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**Original Research Article**

# Effect of Feeding Bypass Fat on Milk yield, Composition, Efficiency of Nutrients and Economics in Cross Bred Cow: A Field Trial

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**A B S T R A C T**

To know the effect on milk yield and milk compositions and economics of feeding rumen-bypass fat to early-mid lactating dairy cows in field condition, a field trial was undertaken at farmer's dairy farm. Thirty cross bred cows in their early to mid-lactation stage (lactation number 2 to 5) were divided into groups T0 - without bypass fat, T1 – bypass fat 10g/kg milk yield. T2 - bypass fat 15g/kg milk yield above the farmers feeding schedule. Dietary supplementation of bypass fat had no significant effect on the average dry matter intake of cows from different groups but significantly ($P<0.05$) decreased in T2 group when presented in kg/whole milk. The milk production increased significantly ($P<0.05$) in T2 group than T0. The average fat%, fat yield and FCM Yield was significantly higher ($P<0.05$) in T1 and T2 groups as compared to T0 group. The average daily CP intake kg/kg milk yield and kg/kg FCM was statistically similar. The average daily TDN intake (kg/day/head) was significantly higher in T2 than control group. The daily feed cost and daily realizable receipt was significantly ($P<0.05$) higher in T1 and T2 groups, as compared to T0 group. The daily return over feed cost (ROFC) was significantly ($P<0.05$) higher in T2 groups as compared to T0 group. When the economics of milk production on feeding bypass fat 10g/kg milk yield and bypass fat 15g/kg milk yield it was observed that increase in daily income by 28 and 40 Rs/day /animal as compared to control group and 47 to 69% more return over the control.

**Keywords**

Bypass fat, Milk yield, Nutrient efficiency, Return over feed cost

## Introduction

During early lactation, the amount of energy required for maintenance of body tissues and milk production often exceeds the amount of energy available from the diet (Goff and Horst, 1997), thus forcing mobilization of body fat reserves to satisfy energy requirement. Rising milk yield during early lactation presents a feed problem in dairy cows as the peak milk yield occurs at 6 to 8 weeks postpartum whereas the maximum feed intake lags behind peak milk yield by several weeks. There are many alternatives to overcome these problems. One of them is feeding of concentrates to dairy animals. Feeding fat to lactating animals is another alternative as it provides a dense source of non-fermentable energy (Sarwar *et al.*, 1999). In this way, animal can get more energy at low dry matter intake. However, fat feeding presents certain problems. Unsaturated fatty acids strongly inhibit activity of carbohydrate-splitting microorganisms which can interfere rumen function. To counteract the undesirable effect of unsaturated fatty acids on the ruminal fermentation, these have been fed as

salts of calcium (Chalupa *et al.*, 1986). Fats, as salts of long chain fatty acids (Ca-LCFA) improve rumen fermentation and have increased digestibility (Schneider *et al.*, 1988). Responses to supplementation of dairy cow diets with rumen-bypass fat have been variable. For example, feeding rumen-bypass fat to dairy cows has been reported to increase fat-corrected milk yield (Erickson *et al.*, 1992), milk and fat corrected milk yields (Klusmeyer *et al.*, 1991a; Rodriguez *et al.*, 1997), and milk fat percentage (Klusmeyer *et al.*, 1991a, 1991b; Elliott *et al.*, 1996). The objective of this study was to determine the effect on milk yield and milk compositions and economics of feeding rumen-bypass fat to early-mid lactating dairy cows in field condition.

## Materials and Methods

The field trial was undertaken at farmer's dairy farm of Kishanganj, Bihar. Thirty cross bred cows in their early to mid-lactation stage (lactation number 2 to 5) and having an average daily two week pretrial milk yield of groups (ten animals in each group) in such a way that the order of lactation and average milk yield of three groups were more or less similar. The present experiment was conducted by using Randomized Block Design (RBD) with three treatments T0 - without bypass fat, T1 – bypass fat 10g/kg milk yield. T2 - bypass fat 15g/kg milk yield. The animals were fed according to farmer's feeding schedule, Mustrad cake, Himul dana, Maize darra, Dal chuni and Paddy straw (kg) 0.5, 2, 2, 0.5, 8 and 0.5, 4, 5, 0.5, 8 respectively to cow yielding 5-10 and 10-20 kg milk/day. The bypass fat (Gaudhara) was purchased from Indian Immunological Pvt Ltd., Hyderabad. The cows were fed concentrate mixture at time of morning and evening milking. For two weeks preliminary trial period only ration were fed. After two weeks preliminary period bypass fat were supplemented with concentrate mixture.

### Recording of observations

Milk production was recorded daily after morning and evening milking by farmers. Milk sample for fat analysis were collected fortnightly from morning and evening milking throughout the experimental period. Fat content of milk was determined by milko tester in milk cooperative society. The cost of feeding experimental animals under the three groups was worked out from daily feed intake and actual purchased price of feeds and fodder. Feed conversion efficiency was calculated as the amount of DM, CP and TDN available from concentrate mixture and paddy straw to produce one kg of whole milk or 4% FCM. Economic efficiency was expressed as the daily feed cost, daily return over feed cost (ROFC) and net difference ROFC over control.

### Statistical Analysis

The data generated during the experiment were subjected to one way analysis of variance as per the methods of (Snedecor and Cochran, 1994).

## Results and Discussion

### Effect of feeding on dry matter intake

The average dry matter intake (DMI) of cow inT0, T1 and T2 groups was 13.95, 14.10 and 14.13 kg/head/d and when expressed as kg/100 kg body weight was 3.19, 3.25 and 3.26, respectively. The average DM intake (kg/day), kg/100 kg body weight and kg/kg whole milk is presented in Table 1. It was observed in the present study that dietary supplementation of bypass fat had no significant effect on the average dry matter intake of cows from different groups. But

significantly (P<0.05) decreased in T2 group when presented in kg/whole milk. Inclusion of fat in the diet has a variable effect on the DMI of ruminants. In studies by Tackett *et al.,* 1996; Jones *et al.,* 2000, the intake was not affected by inclusion of fat in the diets. However, other workers (Rodriguez *et al.,* 1997; Bertrand and Grimes, 1997; Pantoja *et al.,* 1996) reported decreased DM intakes with increasing fat in the diets. The probable reason for decrease in intake may be unsaturated fats, which adversely affected ruminal fermentation. Another reason for low intake was higher inclusion of fat, in most cases, affecting palatability of diet. However, in our study, the fine texture and absence of any smell of Gaudhara may not have affected the DMI by cows.

## Effect of feeding bypass fat on Milk Yield, Fat Per cent, 4% FCM Yield and Fat Yield

Table 1 shows the average milk production for the trial period for T0, T1 and T2. It is observed that average milk production of T0, T1 and T2 was 13.30, 13.94 and 14.70 kg respectively after treatment period of five fortnights. This data showing that milk production increased significantly (P<0.05) in T2 group than T0. Similar result reported by Ramteke *et al.,* 2014 after feeding 15g bypass fat/ kg milk yield to buffalo. Shelke *et al.,* (2012), opined that improvement in whole milk yield is due to higher ME intake observed in this group due to fortification of the diet with rumen protected fat. Similar results were also reported by (Shankhpal *et al.,* 2009b), Shelke and Thakur (2010; 2011; 2012) and Parnerkar *et al.,* (2011).

The average FCM yield (4% FCM) yield, Fat% and Fat Yield is presented in Table1. The fat (%) in milk of experimental cows under T0, T1 and T2 groups was 3.61, 4.19 and 4.25, and fat yield 0.484, 0.591 and 0.629, FCM (kg/head/d) yield 12.58, 14.45 and 15.31, respectively. The average fat%, fat yield and FCM Yield was significantly higher (P<0.05) in T1 and T2 groups as compared to T0group. Shaver (1990) observed average increase of milk about 1.5-2 kg/d/cow by feeding 0.45 kg of supplemental fat. Khorasani *et al.,* (1991) observed that whole canola seed included at up to 5% of dietary DM had a positive effect on milk yield. Fat supplementation increases milk production perhaps due to greater NEL intakes (Andrew *et al.,* 1991; Eastridge and Firkins, 1991). However, there are studies in which milk production in which fat supplementation did not increase milk yield (Jenkins and Jenny, 1992; Pantoja *et al.,* 1996; Solomon *et al.,* 2000).

The increased fat percentage by supplementation of bypass fat supported by the findings of Sarwar *et al.,* 2003 reported that Milk fat percentage was increased at 4.5% added Bergafat. Similar results reprted by other workers (Erickson *et al.,* 1992; Jenkins and Jenny, 1992; Pantoja *et al.,* 1996; Solomon *et al.,* 2000) in which supplemental fat in the diet of cows increased their milk fat percentage. Being highly saturated in its composition and direct relationship of dietary fatty acids with milk fat, bypass fat caused increased milk fat synthesis. The probable reason for increased milk fat percentage might be the linear relationship between dietary, plasma and milk FA (Sarwar *et al.,* 2003). Another reason for increased milk fat percentage was that increased dietary fat enhanced supply of FA to mammary gland from feed, which resulted in lower proportion of denovo fat synthesis. Milk fat, milk protein, milk yield and mean body condition score increased linearly with increased fat saturation (Pantoja *et al.,* 1996). Some workers have reported no change in milk fat percentage of the animals fed supplemental fat.

**Table.1** Effect of feeding bypass fat on dry matter intake, milk production and Fat%

| | Dietary treatments | | | |
|---|---|---|---|---|
| Attributes | T0 | T1 | T2 | SEM |
| Average daily DMI (Kg) | 13.95 | 14.10 | 14.13 | 0.015 |
| DMI (Kg/100kg) | 3.19 | 3.25 | 3.26 | 0.127 |
| DMI (Kg/whole milk) | 1.21 [a] | 1.20 [a] | 1.13 [b] | 0.040 |
| DMI (Kg/kg FCM) | 1.29 | 1.18 | 1.17 | 0.082 |
| Milk yield kg/day | 13.301 [a] | 13.943 [b] | 14.698 [b] | 0.44 |
| Fat% (kg) | 3.61 [a] | 4.19 [b] | 4.25 [b] | 0.177 |
| Fat Yield (kg) | 0.484 [a] | 0.591 [b] | 0.629 [b] | 0.036 |
| FCM Yield (kg) | 12.58 [a] | 14.45 [b] | 15.31 [b] | 0.681 |

[a,.b] Values with different superscripts in arrow differ ($p<0.05$)

**Table.2** Effect of feeding bypass fat on nutrient intakes and return over feed cost

| | Dietary treatments | | | |
|---|---|---|---|---|
| Attributes | T0 | T1 | T2 | SEM |
| CPI (kg/kg Milk yield) | 0.11 | 0.10 | 0.12 | 0.003 |
| CPI (kg/kg FCM) | 0.12 | 0.102 | 0.095 | 0.005 |
| Average TDNI (kg/d) | 8.51 [a] | 8.790 [b] | 8.84 [b] | 0.029 |
| TDNI (kg/kg milk yield) | 0.73 | 0.736 | 0.70 | 0.023 |
| TDNI (kg/kg FCM) | 0.79 [b] | 0.72 [ab] | 0.68 [a] | 0.031 |
| Daily cost of feeding (Rs/head) | 140 [a] | 156 [b] | 159 [b] | 1.643 |
| Daily realizable receipt (Rs/head) | 199 [a] | 242 [b] | 258 [b] | 14.60 |
| Daily return over feed cost (Rs/head) | 59 [a] | 86 [ab] | 99 [b] | 13.93 |
| Net difference in ROFC over control (Rs/head/day) | | 28 | 40 | |
| % more return over control | | 47 | 69 | |

[a,.b] Values with different superscripts in arrow differ ($p<0.05$)

Brown *et al.,* (1962) reported that 6% added tallow or cottonseed oil had no effect on milk fat percentage and milk yield. Moody *et al.,* (1967) reported that vegetable oil or hydrogenated fat in the concentrate of cows kept at high temperature (32°C), had no effect on milk or milk fat production. The cows fed Berga fat (2.5 to 4.5%) had higher 4% FCM yield (Sarwar *et al.,* 2003) and similar results reported by Johnson *et al.,* (1988) and Maiga *et al.,* (1995). Weiss and Wyatt (2000) reported increased FCM yield, when high oil corn silage was added in diet however, DMI was not influenced. The reason for increased FCM in the present study is because of increased milk fat test in cows fed diets containing fat. In contrast to present results, other workers reported no effect on 4% FCM yield (Salfer *et al.,* 1995; Elliott *et al.,* 1993).

Salfer *et al.,* (1995) reported that milk and 3.5% FCM yields were not influenced when supplementation of dietary partially hydrogenated tallow (2%) was initiated prepartum or at parturition. Elliott *et al.,* (1993) fed dairy cows diets containing 2.5 or 5% tallow and observed no significant effects of dietary fat on production of milk and 4% FCM.

## Nutrient Intakes of Cows and Return over Feed Cost during Experimental Period

The average daily CP intake (kg/head/d, kg/kg milk yield and kg/kg FCM) of experimental cows is given in Table 2. The average daily CP intake kg/kg milk yield and kg/kg FCM was 0.11, 0.10 and 0.12; 0.12, 0.10, 0.095 in T0, T1 and T2 groups, respectively and was statistically similar. Similar result reported by Savsani *et al.*, (2015) after feeding 10g bypass fat/kg milk yield in buffalo.

The average daily TDN intake (kg/day/head) was 8.51, 8.79 and 8.84 in T0, T1 and T2 groups, respectively which was significantly higher in T2 than control group. Similarly reported by Ramteke *et al.*, (2014) when Feeding of bypass fat (15g/kg milk yield) to buffalo significantly ($p$<0.01) higher TDNI, Similar results were found by Shelke and Thakur (2011). On the contrary to this Shankhpal *et al.*, (2009a) reported non-significant difference for average TDNI. The average daily TDN intake kg/kg FCM yield was 0.79, 0.72 and 0.68, respectively which was significantly lower in T2 group than control.

The daily feed cost (Rs./head) in T0, T1 and T2 was 140,156 and 159, respectively. The daily feed cost was significantly (P<0.05) higher in T1 and T2 groups, as compared to T0 group. Higher feed cost was on account of feeding bypass fat. The data on daily realizable receipt (Table 2) from sale of milk (Rs/head) was 199, 242, 258 in T0, T1 and T2 groups, respectively and significantly (P<0.05) higher in T1 and T2 than T0 group. This is the reflection of higher milk yield in T1 and T2 groups, as compared to T0 group. The daily ROFC (Rs./head) was 59, 86 and 99 in T0, T1 and T2 groups, respectively. The daily ROFC was significantly (P<0.05) higher in T2 groups as compared to T0 group. When the economics of milk production on feeding bypass fat 10g/kg milk yield and bypass fat 15g/kg milk yield it was observed that increase in daily income by 28 and 40 Rs/day /animal as compared to control group (T0) and 47 to 69% more return over the control.

The study was conducted to examine the influence of bypass fat on the milk yield and its composition and economics of lactating crossbred cows. The dry matter intake was not affected by feeding different levels of fat. However, Milk yield, percent milk fat increased after supplementation of bypass fat. The daily return over feed cost (Rs./head) was 59,86 and 99 in T0, T1 and T2 groups, respectively. Feeding bypass fat 10g/kg and 15g/kg milk yield there was 28 and 40 Rs/day /animal and 47 to 69% more return over the farmer's practices.

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## References

Andrew, S. M., Tyrrell, H. F., Reynolds, C. K. and Erdman, R. A. 1991. Net energy for lactation of calcium soaps of fatty acids for cows fed silage-based diets. Journal of Dairy Science. 74:2588.

Bertrand, J. A. and Grimes, L. W. 1997. Influence of tallow and *Aspergillus oryzae*, fermentation extract in dairy cattle rations. Journal of Dairy Science. 80:1179.

Brown, W. H., Stull, J. W. and Stott, G. H.

1962. Fatty acids composition of milk. 1. Effect of roughage and dietary fat. Journal of Dairy Science. 45:191.

Chalupa, W., Vecchiarelli, B., Elser, A. E., Kronfeld, D. S., Sklan, D. and Palmquist, D. L. 1986. Ruminal fermentation *in vivo* as influenced by long-chain fatty acids. Journal of Dairy Science. 69:1293.

Eastridge, M. L. and Firkins, J. L. 1991. Feeding hydrogenated fatty acids and triglycerides to lactating dairy cows. Journal of Dairy Science. 74:2610.

Elliot, J. P., Drackley, J. K., Schauff, D. J. and Jester, E. H. 1993. Diets containing high oil corn and tallow for dairy cows during early lactation. Journal of Dairy Science. 76:775.

Elliott, J.P., Drackley, J.K. and Weigel, D.J. 1996. Digestibility and effects of hydrogenated palm fatty acid distillate in lactating dairy cows. Journal of Dairy Science 79:1031-1039.

Erickson, P.S., Murphy, M.R., and Clark, J.H. 1992. Supplementation of dairy cow diets with calcium salts of long-chain fatty acids and nicotinic acid in early lactation. Journal of Dairy Science. 75:1078-1089.

Goff, J.P. and Horst, R.L. 1997. Physiological changes at parturition and their relationship to metabolic disorders. Journal of Dairy Science. 80:1, 260-1, 268.

Jenkins, T. C. and Jenny, B. F. 1992. Nutrient digestion and lactation performance of dairy cows fed combinations of prilled fat and canola oil. Journal of Dairy Science. 75:796.

Johnson, J. C. Jr., Utley, P. R., Mullinix, B. G. and Merrill, A. 1988. Effects of adding fat and lasalocid to diets of dairy cows. Journal of Dairy Science. 71:2151.

Jones, D. F., Weiss, W. P. and Palmquist, D. L. 2000. Short communication: influence of dietary tallow and fish oil on milk fat composition. Journal of Dairy Science. 88:2024.

Khorasani, G. R., Robinson, P. H., DeBoer, G. and Kennely, J. J. 1991. Influence of canola fat on yield, fat percentage, fatty acid profile and nitrogen fractions in Holstein milk. Journal of Dairy Science. 74:1904.

Klusmeyer, T.H., Lynch, G.L., Clark, J.H., and Nelson, D.R. 1991a. Effects of calcium salts of fatty acids and protein source on ruminal fermentation and nutrient flow to the duodenum of cows. Journal of Dairy Science.74:2206-2219.

Klusmeyer, T.H., Lynch, G.L., Clark, J.H., and Nelson, D.R. 1991b. Effects of calcium salts of fatty acids and proportion of forage in diet on ruminal fermentation and nutrient flow to the duodenum of cows. Journal of Dairy Science. 74:2220-2232.

Maiga, H. A., Schingoethe, D. J. and Ludens, F. C. 1995. Evaluation of diets containing supplemental fat with different sources of carbohydrates for lactating dairy cows. Journal of Dairy Science. 78:1122.

Moody, E. G., VanSoet, P. J., MacDowell, R. E. and Ford, G. L. 1967. Effects of high temperature and dietary fat on performance of lactating cows. Journal of Dairy Science. 50:1909.

Pantoja, J., Firkins, J. L., Eastridge, M. L. and Hull. B. L. 1996. Fatty acid digestion in lactating dairy cows fed fats varying in degree of saturation and different fiber sources. *J* Journal of Dairy Science. 79:575.

Parnerkar, S., Kumar D., Shankhpal, S.S., and Thube, H. 2010. Effect of feeding bypass fat to lactating buffaloes during early lactation. Proceedings of VII Biennial Animal Nutrition Association Conference, December.17-19, OUAT,

Bhubaneswar, India.pp.126.

Ramteke, P.V., Patel D.C., Parnerkar S., Shankhpal, S.S., Patel, G.R., Katole, S.B. and Pandey Arti, 2014. Effect of feeding bypass fat prepartum and during early lactation on productive performance in buffaloes. Livestock Research International. 2:3, 63-67.

Rodriguez, L.A., Stallings, C.C., Herbein, J.H., and McGilliard, M.L. 1997. Effect of degradability of dietary protein and fat on ruminal, blood, and milk components of Jersey and Holstein cows. Journal of Dairy Science, 80:353-363.

Salfer, J. A., Linn, J. G., Otterby, D. E. and Hanson, W. P. 1995. Early lactation responses of Holstein cows fed a rumen/ inert fat prepartum, and postpartum or both. Journal of Dairy Science. 78:368.

Sarwar, M., Mahr-un-Nisa and Feroz, M. A.1999. Energy utilization is not a constant function of metabolic body size in ruminant animals. International. Journal of Agriculture and Biology. 1:196.

Sarwar, M., Sohaib, A., Khan M. A. and Mahr-un-Nisa, 2003. Effect of feeding saturated fat on milk production and composition in crossbred dairy cows. Asian-Austtralian Journal of Animal Science. 16: 2: 204-210.

Savsani, H.H., Murthy, K.S, Gajbhiye, P.H., Vataliya, P.U. Bhadaniya, A.R., Kalaria, V.A, Ghodasara, S.N. and Patil, S.S. 2015. Milk yield and composition and efficiency of nutrients for milk production in jaffrabadi buffaloes on rations supplemented with varying levels of bypass fat. Buffalo Bulletin, 34:1.

Schneider, Sklan, P. D., Chalupa, W. and Kronfeld, D. S. (1988). Feeding calcium salts of fatty acids to lactating cows. Journal of Dairy Science. 71:2143.

Shankhpal, S.S., Gupta, R.S., Parnerkar, S. and Dhami, A.J. 2009a. Effect of supplementation of bypass fat on feed intake and digestibility of nutrients in lactating crossbred cows. *Proceedings of Animal Nutrition Association World Conference*, February 14-17, New Delhi, India.pp.69.

Shankhpal, S.S., Gupta, R.S., Parnerkar, S. and Dhami, A.J. 2009b. Effect of supplementation of bypass fat on milk production and nutrient utilization in lactating cows. *Proceedings of Animal Nutrition Association World Conference*, February 14-17, New Delhi, India.pp.247.

Shaver, R. D. 1990. Fat sources for high producing dairy cows. In: Proc. 51st Minnesota Nutr. Conf., St. Paul. p. 13.

Shelke, S.K. and Thakur, S.S. 2010. Effect of supplementing bypass fat prepared from soybean acid oil on milk yield and nutrient utilization in Murrah buffaloes. Indian Journal of Animal Science, 80: 354-357.

Shelke, S.K. and Thakur, S.S. 2011. Economics of feeding rumen protected fat and protein to lactating Murraha buffaloes. Indian Journal of Animal Nutrition. 28: 278-282.

Shelke, S.K., Thakur, S.S. and Amrutkar, S.A. 2012. Effect of feeding protected fat and proteins on milk production, composition and nutrient utilization in murrah buffaloes (Bubalusbubalus). Animal Feed Science and Technology. 171: 98-107.

Snedecor, G.W. and Cochran, W.G. (1994) *Statistical Methods.*8th ed., Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, India.

Solomon, R., Chase, L. E., Ben-Ghedalia, D. and Bauman, D. E. 2000. Effect of nonstructural carbohydrate and addition of full fat extruded soybeans

on the concentration of conjugated linoleic acid in milk fat of dairy cows. Journal of Dairy Science. 83:1322.

Tackett, V. L., Bertrand, J. A., Jenkins, T. C., Pardue, F. E. and Crimes, L. W. 1996. Interactions of dietary fat and acid detergent fiber diets of lactating dairy cows. Journal of Dairy Science. 79:270.

Weiss, W.P. and Wyatt, D.J. 2000. Effect of oil content and kernel processing of corn silage on digestibility and milk production by dairy cows. Journal of Dairy Science. 83(2):351-358.