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GROWTH PERFORMANCE, CARCASS CHARACTERISTICS AND SOME HEMATOLOGICAL PARAMETERS OF RABBITS TREATED WITH RECOMBINANT BOVINE SOMATOTROPIN (RBST) AS GROWTH ENHANCER

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ABSTRACT

In Egypt, there is a great necessity for improving production to fulfils the over growing demand for animal proteins. Rabbit meat provides an excellent source of protein for human consumption and may play a significant role in solving a part of meat shortage gap in Egypt. One hundred and twenty Filander rabbits were reared, just after weaning, to determine the effect of recombinant bovine somatotropin (rbST) injection on growth performance and carcass characteristics. A dose of 0, 0.75 and 1.5 mg were injected biweekly basis throughout the experiment. Experimental rabbits were fed ad libitum pelleted growing rations to serve their nutritional requirements for growing period of rabbits according to NRC (1994). The present results revealed that the daily feed intake did not affected significantly by rbST injection. Conversely, the rbST significantly increased daily weight gain and significantly improved feed conversion ratio in both doses.

With respect to carcass characteristics, the dressing percentage of rabbits was significantly increased with rbST injection at both dosages. Similar trend was noticed for weight of internal organs (spleen, kidney and liver). The rbST injection in both doses significantly increased hematocrit level, plasma total protein and

albumen. With respect to liver function, it could be noticed that the rbST significantly improved the liver function via reduced the AST and ALT activity. In conclusion, these data indicate that rbST is an efficacious method of improving growth performance and carcass characteristics in rabbits.

Key words; Rabbits, performance, blood parameters, rbST

INTRODUCTION

Developing countries are often characterized by food deficiency especially in animal protein. There is a great necessity for increasing animal production to fulfill the rapid growth of human demands and to minimize the gab between available and required of animal protein (Galal and Khalil, 1994). The increase in protein production may come from short cycle animals kept by the small scale farmers such as rabbits. Rabbits are suitable to be raised for great and rapid meat production due to their high prolificacy and fecundity, high feed conversion and efficiency and short generation period (FAO, 1987).

Adding several products from different sources to rabbits feed now is widely used for improving performance (Boulous et al., 1992).

Growth promoters (chemical products, antibiotics, enzymes, hormones, etc) play an essential role in the rabbit industry. Although, good results were obtained with these substances, their use might have unfavorable effect and it may result some unfavorable residual in the tissues resulted many problems for consumers. Recently, using antibiotics as a growth promoters and many artificial feed additives in animal production become international refused due to their adverse and side effects on human health (Marzo, 2001). It is indispensable to replace these feed additives with other natural substances have no effects on animal and human health (Abaza and El-Said, 2005).

Great attention must be focused on using natural feed additives such as herbs and medicinal plants in rabbit feeding. Bovine somatotropin (rbST), a natural growth hormone secreted by the anterior pituitary in all animals, has a major effect on the regulation of growth. It is now possible to transfer the DNA sequences responsible for somatotropin synthesis into bacteria and to produce large quantities of somatotropin commercially at economic levels. Interest in increasing growth performance by administering somatotropin (ST)

has been sparked by the in vitro synthesis of mammalian ST using recombinant DNA techniques (Bauman et al., 1982) and by the observations that injections of ST enhance growth in pigs (Chung et al., 1985; Etherton et al., 1987) and increase milk production in cows (Fronk et al., 1983; Peel et al., 1983).

Because many of the biological effects of ST are mediated through the peptide insulin-like growth factor I (IGFI), also referred to as somatomedin-C (Van Wyk, 1984), measurement of IGF-I in plasma and tissues of ST-treated animals may be useful in assessing the biological effects of ST. In the present study, we have studied the effects of rbST injections on performance, carcass characteristics and some hematological parameters of growing rabbits.

MATERIALS AND METHODS

The present work was conducted in an industrial private Rabbitry, located in Belal Village, near El-Nobariah city, El-Beherah Province, Egypt. All rabbits were individually housed in wired battery cages supplied with feeders and stainless steel nipples for feeding and drinking. The initial body weight of rabbits and design of rbST injection are presented in Table (1). The pelleted diets covered the nutritional requirements of the growing and mature phases of rabbits according to NRC (1994) recommendations. Ingredients and chemical composition of the pelleted ration are summarized in Table (2).

Table 1: Initial body weight and design of rbST injection

	Control	T1	T2
Number	40	40	40
Initial body weight (5 wks)	663.5	664.3	658.6
rbST dose	0	0.75 ml/kg	1.5 ml/kg
Interval of injection	-	Every three days	Every three days
Duration of injection (day)	-	28	28
Injection number	-	8	8

rbST = Recombinant Bovine Somatotropin

All batteries were located in a windowed Rabbitry with natural ventilation. Fresh tab water was automatically available all the time in

each cage. All the experimental rabbits were healthy and clinically free from internal and external parasites and were kept under the same managerial and hygienic conditions. The averages of daily weight gain, daily feed intake and feed efficiency were calculated during growing period. At the end of the experiment (at the marketing age, 70 days), twenty meet rabbits from each experimental group was randomly taken for slaughter after being fasted for 12 hours. After complete bleeding, the carcass, spleen, kidneys, liver, heart and lungs were weighed. Dressing percentages are the quotient of carcass weight values divided by their corresponding pre slaughter (live body) weight values.

Blood samples of growing rabbits were collected during slaughter of 25 rabbits within each experiment group on day 70. The samples were collected into dry clean centrifuge tubes, the serum was separated by centrifugation at 3000 r.p.m. for 20 minutes and kept in a deep freezer at (-20 0C) until biochemical analysis. Non-coagulated blood was tested shortly after collection for estimating blood pictures. Red and white blood cells were counted according to Feldman et al. (2000). Hemoglobin concentration and hematocrite value were measured according to Tietz (1982). Total protein level was evaluated according to Armstrong and Corri (1960), albumin level according to Doumas et al. (1971) and globulin levels were obtained by subtracting the values of albumin from the corresponding values of total protein. The activities of glutamic-oxaloacetic transaminase (GOT) {aspartate aminotransferase AST} and glutamic-pyruvic transaminase (GPT) {alanine aminotransferase ALT} were estimated according to Reitman and Frankel (1957).

Statistical analysis

Data were subjected to analysis of variance using the General Linear Model Program of SAS (2001). Percentage values were transformed to Arc. Sin values before being statistically analyzed. Duncan's new multiple range tests was used to test the significance of the differences between means.

Table 2: Composition and calculated chemical analysis of the experimental diet

Ingredients	%
Clover hay	30.00
Wheat bran	26.20
Barley grain	23.00
Soybean meal (44%)	16.00
Molasses	3.00
Limestone	1.00
Sodium chloride	0.50
Vitamins & mineral Premix*	0.30
Total	100.00
Calculated chemical analysis**	
Crude protein, %	16.72
Ether extract	2.95
Crude fiber, %	13.07
Digestible energy (Kcal/kg)	2490.00

** Calculated according to NRC (1994) for rabbits.

Vitamins and minerals premix per kilogram contains*

Items	Concentration	Items	Concentration
Vit.A	10,000 IU	Biotin	0.2mg
Vit.D3	900 IU	Choline	1200.0mg
Vit.E	50.00mg	Niacine	50.0mg
Vit.K	2.00 mg	Zn.	70.0mg
Vit.B1	2.00mg	Cu.	0.1mg
Vit.B2	6.00mg	Mn.	8.5mg
Vit.B6	2.00mg	Fe.	75.0mg
Vit.B12	0.01mg	Folic acid	5.0mg
		Pantothenic acid	20.0mg

RESULTS AND DISCUSSION

Growth performance

Data presented in Table (3) revealed that there was no significant difference among treated groups for daily feed intake. In contrast, Hulot et al. (1994) found that decreasing feed consumption of rbST treated NZW rabbits. Inversely, El-Far (2000) found that feed consumption of rbST treated male NZW rabbits was higher than control group by 5.21%. The conflicting results may be due to many factors such as strain, dosage and environmental conditions. The growing rabbit's injection with rbST at 0.75 or 1.5 mg recorded significantly higher daily weight gain compared to control group. Similar trend was noticed by Hafez et al. (2006). They showed that the rbST treated rabbits reached the marketing weight earlier than the control group by 2 weeks. Also, they reported that rabbits injected with rbST were heavier than control ones by about 4.7% at 12 weeks of age. With respect to feed conversion ratio, it could be observed that the injection of rbST at both doses significantly improved feed conversion ratio compared to control-group.

Improvement of growth performance associated with the rbST injection may be due to the respect to hormones, the concentrations of insulin like growth factor (IGF-I) have been observed to increase after rbST administration (Ronge and Blum, 1989), but the rbST-IGF axis seems strictly dependent on the cow's nutritional status (Ronge and Blum; 1988). Insulin increments due to rbST treatment were also observed (Ronge and Blum, 1989; West et al., 1991), while other authors showed variable insulin changes after rbST treatment (Davis et al., 1988; de Boer and Kennelly, 1989; French et al., 1990). Many other authors have reported small changes of insulin and thyroid hormone concentrations (Butterwick et al., 1989; Chilliard et al., 1989; Cissé et al., 1991), and Johnson et al. (1991) observed a significant reduction of 3,5,3'- triiodothyronine (T3) and cortisol concentrations. Silence (2004) and Dunshea et al. (2005) showed that treatment of Somatotrpin increased protein deposition on skeletal muscles and all tissues including skin. Also, they stated that there is a dose dependent increase in lean deposition and reductions in feed intake, fat deposition and carcass fat reduction.

Table 3: Daily feed intake, daily weight gain and feed conversion of growing Filander rabbits injected with rbST

Trait	rbST (mg/kg)			
	0.0	0.75	1.5	Prob.
Daily feed intake, g	95.8±3.90	98.7±4.20	99.2±4.10	NS
Daily weight gain, g	25.2^{b}±1.10	30.5^{a}±1.70	31.9^{a}±1.20	0.01
Feed conversion ratio	3.80^{a}±0.30	3.23^{b}±0.20	3.11^{b}±0.01	0.05

$^{a, b}$ Means within the same row with different letters are significantly differed
NS = non-significant
rbST = Recombinant Bovine Somatotropin

Carcass characteristics

Dressing weight and internal organs weight of rabbits as affected by rbST injection are summarized in Table (4). Our results showed that the pre-slaughter weight was significantly affected by rbST injection, whereas the rabbit's injection with rbST at 0.75 and 1.5 mg recorded significantly heaviest pre-slaughter body weight compared to control-group. Similar trend was observed for carcass weight. Also, the dressing percentage was significantly increased when injection rbST at 0.75 and 1.5 mg respectively. With respect to internal organs weight, the present results revealed that the injection of rbST at both doses significantly increased spleen, kidneys, and liver, heart and lung weights compared to control-group.

Table 4: Dressing percentage and internal organs weight of growing Filander rabbits injected with rbST

Trait	rbST (mg/kg)			
	0.0	0.75	1.5	Prob.
Pre-slaughter weight, g	1669.1^{b}±39.5	1818.3^{a}±41.5	1851.8^{a}±35.7	0.01
Carcass weight, g	1115.2^{b}±27.7	1287.9^{a}±21.1	1325.6^{a}±30.2	0.001
Dressing, %	66.8^{b}±1.3	70.8^{a}±1.4	71.6^{a}±2.0	0.02
Spleen weight, g	1.61^{b}±0.21	1.79^{a}±0.11	1.81^{a}±0.13	0.05
Kidneys weight, g	12.9^{b}±1.0	14.2^{a}±1.2	14.6^{a}±1.0	0.01
Liver weight, g	51.7^{b}±2.9	59.7^{a}±2.4	61.3^{a}±3.1	0.01
Heart weight, g	6.3^{b}±0.8	7.0^{a}±0.3	7.1^{a}±0.5	0.01
Lung weight, g	10.1^{b}±0.8	11.0^{a}±0.7	11.3^{a}±0.9	0.01

$^{a, b}$ Means within the same row with different letters are significantly differed
NS = non-significant
rbST = Recombinant Bovine Somatotropin

Blood picture and some hematological parameters

Effect of rbST injection on blood picture and some hematological parameters of rabbits are listed in Table (5). It could be observed that the rbST injection at 0.75 and 1.5 mg significantly increased red blood cells count by about 0.6 and 0.7 X 10^6 mm^3 compared to control-group. Similar trend was noticed for white blood cells count, where the white blood cells count of treated rabbits with rbST at 0.75 and 1.5 mg was significantly higher than that of control-group. Both hemoglobin and hematocrit level significantly increased when rbST injection at both doses. The higher level of hematocrit may have enhanced oxygen delivery to the tissue. Also, this increment is supposed to be a factor for increased blood volume as a reaction to increase body oxygen requirement.

Plasma total protein of rabbits injected with 0.75 and 1.5 mg rbST was significantly higher than that of control-group. Similar trend was observed for plasma albumin. Albumen is serves as the major reservoir of protein and involved in colloidal osmotic pressure, acid-base balance, and it acts as a transport carrier for small molecules such as vitamins, minerals, hormones and fatty acids (Margaret, 2001). Our results showed that there was no significant difference among treated group for plasma globulin. The globulins are composed of three fractions, designated alpha, beta and gamma. Alpha-globulins are a group of proteins manufactured almost entirely by the liver. Normally, these proteins increase with acute nephritis, severe active hepatitis, active, usually systemic inflammation, malnutrition and in nephritic syndromes (Margaret, 2001). The gamma-globulin fraction contains most of the immuno-proteins, including IgM, IgA, IgE and IgG. These usually elevate with ongoing antigenic stimulation, usually from infectious agents (Margaret, 2001). Concerning liver function, the present results revealed that the injection of rbST at 0.75 and 1.5 mg improved liver function via significantly reduced the AST and ALT activities compared to control-group.

In conclusion, these results indicate that recombinant bovine somatotropin (rbST), as growth enhancer, is an efficacious methods for improving growth performance, some hematological parameters and carcass characteristics in Filander rabbits.

Table 5: Blood picture and some hematological parameters of rabbits as affected by rbST injection

Trait	rbST (mg)			Prob.
	0.0	0.75	1.5	
Red blood cells (N X 10^6/mm^3)	6.1^b±0.4	6.7^a±0.3	6.8^a±0.3	0.02
White blood cells (N X 10^3/mm^3)	7.6^b±0.3	8.2^a±0.3	8.2^a±0.3	0.01
Hemoglobin, mg/dl	12.0^b±1.1	12.6^a±0.7	12.8^a±0.9	0.04
Hematocrit (%)	33.9^b±1.7	37.5^a±2.1	38.9^a±2.6	0.001
Total protein, g/dl	7.2^b±0.3	7.7^a±0.4	7.8^a±0.2	0.05
Albumen, g/dl	3.9^b±0.5	4.5^a±0.5	4.5^a±0.6	0.01
Globulin, g/dl	3.3±0.3	3.2±0.2	3.3±0.2	NS
A/G ratio	1.2^b±0.01	1.4^a±0.01	1.4^a±0.01	0.05
AST, U/L	26.9^a±0.9	24.5^b±1.0	23.8^b±0.8	0.01
ALT, U/L	15.9^a±0.7	13.1^b±0.7	12.1^b±0.6	0.01

[a, b] Means within the same row with different letters are significantly differed
NS = non-significant
rbST = Recombinant Bovine Somatotropin

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أداء النمو، صفات الذبيحة و بعض صفات الدم فى الأرانب المعاملة بهرمون النمو البكتيرى (rbST) كمحسن للنمو

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فى مصر، يوجد ضرورة كبيرة لزيادة الانتاج الحيونى وذلك لمحاولة تحقيق الطلب الكبير على مصادر البروتين الحيوانى. تعتبر لحوم الارانب مصدر ممتاز للبروتين بالنسبة للانسان وربما تلعب الارانب دورا هاما فى حل مشكلة النقص فى البروتين الحيوانى فى مصر. استخدم فى هذه الدراسة عدد 120 ارنب من سلالة الفلندر لدراسة تاثير الحقن بمادة rbST على معدلات النمو وصفات الذبيحة. تم تقسيم الارانب الى ثلاثة مجاميع وهى الكنترول و المجموعة المحقونة بمعدل 0.75 ملليجم بينما حقنت المجموعة الثالثة 1.5 ملليجم من المادة السابق ذكرها. غذيت الارانب على مصبعات تحتوى على كل المكونات الغذائية التى توفى احتياجات الارانب طبقا (NRC,1997). اوضحت النتائج ان معدل الاستهلاك اليومى من العليقة لا يتأثر بصورة معنوية بالحقن. وعلى العكس من ذلك فقد وجد ان الحقن بمادة rbST ادى الى زيادة معنوية فى معدل الزيادة الوزنية اليومى بالاضافة الى تحسن معنوى فى معدل التحويل الغذائى. شوهد زيادة معنوية فى نسبة التصافى ووزن كل من الطحال والكلية والكبد وذلك فى الارانب المحقونة بمادة rbST. سجلت الارانب المحقونة بمادة rbST مكونات دم خلوية وقيم لبروتينات الدم وكذلك الالبيومين اعلى معنويا من الارانب الكنترول. كما ادى الحقن بهذه المادة الى تحسن فى وظيفة الكبد وذلك عن طريق تقليل نشاط انزيمات الكبد. والخلاصة، فقد اشارات النتائج المتحصل عليها ان الحقن بمادة rbST من الانظمة المؤثرة فى معدل النمو وصفات الذبيحة فى الارانب.