Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2018; 6(6): 167-171

Received: 18-09-2018
Accepted: 19-10-2018

Aayush Yadav
Department of Livestock Production and Management, College of Veterinary Science and Animal Husbandry, NDVSU, Jabalpur, Madhya Pradesh, India

GP Lakhani
Department of Livestock Production and Management, College of Veterinary Science and Animal Husbandry, NDVSU, Jabalpur, Madhya Pradesh, India

Biswajit Roy
Department of Livestock Production and Management, College of Veterinary Science and Animal Husbandry, NDVSU, Jabalpur, Madhya Pradesh, India

Sudipta Ghosh
Department of Livestock Production and Management, College of Veterinary Science and Animal Husbandry, NDVSU, Jabalpur, Madhya Pradesh, India

Bhavna Aharwal
Department of Livestock Production and Management, College of Veterinary Science and Animal Husbandry, NDVSU, Jabalpur, Madhya Pradesh, India

Jyotimala Sahu
Department of Livestock Production and Management, ICAR, ERS-National Dairy Research Institute, Kalyani, West Bengal, India

Correspondence
Aayush Yadav
Department of Livestock Production and Management, College of Veterinary Science and Animal Husbandry, NDVSU, Jabalpur, Madhya Pradesh, India

Economic efficiency of milk production in lactating Murrah buffaloes supplemented with soybean oil

Aayush Yadav, GP Lakhani, Biswajit Roy, Sudipta Ghosh, Bhavna Aharwal and Jyotimala Sahu

Abstract
The study was conducted at Livestock farm, Adhartal, College of Veterinary Science & A.H., NDVSU, Jabalpur (M.P.) and aimed to investigate the effect of soybean oil supplementation on the economics of milk production in lactating Murrah buffaloes. Twelve advance pregnant Murrah buffaloes were selected 21 days pre-partum and randomly divided in 2 groups of 6 each; CON as control and SBO as soybean oil supplemented @ 200 ml/animal/day upto 90 days post-partum. The economics of milk production was calculated on the basis of 6% FCM yield. Results revealed reduced feed cost per kg 6% FCM yield and higher net returns of Rs. 62.83/animal/day in SBO as compared to CON. The additional benefit is due to the significant improvement in average daily milk yield, milk fat content and 6% FCM yield in SBO as compared to CON. This study affirms that SBO provide more economic returns to the dairy farm.

Keywords: Murrah, soybean oil, economics, milk yield, milk fat, FCM yield

1. Introduction
The nutrient requirements of dairy animals must be met from the dietary sources to get the optimum production and reproductive performances. During early lactation, high producing dairy animals require more energy to maintain body condition and support increased milk production but the energy requirements exceeds the amount of energy obtained from dietary sources, resulting in negative energy balance [25]. Regulation and coordination of lipid metabolism are key components of the adaptation to lactation [4] as feeding excessive amount of grains to improve ration energy density is undesirable due to milk fat depression, reduced fibre digestibility and possible rumen acidosis. Alternatively, fat supplements can safely increase the ration energy density without disturbing the ruminal fermentation, which helps to improve the body weight [8], body condition [3], milk yield [29] and milk fat percentage [10]. Supplementation of fat can increase the cost of feeding but it is possible to increase the income of dairy farmers owing to more milk production and milk fat content apart from its positive effect on the health and reproduction status of the animal. The efforts of milk producers and technicians in the quest to minimize costs have been on-going [9], as the cost of feeding per litre milk production is a fairly large factor in determining the economic viability of livestock sector which must be limited by following new measures in the ration formulation. Research has shown that the animal feed is the most significant expense in milk production accounting for as much as 60% of total costs [24]. In this context, vegetable oils are economically feasible and appear to have the greatest impact on economic efficiency such as mustard oil [13]. Research findings addressing the economic feasibility of ruminant diets supplemented with soybean oil is generally lacking and hence, the present study was aimed to evaluate the economic efficiency of milk production in lactating Murrah buffaloes supplemented with soybean oil.

2. Materials and Methods
2.1 Place of work
The proposed work was conducted on 12 advance pregnant Murrah buffaloes from 21 days pre-partum to 90 days post-partum at Livestock farm, Adhartal, College of Veterinary Science & A.H., Nanaji Deshmukh Veterinary Science University, Jabalpur (M.P.). The animals were selected on the basis of similarity in body weight, age, parity (1st to 3rd) and previous lactation

yield and randomly assigned in two groups of six each; CON as control without supplementation and SBO as soybean oil supplementation @ 200 ml/animal/day.

2.2 Feeding regime

The experimental animals were stall fed and maintained in a semi-intensive system of housing. The animals were fed total mixed ration according to their body weight and production as per ICAR [7]. A fixed quantity of chaffed green fodder and wheat straw was offered to the animals. The concentrate consisting of 18 per cent crude protein and 70 per cent total digestible nutrients was offered at a scale of 1 kg per 2.0 kg milk production along with maintenance ration as per routine practices at the farm. The measured quantity of soybean oil was mixed daily in the concentrate of SBO supplemented group at the time of feeding. The total required quantity of feed was offered daily at 5.30 am and 3.00 pm. The water was kept available to the animals round the clock. The experiment was approved by the Institutional Animal Ethics Committee.

2.3 Parameters studied were

2.3.1 Feed intake and Dry matter (%)

Daily intake of concentrate, straw and green fodder was recorded for individual animals. Weighed quantities of concentrate, straw and green fodder were offered to animals and the leftover was collected next day in the morning and weighed. The leftover was subtracted from the initial feed supplied to know the actual amount of feed consumed by the animal. The representative samples of concentrate mixture and roughage were taken in moisture cups and kept in the hot air oven at 100±2˚c for 24 hrs and dry matter was calculated as follows:

$$\text{Dry matter (\%)} = \frac{\text{Dry weight of sample (g)}}{\text{Fresh weight of sample (g)}} \times 100$$

2.3.2 Milk fat (%)

The representative milk samples of individual animals were collected from the milking bucket after complete milking of the individual animal and analysed for milk fat percentage at fortnightly intervals using Lacto Plus (Ultrasonic auto milk analyzer, Netco Pvt. Ltd.).

2.3.3 Milk yield and fat corrected milk (FCM) yield

Animals were hand milked twice a day for ninety days after calving i.e., at 6 am and 4 pm for recording of milk yield individually. Milk obtained from two times milking was combined together to get the actual milk yield of the buffaloes for that day. The milk yield was recorded at fortnightly intervals throughout the experimental period. For the conversion of whole milk into 6 per cent FCM yield, the equation derived by [15] was used. The FCM yield was calculated at fortnightly intervals during 90 days lactation period.

$$\text{6 per cent FCM yield (kg)} = \frac{(0.4 \times \text{MY (kg)} + 15 \times \text{Fat (kg)})}{1.3}$$

2.4 Economics of milk production

The economics of milk production was calculated on the basis of 6 per cent FCM yield.

2.5 Statistical analysis

Data were analyzed using ANOVA [20] and the means showing significant differences in the ANOVA table were compared using the Duncan Multiple Range Test [21].

3. Results and discussion

3.1 Dry matter intake (DMI; kg/animal/day)

The mean±SE values of DMI are presented in table 1. The overall average daily DMI was 19.60±0.44 and 19.93±0.43 in CON and SBO, respectively. Though non-significant but the values were numerically higher in SBO followed by CON. The per cent improvement in DMI from calving to 3 months in CON and SBO was 26.96 and 27.73, respectively whereas; in comparison to CON, per cent increase in SBO was 1.68. Continuous increase in the DMI was observed in lactating Murrah buffaloes throughout the study period.

The animals in NEB consume more DMI because of craving for more nutrients to support higher milk production. This was not seen in the present study as animals were not high yielders and the required energy for supporting milk production was met through the diet. This may be a possible hypothesis for no significant changes in DMI. The short feeding period of 12 weeks or small amount of oil supplementation may be another reason for non-significant changes as reported by [1]. Further findings reveal that SBO group had readily accepted the oil supplementation in their diet and it did not alter the palatability of ration, considering it to be the possible cause for slight increase in DMI in SBO. This result resembled with previous study [22]. Besides, the study corroborated with the investigation of [13] who reported that the higher DMI may be due to the additional fat or energy supplementation which resulted in slight enhancement of concentrate intake and also changed the roughage concentrate ratio slightly in treatment group.

3.2 Daily milk yield (MY; lit.)

The mean±SE values of my are presented in table 1. The overall average daily my was found to be significantly ($p<0.05$) higher in SBO (8.97±0.06) than CON (7.90±0.06). The per cent increase in daily MY from calving to 3 months period in CON and SBO was 22.00 and 21.39, respectively; however SBO showed 13.54 per cent increase in daily MY as compared to CON. The fortnightly average daily MY increased up to 4th fortnight and thereafter decreased gradually.

A number of scientific investigations have been found similar with the present study. In the present study, the increase in milk production is consistent with increase in dietary energy density, energy intake and improvement in efficiency of energy utilization as reported by [6, 29, 2, 11]. In addition, fat has the capacity to reduce heat and energy loss in urine, which potentially increases the efficiency of energy utilization and partitioning of absorbed nutrients for milk production as reported by [11]. Besides, soybean oil is rich in linoleic and linolenic fatty acids that have been documented to influence the milk yield as reported by [23]. However, the present finding mismatched to the report made by [5] that explains gradual adaptation of animals to milking and no effect of lipid supplementation on milk yield as a reason for increase in basal milk production. The highest average per cent increase in daily MY was 13.54 in this study than 7.27 and 7.30 reported by [2, 6], respectively which further indicates that pre and post-partum fat supplementation was more effective in

eliciting the higher milk production response than feeding alone in early lactation. On the contrary, a report [27] suggested the negative effects of long-term oil supplementation on diet digestibility and degradability which contributed to a fair reduction in milk production and is found to be similar with the present findings of decline in MY from 5th fortnight onwards. Less MY in CON as compared to SBO is credited to the non-availability of fat supplements in the ration.

3.3 Milk fat per cent

The mean±SE values of milk fat per cent are presented in table 1. The overall average fat per cent varied significantly ($p<0.05$) and the values were higher in SBO (7.39±0.01) than CON (6.89±0.01). The average fat per cent in milk has increased throughout the study period in both the groups. The per cent increase in milk fat from calving to 3 months period in CON and SBO was 16.32 and 10.01, respectively; however milk fat was significantly higher in SBO by 7.25 per cent in comparison to CON. Further, results reveal higher fat yield (kg) in SBO (0.66) followed by CON (0.54).

The result is supported by the findings of [12] who stated that adding dietary fat increased concentration of low density lipoprotein triglyceride in plasma and thus increased their uptake by the mammary gland with inhibition of short chain fatty acid synthesis. Moreover, the increase in milk fat per cent is attributed to the availability of more saturated and unsaturated dietary fatty acids being directly incorporated in milk fat after absorption from the intestine, which is similar with the findings of [16, 18]. We speculate that any of these conditions were in effect in the current experiment.

3.4 6 percent fat corrected milk yield (FCM yield; kg)

The mean±SE values of 6 per cent FCM yield are presented in table 1. The overall average 6 per cent FCM yield varied significantly ($p<0.05$) and the values were statistically higher in SBO (11.25±0.08) followed by CON (9.47±0.08). The per cent increase in FCM yield from calving to 3 months period in CON and SBO was 34.39 and 29.42; however SBO showed 18.80 per cent increase in FCM yield as compared to CON. The fortnightly average 6 per cent FCM yield (kg) increased up to 4th fortnight and thereafter decreased gradually.

The increase in 6 per cent FCM yield is credited to the higher average daily MY and milk fat per cent in SBO over CON. The present finding is similar with the findings of [26] who reported improvement in the energy density of the diet, enabling the animals to meet their energy and essential fatty acid requirements and expressing their milk production potential whereas [16] reported improved body condition score (BCS) to be the possible cause for increase in FCM yield which resembles with the present study as BCS improved non-significantly in SBO over CON.

Table 1: Fortnightly average dry matter intake (DMI; kg/animal/day), milk yield (MY; lit), milk fat (%) and 6% fat corrected milk yield (FCM yield; kg) in lactating Murrah buffaloes (Mean ± SE) in different groups

Fort.	DMI		MY		Milk fat		6% FCM yield	
	CON	SBO	CON	SBO	CON	SBO	CON	SBO
1	16.80±0.71	16.48±1.03	6.23±0.17	7.34±0.18	6.19±0.02	6.99±0.02	6.95±0.18	8.87±0.23
2	18.07±0.57	19.81±0.80	8.10±0.10	8.90±0.12	6.70±0.04	7.18±0.02	9.49±0.11	10.92±0.15
3	20.32±1.25	20.50±0.85	8.51±0.11	9.54±0.08	6.96±0.01	7.36±0.02	10.23±0.15	11.93±0.14
4	20.37±1.26	20.42±0.97	8.81±0.13	9.81±0.04	7.10±0.01	7.43±0.06	10.73±0.16	12.29±0.10
5	20.90±0.99	20.43±0.88	8.20±0.13	9.32±0.10	7.19±0.01	7.67±0.01	10.08±0.15	11.98±0.15
6	21.33±0.78	21.05±1.06	7.60±0.12	8.91±0.13	7.20±0.01	7.69±0.01	9.34±0.14	11.48±0.17
Average	19.60±0.44	19.93±0.43	7.90^{a}±0.06	8.97^{b}±0.06	6.89^{a}±0.01	7.39^{b}±0.01	9.47^{a}±0.08	11.25^{b}±0.08

[a and b] Mean with different superscript differ significantly within rows ($p<0.05$)

3.5 Economics of milk production

The economics of soybean oil supplementation on average cost of milk production for experimental period of three months is presented in table 2.

The average total feed cost (Rs.) per animal per day during the experimental period in CON and SBO was 191.80 and 207.29, respectively. The average 6 per cent FCM yield (kg) in CON and SBO was 9.47 and 11.25, respectively. The average total cost (Rs.) of feed per kg 6 per cent FCM yield was calculated as 20.25 and 18.42 for CON and SBO, respectively. Reduction in feed cost (Rs.) per kg 6 per cent FCM yield in comparison to CON was 1.83 in SBO. The per cent reduction in feed cost per kg 6 per cent FCM yield in SBO was 9.03 in comparison to CON. Based on the cost of feed and returns from 6 per cent FCM yield, the return (Rs.) per animal per day was calculated as 224.88 and 287.71 in CON and SBO, respectively. The per cent return per animal per day in SBO was 27.94 in comparison to CON. The net return (Rs.) per animal per day in SBO was 62.83 in comparison to CON.

Similar findings have shown to give additional profit of Rs. 36/- per buffalo per day [14]; 46.91/- per buffalo per day [17]; 15.53/- per buffalo per day [26]; 50/- per cow per day [19]; 94.46/- per cow per day [28] and 127.49/- per cow per day [13]. Farmers are typically paid on the basis of the fat content of the milk they are producing, hence increase in milk fat yield and milk yield in SBO supplemented group than CON group has led to increase in revenue of the dairy farmers suggesting that SBO supplementation is economically feasible and the finding is similar with the findings of [26].

Table 2: Economics of soybean oil supplementation on milk production in lactating Murrah buffaloes

Attributes	CON	SBO
Amt. (kg) of concentrate/animal/day	6.88	6.89
Amt. (kg) of dry roughage/animal/day	10.80	9.98
Amt. (kg) of green roughage/animal/day	19.50	19.54
Cost (Rs.) of concentrate/animal/day	116.41	116.58
Cost (Rs.) of dry roughage/animal/day	36.39	33.63
Cost (Rs.) of green roughage/animal/day	39.00	39.08
Cost (Rs.) of soybean oil/animal/day @ Rs. 90/lit	-	18.00

Total feed cost (Rs.)/animal/day	191.80	207.29
Average 6 per cent FCM yield (kg)/animal/day	9.47	11.25
Return (Rs.) from 6 per cent FCM yield produced/animal/day @ Rs. 44/lit	416.68	495.00
Cost of feed (Rs.)/kg 6 per cent FCM yield	20.25	18.42
Return (Rs.)/animal/day	224.88	287.71

Cost of ingredients: Concentrate- Rs. 16.92/kg; Dry roughage- Rs. 3.37/kg; Green roughage- Rs. 2.00/kg; Soybean oil- Rs. 18.00/200 ml; Milk- Rs. 44.00/lit.

4. Conclusion

The present findings indicate that the supplementation of SBO has reduced feed cost (Rs.) per kg 6 per cent FCM yield by 1.83 as compared to CON. The net return (Rs.) per animal per day is therefore higher in SBO by 62.83 in comparison to CON. The additional benefit is due to the significant ($p<0.05$) improvement in average daily milk yield by 13.54 per cent, milk fat by 7.25 per cent and 6 per cent FCM yield by 18.80 per cent in SBO as compared to CON besides non-significant improvement in dry matter intake in SBO as compared to CON. From our study it can be inferred that SBO supplementation is economically feasible and could be recommended during early lactation to get maximum benefits to the farmers by improving production performances.

5. References

1. Altenhofer C, Spornraft M, Kienberger H, Rychlik M, Herrmann J, Meyer HHD *et al*. Effects of rapeseed and soybean oil dietary supplementation on bovine fat metabolism, fatty acid composition and cholesterol levels in milk. Journal of Dairy Research. 2014; 81:120-128.
2. AlZahal O, Odongo NE, Mutsvangwa T, Or-Rashid MM, Duffield TF, Bagg R *et al*. Effects of monensin and dietary soybean oil on milk fat percentage and milk fatty acid profile in lactating dairy cows. Journal of Dairy Science. 2008; 91(3):1166-1174.
3. Boken SL, Staples CR, Sollenberger LE, Jenkins TC, Thatcher WW. Effect of grazing and fat supplementation on production and reproduction of Holstein cows. Journal of Dairy Science. 2005; 88(12):4258-4272.
4. Drackley JK. Biology of dairy cows during the transition period: The final frontier. Journal of Dairy Science. 1999; 82(11):2259-2273.
5. Gagliostro GA, Patino EM, Negrette MS, Sager G, Castelli L, Antonacci LE *et al*. Milk fatty acid profile from grazing buffaloes fed a blend of soybean and linseed oils. Arquivo Brasileiro de MedicinaVeterinaria e Zootecnia. 2015; 67(3):927-934.
6. Gowda NKS, Manegar A, Raghavendra A, Verma S, Maya G, Pal DT *et al*. Effect of protected fat supplementation to high yielding dairy cows in field condition. Animal Nutrition and Feed Technology. 2013; 13:125-130.
7. ICAR. Nutrient requirements of cattle and buffalo. Indian Council of Agriculture Research, New Delhi, 2013.
8. Kale V, Kumar S, Kewalramani N, Mani V, Tyagi N, Tyagi AK. Comparative study of mustard, soybean and rice bran oil: Effects on nutrient utilization, growth performance and blood metabolites in growing Murrah buffalo (*Bubalus bubalis*) heifers. Animal Nutrition and Feed Technology. 2016; 16(3):383-392.
9. Lage LA, Lopes MA, Lopes FCF, da Gama MAS, Ribeiro CGS, Rodriguez NM *et al*. Economic feasibility of adding sunflower oil to elephant grass-based diets of lactating dairy cows. Semina: Ciencias Agrarias. 2016; 37(4):2313-2320.
10. Mele M, Serra A, Buccioni A, Conte G, Pollicardo A, Secchiari P. Effect of soybean oil supplementation on milk fatty acid composition from Saanen goats fed diets with different forage: concentrate ratios. Italian Journal of Animal Science. 2008; 7:297-311.
11. Otto JR, Nish P, Balogun RO, Freeman MJ, Malau-Aduli BS, Lane PA *et al*. Effect of dietary supplementation of pasture-based primiparous Holstein Friesian cows with degummed crude canola oil on body condition score, live weight, milk yield and composition. Journal of Applied Animal Research. 2016; 44(1):194-200.
12. Palmquist DL, Jenkins TC. Fat in lactation rations: Review. Journal of Dairy Science. 1980; 63:1-14.
13. Parihar S, Lakhani GP, Baghel RPS, Ghosh S, Roy B. Changes in productive and reproductive performance of indigenous lactating cattle fed on mustard oil and molasses supplementation. International Journal of Livestock Research. 2018; 8(1):166-170.
14. Parnerkar S, Kumar D, Shankhpal SS, Thube M. Effect of feeding bypass fat to lactating buffaloes during early lactation. *In*: Proceedings of 14th Biennial Conference on Livestock Productivity Enhancement with Available Feed Resources. Animal Nutrition Society of India, Pantnagar, 2011, 111-112.
15. Rice VA. Breeding and improvement of farm animals. McGraw Hill Book Co., Bombay, 1970.
16. Sharma S, Singh M, Roy AK, Thakur S. Effect of pre-partum prilled fat supplementation on feed intake, energy balance and milk production in Murrah buffaloes. Veterinary World. 2016; 9(3):256-259.
17. Shelke SK, Thakur SS. Economics of feeding rumen protected fat and protein to lactating Murrah buffaloes. Indian Journal of Animal Nutrition. 2011; 28:278-282.
18. Shelke SK, Thakur SS, Amrutkar SA. Effect of feeding protected fat and proteins on milk production, composition and nutrient utilization in Murrah buffaloes (*Bubalus bubalis*). Animal Feed Science and Technology. 2012; 171:98-107.
19. Singh M, Sehgal JP, Roy AK, Pandita S, Rajesh G. Effect of prill fat supplementation on hormones, milk production and energy metabolites during mid-lactation in crossbred cows. Veterinary World. 2014; 7:384-388.
20. Snedecor GW, Cochran WG. Statistical Methods, Edn 7, Oxford & IBH Publishing Co., New Delhi, 1994.
21. Steel RGD, Torrie JH. Principles and procedures of statistics. A biometrical approach, Edn 2, McGraw Hill Book Co., New York, 1980.
22. Suharti S, Khotijah L, Nasution AR, Warmadewi DA, Cakra GLO, Arman C *et al*. Productive and reproductive performances and blood profile of Bali cows supplemented with calcium soap-soybean oil. Pakistan Journal of Nutrition. 2017; 16(11):882-887.
23. Sultana H, Ishida T, Shintaku T, Kanda S, Itabashi H. Effect of feeding Ca-salts of fatty acids from soybean oil and linseed oil on c9,t11-CLA production in ruminal

fluid and milk of Holstein dairy cows. Asian-Australasian Journal of Animal Sciences. 2008; 21(9):1262-1270.
24. Thomas CK, Sastry NSR. Dairy Bovine Production, Edn 2, Kalyani Publishers, New Delhi, 2012.
25. Tyagi N, Thakur SS, Shelke SK. Effect of bypass fat supplementation on productive and reproductive performance in crossbred cows. Tropical Animal Health and Production. 2010; 42:1749-1755.
26. Vahora SG, Parnerkar S, Kore KB. Productive efficiency of lactating buffaloes fed bypass fat under field conditions: Effect on milk yield, milk composition, body weight and economics. Iranian Journal of Applied Animal Science. 2013; 3(1):53-58.
27. Veira DM, Charmley LL, Charmley E, Lee AJ. The effect of feeding soybean oil to mid lactation dairy cows on milk production and composition and on diet digestion. Canadian Journal of Animal Science. 2001; 81:425-428.
28. Yadav G, Roy A, Singh M. Effect of prilled fat supplementation on milk production performance of crossbred cows. Indian Journal of Animal Nutrition. 2015; 32:133-138.
29. Ye JA, Wang C, Wang HF, Ye HW, Wang BX, Liu HY *et al*. Milk production and fatty acid profile of dairy cows supplemented with flaxseed oil, soybean oil, or extruded soybeans. Acta Agriculturae Scandinavica. 2009; 59(2):121-129.