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Effect of supplementations of vitamin E and organic selenium on productive performance of broiler breeders

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***Abstract*---**Nutrition supplementation in broiler breeder diets are necessary to provide the nutritional requirements for the optimal performance of the broiler breeder flock after significant genetic improvement of production performance. The study aimed to determine the effect of adding vitamin E and organic selenium to the diet of broiler breeder Rose 308 in the productive and reproductive traits. The experimental flock consist of 60 hens and 10 cocks at 41 weeks of age. The birds divided into four groups for treatments application, and each treatment had three replicates (five hens per replication). The first treatment T1 fed a standard diet without addition (control) containing 15% crude protein and metabolic energy 2775 kilocalories / kg of diet, and T2 used a standard diet and 500 mg vitamin E / kg of diet supplementation, and T3 used a standard ration plus 0.5 mg of organic selenium (Availa powder) / kg of diet supplementation, and T4 used a standard diet plus a mixture of vitamin E and organic selenium (Availa powder) in proportions 500 and 0.5 mg, respectively. The results showed a significant superiority of the second treatment over the control treatment and other treatments in egg weight, as well as the T1 and T2 recorded significant high number of eggs, the percentage of egg production and the number of weekly eggs / hen compared with T4 group There were no significant differences among treatments in the characteristics of egg quality, fertility and hatchability.

***Keywords*---**availa powder, ross 308, Vit. E, broiler breeder, diet supplementation.

Introduction

Most economical traits in the broiler breeder flock represent quantitative traits which affected with both genetic and environmental factors (Hassan,2011). Nutrition represents one of important environmental factors that affecting production performance of domestic birds, as the lack of nutrients prevents the flock from expressing its genetic potential (Al-Hassani and Al-Shukri., 2016) , so the poor nutrition can negatively affects the growth rate, meat quality, egg production, fertility and others, which causes significant economic losses (Nawab et al., 2018)

Feed supplementations are necessary for broiler breeders to meet nutritional requirements due to the intensive selection and genetic improvement (Garrett ,2011) and among those additives is the organic selenium, which plays an important role in human and animal health and production performance (Lekatz et al., 2011). Selenium is found in several forms such as organic, inorganic and Nano form, and the action of each form differs in terms of absorption mechanism, efficiency and metabolism, and many studies reported that organic selenium has an efficiency similar to nanoparticles compared to inorganic(Markovic et al.,2018). The deficiency of selenium in the diet may cause many diseases, including cardiovascular diseases ,((Hallet al.,2014) on other hand, it has been proven that selenium enhances the activity of antioxidants in broilers, improves the health and production, and increases its content in meat and eggs (Fisinin et al., 2009; Surai and Kochish,2018).

Vitamin E is also one of the vitamins necessary for growth (Pignitter et al.,2014). and that its deficiency is due to its insufficient availability in the diet or as a result of a functional defect in its absorption in the intestine (Mohanta et al,2015). The deficiency of vitamin E causes the appearance of many symptoms for many diseases, such as soft brain disease in chickens, and it is used to treat certain diseases due to its role in the oxidation process (Showell et al.2017) Vitamin E reduces the oxidation of fatty acids in tissues (Shakirullah et al,2017), and oxidative stress is one of the most important metabolic problems facing the development of poultry industry (Panda and Cherian,2014). Vitamin E is one of the most important antioxidants for the bird, which activates all major metabolic pathways , and works to improve growth productive performance of broiler chickens to meet the needs of market of poultry meat (Christaki,2012; Lu et al,2014; Cufadar et al,2017; Aliarabi et al,2018)

The supplementation of vitamin E to the broiler diet has improved the productive performance of the flock such as live body weight, body weight gain and feed conversion ratio and egg production (Nafea and Ahmed.2020) and egg quality characteristics(Abd et al,2019). Broiler industry in Iraq depends mainly on importing hatching eggs or producing hatching eggs from global broiler breeders especially Ross 308 flocks to supply hatcheries requirements, and there are many studies conducted in Iraq to improve the performance of broiler breeders and their progeny in local environment (Hassan and Al-Hamdani,2009 ; Hassan,2009; Hassan and Ali,2017 ; Ali and Hassan,2018). The study aimed to determine the effect of adding vitamin E, organic selenium and adding a mixture of vitamin E

and organic selenium to the diets of broiler breeder Rose 308- on the hatching egg production and egg quality traits.

Materials and Methods

The experiment was conducted in the poultry house in the animal station in the Department of Animal Production at the College of Agriculture/University of Diyala during the period from Dec. 22, 2021 to Feb. 15, 2022. The study aimed to determine the effect of adding vitamin E and organic selenium on the productive performance of broiler breeders Rose-308. Experimental units consist of 60 hens and 10 cocks from the breeding flock of Ross 308 broiler breeders at 41 weeks of age, and the flock was housed in pens with dimensions of 2 x 1.5 m. Egg production and egg quality traits were measured in two periods (each period 28 days), the hens diet contain 15% crude protein and metabolic energy 2775 kilocalories / kg of diet and in a restricted program using 175 g / hen per day, the male diet contain 13.5% of crude protein and metabolic energy 2780 kilocalories/kg of diet per day, and in a restricted program 125 g/ cock according to the recommendations of Aviagen company. The experimental flock was divided into four groups, and each treatment had three replicates (each replicate five hens).. The first treatment T1was fed on a standard diet without additives, the second treatment T2 on a standard diet supplemented with 500 mg of vitamin E / kg of diet, and the third treatment T3 on a standard diet plus 0.5 mg of organic selenium (Availa powder) / kg of diet, and the fourth treatment T4 supplemented with a mixture of vitamin E and organic selenium in proportions 500 and 0.5 mg respectively. Availa powder contains organic selenium selenomethionine hydroxyanalogue with 0.1%.

Statistical analysis

Experimental data were analyzed according to Completely Randomized Design and the significant differences among means were detected using Duncan's Multiple Range Test at probability of 0.05 (Duncan,1955). The linear model:

$$\mathbf{Yij = \mu + \tau_i + \varepsilon_{ij}}$$

Where:
Yij= observation
μ=overall mean.
τ_i=treatment effect (i=1,2,3,4)
ε_{ij}= The experimental error of observation, that normally distributed with mean equal to zero and variance equal to σ2e.

Results and Discussion

Table 1. shows the effect of the supplementation treatments on egg production traits of broiler breeder, hence there were significant superiority of T1 and T2 in hen day egg production, period egg number and weekly egg number per hen compared with T4. There were significant high egg weight recorded in T2 compared with other treatments, the results agreed with(Zorzetto et al,2021) , who pointed significant increase in egg production and egg weight in broiler

breeder hens fed with diet supplemented with organic selenium (0.3 mg / kg of diet) at 56 – 60 weeks of age. The results also agreed with(Ziaei et al,2013), who recorded significant differences when adding vitamin E and selenium at percent of 125 and 250, 0.50 and 0.75 mg/kg of diet, respectively, in egg production, and egg weight, and the significant superiority recorded when adding vitamin E at percent of 250 mg/kg of diet. kg in laying hens at 65 weeks of age. The results did not agree with(Ziaei et al,2013), as they recorded no significant differences in egg production when adding selenium at a percentage of 0.3 mg/kg of diet in the diet of laying hens at 42 weeks of age.

Table 1. Means ±Standard Error of egg production traits of supplementation treatments in Ross 308 broiler breeder

Treatment	Number of egg	Egg Production (%)	Egg weight (g.)	Weekly number of eggs/hen
Control	28.67 ± 0.46 a	81.92 ± 1.32 a	66.29 ± 0.22 b	5.73 ± 0.09 a
Vitamin E	27.17 ± 0.57 ab	78.22 ± 1.45 ab	68.02 ± 0.30 a	5.43 ± 0.11 ab
Selenium	28.46 ± 0.49 a	81.32 ± 1.41 a	66.06 ± 0.36 b	5.69 ± 0.10 a
Vitamin E * Selenium	26.46 ± 0.75 b	75.60 ± 2.16 b	66.44 ± 0.37 b	5.29 ± 0.15 b
P-value	0.024	0.024	0.000	0.024

Means with different letters refers to significant differences at P≤0.05

Table 2 refers to significant differences (P ≤ 0.05) in the number of eggs, egg production and the number of weekly eggs / hens, resulting from the effect of the interaction among periods and supplementation treatments, hence T1 in the first period recorded superiority compared with T4 in the two periods, no differences were observed among the other treatments, also egg weight, the vitamin E supplementation treatment in the second period appeared superiority to all treatments in the two periods. The results did not agree with (Wang et al,2021) , as they noticed significant differences in egg production when adding 0.45 mg/kg selenium in broiler breeder diet at the age of 49-64 weeks. The results did not agree with (Khan et al,2017), as they pointed that there were no significant differences in the number of weekly eggs/hen when adding selenium at a percent of 0.15 mg/kg of diet at 49 weeks of age.

Table2. Means ± standard error of egg production traits result from the effect of the interaction among periods and treatments in Ross 308 broiler breeder

Period	Treatment	Number of egg	Egg Production (%)	Egg weight (g.)	Weekly number of eggs/hen
41-45	Control	29.67 ± 0.45 a	84.76 ± 1.28 a	65.66 ± 0.29 c	5.93 ± 0.09 a
	Vitamin E	27.17 ±	78.81±	67.24 ±	5.43 ± 0.18

		0.89 abc	2.00 abc	0.42 b	abc
	Selenium	29.25 ± 0.73ab	83.57± 2.08 ab	64.96 ± 0.41c	5.85 ± 0.15 ab
	Vitamin E * Selenium	27.00 ± 1.31 bc	77.14 ± 3.74 bc	65.05 ± 0.38 c	5.85 ± 0.26 bc
45-49	Control	27.00 ± 0.71 abc	79.07± 2.04 abc	66.92 ± 0.23 b	5.53 ± 0.14 abc
	Vitamin E	27.17 ± 0.76 abc	77.63 ± 2.17abc	68.80 ± 0.29 a	5.43 ± 0.15 abc
	Selenium	27.67 ± 0.61 abc	79.06 ± 1.74 abc	67.16 ± 0.38 b	5.53 ± 0.12 abc
	Vitamin E * Selenium	25.92 ± 0.78 b	74.06 ± 2.24 c	67.82 ± 0.30 b	5.18 ± 0.16 c
P-value		0.036	0.032	0.000	0.036

Means with different letters refers to significant differences at P≤0.05

Table 3. shows the effect of addition treatments in broiler breeder diet on egg quality traits, and the results recorded that there were no significant differences among treatments in egg weight, shape index, Albumen height, yolk height, yolk diameter, Albumen diameter, shell weight, shell thickness, yolk weight and white weight. The results agreed with (Zorzetto et al,2021), as they did not recorded significant differences in the thickness of shell and the height of albumen when adding selenium at a percent of 0.3 mg/kg of diet in broiler breeder flock at the age of 56-60 weeks. The results agreed with (Wang et al,2021) , as they showed no significant differences in egg weight, shape index, shell thickness, albumen height and yolk weight when adding selenium at a percent of 0.3 mg/kg of diet in laying flock at 42 weeks of age.

Table3. Means ± standard error of egg quality characteristics resulting from addition treatments in Ross 308 broiler breeder

Trait	Control	Vitamin E	Selenium	Vitamin E * Selenium	P-value
weight egg (g)	64.50 ± 1.09	66.60 ± 0.87	66.20 ± 1.30	65.80 ± 1.22	0.589
Shape index (%)	75.85 ± 1.10	77.84 ± 1.46	76.18 ± 1.01	74.64 ± 0.53	0.231
Height Albumen (mm)	8.08 ± 0.14	8.03 ± 0.18	7.99 ± 0.28	8.01 ± 0.20	0.992
height Yolk (mm)	20.54 ± 0.18	20.88 ± 0.19	20.70 ± 0.30	20.23 ± 0.18	0.217
Albumen diameter (mm)	84.10 ± 1.07	82.90 ± 1.56	81.20 ± 1.02	80.90 ± 1.07	0.214
Yolk diameter(mm)	43.50 ± 0.43	42.70 ± 0.52	43.40 ± 0.48	42.60 ± 0.40	0.389
Shell weight(g.)	7.55 ± 0.22	8.00 ± 0.15	7.65 ± 0.18	7.70 ± 0.15	0.327
Shell	0.25 ±	0.27 ±	0.28 ±	0.25 ±	0.712

thickness(mm)	0.03	0.02	0.03	0.03	
Yolk weight(g.)	20.45 ± 0.22	20.85 ± 0.41	20.10 ± 0.23	20.30 ± 0.26	0.324
Albumen weight(g.)	37.65 ± 1.10	37.70 ± 1.01	38.50 ± 0.94	36.65 ± 0.94	0.634

Table 4. Effect of addition treatments in broiler breeder diet on fertility and hatchability, and the results recorded that there were no significant differences in fertility, hatchability of total eggs, hatchability of fertile eggs. The results did not agree with (Zorzetto et al,2021), that they observed an improvement in hatchability of total eggs when adding selenium at a percent of 0.3 mg/kg of diet of broiler breeders at the age of 56-60 weeks. The results did not agree with (Wang et al,2021), as they noticed significant differences in fertility and hatchability, and the results recorded that there were no significant fertility, hatchability of total eggs, hatchability of fertile eggs when adding selenium by 0.45 mg/kg in the diet of broiler breeders at the age of 49-64 weeks. The results did not agree with (Ziaei et al,2013; Emamverdi et al ,2019)The results agreed with (Li et al,2020) , as they did not recorded significant differences in fertility, hatchability when adding selenium at a percent of 0.15 mg/kg of diet of broiler breeders at 63 weeks of age.

Table4. Means ± standard error of fertility, hatchability and embryonic mortality (%) in the treatments of additions in the diet of broiler breeders

Period	Control	Vitamin E	Selenium	Vitamin E * Selenium	P-value
Fertility	76.09 ± 9.17	55.71± 21.64	90.95 ± 1.16	85.10 ± 2.55	0.244
Hatchability of total eggs	66.96 ± 10.99	47.19 ± 18.46	83.93 ± 2.35	75.14 ± 7.57	0.212
Hatchability of fertile eggs	87.28 ± 6.36	83.08 ± 4.59	92.38 ± 3.81	87.91 ± 6.46	0.697
Embryonic mortality	12.72 ± 6.36	16.92 ± 4.59	7.62 ± 3.81	12.09 ± 6.46	0.697

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