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Health performance of crossbred Indian dairy calves reared on whey-based commercial milk replacer

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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 (CMR) as their digestive systems are not ready for cent 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 to be considered while feeding milk replacer are quality and per cent of protein and fat, amount of solids in the final mixture, environmental temperature and weight of calf before the feeding programme (Corbett 2003). When high quality milk replacers are compared with whole milk diets, performance is similar (Green 1996). The poor performance of calves on milk replacers often is attributable to selection of an inappropriate or poor quality milk replacer or underfeeding to the calves. Therefore, the choice of the type of liquid feed can have an 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*. 2011). Early milk replacers were actually milk extenders and fed in gruel form along with whole milk (Godden *et al*. 2005). 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. The present study, therefore, was aimed to study the effect of feeding calf milk replacer on health performances of crossbred dairy calves raised under intensive managemental condition.

Selection of animals, housing and experimental feeding: Eighteen Karan-Friez (Tharparkar´Holstein Friesian) and 6 Karan-Swiss (Sahiwal´Brown Swiss) calves of either sex were selected at birth, which were randomly but equally distributed into 3 groups, viz. control (C): whole milk plus skimmed milk-based feeding, treatment-1 (T-1): whole milk-based feeding and treatment-2 (T-2): whey-based commercial milk replacer feeding. All calves were housed individually under similar managemental conditions in well-ventilated stalls of dimension 1m×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.

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

All calves received colostrum from their respective mothers for first 5-day of life. The whole milk and skimmed milk were boiled and fed after cooling down to the equivalent body temperature (39°C) of the calves. The commercial milk replacer powder (Vodor one) was mixed with luke warm water (1:7) at 60°C and fed after cooling down at equivalent body temperature. The nutritional composition of CMR used in the study is presented in Table 1. The amounts of liquid milk (whole milk, skim milk and CMR) were adjusted weekly as per their body weight gain and given in to two equal daily doses at 8.00 AM and 4.00 PM. The concentrate mixtures were given after 1 month of age as per the schedule, however green fodders were given simultaneously at free choice. Apart from these,

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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 day 7 of age and regularly monitored under the supervision of veterinarian.

Recording of growth and health parameters: Body weight of individual calf was recorded at weekly interval in morning hours on electronic balance, before offering of feed and water. Health of the calves were evaluated based on number of calves suffered from diarrhoea, days in diarrhoea and fecal consistency score (FCS). The values of FCS were recorded twice a day throughout the study period, as per Larson *et al.* (1977). The FCS was recorded for each individual calf on the basis following scale: 1= normal fecal consistency, 2 = slightly liquid feces, 3 = moderately liquid feces, 4 = severely liquid feces. FCS count more than 2 was considered as diarrhoea. Other general disease incidences such as fever, respiratory problems or ocular infections etc. were also recorded throughout the experimental period.

Statistical analysis: The data were analyzed as per the standard procedures (Snedecor and Cochran, 1994). Analysis of Variance (ANOVA) and Completely Randomized Design (CRD) design were applied for analyzing the data.

Growth performances: The average birth weights of calves in control, T-1 and T-2 were not significantly different from each other. T-1 had significantly higher final body weight than T-2 ($P<0.01$). However, control group was not significant from T-1 and T-2. The total body weight gains in T-1 showed significantly higher weight gain than control ($P<0.05$) and T-2 ($P<0.01$). The overall average daily weight gains (ADG) in T-1 showed significantly higher ADG than control ($P<0.05$) and T-2 ($P<0.01$).

The significantly higher body weight in T-1 group might be due to higher overall dry matter intake (Silva and Huber 1986) and lower value of FCS (Quigley *et al*. 2006) than T-2 group. However, no significant difference was observed between control and T-2 groups (Blome *et al.* 2003). The higher ADG recorded in T-1 group might be due to the higher nutritive value and better utilization of available nutrients in whole milk. The present study corresponds with the finding of Fisher (1976) who reported that early postnatal growth performance of calves on some milk replacers was inferior to that of whole milk. Some milk replacers, having protein source other than whole milk (casein), do not form rennin clot in abomasum and passes out rapidly as watery clot without undergoing adequate gastric digestion as earlier reports (Hill *et al*. 2007). 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. Arora *et al.* (1973) also reported that reduction of whole milk in the diet of calves was reflected by slow rate of body weight gain, reduced vitality and increased health disorders like diarrhoea.

Health performance and fecal consistency score (FCS)

The monthly fecal consistency scores (FCS) are presented in Table 2. T-1 showed significantly lower FCS count than control and T-2 ($P<0.05$). The present study revealed a minimum percentage of enteric and reparatory disorders except for few cases of eye infection, bloat, navel ill, pneumonia and fever. The incidence of diarrhoea on the basis of FCS count has been presented in Table 3. The numbers of calves suffered from diarrhoea were 3, 2 and 4 and the corresponding total days in diarrhoea are 13, 8 and 17 days in control, T-1 and T-2 groups, respectively. The percentage of days in diarrhoea out of total feeding days is higher in T-2 than control and T-1. The incidence of diarrhoea was higher in first month and decreased subsequently in the following months (Table 3).

Table 2. Fecal consistency score of calves under different treatment groups

Treatments	Fecal consistency score			Overall
	1st month	2nd month	3rd month	
Control	$1.247^{a}\pm0.033$	1.033 ± 0.008	$1.015^{a}\pm0.007$	$1.098^{a*}\pm0.008$
T-1	$1.125^{b}\pm0.009$	1.048 ± 0.020	$1.037^{b}\pm0.008$	$1.066^{b}\pm0.011$
T-2	$1.286^{ac}\pm0.018$	1.054 ± 0.020	$1.074^{bc}\pm0.019$	$1.138^{ac\pm}0.015$

Means bearing different superscripts (a, b, c) within the column differ significantly ($P<0.05$)

Table 3. Incidence of diarrhoea in crossbred dairy calves

Treatment	No. of calves affected	No. of affected calf-days	Percent of calf days(% days of feeding)			Overall
			1st month	2nd month	3rd month	
Control	3	13	3.57 (6)	3.57 (6)	0.59 (1)	2.59
T-1	2	8	2.97 (6)	1.78 (2)	0	1.58
T-2	4	17	5.95 (10)	2.97 (5)	1.19 (2)	3.37

Numbers in the parentheses indicate numbers of calf days in diarrhoea.

The FCS counts were significant between milk and milk replacer based feeding groups. However, a nonsignificant effect of feeding milk replacer on FCS was reported in Holstein calves by Jaster *et al.* (1990) and Terosky *et al.* (1997). The significantly higher FCS in T-2 group might be due to the presence of whey protein in the milk replacers which do not coagulate in abomasum of the neonates but passes out as watery clot. In the first month of the study the FCS counts were significantly higher in all the groups indicating the higher incidences of diarrhoea as compared to the following months. These are in agreement with the findings of Quigley (2006). Huuskonen *et al.* (2005) reported a lesser incidence of diarrhoea in calves fed with vegetable oil but the present study recorded higher FCS count in T-2 group inspite of providing the vegetable oil as fat source. Apart from the source of fat in causing diarrhoea, the level of fluid and dry matter intake might have caused the incidences of diarrhoea in T-2 group. Stiles *et al*. (1974) also reported that calves offered with milk replacer at higher intake level of fluid had greater number of days in diarrhoea and dehydration as compared to low and medium level of fluid intake. No relationship between FCS and health status could be established in the present study. However, the present study reveals a minimum percentage of enteric and reparatory disorders in all the groups. Similar findings on health status were reported by Timmerman *et al*. (2005).

As it is evident from the preceding discussion, an abundance of research works needs to be conducted on biological and managemental issues associated with enhanced growth without affecting health of dairy calves during early nutrition programme. From the present study it could be concluded that the overall growth and health 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. Nevertheless, by raising crossbred calves on milk replacer based feeding we not only can economize the cost of feeding but can also save the milk for human consumption where the market price of whole milk is very high.

SUMMARY

Newly born crossbred calves (24) of either sex were selected and equally distributed into control, Treatment-1(T-1) and Treatment-2 (T-2) groups for evaluating the effect of feeding milk replacer on their health performances. Control group received whole milk and skim milk as per the institute feeding schedule, whereas the T-1 and T-2 groups were fed on whole milk and milk replacer, respectively at the constant rate $1/10^{th}$ of their body weight for first three months of age. The overall average daily gain in T-1 showed significantly higher average daily gain than control and T-2. Health of calves was evaluated in terms of number of calves days in diarrhoea and their fecal consistency scores (FCS). The values of FCS were significantly higher in T-2 than T-1 and control indicating that calves in milk replacer group had higher incidences of diarrhoea than other 2 groups fed on whole milk. No any major health problems or mortality were observed during the study in any of the groups. From the present study it was concluded that in spite of slightly higher incidences of digestive problems in calves during the winter months, milk replacer feeding could be a better option for commercial dairy producers and resource poor farmers in order to save the whole milk for human consumption.

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