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Impact of feeding milk replacer on dry matter intake and feed conversion efficiency in crossbred calves

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Abstract
Eighteen healthy crossbred calves both male and female around one week of age were selected and randomly divided into three groups of six each (T1, T2, and T3), as uniformly as possible with regard to age, sex, and body weight. The calves of T1 received whole milk as per routine farm practice, T2 group was offered whole milk plus commercial milk replacer as per manufacturers recommendation and T3 group was offered a formulated milk replacer @ 12.5 per cent of body weight. All the calves received ad libitum green fodder. The milk and milk replacers of T1, T2 and T3 had 25.68±0.14, 20.63±0.14 and 24.85±0.11 per cent crude protein, respectively. The calf starter and green fodder contained 21.4±0.44and 12.18±0.14 per cent crude protein. The average daily dry matter intake (DMI) in dietary treatments T1, T2, and T3 were 0.800±0.04, 0.701±0.01, and 0.640±0.01 kg, respectively. The dry matter intake of crossbred calves was significantly different in 3rd, 5th and 6th fortnight. The mean cumulative feed conversion efficiency was 2.61±0.13, 3.50±0.44 and 2.59±0.26 for T1, T2, and T3 respectively. The feed conversion efficiency was statistically non-significant among the dietary treatments. Thus raising of crossbred claves under formulated milk replacer feeding could be better option for dairy farmers.

Keywords: crossbred calves, milk replacer, dry matter intake, feed conversion efficiency

Introduction
Nutritional and health care aspects of calf rearing are the prime concern in dairy calf management. Apart from that, economics of rearing should always be kept in mind as whole milk feeding may affect the profitability of dairy farm. The first 90 days of calves was always neglected by dairy farmers in terms of feeding milk which resulted in mortality and delayed puberty. Therefore, initial milk feeding and impact on farmers economy has to be addressed. As an alternative to milk feeding, many countries today developed milk replacers, thus cutting down the rearing cost and sparing milk for human consumption (Mete *et al*., 2000) [7]. Milk replacer is a good liquid feed alternative to raise calves. It is having many advantages like being cheaper than whole milk, storage flexibility, and day to day constancy of product and conducive to the control of diseases in the calves (Heinrichs, 1995) [6]. This present study was aimed to compare the different milk replacer feeding on DMI and feed conversion efficiency in crossbred calves.

Materials and Methods
The study was conducted for a period of three months in University Livestock Farm and Fodder Research and Development Scheme (ULF and FRDS), College of Veterinary and Animal Sciences, Mannuthy during 2017-2018. Eighteen healthy crossbred calves both male and female around one week of age were selected and randomly divided into three groups of six each (T1, T2, and T3), as uniformly as possible with regard to age, sex and body weight. The calves were dewormed as per routine farm practice (at 15th and 45th day of age) during the experimental period. All the experimental calves were maintained under identical conditions of feeding and management throughout the experimental period, except for milk feeding as followed.
T1: Feeding whole milk (Farm practice)
T2: Feeding commercially available milk replacer (CMR)
T3: Feeding formulated milk replacer (FMR) (consisting of Milk, skimmed milk powder, Soya meal, Maize, Palm oil mineral and salt) with 25 per cent crude protein.

All the calves were weaned in the first week of age and fed colostrum @ 10% body weight. From the first week to 90 days T1 was fed with whole milk as per standard routine farm

practice. The group T2 was fed with a combination of Commercial milk replacer (Jeevan-Amul®) and whole milk as per manufacturer recommendations and the group T3 was fed with a formulated milk replacer given @ 12.5 per cent body weight. The formulated milk replacer consists of Table -1 proportion (Shukla *et al*., 2016). All calves were fed liquid milk and milk replacer with an upper limit of 4 kg/day. The liquid milk replacer of T2 and T3 was prepared by dissolving 100 g powder in one liter of boiled water and fed at 38 °C to 40 °C temperature in two equal parts. All the groups were fed throughout the experiment period as per the schedule Table-2, Table-3 and Table-4.

Table 1: Composition formulated of milk replacer

Ingredients	Parts (%)
Milk	20
Skimmed milk powder	10
Soya meal	25
Maize	30
Palm Oil	12
Minerals	2
Salt	1
Nicomix	0.020
Total	100

Table 2: Feeding schedule of treatment 1 group of calves

Age in weeks	Whole milk (Body weight)	Calf starter (g)
1 wk	Colostrum 1/10 B.wt	Nil
2 wk	1/10	Nil
3-4 wks	1/10	150g
5-6 wks	1/10	400g
7-8 wks	1/15	
9-12 wks	1/20	600g

Table 3: Feeding schedule of treatment 2 group of calves

Age in weeks	Whole milk(kg)	Commercial milk replacer (g)	Calf starter (g)
1 week	Colostrum 1/10 B.wt	Nil	Nil
2 week	3.0	50	Nil
3week	1.0	150	150g
4 week	1.0	250	
5 week	Nil	350	400g
6 week		450	
7 week		500	
8 week		400	
9-12 weeks		400	600g

(*As recommended by manufacturer)

Table 4: Feeding schedule of treatment 3 group of calves

Age in weeks	Whole milk	Formulated milk replacer	Calf starter (g)
1 week	Colostrum 1/10 B.wt	Nil	Nil
2 wk	1/10	Nil	Nil
3-4 wks	Nil	Milk @ 12.5% of body weight upper limit 4 kg	150g
5-8 wks	Nil		400g
9-12 wks	Nil		600g

* Green fodder will be fed ad libitum in all three experiment groups.

Analysis of Feed and Fodder

Proximate analysis of milk, milk replacers, calf starters, green grass and dung were done as per the standard procedures (AOAC, 2012) [1].

Total Dry Matter Intake

A feeding trial was conducted for a period of ninety days using eighteen healthy weaned crossbred calves. The measured quantity of milk, milk replacer, weighed calf starter and ad libitum good quality green grass were offered to all the experimental animals during the forenoon and afternoon periods. Individual data on quantities of milk, milk replacer, calf starter and green grass offered daily were recorded. The leftover portion of the calf starter and green grasses if any were weighed daily and their moisture content was analyzed to calculate the dry matter intake. Daily dry matter intake from milk, milk replacer, calf starter and green grass with respect to each calf were calculated throughout the experimental period.

Feed Conversion Effeciency

Overall feed conversion efficiency was calculated as dry matter intake (kg) per kg weight gain.

Results

The chemical composition of milk, milk replacers, calf starter and green fodder is presented in Table 5. The milk and milk replacers of T1, T2 and T3 had 25.68±0.14, 20.63±0.14 and 24.85±0.11 per cent crude protein, respectively. The calf starter and green fodder contained 21.4±0.44and 12.18±0.14 per cent crude protein. The average daily dry matter intake (DMI) in different dietary treatments, calculated on fortnight basis are presented in Table 6.The average daily DMI in dietary treatments T1, T2, and T3 were 0.800±0.04, 0.701±0.01, and 0.640±0.01 kg, respectively. The dry matter intake of crossbred calves was significantly different in 3rd, 5th and 6th fortnight. The cumulative feed conversion efficiency in three dietary treatments are tabulated in Table 7. The mean cumulative feed conversion efficiency was 2.61±0.13, 3.50±0.44 and 2.59±0.26 for T1, T2, and T3 respectively. The feed conversion efficiency was statistically non-significant among the dietary treatments.

Table 5: Chemical composition of feeding items in per cent (DM basis)

Parameter	Dietary treatments			Calf starter	Green grass
	T_1 Milk	T_2 Milk replacer	T_3 Milk replacer		
Dry matter	12.60±0.15	91.56±0.12	91±0.2	90.0±0.07	23.03±0.47
Crude protein	25.68±0.14	20.63±0.14	24.85±0.11	21.4±0.44	12.18±0.14
Crude fibre	-	1.49±0.05	2.25±0.05	4.3±0.22	32.76±0.71
Ether extract	26.65±0.65	16.12±0.24	16.27±0.30	3.44±0.1	1.67±0.09
Nitrogen free extract	39.65±0.45	52.37±0.55	52.03±0.91	58±0.02	43.81±0.19
Total ash	5.39±0.07	8.18±0.59	7.74±0.12	5.88±0.10	9.76±0.08

Table 6: Fortnightly average daily dry matter intake of calves [1] (kg)

Fortnight	Dietary treatments			P value	F value
	T_1	T_2	T_3		
1	0.33±0.02	0.36±0.01	0.3±0.01	0.075	3.096
2	0.42±0.02	0.36±0.01	0.36±0.01	0.056	3.515
3	0.56±0.04[a]	0.46±0.01[b]	0.43±0.01[b]	0.019*	5.187
4	0.84±0.08	0.77±0.03	0.69±0.01	0.191	1.85
5	1.18±0.06[a]	0.98±0.03[b]	0.96±0.05[b]	0.022*	4.964
6	1.44±0.03 [a]	1.26±0.01 [b]	1.19±0.05 [b]	0.001**	11.17

[1]Average of six values with SE

**a, b - Means bearing different superscripts within same rows differ significantly (P<0.01)

* Significant at 0.05 level (P<0.05)

Table 7: Cumulative feed efficiency of calves [1]

Parameters	Dietary treatments			P value	F value
	T_1	T_2	T_3		
Total dry matter intake (kg/animal)	71.99±3.73[a]	63.32±1.28[b]	57.64±1.25[b]	0.003[*]	9.110
Average daily dry matter intake (kg/animal)	0.800±0.04[a]	0.701±0.01[b]	0.640±0.01[b]	0.002[*]	9.291
Total body weight gain (kg)	28.11±2.50	19.26±1.88	23.73±2.44	0.077 [ns]	3.051
Feed efficiency	2.61±0.13	3.50±0.44	2.59±0.26	0.092[ns]	2.805

[1]Average of six values with SE

*a, b- Means with different superscripts within the same row differ significantly (P<0.01)

ns- Non significant, P>0.05

Discussion

The average daily dry matter intake (DMI) in different dietary treatments was calculated on fortnight basis. The dry matter intake of crossbred calves were significantly different (P<0.01) at 3rd and 6th fortnight in T1 when compared to T2 and T3. The 5th fortnight DMI in T_1 had significant difference (P<0.05) compared to other groups. The total DMI during the experiment period was 71.99 ± 3.73, 63.32 ± 1.28 and 57.64 ± 1.25 kg in T_1, T_2 and T_3 respectively. The average daily DMI in T1, T2, and T3 were 0.800 ± 0.04, 0.701 ± 0.01 and 0.640 ± 0.01 kg, respectively. On statistical analysis, calves maintained under milk feeding were having significantly higher (P<0.01) DMI than those maintained under other treatment groups. The significantly higher dry matter intake of T1 group might be due to higher total solids, palatability and nutrient profile of whole milk than milk replacers. Similar findings were recorded by Azevedo *et al.* (2016) [3] and Lunagariya *et al.* (2017) [5] In contrary to the present findings, Bharti *et al.* (2012) [4], Abdullah *et al.* (2013) [2] and Shakaya *et al.* (2017) average daily dry matter intake had no significant difference between the groups. The DM consumed for each kg weight gain is 2.61±0.13, 3.50±0.44 and 2.59±0.26 kg in T1, T2, and T3 respectively. The FCR was not significantly different among the treatments. The dry matter intake (per kg weight gain) is highest in T2 followed by T1 and T3. Formulated milk replacer showed better feed conversion efficiency when compared to other groups. The findings were similar to the observations made by shakya *et al.* (2017) [8]. In contradiction to the above finding, Bharti *et al.* (2012) [4], Abdullah *et al.* (2013) [2] and Lunagariya *et al.* (2017) [5] reported significant different in FCE feeding of milk replacer.

Conclusion

The Dry matter intake and Feed conversion efficiency were not found to be affected by the use of milk replacers. Formulated milk replacer serves as a better option for dairy farmers and in saving milk for human consumption.

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