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Effect of magnetic field on productive and hysiological performance in broiler breeder

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***Abstract*---**The experiment was conducted to determine the effect of magnetic field on the productive and physiological performance of Ross 308. The experimental flock consist of 60 hens and 10 cocks of broiler breeders, which randomly divided into four groups and distributed on the treatments with three replicates for each treatment. The treatments included the control treatment (T1), exposure the stored semen to 803 gauss magnetic field for 24 hours (T2), exposure the fertile eggs to 250 gauss magnetic field for 72 hours before entered the incubator (T3) and exposure the individual cages to 250 gauss magnetic field for 8 weeks (T4), and the performance traits of hen day egg production, egg weight, recorded from magnetization cages group and compared with control group. The results showed a significant decrease (P≤0.05) in fertility and hatchability of total eggs in T2 compared with other groups, and there was no significant difference in the hatchability of fertile eggs and embryonic mortality among treatments, egg weight and the hen day egg production. (HD). There was a significant increase in the plasma glucose in T4 compared with other treatments, as well as, there was a significant decrease in the number of white blood cells in T4 compared to the control group.

***Keywords*---**semen magnetization, eggs magnetization, magnetization of breeding cages, magnetic intensity

Introduction

The Iraqi poultry industry used many global broiler breeder hybrids such as Ross, Hubbard and Arbor Acres to provide the hatcheries with hatching eggs which supply broiler farms with one day chicks for broiler production (Hassan ,2009; Ali and Hassan ,2018). The global poultry industry plays important role to provide human with protein source and help to achieve the food security (Billard, 2004).

Most productive and physiological traits classified as quantitative traits which affected by genetic and environmental factors, and one of the important environmental factors due to the wide spread of using electromagnetic devices in our life, so all organism forced to magnetic field exposure. There is a warning of the frequent exposure to magnetic field which may cause harmful effect for public health(Krewski,et al. , 2003), and some studies focus on communication devices, including mobile phones that depend on electromagnetic waves, and what they cause to the risk of cancer Kundi , et al . , (2004) Hence the exposure to magnetic fields can increase the activity, concentration, and life span of free radicals, which may cause oxidative stress, genetic mutations, and/or apoptosis(Ghodbane, et al. ,2013). In general, magnetic field classified into weak magnetic field when the field intensity less than 1 mT, the medium magnetic field when the field intensity between 1 mT – 1Tesla, and the strong magnetic field when the field intensity 1-5 Tesla, and it is called the ultra-strong field when the field intensity is more than 5 Tesla (Ghodbane, et al., 2013). One of the published studies on rats mentioned that exposure rats to a weak magnetic field similar to mobile phones during different periods of pregnancy led to a decrease in birth weight and spleen weight, especially when exposed during the early periods of pregnancy which affects the embryonic development of the spleen and the immune system in the body (Bayat, et al. ,2011). Also exposure of poultry eggs to magnetic fields in the pre-incubation period had an effect on the embryonic growth during the incubation period and extended to the growth of the hatching chicks, even partially (Lahijani,and Sajadi ,2004 ; Shafey, et al . ,2011).

The magnetic field exposure technique was considered as one of the future techniques for bird embryos to produce chicks with a high production capacity (Mustafa, 2007), and one of the environmental factors that researchers focused on (Shafey, and, AL-Batshan,2006). There were many studies recorded advantages of using magnetic field in the poultry production, such as treatment of coccidiosis (Elmusharaf, et al. ,2007) also in stimulating the movement of blood and lymph, secretion of hormones, and the delivery of nutrients to all cells of the body (Pawlak, et al., 2018).

The study aimed to determine the effect of direct magnetic exposure of stored semen, fertilized eggs before incubation and the live hen body on fertility, hatchability, and the effect of magnetic field exposure on eggs production traits.
In a study conducted by AL-Jubouri (2020) in exposing semen to a magnetic field with a strength of 500 gauss, a significant decrease in the fertility rate was observed, as the recorded percentage was 34.57% compared to the control treatment of 46.60% of semen not exposed to the magnetic field.

Material and Methods

This study was conducted in the poultry house in the animal research station of the Department of Animal Production - College of Agriculture - University of Diyala, to study the effect of the magnetic field on some productive traits of Ross 308 broiler breeder hens. The first group represents control without treatment (T1) storage diluted semen for 24 hours at a temperature of 2°C under the influence of a magnetic field intensity of 803 gauss (The extender used in dilution was modified lake plus Turin according to (Hassan and Mohammad, 2021)

represent T2; Treated fertile eggs with magnetic field with 250 gauss intensity for 72 hours. Treated the individual cages of the hens with magnetic field 250 gauss intensity during the experimental period (T4). The measurements performed in all groups on reproductive traits including fertility and hatchability, while the egg production performance and the blood parameters were recorded in T1 and T4.
Statistical analysis.

The statistical analysis of data performed according to two independent samples T test to detect significant differences between magnetic cages and control groups. While the analysis procedure used completely randomized design for reproductive traits among the four groups, and test significance of differences among means using Duncan multiple ranges test at 0.05 probability.

Results and Discussion

The effect of exposure to the magnetic field on the percentage of egg production and weight:

Table 1 shows that there were no significant differences between T1 and T4 in hen day egg production and egg weight during the first period (36 - 39 weeks of age) and the second period (40 - 43 weeks of age). The results agreed with Mustafa (2007) who study the effect of magnetic water with 500 gausses for broiler breeder hens Cobb-500, and did not record significant differences in the egg production.

Table 1. Means ± standard error of hen day egg production and egg weight in the magnetic cages group and the control group of Ross 308 broiler breeders.

Treatments	First period		Second period	
	Egg production (%)	Egg weight (g.)	Egg production (%)	Egg weight (g.)
Control	0.631±88.333	0.354±63.216	1.718±88.093	0.633±64.0733
Magnetization of cages	1.715±89.760	0.514±62.393	1.037±86.666	0.651±64.240
P-value	0.479	0.258	0.517	0.863

The first period, 36-39 weeks of age, and the second period, 40-43 weeks of age, the percentage of egg production was calculated based on HD.

Effect of magnetic field on fertility and hatchability

Table 2 appeared significant decrease in fertility and hatchability of total eggs hence fertility declined in T2 compared to the control, while a significant difference was recorded in the hatchability of total eggs, as the treatment T4 (magnetizing individual cages) outperformed the treatment of T2 (magnetizing the stored semen). The hatchability of fertilized eggs and embryonic mortality was 92.95%, 7.05%, respectively, compared to the control , 82.69%, 17.31%, respectively, and there were no significant differences between the two treatment due to the high variance among the observations within treatment, the results agreed with (AL-Jubouri,2020) who found that there was a significant decrease in

the fertility between the semen exposed to the magnetic field and the semen not exposed to the magnetic field, as exposing the semen to magnetization with a intensity of 500 gauss for a period of 15 minutes led to a decrease in the fertility of 34.57 % compared to the fertility of un magnetized semen, (46.60%).

The study agreed regarding the total hatchability, hatchability of fertile eggs, and mortality, as there were no significant differences compared to the control ([AL-Jubouri,2020) , but a significant difference was found between treatment T4 and T2, as it reached the averages are 90.82% and 58.99%, respectively, in the hatchability . The results of hatching and the percentage of embryonic mortality agreed with (Pandian, et al. ,2013; Elsabry,et al ,2021)stated about the absence of significant differences in the percentage of hatching to fertilized eggs and the percentage of embryonic deaths in their study on the effect of the magnetic field on some reproductive traits. The results differed with (Ibrahim,2017; EL-Sabrout and Hanafy, 2017) indicated that there are significant differences between the magnetization treatment of eggs and the control in the hatchability of total eggs and the percentage of hatching from fertilized eggs.

Table 2. Means ± standard error of magnetization effect on fertility, hatchability, hatchability for fertile eggs, embryonic mortality (%) for Ross 308 broiler breeders

Traits	Control	magnetization of semen stock	magnetization of hatching eggs	magnetization of chicken cages	the level of significance in ANOVA table
Fertility	a2.58±89.38	b4.32±68.21	a5.15±87.70	a0.02±97.71	0.002
Hatchability	ab8.67±73.87	b8.10±58.99	ab8.00±78.77	a2.32±90.82	0.078
Hatchability of fertile eggs	9.59±82.69	7.42±85.78	4.83±89.47	2.36±92.95	0.724
Embryonic mortality	9.59±17.31	7.42±14.22	4.83±10.53	2.36±7.05	0.724

Means with different letters differ significantly from each other at a probability level of 0.05 according to Duncan's multiple range test.

Effect of magnetic field on blood parameters

Table 3 shows the biochemical characteristics of the blood and shows that there was no significant effect on cholesterol, Triglyceride and total protein between the control treatment and the magnetization of individual cages, while T4 recorded a significant superiority in glucose concentration compared to the control and the results did not agree with(Saleh,2015). The use of magnetized water in the ratio of total protein, cholesterol and Triglyceride.

Table 3. Means± standard error of the effect of the interaction between control and magnetization of individual cages in the blood parameters of boiler breeder hens during periods of the experiment.

blood traits	Eight weeks later		Start of experiment		P-Value
	the control	magnetization of semen	magnetization of hatching eggs	magnetization of individual cages	
Cholesterol (mg/ml)	23.01±177.80	21.24±182.18	7.46±145.80	6.79±157.00	0.379
Triglyceride (mg/ml)	477.30±1372.40	519.44±1473.90	91.01±1033.00	50.69±952.40	0.682
Total protein (g/L)	bc0.76±50.46	c2.69±46.46	a2.07±62.50	ab2.83±56.52	0.001
glucose (mg/ml)	ab4.34±187.40	b5.01±179.20	b3.65±167.20	a6.98±196.40	0.056

Means with different letters differ significantly from each other at a probability level of 0.05 according to Duncan's multiple range test.

Table 4 shows a significant decrease in T4 treatment in white blood cells compared to control , which recorded 97.99, 107.91, respectively, and before the experiment, which recorded 97.99, 108.28, 105.58 (for magnetization of individual cages after the experiment, magnetization of individual cages and control at start of the experiment, respectively), and no significant difference was recorded in the types of white blood cells (New, Lym, Mon, Eos, Bas, Aly). These results were consistent with Davidson (2000) mentioned that exposure to the magnetic field led to a reduction in white blood cells and the rate of blood cell sedimentation, which levels vary within the body according to different diseases or infections and return them to their normal level.AL-Khazraji(2009) indicated that there was no significant effect of the use of magnetized water on white blood cells when raising mice compared to the control.

Regarding red blood cells and hemoglobin, no significant differences were recorded between the control and the magnetization of individual cages. This study agreed with Shi , et al (2005) found when exposing mice to an electromagnetic field for a period of 100 days. The general examinations of the blood parameters (WBC, RBC, HGB) did not show any differences. Statistically significant between the control group and the electromagnetic field exposure group, and it also agreed with Younis,and,Thabet,(2021) who found in the absence of significant difference in red blood cells, white blood cells and hematopoiesis when exposing chicken embryos to magnetic field intensity 1800 gauss for 90 minutes. The results about the effect of magnetization on some cellular blood traits (RBC, WBC, PCV, HB) did not agree with the results obtained by(Saleh,2015).

AL-Mufarreiatall (2005) as the results of these studies indicated a significant superiority in the above blood parameters compared to the control, which they attributed to the effect of magnetically treated water on the speed of penetration and diffusion within cells and tissues, which leads to an increase in blood movement and thus an increase in the production of red blood cells. This difference in the influence of the magnetic field on blood characteristics between studies may be attributed to differences in the use of the intensity and type of

magnetic field used, where in our study direct exposure (of the chicken's body) to the magnetic field was made.

Table 4. Means ± standard error of biochemical blood traits in the magnetic cage group and the control group of Ross 308 broiler mothers

measurement time / blood traits	before the experiment		Eight weeks later		Significance in ANOVA table
	The control	Magnetizing fowl cages	The control	Magnetizing fowl cages	
white blood cells	4.53±105.58 a	1.18±108.28 a	1.39±107.91 a	0.59±97.99 b	0.032
Neutrophils	0.38±1.55	2.83±4.33	2.23±5.17	0.95±2.19	0.491
Lymphocytes	5.38±83.16	9.78±66.86	19.00±70.90	4.30±53.86	0.357
Monocytes	1.38±4.02	2.17±3.40	4.09±9.81	3.15±4.76	0.405
Eosinophils	2.55±16.79	6.01±33.60	11.83±21.62	3.29±37.49	0.159
Basophils	0.00±0.07	0.03±0.09	0.00±0.07	0.01±0.07	0.613
red blood cells	0.15±2.16 b	0.08±2.38 ab	0.07±2.57 a	0.04±2.47 a	0.049
Hemoglobin	0.82±11.90 c	0.37±12.88 bc	0.30±14.70 a	0.25±13.90 ab	0.006
Haematocrit	1.99±31.36	1.25±34.16	0.82±37.54	5.70±29.50	0.318

Means with different letters differ significantly from each other at a probability level of 0.05 according to Duncan's multiple range test.

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