EFFECT OF DIETARY ZINC AND VITAMIN E SUPPLEMENTATIONS ON REPRODUCTIVE PERFORMANCE AND SOME BLOOD CONSTITUENTS OF ROMANOV CROSSBRED EWES

By

El-Shamaá, I.S.[1] and M. Abd El-Momin [2]

[1]Anim. Prod. Depart., Fac. of Agric., Kafr El-Sheikh, Tanta Univ.

[2] Anim. Prod. Res. Inst., Agric. Res. Center, Dokki, Giza

ABSTRACT

A total number of thirty four mature 1/2 Romanov x 1/2 Rahmani ewes, at the average age 2.5-3.0 years with an average live body weight 44-47 kg, were used in this study to investigate the effect of zinc, vitamin E and their combination on reproductive performance and some blood constituents. The ewes were divided randomly to four experimental groups. The first three groups [G_1 (n= 7), G_2 (n = 9) and G_3 (n = 9)] were fed the control basal ration supplemented with 50 mg Zn, 15 mg vitamin E and a such combination/head/day, respectively. The fourth group (n = 9) was fed a control basal ration which contained 29.8 mg zinc. The Zn and vit. E were provided to the basal ration for one month before mating and continued throughout pregnancy. Results revealed that the average daily gain was significantly ($P < 0.05$) higher in the supplemented groups than in control. The percentage increase was 56.8, 45.9 and 88.1% for Zn, vit. E and their combination respectively. Lambing percent and litter size were improved in supplemented ewes, furthermore the twinning phenomenon was achieved as a result of Zn or vit. E supplementation. Zn, vit. E and their combination supplemented ewes had higher ($P < 0.05$) serum total protein, globulin, Zn and copper than in control. On the contrary, serum albumin, GOT and GPT activity, cholesterol and manganese were not significantly differ between different groups.

INTRODUCTION

Zinc (Zn) is an essential for many biochemical reaction in the body. It is also a constituent of several metallo enzymes (Hahn and Baker, 1993), nutrients metabolism (Froetschel *et al.*, 1990), activated immunity protection (Bires *et al.*, 1993) and improved fertility (Fitzgerald *et al.*, 1986). Apgar and Ftizgerald (1985) and Hoda Ali *et al.* (1998) concluded that dietary Zn supplement improved conception rate and litter size in ewes. On the other hand, Pond and Wallace (1986) found that no effect of dietary Ca or Zn level or vitamins A, D and E administration on ewe body weight changes, number of lambs born, survival rate, lamb birth weight or lamb weaning weight.

Vitamin E (vit. E) is an efficient antioxidant and a modulator of the immune system. Furthermore, the extent of the effect of vit. E in protecting cell membrane lipids from oxidant damage by oxygen free radicals (Matthai, 1996). Supplemental vit. E has been shown to increase rate of weight gain (Pehrson *et al.*, 1991), feed intake and improve of fertility of ova (Segerson and Ganapathy, 1980). On the other hand, Kott *et al.* (1998) reported that, supplemental vit. E had no effect on ewe weight, body condition score, fertility, or prolificacy but reduced lamb mortality. In another study, Kott *et al.* (1983) found that vit. E plus selenium had no effect on fertility (number of ewes lambing of ewes bred), prolificacy (number of lambs born/ewe lambing) or lamb sex ratio.

The objective of the present study was to investigate the effects of zinc or vitamin E and both combination on some reproductive efficiency, growth and some blood constituents in Romanov crossbred ewes.

MATERIALS AND METHODS

Animals and management:

A total number of thirty four mature, non-pregnant 1/2 Romanov x 1/2 Rahmani ewes, aged 2.5-3.0 years with on the average weighed 44-47 kg, were used for the current study. Animals were kept at Mehallet Mousa Station, Animal Production Research Institute, Ministry of Agriculture during December, 1999 till May, 2000.

The experiment was carried out one month before mating and five months throughout pregnancy. Ewes were fed on concentrate mixture (0.5 kg), rice straw (0.6 kg) and green berseem (4-5 kg) throughout the experimental period, according to the standard allowances recommended by N.R.C., (1988).

Experimental treatments:

Ewes were randomly divided into four experimental groups, which housed in four separate semi open pens and allowed to drink water freely ad. libitium. Zinc content of basal diet was determined on dry matter basis by atomic absorption spectrophotometer.

Ewes in group 4 (n =9) were fed the basal diet which contained 29.8 mg Zn (concentrate mixture = 16.4 mg Zn, rice straw = 2.7 mg and Berseem = 10.7 mg) without any supplementation, while both groups 1 (n = 7), 2 (n = 9) and 3 (n = 9) were fed the control basal diet and drenched daily dose per head of either 50 mg Zn as zinc oxide, 15 mg vitamin E or both combination, respectively. At mating time, ewes were allowed to mate naturally for one month with two fertile rams for each group.

Experimental procedure:

Ewes were weighed at the beginning of the experiment and thereafter at monthly intervals till lambing to determine body weight change (B.W.). Individual blood samples were taken via jugular vein puncture (once/week) during the mating period and then monthly during the pregnancy period. Samples were left to coagulate at room temperature for 30 minutes, then centrifuged at 3000 r.p.m. for 10 minutes to collect serum and which was stored at -20°C for determination of total protein (g%), albumin (g%), globulin (g%), cholesterol (mg %), activity of glutamic oxaloacetic transaminase (GOT, IU/L) and glutamic pyruvic transaminase (GPT, IU/L) as described by Varoley (1976). Serum zinc, manganese (Mn) and copper (Cu) levels were determined by atomic absorption, spectrophotometer.

Statistical analysis:

The obtained data were statistically analysed according to General Linear Models Procedure adapted by SPSS (1997) for user's Guide. Where appropriate means were separated using Duncan's multiple range tests.

RESULTS AND DISCUSSION

Body weight change:

Results in Table (1) shows that the average daily gain was significantly increased in treated ewes than control. The percentage of increase was 56.8 & 45.9 and 88.1% for Zn and/or vit. E, respectively. Higher average of daily gain in ewes supplemented with Zn and/or vit. E confirmed by previous finding which considered Zn a key role in regulating feed intake (Hatfield *et al.*, 1995), since Zn supplementation might sufficiently increase the palatability of the diet (Masters and Moir, 1983). In rabbits, Abd El-Rahim *et al.* (1995) and Gadalla (2001) and in sheep, Hoda Ali *et al.* (1998) and Kott *et al.* (1998) found significant improvement in growth performance has been achieved when the diet was supplemented with Zn. On the other hand, El-Deeb and Afifi (2000) concluded that no differences in body weight or feed consumption during the 2 months trials in bucks as a result of Zn supplementation. The improvement in growth performance in ewes resulted form the additional vit. E in the diet was in agreement with those reported by Abdallah *et al.* (2001) in rabbit, who noted that the beneficial effects of vit. E can be attributed to their efficient antioxidant and a scavenger of oxygen free radicals which are toxic by-products of many metabolic processes (Dawson *et al.*, 1990). The present results indicated that ewes of the control group were in a case of poor Zn status.

Table (1): Body weight change during gestation period (X ± SE) for ewes fed diets supplemented with zinc, vitamin E or Zn + vit. E.

Traits	Treatments			
	Zn	Vit. E	Zn + vit. E	Control
No. of ewes	7	9	9	9
B.W at mating	43.7 ± 1.55 ^{A}	46.3 ± 1.28 ^{A}	44.4 ± 2.13 ^{A}	47.11 ± 1.59 ^{A}
B.W after 1 month	45.0 ± 1.76 ^{AB}	46.3 ± 1.47 ^{A}	46.2 ± 2.27 ^{AB}	47.60 ± 1.54 ^{A}
B.W after 2 months	48.4 ± 1.44 ^{BC}	48.8 ± 1.59 ^{AB}	49.9 ± 2.21 ^{BC}	49.8 ± 1.33 ^{A}
B.W after 3 months	50.7 ± 1.15 ^{CD}	51.2 ± 1.65 ^{BC}	52.7 ± 2.27 ^{C}	51.3 ± 1.67 ^{A}
B.W after 4 months	53.3 ± 1.23 ^{DE}	54.2 ± 1.85 ^{CD}	55.6 ± 2.29 ^{CD}	52.9 ± 1.78 ^{AB}
B.W after 5 months	56.7 ± 2.09 ^{E}	58.4 ± 1.94 ^{DE}	60.0 ± 2.51 ^{D}	55.4 ± 2.06 ^{B}
Average daily gain (g)	86.7 ± 0.8 ^{c}	80.7 ± 0.9 ^{c}	104 ± 1.13 ^{b}	55.3 ± 0.6 ^{A}

a, b,c, values with in columns for each treatment , with different superscripts significantly ($P < 0.05$).

A, B,C, values with in rows for each treatment , with different superscripts significantly ($P < 0.05$).

Table(2):Reproductive performance of ewes received Zn,vit.E or Zn+vit. E..

Traits	Zn		Vit. E		Zn + Vit. E		Control	
	No.	%	No.	%	No.	%	No.	%
Ewes conceived	6	85.7 ^{b}	8	88.9 ^{b}	8	88.9 ^{b}	5	55.6 ^{a}
Ewes lambed	6	85.7 ^{b}	8	88.9 ^{b}	8	88.9 ^{b}	4	44.4 ^{a}
Litter size per ewes lambed	10	1.67 ^{b}	14	1.75 ^{b}	12	1.5 ^{b}	4	1.0 ^{a}
Twinning rate	4	66.7	6	75.0	4	50.0	0	0.0

a, b,c, values with in columns for each treatment , with different superscripts significantly ($P < 0.05$).

Reproductive performance of ewes:

Data presented in Table 2, indicate that ewes supplemented with either Zn and/or vit. E had better ($P < 0.05$) conception rate than the control unsupplemented ewes. This result is in agreement with that reported by Hoda Ali *et al.* (1998) who found a marked increase in fertility percent (83.3 and 88.8%) at first and second weeks of mating respectively for Zn supplemented ewes as compared with non-supplemented group (50 and 60%). She added that Zn supplementation reduced the non reproductive period in ewes which is probably very important item for improving the reproductive efficiency in sheep (Robinson, 1993). On the contrary, Kott *et al.*, 1983 and 1998 reported that fertility or prolifacy in sheep was not improved by vit. E supplement. When they consumed diets marginally deficient in Se. The lambing percent in ewes treated with Zn, vit. E or Zn + Vit. Ewas approximately twice that of control ewes (85.7 & 88.9 & 88.9% vs. 44.4%, respectively), Table (2). The results are in accordance with the study of Hoda Ali *et al.* (1998) who found that Barki ewes receiving Zn supplementation in their diet had higher lambing percent (77.7%) than unsupplemented ewes (40%). Table (2) also indicates that ewes fed diet supplemented with Zn

supplemented with Zn and/or vit. E gave higher litter size as compared with control. Moreover, it was evident that, the oral supplementation of Zn and/or vit. E to the experimental ewes increased the incidence of twinning (66.7, 75 and 50%, respectively).

The obtained results were higher than that found by Hoda Ali *et al.* (1998) in Barki ewes. The improvement of reproductive ability obtained in the present work may be explained on the basis that zinc is involving in endocrine and metabolic plasma constituents associated with normal pregnancy and parturition (Fitzgerald *et al.*, 1986). Meanwhile, treatment with vit. E causes a reduction in fertilization failure and/or embryonic mortality (Kott *et al.*, 1998) and it also increases immunity of animals (Mohamed *et al.*, 1994).

Blood serum constituents:

Results in Table (3) shows that Zn and/or vit. E supplementation significantly ($P < 0.05$) increased serum total protein and globulin in treated ewes. The total protein is higher in ewes supplemented with Zn and/or vit. E than control ewes by about 11.3 & 5.7 and 6.33%, respectively. Also, globulin is higher by about 12.9 & 8.14 and 13.3%, respectively. This finding was confirmed the previous finding that Zn and vit. E had an immunostimulatory effect in lambs (Vergens *et al.*, 1990 and Kegley and Spears, 1994). Mohamed *et al.* (1994) found that vitamin E and/or zinc enhanced the immune parameters of the buffalo calves. The increase in these parameters may be related to the role of Zn in activation of some enzymes that are responsible for the utilization of amino acids in protein synthesis, secrete insulin-like growth factor that well increase protein synthesis (in rabbits, El-Masry and Habbeeb, 1989) and the decrease in the catabolic hormone such as glucocorticoids (Alvarez and Johnson, 1973). In regard to albumin values, Table (3) shows that ewes fed diet supplemented with Zn and/or vit. E had slight increase than control ones, but differences were not significant. Also, concentrations of cholesterol, GOT and GPT activity were higher insignificantly in ewes fed on diet supplemented Zn and/or vit. E, Table (4). In contrast, El-Masry *et al.* (1994) found that zinc supplementation decreased plasma cholesterol and transaminase enzymes activities. Serum zinc, copper and manganese concentrations are presented in Table (5). It was clear that dietary Zn supplement either alone or in combination with vitamin E were associated with increasing in serum Zn concentration specially at late pregnancy as compared with control and ewes supplemented vit. E alone, a similar finding was reported by Masters and Moir (1984) and Hoda Ali *et al.* (1998). Serum Cu concentration was significantly higher in ewes supplemented Zn-alone or combination with vit.

Table (3): Blood proteins, albumin and globulin (X ± SE) of ewes supplemented with Zn, vit. E or Zn + vit. E

Treatments	Before mating (weekly)				Overall	During pregnancy (monthly)					Overall	All overall
	1	2	3	4	mean ± SE	1	2	3	4	5	mean ± SE	mean ± SE
	Protein (g%)											
Zn	6.76±0.29 ^{a}	6.52±0.64 ^{a}	6.62±0.51 ^{a}	7.11±0.27 ^{ad}	6.75±0.32	7.25±1.4 ^{bd}	7.61±0.08 ^{b}	8.41±0.56 ^{c}	8.71±0.25 ^{c}	9.89±0.63 ^{c}	8.37±0.42	7.56±0.17 ^{A}
Vit. E	6.70±0.66 ^{a}	6.85±0.39 ^{a}	6.97±0.18 ^{a}	7.18±0.54 ^{b}	6.93±0.26	7.20±0.48 ^{b}	7.30±0.37 ^{b}	7.35±0.43 ^{b}	7.46±0.30 ^{b}	7.85±0.67 ^{b}	7.43±0.31	7.18±0.13 ^{AB}
Zn + vit. E	6.49±0.10 ^{a}	6.81±0.10 ^{bc}	6.83±0.70 ^{bc}	7.21±0.30 ^{c}	6.84±0.16	7.37±0.50 ^{cd}	7.38±0.10 ^{cd}	7.62±0.60 ^{ce}	7.69±0.30 ^{ce}	7.86±0.20 ^{ce}	7.59±0.12	7.2±0.15 ^{A}
Control	5.95±0.48 ^{a}	7.7±0.06 ^{cf}	6.75±0.6 ^{bdf}	7.52±0.08 ^{cf}	6.98±0.11	6.14±0.17 ^{ab}	6.18±0.098 ^{cde}	6.38±0.24 ^{abce}	7.11±0.12 ^{f}	7.16±0.36 ^{de}	6.59±0.15	6.79±0.15 ^{B}
Overall mean ± SE	6.48±0.18 ^{a}	6.97±0.28 ^{ab}	6.79±0.10 ^{ab}	7.26±0.18 ^{b}	6.88±0.21	6.99±0.22	7.34±0.27 ^{cd}	7.44±0.33 ^{bc}	7.99±0.23 ^{d}	8.20±0.22	7.59±0.18	7.19±0.08
	Albumin (g%)											
Zn	4.07±0.2 ^{c}	3.57±0.03 ^{a}	3.55±0.2 ^{a}	4.24±0.2 ^{c}	3.86±0.12	4.13±0.2 ^{c}	4.1±0.9 ^{c}	4.59±0.2 ^{c}	4.86±0.4 ^{cd}	3.74±0.1 ^{b}	4.28±0.3	4.07±0.12 ^{A}
Vit. E	3.67±0.3 ^{b}	3.61±0.3 ^{ab}	3.49±0.1 ^{a}	4.39±0.3 ^{c}	3.79±0.08	3.57±0.1 ^{ab}	3.66±0.2 ^{ab}	4.39±0.1 ^{c}	4.21±0.3 ^{bc}	3.54±0.2 ^{ab}	3.87±0.1	3.83±0.09 ^{A}
Zn + vit. E	3.76±0.3 ^{ab}	3.71±0.5 ^{b}	3.57±0.2 ^{a}	3.71±0.3 ^{b}	3.69±0.15	3.94±0.3 ^{b}	3.84±0.1 ^{b}	3.64±0.3 ^{a}	3.37±0.3 ^{a}	3.78±0.4 ^{b}	3.71±0.18	3.72±0.09 ^{A}
Control	3.89±0.3 ^{b}	3.77±0.1 ^{ab}	3.52±0.1 ^{a}	3.92±0.2 ^{ab}	3.76±0.11	3.46±0.2 ^{a}	3.45±0.1 ^{a}	3.53±0.2 ^{a}	4.33±0.1 ^{c}	3.61±0.2 ^{a}	3.68±0.09	3.70±0.05 ^{A}
Overall mean ± SE	3.85±0.1 ^{ab}	3.67±0.1 ^{ab}	3.58±0.7 ^{a}	4.07±0.1 ^{b}	3.79±0.09	3.77±0.1 ^{ab}	3.76±0.2 ^{ab}	4.04±0.2 ^{b}	3.97±0.2 ^{ab}	3.67±0.1 ^{ab}	3.84±0.11	3.83±0.05
	Globulin (g%)											
Zn	2.69±0.3 ^{a}	2.95±0.5 ^{a}	3.07±0.4 ^{a}	2.87±0.4 ^{a}	2.89±0.2	3.12±0.2 ^{a}	3.51±0.1 ^{b}	3.82±0.5 ^{b}	3.85±0.3 ^{b}	6.15±0.5 ^{c}	4.08±0.3	3.49±0.06 ^{A}
Vit. E	3.03±0.3 ^{a}	3.24±0.4 ^{a}	3.48±0.1 ^{a}	2.79±0.3 ^{a}	3.14±0.3	3.63±0.4 ^{b}	3.64±0.2 ^{b}	2.96±0.6 ^{a}	3.25±0.2 ^{ba}	4.31±0.6 ^{c}	3.56±0.2	3.35±0.07 ^{AB}
Zn + vit. E	2.73±0.4 ^{a}	3.10±0.4 ^{a}	3.26±0.3 ^{a}	3.50±0.3 ^{a}	3.15±0.2	3.43±0.3 ^{a}	3.54±0.4 ^{a}	3.98±0.4 ^{b}	4.32±0.2 ^{b}	4.10±0.6 ^{b}	3.88±0.3	3.50±0.09 ^{A}
Control	2.06±0.1 ^{a}	3.93±0.1 ^{de}	3.23±0.1 ^{bcd}	3.60±0.1 ^{de}	3.22±0.08	2.68±0.1 ^{ab}	2.71±0.2 ^{de}	2.85±0.4 ^{bc}	2.78±0.4 ^{bc}	3.55±0.2 ^{cd}	2.91±0.1	3.07±0.07 ^{B}
Overall mean ± SE	2.63±0.18 ^{ab}	3.30±0.2 ^{ab}	3.21±0.13 ^{ab}	3.19±0.2 ^{ab}	3.09±0.1	3.22±0.2 ^{ab}	3.58±0.2 ^{b}	3.40±0.2 ^{b}	4.02±1.2 ^{c}	4.53±0.2 ^{c}	3.75±0.1	3.43± 0.04

a, b, c, ... values within columns for each character, with different superscripts significantly ($P < 0.05$)

A, B, C, ... values within rows for each character, with different superscripts significantly differ ($P < 0.05$)

Table (4): Serum GOT, GPT and cholesterol (X ± SE) of ewes supplemented with Zn, vit. E or Zn + vit. E.

Treatments	Before mating (weekly)				Overall	During pregnancy (monthly)					Overall	All overall
	1	2	3	4	mean ± SE	1	2	3	4	5	mean ± SE	mean ± SE
	GOT (IU/L)											
Zn	37.9±0.7 ^{cb}	36.6±0.7 ^{bc}	38.4±0.6 ^{abc}	35.3±1.0 ^{a}	37.1±0.2	38.1±0.2 ^{cb}	37.9±0.5 ^{de}	39.7±0.5 ^{de}	38.9±0.4 ^{ce}	40.5±1.2 ^{e}	39.2±0.26	38.1±0.4 ^{A}
Vit. E	37.3±0.9 ^{ab}	36.5±1.6 ^{ab}	37.8±0.8 ^{ab}	37.7±0.4 ^{ab}	37.3±0.81	36.4±1.3 ^{a}	38.7±0.3 ^{ab}	38.7±0.3 ^{ab}	39.8±0.9 ^{d}	37.2±0.8 ^{a}	38.2±0.4	37.8±0.3 ^{A}
Zn + vit. E	38.1±0.8 ^{bd}	37.7±0.9 ^{bc}	38.1±0.9 ^{bd}	35.3±0.5 ^{a}	37.3±0.61	36.5±0.8 ^{ac}	37.7±1.3 ^{bc}	38.0±0.3 ^{bc}	39.4±1.0 ^{d}	37.9±1.1 ^{ac}	37.9±0.12	37.6±0.3 ^{A}
Control	38.3±1.3 ^{ab}	37.3±0.7 ^{a}	37.6±0.4 ^{ab}	37.0±0.9 ^{a}	37.6±0.92	38.0±0.9 ^{ab}	3.69±0.8 ^{ab}	38.4±0.1 ^{ab}	52.2±1.3 ^{b}	37.7±0.8	40.6±0.7	39.3±1.5 ^{A}
Overall mean ± SE	37.9±0.4 ^{a}	37.0±0.5 ^{a}	38.0±0.3 ^{a}	36.3±0.5 ^{a}	37.3±0.31	37.3±0.5 ^{a}	37.8 ± 0.2 ^{a}	38.7±0.2 ^{a}	42.6±0.3	38.3±0.6	38.9±0.38	38.2±0.4
	GPT (IU/L)											
Zn	18.0±0.4 ^{ca}	19.7±0.5 ^{d}	22.8±1.0 ^{c}	18.1±0.4 ^{a}	19.7±0.32	17.8±0.9 ^{a}	23.9±0.3 ^{e}	16.5±0.9 ^{a}	18.5±0.4 ^{cb}	18.3±0.6 ^{ab}	19.0±0.12	19.3±0.5 ^{A}
Vit. E	18.0±1.9 ^{abc}	19.4±0.9 ^{bc}	23.4±0.7 ^{d}	19.7±0.9 ^{bc}	20.1±0.61	18.3±0.7 ^{abc}	20.9±1.3 ^{cd}	17.1±0.9 ^{ab}	18.7±0.1 ^{abc}	16.3±1.4 ^{a}	18.3±0.68	19.1±0.5 ^{A}
Zn + vit. E	17.2±0.7 ^{a}	18.7±0.7 ^{a}	23.7±1.7 ^{c}	16.2±1.4 ^{a}	19.8±0.41	17.6±1.1 ^{a}	19.2±0.6 ^{b}	18.7±0.2 ^{a}	19.8±0.9 ^{b}	16.8±0.5 ^{a}	18.4±0.4	18.6±0.5 ^{A}
Control	16.0±0.01 ^{ab}	17.5±0.7 ^{abc}	21.8±0.9 ^{c}	18.5±0.7 ^{abc}	18.5±0.31	19.0±0.1 ^{abc}	21.0±3.8 ^{c}	15.3±0.01 ^{a}	17.8±0.1 ^{abc}	20.1±1.1	18.6±0.11	18.5±0.6 ^{A}
Overall mean ± SE	17.3±0.4 ^{ab}	18.8±0.4 ^{ab}	22.9±0.05 ^{d}	18.1±0.6 ^{ab}	19.3±0.22	18.2±0.4 ^{ab}	21.3±1.0 ^{c}	16.9±0.5 ^{a}	18.7±0.3 ^{b}	17.9±0.6 ^{ab}	18.6±0.16	18.9±0.3
	Cholesterol (mg %)											
Zn	191.7±4.2 ^{ca}	146.2±8.3 ^{cb}	188.8±5.8 ^{a}	177.6±7.8 ^{a}	176.1±4.4	204.6±2.3 ^{cd}	194.7±7.4 ^{ce}	204±2.2 ^{ec}	244.4±13.9 ^{e}	177.1±10.9 ^{a}	205.0±4.5	193.6±3.5 ^{A}
Vit. E	199±2.3 ^{bc}	189±4.0 ^{ab}	188±1.7 ^{b}	163.0±6.5 ^{a}	184.8±2.9	198±1.0 ^{bc}	189±5.1 ^{b}	200±7.2 ^{bc}	206±6.2 ^{c}	170±2.5 ^{a}	192.6±3.9	189±2.9 ^{A}
Zn + vit. E	201±0.3 ^{ef}	184.9±4.0 ^{ac}	177±1.7 ^{ac}	173±9.0 ^{a}	183.9±3.3	193±4.8 ^{bc}	182±5.5 ^{ac}	181±15.7 ^{ac}	217±9.4 ^{f}	189±5.0 ^{bc}	192.4±4.8	189±3.3 ^{A}
Control	192±1.6 ^{b}	184±3.4 ^{ab}	193±1.5 ^{b}	183±4.3 ^{ab}	188.0±1.8	188±9.3 ^{b}	181±5.7 ^{ab}	193±4.2 ^{b}	234±8.4 ^{c}	170±8.1	193.2±3.2	191±3.6 ^{A}
Overall mean ± SE	196±2.0 ^{d}	189±2.6 ^{cd}	187±2.2 ^{bcd}	174±3.8	186.5±1.3	195±2.9 ^{d}	183±2.6 ^{abc}	194±4.7 ^{d}	220±5.2 ^{c}	177±3.7 ^{ab}	193.8±2.3	191±1.7

a, b, c. .... values within columns for each character, with different superscripts significantly ($P < 0.05$)

A. B. C. .... values within rows for each character, with different superscripts significantly differ ($P < 0.05$)

Table (5): Serum zinc, copper and manganese of ewes supplemented with Zn, vit. E or Zn + vit. E.

Treatments	Before mating (weekly)				Overall	During pregnancy (monthly)					Overall	All overall
	1	2	3	4	mean ± SE	1	2	3	4	5	mean ± SE	mean ± SE
	Zn (ppm)											
Zn	8.3+1.5 ^{a}	8.3+0.3 ^{a}	10.3+0.5 ^{b}	10.7+0.8 ^{b}	9.4+0.3	10.2+0.5 ^{b}	10.6+0.3 ^{b}	12.9+0.4 ^{c}	12.0+1.3 ^{c}	12.6+1.5 ^{c}	11.7+0.4	10.66+0.40 ^{A}
Vit. E	6.1+0.7 ^{a}	6.7+1.4 ^{a}	7.5+0.8 ^{b}	7.2+0.8 ^{a}	6.9+0.6	7.2+0.9 ^{b}	7.1+0.2 ^{a}	8.3+0.7 ^{b}	7.7+0.4 ^{b}	6.4+0.8 ^{a}	7.3+0.5	7.17+0.23 ^{B}
Zn + vit. E	7.1+1.3 ^{a}	6.9+1.4 ^{a}	8.5+0.8 ^{cd}	9.0+0.9 ^{cb}	7.9+0.8	9.5+0.6 ^{fcb}	10.6+1.7 ^{fc}	11.1+1.4 ^{fc}	13.3+1.5 ^{f}	12.3+0.8 ^{fe}	11.4+0.8	9.80+0.53 ^{C}
Control	6.8+0.7 ^{a}	5.8+0.6 ^{a}	6.0+0.9 ^{a}	7.8+0.4 ^{c}	6.6+0.3	7.6+0.6 ^{b}	7.2+0.12 ^{a}	7.2+0.8 ^{a}	9.2+0.2 ^{c}	7.6+0.01 ^{b}	7.8+0.2	7.22+0.25 ^{B}
Overall mean ± SE	7.1+0.8 ^{a}	6.9+0.7 ^{a}	8.1+0.5 ^{b}	8.7+0.6 ^{b}	7.7+0.2	8.6+0.4 ^{b}	8.9+0.5 ^{b}	9.9+0.4 ^{c}	10.6+0.7 ^{c}	9.7+0.6 ^{c}	9.5+0.2	8.71+0.36
	Cu (ppm)											
Zn	1.55+0.2 ^{b}	1.65+0.12 ^{b}	1.67+0.13 ^{b}	2.11+0.3 ^{c}	1.7+0.2	2.8+0.2 ^{d}	2.0+0.3 ^{c}	1.8+0.2 ^{c}	1.7+0.12 ^{b}	1.6+0.7 ^{b}	1.98+0.1	1.84+0.08 ^{A}
Vit. E	1.85+0.2 ^{b}	1.65+0.2 ^{a}	1.55+0.2 ^{b}	1.5+0.6 ^{b}	1.6+0.12	1.6+0.11 ^{b}	1.3+0.3 ^{b}	1.2+0.13 ^{b}	1.1+0.2 ^{b}	1.9+0.2 ^{a}	1.42+0.1	1.51+0.08 ^{B}
Zn + vit. E	1.47+0.13 ^{b}	1.7+0.3 ^{b}	2.0+0.6 ^{a}	2.1+0.3 ^{a}	1.8+0.3.	1.95+0.2 ^{a}	1.93+0.14 ^{a}	1.7+0.3 ^{b}	1.65+0.4 ^{b}	1.4+0.011 ^{b}	1.73+0.2	1.77+0.11 ^{A}
Control	1.6+0.12 ^{a}	1.8+0.3 ^{b}	1.8+0.2 ^{b}	2.1+0.1 ^{b}	1.8+0.14	1.6+0.2 ^{a}	1.6+0.12 ^{a}	1.4+0.4 ^{a}	0.9+0.3 ^{c}	0.6+0.10 ^{c}	1.23+0.16	1.51+0.10 ^{B}
Overall mean ± SE	1.62+0.2 ^{a}	1.7+0.12 ^{a}	1.8+0.08 ^{a}	2.0+0.11 ^{b}	1.7+0.09	2.0+0.9 ^{b}	1.7+0.15 ^{a}	1.5+1.12 ^{a}	1.3+0.13 ^{a}	1.4+0.06 ^{a}	1.58+0.4	1.64+0.5
	Mn (ppm)											
Zn	0.93+0.2 ^{b}	0.94+0.23 ^{b}	0.88+0.8 ^{b}	0.98+0.13 ^{c}	0.93+0.3	0.95+0.26 ^{b}	0.55+0.14 ^{ab}	0.28+0.04 ^{a}	0.4+0.04 ^{a}	0.38+0.14 ^{a}	0.51+0.21	0.720+0.07 ^{A}
Vit. E	0.49+0.17 ^{a}	1.15+0.12 ^{b}	1.57+0.14 ^{b}	1.44+0.22	1.16+0.11	1.31+0.32 ^{b}	0.26+0.06 ^{a}	0.29+0.04 ^{a}	0.36+0.05 ^{a}	0.47+0.1 ^{a}	0.54+0.02	0.850+0.06 ^{A}
Zn + vit. E	1.03+0.2 ^{a}	1.02+0.12 ^{a}	1.11+0.7 ^{b}	1.26+0.11 ^{b}	1.11+0.09	1.38+0.23 ^{b}	0.14+0.02 ^{c}	0.53+0.2 ^{c}	0.3+0.2 ^{c}	0.32+0.05	0.53+0.11	0.820+0.06 ^{A}
Control	0.86+0.13 ^{b}	1.04+0.11 ^{b}	0.93+0.09 ^{b}	1.46+0.01 ^{c}	1.07+0.06	1.46+0.25 ^{c}	0.46+0.03 ^{a}	0.36+0.01 ^{a}	0.29+0.01 ^{a}	0.54+0.1 ^{a}	0.62+0.01	0.850+0.08 ^{A}
Overall mean ± SE	0.83+0.08 ^{b}	1.04+0.07 ^{c}	1.05+0.06 ^{c}	1.28+0.08 ^{c}	1.05+0.03	1.19+0.12 ^{c}	0.36+0.06 ^{a}	0.38+0.04 ^{a}	0.34+0.02 ^{a}	0.43+0.05 ^{a}	0.54+0.07	0.81+0.04

a. b. c. ..... values within columns for each character, with different superscripts significantly ($P < 0.05$)

A. B. C. ..... values within rows for each character, with different superscripts significantly differ ($P < 0.05$)

E than the other two groups (Table, 5). Underwood (1981) suggested that low serum Cu resulted in low fertility and or reproductive failure in many farm animals. Also, serum Mn concentration was slightly lower in the ewes given the diet supplemented with Zn either alone or combined with vit. E as compared with the other two groups but differences were not significant. A similar finding was reported by Attia *et al.* (1987) who found that serum manganese levels were not significantly affected by the zinc supplementation.

In conclusions the addition of 50 mg Zn, 15 mg vit. E or 50 mg Zn + 15 mg vit. E to basal ration of ewes increased their body weight gain, improved their reproductive performance, litter size and increased of twinning rate without any deleterious effect on blood constituents.

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الملخص العربى
اضافة الزنك وفيتامين هـ الى علائق خلطان تعاج الرومانوف وتأثيرهما على الاداء التناسلى وبعض مكونات الدم

ابراهيم سعد الشماع[1] & محمود عبد المؤمن[2]
[1] كلية الزراعة بكفرالشيخ - جامعة طنطا
[2] معهد بحوث الانتاج الحيوانى - وزارة الزراعة - الدقى - جيزة

استخدم فى هذه الدراسة ٣٤ نعجه خليط الرومانوف (٢/١ رومانوف × ٢/١ رحمانى) متوسط عمرها ٢,٥-٣ سنوات ومتوسط وزن الجسم ٤٤-٤٧ كجم لدراس تأثير اضافة الزنك او فيتامين هـ او كليهما معا على الاداء التناسلى وبعض مكونات الدم لهذه النعاج. قسمت النعاج عشوائيا الى اربعة مجاميع تجريبية الثلاثة المجاميع الاولى غذيت على العليقة الاساسية مضافا اليها ٥٠ مليجرام زنك ، ١٥ مليجرام فيتامين هـ أو كليهما معا فى اليوم على الترتيب. المجموعة الرابعة (الضابطة) غذية على عليقة اساسية تحتوى على ٢٩,٨ مليجرام زنك. وقد اعطت الاضافات قبل التلقيح بشهر واحد واستمرت خلال فترة الحمل.

وقد اتضح من النتائج أن معدل الزيادة اليوميه للنمو كانت عالية بمعنوية (٠,٠٥٪) فى المجاميع التجريبية المعاملة بالمقارنة بالمجموعة الضابطة. وكانت النسبة المئوية للزيادة هى ٥٦,٨ ، ٤٥,٩ و ٨٨,١٪ لكل من مجموعة الزنك ، فيتامين هـ او كليهما معا على الترتيب.

تحسنت النسبة المئوية للولادات وعدد المواليد فى المجاميع المعاملة واكثر من ذلك فان حدوث ولادات التوائم قد تحققت بإضافات الزنك او فيتامين هـ او لكليهما معا.

سيرم البروتين ، الجلوبيولين ، الزنك و النحاس كانت عالية فى المجاميع المعاملة بالمقارنة بالمجموعة الضابطة وعلى العكس من ذلك فان سيرم الالبيومين ، النشاط الانزيمى لكلا من ال GPT & GOT ، الكولسترول والمنجنيز لم تختلف معنويا بين المجاميع التجريبية المختلفة.