Effect of Adding the Vitamin E and Selenium to the Drinking Water on Fertilization Rate of Local Syrian Chicken

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Abstract:

This research was conducted at the Animal Production Research Center of Video, (Faculty of Agriculture, Tishreen University), to study the effect of adding different concentrations of vitamin E and selenium to the drinking water on fertilization rate of the brown type of the local Syrian chicken.

Results showed no significant differences in egg weight when adding concentrations of mixture of Vitamin E and Se, compared with the control over 150 days after collection of eggs post reaching the sexual maturity. Where the highest value of mean of egg weight was about 51.26 g when the mixture was added by the concentration (0.3 g E + 0.6 mg Se). The lowest value was (50.21 g), when the mixture was added in the concentration of (0.2g E + 0.4 mg Se). While the control and the treatment of (0.1 g E + 0.2 mg Se) reached about 50.25g and 50.24 g, respectively.

On the other hand, it was found that there were significant differences between the different concentrations of the previous mixture and the control with respect to the number of eggs and the fertilization rate during the same previous period. Where the highest value of the mean of egg number was about (80.67 egg) when the mixture was added at the concentration of (0.3 g E + 0.6 mg Se), and the lowest ratio was (71.00 egg) at (0.1 g E + 0.2 mg Se). While at the control and the concentration of (0.2 g E + 0.4 mg Se), it reached about (70.00 and 74.00 egg), respectively.

It was also found that the highest mean of fertilization rate was recorded when the previous antioxidants were added at the concentration of (0.3 g E + 0.6 mg Se), where it attained about (90.10 %). Whereas the lowest one was about (80.20 %) by the concentration of (0.1 g E + 0.2 mg Se). While at the control and the concentration of (0.2 g E + 0.4 mg Se), it was about (80.67 and 85.10%), respectively.

Keywords: *local Syrian chicken, vitamin E, selenium, drinking water and fertilization rate.*

I. INTRODUCTION

Oxidation stress considers a metabolic reaction that uses oxygen. It characterized by an imbalance between the oxidants and antioxidants in the organism. This imbalance is due to the excessive production of oxidants or to reducing in its antioxidants [1].

Excessive production of oxygenated species and oxidizing molecules often causes cellular and histological damage [2].

It damages biological molecules, especially lipids, including membrane cholesterol and fatty acids [3], and proteins [4], and DNA [5].

Peroxides damage is one of the causes of testicle function weakness, and despite the low level of oxygen in the testicle environment, it remains more susceptible to oxidation, due to the presence of unsaturated fatty acids, and thus the continuous generation of ROS [6].

The deterioration of sperm function causes male infertility and sub-fertility. The controlling of ROS levels that cause sperm dysfunction depends on the normal physiological condition of the sperm and the acrosome reaction.

Therefore, it was necessary to maintain a balance between the removal of free radicals and low physiological levels, which are necessary for sperm function and hence the rate of fertilization. Whereas there are a strong relation between the sperm function and its ability to move and fertilize the egg [7].

Vitamin E is one of the most important antioxidant compounds, it works to stop the hyperoxidation reactions of fat by breaking the oxidative chain [8]. It also protects cell membranes from oxidation by reacting with free radicals produced in the chain of lipid oxidation reactions, thereby removing them and preventing oxidation reactions from continuing [9]. It also increases the activity of antioxidant enzymes, improves fertility by improving sperm quality

and increasing sperm concentration [10], and ratio of each of FSH and LH [11].

Selenium also works in addition to vitamin E in the prevention of oxidation and maintains the cohesion of cells, that is, they have a complementary role in protecting the cell against the oxidation of fat and free radicals and thus preserve the reproductive characteristics of animals. This is due to the role of selenium in enhancing the role of vitamin E, whereas adding them to the diet improves the quality and quantity of semen [12].

It is part of glutathioneperoxidase, the enzyme responsible for protecting the cell membrane from free radicals, and there was a positive correlation between selenium level in sperm plasma and sperm integrity [13].

Therefore, this research is devoted to determine the effect of adding different concentrations of vitamin E and selenium to drinking water on the fertilization rate in the brown type of local Syrian chicken using natural insemination.

The importance of the research comes from the lack of local studies dealing with antioxidants and the effect of their addition in drinking water on the fertilization of local Syrian chickens using natural insemination method.

Therefore, the aim of this research was to study the effect of the addition of some antioxidants such as vitamin E and selenium in the drinking water on the fertilization rate and to determine the most effective concentration in increasing the fertilization rate in the local Syrian chickens.

II. MATERIALS AND METHODS

The study was carried out at the Animal Production Research Center in Vidio, at the Faculty of Agriculture, Tishreen University, and in the Laboratory of Animal and Poultry Physiology at the Faculty of Agriculture from April to August of 2019.

Studied animals:

Brown type chickens from local Syrian chickens were used for this study. Four-months old roosters and hens were collected in the same age and full brown color of the feathers covering the body. When they reached six months, chickens in similar weight and color, and sound structure were selected.

Thirty-six hens and nine roosters were selected for each experiment. Chickens were reared in terrestrial care method, and when they reached six months, the selected chickens were placed in replicates. Whereas, the replicate was 4 hens and 1 rooster. Three replicates were used for each concentration of antioxidants in the experiment. A 5 cm thick sawdust was used.

When egg production in the studied population reached 50% in two consecutive days (i.e. when they reached sexual maturity), hens were placed in individual cages, so that the eggs were collected from each chicken. A balanced fodder mix of the studied rooster was provided at 120 g per chicken / day until reaching sexual maturity. After reaching sexual maturity, the fodder was increased to 160 g / chicken / day. Table (1) indicates the proportions of the food included in the composition of the fodder mixtures mentioned

Table (1): Percentages of foodstuffs included in the fodder mixture composition

Material	Percentage %
maize	**63**
soy bean (44%)	**16**
fodder barley	**2**
wheat bran	**2**
focus fodder	**10**
residues	**7**
metabolite energy (Kcal/Kg)	**2524**
raw protein %	**14.97**

Prepare the chickens:

After the studied chickens reached sexual maturity and put males with females for a week, the hens were isolated in individual cages for two weeks, during which eggs were

collected for each hen separately for incubation. Then roosters placed with hens for a week, and then separated for two weeks, and thus. One month after adding vitamin E and selenium to the drinking water of the studied chickens at different concentrations, the same previous steps were followed and eggs were collected from each chicken.

The lighting system was maintained 16 hours a day during all phases of the research, from five and a half morning to nine and a half pm.

Method of adding antioxidants to drinking water and presenting them to the studied chickens:

Three concentrations of vitamin E with selenium were prepared, (0.1 g E + 0.2 mg Se / L water), (0.2 g E + 0.4 mg Se / L water) and (0.3 g E + 0.6 mg Se / L water). It was added to the drinking water a month before the start of the experiment, and continued to be added until the end of the experiment. Drinking water containing antioxidants was provided to the chickens twice daily at a rate of one and a half liters per replicate each time using hanging palates at a suitable height for chickens to ensure that they are not contaminated and poured by chickens. Chickens were parched for four hours before being added each time, in order to ensure consumption the largest amount of antioxidants. Where it was added at eight in the morning and four in the afternoon. The palates were monitored continuously and added drinking water as needed.

Egg Collection:

Eggs were collected from each hen separately and cleaned with dry cloths and, if necessary, wet pieces without harm to the cuticle layer. Eggs were numbered to distinguish the eggs produced by each hen and for each replicate according to each concentration of studied antioxidants.

Number of produces eggs:

The amount of produced eggs from each hen was calculated by natural and artificial insemination methods, before and after the addition of antioxidants to the drinking water. Whereas individual rearing inside cages was depending. Where in the natural insemination, hens were put in individual cages for 2 weeks after a week of put them with rooster. During that, eggs were collected for each hen separately.

The mean of quantity of produced eggs per replicate was then calculated. The quantity of produced eggs during the first five months of the biological cycle of egg production was calculated after reaching sexual maturity.

Egg Weight:

Eggs were weighed for each hen individually, then calculated the average weight of produced eggs per replicate before and after the addition of antioxidants to the drinking water, using an electronic digital balance.

Incubation and screening of incubated eggs:

After collection, weight and numbering the eggs were incubated in a hatchery within a week of collection at 37.5 ° C and humidity 55 to 60 % for 18 days, with automatic stirring every 2 hours, then the temperature was reduced to 37.2 ° C in the last three days. Humidity was increased to 80 -85% during the 19 and 20 days of incubation, then reduced it to 50 % on the day 21, with stirring stopped during the last three days.

At the sixth day, unfertilized eggs were excluded. And at the 11^{th} day of embryo age, dead embryos were excluded, where in this period, the embryo was well shown inside the egg [14].

Calculate the Fertilization Rate:

Fertilization ratio is calculated from the following equation:

Fertilization rate % = (number of fertilized eggs / total number of incubated eggs) x 100 [15].

Fertilization rate was calculated for each female separately, then the average percentage of each replicate was calculated before and after a month of adding different concentrations of the studied antioxidants.

Statistical analysis:

The experiment was designed according to the completely randomized blocks. The statistical program Genstat-12 was used to analyze the variance (ANOVA), and to calculate the lowest significant range L. S. R according to Duncans test (Duncans) to determine the significant differences between the studied treatments.

III. RESULTS AND DISCUSSION

Evaluate the egg weight:

An egg weight was studied as one of the main characteristics affecting on the production. It was collected during the first five months of egg production from the date of sexual maturity, after the fertilized females were placed in individual cages, and a month after the addition of antioxidants by the studied concentrations to drinking water, eggs were weighed from each

hen separately and then calculated the average of eggs weight for each replicate.

Table (2) shows the average of eggs weight after one month after the addition of the studied concentrations of the mixture. Also it shows no significant differences in the average of egg weight between the added concentrations (P > 0.05).

Table (2): Mean of egg weight /g/ for different concentrations of the mixture of Vitamin E and Se/ 1 L water

The concentration	mean of egg weight (g)
the control	**50.25a**
0.1 g E+ + 0.2 mg Se	**50.24a**
0.2 g E + 0.4 mg Se	**50.21a**
0.3 g E + 0.6 mg Se	**51.26a**

similar letters at the same column means no significant differences (p>0.05)

Table (2) shows that the average weight of the largest egg was recorded when adding the mixture in concentration (0.3 g E + 0.6 mg Se) per liter of water, reaching (51.26 g), and recorded the lowest value of this average when added in concentration (0.2 g E + 0.4 mg Se) was (50.21 g). While the mean value at control and concentration (0.1 g E + 0.2 mg Se) was (50.25 and 50.24 g), respectively.

Compared with other studies, the mean of eggs weight at this study, whether addition the mixture by any concentration or without any addition was lower compared to the average of egg weight in the Ross strain, where the value of this average was about (67.4 g) [16]. The breed of laying hens "Olympia strain" in Nigeria was (60.1 g) [17]. The white leghorn strain ranged between (60-62 g) [18], and the domestic strain Famennoise (dual purpose) in Belgium was (55.43 g) [19].

But the mean value in this study was higher compared to Dandrawi and local poultry in Egypt where these values were (45 and 40 g), respectively, and the Egyptian Sinai strain was (44.12 g) [20]. The bare-necked chicken in Nigeria is (43.04 g), and the covered neck is (40.83 g) [21]. The local poultry in Kenya were (46 g) [22]. The Egyptian Fayoumi chicken attained (46.70 g) [23]. Also its value was significantly higher compared to the local Malaysian poultry of 39 grams [24]. To other studies, the mean value of this study was similar. As to re. [25] in India, where the white leghorn chicken strain was (53.55 g). And as (53.2 g) in Tanzania [26]. The Syrian black chicken was (52.33 g) [23].

Evaluate the number of produced egg:

Egg production was studied during the first five months of the biological cycle of laying eggs, and one month after the addition of antioxidants to the drinking water in different concentrations, where the first five months give a clear picture of the productive capacity of the individual or group. Table (3) shows the presence of significant differences in the number of eggs among the different concentrations of antioxidants added to the drinking water (P <0.05).

Table (3): Means of egg number using the different concentrations of the mixture of vitamin E and Se

The studied concentrations	mean of egg number (egg)
The control	**70.00 d**
0.1 g E +0.2 mg Se	**71.00c**
0.2 g E +0.4 mg Se	**74.00 b**
0.3 g E +0.6 mg Se	**80.67 a**

Different letters in the same column lead to significant differences (p < 0.05)

Table (3) shows that the highest value of the average of egg production in 150 days was when the mixture was added at the concentration of (0.3 g E + 0.6 mg Se per liter of water), reaching to (80.67 egg), while the lowest value for this average was recorded when adding the previous mix at the concentration (0.1 g E + 0.2 mg Se), which was (71.00 egg). While its value at the control and when the previous mixture was added at a concentration of (0.2 g E + 0.4 mg Se) attained about (70.00 and 74.00 egg), respectively.

Compared with results of other studies, it was found that egg production according to this study was lower compared to the Mamoura and Silver Park starin during a period of 150 days, where for these two strains, the value was (89.9 egg) [27]. In Iraq, for the white strain of Leghorn, it was (124 egg) [28]. And it was (81.35 egg) to the first generation members of the lead type [29], and (82.85 and 87.48 egg) in five months to the first generation of the brown and black types of the local Syrian poultry [30]. Whereas the mean value in this study was higher compared to the number of eggs in Fayoumi during the 90 days of production, reaching (44 egg), and with the Egyptian local strain (white local poultry) attained (41 egg) [31]. And for the Kuchi and Medium strains in Tanzania it was (45 and 49 egg), respectively [32].

The mean value in this study was higher compared to the egg production in hybrids resulting from hybridization of white leghorn males with local female within 100 days (63.49 egg). Also, when brown male chickens were crossed with female white leghorn, the average production of this hybrid was (64.03 egg) [33].

Evaluate of the fertilization rate:

After studying the fertilization rate of each hen separately by conducting a scan 11 days of incubation the eggs produced, and calculating the average of fertilization rate for each replicate during the first five months of the biological cycle of lay eggs, and a month after the addition of antioxidants to the drinking water in different concentrations, Table (4) shows significant differences in the fertilization rate between different concentrations of antioxidants added to the studied drinking water ($P < 0.05$).

Table (4): Mean of fertilization rate using different concentrations of the mixture of vitamin E and Se

The studied concentrations	mean of fertilization rate %
the control	**80.67c**
0.1 g E + 0.2 mg Se	**80.20 c**
0.2 g E + 0.4 mg Se	**85.10 b**
0.3 g E + 0.6 mg Se	**90.10 a**

different letters indicated to significant differences ($p<0.05$)

Table (4) shows that the highest mean of fertilization rate was recorded when adding the mixture at (0.3 g E + 0.6 mg Se), with a value of (90.10%). While the lowest value of this indicator was recorded when adding the previous mix at (0.1 g E + 0.2 mg Se), where it reached to (80.10%). While its value at the control and when adding the previous mix at (0.2 g E + 0.4 mg Se) is about (80.67% and 85.20%), respectively.

Compared with other studies, this research shows that the rate of fertilization whether or not any additives of the studied antioxidants was lower compared to the local Egyptian strain "Gimmizah", which was (90.37 %) [34], and compared to the strain "D. nana" (IFF) which was (92.70 %) [35], and compared with the global Leghorn strain, which was (95%) [36], and compared with the "Normal Feathered strain" in Nigeria, which reaching (92.3%) [37]. But it was higher compared with the five local strains in Ethiopia, Netch and Tukur (56%), Kei (57%), Gebsima (53%), Melata (60%) [38].

Comparing the average of fertilization rate according to this study in the control and when adding the mixture in all studied concentrations except the concentration (.03 g E + 0.6 mg Se), it was found to be lower compared to the local Egyptian Fayoumi strain, reaching (89%) [39], and to the (INN) D.Nana strain in Bangladesh (87.60%), and to the Red Rod Island (dual purpose) in Egypt (89.82%) [34], and to the three lines alpha-beta-gamma, in the strains of white Russian which attained (85.7, 81.7 and 86.3%), respectively [36], and to the first generation of local Syrian poultry which was 88.2% [40], and to the hybrid resulting from the mixing of white plymouth rock and Cornish chicken which was (85.39%) [41], and to the Syrian black type (83.92%), and at the hybrid resulting from crossbreeding between males of the Syrian black type and Egyptian Fayoumi hens (87.83%) [23], and to the local Syrian poultry about (89.8%) [42]. While it was higher compared to the local strain of South Asian "Aseel" which attained (55%) [43], and to Dwarf Bitwel and Bare Neck strains in Sudan, which were (76.08 and 71.31%), respectively [44], and to the naked neck strain in Nigeria which was (78.4%) [37].

IV. CONCLUSION

It was notable existence an improvement in indicators of egg number and fertilization ratio due to the addition of vitamin E and selenium to Syrian chicken drinking water. Therefore, we suggest that vitamin E and selenium should be

added with long-term breeding and selection programs.

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