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EFFECT OF RECOMBINANT BOVINE SOMATOTROPIN ON MILK PRODUCTION AND COMPOSITION OF LACTATING BEETAL GOATS

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ABSTRACT

The present study was designed to determine the effect of recombinant bovine somatotropin (rbST) on milk production, composition, and weight gain and biochemical parameters in lactating Beetal goats. Fifteen goats were divided into three group's comprising A, B & C with five animals in each group according to the lactation stage, parity and milk yield. Group A was used as control, while B & C were subcutaneously injected with 50 & 100 mg /week of rbST for 8 weeks. The treatment of goats with rbST rapidly increased milk yield after the onset of treatment. The highest increase in milk production (29%) was observed in group C that was treated with 100 mg rbST/week while the lowest value was observed in the group A (control). Mild increase in milk protein, lactose, ash, total solids and fat was observed in rbST treated groups On the basis of above mentioned findings it is concluded that 50 mg/wk dose of rbSt is efficacious in increasing milk yield without any adverse effect onhealth of lactating Beetal goats.

Key words: Recombinant Bovine Somatotropin, Milk Production, Beetal Goats, Milk Composition.

INTRODUCTION

Livestock plays an important role in the economy of the country and contributed approximately 55.1 percent of agriculture value added and 11.5 percent to national GDP. (Economy Survey 2010-2011). The role of livestock in the rural economy may be realized from the fact that 30-50 million rural population is engaged in livestock raising, having household holdings of 2-3 cattle / buffalo and 5-6 sheep / goats per family which help to drive 30-40 % of their income from it. According to the Economic Survey of Pakistan 2010-11, the population of goat stood at 61.5 million. Goats annually contribute approximately 759,000 tones of milk, 2,685 millions skins and 23.2 thousand tones of hairs to the national economy (Economy Survey 2010-2011). Mutton production is mainly contributed by sheep and goat that accounts 616 thousand tons in Pakistan (Economy Survey 2010-2011). Goats are mostly raised for income and employment to a predominantly poor population (Ali, 2006). It is also a source of foreign exchange and contributes 2.5 % of the annual milk production (Iqbal *et al.,* 2008).

In Pakistan there are twenty five recognized breeds of goats (Hasnain, 1985) in which four Beetal, Nachi, Teddi and Dera Din Pannah are in Punjab province. Beetal goat of immense importance as it is called poor man's cow, is the goat of central Punjab which is mainly kept for milk and meat production and the males for meat purposes especially for Eid-ul-Duha/ animal slaughter festival.

It is accepted that goats are easy to milk and are termed as walking refrigerator for the storage of milk and can milk number of time in a day (Le Du, 1989). Goat milk is known to have better qualities such as digestibility and longer shelf life than cow milk. Dairy goats are supporting millions of malnourished human population in the developing world and thereby contributing through their milk more than that of cow. Moreover, from the health point of view, goat milk consumption has become an upper edge for the humans having peptic ulcers, allergy and various gastro intestinal disorders that usually develop from intolerance to cow milk (Haenlein, 2004). Goat milk has also been found to be very useful for diabetic patients (Nagura, 2004). Approximately 40 percent of all patients sensitive to cow milk proteins tolerate goat milk proteins (Brenneman, 1978), possibly because lactalbumin is immune specific between species (Hill, 1939). These facts also favors goat for adopting as dairy animals and can prove an ideal preposition especially for developing world where majority of goat population is found with people having low economic status.

Bovine somatotropin (bST) was for the first time approved by the Food and Drug Administration (FDA) On November 5, 1993,as the first biotechnological product for animal production, for commercial use. This action ushered in a remarkable new era for animal agriculture and the dairy industry. Bovine somatotropin, abbreviated as bST, is a protein hormone produced in cattle by the pituitary gland located at the base of the animal's brain. This is actually natural substance that affects the way the body operates and has the tendency to increase mitotic cell division or growth. A hormone

similar to bST is produced in all species of animals and is important for growth, development, and other body functions. It was observed in the 1930, in an experimental trial that bST injected into lactating cows significantly increased milk production (Nott, 1999).

The milk yield response to goat and sheep is more variable than that in cows (Mepham *et al*., 1984; Davis *et al*., 1989). Bovine somatotropin also has been shown to positively affect growth (Early *et al*., 1990a) and carcass composition (Early *et at*., 1990b; Mclaughlin *et al*., 1993). In Pakistan no studies have been reported on the effect of rbST on milk production and composition of lactating Beetal goats.

Keeping in view the importance of goats in our country the present study was designed to investigate the effect of rbST on milk production and its composition in Beetal goats.

MATERIALS AND METHODS

The study was designed in lactating Beetal goats at Small Ruminant Training and Research Center Ravi Campus Pattoki, University of Veterinary and Animal Sciences Lahore, Pakistan. The milk samples were collected and processed at WTO quality operation Laboratory of the University of Veterinary and Animal Sciences Lahore Pakistan. Fifteen lactating Beetal goats of almost same age, body weight, and parity were selected. Goats were in their 2nd – 3rd lactation. Water was made available to all the goats round the clock.

Allocation of experimental animals: Fifteen experimental does were divided into three (3) equal groups of five animals each (A, B and C). The group A was treated as control group, while animals in groups B & C were subcutaneously injected with single dose of 50 & 100 mg / week of rbST up to 8 weeks, respectively, on individual basis.

Feeding management: All experimental animals were kept under same management condition. Chaffed, green fodder was offered ad libitum and total mixed bailed ration (TMBR) was fed after milking in morning and evening. The goats were shifted on TMBR during the adjustment period of ten days before the start of experiment. Feed was offered twice daily ad-libitum in separate mangers to each animal. Feed refusal was recorded on daily basis to calculate the individual intake of seasonal green fodder and TMBR.

PARAMETERS STUDIED

1) **Milk Yield:** Initially the goat milk yield was recorded on two consecutive days at the beginning and at the end of the experiment at 06:30am and 05:30pm by using hand milking technique. Further, the milk yield of all the experimental lactating goats was recorded on weekly basis till the end of experiment.

2) **Milk composition:** To study the milk composition, samples were collected fortnightly from all goats. The 250 ml of milk samples was collected into plastic vials from each group, stored at 4^{o}C. The samples were analyzed for fat, milk protein, total solids & ash percentage while lactose was calculated by difference from total solid.

Statistical Analysis: The data obtained were analyzed by using ANOVA technique under completely randomized design through SAS 9.1.3. The difference among means was tested through Least Significant Difference (LSD) test (Steel *et al.,* 1997).

RESULTS

Milk Production: Results showed the significant effect of rbST on milk production in the treatment groups. The goats treated with rbST rapidly increased milk yield after the onset of treatment. Average an increase in milk yield for goats treated with 50mg or 100mg were 39 and 40 % as compared to control group (Table-1), the increase in control group might be due to advancing lactation.

Analysis of variance revealed a significant ($P<0.05$) difference in milk production among the groups. However, there was non significant difference ($P>0.05$) between the group B & C. The highest increase in milk production % (29%) was observed in treatment C that was treated with 100 mg rbST/week while the lowest value was observed in the treatment A (control).

Milk composition: To study the milk composition samples were collected fortnightly from all goats. The 250 ml of milk was collected in plastic vials from each group, stored at 4^{o}C. The samples were analyzed for, Protein, Lactose, Ash, Total solids and Fat %age.

a. Protein: Protein content in milk of rbST treated goats showed non significant difference ($P>0.05$) during the whole period of the treatment. A slight increase in protein contents in treatments A, B, and C (4.66, 7.40 and 9.33 %) was observed in the milk of Beetal goat, respectively (Table-1).The increase in protein contents of milk from rbst treated (100mg/wk) was comparatively more (9.33 Vs 7.40 %) as compared to (50 mg/wk). treated group, However, the difference was non significant.

b. **Lactose:** Analysis of variance for lactose content in milk of rbST treated goats showed non-significant difference among different groups during the whole period of the treatment (Table-1). However, an increase in lactose contents in treatment groups A, B, and C was observed as 2.28, 9.06 and 10.42 %, respectively, in the milk of Beetal goat. The highest increase in lactose

content (10.42 %) was observed in group C that was treated with 100 mg bST/week while the lowest value was observed in the treatment A, untreated.

c. **Ash:** A non-significant (P> 0.05) difference in ash contents (%) among milk of rbST treated groups was observed during the whole period of the treatment (Table-1). A slight increase in ash content in treatment groups A, B, and C (2.00, 1.90 and 3.92 %) respectively, in the milk of Beetal goat was observed. The highest increase in ash content (3.92 %) was observed in group C that was treated with 100 mg bST/week while the lowest value was observed in group B (50 mg/wk). the differences were however, non. significant.

d. **Total Solids:** Analysis of variance indicated non significant difference in total solids among different groups during the whole period of the treatment (Table-1). However, a slight increase in total solids contents in different treatment groups A, B, and C (3.17, 3.00 and 3.22 %) was observed in the milk of Beetal goats, respectively. The highest increase in total solids content (3.22 %) was observed in group C that was treated with 100 mg of rbST per week, while the lowest value was observed in the treatment group B. Statistically non significant difference was observed in milk total solids among different groups during the whole experiment period.

e. **Fat %age:** Fat % in milk of rbST treated goat groups showed non significant difference during the whole period of the treatment (Table-1). The increase in fat contents in treatment groups A, B, and C were 7.9, 6.66 and 8.81 % over the initial fat contents in the milk of Beetal goat, respectively. The highest increase in milk fat content (8.81 %) was observed in group C that was treated 100 mg bST/week while the lowest value was observed in the treatment B. Statistically there was non significant difference were observed in milk fat content % during the whole experiment period.

DISCUSSION

Somatotropin appears to promote milk production by a partitioning effect on absorbed nutrient, so to supply more substances for mammary synthesis, and also the level of nutrition may influence yield responses for milk and milk composition, and nutrient flow in rbST-treated lactating ruminants. (Peel and Bauman (1987) The average increase in milk yield of goats treated with 50 mg and 100 mg of rbST were 28 and 29 % above the control group. However no significant difference was noted between the 50 and 100mg treatment groups. Similar results were reported by Bauman and Currie, (1980). The results of Faulkner (1999) are also in agreement to the present study who reported that there was increase in the availability of glucose within the mammary epithelial cell in response to growth hormone treatment that would result in increase in the rate of lactose synthesis and hence stimulation of milk production. The rbST significantly influenced the milk yield, however milk composition and blood parameters were unaffected by the treatment Floris *et al.* (1991). Similar results were observed by Disenhaus *et al*. (1995) who conducted experiment in ten multiparous lactating Alpine or Saanen goats to test the effect of rbst on galactopoiesis which showed significant increase in milk yields.

Similar results were observed by Fernandez *et al.* (1995) and Gallo *et al.* (1997) who reported that rbST is efficacious in increasing actual milk yield without adverse effects for lactating ewes and does. The results of Brozosa *et al.* (1998) are in line with our study who observed that ewes treated with rbST significantly increased 22.21 % milk yield from the control without any adverse effect. Baldi (1999) reported similar findings in manipulation of milk production and quality by use of somatotropin in dairy ruminants other than cow and concluded with increased milk yield (20-30%) following treatment with bST in dairy ewes.

The bovine somatotropin (bST) greatly effect on mammary gland function and composition in the declining phase of lactation in goats (Baldi *et al.,* 2002). Similer observation were recorded by Sallam *et al.* (2005) who Administration of rbST in dairy goats. Similar findings were reported by Chadio (2009) who observed that rbST administration in goat increase milk yield.

Increase in protein contents from rbST treated (100 mg/wk) were comparatively more as compared to 50 mg/wk treated group, however, the difference was non significant. Similar findings were reported by D'urso *et al.* (1998) who studied the effect of sustained-release somatotropin on performance of ewes and evaluated the effects of rbST. They concluded that rbST treatment had little effect on protein contents in milk of ewes. Observations of Sallam *et al.* (2005) are also in line with present study who evaluated the effects of rbST on milk production, composition and some hemato-biochemical characteristics in Damascus goats. Increase in lactose contents in treatment groups A, B, and C was observed as 2.28, 9.06 and 10.42 %, respectively in the milk of Beetal goat. Results are in line with Chadio (2009) he observed that rbST administration had not significant effect on lactose contents in milk. Peel and Buman (1987) also reported similar results that lactose contents in milk were not substantially altered due to bST administration.

Fat (%) in milk of rbST treated groups showed non significant difference during the whole period of the treatment.However mild increase value was observed in group C. Similar findings were reported by D'urso *et al.* (1998). They reported that rbST treatment had little effect on fat contents in milk of ewes. Sallam *et al.* (2005) are

also in line with present study who evaluated the effects of rbST on milk production, composition and some hemato-biochemical characteristics in Damascus goats. Results are in line with Chadio (2009) he observed that rbST administration had not significant effect on fat contents in milk. The observations of Disenhaus *et al.* (1995) are in contrary with the findings of the present study, who reported that rbst greatly increase the milk fat content of goat milk yield in Alpine or Saanen goats. It was concluded that rbST has significant effect on milk production and its composition in lactating goats.

Table 1. Increase in milk yield (%) in lactating Beetal goats treated with different doses of rbST

Groups	Initial (ml) Mean ± S.E	Final (ml) Mean ± S.E	Difference(ml)	% increase
		Increase in milk yield (%)		
A (control)	860±281.78	960±222.53	100	11
B (50mg/wk)	1261±210.28	1757±182.58[b]	496	39
C (100mg/wk)	1050±224.82	1473±226.00[b]	423	40
		Milk protein content (%)		
A (control)	3.00±0.07	3.14±0.05	0.14	4.66
B (50mg/wk)	3.10±0.11	3.33±0.06	0.23	7.4
C (100mg/wk)	3.00±0.13	3.28±0.08	0.28	9.33
		Increase in milk lactose content (%)		
A (control)	3.50±0.12	3.58±0.03	0.08	2.28
B (50mg/wk)	3.53±0.21	3.87±0.15	0.32	9.06
C (100mg/wk)	3.55±0.09	3.92±0.17	0.37	10.42
		Increase in milk ash (%)		
A (control)	0.50±0.001	0.51±0.012	0.01	2.00
B (50mg/wk)	0.51±0.008	0.52±0.002	0.01	1.90
C (100mg/wk)	0.51±0.012	0.53±0.006	0.02	3.92
		Increase in milk total solids contents		
A (control)	11.30±0.08	11.66±0.27	0.36	3.17
B (50mg/wk)	12.00±0.25	12.36±0.50	0.36	3.00
C (100mg/wk)	12.40±0.75	12.80±0.92	0.40	3.22
		Cmposition of milk fat %		
A (control)	4.30±0.28	4.64±0.67	0.34	7.90
B (50mg/wk)	4.50±0.13	4.80±0.23	0.30	6.66
C (100mg/wk)	4.40±0.41	4.76±0.27	0.36	8.81

The different superscript in a column indicate significant difference ($P<0.05$)

REFERENCES

Ali, Q. (2006). The goat sector in Pakistan, Goats – undervalued asset in Asia, Proceed. APHCA-ILRI regional workshop on goat population system and markets. : 47-50

Economic Survey of Pakistan (2010-2011). Agricultural Census Organization, Statistics Division, Government of Pakistan, Islamabad..

Baldi, A. (1999) Manipulation of milk production and quality by use of somatotropin in dairy ruminants other than cow. Domest. Anim. Endocrinol., 17 (2-3): 131-137.

Baldi, A., S. Modina, F. Chel, F. Gandolfi, L. Pinotti, L. B. Scesi, F. Fantuz and V. Dell'Orto (2002). Bovine somatotropin administration to dairy goats in late lactation: Effects on mammary gland function, composition and morphology. J. Dairy. Sci., 85 (5): 1093-1102.

Bauman, D. E. and W. B. Currie (1980). Partitioning of nutritent during pregnancy and lactation: A review of mechanisms involving homeostasis and homeorhesis. J. Dairy. Sci., 63: 1514-1521.

Brenneman, J. C. (1978). Basics of food allergy. Charles C. Thomas Publ., Springfield, Illinois.

Brozosa, C., Ph Saratsisa, C. Boscosa, S. C. Kyriakisb and P. Tsakalofaorm (1998). Effects of long-term recombinant bovine somatotropin (bST) administration on milk yield, milk composition and mammary gland health of dairy ewes. Small Rumin. Res., 29 (1): 113-120.

Chadio, S. (2009). Effects of recombinant bovine somatotropin administration to lactating goats. Small Rumin. Res.,35 (3): 263-269.

Davis, S. R., P. D. Gluckman, S. C. Hodgkinson, V. C. Farr, B. H. Breier and B. D. Burleigh (1989). Comparison of the effects of administration of recombinant bovine growth hormone or NMet

insulin-like growth factor-I to lactating goats. J. Endocrinol., 123: 33-39.

Disenhaus, C., H. Jammes, J. Hervieu, F. Ternois and D. Sauvant (1995). Effects of recombinant bovine somatotropin on goat milk yield, composition and plasma metabolites. Small Rumin. Res., 15 (2): 139-148.

D'urso, G., M. Avondo, S. Bordonaro, D. Marletta and A. M. Guastella (1998). Effect of sustained-release somatotropin on performance and grazing behavior of Ewes housed at different stocking rates. J. Dairy. Sci., 81 (4): 958-965.

Early, R. J., B. W. McBride and R. O. Ball (1990a). Growth and metabolism in somatotropin-treated steers: 1. Growth, serum chemistry and carcass weights. J. Anim. Sci., 68: 4134-4143.

Early, R. J., B. W. McBride and R. O. Ball (1990b). Growth and metabolism in somatotropin-treated steers: II. Carcass and noncarcass tissue components and chemical composition. J. Anim. Sci., 68: 4144-4152.

Faulkner, A. (1999). Change in plasma and milk concentrations of glucose and IGF-1 in response to exogenious growth hormone in lactating goats. J. Dairy. Res., 66: 4134-4143.

Fernandez, N., M. Rodriguez, C. Peris, M. Barcelo, M. P. Molina, A. Torres and F. Adriaens (1995). Bovine somatotropin dose titration in lactating dairy Ewes. Milk yield and milk composition. J. Dairy. Sci., 78 (5): 1073-1082.

Floris, B., V. Carcangiu, P. P. Bini, and P. Nuvole (1991). Effect of recombinant bovine somatotropin on the secretion and composition of milk in Sardinian ewes. Boll Soc. Ital Biol Sper., 67 (10-11) 947- 954.

Gallo, L., L. Bailoni, S. Schiavon, P. Carnier, M. Ramanzin, I. Andrighetto and G. Bittante (1997) Effect of slow-release somatotropin on the pattern of milk yield between and within injection intervals. J. Dairy. Sci., 80 (1): 46-51.

Haenlein, G. F. W. (2004). Goat milk in human nutrition. Small Rumin. Res., 51: 155-163.

Hasnain, H. U. (1985). Sheep and Goats in Pakistan. FAO Animal Production and Health Paper 56. FAO, Rome.

Hill, L. W. (1939). Immunological relationship between cow's milk and goat's milk. J. pediatrics. 15: 56-59.

Iqbal, A., B. B. Khan, M. Tariq and M. A. Mirza (2008). Goat-A Potential dairy animal: present and future prospects. Pak. J. Agri. Sci., 45(2): 227-230.

Le Du, J. (1989). La traite mecanique des chevres. INRA Prod. Anim. 2(1):31-38.

McLaughlin, C. L., H. B. Hedrick, J. J. Veenhuizen, R. F. Finn, R. L. Hintz, G. F. Hartnell, T. R. Kasser and C. A. Baile (1993). Comparison of performance, clinical chemistry, and carcass characteristics of finishing lambs treated with recombinant ovine or bovine somatotropins. J. Anim. Sci., 71 (6): 1453-1463.

Mepham, T. B., S. E. Lawrence, A. R. Peters and I. C. Hart (1984). Effects of exogenous growth hormone on mammary function in lactating goats. Horm. Metab. Res., 16: 248-253.

Nagura, Y. (2004). Utilization of goat milk and meat in Japan. Farming, Japan. 36.

Nott (1999). Biotechnology information series (Bio-3) north central regional extension publication Iowa State University - University Extension.

Peel, C. J. and D. E. Bauman (1987). Somatotropin and lactation. J. D. Sci., 70: 474-486.

Sallam, S. M. A., M. E. A. Nasser and M. I. Yousef (2005). Effect of recombinant bovine somatotropin administration on milk production, composition and some hemato-`biochemical parameters of lactating goats. Egyptian J. Anim. Prod., 42 (1): 33-46.

Steel, R. G. D., J. H. Torrie and D. A. Dickie (1997). Principles and procedures of statistics biometric approach. Third edition. McGraw-Hill Publishing Company. Toronto.