±0.086	2.062^{b}±0.109	1.68$^{b\pm}$0.06
T2	1.649±0.106	2.728^{b}±0.207	3.115^{a}±0.289	2.49^{a}±1.14

Means bearing same superscript within the same column do not differ significantly.

replacer vary and in most instances milk contains more fat than reconstituted milk replacer (Blome *et al.* 2003).

The overall growth performance and feed conversion efficiency of the crossbred calves fed on commercial calf milk replacer was comparatively lower than the calves raised on whole milk based or whole milk plus skim milk based feeding. However, practice of milk replacer based feeding can save the milk for human consumption and could economize the cost of feeding of calf rearing, where the market price of whole milk is very high. Further it needs to carry out more research works with considering equivalent nutrient composition of commercial milk replacer to whole milk for better performance of dairy calves under Indian conditions.

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