

## Effect of Recombinant Bovine Somatotropin (Boostin-250) on Blood Metabolites and Milk Yield of Lactating Buffaloes

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**ABSTRACT :** In order to investigate the effect of recombinant bovine somatotropin (rbST) on blood metabolites and milk yield of lactating buffaloes, 30 lactating buffaloes after acclimatization for 30 days were divided into 2 groups as control (n=10) and experimental (n=20). Animals were injected 250mg of rbST (Boostin-250) on 0, 14<sup>th</sup> and 28<sup>th</sup> day subcutaneously at ischio-rectal fosse, where as control animals were given placebo of 2 ml normal saline. Fortnightly blood samples were collected from 15 days prior to 60 days post injection to estimate different blood metabolites. Daily milk yield was recorded and weekly average yield of each animal was calculated. From this study, it was found that blood metabolites such as glucose, triglycerides, total proteins, albumin, globulin and electrolytes like sodium and potassium were not altered by rbST injection. However, there was a significant ( $p < 0.05$ ) decrease in blood urea nitrogen (BUN) concentration in experimental group as compared to that of control group. The weekly average milk yield was significantly ( $p < 0.001$ ) higher (25%) in rbST injected group over the control group. (*Asian-Aust. J. Anim. Sci. 2004, Vol 17, No. 9 : 1232-1235*)

**Key Words :** rbST, Blood Metabolites, Milk Yield, Buffaloes

### INTRODUCTION

The contribution of buffaloes to milk production is more than 50% of total production in India (FAO, 2002). With the increase in demand of foods for the ever-growing human population, there is a need to increase the livestock productivity. Efforts are needed to accelerate the milk production at reduced costs to ensure the required availability of milk and greater nutritional security as Indians are traditionally milk consumers.

The effects of somatotropin (ST) in lactating animals have been the subject of scientific interest for many years. The recombinant bovine somatotropin (rbST) contains an additional methionine at the N-terminal comparing to pituitary ST. It is biochemically equivalent to pituitary derived ST. It has been reported that injection of bST stimulate milk production in a number of species (Bauman et al., 1985; Ludri et al., 1989; Tanwattana et al., 2003). British scientists used bST as a crude extract of anterior pituitary to increase milk production to alleviate food shortage during second world war (Bauman and Vernon, 1993). In the early 80's scientists produced ST by recombinant DNA technology, which was first used in lactating cows (Bauman et al., 1982). Abas and Ozpinar (2001), reported 20% increase in milk yield due to rbST injection. Similarly, Ludri et al. (1989) in buffaloes found higher milk yield of 16.8 and 29.5% due to exogenous administration of 25 and 30 mg somatotropin, respectively.

There are contradictory reports about the effect of exogenous ST on blood metabolites. Therefore, the present study was conducted to determine the effect of rbST (Boostin-250, M/S LG Chemicals, India) on blood metabolites and milk yield of lactating murrah buffaloes during peak yield.

### MATERIALS AND METHODS

Thirty healthy lactating murrah buffaloes of first to second lactation were procured for the present study. These animals were in 60-75 days of postpartum. They were divided into 2 groups as control (n=10) and experimental (n=20). The animals were dewormed using broad-spectrum anthelmintics before starting the experiment and were vaccinated against FMD and HS as routine vaccination schedule. These animals were maintained at Institute livestock farm under standard feeding and managerial practices.

#### rbST injection schedule

rbST (Boostin-250) was obtained from LG Chemicals, India Pvt.Ltd. Animals were injected with 250 mg of rbST on 0, 14<sup>th</sup> and 28<sup>th</sup> day by subcutaneous route at ischio-rectal fosse. The control animals were given placebo of 2 ml normal saline.

#### Blood sampling

Six fortnightly blood samples starting from 15 days prior to and 60 days post injection were collected from all the buffaloes. The plasma and serum were separated. 1%

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**Table 1.** Fortnightly changes in blood metabolites of lactating buffaloes injected with rbST (Boostin-250)

Parameters/fortnights	Pre treatment		Post-treatment				Overall mean	Significance		
	1	2	3	4	5	6		T	P	T×P
Glucose (mg/dl)								NS	NS	NS
Control	44.75±1.86	48.05±3.19	45.90±1.81	43.24±1.43	49.60±1.97	47.69±1.38	46.54±1.20			
Treatment	48.80±2.65	46.97±3.97	44.87±1.06	44.93±1.29	47.67±2.03	47.35±1.52	46.77±0.85			
BUN (mg/dl)										
Control	34.78±1.45	36.09±3.23	30.31±1.08	34.95±1.78	43.02±2.44	38.66±1.64	36.30 <sup>A</sup> ±0.72	*	***	NS
Treatment	32.35±0.78	35.87±1.16	24.53±1.10	31.52±1.34	40.13±1.03	40.21±1.46	34.10 <sup>B</sup> ±0.51			
Triglycerides (mg/dl)										
Control	31.77±5.31	35.37±4.74	36.44±2.07	40.86±6.64	40.18±3.73	40.61±2.37	37.54±1.59	NS	NS	NS
Treatment	36.84±2.72	36.25±2.62	33.54±1.63	41.77±3.77	37.76±2.28	41.64±1.72	37.97±1.13			
Protein (g/dl)										
Control	7.38±0.40	6.96±0.18	7.03±0.33	6.85±0.28	6.62±0.11	6.68±0.14	6.92±0.10	NS	***	NS
Treatment	7.64±0.16	7.21±0.14	7.53±0.24	7.08±0.20	6.39±0.15	6.77±0.16	7.10±0.07			
Albumin (g/dl)										
Control	4.20±0.15	3.90±0.14	4.30±0.16	4.89±0.23	4.05±0.16	3.98±0.13	4.22±0.06	NS	***	NS
Treatment	4.46±0.09	3.85±0.09	4.45±0.09	4.85±0.09	4.21±0.07	4.12±0.08	4.32±0.04			
Globulin (g/dl)										
Control	3.17±0.21	3.05±0.12	2.72±0.25	1.96±0.18	2.57±0.21	2.70±0.17	2.70±0.09	NS	***	NS
Treatment	3.19±0.15	3.36±0.14	3.08±0.24	2.22±0.19	2.17±0.12	2.64±0.14	2.79±0.07			
A/G ratio										
Control	1.39±0.12	1.31±0.09	1.69±0.16	2.65±0.24	1.70±0.17	1.55±0.13	1.71±0.10	NS	***	NS
Treatment	1.45±0.07	1.20±0.08	1.68±0.19	2.70±0.41	2.08±0.14	1.65±0.10	1.79±0.07			
Sodium (meq/L)										
Control	174.2±5.27	171.3±2.60	156.2±2.16	149.8±1.78	169.9±1.18	17.50±3.69	165.3±1.37	NS	***	NS
Treatment	170.9±2.33	168.1±2.21	158.7±3.02	150.1±1.19	170.6±2.49	173.5±2.25	165.6±0.97			
Potassium (meq/L)										
Control	5.42±0.18	5.35±0.12	6.26±0.49	5.16±0.13	6.66±0.49	6.66±0.37	5.92±0.14	NS	***	NS
Treatment	5.78±0.13	5.46±0.21	6.27±0.37	5.05±0.13	7.25±0.30	7.22±0.22	6.17±0.10			

\* p<0.05, \*\* p<0.01, \*\*\* p<0.001. NS: non significant. Means bearing different superscripts in rows differ significantly.

T×P: treatment×period interaction.

EDTA in normal saline was used to separate plasma. Serum and plasma in the form of aliquots were stored at -20°C till further analysis.

Glucose was estimated by GOD/POD method described by Henry et al. (1974). BUN by Berthelot method (Henry, 1968), total protein by Biuret method (Dumas et al., 1971) and albumin was estimated by BCG method of Rodkey (1965) using diagnostic kits (Reckon Diagnostic Pvt. Ltd, Baroda, India). Triglyceride was estimated by enzyme colorimetric method (Bucolo and David, 1973) using kit (Chema Diagnostic, Padre Vincenzo Pellegrini, Jesi (An) Italy). Sodium and Potassium were estimated by Flame photometry.

#### Milk sampling

Daily milk yield (kg/d) both during the morning and evening hours was recorded and weekly average of each animal was calculated.

#### Statistical analysis

Analysis of variance (ANOVA) with 2 way and 1 way classification were used to determine the effect of treatment

(rbST injection and placebo injection) and their interaction with respect to blood metabolites and milk yield (Snedecor and Cochran, 1989).

## RESULTS

The fortnightly mean blood metabolite concentrations in the control and experimental groups are shown in Table 1. The plasma glucose and potassium and serum triglycerides, total protein, albumin, globulin and sodium concentration did not vary significantly due to rbST injection. However, the blood urea nitrogen (BUN) concentration in the rbST injected group (34.10 mg/dl) decreased significantly (p<0.05) as compared to that of control group (36.30 mg/dl).

The average daily milk yield (kg/d) in the control and experimental groups varied between 7.40 to 9.87 and 7.77 to 11.66, respectively (Table 2). The yield was comparable between the experimental and control group during the first three and last two weeks, however, varied significantly during fourth to seventh week of experimental period. The overall daily milk production was significantly (p<0.001) higher in the rbST injected group.

**Table 2.** Weekly changes in average milk yield (kg/d) of lactating buffaloes injected with rbST (Boostin-250)

Weeks	Control	Treatment	Significance
1	9.87±0.64	9.83±0.39	T ***
2	9.79±0.61	9.89±0.40	P ***
3	9.72±0.56	10.84±0.42	T×P *
4*	9.00±0.51	10.81±0.39	
5***	8.77±0.54	11.66±0.42	
6*	8.27±0.46	9.90±0.37	
7**	8.09±0.36	9.90±0.42	
8	7.40±0.65	8.17±0.32	
9	7.42±0.46	7.77±0.33	
Over all mean	8.70±0.18 <sup>A</sup>	9.86±0.13 <sup>B</sup>	

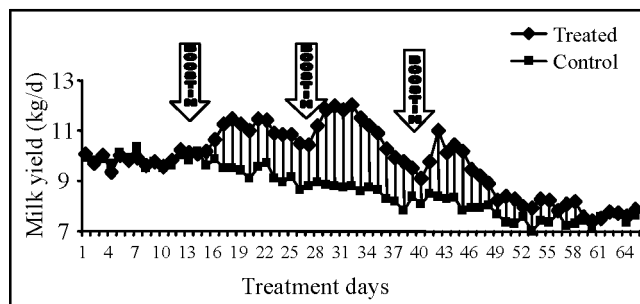
\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

NS: non significant. Means bearing different superscripts in a columns and row differ significantly.

T×P: treatment×period interaction.

## DISCUSSION

Plasma glucose level (mg/dl) in buffaloes during different fortnights suggested that there was no significant effect of treatment and period on glucose concentration due to rbST injection. The present finding is similar to earlier reports of Skarda et al. (1992) and Abas and Ozpinar (2001). No change in the blood glucose level observed in this study may be suggestive of the fact that the injected dose of rbST does not have any influence on gluconeogenesis as have been observed by Fullerton (1989). The decrease in BUN concentration due to rbST injections found in the present study was similar to those of Vicini et al. (1990) and Kweon et al. (2000). The BUN concentration is closely associated with the breakdown and deamination of protein in the rumen and utilization of  $\text{NH}_3$  for microbial protein synthesis. Somatotropin treatment results in dramatic improvement of efficiency of amino acid utilization for protein accretion resulting in lowered BUN concentration (Boyd et al., 1991). Somatotropin increases nitrogen retention through its nitrogen-sparing action and anabolic effect on body protein synthesis. However, in the present study though the same has been indicated by low BUN concentration in rbST treated buffaloes but no such anabolic effect of rbST injection was reflected in the serum proteins, which was in the same line observed by Lough et al. (1988). Triglycerides are stored during period of excess energy availability and are mobilized during periods of energy deprivation. No significant change in the serum triglycerides concentration could be attributed to the higher milk production in the rbST treated animal as diversion of surplus glucose for milk fat synthesis. The no difference in sodium and potassium concentration (meq/L) between control and experimental group may be suggestive of no effect of injected dose of rbST on electrolytes like sodium and potassium at 14 days interval. This finding was similar to the result of Lough et al. (1988).

**Figure 1.** Daily average milk yield (kg/d) injected with rbST (Boostin-250).

Concomitant to the findings of the present study, Bauman et al. (1985), Burton et al. (1991), Lean et al. (1992) and Skarda et al. (1992) reported higher milk production due to rbST injection. Bauman et al. (1985) recorded 23-41% higher milk yield in the rbST injected dairy cows as compared to that of non injected group. Ludri et al. (1989) also reported higher milk yield of 16.8% and 29.5% over control group due to exogenous administration of 25 and 30 mg somatotropin daily for 14 days in buffaloes. In the present study also, the rbST injected buffaloes exhibited higher milk yield ranging from 8% (third day of injection) to 39.27% (twentieth day of injection) with an overall average increase of 25% as compared to control group.

The milk yield response of rbST is dose dependent and related to lactation period and potentiality of an animal. The pattern of response of rbST is one, where milk yield is gradually increases over the first few days of rbST treatment and reaches a maximum during the end of that week (Figure 1). On termination of treatment the milk yield returns to pretreatment value, but on continuation of treatment the response is observed for considerable period, however following the decline due to advancement of lactation period. The increase in milk synthesis with somatotropin treatment most likely involves changes in the activity of the key regulatory enzymes resulting in an increased synthesis rate per epithelial cells and also involvement of both extra-mammary and intra-mammary mechanism of action (Tanwattana et al., 2003).

In conclusion the present study suggested that 250 mg of rbST (Boostin-250) injection resulted significantly higher milk production (25%) which was supported by the lowered BUN concentration in lactating buffaloes.

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