Egyptian Journal of Sheep & Goat Sciences, Vol. 12, No. 1, P: 49--58, April 2017

NUTRIENT DIGESTIBILTY, PRODUCTIVE PERFORMANCE AND SOME SERUM BIO-INDICES AS AFFECTED BY VITAMIN A AND E SUPPLEMENT TO GROWING LAMBS

E. M. Ibrahim
Anim. Prod. Depart. Fac. of Agric., Minia Univ., Egypt
Email: emad_i@mu.edu.eg

ABSTRACT

A total number of thirty two Ossimi male lambs (averaged 3 months old and 21.05 ± 1.06 kg BW) were used to evaluate the influence of vitamin A and E supplement on nutrient digestibility, productive performance and some serum bio-indices. The animals allocated into four equal groups. The first group without supplement served as control, while the treated lamb groups T1, T2 and T3 were orally supplemented with vitamin A (50.000 IU/head/biweekly), vitamin E (400 mg/head/biweekly), and vitamin A (50.000 IU) plus vitamin E (400 mg) /head/biweekly, respectively. The results showed no significant differences in all digestibility values of DM, OM, CP, EE, CF, ADF, NDF and NFE among lambs received treatments T1, T2 and T3 *vs.* control. In addition, averages percentages of nutritive values (DCP and TDN) were comparable for lambs treated with T1, T2 and T3 *vs.* control. Averages of final body weight (FBW) and daily gain (DG) were increased (P<0.05) for lambs of T1 and T3 compared with control or T2. The averages of FBW and DG were greater (P<0.05) for the treatment T3 than T1 or T2. No significant differences were noticed in wheat straw intake, dry matter intake and total dry matter intake for lambs treated with T1, T2 and T3 *vs.* control. However, digestible crude protein intake and total digestible nutrients intake increased (P<0.05) for lambs treated with T1, and T3 vs. control or T2. Feed conversion of DMI, DCPI and TDNI were improved (P<0.05) for lambs received T1 and T3 vs. those received T2 or control, with higher (P<0.05) improvement in FC-DCPI for lambs of T3 than those received T1 or T2. Data indicated that serum total protein and globulin levels were higher (P<0.05) with all treatments T1, T2 and T3 than control, while, serum albumin concentrations were increased (P<0.05) with treatments T1, and T3 *vs.* T2 or control. No significant differences in serum concentrations of glucose, cholesterol and AST enzyme for lambs received T1, T2 and T3 compared with the untreated control lambs. It could conclude that supplement of vitamin A plus E has synergistic useful effect able to improve feed intakes and feed conversion of growing lambs, enhancing their performance and develop favorable signs in some serum bio-indices.

Key words: *Vitamin A and vitamin E, Lambs, Digestibility, Productive performance and some serum bio- indices.*

INTRODUCTION

Vitamins A and E are fat-soluble vitamins involved in several biological processes such as immunity, reproduction, growth and animal development. They are cellular antioxidants that prevent peroxidative damage in cell membranes, thus, they play an essential role in the well-functioning animal immune system **(Meglia *et al.*, 2004)**. Vitamin A, retinol, regulate the epithelium turn over, mucosal glycoproteins, immune-globulines and the differentiation of myeloid cells **(Toker, 2007)**; as well as growth hormone gene expression **(Bedo *et al*., 1989)**. Vitamin E, as an antioxidant, prevents the cell membrane against damage by inhibiting lipid peroxidation **(Brown *et al*., 1998)**. Inadequacy in both vitamins, as antioxidant defense, could impair immune function and health of animal. Variable improvements in sheep productive performance and immune status were shown to be related with vitamin E supplementation at levels above requirements **(Rooke *et al.*, 2004)**. According to **St-Claire *et al.* (2004)**, utilization and absorption of vitamin A is related to vitamin E intake; meanwhile vitamin E can protect vitamin A from oxidative breakdown **(Gallo-Tores, 1980)**. In addition, vitamin E at small doses could increase vitamin A utilization, while larger doses decrease the amount of vitamin A formed

and stored in the liver **(St-Claire *et al.*, 2004)**. So, loss of vitamin A from liver stores is accelerated during vitamin E deficiency **(Watts, 1991)**. Also, depression of vitamin E utilization could be occurred with high levels of dietary vitamin A in cattle **(Schelling *et al.*, 1995).** In sheep, however, over-supplementation of dietary vitamin A does not antagonize vitamin E turnover **(Hidiroglou, 1993)**.

Vitamin A, as a potential antioxidant, might be considered similar to vitamin E in animal nutrition **(Kartha and Krishnamurthy, 1977)**. However, the mechanistic aspects related to interaction between both vitamins, as micronutrients, are not fully clarified, and the reports on their effects on nutrient digestibility and utilization are very limited. Therefore, the present study aimed to investigate the effect of supplemental vitamin A and vitamin E on nutrient digestibility, productive performance and some related serum bio-indices in sheep.

MATERIAL AND METHODS

Animals:

This study used 32 growing Ossimi lambs (averaged 3 months old and 21.05 ± 1.09 kg weight). The experiment was carried out at the Farm of Animal Production Department, Faculty of Agriculture, Minia University during the months from January to April, 2015.

Experimental treatments:

The animals were allocated into four equal groups. The first group without supplement served as control, while the treated groups T1, T2 and T3 were orally supplemented with vitamin A (50.000 IU/head/biweekly), vitamin E (400 mg/head/biweekly), and vitamin A (50.000 IU) plus vitamin E (400 mg) /head/biweekly, respectively.

Feeding and management:

The experimental animals were fed on concentrate feed mixture, contained 48 % wheat bran, 17 % yellow corn, 13 % soybean meal,10.8 % sunflower meal, 4.2 % molasses, 4 % rice hulls, 2 % calcium carbonate and 1 % sodium chloride to cover their requirements according to live body weight **(NRC, 2007)**. In this study, wheat straw (WS) as roughage source was offered *ad libitum.* The calculated concentrations of ß-carotene and vitamin E in the CFM were 1.78 mg/kg DM and 13.09 mg/kg DM, respectively. The NRC recommend for growing lambs allowances of 69 µg ß-carotene/kg live weight/day (47 IU of vitamin A/kg live weight/day) and 20-25 mg of vitamin E /lamb/day. Feed was offered twice daily at 8 am and 2 pm and drinking water was available along the experiment. The measurements of lambs' body weight were recorded at starting of the experiment and biweekly thereafter, while feed intakes recorded daily. Averages of daily gain and feed conversion rates of lambs were calculated. All the parameters were recorded at the morning before animals accessed to feed or water.

Dietary Sampling and laboratory analysis:

Dietary samples were collected daily in the last week of each month along the experiment period and a composite sample was performed. A portion of the composite sample was dried at 105 °C in a forced air oven until constant weight for DM determination. The rest of composite sample was dried at 70 °C for a constant weight, grounded and kept in closely tied jars for later laboratory analysis. Diets were analyzed for dry matter (DM), organic matter (OM), crude protein (CP), crude fiber (CF), ether extract (EE) and ash according to **AOAC (2003)**. Neutral detergent fiber (NDF) and acid detergent fiber (ADF) were determined according to **Goring and Van Soest (1970)**. Grasp fecal samples were collected before feeding at 7 am and 1 pm from each lamb at the last week of each month and mixed together, dried at 70 °C till constant weight and analyzed for DM, OM, CP, CF, NDF, ADF, EE and ash. Total tract digestibility of DM, OM, CP, CF, NDF, ADF, EE and NFE were determined using acid insoluble ash as an internal marker according to **Van Keulen and Young (1977)**. Approximate analysis of concentrate feed mixture (CFM), wheat straw (WS) and total mixed ration (TMR) are presented in Table (1).

Table 1: Approximate analysis of concentrate feed mixture (CFM), wheat straw (WS) and total mixed ration (TMR) fed to lambs (% on DM basis).

Items	CFM [1]	WS	TMR
DM	88.40	88.29	88.37
OM	89.66	90.30	89.85
CP	18.76	3.08	14.01
EE	3.13	1.45	2.62
CF	10.22	41.05	19.56
NDF	40.10	87.57	54.48
ADF	13.92	61.17	28.23
NFE	57.55	44.72	53.66
Ash	10.34	9.70	10.15

CFM[1] = Concentrate feed mixture contained 48 % wheat bran, 17 % yellow corn, 13 % soybean meal,10.8 % sunflower meal, 4.2 % molasses, 4 % rice hulls, 2 % calcium carbonate and 1 % sodium chloride.

Serum bio-indices analysis:

Non-heparinized blood samples collected from the jugular vein of lambs. Samples were left to clot at room temperature for at least 4 h, then the clots removed and sera were cleared and stored at -20 ºC for later assay. Serum glucose, total protein, albumin, cholesterol and aspartate transaminase (AST) enzyme were determined colorimetrically using Bio-diagnostic product kits (Egypt). Serum globulin concentrations were calculated by difference between total protein and albumin concentrations. The analyses were performed at Cairo University Research Park (CURP), Faculty of Agriculture, Cairo University.

Statistical analysis:

Data were analyzed by least square means analysis of variance using General Linear Models (GLM) procedure of the statistical analysis system **(SAS, 2000)**. The model used to analyze the different treatments studied for lambs was as follows:

$Y_{ij} = \mu + Ti + eij$

Where: Yij = Observation, μ = Overall mean; Ti = Effect of i^{th} treatments and eij= Experimental error. Duncan's Multiple Range test used to detect differences between means of the experimental groups **(Duncan, 1955)**.

RESULTD AND DISCUSSION

Digestibility coefficients and feeding values:

The results presented in Table (2) indicated that there were no significant differences in all nutrient digestibility coefficients of DM, OM, CP, EE, CF, NDF, ADF and NFE among lambs received treatments vitamin A (T1), vitamin E (T2) and vitamin A plus vitamin E (T3) when compared with control. Also, the averages of nutritive values (DCP and TDN) were comparable for lambs treated with T1, T2 and T3 compared with control. The lake of vitamin E treatment (T2) to affect nutrients digestibility may reflect the non-significant changes in growth performance (Final body weight and Daily gain), feed intakes (WSI, DMI, TDMI, DCPI and DCPI) and feed conversions (FC-DMI, FC-DPCI and FC-TDNI) for lambs treated with vitamin E. Information available on the effect of vitamin A and E on nutrient digestibility are very limited. In general, normal feeding include reasonable sources of vitamin A and E which reflect on digestibility coefficients of DM, OM, CP, EE, CF, NDF, ADF and NFE not significantly changed due to vitamin E supplementation to sheep **(Almeida *et al*., 2016)** and beef cattle **(Wei *et al*., 2016)**. In rabbit bucks, all nutrient digestibility coefficients were also not significantly affected by vitamin E supplement except ether extract **(Amao *et al*., 2012)**.

Table 2: Effects of vitamin A and E supplement on nutrient digestibility coefficients and nutritive values of the experimental treatments (Mean ± SEM).

Parameters	Treatments				SEM	Sig.
	Cont.	T1	T2	T3		
Nutrient digestibility (%)						
DM	73.18	73.76	73.40	74.20	0.47	NS
OM	74.34	74.80	74.51	75.73	0.64	NS
CP	71.69	71.98	71.81	72.32	0.71	NS
EE	70.69	70.94	70.79	71.07	1.07	NS
CF	63.01	63.19	62.23	62.60	1.12	NS
NDF	61.65	60.01	60.80	60.83	1.09	NS
ADF	60.95	59.77	60.11	60.30	1.08	NS
NFE	81.33	81.15	80.40	82.26	1.45	NS
Nutritive value (%)						
DCP	10.04	10.08	10.06	10.13	0.10	NS
TDN	70.17	70.17	69.55	70.71	1.10	NS

NS = not significant

T1 = vitamin A, **T2** = vitamin E, **T3** = vitamin A plus vitamin E.

Table 3: Effects of vitamin A and E supplement on productive performance of growing lambs (mean ± SEM).

Parameters	Treatments				SEM	Sig.
	Control	T1	T2	T3		
Body weight:						
Initial body weight (kg)	20.92	21.08	21.37	20.83	1.06	NS
Final body weight (kg)	32.98 ^{c}	37.38 ^{b}	34.11 ^{c}	40.76 ^{a}	1.39	*
Daily gain (g/day)	134.00 ^{c}	181.00 ^{b}	141.55 ^{c}	221.44 ^{a}	8.33	*
Feed intake (kg/head/day):						
WSI	0.41	0.43	0.42	0.44	0.02	NS
DMI	0.94	1.00	0.97	1.03	0.04	NS
TDMI	1.35	1.43	1.39	1.47	0.05	NS
DCPI	0.136 ^{c}	0.144 ^{b}	0.140 ^{bc}	0.149 ^{a}	0.01	*
TDNI	0.947 ^{b}	1.003 ^{a}	0.967 ^{b}	1.039 ^{a}	0.02	*
Feed conversion (kg feed / kg gain):						
FC-DMI	10.07 ^{a}	7.90 ^{b}	9.82 ^{a}	6.64 ^{b}	0.52	*
FC-DCPI	1.020 ^{a}	0.796 ^{b}	0.989 ^{a}	0.673 ^{c}	0.04	*
FC-TDNI	7.067 ^{a}	5.541 ^{b}	6.832 ^{a}	4.692 ^{b}	0.30	*

^{a,b,c} means within the same row having different superscripts significantly different (* P<0.05), NS = not significant

T1 = vitamin A, **T2** = vitamin E, **T3** = vitamin A plus vitamin E.

Animal productive performance:

As shown in Table (3), averages of final body weights and daily gain (DG) were increased (P<0.05) for lambs of T1 and T3 compared with control or those treated with vitamin E alone (T2). The averages of DG were greater (P<0.05) with T3 treatment than T1 or T2. The averages of feed conversion rates were higher (P<0.05) with T1 and T3 treatments than control or T2. The results showed no significant differences in wheat straw intake (WSI), dry matter intake (DMI) and total dry matter intake (TDMI) for lambs treated with T1, T2 and T3 *vs.* control. Digestible crude protein intake (DCPI) was increased (P<0.05) for lambs treated with T1, T2 and T3 compared with control, while total digestible nutrients intake (TDNI) increased (P<0.05) for lambs received T1 and T3

compared with T2 or control. Feed conversion of DMI and TDNI improved (P<0.05) for lambs received T1 and T3 compared with those received T2 or control, while feed conversion of DCPI increased (P<0.05) for lambs received T1 and T3 compared with those received T2 and control with higher (P<0.05) improvement in FC-DCPI for lambs of T3 than those received T1 or T2.

The current results indicated that the productive performance of treated lambs significantly improved when lambs treated with vitamin A or combined treatment of vitamin A and E. The role of vitamin A in improving animal growth performance has detected in some works dealt with sheep **(Soliman, 2005)**. Also, supplement of vitamin A benefited productive performance in cattle calves **(El-Masry *et al.*, 1998)**; keeping up its health and productivity **(Alosilla *et al.*, 2007)**. In the same way, vitamin A supplementation had shown to improve daily gain in steers **(Zinn *et al.*, 1996)** and cattle **(Pyatt *et al.*, 2005).** Also, a slight increase in average daily gain was noticed in cattle supplemented with 2,700 IU/kg compared with those not supplemented with vitamin A **(Gorocica-Buenfil *et al.*, 2008)**. So, growth performance was decreased in vitamin A-deficient lambs during stages of growth compared with vitamin A-sufficient lambs **(Bruns and Webb, 1990)**. Retinoic acid, a form of vitamin A, had shown to regulate growth hormone gene expression **(Bedo *et al.*, 1989)**. So, the deficiency of vitamin A, as growth promoter, may cause metabolic disorders led to negative influences on animal productivity such as feed efficiency and weight gains **(Pond *et al.*, 1995)**.

Concerning the point that vitamin A treatment did not affect DMI, this study agree with **Bryant *et al.*, (2010)**, who found no differences in DMI among cattle fed varying doses of vitamin A supplement *vs.* control. It was clear that, in this study, supplement of vitamin A alone significantly improved digestible crude protein intake (DCPI) and total digestible nutrients intake (TDNI) and feed conversions of dry matter intake (FC-DMI), digestible crude protein (FC-DCP) and total digestible nutrients intake (FC-TDN) for lambs of T1 compared to control. These results are strongly supported by some works showed beneficial effect of vitamin A supplement to improve feed conversion in steers **(Zinn *et al.*, 1996)** and cattle **(Pyatt *et al.*, 2005)**.

Regarding vitamin E treatment, there was a trend, but non-significant, to enhance performance of lambs. This non-significant effect of vitamin E on growth of lambs could related to the lack of its effect on feed intakes and feed conversions of DMI, DCP and TDN as well as the feeding values of DMI, DCP and TDN for lambs treated with vitamin E. These results are conforming with some studies tried to detect the responses to vitamin E supplement in cattle **(Rivera *et al.*, 2002), in Awassi** sheep **(Macit *et al.*, 2003)** and in rabbit bucks **(Amao *et al.*, 2012)**.

Meanwhile, it was interesting to note that the combined treatment of both vitamins significantly enhanced the DG than each of vitamin treatment alone. This response of DG for lambs received the combined treatment of both vitamins (T3) was noticed to agree with the significant (P<0.05) higher improvement detected in DCPI, TDNI, FC-DMI, FC-DCP and FC-TDN for lambs of T3 than those treated with each vitamin alone. These findings may indicate a synergistic effect of combining both vitamins to support performance of lambs. Similar effect was noticed on calves treated with vitamin A plus vitamin E **(Salinas-Chavira *et al.*, 2014)**. An early observation reported by **Gallo-Tores (1980)**, vitamin E may have a positive role on the utilization and absorption of vitamin A and that role can protect vitamin A from oxidation. On the other hand, some studies showed no effect of high vitamin A supplementation on animal performance with sheep **(Arnett *et al.*, 2007)**. Other study, also, showed that vitamin A supplement (60 IU/100 kg BW/ day) depletion did not affect cattle growth **(Kruk *et al.*, 2008).** The differences in growth performance response to vitamin A supplement between studies could be attributed to several factors such as duration of treatment, age, growth phase, species, vitamin availability, dosage,

Table 4: Effects of vitamin A and E supplement on some serum bio-indices of growing lambs (mean ± SEM).

Parameters	Treatments				SEM	Sig.
	Control	T1	T2	T3		
Total protein (g/dl)	6.20 ^{c}	7.51 ^{a}	7.00 ^{b}	7.70 ^{a}	0.12	*
Albumin (g/dl)	3.00 ^{b}	3.71 ^{a}	3.20 ^{b}	3.80 ^{a}	0.06	*
Globulin (g/dl)	3.20 ^{b}	3.80 ^{a}	3.80 ^{a}	3.90 ^{a}	0.07	*
Glucose (mg/dl)	50.4	54.8	52.9	53.5	3.5	NS
Cholesterol (mg/dl)	81.5	84.7	87.9	91.0	6.7	NS
AST (U/L)	99.2	101.8	111.5	104.6	8.7	NS

^{a,b,c} means within the same row having different superscripts significantly different (* P<0.05), NS = not significant

T1 = vitamin A, **T2** = vitamin E, **T3** = vitamin A plus vitamin E.

route of administration and environmental conditions.

SERUM BIO-INDICES:

The results of serum bio-indices for lambs treated with vitamin A and E illustrated in Table (4). Data indicated that serum total protein and globulin levels were higher (P<0.05) with all treatment T1, T2 and T3 than control, while, serum albumin concentrations were increased (P<0.05) with treatments T1, and T3 *vs.* T2 or control. This response of serum total protein and its fractions may point out that supplement of vitamin A and E with treated lambs could positively modified protein metabolism. This increment in serum protein profile may be related to their additive effect to improve digestible crude protein intake, total digestible nutrients intake and feed conversions of digestible crude protein and total digestible nutrients intake, reflecting their synergistic effect on enhancing growth performance (final body weight and daily gain). These results are consistent with the similar observations reported on sheep by **Soliman, (2005); El-Shahat and Monem, (2011)**, and on growing calves by **El-Masry *et al.*, 1998)**. It would be realized that deficiency of vitamin A is frequently associated with protein-energy malnutrition and during this malnutrition, plasma a retinol, retinol binding protein, and pre albumin concentrations are generally noted to be decreased **(Dhur *et al.*, 1991)**. The observed increase (P<0.05) in serum globulin levels with T2 treatment (vitamin E) and T3 (vitamin A plus E) could attributed to the role of both vitamins on improving immune status of animal as previously reported by **Smith and Hays, (1987); Yang *et al.*, (2010)**. Therefore, the deficiency in both vitamins may compromise with immune-competence of the animal **(Shinde *et al.*, 2007 and Yatoo *et al.*, 2013)**.

As shown in Table (4), there were no significant (P>0.05) differences in serum concentrations of glucose, cholesterol, aspartate transaminase (AST) enzyme for lambs received T1, T2 and T3 when compared to the unsupplemented control lambs. These observations agree with some results reported on sheep **(Njeru *et al.*, 1994)**, revealing that lambs received vitamin A and/or vitamin E supplement maintained these parameters in their normal metabolic levels. It noticed that the changes in serum bio-indices, in this study, were within the normal physiological value ranges reviewed for sheep **(Duncan and Prasse, 1986)**.

CONCLUSION

The present study concluded that supplement of vitamin A plus E has synergistic useful effect able to improve feed intakes of DCP, TDN and feed conversion of DMI, DCP and TDN of Ossimi lambs leading to significant enhancement of final body weight and daily gain and some serum bio-indices (total protein) compared to supplement of each vitamin alone, suggesting that absorption and utilization of vitamin A is related to vitamin E availability.

REFERENCES

Almeida, F. A.; A. G.S. Sobrinho; G. M. Manzi; N. L. L. Lima; R. O. Sales; N. M. B.

L. Zeola; V. Endo; T. H. Borghi (2016): Performance, nutrient digestibility, and quantitative carcass traits of lambs fed sunflower seeds and vitamin E. Ciências Agrárias, Londrina, 37: 2133-2144.

Alosilla, C.E. Jr.; L.R. McDowell; N.S. Wilkinson; C.R.Staples and W.W. Thatcher (2007): Bioavailability of vitamin A sources for cattle. J. Anim. Sci., 85: 1235-1238.

Amao, O. A.1, Adejumo, D. O., Togun, V. A. and Oladunjoye, I. O. (2012): Growth response and nutrient digestibility of pre-pubertal rabbit bucks fed cottonseed cake-based diets supplemented with vitamin E. African Journal of Biotechnology. 11: 14102-14109.

A.O.A.C. (2003): *Official methods of analysis* (17th ed.) Association of official analytical chemists, Arlington, USA.

Arnett, A. M.; M. E. Dikeman; C. W. Spaeth; B. J. Johnson and B. Hildabrand (2007): Effects of vitamin A supplementation in young lambs on performance, serum lipid, and longissimus muscle lipid composition. J. Anim. Sci., 85:3062-3071.

Bedo, G.; P. Santisteban and A. Aranda (1989): Retinoic acid regulates growth hormone gene expression. Nature, 339:231-234.

Brown K., A. Reid, T. White, T. Henderson, S. Hukin, C. Johnstone, A. Glen (1998): Vitamin E, lipids, and lipid peroxidation products in tardive dyskinesia. Soi. Biol. Psychi., 43: 863 - 867.

Bruns, N.J. and K.E. Webb Jr. (1990): Vitamin A deficiency: serum cortisol and humeral immunity in lambs. J. Anim. Sci. 68:454-459.

Bryant, T. C.; J. J. Wagner, J. D. Tatum, M. L. Galyean, R. V. Anthony and T. E. Engle (2010): Effect of dietary supplemental vitamin A concentration on performance, carcass merit, serum metabolites, and lipogenic enzyme activity in yearling beef steers. J. Anim. Sci., 88:1463-1478.

Dhur, A.; P. Galan, and S. Hercberg (1991): Vitamin A Deficiency and Immunity. J. Clin. Biochem. Nutr., 11, 1-19.

Duncan, D.B. (1955): Multiple range test and multiple F-test. Biometrics, 11: 1-42.

Duncan, J.R. and K.W. Prasse (1986): *Veterinary Laboratory Medicine*, 2nd Ed., Iowa State University Press, USA.

El-Masry, K. A.; H. M.Youssef; A. M. Abdel-Samee; I. F. M. Maria and M. K. Metawally (1998). Effects of supplemental Zn and vitamin A on some blood biochemical and immune indices related to growth performance in growing calves. First international conference on animal production and health in semi-arid areas, El-Arish, Egypt, 1-3 Sept., 130-151.

El-Shahat, K.H. and U.M. Abdel Monem (2011): Effects of dietary supplementation with vitamin E and /or selenium on metabolic and reproductive performance of Egyptian Baladi ewes under subtropical conditions. World Appl. Sci. J., 12:1492-1499.

Gallo-Torres D.C. (1980): *Absorption, blood transport and metabolism of vitamin E*. In: Maclin L.J. (ed.): A Comprehensive Treatise. Marcel Dekker, New York. Pages:170-267.

Goring, H.K. and P. J. Van Soest (1970): Forage fiber analysis U.S.D.A. Agricultural hand book No. 379.

Gorocica-Buenfil, M. A., F. L. Fluharty, and S. C. Loerch. (2008): Effect of vitamin A restriction on carcass characteristics and immune status of beef steers. J. Anim. Sci. 86:1609–1616.

Hidiroglou, M (1993): Assessment of the oral administration of a high dose of retinol on vitamin E status of sheep. Vet. Res., 24:477-482.

Kartha, V.N. and S. Krishnamurthy (1977): Antioxidant function of vitamin A. Int. J. Vitam. Nutr. Res., 47:394-401.

Kruk a, Z.A.; C.D.K. Bottema, J.J. Davis, B.D. Siebert, G.S. Harper, J. Di, W.S. Pitchford, (2008): Effects of vitamin A on growth performance and carcass quality in steers. Livestock Science 119: 12–21.

Macit, M., V. Aksakal, E. Emsen, N. Esenbuğa, and M. İ. Aksu.(2003): Effects of vitamin E supplementation on fattening performance, non-carcass components and retail cut percentages, and meat quality traits of *Awassi* lambs. Meat Sci. 64:1-6.

Meglia, G.E.; K. Holtenius; L. Petersson; P. Ohagen and K. Waller (2004): Prediction of vitamin A, vitamin E, selenium and zinc status of Periparturient dairy cows using blood sampling during the mid-dry period. Acta Veter. Scand., 45:119.

Njeru, C. A.; L. R. McDowell; N. S. Wilkinson and S. N. Williams (1994): Assessment of vitamin E nutritional status in sheep. J. Anim. Sci., 72:3207-3212.

NRC (2007): *'Nutrient requirements of small ruminants sheep, goats, cervids, and new world camelids.'* (National Academies Press: Washington, DC).

Pond, W.G.; D.C. Church and K.R. Pond (1995): *Basic animal nutrition and feeding*. 4th ed. Jhon Wiley & Sons. New York. USA. Pages: 223-229.

Pyatt, N. A., L. L. Berger, and T. G. Nash (2005): Effects of vitamin A and restricted intake on performance, carcass characteristics, and serum retinol status in Angus × Simmental feedlot cattle. Prof. Anim. Sci. 21:318–331.

Rivera, J. D.; G. C. Duff; M. L. Galyean; D. A. Walker and G. A. Nunnery (2002): Effects of supplemental vitamin E on performance, health, and humoral immune response of beef cattle. J. Anim. Sci., (12):23 - 30.

Rooke, J. A.; J. J. Robinson and J. R. Arthur (2004): Effects of vitamin E and selenium on the performance and immune status of ewes and lambs. J. Agric. Sci., 142: 253-262.

Salinas-Chavira, J.; A.A. Arrizon; A. Barrreas; C.Z. Chen; A. Plascencia and R.A. Zinn (2014): Evaluation of supplemental vitamin A and E on 56-day growth performance, dietary net energy, and plasma retinol and tocopherol concentrations in Holstein steer calves. Prof. Anim. Sci. 30:510-514.

SAS (2000): SAS/STAT Guide for personal computers, SAS Inst., Cary. N.C., USA.

Schelling, G.T.; R.A. Roeder; M.J. Garber and W.M. Pumfrey (1995): Bioavailability and interaction of vitamin A and vitamin E in ruminants. J. Nutr., 125 (6 Suppl.): 1799S-1803S.

Shinde P.L.; R.S. Dass; A.K. Garg and V.K. Chaturvedi (2007): Immune response and plasma alpha-tocopherol and selenium status of buffalo (*Bubalus bubalis*) calves supplemented with vitamin E and selenium. Asian-Austr. J. Anim. Sci., 20:1539-1545.

Soliman, E.B. (2005): physiological reactions and growth performance of lambs supplemented by vitamin A with zinc under summer conditions. Assuit Vet. Med. J. 51: 21-38.

Smith, S. M. and C. E. Hayes (1987): Contrasting impairments in IgM and IgG responses of vitamin A-deficient mice. (Immunity/T lymphocytes/B lymphocytes immunoglobulins / retinoids). Proc. Natl. Acad. Sci., 84:5878-5882.

St-Claire, M.B.; M.J. Kennet and C.L. Besch-Williford (2004): Vitamin A toxicity and vitamin E deficiency in a rabbit colony. Amer. Associ. for Lab. Anim. Sci., 43:26-30.

Toker, N. Y. (2007): Blood serum vitamin A and E concentrations and distribution into lipoprotein fractions of pregnant sheep and newborn lambs. Revue Med. Vet., 158: 413-417.

Van Keulen, J. and B. A. Young (1977): Evaluation of acid insoluble ash as a natural marker in ruminant digestibility studies. J. Anim. Sci., 44:282.

Watts, D. L. (1991): The Nutritional Relationships of Selenium. J. of Orthomolecular Med., 9: 111-117.

Wei, C.; S. Lin; J. Wu, G. Zhao, T. Zhang; and W. Zheng (2016): Supplementing Vitamin E to the ration of beef cattle increased the utilization efficiency of dietary nitrogen. Asian Australas. J. Anim. Sci., 29: 372-377.

Yang, W.; P. Wang; Y. Jing; Z. Yang; C. Zhang; S. Jiang and G. Zhang (2010):

Effects of vitamin A on growth performance, antioxidant status and blood constituents in lactating Grey Goat. Amer. J. of Anim. and Vet. Sci., 5: 274-281.

Yatoo, M.I.; A. Saxena; P.M. Deepa; B.P. Habeab; S. Devi; R.S. Jatav and U. Dimri (2013): Role of trace elements in animals: a review, Vet. World, 6: 963-967.

Zinn, R. A., E. Alvarez, and R. L. Stuart (1996): Interaction of supplemental vitamin A and E on health and performance of crossbred and Holstein calves during the receiving period. Prof. Anim. Sci. 12:17–23.

الملخص العربى

معاملات الهضم الغذائيه، الأداء الإنتاجى وبعض مؤشرات السيرم الحيويه
نتيجه للإمداد بفيتامين أ وفيتامين ه علي الحملان النامية

عماد الدين محمد إبراهيم
قسم الإنتاج الحيوانى- كلية الزراعة- جامعة المنيا

تم استخدم إجمالي عدد 32 حمل أوسيمى (بمتوسط عمر ثلاثة شهور ووزن 21.05 ± 1.06 كجم) لتقييم تأثير الإمداد بفيتامين أ وفيتامين هـ على معاملات الهضم الغذائيه، الأداء الإنتاجى وبعض مؤشرات السيرم الحيويه. وزعت الحيوانات إلى أربعه مجموعات متساويه. المجموعه الأولي استخدمت كنترول بينما المجموعات المعامله T1 ، T2، T3 تم إمدادها بالتجريع بفيتامين أ (50.000 وحدة دولية/رأس/أسبوعين) ، فيتامين ه (400 ملجم /رأس/أسبوعين) ، فيتامين أ + فيتامين ه (50.000 وحدة دولية + 400 ملجم /رأس/أسبوعين) على التوالي.

أظهرت النتائج عدم وجود فروق معنويه في جميع معاملات الهضم الغذائيه للماده الجافه ، الماده العضويه ، البروتين الخام ، المستخلص الأثيري ، الألياف الخام ، الألياف المستخلص بالمحاليل الحامضيه ، الألياف المستخلصه بالمحاليل المتعادله بين الحملان المعامله بـ T1 ، T2، T3 مقارنه بالكنترول. أيضا كانت متوسطات القيمه الغذائيه (البروتين المهضوم – المركبات الغذائيه الكليه المهضومه) متقاربه بين الحملان المعامله بـ T1 ، T2، T3 مقارنه بالكنترول. زادت متوسطات أوزن الجسم النهائيه ومعدلات الزيادة اليومية فى الوزن ($P<0.05$) لحملان المعاملة T1، T3 مقارنة بحملان الكنترول و T2. كانت متوسطات أوزان الجسم النهائيه ومعدلات الزيادة اليومية فى الوزن أعلى للمعامله T3 عن كل من المعاملة T1 ، T2. لم تلاحظ أية تغييرات معنوية في المأكول من تبن القمح، الماده الجافه و الماكول الكلي من الماده الجافه للحملان المعامله بـ T1 ، T2، T3 مقارنه بالكنترول. بينما زاد المأكول من البروتين المهضوم والمركبات الغذائيه الكليه المهضومه ($P <0.05$) لحملان المعاملة T1، T3 مقارنة بحملان الكنترول أو T2. تحسنت معدلات التحويل الغذائي للماده الجافه ، البروتين المهضوم والمركبات الغذائيه الكليه المهضومه ($P <0.05$) لحملان المعاملة T1، T3 مقارنة بحملان المعامله T2 أوالكنترول. أظهرت النتائج ارتفاع مستويات تركيزات السيرم من البروتين الكلي والجلوبيولين ($P <0.05$) لجميع المعاملات T1 ، T2، T3 مقارنة بالكنترول بينما زاد تركيز مستوى ألبيومين السيرم ($P<0.05$) للمعاملات T1، T3 مقارنة بـ T2 أو الكنترول. لم تلاحظ أية اختلافات معنوية ($P>0.05$) في تركيزات سيرم الدم من الجلوكوز ، الكوليستيرول وانزيم (AST) لحملان المعاملات T1 ، T2، T3 مقارنة بحملان الكنترول الغير معامله.

يمكن أن نستخلص من هذه الدراسه أن الإمداد بفيتامين أ وفيتامين هـ له تأثيرتكاملي مفيد في تحسين المأكول ومعدل التحويل الغذائي للحملان الناميه مما أدى إلى تعزيز الأداء الإنتاجي وبعض مؤشرات السيرم الحيويه.