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RESEARCH ARTICLE

Effect of supplementation of rumen bypass fat with chromium on milk yield and milk fat per cent in dairy cow

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Abstract : The present study was undertaken with the objective to evaluate the effect of rumen bypass fat with chromium supplementation on milk yield and milk fat per cent in dairy cows. Total 12 normal healthy advanced pregnant cows (1 week before expected parturition) was selected and divided randomly into two equal groups. One group (Group I) was kept without supplementation of bypass fat and given only basal diet as a control group. The second group (Group II) was supplemented with rumen bypass fat @ 100 g per animal per day along with basal diet for one week prepartum and upto the period of 4 weeks after parturition. The milk yield and milk fat per cent recorded before supplementation ('0' day) and on 7th, 14th, 21st and 30th day after supplementation of bypass fat, respectively. The milk yield was increased by 12.73 per cent in group supplemented with bypass fat (Group II) as compared to control group (7.02%) on 30th day post supplementation. The milk fat per cent was higher (4.18%) in group supplemented with bypass fat (Group II) as compared to control group (3.75%) on 30th day of post supplementation. The study concluded that, the supplementation of rumen bypass fat @ 100 g per cow per day for one week before expected parturition and upto 4 weeks after parturition improved milk yield and milk fat per cent and proved to be beneficial in fulfilling the energy demand for milk production.

Key words : Dairy cows, Bypass fat, Milk yield, Milk fat per cent, Chromium, Parturition

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INTRODUCTION

In India majority of the diets fed to milch animals are dominated by crop residues, which are low in energy, protein and minerals. Energy is the major limiting nutrient that affects the production potential of lactating animals and the animals are not able to get sufficient energy from their diets resulting in a lower productive performance. During the early post partum period, milk production increases dramatically, while energy intake may not be adequate to sustain the higher production level. This results in negative energy balance and cows metabolize fat to meet their

energy needs (Barley and Baghel, 2009). As a result, most of the cows loss a considerable amount of weight to meet energy demand. Severe weight loss can lead to ketosis, fatty liver formation, reduced reproductive performance and decreased milk yield. Productivity of lactating animas can be enhanced by strategic supplementation with energy and energy density can be measured by incorporating fat in their diet (Sirohi *et al.*, 2010). However, fats which are not protected causes physical and chemical changes in the microbial fermentation of feed that are generally negative and feeding of free or unprotected fat above 1 per cent level has a depressing effect on rumen cellulolytic microbial activity (Palmquist, 1991). This can be overcome by feeding rumen bypass fat which is resistant to biohydrogenation by the rumen microbes and also reduces the risk of metabolic acidosis. Therefore an attempt was made to access the effect of dietary supplementation of bypass fat on milk yield and milk fat per cent of dairy cows.

RESEARCH METHODOLOGY

In the present study, total 12 advanced healthy pregnant crossbred cows (one week before expected parturition) were selected from Dairy farm of Agricultural University, Akola and divided randomly into two equal groups. One group (Group I) of 6 cows kept without supplementation of bypass fat and given only basal diet as a control group. Second group (Group II) of 6 cows was supplemented with bypass fat ("Extra Energy Plus" – each kg containing - Pure bypass fat - 200 g, Fermented live yeast culture-50 g, Calcium propionate- 10 g and Chromium chelated with Amino Acid- 40 g) @ 100 g per animal per day along with normal diet for 1 week prepartum and upto 4 weeks after parturition. The milk yield was recorded before treatment ('0' day) and daily after treatment. Milk fat per cent was estimated by Gerber method (Richmond, 2004) using Gerber's butyrometer before supplementation ('0' day) and on 7th, 14th, 21st and 30th day after supplementation of bypass fat. The data collected during the present study was analyzed statistically by using two ways Factorial Randomized Block Design (FRBD) as described by Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

The effect of supplementation of bypass fat on milk yield and milk fat per cent in cross bred cows is presented in Table 1.

The group (II) supplemented with bypass fat showed significant ($P<0.05$) improvement in milk yield as compared to the control group kept without supplementation of bypass fat (Table 1). In Group II milk yield was significantly ($P<0.05$) improved on 14th, 21st and 30th day of parturition as compared to milk yield on '0' day (on day of parturition) and showed increasing trend in milk yield (Table 1). The control group (Group I) showed increasing trend in milk yield initially (7th and 14th day), thereafter it did not sustained the increasing trend in subsequent period of lactation. It might be attributed to low energy supplementation which brings the animals in negative energy balance. The average milk yield was increased by 12.73 per cent in group II supplemented with bypass fat than that of control group (7.01%) on 30th day of parturition (Table 1). The findings of the present study are in accordance with the findings of Garg and Mehta (1998); Ben Salem and Bouraoui (2008); Barley and Baghel (2009); Tyagi *et al.* (2009); Tyagi *et al.* (2010); Zhang *et al.* (2011); Garg *et al.* (2012); Wadhwa *et al.* (2012); Dhulipalla *et al.* (2013) and Patil *et al.* (2013) who also recorded rise in milk yield in lactating dairy animals after supplementation of bypass fat. In contrast, Lounglawan *et al.* (2006) reported no improvement in milk yield by lactating dairy animal by supplementation of rumen bypass fat, which might have been due to the cows being in early mid lactation and in positive energy balance, therefore, a large milk production response to supplemented fat was not observed.

The technology of bypass fat protects the nutrient from degradation and bio-hydrogenation in rumen with increase in the energy density of the diet, enabling the animals to meet their energy and essential fatty acid requirements expressing their milk production potential to the fullest extent (Krishna Mohan and Reddy, 2009). Increased milk yield observed in bypass fat supplemented group may be attributed to enrichment of ration with bypass fat that increased energy density of the ration resulting in preventing the deleterious effect of negative energy balance (Tyagi *et al.*, 2010; Shelke and Thakur, 2011; Zhang *et al.*, 2011; Garg *et al.*, 2012 and Dhulipalla *et al.*, 2013). The improvement in milk yield in bypass fat supplemented group might also be due to its content *viz.*, Chromium chelated with amino

Table 1: Mean values of milk yield (kg) and milk fat (%) before ('0' day) and at different intervals after bypass fat supplementation in group I (control group) and group II

Parameters	Groups	Intervals					Pooled mean
		On day of parturition	Different intervals after parturition				
		0^{th} Day	7^{th} Day	14^{th} Day	21^{st} Day	30^{th} day	
Milk yield (kg)	Group I	3.58^{ac} ±0.11	3.82^{bcd} ±0.11 (6.28)	3.95^{bd} ±0.07 (9.37)	3.83^{bd} ±0.13 (6.53)	3.85^{b} ±0.06 (7.01)	3.81^{p} ±0.05
	Group II	3.77^{c} ±0.06	3.93^{cd} ±0.07 (4.07)	3.97^{d} ±0.06 (5.04)	4.00^{d} ±0.05 (5.75)	4.32^{e} ±0.05 (12.73)	4.00^{q} ±0.04
	Pooled mean	3.68^{A} ±0.06	3.88^{B} ±0.06	3.96^{BC} ±0.04	3.92^{B} ±0.07	4.08^{C} ±0.08	
Milk fat (%)	Group I	3.53^{ad} ±0.06	3.92^{bc} ±0.09	3.88^{bc} ±0.11	4.05^{c} ±0.09	3.75^{ab} ±0.13	3.83 ±0.05
	Group II	3.57^{d} ±0.07	3.68^{bcd} ±0.09	3.82^{bcde} ±0.10	3.98^{cef} ±0.06	4.18^{f} ±0.07	3.85 ±0.05
	Pooled mean	3.55^{A} ±0.04	3.80^{B} ±0.07	3.85^{BC} ±0.07	4.02^{C} ±0.05	3.97^{BC} ±0.10	

Similar superscript indicates non-significant variation within each parameter

acids, calcium propionate and live yeast culture, supplemented in the present study. Chromium enhances the cellular uptake of glucose through linkage of chromodulin (chromium binding protein) with the insulin receptors and glucose transporters. Thus, chromium increased the synthesis of fat in the adipose tissue (lipogenesis) and reduced the rate of mobilization of fatty acids from adipose tissue. Such an effect of reduced lipolysis would presumably allow a greater increase in feed intake, stabilize hepatic fat metabolism and reduce hepatic ketogenesis, all working resulted into increase in milk yield. The calcium propionate, which may reduce net lipolysis allowing increase feed intake, resulted into increase milk production (Mc Namara and Valdez, 2005).

The average milk fat (%) in Group I and Group II on '0' day and on 7^{th}, 14^{th}, 21^{st} and 30^{th} day post parturition are given in Table 1. The statistical analysis revealed significant variation ($P<0.05$) in milk fat (%) between different intervals. However, no significant difference was observed between the supplemented (Group II) and control group (Group I). In group II, average fat per cent showed increasing trend during subsequent intervals. However, inconsistent increase in fat per cent was observed in control group. The group (Group II) supplemented with bypass fat shown significant increase ($P<0.05$) in milk fat per cent on 21^{st} and 30^{th} day of parturition as compared to milk fat per cent on '0' day (Table 1). The fat per cent was significantly higher (4.18 ±0.07) on 30^{th} day in bypass fat supplemented group than control group (3.75 ±0.13). Similar to our results, earlier studies reported a clear cut rise in milk fat due to supplementation of bypass fat in lactating dairy animals (Barley and Baghel, 2009; Zhang *et al.*, 2011; Garg *et al.*, 2012; Dhulipalla *et al.*, 2013 and Patil *et al.*, 2013).

In the present study, the fat per cent of milk was increased significantly during the period of early mid lactation when compared to initial milk fat per cent. It was due to correction of energy balance (Barley and Baghel, 2009). The response of milk fat concentration to supplemental fat seems to be dependent upon many factors including the fat concentration and composition in the basal diet and in the supplement as well as forage source and amount. One possible reason is that supplemental fat increased dietary energy. Moreover, about 50 per cent of the fat found in milk is synthesized is the mammary gland from acetate and butyrate, while 40-45 per cent from the dietary source and less than 10 per cent are derived from the mobilization of adipose tissue (Palmquist and Jenkins, 1980). So, supplemental fat source can increase milk fat of dairy cows (Zhang *et al.*, 2011). According to Ashes *et al.* (1997) the effect of fat supplementation on milk fat and fatty acids composition are influenced by the type and amount of dietary fat degree of inertness or protection in the rumen.

Conclusion :

The present study concluded that the rumen bypass fat @ 100 g per cow per day along with normal diet from 1 week expected parturition and upto 4 weeks after parturition found effective in improving milk yield and milk fat per cent and proved to be beneficial in fulfilling the energy demand for milk production and preventing the cows entering into negative energy balance during early mid-lactation.

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