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EFFECT OF VITAMIN E AND SELENIUM INJECTION ON LAMB VIABILITY, GROWTH PERFORMANCE AND SOME BLOOD SERUM CONSTITUENTS IN SAIDI LAMBS

(With 4 Tables and 2 Figures)

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تاثير اعطاء فيتامين هـ , والسيلينيوم عن طريق الحقن على الحيويه وكفاءة النمو وبعض مكونات الدم في الحملان الصعيدي

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شمل البحث تجربة لدراسة تأثير الحقن بمضادات الاكسده (فيتامين هـ , والسيلينيوم) علىالحيويه و أداء النمو وبعض مكونات الدم في الحملان الصعيدي (٢٣ حملا). قسمت الحيوانات إلى مجموعتين , الأولى ضابطة (١٢حيوان) والتي لم تحقن بفيتامين هـ والسيلينيوم , والثانية (١١حيوان) تم حقنها بمعدل ٢٠ ملجم بفيتامين هـ و٢٢ ملجم سيلينيوم لكل كجم وزن حي أسبوعيا لمدة ٢٤ أسبوع أعطي فيتامين هـ والسيلينيوم في صورة محلول يحتوي كل واحد مل علي ١٥٠ ملجم فيتامين هـ و ١,٦٧سيلينيوم. بعد فترة الرضاعة غذيت الحيوانات علي العليقة الخشنة والمركزة حتى الشبع. أخذت عينات الدم لتحليل الجلوكوز و البروتين الكلي و الألبيومين و الجلوبيولين الكلي و الهيموجلوبين ونسبة الهيماتوكريت و أنزيمات الكبد (AST, ALT). أظهرت النتائج أن الحقن بفيتامين هـ والسيلينيوم يؤدى ألي تحسين معد ل النمو اليومي. انخفاض نسبة النفوق في الحيوانات المعاملة بفيتامين هـ والسيلينيوم مقارنة بالحيوانات غير المعاملة (٩ % مقابل ٢٥%) الحيوانات المعاملة بفيتامين هـ والسيلينيوم تميل أن تكون أعلا فى تركيز الجلوكوز والجلوبيوليين والهيموجلوبين ونسبة الهيماتوكريت مقارنة بالمجموعة الضابطة. انخفاض معنوي في إنزيم الكبد(الأنين امينوترانسفيريز ALT) بحوالي ٢٨% في الحيوانات المعاملة مقارنة بالحيوانات الغير معاملة. نستخلص من هذه الدراسة أن الحقن بفيتامين هـ والسيلينيوم أدي إلى تحسين معدلات النمو وصورة الدم المختبرة مع ا انخفاض معدل النفوق في الحملان الصعيدي.

SUMMARY

The experiment was conducted to study the effects of antioxidant namely vitamin E and selenium (E-Se) injection on lamb mortality, growth and some blood parameters in 23 Saidi lambs at 2 weeks of age. Animals were divided into two groups, a control group (12 animals) with no E-Se injection and the other group (11 animals) was injected weekly with 20 mg vitamin E and 0.22 mg selenium per kg body weight. After suckling period, animals were fed roughage and concentrate diet *ad libitum*. Blood samples were taken for determination of Hb, PCV, glucose, total protein, albumin, globulin, AST and ALT. Lamb Mortality was recorded. The results concluded that vitamin E and Selenium injection improved body weight and daily gain. Lamb mortality rate was lower in E-Se treated lambs than in control (9 Vs 25%). Animals injected with E-Se tended to have more serum glucose, globulin, hemoglobin and PCV, % ($P<0.05$) than those of controls. Overall mean of A LT was decreased significantly by 28% in E-Se treated lambs compared with control lambs. In conclusion, vitamin E and selenium injection may improve both body weight and selected blood profile and decreased mortality rate of Saidi lambs.

Key words: Vitamin E, Selenium, Growth, mortality, Some blood serum metabolites, Saidi lambs

INTRODUCTION

Selenium was recognized as a potentially toxic minerals many years before it was identified as an essential nutrient, selenium is an important part of the enzyme glutathione peroxidase (Rotruck *et al.*, 1973). This enzyme destroys peroxides before they can damage body tissues. Vitamin E is also effective as an antioxidant, where it is required to maintain cell membrane structure and function (Bendich, 1990). Therefore, both selenium and vitamin E prevent peroxide damage to body cells. This aids the body's defense mechanisms against stress.

Selenium and vitamin E are needed by animals and both have metabolic roles in the body in addition to an antioxidant effect. Selenium plays a critical role in increasing the immune response in animals. Dimitrov *et al.* (1987) reported that pre treatment of polymorphonuclear neutrophils in selenium deficient pigs, with selenium, restored their

oxidative metabolism, which is closely related to the ability of the neutrophils to kill microorganisms.

Selenium deficiency has serious effects on lamb production. The manifestations are reduced growth and white muscle disease, which affects lambs at two to eight weeks of age (NRC,1985). In New Zealand studies lack of selenium causes high embryonic mortality, infertility, and high lamb mortality (Hartley, 1963).

Analysis of records collected from farm of Animal Production Department, Faculty of Agriculture, Assiut University, Assiut revealed that sheep offsprings suffer from general weakness with frequantly mortalties of no infectious causes. Therefore, the aim of this study was to investigate the effect of vitamin E with selenium (E-Se) on growth performance, health and some serum metabolites in Saidi lambs.

MATERIALS and METHODS

The present study was carried out in the experimental farm of Animal Production Department, Faculty of Agriculture, Assiut University, Assiut, Egypt.

The objective of the present study was to evaluate the effect of long- term vitamin E and selenium injection on lamb health, growth performance and some blood parameters in Saidi lambs

Animals and management:

Twenty three Saidi lambs of about 2 weeks age were randomly allocated into two groups, a control group (12 animals) and an experimental group, injected with 20 mg vitamin E per kg body weight and 0.22 mg selenium per kg body weight during 24 weeks experimental period. Vitamin E was in a solution containing 150 mg vitamin E and 1.67 mg Se per 1 ml. Animals were dosing at weekly intervals for 24 weeks. The animals were fed Egyptian clover (Berseem) and concentrate mixture *ad libitum*. The concentrate mixture consisted of 40% wheat bran, 32% maize, 25% decorticated cotton seed meal, 2% limestone and 1% sodium chloride. Lambs were left to suckle their mothers during the day and night. Animals had free access water.

Growth Performance:

Animals were weighed at the beginning of the experiment and every month thereafter. Weights were recorded in the morning before feeding. Live weight gain was calculated .

Blood samples and analysis:

Blood samples were collected from the jugular vein on the 11th, 23rd .and 24th week of experimental period. Blood samples were collected into two vials, one dry, clean and sterilized for serum collection while the other contained heparin for obtaining whole blood for determination of hemoglobin content (Hb) and packed cell volume (PCV,%). Serum separated from the whole blood by centrifugation at 4000 rpm for 15 min and stored at –20 °C until subsequent analysis. Hemoglobin (Hb, g/dl) concentration was determined by the method of Coles. (1967). Packed cell volume (PCV,%) was measured according to Schalm (1986). Serum glucose and total protein concentrations were determined using kits of Biocon (Germany). Blood serum albumin, aspartic amino-transferase (AST) and alanine amino-transferase (ALT) concentrations were determined using kits of Diamond Diagnostics (Egypt). Blood serum globulin concentration was obtained by difference between serum total protein and albumin.

Statistical analysis:

The data were statistically analyzed using the General Liner Model (GLM) percedure of SAS (1989). The following model was used:

Yij =u + Ti + Eij

Where yij = the observation

u = general mean.

Ti = the effect due to vitamin E with selenium.

Eij = the errors resulted from individual observation.

RESULTS and DISCUSSION

Growth performance:

Table 1 and figure 1 show that lambs treated with vitamin E-Se had heavier live body weight than control ones for all experimental periods. However, total body weight gain or average daily gain of lambs treated with vitamin E-Se was about 18% compared with control ones. These findings agreed with Naziroglu *et al.* (1997) in lambs and with Spears *et al.* (1986) and El-Gaafrawy *et al.* (2000) in calves. These findings in our investigation could be attributed to the effect of vitamin E and selenium injection on improving the efficiency of digestion by increasing the number of protozoa (microflora). The improvement of microbial digestion, which is main digestion in the ruminant, resulted in increasing the percent of volatile fatty acids in the blood which are highly important for the growth and vitality of the lambs (Velasquez-Pereira *et al.*, 1999)

Mortality rate:

Data in Table 1 and figure 2 show that lamb mortality rate was lower in E-Se treated lambs than in controls (9 vs 25%, Table 1) . Three animals died in control group compared with one animal died in treatment group. Our results agreed with Velasquez-Pereira *et al.* (1999) and Kott *et al.*(1998) who found that vitamin E supplementation significantly reduced lamb mortality when compared with no supplementation (12 vs. 17 %, respectively). Feldmann *et al.* (1998) concluded that selenium and vitamin E seemed to improve the status of health in the Se-deficient calves as shown to reduce the amount of antibiotics and GSH-Px-activity. Also our results come in accordance with Spears *et al.* (1986), they reported that selenium and vitamin E injections reduced calf death losses from 15.3% to 4.2% .

Serum metabolites:

Table 2 shows the changes of serum total protein, albumin and globulin in treated lambs compared with control ones. Serum total protein and globulin concentrations were not significantly affected by vitamin E and selenium injection. These results agreed with Metry *et al.* (1998), they found that serum total protein, albumin and globulin concentrations were not significantly affected by vitamin E and selenium in calves. Vitamin E and selenium injection decreased ($P<0.05$) the overall mean of serum albumin concentration (Table 2). However, serum globulin level tended to be higher in treated lambs than in control ones. Similarly this finding agreed with Rock *et al.* (2001) in lambs and Reddy *et al.* (1986) in calves. This could be attributed to the effect of selenium and vitamin E which increased absorption of globulin and essential protein digested products which was eventually reflected on the obtained parameters.

Serum glucose concentration was not significantly affected by vitamin E and selenium injection (Table 3), but the level of serum glucose increased by about 9 % and 19 % in E-Se treated lambs at 11^{th} and 23^{rd} week of experimental period, respectively. However, the overall mean of serum glucose concentration increased by vitamin E and Se injection (Table 3). High serum glucose in animals injected with E-Se may be related to that vitamin E increased cortisol secretion (Sconberg *et al.* 1993). Also, selenium increased tri-iodothyronin (T_3) and thyroxin (T_4) secretions (Rock *et al.* 2001). In accordance, such hormonal changes are involved in rising blood glucose (Hadley, 1984). In addition high level of adrenaline and cortisol are inhibitory to insulin

secretion and stimulatory to glucagon where both actions increased blood glucose.

Table 3 shows that serum AST tended to be higher in animals treated with vitamin E and selenium. Our results came in agreement with El-Gaafrawy *et al.* (2000) in calves. High serum glucose of E-Se treated animals in the present study (Table 3) may be related to high AST, as it is very important in glucose synthesis from non-carbohydrates metabolite sources (Harper *et al.*, 1977).The overall mean of serum ALT had lower in lambs treated with E-Se than control lambs.

Hematological findings:

Table 4 shows that vitamin E and selenium injection increased packed cell volume % (PCV%) by 10, 7 and 14% at 11th, 23rd and 24th week of experimental period, respectively. However, the mean of PCV% of lambs treated with vitamin E-Se was significantly higher (38.9) than that of controls (35.4). The overall mean of hemoglobin concentration (Hb) of treated lambs was higher than that of control lambs, but the difference was not significantly. These results agreed with Spears *et al.* (1999) in calves, Hill *et al.* (1999) in neonatal pigs and Bickhardt *et al.* (1999) in goats. These findings in the present investigation could be attributed to that vitamin E protects the biological membranes from oxidative damage with consequent beneficial effect in preservation and keeping erythrocytes from any hazard or damage effect with consequent increase in the amount of erythrocytes with subsequent relative increase in the Hb contents inside erthrocytes.

In conclusion: injection with vitamin E and selenium improved growth and health performance which were clearly manifested by the improvement of live body weight gain and decreased mortality rate of Saidi lambs with improvement in the studied blood constituents.

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Table 1: Effect of antioxidant (Vitamin E and selenium) injection on growth performance and mortality rate in Saidi lambs (mean ± SE)

Item	**Control**	**Treatment**
Initial body weight (kg)	8.82 ± 0.67	8.03 ± 1.08
Body weight (kg) at:		
4th week	11.95 ± 0.83	12.53 ± 1.66
8th week	15.63 ±0.93	16.48 ± 2.05
12th week	19.30 ± 1.43	20.15 ± 2.22
16th week	21.65 ±1.70	23.15 ± 2.17
20th week	23.97 ± 2.82	25.98 ± 2.54
24th week	27.20 ± 2.82	29.76 ± 2.93
Total gain (kg)	18.38 ± 2.44	21.73 ± 1.72
Average daily gain (g)	109.40 ± 16	129.34 ± 11
Lamb mortality (%)	25	9

Table 2: Effect of antioxidant (Vitamin E and selenium) injection on Serum concentrations of total protein, albumin and globulin in Saidi lambs (mean ± SE)

Sampling Week	Total protein		Albumin		Globulin	
	Control	Treatment	Control	Treatment	Control	Treatment
11th week	7.97±0.33	7.41±0.33	5.34±0.28	5.58±0.28	2.64±0.39	1.83±0.39
23rd week	7.38±0.38	7.56±0.33	6.11±0.30	5.22±0.28*	1.37±0.45	2.34±0.39
24th week	7.29±0.31	7.12±0.30	4.96±0.27	4.18±0.25*	2.65±0.39	3.06±0.35
Mean	7.55±0.34	7.34±0.32	5.42±0.28	4.93±0.27*	2.30±0.41	2.46±0.37

* (P <0.05)

Table 3: Effect of antioxidant (Vitamin E and selenium) injection on serum concentration of glucose, aspartate amino transaminase (AST) and alanine amino transaminase (ALT) in Saidi lambs (mean ± SE)

	Glucose		AST		ALT	
	Control	Treatment	Control	Treatment	Control	Treatment
11th week	62.86 ±5.68	68.81 ±5.66	25.16± ±1.97	27.55 ±1.97	14.64 ±1.95	13.18 ±1.95
23rd week	52.5 ±6.08	62.35 ±5.67	29.17 ±2.11	36.02 ±1.97**	14.52 ±2.08	13.58 ±1.95
24th week	70.22 ±5.08	68.06 ±5.08	27.55 ±1.97	11.89 ±1.77	13.92 ±1.84	05.44 ±1.74**
Mean	62.92 ±5.47	66.53 ±5.61	22.05 ±2.02	24.13 ±1.90	14.33 ±1.96	10.33 ±1.88*

* (P <0.05), * * (P <0.01)

Table 4: Effect of antioxidant (Vitamin E and selenium) injection on serum concentration of hemoglobin (g/100ml) and packed cell volume (PCV %) in Saidi lambs (mean ± SE)

Sampling week	Hemoglobin		PCV %	
	Control	Treatment	Control	Treatment
11th week	11.25±0.64	11.69±0.64	37.63±1.79	1.25±1.79
23rd week	10.51±0.74	11.49±0.64	34.29±1.91	36.63±1.79
24th week	11.77±0.60	11.73±0.60	34.00±1.7938.	75±1.79*
Mean	11.26±0.66	11.64±0.63	35.35±1.83	38.88±1.79*

* (P <0.05)

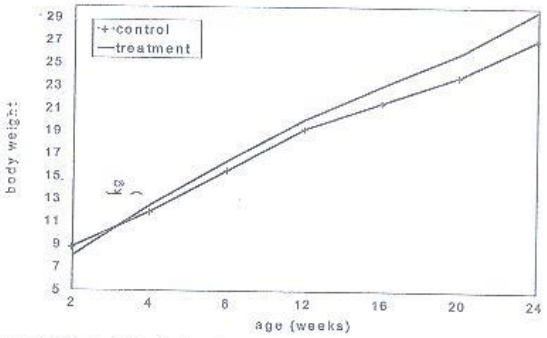

Figure 1: Effect of vitamin E and selenium injection on body weight of Saidi lambs

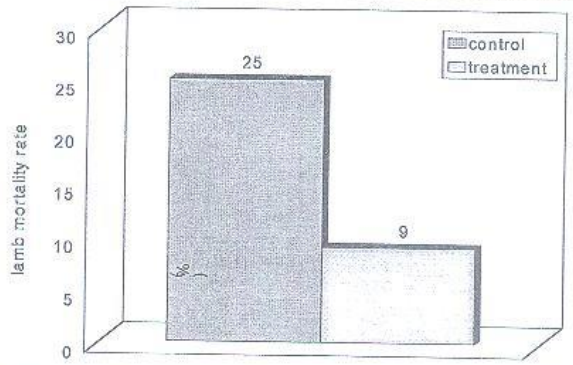

Figure 2: Effect of vitamin E and selenium injection on mortality rate of Saidi lambs