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Effect of Supplementation of Monensin Sodium on rumen metabolism and Milk Yield in Early Lactating Buffalo (*Bubalus Bubalus*)

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Abstract

The study was carried out to assess the effect of monensin sodium supplementation on rumen fermentation metabolites and milk yield in early lactating buffaloes. Twelve buffaloes in their 2nd week of lactation were selected. Control group was fed on standard ration whereas the treatment group was supplemented with monensin sodium @ 200 mg/head/day in addition to standard ration. Rumen liquor and blood sample was collected at 2nd and 12th week of lactation. Total and individual volatile fatty acids concentration was estimated by gas chromatography. Monensin sodium ($P \leq 0.05$) decreases acetate and increases propionate concentration and decreases the ratio of acetate to propionate in the rumen liquor without altering the total volatile fatty acid concentration in experimental period. Supplemented buffaloes yielded 8.22 per cent more milk than the control.

Introduction

India has 105.1 millions buffaloes which is approximately 56.7 per cent of the total world buffalo population. They contribute 47.85 million MT of milk amounting to 55% of total milk produced in India. Although buffaloes are better converter of poor quality fibrous feeds into milk, there are few reports on low milk yield, poor reproductive performance and low growth rate because of poor feeding practices, irregular and inadequate availability of quality feedstuffs. Lactating dairy animals have high demand for energy and protein for milk synthesis. Mobilizing energy and protein from body tissues stores and repartition of nutrients away from extra mammary tissues are the primary alternatives source of sufficient nutrients for milk production during early lactation. Excessive utilization of body

reserves, especially fat, can subject lactating animals to negative energy balance leading to a series of metabolic disorders and consequent production losses (Fourichon *et al.,* 1999). Several methods of modifying ruminal fermentation have been developed by various researchers to enhance feed utilization in cattle and buffaloes. Fermentation modifiers are used in feed to manipulate rumen fermentation for better feed utilization and improved milk production. Monensin is one of the fermentation modifiers that have been extensively used in dairy and beef cattle to improve the feed utilization and productive response (Schelling, 1984). The aim of the present study was to assess changes in concentration of the rumen fermentation metabolites (TVFA) and milk yield in early lactating buffaloes by supplementing monensin sodium @ 200mg/day/ animal.

Materials and Methods

Twelve apparently healthy local non descript buffaloes (Av. body weight 362.5±12.5) in their 2nd week of third lactation were selected from an organized private dairy farm in Bidar district of Karnataka state, India. They were randomly divided into two equal groups of six animals each and one group served as control and the other treatment group. Control group was fed on standard ration comprising of concentrate, green fodder (Napier grass; *Pennisetum purpureum*) and dry fodder (Jowar stover; *Sorghum bicolor*) as per Paul *et al.* (2002) to meet the nutrient requirements.. The concentrate, napier fodder and jowar stover contained 18.66, 9.7 and 3.7% crude protein, respectively. The treatment group also received standard ration as that of control group and in addition, they were supplemented with monensin @ 200 mg per head per day. Third week of lactation was adaptation period for treatment group, where they received monensin gradually in increasing dose from 50 mg per day to 150 mg per day/head. Monensin sodium was uniformly mixed in the concentrate mixture and was supplemented in divided dose i.e. 100 mg in the morning and 100 mg in the evening daily during the experimental period i.e. from 4th to 12th week of lactation. Rumen liquor samples were collected from all the buffaloes during the 2nd and 12th week of lactation by means of stomach tube attached to a suction pump. The rumen liquor samples were filtered by four layers of cheese cloth and 800 µl was transferred into microcentrifuge tube and 200 µl of 20% metaphosphoric acid was added and centrifuged at 5000 rpm for 20 minutes. The supernatant was collected and stored at -20°C for TVFA analysis. The concentration of individual volatile fatty acids viz., acetate, propionate, butyrate, isobutyrate, isovalerate and valerate were estimated by gas chromatography (Agilent; Model 7890A GC System) using flame ionization detector, programmable temperature vaporizer injector and capillary column (Agilent J&W DB-WAX GC Column 40 m × 0.18 mm × 0.18 µm). The Ruminal liquor samples were injected by an automatic injector at an injection volume of 1µl using the split method. Milk yield of both morning and evening milking of individual buffalo was recorded in kilogram using a standard weighing balance and values were pooled to express the daily milk yield. Milk yield was recorded at a weekly interval up to 12th week of lactation. The data were analyzed statistically by student t-test as per Snedecor and Cochran (1994).

Results and Discussion

Average mean concentration (mmol/L) of individual volatile fatty acids viz., acetate, propionate, butyrate, isobutyrate, isovalerate, valerate and TVFA in control and treatment group at 2nd and 12th week of lactation is presented in Table 1. The concentration of individual and total volatile fatty acids was similar in the rumen liquor samples of all the buffaloes at the initiation of the experiment. Monensin supplementation significantly ($P \leq 0.05$) decreases acetate concentration, increases propionate concentration and decreases the ratio of acetate to propionate (A/P) in the rumen liquor of early lactating buffaloes without altering the TVFA. However, its supplementation in the treatment group had no effect on the concentration of other volatile fatty acids and TVFA after 12 week of lactation.

Decrease in the rumen acetate and acetate: propionate ratio and increase in the ruminal propionate concentration without altering the TVFA concentration in present study was similar to the observation of the previous studies by Randall *et al.* (1978) in steers, Maas *et al.* (2001) in sheep, Erasmus *et al.* (2005) and Lamba *et*

Table 1: Average concentration of individual volatile fatty acids (VFA) and total VFA in the rumen liquor of control and monensin supplemented lactating buffaloes at 2nd and 12th of lactation (Mean±SE)

Volatile fatty acids (mMol/L)	Control group	Treatment group
Acetate		
2nd week	52.20±0.98	51.72±0.48
12th week*	53.16a ±0.52	46.49b ±0.65
Propionate		
2nd week	12.52±0.29	12.27±0.24
12th week*	12.21a ±0.15	19.39b ±0.90
Isobutyrate		
2nd week	0.24±0.10	0.23±0.10
12th week	0.21±0.10	0.22±0.10
Butyrate		
2nd week	8.26±0.47	8.26±0.10
12th week	8.40±0.19	8.67±0.55
Isovalerate		
2nd week	0.44±0.10	0.43±0.10
12th week	0.42±0.10	0.41±0.10
Valerate		
2nd week	0.37±0.10	0.35±0.10
12th week	0.34±0.10	0.32±0.10
TVFA		
2nd week	74.03±1.17	73.27±0.53
12th week	74.13±0.48	75.49±0.91
A:P ratio		
2nd week	4.18±0.10	4.22±0.10
12th week*	4.17a ±0.10	2.60b ±0.18

®Means with different superscript in each row differ significantly with other (P≤0.05)

Table 2: Mean milk yield (kg/d) of control and monensin supplemented buffaloes

Week of Lactation	Control	Treatment
4th	6.43±0.52	6.65±0.33
5th	7.20±0.73	6.82±0.40
6th	7.38±0.47	6.97±0.47
7th	7.33±0.40	8.15±0.40
8th	7.42±0.26 [a]	8.10±0.26 [b]
9th	7.22±0.69 [a]	8.28±0.18 [b]
10th	7.15±0.07 [a]	8.54±0.66 [b]
11th	7.30±0.32 [a]	7.96±0.34 [b]
12th	7.09±0.27 [a]	8.38±0.45 [b]
Average	**7.17±0.10 [a]**	**7.76±0.24 [b]**

Means with different superscript in each row differ significantly with other (P≤0.05)

al. (2013) in cows. The increased propionate and decreased acetate concentration in the ruminal fluid of monensin supplemented early lactating buffaloes is due to selective antimicrobial action of monensin in rumen. Monensin sodium selectively inhibits growth of gram-positive organisms and shift the flow of electrons from formate and methane to succinate or propionate as alternate electron sink products in the mixed microbial population (Van Nevel and Demeyer, 1977), thereby reduces acetic acid production and methanogenesis and increases the production of propionate in rumen liquor (Goodrich *,* 1984).

The mean milk yield (Kg/d) of control and treatment groups from 4th week to 12th week of lactation were presented in Table 2. There was no significant difference in milk yield between control and monensin supplemented buffaloes from 4th to 7th week of lactation, where as monensin supplemented buffaloes showed significantly ($P \leq 0.05$) higher milk yield than that of control group from 8th week to 12th week of lactation. The average milk yield (Kg/d) of the entire experimental period was 7.17±0.10 and 7.76±0.24 in control and treatment group respectively. The average milk yield was significantly higher ($P \leq 0.05$) in treatment group as compared to that of control group. On an average, monensin supplemented early lactating buffaloes yielded 8.236 per cent (0.59kg/d) more milk than the control group during the experimental period. Results of the this experiment are similar to the findings of Lynch *et al*. (1990), Van Der Werf *et al.*(1998), Ipharraguerre and Clark. (2003) and Gandra *et al.* (2010) who have reported increased milk yield in different breeds of dairy cows upon dietary supplementation of monensin. However, Khodamoradi *et al.* (2013), Lamba *et al.* (2013) and Van Der Merwe (2001) had observed no significant difference in the milk yield in monensin supplemented cows. McGuffey *et al*. (2001) reported that the supplementation of ionophores in animal feed resulted in an alteration of ruminal bacterial populations, which altered the final products of fermentation by increasing propionate proportion and reducing acetate and butyrate concentration. Increased milk yield in monensin supplemented buffaloes might therefore be due to increased supply of glucogenic precursor like propionate, resulting from changes in the pattern of rumen fermentation, thereby increasing the glucose availability for milk production.

Based on the results of the present study, it can be concluded that monensin sodium supplementation @200mg/head/day to early lactating buffaloes may be beneficial in improving the production as it shifts the rumen fermentation more towards propionate and increases the blood glucose availability for more milk yield.

Conflict of Interest

All authors declare no conflict of interest.

References:

Erasmus L J, Rabinson P H, Ahmadi A, Hinders R and Gerret J E. (2005). Influence of prepartum and post partum supplementation of yeast culture and monensin or both on ruminal fermentation and performance of multiparous dairy cows. *Animal Feed Technol* **122**, 219-239.

Fourichon C, Seegers H, Bareille N and Beaudeau F. (1999). Effects of disease on milk production in the dairy cow. *Prev. Vet. Med* **41**, 1-35.

Gandra J R, Renno F P, Freitas J E, Santos M V, Silva L F P. and Araujo A P C. (2010). Productive performance and milk protein fraction composition of dairy cows supplemented with sodium monensin. *R. Bras. Zootec.*, **39**(8):1810-1817.

Goodrich R D, Garrett J E, Gast D R, Kirick M A, Larson D A and Meiske J C. (1984). Influence of monensin on the performance of cattle. *Journal of Animal Science* **58**(6), 1484-1498.

Ipharraguerre I R and Clark J H. (2003). Usefulness of ionophores for lactating dairy cows: a review. *Animal Feed Science and Technology.*, **106:**39–57.

Khodamoradi S H, Fatahnia F, Taherpour K, Pirani V, Rashidi L and Azarfar A. (2013). Effect of monensin and vitamin e on milk production and composition of lactating dairy cows. *J.Anim.Phys.Anim.Nutr.*, **97**:666-674.

Lamba J S, Grewal R S Ahuja C S, Malhotra P and Tyagi, N., (2013). Effect of monensin on the milk production, milk composition, rumen metabolism and blood biochemical profile in crossbred cows. *Indian J. Anim. Nutr* **30**(1), 38-42.

Lynch G A, Hunt M E and McCutcheon S N. (1990). A note on the effect of monensin sodium administered by intraruminal controlled-release devices on productivity of dairy cows at pasture. *Anim.Prod.*, **51**:418.

Maas J A, Wilson G F, Mccutcheon S N, Lynch G A, Burnham D L and France J. (2001). The effect of season and monensin sodium on the digestive characteristics of autumn and spring pasture fed to sheep. *J. Anim. Sci* **79**, 1052–1058.

McGuffey R K, Richardson L F and Wilkinson J I D. (2001). Ionophores for Dairy Cattle: Current Status and Future Outlook. *J. Dairy Sci.*, **84:** E194-E203.

Paul S S, Mandal A B and Pathak N N. (2002). Feeding standards for lactating riverine buffaloes under tropical condition. *Journal of dairy research (UK),* **69,** 173-180.

Randall W, Van Maanen, Joseph H, Herbein A, Dare McGilliard and Jerry Young W. (1978). Effects of monensin on in vivo rumen propionate production and blood glucose kinetics in cattle. *J. Nutr* **108**, 1002-1007.

Schelling, G.T. (1984) Monensin : Mode of action in the rumen. J. Anim Sc. **58**:1518-1527

Snedecor G W and Cochran. (1994): Statistical Methods. 8thedn. *Oxford and IBH. Pub.Co.,* Calcutta.

Van Der Merwe B J, Dugmore T J and Walsh K P. (2001). The effect of monensin on milk production, milk urea nitrogen and body condition score of grazing dairy cows. *S.Afr.J.Anim.Sci.,* **31**(1):49-55.

Van Der Werf J H J, Jonker L J and Oldenbroek J K. (1998). Effect of Monensin on Milk Production by Holstein and Jersey Cows. *J.Dairy Sci.*, **81**(2):427–43.

Van Nevel C J, Demeyer D I. (1977). Effect of monensin on rumen metabolism in vitro. *Appl. Environ. Microb* **34**, 25-30.

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