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Harish Rohila
Department of Livestock Production Management, College of Veterinary Sciences, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar, Haryana, India

SK Chhikara
Department of Livestock Production Management, College of Veterinary Sciences, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar, Haryana, India

Amar Shroha
Department of Livestock Production Management, College of Veterinary Sciences, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar, Haryana, India

Sushil Kumar
Department of Animal Nutrition, College of Veterinary Sciences, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar, Haryana, India

Correspondence
Harish Rohila
Department of Livestock Production Management, College of Veterinary Sciences, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar, Haryana, India

Effect of feeding bypass fat on economics of milk production in early lactating Murrah buffaloes

Harish Rohila, SK Chhikara, Amar Shroha and Sushil Kumar

Abstract
Eighteen early lactating Murrah buffaloes were randomly divided into three groups to study effect of rumen protected fat supplementation on recovery of body weight during post partum period. Control group T1 was fed with a basal diet without bypass fat and treatment groups T2 and T3 were supplemented with bypass fat @ 100g/day/animal and 150g/day/animal, respectively. The average daily feeding cost in treatment T1, T2 and T3 were Rs. 160.85, 172.45, 178.25 respectively. The mean value of daily 6% FCM and total revenue in treatment T1, T2 and T3 were 13.68kg, 14.31kg, 15.12kg and Rs. 454.17, 475.09, 501.98 respectively. The realizable receipt was calculated based on the milk procurement price declared by local cooperative milk collection center. The return over feed cost was calculated taking difference of the realizable receipt by sale of milk and the total feed cost. The cost of feed was low in control group (Rs. 160.85) as compared to treatment group (Rs. 172.45, 178.25) but when compared to per kg production it was lower in bypass fat groups than control. So, net increased in revenue were Rs. 9.3 and 30.41 respectively and percentage increase in revenue in T2 and T3 were 3.2 and 10.37 percent respectively. So, it may be concluded that by incorporating supplementation of bypass fat it is possible to increase income of dairy farmers owing to more milk production and fat content. Farmers are typically paid on the basis of the fat content of the milk they are producing, hence increase in fat percent and yield and there will be corresponding increase in revenue of the dairy farmers.

Keywords: Rumen protected fat/bypass fat, economics, early lactation and Murrah buffaloes

Introduction
Most of the animals in developing countries including India are fed on agriculture by-products and low quality crop residues, which have got inherent low nutritive value and digestibility. The shortage of feed resources coupled with their poor nutritive value is of major concern to low productivity of dairy animals. High producing buffaloes in early lactation do not consume sufficient dry matter to support maximal production of milk (Goff and Horst, 1997) [5]. Demand for energy is very high during early stage of lactation but supply is not commensurate with demand due physiological stage or limited intake may affects production potential of animal in the whole lactation length (Sirohi *et al.* 2010) [15]. Hence, during early lactation, dairy animals are often forced to draw on body reserves to satisfy energy requirements (negative energy balance); this leads to substantial loss in body weight which adversely affects production, resulting in lower yield (Kim *et al.* 1993) [6]. And the occurrence of health problems during the transition period is a major complicating factor for subsequent reproductive performance resulting in additional economic losses (Ferguson, 2001; Remppis *et al*., 2011) [2, 13]. Poor transitions also result in losses from milk income.
Supplementation of bypass fat not only increases energy intake but also increase unsaturated fatty acid content of buffalo milk and more economic returns to dairy farmers (Parnerkar *et al.* 2010) [10]. Diets containing supplemental fat often stimulate increased milk production because of increased energy intake, improved efficiency of utilization of energy, or both (Maiga and Schingoethe, 1997) [7]. So, the present work was under taken to study the effect of feeding bypass fat on economics of milk production in early lactating murrah buffaloes.

Materials & Methods
The experimental feeding trial was conducted for a period of 12 weeks at Buffalo Farm, Department of Livestock Production Management, LUVAS, Hisar. Hisar city is situated in semi-arid region and climatic condition is sub-tropical in nature. Geographically, Hisar is situated at 29° 10' N latitude, 75° 40' E longitude and at 215.2 meters altitude.

Selection and maintenance of animals
Eighteen healthy female Murrah buffaloes, between 1st to 4th lactation stage were selected. The health of animals was good without any illness. All the animals were dewormed and disinfested for ecto-parasites before start of the experiment adopting standard protocol. The animals were maintained under isomanagerial conditions and similar husbandry practices except the different feeding treatments.

Experimental design
These animals were divided randomly into 3 groups based on their milk production (average milk yield of 8.6 litres) and the average 23 days post-partum following factorial completely randomized design (FCRD) shown in table 1.

Feeding and watering
During the entire study period, the animals were given seasonal green fodder (Maize) and concentrates mixture to meet their protein and energy requirement for growth as per ICAR standards (Ranjhan, 1998) [12]. The chaffed seasonal green fodder (particle size- 2.0 to 2.5 cm) like maize were given @25 kg/animal/day along with wheat straw (particle size- 1.5 to 2.0 cm) @7kg/animal/day. The amount of concentrate mixture was given daily to each animal @5kg/animal/day. In addition, experimental groups T2 and T3 provided with bypass fat @100g/animal/day and @150g/animal/day respectively shown in table 2. Bypass fat was added and mixed in concentrate mixture uniformly in everyday and fed individually to each animals of treatment group. The roughage: concentrate ratio of the diet was kept 60:40. Animals were given *ad-lib* fresh water throughout the experimental period. Before formulation of rations, the feed ingredients were analyzed (AOAC, 2005) [1] for proximate composition (Table 3). The concentrate mixture of basal diet (T1) was formulated by using 25, 15, 20, 10, 27, 2 and 1 kg of maize, GNC, barley, mustard cake, wheat bran, mineral mixture and salt, respectively. The Ingredient of concentrate mixtures is presented in table 4.

Observations
Milk yield
The buffaloes were milked twice daily. Weekly milk yield of morning and evening at two consecutive days, (Saturday and Sunday) was recorded with the help of digital weighing balance.

Milk sampling and composition
The milk was sampled at weekly interval at two consecutive days, (Saturday and Sunday), for each animal in separate bottles of both morning and evening and mixed before proceeding for estimation of major constituents of milk. Milk sample were analyzed for estimation of fat, protein, SNF, total solid with the help of Lactoscan milk autoanalyser.
6% fat corrected milk (FCM): was calculated by the method of Rice *et al* (1970) [14] by using following formula
6% FCM = 0.308*total milk+11.54*total fat

Economics
Prices of feeds and fodder, prevailing at the time of purchase (including price of greens), were collected from the Department of Animal Nutrition of the University. On the basis of this price, total expenditure incurred on feeding of various experimental groups was calculated. The realizable receipt was calculated based on the milk procurement price (Rs 33.2./kg FCM) declared by local cooperative milk collection center. The return over feed cost was calculated taking difference of the realizable receipt by sale of milk and the total feed cost.

Statistical analysis
Data obtained were subjected to statistical analysis as per Snedecor and Cochran (1994) [16] using Completely Randomized Design (CRD). All the data were subjected to ANOVA using the General Linear Models procedure of SPSS software. The mean differences among different treatments were separated by Duncan's multiple range tests. Consequently, a level of (P<0.05) was used as the criterion for statistical significance.

Results and Discussion
Milk Yield, milk fat and FCM
The effect of feeding bypass fat on milk yield, milk fat and FCM is depicted in Table 5. The average daily milk yield and 6% fat corrected milk was significantly (P<0.05) increased in T3 group as There was significant (P<0.05) improvement in milk fat percent due to feeding of bypass fat.

Economics
The cost of feed ingredients of experimental rations and the average daily feeding cost in treatment T1, T2 and T3 shown in table 6. And table 7. The average daily feeding cost in treatment T1, T2 and T3 were Rs. 160.85, 172.45, 178.25 respectively. The mean value of daily 6% FCM and total revenue in treatment T1, T2 and T3 were 13.68kg, 14.31kg, 15.12kg and Rs. 454.17, 475.09, 501.98 respectively (Table 8.). The realizable receipt was calculated based on the milk procurement price (Rs.33.2/kg FCM) declared by local cooperative milk collection center. The return over feed cost was calculated taking difference of the realizable receipt by sale of milk and the total feed cost. The cost of feed was low in control group (Rs. 160.85) as compared to treatment group (Rs. 172.45, 178.25) but when compared to per kg production it was lower in bypass fat groups than control. So, net increased in revenue were Rs. 9.3 and 30.41 respectively and percentage increase in revenue in T2 and T3 were 3.2 and 10.37 percent respectively.
The total revenue of milk production was significantly improved in bypass fat supplemented buffaloes as compared to control animals. The net returns on sale of milk were significantly increased in bypass group as compared to control group.

Table 1: Experimental design

Treatments	T_1	T_2	T_3
No. of animals	6	6	6
Average days post partum	23.6	23.8	24.5
Milk yield (Kg.)	11.41	11.13	11.21

Table 2: The details feeding plan of animals in different treatments

No.	Group	Treatment
1.	T_1 (control)	Seasonal green fodder + wheat straw + conventional concentrate mixture
2.	T_2	Seasonal green fodder + wheat straw + conventional concentrate mixture +100 gram bypass fat/day/animal.
3.	T_3	Seasonal green fodder + wheat straw + conventional concentrate mixture +150 gram bypass fat/day/animal.

Table 3: Chemical composition of feed ingredient (on DM basis)

Ingredients	DM	CP	CF	EE	Ash	OM	NFE
Wheat straw	95.00	2.85	35.61	1.02	12.97	87.03	47.55
Green maize	23.00	7.71	28.30	3.11	9.11	90.89	51.77
Maize	88.08	9.13	2.52	3.44	2.83	97.17	70.16
Ground nut cake(GNC)	93.47	40.23	9.43	9.05	8.9	91.10	25.86
Barley	93.80	10.03	8.03	1.86	4.35	95.65	75.73
Mustard cake	90.20	35.10	6.97	8.31	9.94	90.06	39.68
Wheat bran	88.60	14	7.99	4.3	93.64	6.36	59.79

Table 4: Ingredient of concentrate mixtures

Ingredient (kg/100kg)	Quantity
Maize	25
Groundnut cake(GNC)	15
Barley	20
Mustard cake	10
Wheat bran	27
Mineral mixture	2
Salt	1
Total	100

Table 5: Effect of feeding bypass fat on milk yield, milk fat and FCM

Observations	Experimental groups		
	T1	T2	T3
Milk yield (Ltr.)	12.43±0.16	12.55±0.26	13.10±0.12
6% FCM (Ltr.)	13.68±0.22	14.31±0.28	15.12±0.22
Milk fat (%)	6.85±0.07	7.26±0.08	7.30±0.09

Table 6: Cost of feed ingredients of experimental rations prevailed during experimental period.

Ingredients	Price per 100 kg (Rs.)
Barley	1320
Maize	1719
Groundnut Cake	2559
Mustard Cake	1791
Wheat Bran	1283
Mineral mixture	5500
Common Salt	220
Green Fodder (Maize)	250
Wheat Straw	180

Record maintained at Feed and Fodder store at Lala Lajpat Rai University of Veterinary and Animal Science.

Table 7: Average cost of concentrate mixture, roughage, green fodder, bypass fat and daily feeding cost under different dietary treatments to the lactating Murrah buffaloes.

Treatment	Cost of concentrate (Rs./kg)	Cost of green fodder (Rs./kg)	Cost of wheat straw (Rs./kg)	Cost of bypass fat (Rs./kg)	Daily feeding cost (Rs.)
T1	17.15	2.50	1.80	-	160.85
T2	17.15	2.50	1.80	116	172.45
T3	17.15	2.50	1.80	116	178.25

Table 8: Average net revenue increase in treatment T2 and T3

Treatment	Mean value daily 6% FCM (kg)	Cost per kg 6% FCM (Rs.)	Total revenue (Rs.)	Daily feeding cost (Rs.)	Net revenue (Rs.)	Net increase in revenue in T2 and T3 (Rs.)	Percent increase in revenue in T2 and T3
T1	13.68	33.2	454.17	160.85	293.32	-	-
T2	14.31	33.2	475.09	172.45	302.64	9.3	3.2%
T3	15.12[a]	33.2	501.98	178.25	323.73	30.41	10.37%

Corrobo-rating our finding, there was increase in economic returns due to increase in fat content of milk by feeding of bypass fat in lactating animals (Vidhate *et al.* 2006) [17]. Similarly, Garg *et al.* (2002) [3] found higher net average daily income by feeding 1.0 kg protected sunflower meal and 1.0 kg protected fat/protein to lactating cows. The daily revenue was increased by 8.52% and 13.58%, respectively.

According to Parnerkar *et al*. (2010) [10] bypass fat feeding to buffaloes yielding 8-9 kg of milk daily resulted in Rs. 26.61 more income per day during early lactation. The feeding of indigenously prepared bypass fat to dairy animals has shown to give additional profit of Rs. 34.50/- per cow per day (Naik *et al*., 2009b) [8], Rs. 11.60/- per cow per day (Gowda *et al*., 2013) [4] and Rs. 39.66/- per buffalo per day (Parnerkar *et al*., 2011) [11]; besides improvement in reproductive performance and health of the animals.

So, it may be concluded that by the supplementation of bypass fat it is possible to increase income of dairy farmers owing to more milk production and fat content. Farmers are typically paid on the basis of the fat content of the milk they are producing, hence increase in fat percent and yield there would be increase in revenue of the dairy farmers. The total revenue of milk production was significantly improved in bypass fat supplemented buffaloes as compared to control animals. The net returns on sale of milk were significantly increased in bypass group as compared to control group.

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