Economics of Using Recombinant Bovine Somatotropin in Small Ruminants

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Abstract: This study examined the impact of recombinant bovine somatotropin (rbST) on income of small ruminants production. Fifteen Rahmani ewes and fifteen Damascus does in their third to fourth lactation season and at 30-40 days postpartum were used in this study. Every Rahmani ewes and Damascus does divided into three groups, five animals each. The first group was served as control, while the second and third groups were injected, once every other week for 60 days, with low (50 mg/animal) and high (100 mg/animal) doses of rbST, respectively. Injection with rbST significantly (P<0.01) increased total milk yield by 19.0 and 27.0 % for low and high doses, respectively compared to control ewes. While, in Damascus does milk yield significantly (P<0.05) increased by 24.3 and 22.5 % for low and high doses of rbST, respectively compared to control does. Average daily gain (ADG) of lambs that were suckling rbST-treated ewes was higher (7.7 and 11.0 % for low and high dose of rbST, respectively) than for lambs of control ewes. Also, ADG of kids that were suckling rbST-treated does was higher (11 and 10.5 % for low and high doses of rbST, respectively) than for kids of control does during the treatment period. Total additional income from extra milk from ewe and gain of lamb was 37.10 and 56.76 LE/60 days, for low and high rbST-dose groups, respectively. Net returns were 62.26 and 50.67% for the low and high rbST-dose group, respectively. While, total additional income from extra milk of doe and kid gain was 45.25 and 42.05 LE/60 days, for the low and high rbST-dose groups, respectively. Net returns were 69.06 and 33.41 % for the low and high rbST-dose group, respectively. This study suggested that low rbST dose (50 mg/14d) is recommended in order to get ideal economic return from using rbST in lactating small ruminant.

Key words: Somatotropin, Milk yield, Economic, Profit, Sheep, Goat

INTRODUCTION

Biotechnology has been heralded as a development that will have revolutionary impact on animal production. Recombinant bovine somatotropin (rbST) is a powerful technology to improve cattle performance, and its effects on milk yield and composition of dairy cows have been extensively reviewed[14,5,10,18]. Treating lactating sheep or goats with rbST increased milk yield[12,13,16]. The use of biotechnologies, such as rbST, could lower the farm costs of agricultural production. However, their use could also reduce output prices, due to increase in supply and possible decreases in demand arising from consumer concerns. Improvement of efficiency and economic return is an important goal in dairy farming, as in any agricultural enterprise. With bST use, a unit of milk is produced with less feed and protein supplement and with a reduction in animal excreta[11].

Numerous studies estimated and discussed the possible impact of bST on farm profitability before the commercial release of the product. A study in 1987 by the USDA projected returns from bST use to be $157 per cow. Schmidt[17] estimated returns over various responses and prices and projected that, at $0.26/kg of milk and a bST production response rate of 15%, the annual return would increase by $162 per cow. A later estimate of the change in net revenue caused by the use of bST ranged from negative values on poorly managed farms with low production, to $92 per cow on farms with a base production of 7620 kg and a 12% response.

Economic evaluation of the effects of adoption of bST have used linear program models of dairy farms in various areas of the U.S.[14,15]. The economic implications of rbST use are dependent upon a number of factors, such as production response to rbST, return required for farmers to adopt rbST, farm price of rbST, price of milk and the extent of adoption[11]. Economic value of rbST is
exerted by increasing the production of existing cows and, thus, is generally independent of the scale of the farm. The principal cash costs for using this technology are the cost of the product and the additional feed needed to produce the milk. For the economic analysis, induced cows were compared to first-lactation cows in the same herd using fair market value for costs and multiple component pricing for milk. Net present value for an induced cow was significantly greater than that for a first-lactation cow and concluded that bST use in induced cows is profitable. From the previous data, there is no enough data on the economic evaluation of the effect of rbST in small ruminants. Therefore, the objective of the present study was to evaluate rbST implication in lactating ewes and does.

MATERILS AND METHODS

Animals and treatments: Fifteen lactating Rahmani ewes each weighing 43.4 ± 1.78 kg with single lamb and fifteen lactating Damascus does each weighing 29.12 ± 1.34 kg were used in the present study. Ewes and does were in their third to fourth lactation season and at 30-40 days postpartum. The animals were kept in a free stall and had free access to water. They were fed on concentrate mixture and berseem hay twice daily at 0700 and 1500 h. The diet was offered in amounts calculated to provide 120% of the NRC recommended amount. Individual intakes of berseem hay and concentrate were recorded daily. The animals were divided into 3 homogenous groups, 5 animals each, according to lactation stage, parity and milk yield. The first group was used as a control, while the second and third groups were subcutaneously injected with 50 or 100 mg/2 weeks/animal of rbST (Somatec) for 8 weeks. A sustained release formulation of rbST was purchased from Elanco-Eli Lilly export S.A., Geneva.

Milk production and growth performance: Milk yield was recorded twice weekly at 0700 and 1600 h by using weigh-suckle-weigh technique. At approximately 0800 am, lambs were removed from their dams and placed in an adjacent pen. Following a 5-h separation period, the lambs or kids were weighed and then joined with their dams to nurse. After lambs or kids had finished nursing (approximately 15 min), they were re-weighed. Milk yield for the 5-h period was taken as the difference in lamb or kid weight before and after nursing.

Economics evaluation assumptions: The cost of 50 mg rbST was 3.5 L.E. Hence, total cost per animal within 60 days was 14 or 28 L.E with biweekly injections of 50 or 100 mg of rbST in the sustained release form. Extra cost of rbST injections for labor was not included because of intermediate price of rbST and the small labor requirement to inject.

Milk pricing is determined to be 3.00 L.E. through the Research Station of Animal Production at Borg El-Arb, Alexandria, Egypt. The live body weight price in sheep and goats is determined to be 17.0 L.E. per kilogram.

RESULTS AND DISCUSSIONS

Milk production and average daily gain lambs: Milk production of lactating ewes and growth performance of lambs were presented in Table 1 as described by our previous study. Average increases in milk yield for ewes treated with low and high doses of rbST were 19.0 and 27.0% above the control group, respectively (Table 1). Differences between treated and control ewes continued to increase during the entire treatment period, reaching 19.0 and 27.0% for low or high dose of control yield in wk 8. Body weight and dry matter intake of ewes were not affected by rbST treatment. Lambs of rbST-treated ewes had higher average daily gain (ADG) than the lambs of control ewes by 7.7 and 11.0% for low and high doses of rbST, respectively (Table 1).

The profitability of rbST usage in lactating ewes: The profitability of rbST usage in lactating ewes and growth performance of lambs are presented in Table 2. There was no additional feeding and labor cost due to rbST treatment because there were no difference in dry matter intake and management between control and rbST-treated animals. Therefore, the profitability of rbST usage will depend only on return from extra kilograms of milk and gain due to rbST treatment and rbST cost. The feeding cost is not included in the calculation of the profitability of rbST usage because the quantities of concentrate mixture fed to each animal were predetermined and were held constant during the experiment. Thus, the variation in DMI during experiment were due to changes in roughage intake. Since the price of roughage is much lower than that of concentrate, its value is neglected.

It is obvious from Table (2) that the profitability of rbST usage due to the extra milk production were 22.14 and 33.30 LE per ewe/60 days, for the low and high rbST-dose groups, respectively. While, the profitability of rbST usage due to the extra gain production in lambs were 14.96 and 23.46 LE per lamb/60 days, for the low and high rbST-dose groups, respectively. The total additional income from extra milk and gain was 37.10 and 56.76 LE/60 days, for the low and high rbST-dose groups, respectively. The net returns were 62.26 and 50.67 % for the low and high
rbST-dose group, respectively. Under typical conditions on cows produced from 5-15 pounds milk/day.

**Milk production and average daily gain of kids:** Milk production of lactating does and growth performance of kids were presented in Table (3) as described by our previous study[16]. Average increases in milk yield for does treated with 50 mg or 100 mg of rbST were 24.3 and 22.5 % above the control group, respectively. Body weight and dry matter intake of the does were not significantly (P<0.05) affected by rbST treatment[16]. Kids of rbST-treated does had higher average daily gain (P<0.05) than the kids of control goats by 11 and 10.5 % for 50 mg and 100 mg rbST, respectively.

**The profitability of rbST usage in lactating does:** The profitability of rbST usage in lactating does and growth performance of kids are presented in Table (4). There was no additional feeding and labor cost due to rbST treatment because there were no difference in dry matter intake and management between control and rbST-treated animals. Therefore, the profitability of rbST usage will depend only on return from extra kilograms of milk and gain due to rbST treatment and rbST cost. The feeding cost is not included in the calculation of the profitability of rbST usage because the quantities of concentrate mixture fed to each animal were predetermined and were held constant during the experiment. Thus, the variation in DMI during experiment were due to changes in roughage intake. Since the price of roughage is much lower than that of concentrate, its value is neglected.
It is obvious from Table (4) that the profitability of rbST usage due to the extra milk production were 34.20 and 31.68 LE per ewe/60 days, for the low and high rbST-dose groups, respectively. While, the profitability of rbST usage due to the extra gain production in kids were 11.05 and 10.37 LE per kid/60 days, for the low and high rbST-dose groups, respectively. The total additional income from extra milk and gain was 45.25 and 42.05 LE/60 days, for the low and high rbST-dose groups, respectively. The net returns were 69.06 and 33.41 % for the low and high rbST-dose group, respectively.

The net return of rbST usage in lactating ewes and does was 62.26 and 69.06% for low dose (50 mg rbST), respectively. While, the return was declined to 50.67 and 33.41 % for high dose (100mg rbST) in ewes and does, respectively. The economic benefit of using rbST was calculated by merely subtracting the additional incremental costs associated with using rbST from the incremental income. The production response to rbST depends on the quality of management provided on the dairy. For maximum response, cows must be fed adequate additional quantities of a properly balanced diet. In
addition, factors such as cow comfort, hygiene, proper ventilation, heat abatement in hot and humid weather, water, and general health also contribute to the ability of the cow to respond to the product. These are the same factors that influence optimal production in any dairy cow [8]. Recombinant somatotropin was generally projected to be profitable for dairy farmers and use of rbST had statistically significant increases in kilograms of milk sold per cow and return over purchased feed cost [3,13,19].

Also, a very large study in New York tracked 340 commercial dairy herds, one half that never used rbST and one half that used the product at a significant level (more than 50% of cows) since the product was introduced. The study involved over 80,000 cows over more than 200,000 lactations. Production and other aspects were compared to the four-year baseline set in all herds pre-rbST. Recombinant bovine somatotropin has been shown to be effective in healthy, properly fed cows and to be safe for cows in wide adoption across the spectrum of US dairy herds [8].

It is concluded that high rbST dose caused higher milk response than that of the low dose but low rbST dose had higher profitability and return than the high dose. Therefore, it is recommended to use the low rbST dose (50 mg/14d) in order to get ideal economic return in lactating sheep and goats. The benefit of rbST is its ability to increase milk production significantly and, in doing so, to lower farm fixed costs over units of milk produced.

REFERENCES