Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2019; 7(1): 1439-1442

Received: 12-11-2018
Accepted: 15-12-2018

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

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

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

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

Effect of rumen protected fat supplementation on nutrient utilization and body condition in dairy animals: A review

Harish Rohila, Amar Shroha and Rakesh Kumar

Abstract
RPF (Rumen Protected Fat)/ bypass fat in the rations of the high producing dairy animals is very crucial for enhancing the energy density of ration. Rumen Protected Fat means that resists lipolysis and bio hydrogenation in rumen by rumen microorganisms, but gets digested in lower digestive tract. 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. 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. Cereal grains and fats plays an important role as source of energy in the ration but due to use of cereals for human consumption and monogastric animals the alternate source of energy in dairy ration is supplemental fat/RPF (Rumen Protected Fat)/ bypass fat. And inclusion of unprotected fat in dairy ration is limited to 3% of dry matter (DM) intake, beyond which digestibility of DM and fibre are reduced. So, diets containing rumen protected fat often stimulate energy intake, improved efficiency of utilization of energy without adversely affecting the DM intake and improved body condition in dairy animals.

Keywords: Rumen protected fat, nutrient utilization, body condition and dairy animals

Introduction

Dairy 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. And shortage of feed resources coupled with their poor nutritive value is of major concern. Lactating buffaloes in early lactation do not consume sufficient dry matter to support maximal production of milk (Goff and Horst, 1997) [9]. 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) [32]. 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 (Kim *et al.* 1993) [11].Cereal grains plays an important role as source of energy but due to use of cereals for human consumption and monogastric animals the alternate source of energy in dairy ration is supplemental fat (Saijpaul *et al.* 2010) [23]. And inclusion of unprotected fat in dairy ration is limited to 3% of dry matter (DM) intake, beyond which digestibility of DM and fibre are reduced (NRC, 2001) [18]. It has also depressing effect on rumen cellulolytic microbial activity (Ranjan *et al.* 2010) [22]. Another attempts have been made to augment milk production from dairy animals with bovine somatotropin which is galactopoietic in nature (Bachman *et al*., 1992; Singh and Ludri, 1994) [1, 30]. Because of the environmental hazards and secretion of hormone into milk, the application of this technology could not become popular (Prasad and Singh, 2010) [19]. Subsequently researchers focused on the use of nonhormonal preparations and herbal medicine to augment lactation because they augment milk yield without affecting the energy balance (Singh *et al*., 2014) [31]. So, bypass fat supplementation increases energy density of the diet which is reflected in improved BCS and productive performance of animals (Ganjkhanlou *et al*., 2009) [7]. And by protecting the fats from ruminal degradation, it is possible to increase fat content of the ration up to 6-7% of the DM intake, so that the fats get digested and absorbed optimally in the lower tract for milk and fat production without affecting digestibility of DM and fibre.

It is stated that supplementing ration of lactating animals with bypass fat enhances energy intake in early lactation which reduces deleterious effect of acute negative energy balance on lactation (Tyagi *et al.* 2010) [36]. 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) [13]. Bypass fat in the form of calcium salts of fatty acids (Palm oil and others) has been known to increase energy density of the ration without adversely affecting the DM intake and digestibility (Naik *et al*. 2009) [16].

Effect of RPF on dry matter intake

Jenkins and Palmquist (1984) observed no significant difference in dry matter intake by addition of calcium soaps of fatty acids in rations of lactating Holstein cows [10]. Schauff and Clark (1992) found a linear decrease in dry matter intake when cows were fed rations containing 3, 6, and 9 per cent of protected fat as calcium soaps of long chain fatty acids and attributed to the worse palatability of the supplemental fat [25]. Schneider *et al*. (1988), Erickson *et al*. (1992) reported no difference in DM (Dry Matter) intake [26, 5]. Kim *et al*. (1993) reported reduction in DM intake attributable to dietary CSFA has been reported [11]. Garg and Mehta (1998) also did not find any significant effect of bypass fat on dry matter intake[8]. Sarwar *et al*. (2004) reported daily dry matter intake ranging from 10.8 to 11.0 kg in different groups of lactating Nili-Ravi buffalos fed 0 to 6 per cent ruminally protected fat, which was statistically non significant [24]. Tyagi *et al.* (2009) have reported that daily dry matter intake of the ration had remained unaffected on supplementing rumen bypass fat [37]. Most of the workers reported that the DM intake of dairy animals was not altered (Naik *et al*., 2007b; 2009a; Tyagi *et al*., 2009b; Thakur and Shelke, 2010; Sirohi *et al.*, 2010; Mudgal *et al.*, 2012) on supplementation of bypass fat [15, 17, 39, 28, 32, 14]. Chouinard *et al*. (1997) reported decrease and Tyagi *et al.* (2009a) reported increase in DM intake in dairy animals fed bypass fat [2, 38]. Bypass fat supplementation in the ration of lactating animal, enhances the energy intake and reduces the adverse effect of NEBAL during early lactation (Drackley, 1999; Ganjkhanlou *et al*., 2009) without affecting rumen cellulolytic bacterial activity (Thakur and Shelke, 2010) [4, 7, 35]. Shelke *et al.* (2011), Mudgal *et al.* (2012), Ranjan *et al.* (2012) and Desai (2012), did not found significant effect on DMI [29, 14, 21, 3].

Effect of RPF on efficiency of nutrient utilization

Maiga and Schingoethe, (1997) reported that diets containing supplemental fat often stimulate increased milk production because of increased energy intake, improved efficiency of utilization of energy, or both [13]. Naik *et al.* (2007b) reported that no effect on DCP intake by the supplementation of bypass fat to dairy animals [15]. Naik *et al*. (2007b), Sirohi *et al*. (2010) reported that TDN intake was either not altered on supplementation of bypass fat in the diet of the dairy animals [15, 32]. Naik *et al*. (2009a) reported no increase in the DE and ME intake on bypass fat supplementation to buffaloes [17]. Tyagi *et al*., (2009a), Thakur and Shelke, (2010) reported that TDN intake was increased on supplementation of bypass fat in the diet of the dairy animals [38, 28]. Tyagi *et al*. (2009a; 2009b), Thakur and Shelke, (2010) reported no effect on CP intake and by the supplementation of bypass fat to dairy animals [38, 39, 28]. Tyagi *et al.* (2009a) reported decrease in the intake (kg) of DM (0.81 vs 0.78 and 0.82 vs 0.76); CP (0.12 vs 0.11; 0.12 vs 0.11) and TDN (0.52 vs 0.51; 0.52 vs 0.50) per kg of milk and FCM production in crossbred cows indicating better utilization of DM, CP and TDN due to bypass fat supplementation [38]. Sirohi *et al*. (2010) also observed decrease in the CP intake (130.72 vs 118.87, g) per kg FCM production in crossbred cows indicating better utilization of the dietary CP [32]. Sirohi *et al*. (2010) reported increase in CP intake (1.44 vs 1.60; kg/d) in lactating crossbred cows supplemented with bypass fat [32].

2.5 Effect of RPF on body weight and body condition

Komaragiri *et al.* (1998) reported that the addition of fat in early lactation diets is commonly thought to improve energy balance by reducing body fat mobilization and use of supplemental dietary fat for milk production [12]. Solorzano Kertz, (2005) reported that supplementation of fats is done to minimize the body weight loss and hasten body weight gain postpartum while maintaining milk production in dairy animals [34]. Purshothaman *et al.* (2008) reported no significant effect of feeding calcium salt of palm oil fatty acids on body weight change in dairy cows [20]. Ganjkhanlou *et al*. (2009) reported that bypass fat supplementation increases energy density of the diet which is reflected in improved BCS and productive performance of animals [7]. Wadhwa *et al*. (2012) reported that the body weight of the animals improved in the bypass fat supplemented group as compared to the control group (551 vs. 508, kg), though the differences were nonsignificant [41]. Vahora *et al*. (2013) reported that feeding of calcium salt of palm oil fatty acids significantly reduced (p<0.05) the loss in body weight (11.72 vs. 38.30) in comparison to that of control group [40]. Metabolic body weight at the beginning of experiment was more (p<0.05) in the control cows; however after 90 days of experiment the metabolic weight increased significantly (p<0.05) in the PF supplemented cows (Singh *et al*., 2014) [31]. Singh *et al*. (2014) reported that the decline in BCS (p<0.01) was more in control than the PF supplemented cows [31]. Friggens *et al*. (1993), Sharma *et al*. (2015) observed that additional dietary fat could result in better energy partitioning and improved energy balance in dairy animals [6, 27].Garg and Mehta (1998) observed that the BSC of the cows improved due to bypass fat feeding indicating reduction in weight loss in the first quarter and helped gaining substantially after 90 days of feeding [8]. Naik *et al*. (2009b) reported better recovery in BW (-2.08 vs +14.13, kg) and BSC (-0.06 vs +0.02) in crossbred cows during early lactation in bypass fat supplemented group [42]. Thakur and Shelke (2010) reported that supplementation of calcium salts of soya acid oil fatty acids at 4% of DMI improved the ADG (553.10 vs 577.60, g) in Murrah buffalo calves owing to higher TDN intake (2.14 vs 2.42, kg/d) [28].

Conclusions

It may be concluded that by supplementation of bypass fat in the diet of dairy animals it is possible to alleviate problems of negative energy balance without adversely affecting the dry matter intake and rumen fermentation. Supplementation of bypass fat gives additional benefit due to increase in milk yield, efficiency of nutrient utilization, post-partum recovery of the body weight and body condition score of the dairy animals.

References

1. Bachman KC, Wilfond DH, Head HH, Wilcox CJ, Singh M. Milk yields and hormone concentrations of holstein cows in response to sometribove (somatotropin) treatment during the dry period. Dairy Sci. 1992; 75:18831890.
2. Chouinard PY, Girard V, Brisson GJ. Lactational response of cows to different concentrations of calcium salts of canola oil fatty acids with or without biocarbonates. J of Dairy Sci. 1997; 80:1185-1193.
3. Desai VR. Effect of feeding bypass fat on milk production from buffaloes of tribal area in Panchmahal and Vadodara districts. M.V.Sc. Thesis submitted Anand Agriculture University, Anand, Gujarat, India. 2012
4. Drackley JK. Biology of dairy cows during the transition period: The final frontier? J Dairy Sci. 1999; 82:2259-2273.
5. Erickson PS, Murphy MR, Clark JH. Supplementation of dairy cow diets with calcium salts of long-chain fatty acids and nicotinic acid in early lactation. J Dairy Sci. 1992; 75(1):078-1,089.
6. Friggens NC, Hay DEF, Oldham JD. Interactions between major nutrients in the diet and the lactational performance of rats. Br. J Nutr. 1993; 69:5967.
7. Ganjkhanlou M, Rezayazdi K, Ghorbani GR, Banadaky HD, Morraveg H, Yang WZ. Effects of protected fat supplements on production of early lactation Holstein cows. Anim. Feed Sci. Tech. 2009; 154:276-283.
8. Garg MR, Mehta AK. Effect of feeding bypass fat on feed intake, milk production and body condition of Holstein Friesian cows. Indian J of Anim. Nutr. 1998; 15:242-245.
9. Goff JP, Horst RL. Effects of the addition of potas-sium or sodium, but not calcium, to prepartum rations on milk fever in dairy cows. J Dairy Sci. 1997; 80:176-186.
10. Jenkins TC, Palmquist DL. Effect of fatty acids or calcium soaps on rumen and total nutrient digestibility of diary rations. J Dairy Sci. 1984; 67:978-986.
11. Kim YK, Schingoethe DJ, Casper DP, Ludens FC. Supplemental dietary fat from extruded soybeans and calcium soaps of fatty acids for lactating dairy cows. J Dairy Sci. 1993; 76:197-204.
12. Komaragiri MVS, Casper DP, Erdman RA. Factors affecting body tissue mobilization in early lactation dairy cows. 2. Effect of dietary fat on mobilization of body fat and protein. J Dairy Sci. 1998; 81:169-175.
13. Maiga HA, Schingoethe DJ. Optimizing the utiliza-tion of animal fat and ruminal bypass proteins in the diets of lactating dairy cows. J Dairy Sci. 1997; 80:343-352.
14. Mudgal V, Baghel RPS, Ganie A, Srivastava S. Effect of feeding bypass fat on intake and production performance of lactating crossbred cows. Indian J of Anim. Research. 2012; 46:103-104.
15. Naik PK, Saijpaul S, Rani N. Preparation of rumen protected fat and its effect on nutrient utilization in buffaloes. Indian J of Anim. Nut. 2007b; 24:212-215.
16. Naik PK, Saijpaul S, Sirohi AS, Raquib M. Lactation response of cross bred dairy cows fed on indigenously prepared rumen protected fata field trial. Indian J. Anim. Sci. 2009; 79:1045-1049.
17. Naik PK, Saijpaul S, Rani N. Effect of ruminally protected fat on in vitro fermentation and apparent nutrient digestibility in buffaloes (Bubalus bubalis). Anim. Feed Sci. and Tech. 2009a; 153:68-76.
18. NRC. Nutrient Requirements of Dairy Cattle. 7th Ed. National Academy Press, Washington, DC, USA, 2001.
19. Prasad J, Singh M. Milk production and hormonal changes in Murrah buffaloes administered recombinant Bovine Somatotropin (rBST). Agric. Biol. J North Am. 2010; 1:1325-1327.
20. Purushothaman S, Kumar A, Tiwari DP. Effect of feeding calcium salts of palm oil fatty acids on performance of lactating crossbred cows. Asian-Aust. J Anim. Sci. 2008; 13(21):376-385.
21. Ranjan A, Sahoo B, Singh VK, Srivastava S, Singh SP, Pattanaik AK. Effect of bypass fat supplementation on productive performance and blood biochemical profile in lactating Murrah (*Bubalus bubalis*) buffaloes. Tropical Anim. Health and Production. 2012; 44:1615-1621.
22. Ranjan A, Sahoo B, Singh VK, Shrivastava S, Singh SP, Rajesh K. Effect of bypass fat supplementation on productive performance and blood biochemicals of lactating Murrah buffaloes. 2010, 115-121
23. Saijpaul S, Naik PK, Neelam R. Effects of rumen protected fat on in vitro dry matter degradability of dairy ra-tions. Indian J Anim. Sci. 2010; 80:993-997.
24. Sarwar M, Khan MA, Mahr-Us-Nisa. Influence of ruminally protected fat and urea treated corncobs ensiled with or without corn steep liquor on nutrient intake, digestibility, milk yield and its composition in Nili-Ravi buffaloes. Asian- Aust. J Anim. Sci. 2004; 17:86-93.
25. Schauff DJ, Clark JH. Effects of feeding diets containing calcium salts of long chain fatty acids to lactating dairy cows. J Dairy Sci. 1992; 75:2990-3002.
26. Schneider P, Sklan D, Chalupa W, Kronfeld DS. Feeding calcium salts of fatty acids to lactating cows. J Dairy Sci. 1988; 71:2,143-2,150.
27. Sharma S, Singh M, Roy AK, Thakur S. Prepartum prilled fat supplementation effect on feed intake, energy balance and milk production performance of murrah buffaloes. Vet. World, (In Press), 2015.
28. Shelke SK, Thakur SS. Effect of supplementing bypass fat prepared from soybean acid oil on milk yield and nutrient utilization in Murrah buffaloes. Indian J of Anim. Sci. 2010; 80:354-357.
29. Shelke S, Thakur SS, Amrutkar SA. Effect of prepartum supplementation of rumen protected fat and protein on performance of murrah a buffaloes. Indian J of Anim. Sci. 2011; 81:946-950.
30. Singh M, Ludri RS. Plasma growth hormone profile and milk yield responses of Murrah buffaloes treated with slow release formulation of somidobove. Buffalo J. 1994; 10:81-84.
31. 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. Vet. World. 2014; 7:384-388.
32. Sirohi SK, Wali TK, Mohanta R. Supplementation effect of bypass fat on production performance of lactating crossbred cow. Indian J of Anim Sci. 2010; 80:733-736.
33. Singh SP, Mehla RK, Singh M. Plasma hormones, metabolites, milk production and cholesterol levels in murrah buffaloes fed with asparagus racemosus in transition and postpartum period. Trop. Anim. health Prod. 2012; 44:1827-1832.
34. Solorzano LC, Kertz AF. Rumen inert fat supple-ments reviewed for dairy cows. Feedstuffs. 2005; 77:1-5.
35. Thakur SS, Shelke SK. Effect of supplementing bypass

fat prepared from soybean acid oil on milk yield and nutrient utilization in Murrah buffaloes. Indian J of Anim. Sci. 2010; 80:354-357.
36. Tyagi N, Thakur SS, Shelke SK. Effect of bypass fat supplementation on productive and reproductive performance in crossbred cows. Trop. Anim. Health Prod. 2010; 42:17491755.
37. Tyagi N, Thakur SS, Shelke SK. Effect of feeding bypass fat supplement on milk yield, its composition and nutrient utilization in crossbred cows. Indian J Anim. Nutr. 2009; 26(1):1-8.
38. Tyagi N, Thakur SS, Shelke SK. Effect of feeding bypass fat supplement on milk yield, its composition and nutrient utilization in crossbred cows. Indian J of Anim. Nutr. 2009a; 26:1-8.
39. Tyagi N, Thakur SS, Shelke SK. Effect of pre-partum bypass fat supplementation on the performance of crossbred cows. Indian J of Anim. Nutr. 2009b; 26:247-250.
40. 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. Iran. J Applied Anim. Sci. 2013; 3:53-58.
41. Wadhwa M, Grewal RS, Bakshi MPS, Brar PS. Effect of supplementing bypass fat on the performance of high yielding crossbred cows. Indian J Anim. Sci. 2012; 82:200-203.
42. Naik PK, Saijpaul S, Sirohi AS, Raquib M. Lactation response of cross bred dairy cows fed indigenously prepared rumen protected fat - A field trial. Indian J of Anim. Sci. 2009b; 79:1045-1049.