Original Research

Effect of Monensin Supplementation on Serum Biochemical and Liver Specific Enzymes Activities in Early Lactating Buffalo (*Bubalus Bubalus*)

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Abstract

The study assessed the effect of monensin sodium supplementation on blood biochemical parameters and liver specific enzymes activities in early lactating buffaloes. 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. Biochemical parameters and activities of liver specific enzymes were assessed by semi-automatic biochemical analyzer. The mean concentration of glucose was higher and BUN, cholesterol values were lower (P<0.05) in supplemented animals as compare to control animals. Therefore, it can be concluded that monensin sodium supplementation 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 milk production. No effect on the activities of liver specific enzymes was noticed in treatment group suggestive of its safety in using it as a feed additive.

Key words: Monensin, Liver, Biochemical, Buffalo

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Introduction

Buffalo is better converter of poor quality fibrous feeds into milk. Low milk yield, poor reproductive performance and low growth rate is reported due to poor feeding practices, irregular and inadequate availability of quality feedstuffs in Indian condition. Lactating dairy animals have to cope up with high energy and protein demands for milk synthesis. Mobilizing energy and protein from body tissues stores and

repartition of nutrients away from extra mammary tissues are the primary alternatives to supply 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). It is believed that a reduction of this negative balance will contribute to increase in production and health in high yielding lactating animals (Johnson and Johnson, 1995).

Several methods of modifying ruminal fermentation have been developed by various researchers to enhance feed utilization in cattle and buffaloes. Fermentation modifiers are the products that are used in feed to manipulate rumen fermentation for better feed utilization and improved milk production. One of ionophore group of antibiotics, monensin is one of the fermentation modifier that has been extensively used in dairy and beef cattle to improve the feed utilization and productive response. The present study was undertaken to study the effect of monensin supplementation on blood metabolites and serum liver specific enzymes in early lactating buffaloes.

Materials and Methods

Twelve apparently healthy early lactating buffaloes in their 2nd week of lactation with an average body weight of 350 to 375 kg were selected and randomly divided into two equal groups of six animals in an organized private dairy farm in Benchincholli village of Bidar District of Karnataka, India. Before start of the experiment, the animals were kept under adaptation period for one week (3rd week of lactation) and given *ad lib* Napier chopped green fodder and jowar stover. The experiment was carried out from 2nd week of lactation to 12th week of lactation. The control diet comprised of concentrate mixture, Napier gross and jowar stover. Concentrate mixture were formulated using maize, wheat bran, cotton seed cake, ground nut cake, toor chunni, mineral mixture, dicalcium phosphate and salt to meet the nutrient requirements as per Paul *et al.,* 2002. Treatment group diets were formulated using control diet (14.67% DCP and 77%TDN) with 200mg monensin sodium (Rumacox, Gurjari Impex, Mumbai) per head per day.

For the estimation of various blood metabolites, blood samples were collected from jugular vein three hours after feeding, in the morning hours at 0 (2nd week) day and 60th (12th week) day. Blood samples were collected in vials coated with clot-activator and serum was separated after one hour and stored at -20^{o}C until analysis. The blood biochemical parameters *viz.* glucose, total protein, blood urea nitrogen, cholesterol and triglycerides and the activities of the liver specific enzymes *viz.* serum glutamic-pyruvic transaminase (SGPT), serum glutamic oxaloacetic transaminase (SGOT) and gamma glutamyl transferase (GGT) in the serum were estimated by semi-automated biochemistry analyser (ARTOS®) using SWEMED® Diagnostic Kits**,** Bangalore following the instructions and procedure supplied with the diagnostic kits.

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Results and Discussion

The average mean concentration of serum glucose, blood urea nitrogen, cholesterol, triglyceride and total protein at 2nd and 12th week of lactation is presented in Table 1.

Table 1: Average concentration of some serum biochemical parameter of control and monensin sodium supplemented buffalo

Biochemical Parameters	Control Group	Treatment Group
Glucose(mg/100ml)		
2nd week	42.05±0.43	41.52±0.36
12th week*	50.37^{a} ±0.89	53.71^{b} ±0.69
BUN (mg/100 ml)		
2nd week	16.47±0.31	16.40±0.30
12th week*	16.73^{a} ±0.20	17.54^{b} ±0.33
Cholesterol(mg/100 ml)		
2nd week	70.70±0.80	70.38±0.60
12th week*	70.82^{a} ±0.40	72.65^{b} ±0.88
Triglycerides (mg/100 ml)		
2nd week	12.60±0.27	12.73±0.39
12th week	12.80±0.47	13.77±0.53
Total protein(g/100 ml)		
2nd week	7.22±0.10	7.14±0.11
12th week	7.19±0.16	7.34±0.14

Present finding of the study shows significant ($P<0.05$) increase in the glucose concentration in monensin supplemented early lactating buffalo. The results of this experiment are similar to the findings of Ronkey *et al.* (2012) and Lamba *et al.* (2013), whereas, Martineau *et al.* (2007) and Ghorbani *et al*. (2011) have not observed any significant effect of monensin supplementation on serum glucose levels. The increase in blood glucose level with monensin feeding in the present study was due to increased propionate production. Higher concentrations of propionate resulted into more glucose production as propionate is converted to methyl malonyl-CoA and then to succinyl Co-A, which is an intermediate of TCA cycle (Lean *et al.*, 1992). In addition, the propionic acid fermentation is more energetically efficient and theoretically reduces the large loss of methane associated with production of acetic acid and butyric acid (Bergen and Bates, 1984). Monensin might also increase glucose availability by increasing the proportion of dietary starch that is digested post rumen (Haimoud *et al.*, 1995).

Higher blood urea nitrogen levels in monensin supplemented early lactating buffaloes in present work is akin to the findings of Martineau *et al.* (2007) and Ghorbani *et al*. (2011) who have reported increased BUN levels in response to monensin supplementation in cows. In other research studies *i.e.* Helal and Lasheen (2008) in buffaloes, Ronkey *et al*. (2012) in bucks, Lamba *et al.* (2013) in crossbred cows have observed no change in BUN levels after monensin supplementation. In contrast, Ding *et al.* (2008) reported significantly decreased plasma urea nitrogen concentrations in monensin supplemented weaned lambs.

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Monensin reduces ruminal degradation of dietary proteins and thereby increases the availability of dietary proteins at the level of abomasum for regular digestion and absorption which leads to more production of urea (Poos *et al.,* 1979). Monensin supplemented to lactating buffaloes showed significantly (P<0.05) higher levels of serum cholesterol concentration than the control buffaloes. These results are in conformity with observations of Kaneene *et al.* (1997) in early lactating cows and Martineau *et al.* (2007) in mid lactating cows who have reported that increase in cholesterol levels due monensin supplementation was presumably an effect of monensin on increased bacterial lipid synthesis, thereby increasing amount of lipids available for absorption. Cattle lack a homeostatic mechanism for regulating cholesterol and phospholipid concentrations and the amount of these lipid components depends on the quantity of long-chain fatty acids absorbed from the alimentary tract. Kaneene *et al*. (1997) reported that the higher cholesterol values suggest a greater lipoprotein export from the liver. In contrast, Lamba *et al.* (2013) in crossbred cows have reported no significant effect of monensin supplementation on cholesterol levels.

In the present experiment monensin supplementation to lactating buffaloes had no effects on the triglyceride levels. Our results are similar to the findings of Mohebbi-Fani *et al*. (2006) in cows, Ding *et al*. (2008) in weaned lambs. In contrast, Lamba *et al.* (2013) found the increased triglycerides level in monensin treated lactating crossbred cows. No significant (P< 0.05) difference was noticed in the total protein values between control and monensin supplemented buffalos during the experiment. These results are similar to the findings of Helal and Lasheen (2008) in Egyptian buffaloes, Ronkey *et al.* (2012) in bucks, Besharati *et al.* (2013) in cows. No significant (P<0.05) difference in the activity of SGOT was observed in the serum of control and monensin supplemented buffaloes during early lactation. These results are in agreement with the reports of Helal and Lasheen (2008) and Sadjadian *et al.* (2013) who had noticed monensin supplementation had no significant effect on the SGOT activity in Egyptian buffaloes and Saanen goats respectively. However, in contrast to the results of the present study, Martineau *et al.* (2007) found the increased SGOT in mid lactating multiparous Holstein cows and Lamba *et al.* (2013) found the decreased activity of SGOT in lactating crossbred cows. Dietary supplementation of monensin to early lactating buffaloes had no influence on the SGPT activity as there was no significant (P<0.05) difference between control and monensin supplemented buffaloes in serum SGPT activity. Similarly, Helal and Lasheen (2008) and Lamba *et al.* (2013) have reported no influence of monensin supplementation on serum SGPT activity in response monensin supplementation in Egyptian buffaloes and crossbred cows respectively. Similar to SGOT and SGPT, dietary supplementation of monensin to early lactating buffaloes had no significant (P< 0.05) difference in serum GGT activity between control and monensin supplemented buffaloes (Table 2). The results are in agreement with that of Lamba *et al.* (2013) who observed similar results in crossbred cows whereas in contrast, Martineau *et al.* (2007) found the significant rise in the activity of GGT in monensin

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supplemented mid lactating multiparous Holstein cows. This variation may be due to difference in the stage of lactation of experimental animals.

Table 2: Average concentration of liver specific enzymes of control and monensin sodium supplemented buffalo

Liver Specific Enzymes	Control Group	Treatment Group
SGOT (U/L)		
2nd week	83.70±0.95	82.10±0.57
12th week	82.47±0.46	81.46±0.51
SGPT (U/L)		
2nd week	17.43±0.45	17.54±0.24
12th week	17.00±0.22	16.97±0.19
GGT (U/L)		
2nd week	18.65±0.49	18.94±0.31
12th week	17.69±0.19	17.62±0.22

Conclusion

Monensin supplemented buffaloes had almost 7-8% more serum glucose than that of control group. Blood urea nitrogen and cholesterol levels are higher and no significant difference in the triglycerides and total protein concentration between control and monensin supplemented buffaloes. Higher energy is available for more milk production as its demand is high in early lactating buffalo. Monensin supplementation had no effect on the serum activities of liver specific enzymes *viz.* SGOT, SGPT and GGT in treatment group suggestive of its safety in using it as a feed additive for increase production of propionate.

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