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Effect of Supplementation Selenium and Vitamin E on Blood and Stress Parameters of Awassi Lambs

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Abstract

The study was established in local farm sheep in Muwafaqia / Wasit - Iraq, from 1/10/2018 until 15/1/2019, to evaluate the effect of adding selenium with or without Vitamin E on some of the physiological characteristics of Awassi male lambs. Sixteen lambs were selected after weaning with an average weight of (24.30) kg and aged (3-4) months. All lambs fed 2% of body weight with a concentrated diet and randomly divided into (4) groups. Control group (no additives), Selenium group (0.4 mg selenium), Vitamin group (100 mg vitamin E) and combination of selenium + vitamin E group (0.4 mg selenium + 100 mg vitamin E) per kg dietary dry matter for 90 days. At the end of the experiment, blood parameters (white blood cell (WBC), red blood cell (RBC), packed cell volume (PCV), hemoglobin (HB), mean concentration hemoglobin (MCH), and mean concentration hemoglobin count (MCHC) and stress parameters were measured. The result showed selenium + vitamin E and selenium treatments significantly increased ($p < 0.05$) in PCV as compared with vitamin treatment and the control group. While treatment of vitamin significantly increased ($p < 0.05$) in hemoglobin concentration compared to treatment of combination selenium + vitamin E. Stress parameters such as respiratory rate and heartbeat decreased significantly ($p < 0.05$) in treatment of combination selenium + vitamin E compared to other treatments. There were no significant differences between the study treatments in the WBC count.

Keywords: Selenium, vitamin E, blood and stress parameters, Awassi lambs.

Introduction

The content of mineral elements provided to farm animals through diet depends on many factors, including soil characteristics, its content of mineral elements, and the period of plant growth, as deficient nutrition of mineral elements causes multiple symptoms such as poor growth, low production, and high mortality (Mazokopakis and Protopapadakis, 2007). Most environments in the world suffer from a deficiency of selenium in plants, and it is necessary to provide it in the diets of ruminants, especially in areas that suffer from an acute deficiency of this element (Flohé et al., 2000).

One of the recent studies proved that selenium has a role in reducing oxidative stress resulting from low glutathione peroxidase enzyme concentrations in ruminants (Diaz-Sanchez

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et al., 2017). Many studies have indicated that selenium affects the blood parameters in goats (Diaz-Sanchez et al., 2017), cows (Slavik et al., 2008), and sheep (Boldizarova et al., 2005).

Vitamin E is available in wide ranges in the feed, especially as α- tocopherol, which is the most diffusion and activation, the amounts of the vitamin E increase when feeding on a green diet, as it is considered one of the antioxidants (Suttle, 2016). Vitamin E is important for animal growth and improving the health and immune status throughout improving the blood picture (Daramola et al., 2016).

Body temperature, respiratory and heartbeat rates are the most important indicators of stress that the animal is exposed under acute environmental conditions, and the combined effect of selenium and vitamin E keeps respiratory rates within the normal range during heat stress in female Bengali goats (Sivakumar, et al., (2010) and Malpura breed ewes (Sejian, et al., 2014). However, Ghanem, et al., (2016) indicated that added selenium and vitamin E in the diet of lamb, which suffers from a deficiency of the two compounds, leads to an increase in the heart rate and respiratory rates. Also, Qureshi, et al., (2017) reported that feeding ewes of the selenium (0.3 mg/ kg diet) and vitamin E (50 mg/ kg diet) caused a significant decrease in respiratory and heartbeat rates at the end of the experiment compared to the control group. This study aims to investigate the effect of selenium and vitamin E supplementation on the blood and stress parameters of Awassi lambs after weaning.

Materials and methods

Ethical approval

Experimental animal: all applicable national and international guidelines for the care and use of animals were followed.

Experimental animal

The experiment was conducted in local farm sheep in Muwafaqia / Wasit - Iraq, from 1/10/2018 until 15/1/2019 (the study period is 90 days with a 15-day preliminary period). Sixteen Awassi male lambs aged 3-4 months and weighted 24.375 ± 1.300 kg were randomly selected and divided into 4groups (4 lambs per group). The first group (control) without any additives. Second group, (Se) 0.4 mg selenium/kg of diet (produced by MERCK Company /Germany). Third group, (Vit. E) 100 mg vitamin E/ kg diet (produced by HIMEDIA Company /India) and Fourth group, (Se + Vit. E) 0.4 of selenium + 100 of vitamin E mg/ kg of diet, respectively. Lambs were housed in pens (one pen per group) and supplied with plastic receptacles for water and food. All animals fed daily at 7 a.m. on the same concentrate diet including barley (50 %), wheat bran (35 %), soybean meal (5 %), yellow corn (9 %), and mineral mixture without selenium (1 %), to provide the nutritional requirements of sheep according (NRC., 1985), the concentrate ration was adjusted based on 2% of the achieved weight body weekly. The remaining feed from the last day was collected and weighed for each group before the morning meal. Average total weight gain and feed conversion efficiency were calculated according to the following equations:

Average total weight gain (kg) = final body weight - initial body weight.

Feed Conversion Efficiency (FCE) = weight gain (kg) x 100/feed intake (kg)

Collection of blood samples and laboratory analysis

Blood samples were taken from the jugular vein, (2) ml, placed in plastic test tubes include EDTA (Ethylene Diamine Tetra acetic acid) to determine blood pictures. White blood cells (WBC) and red blood cells (RBC) were measured by using the method of Hughes-Jones et al., (2004). Packed cell volume (PCV), hemoglobin (Hb), mean concentration hemoglobin (MCH), and mean concentration hemoglobin count (MCHC) were measured by using the method of Dacie et al., (1984).

Calculate stress measures

The heartbeat, pulse/minute was measured using a medical headset, and breathing rate by holding the hand moistened with water in the mouth and nose of the lamb (inhalation and exhalation) / min per lamb/weekly at (7) a.m. and (6) p.m. (Alhidary et al., 2012).

Statistical analysis

The data were statistically analyzed using the Completely Randomized Design (CRD). Statistically significant differences were determined at $P<0.05$. The obtained data were analyzed statistically using the SPSS, (2013).

The model was as follows:

$Yij = \mu + Ti. + eij.$

Where:

Yij : The observation of the treatment with selenium or vitamin E.

μ : The general average of the studied trait.

Ti..: The effect of the treatment.

eij.: The random error is normally distributed with a mean of zero and a variance of its magnitude $\sigma^2 e$.

Results and Discussion

Average weight and feed conversion efficiency

Treatment of combination selenium + vitamin E and the treatment of selenium significantly increased ($p <0.05$) for average total weight (17.25 and 17.60) kg, respectively compared to treatment of vitamin and control group (12.60 and 14.60) kg, respectively, feed conversion efficiency improved in lambs of combination selenium + vitamin E treatment and selenium treatment of (4.298 and 4.349) kg/kg, respectively, compared to vitamin treatment and control group (5.647 and 4.956) kg/kg respectively. (Table 1). This increase in body weight may be due to lambs eating higher levels of dry matter and thus the higher proportion of digested energy and digested protein, which was reflected in the increase in its growth

compared to treatments that ate less dry matter, or to the role of selenium in growth and metabolism of the bones (Cao et al., 2012), or the role of selenium and vitamin E to increase the appetite and efficiency of animal feed consumption (Shetawi et al.,1992). This is consistent with (Dominguez-Vara et al., 2009; Das, 2011; Ramadan et al., 2018) in goat and sheep.

Table 1. The effect of adding selenium and vitamin E on average total weight and efficiency food conversion for lamb males (mean ± standard error)

Trait / TRT	Initial weight (Kg)	Final weight (Kg)	Average total weight gain (kg)	Feed intake (kg)	Feed conversion efficiency (kg/kg)
Control	24.40 ± 1.25	39.00 ± 0.64 b	14.60 ± 0.53 b	0.798	4.956
Se	24.60 ± 1.29	42.20 ± 1.70 a	17.60 ± 0.53 a	0.848	4.349
Vit. E	24.00 ± 1.51	36.60 ± 1.24 c	12.60 ± 0.53 c	0.785	5.647
Se+ Vit. E	24.50 ± 1.14	41.75 ± 1.37 a	17.25 ± 0.53 a	0.821	4.298

Different letter within column means significant difference (P<0.05).

Blood parameters

Table (2) explained the effect of adding selenium and vitamin E on some blood pictures. The mean total number of WBC for all treatments did not record any significant differences (p <0.05) among the months of the experiment. However, the values are within the normal range (Spears et al., 1986). Probably these antioxidants (selenium and vitamin) have an active mechanism for protecting the membrane cells of WBC from oxidative damage in various animal species (Chow, 1991). This is consistent with (Shinde et al., 2009; Alhidary, et al., 2012), in their study of different types of farm animals, while the results did not agree with Kassab and Mohammed, (2017) in Sohag ewes, Morán et al., (2017) in Assaf breed and (Shi et al., 2018) in black goats. The differences between those results and our result may be due to age, the duration of addiction, the different concentrations used, and physiological status. The means of RBC for combination selenium + vitamin E treatment and selenium treatment were significantly higher (p <0.05) recorded (8.828 and 8.545) cell x 10^6/L, respectively, compared with vitamin treatment and control group (7.282 and 7.411) cell x 10^6/L respectively, may be due to the role of selenium in maintaining the life of red blood cells, increasing it's resistance and keeping it's within the stable saline balance (isotonic) (Radostits et al., 2007), or positive correlation between selenium concentration in the blood and the effectiveness of selenium enzymes glutathione peroxidase (GPx) and superoxide dismutase (SOD) in red blood cells which reduce hemolysis (Zachara et al., 1993). Or that the vitamin is one of the basic components of the membrane of the red blood cells and its

deficiency cause abnormalities in the red bone marrow with abnormal long-term blood changes (Radostits et al., 2007). The results were consistent with (Boldizarova et al., 2005), in male lambs of Valaska breed and (Al-Slyvany and Al-Zubaidi, 2011) in the female lamb of Awassi breed. While, the mean of PCV in combination selenium + vitamin E treatment significantly increased ($p < 0.05$) recorded (32.20%) compared with vitamin treatment and control group (29.30 and 26.70) % respectively, this may be the result of the protective role of vitamin against hemolysis (Capper et al., 2005). These were agreed with the results of Matar et al., (2013); Morán et al., (2017); Maraba et al., (2018).

Table 2. The effect of selenium and vitamin E on some of blood picture (mean ± standard error)

Trait / TRT	WBC × 10^3/L	RBC × 10^6 /L	PCV %
Control	5.201 ± 0.294	7.411 ± 0.176 b	26.70 ± 1.115 c
Se	5.106 ± 0.905	8.545 ± 0.847 a	30.60 ± 3.209 ab
Vit. E	5.499 ± 0.337	7.282 ± 0.678 b	29.30 ± 2.338 b
Se+ Vit. E	5.003 ± 0.198	8.828 ± 0.667 a	32.20 ± 2.692 a

Different letter within column means significant difference ($P<0.05$).

Vitamin treatment increased significantly ($p < 0.05$) in hemoglobin concentration reached (10.26 g/100 ml) compared to combination selenium + vitamin E treatment which reached (8.90 g/100 ml). MCH increased significantly ($p < 0.05$) in vitamin treatment which recorded (27,90 picogm) compared to combination selenium + vitamin E treatment, selenium treatment and control group which recorded (17.90, 21.30 and 21.00) Picogm, respectively, In addition, MCHC increased significantly ($p < 0.05$) for vitamin treatment (78.10 g/100 ml) compared to combination selenium + vitamin E treatment, selenium treatment and control group (49.20, 58.80 and 59.10) g/100 ml, respectively (Table 3). The significant increase in the mean amount of hemoglobin in erythrocytes (MCH) and concentration of hemoglobin in erythrocytes (MCHC) for vitamin treatment, the reason for this may be that vitamin E plays a role in maintaining the persistence of metabolism, which strengthens the need to improve standards blood, including hemoglobin, is the necessary oxygen transporter for such processes (Huisman, 1975). This is consistent with (Alhidary et al., 2012; Soliman et al., 2012). However, it does not agree with (Morán *et al.*, 2017; Maraba *et al.*, 2018).

Table 3. The effect of selenium and vitamin E on some blood picture (mean ± standard error)

Trait / TRT	Hb g/100 ml	MCH Pico gm	MCHC g/100 ml
Control	9.30 ± 0.35 ab	21,00 ± 1.19 b	59.10 ± 3,31 b

Se	9.43 ± 0.31 ab	21,30 ± 2.24 b	58.80 ± 7,00 b
Vit. E	10.26 ± 0.43 a	27,90 ± 1.79 a	78.10 ± 4,53 a
Se+ Vit. E	8.90 ± 0.42 b	17,90 ± 0.86 b	49.20 ± 2,83 b

Different letter within column means significant difference (P<0.05).

Stress parameters

A Significant (p <0.05) decrease was observed for respiratory rate and heartbeat in treatment of combination selenium + vitamin E, with (42) respiratory movement /minute and (88) pulse /minute respectively compared with other treatments (Table 4). It may be due to the role of vitamin + mineral supplementation by lowering cortisol in the blood (Sivakumar et al., 2010). As the release of this hormone is one of the main signs of stimulating the hypothalamic-pituitary-adrenal gland axis as a physiological reaction by these glands to face the state of stress in the body, the hormone works to regulate the respiratory rate and heartbeat during stress state (Ihsanullah et al., 2017), it is considered a general stress hormone and performs a decisive effect in many physiological activities, especially respiratory rate, heartbeat and body temperature (Marai et al., 2000), or to the direct effect of vitamin on the thermal regulation zone in the hypothalamus (Ganong, 2001). This is consistent with the results of (El-Shahat and Abdel Monem, 2011; Alhidary et al., 2012), for breathing rate, while, this result did not agree with the results indicated (Katamoto et al., 1998) in terms of respiratory rate when injected selenium and vitamin after exposing goats to heat stress. While, agreed in a heartbeat with Qureshi et al., (2017) in ewes of Damani and Balkhi breeds and with Ghanem et al., (2016) in lambs. However, it differed from the results of Chauhan et al., (2016), this variation may be attributed to the type and breed of experimental animals and stressful environmental studies.

Table 4. The effect of selenium and vitamin E on stress parameters (mean ± standard error)

Trait / TRT	Respiratory rate Respiratory movement/minute	Heartbeat Pulse/minute
Control	59 ± 0.85 a	102 ± 0.57 a
Se	55 ± 0.57 a	104 ± 0.86 a
Vit. E	53 ± 0.85 a	100 ± 2.01 a
Se+ Vit. E	42 ± 0.85 b	88 ± 0.75 b

Different letter within column means significant difference (P<0.05).

Conclusions

The results showed that add element selenium (0.4) mg with 100 mg of vitamin E/ Kg of dry matter to the diets of lambs achieved improved significantly in most of the qualities of productivity and rates of growth as a live body weight final daily gain, proved to be effective

in improving the standards lambs treatment as the number of cells of blood the red and the size of cells compressed and hemoglobin blood and the average quantity and the average concentration in red blood cells and indicators to overcome the conditions of stress improvement in the rate of breathing and pulse of the heart.

Conflict of interest

The authors declare that they have no conflict of interest.

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