ARTICLE / INVESTIGACIÓN

Epigenetic effects on broiler exposure to magnetic field on progeny meat production traits

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Abstract: This experiment was conducted to determine the effect of the exposure of Ross 308 broiler breeders to a magnetic field on the meat production traits of progeny. The experimental flock consisted of 60 hens and ten cocks of Ross 308 broiler breeders at 36 weeks of age, divided randomly into four groups; each group applied for treatment with three replicates. The treatments were control (T1), storage of semen in an 803 gauss magnetic field for 24 h (T2), storage of fertilized eggs in a magnetic field of 250 gausses for 72 h before entering the incubator (T3), and exposing individual cages to 250 gausses of magnetic field for 8 Weeks (T4). The progeny result from the broiler breeders groups was recorded for body weight and feed intake, compared with the control (T1). The results showed no significant differences among progeny groups in body weight, weekly weight gain and weekly feed intake during the rearing period.

Key words: Epigenetic, magnetic broiler breeders, broiler progeny performance.

Introduction

Quantitative traits are affected by genetic and environmental factors, but each trait's relative importance differs from one trait to another and can be estimated by heritability[1]. Environmental factors refer to all non-genetic factors, including ambient conditions, management, etc., and many genetics studies pointed out that the ecological effects did not transmit to the next generations[2]. Some of these factors depend on lifestyle and behavior[3]. The current knowledge improved evidence that environmental conditions can be affected gene expression without changing the DNA sequence. These changes can be heritable, which refers to epigenetic phenomena, recognized as a critical mechanism for regulating gene expression through DNA methylation and histone modification[4]. They also control the degree of gene activity, i.e., which genes are activated and inactivated[5].

Magnetic fields represent one of the critical environmental factors due to the increasing use of electrical devices, power lines, electromagnets and static magnetic in our lifestyle[6]. Some epidemiological studies have suggested a weak relationship between magnetic fields and some types of cancer in humans. The Swedish National Institute of Working Life conducted one of the most significant studies investigating various industries and occupations. The results indicated an association with chronic lymphocytic leukemia and an increased risk of brain cancer for males exposed to an average magnetic field of more than 0. 2 microteslas[7,8]. It further reported a significant decrease in blood glucose, total protein, cholesterol and triglycerides in a magnetic group of quail compared to the control group, which may affect product performance.

In poultry production, most economic traits are quantitative traits, so the genetic and environmental factors are considered during the selection procedure for the desired traits. Epigenetics controls how the animal's genetic makeup is used; hence, epigenetics is driven by environmental cues that activate or deactivate various mechanisms that control gene expression during transcription, post-transcription, and translation levels[9]. Animal adaptation to the changes in ecological conditions occurs by adjusting their developmental growth, metabolism, and behavior to promote survival and reproduction[10,11]. The recent study aimed to investigate the epigenetic effects of the exposure of broiler breeders to magnetic fields on their progeny for meat production traits.

Materials and methods

This study was conducted in the poultry field belonging to the Department of Animal Production - College of Agriculture - University of Diyala, in the governorate of Diyala, Iraq, and the experiment aimed to determine the epigenetic effects of the magnetic field exposed to the broiler breeders Ross 308 on the productive and physiological traits of their progeny. The broiler progeny results from broiler breeder groups treated with the following conditions: (T1) the control, (T2) the stored semen exposure to the magnetic field of 803 gausses for 24 hr., (T3) the fertilized eggs exposure to a magnetic field of 250 gausses for 72 hr., (T4) the individual cages exposure to a magnetic field of 250 gausses during for 8 weeks. The resulting progeny chicks were reared for three replicates for 6 weeks, and Table 1 appears the chemical analysis of the diet used in the study.

The lengths of the chicks were measured using a ruler inserted from the beak to the end of the middle finger in the legs of chicks, and weekly feed intake= feed intake by day ×7.

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$$\text{Uniformity} = \frac{\text{Number of birds whose weight is within 10\% above or below the standard weight}}{\text{Total number of birds}},$$

$$\text{Dressing percentage.} = \frac{\text{carcass weight}}{\text{live body weight}} \times 100$$

chemical analysis of the diet	Parent		Progeny
	Male	female	
Protein	13.33	13.99	22
Energy	2788.8	2772.84	2900
Calcium	2.73	0.76	9.10
Phosphorous	0.32	0.47	4.60
Methionine	0.31	0.3	
Lysine	0.71	0.65	14.7
Fats	-	-	27
Fiber	-	-	26
methionine + cysteine	0.57	0.56	11.30
Ash	-	-	64.45

Table 1. Chemical analysis of the diet of the parent and progeny.

The statistical analysis procedure was performed using a general linear model with Complete Randomize Design CRD. The significant differences among the treatment means were detected using Duncan's multiple ranges test[12] at 0.05 probability.

Results and discussion

The epigenetic effects on progeny performance.

Table 2 shows no significant differences among groups in the length and weight of the chick at one day old. The results did not agree with (13) who recorded heaver chicks in the treated magnetic group compared with the control, hence found 46.40 and 42.90 g. for male and female chicks, respectively, while the control group was 43.80 and 41.10 g. respectively. The results agreed with (14), who found that exposing the fertile eggs to a magnetic field did not affect the chick's weight and length. This difference may be attributed to differences in magnetic field intensity, exposure period, and magnetic procedure in the current study compared to the previous studies mentioned above.

Epigenetic effects of the magnetic field in body weight of progeny

Table 3 shows no significant differences in the chick's body weight resulting from magnetically treated groups of broiler breeders and control groups. The results did not agree with (15) who reported a significant increase in body weight when the fertile eggs were exposed to a magnetic field of 1800 gauss for 30 and 90 minutes. The authors explained the differences due to the effect of the magnetic field on the thyroid gland. The results agree with (16) in body weight and feed conversion ratio, which used magnetic drinking water in the experiment. And in the same direction[17].

The results did not agree with (14), who found significant differences in weight gain among the experimental treatments. The results did not agree with (13), who used magnetic drinking water to broiler with an intensity of 500, 1000, and 2000 gauss and recorded body weights of 3490 and 2870 g at the age of 49 days for males and females in 2000 gauss treatment. Compared to the control, 2980 and 2607 g for males and females, respectively.

Epigenetic effects of a magnetic field in feed intake

Table 4 shows that were no significant differences in the feed intake in the progeny that resulted from magnetically treated groups of broiler breeders and control group. (18) reported that exposure of fertile eggs of broiler breeders with a magnetic field intensity of 18 gausses for 60 and 75 minutes reduces body weight gain and broiler feed intake

Traits	Control	Magnetization of stored semen	Magnetic fertile eggs	Magnetic of individual cages	P-Value
Chick length (cm)	17.57±0.03	17.30±0.10	17.32±0.10	17.38±0.13	0.467
Chick/egg weight (%)	72.68±1.12	70.36±0.21	74.03±0.87	74.93±1.68	0.081

Table 2. Means ± standard error of chick length, Chick/egg weight resulting from magnetic groups of boiler breeder Ross 308.

Age	Control	Magnetization of stored semen	Magnetic fertile eggs	Magnetic of individual cages	P- value
One day	45.91±0.25	44.86±0.10	46.34±0.40	45.37±1.48	0.547
Week1	144.65±3.49	141.10±1.47	147.72±6.68	149.22±4.52	0.604
Week2	379.54±7.65	376.32±5.11	376.46±8.48	375.54±8.00	0.981
Week3	823.63±216	828.66±26.46	817.28±34.45	824.04±19.17	0.992
Week4	137.83±37.48	1420.79±2.61	1467.51±40.55	1394.88±30.71	0.394
Week5	2138.63±22.28	2173.66±12.42	2144±52.43	2060.96±54.74	0.300
Week6	2790.50±40.18	2882.03±45.9	2904±53.17	2756.41±54.105	0.390

Table 3. Means ± standard error of body weight (gm) for Ross 308 broilers resulting from magnetic field treatments in the broiler breeders.

Age	Control	Magnetization of stored semen	Magnetic fertile eggs	Magnetic of individual cages	P- value
Week1	134.67±4.39	133.32±6.77	148.66±14.10	146.43±5.86	0.511
Week2	31.12±7.70	312.21±7.87	325.60±6.03	329.12±15.65	0.511
Week3	592.30±6.89	607.14±25.34	607.61±18.117	630.33±18.60	0.567
Week4	897.01±24.68	927.39±4.89	986.61±54.60	896.15±14.20	0.210
Week5	1119.53±23.64	1099.80±5.21	1105.56±26.02	1044.07±35.37	0.234
Week6	1260.86±27.50	14992.81±21.89	1285±7.85	1267.19±35.37	0.437

Table 4. Means ± standard error of the feed intake (gm) for progeny groups result from magnetic treatments in broiler breeders.

of progeny during the experimental period of 39 days. The results agree with (13), which indicated that there were no significant differences in the feed intake in the progeny resulting from fertile eggs' exposure to the magnetic field.

Epigenetic effects of the magnetic field in uniformity of body weight of progeny

Table 5 shows a significant decrease in the body weight uniformity of chicks resulting from magnetic of cages treatment (81.55%) compared to the control (90.32%) at one day old, and the difference disappeared during the rearing period. This situation may refer to the epigenetic effects of the magnetic field during embryonic development but not include the rearing period.

Conclusions

No significant epigenetic effects were detected due to the broiler breeder's magnetic field exposure and its relation to the progeny performance for meat production traits. There is evidence that the exposure of rearing cages to a magnetic field can enhance embryonic development, which reflects on the body weight of chicks at hatching

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Age	Control	Magnetization of stored semen	Magnetic fertile eggs	Magnetic of individual cages	P- value
One day	90.32±1.62**a**	78.65±2.75**ab**	88.88±1.43**a**	81.55±1.40**b**	0.047
Week1	60.06±3.02	66.87±2.58	69.15±3.10	68.46±4.05	0.252
Week2	68.33±4.07	74.90±3.52	74.04±1.49	77.95±5.45	0.418
Week3	72.85±2.15	70.44±5.48	76.30±7.69	74.56±4.83	0.884
Week4	72.28±1.31	62.41±2.73	59.69±6.65	65.00±6.31	0.672
Week5	69.24±8.95	63.60±3.92	58.43±8.24	70.77±7.70	0.650
Week6	65.70±5.23	63.36±3.34	63.81±8.59	58.81±5.33	0.864

According to Duncan's multiple ranges test, means with different letters refer to significant differences from each other at P⩽ 0.05.

Table 5. Means ± standard error of the uniformity (%) for body weight for progeny groups result from magnetic treatments in broiler breeders.

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