Egypt. Poult. Sci.Vol. (38) (I): (51-64) (2018) **(1779)**

Egyptian Poultry Science Journal

http://www.epsaegypt.com

ISSN: 1110-5623 (Print) – 2090-0570 (Online)

PRODUCTIVE, EGG QUALITY AND PHYSIOLOGICAL RESPONSES OF GIMMIZAH CHICKEN AS AFFECTED BY MAGNETIZED WATER OF DIFFERENT STRENGTHS

Saber S. Hassan[1], Youssef A. Attia[1,2], Ali M. H. El-Sheikh[3], and Abdelkader M. Abdelkader[3]

[1] Ani. and Poult. Prod. Dep., Fac. of Agric., Damanhour Uni., Egypt

[2] Arid Land Agric. Dep., Fac. of Meteoro., Envir., and Arid Land Agric., King Abdulaziz Uni., Jeddah, Saudi Arabia.

[3] El-Sabahia Poult. Res. Station, Alex. Gov.

Corresponding author: saber.hassan@damahour.edu.eg

Received: 08 / 01 /2018 Accepted: 07 /02 /2018

ABSTRACT: A total number of 120 28 week-old laying hens of Gimmizah strain were distributed among four treatment groups in a completely randomized design with three replicates per treatment and ten hens per replicate. The first group kept as a control group received non-magnetized tap water and the other groups received tap water exposed to different intensity of magnetic strengths 2000, 3000 and 4000 gauss respectively. Laying hens were housed in 12 floor pens (2 m × 1.2 m × 2 m) furnished with wheat straw. Laying hens on - 3000 and 4000 gauss magnetized water consumed significantly more feeds and all groups on the magnetized water had significantly better feed conversion ratio (FCR) than the control group. Egg weight and egg mass were significantly increased in groups supplemented with different strengths of magnetized water compared with the control group and albumen (%) and albumen dry matter (%) were significantly higher of groups offered 2000 and 3000 gauss tap water. Yolk (%) was significantly higher of group on 3000 gauss tap water compared to the control group. Shell thickness was significantly increased in group received 4000 gauss tap water compared with control group. Blood serum glucose and globulin were significantly increased in groups supplemented with 2000 and 3000 gauss water compared with the control group and group supplemented with 4000 gauss water. However, all groups supplemented with different strength of magnetic water had significantly decreased albumin/ globulin ratio. Serum phosphorus level, and blood pH increased. Triiodothyronine increased significantly in groups received magnetized water compared to control and the 2000 gauss group showed the highest response. Red blood cell count (RBCs) and haemoglobin (Hgb) were significantly increased in groups supplemented with 2000 and 3000 gauss water compared with control group.

It could be concluded that productive performance, physiological response and egg shell quality of Gimmizah chicken were improved due to offering magnetized water with 2000 gauss was adequate to provide the beneficial effects.

Key words: magnetic-water - Gimmizah - laying - egg quality - physiological response

INTRODUCTION

Many researchers utilized magnetization techniques to improve water quality for use in different fields as medical, engineering and agriculture particularly in plant, animal and poultry production (Helal, 2002). Natural water after sterilization is called dead water, so magnetic water transfer water from dead to live (Batmanghelidj, 2005; Khudiar and Ali, 2012; Al-Nuemi et al., 2015). Physics shows that water changes weight under the influence of magnetic fields more hydroxyl (OH-) ions are created to form alkaline molecules, and reduce acidity. Increasing both the electric conductivity and the dielectric constant of water was documented (Ibrahim, 2006). The mineral content of water may be changed with exposure to strong magnetic field, and the quality can be improved by increasing the magnetic field over a more prolonged time than by a weak magnetic field over a shorter duration (Lam, 2001).

Nowadays, the use of magnets to improve water quality is of significant interest due to low cost compared to chemical and physical treatments (Yacout et al., 2015). There was an improvement in water quality when exposed to the magnetic field with considerable change in the pH, total dissolved solids, total hardness, conductivity, salinity, dissolved oxygen, evaporating temperature, minerals, organic matter and total count of bacteria (Khudiar and Ali, 2012; Al-Mufarrej et al., 2005). Increasing the permeability of the cells, allowing the expansion of the gastrointestinal tract and increase feed utilization, which lead to increasing water permeability to improve absorption of nutrients and minerals in the body (Oyngi et al., 2012). In addition, magnetic water improves blood picture and increase the concentration of ions in the blood and therefore at the speed of chemical reactions and feed metabolism and increase the minerals, vitamins and immunity of animals (Lam, 2001; Saeed and Al-Shidede, 2013).

Little research has been performed to know the importance of water exposed to a magnetic field on productivity and reproductive performance of the animal and poultry particularly with laying hens. Rona (2004) showed that magnetic drinking water for broiler chickens resulted in shortening of fattening period, increasing growth rate by 5-7% and improving flavor and tenderness of meat. Al-Mufarrej et al. (2005) reported that magnetically treated water reduced daily water consumption of birds by approximately 5.46% without any significant effect on the performance, carcass quality and immune system of meat chickens. Al-Fadul (2006) concluded that the magnetization of water improves the water properties, which consequently improves the growth performance, feed efficiency and saves water consumption for broilers. Magnetized water result in reduced DNA damage (Hafizi et al., 2014; Shah and Nagarajan, 2013) and improve animal performance (Gholizadeh et al., 2008; Attia et al., 2015; El-Hanoun et al., 2017a; b). However, contradictorily results were reported indicated that magnetic water did not positively affect animal performance, carcass composition, blood glucose, urea, N_2, K, Mg and P in blood lambs and goats (Patterson and Chestnutt, 1994; Sargolzehi et al., 2009) and broiler chickens (Alhassani and Amin, 2012). The literature review indicate a contradiction between different laboratory and lack of results with laying hens, therefore, this study aims to

evaluate the productive, egg quality and physiological responses of Gimmizah chicken as affected by magnetized water of different strengths.

MATERIALS AND METHODS

Chickens, experimental design, and diets

A total number of 120 28 wk old laying hens of Gimmizah developed strains were distributed in a completely randomized-design among four treatment groups with three replicates per treatment and ten hens per replicate. Hens were housed in 12 floor pens (2 m × 1.2 m × 2 m) furnished with wheat straw in environmentally controlled light proof house (Close system). Each treatment groups were offered one of the following drinking water regimen:

Group 1: Tap water only (control group).

Group 2: Tap water exposed to a magnetic field of 2000 gauss.

Group3: Tap water exposed to a magnetic field of 3000 gauss.

Group 4: Tap water exposed to a magnetic field of 4000 gauss.

Husbandry:

During hot weather, house was cooled using cool-cell-pads to the optimum temperature of 22-24°C, the relative humidity was adjusted automatically and ranged between 45-55%. Mash laying hens feed (Table 1) and fresh water were provided daily ad-libitum throughout the experimental period. Vaccination and medical program were done according to common veterinarian care practice. Twenty five-watt incandescent bulbs located at the center of each pen at about 2.5 m height were used as the source of light to illuminate the house. Birds were exposed to photoperiod regimen 16 hrs light-8 hrs dark cycles. Ingredients and chemical analysis of the diet are presented in table 1. Laying hens were reared according to common husbandry practice for laying hens.

Measurements

Live body weight and gain:

Live body weight (g) of each bird was record at the beginning (at 28 wk of age) and the end of experimental period (49 wk of age) in early morning before receiving any feed or water. Also, body weight gain during the experimental period was calculated.

Feed intake, feed conversion and mortality rate:

Feed intake was measured weekly, the diets were weighed at the beginning and the residual diets was collected and weight to calculate the amount of feed consumed g/ bird/ day, Feed conversion ratio as calculated at the amount of feed consumed (g) required to produced a unit (g) of egg mass (Feed conversion ratio = g feed/ g egg). Mortality rate of dead birds was presented as the number of bird dead in each treatment during the whole of experimental period.

Egg production, egg weight and egg mass:

Eggs were collected and recorded daily. The percentage of egg production (%) for each replicate was calculated according to the following equation:

Egg production percentage = $\frac{\text{Number of eggs produced}}{\text{number of live hens}} \text{x} 100$

However, eggs were individually weighed daily for each replicate and the average egg weight was recorded. In addition, egg mass (g/ hen/ day) was calculated every four weeks using the following equation:

Egg mass (g/ hen/ day) = average egg weight (g) × egg number every four 4 weeks of hen.

The measurements of egg quality:

Three eggs from each replicate per treatment at 32, 36, 40 and 44 weeks of age as a total of 36 eggs from each treatment were chosen randomly from the same days of production to measure the egg quality according to Attia et al., (1995).

All eggs were weighed and then broken on a flat glass plate to estimate the yolk and the shell weight and recorded separately. Albumen weight was calculated by subtracting the yolk weight plus shell weight from the weight of egg. Yolk, albumen and shell weights were calculated as percentage of egg weight. Egg yolk visual color scale was determined by matching the yolk with one of the 15 bands by Roche yolk color Fan (Vuilleumier, 1969). Shell thickness with membranes was measured by a micrometer (S-6428, BC.Ames, Melrose, MA, USA), to the nearest 0.01 mm.

Blood parameters:

At 35, 42 and 49 weeks of age, 3 mL of blood were obtained from wing vein of 8 hens form each treatment, which divided into two samples in Eppendorf tubes. One was heparinized test tube by using Ethylenediamine tetraacetate acid (EDTA) as an anticoagulant to study blood hematological parameters immediately after blood collection. The other was non-heparinized to determine other biochemical constituents by using commercial kits produced by Diamond Diagnostics Company (29 Tahreer St. Dokki, Giza, Egypt). Blood samples were centrifuged at 3000 rpm for 20 minutes, and the serum was stored at -20°C for further analysis.

Serum total protein (Henry, 1974) and serum albumin (Doumas et al., 1971) were determined whereas serum globulin was estimated by differences between total protein and albumin (Coles, 1974). In addition, the albumin-to-globulin ratio was calculated.

Serum calcium was determined using the method described by Tietz (1970). Serum phosphorus (P) was determined according to the method of Tietz et al., (1986). Serum calcium to phosphorus ratio (Ca/ P) was calculated. The triiodothyronine (T3) was analyzed using radioimmunoassay (RIA) kits according to the method described by Hollander and Shenkman (1974).

The blood's haematological characteristics, such as haemoglobin (Hgb) and packed cell volume (PCV), were determined based on Eilers (1967) method; red blood cells (RBCs) were determined as suggested by Hepler (1966); and the blood mean cell volume (MCV), mean cell haemoglobin (MCH) and mean cell haemoglobin concentration (MCHC) were calculated. The blood pH was determined using pH meter.

Statistical analysis

An analysis of variance was done using a one-way analysis of variance, as described by SAS® (2009). Using the following model:

$$Yij = \mu + Fi + eij$$

Where Y_{ij}=the dependent variable, μ=the overall mean; F_i=the effect of strength of magnetized water treatments and e_{ij}=the random error. The replicate was the experimental unit. All percentages were transformed to log10 to normalize the data distribution before analysis. The mean difference at $P \leq 0.05$ was tested using the Student-Newman-Keuls test. The survival rate was analyzed using the chi-square test.

RESULTS

1-The performance and some Productive characteristics

The effect of different strength of magnetized water on some productive characters of Gimmizah developed hens are presented in table (2). The results showed that all groups offered different strength of magnetic water showed similar egg production percentage, while egg production percentage improved in magnetized water groups compared with the control group. The groups received different strength of magnetized water significantly ($p \leq 0.05$) increased egg weight and egg mass compared with the control group. In addition, the groups offer 2000 and 3000 gauss magnetic water significantly increased final body weight and body weight gain compared with the control group and group supplemented with 4000 gauss water. The different groups exposed to magnetized water significantly increased feed intake particularly group supplemented with 3000 and 4000 gauss. Groups supplemented with different strengths of magnetic water significantly improved FCR compared with the control group. Water intake and water/ feed ratio were significantly lower of magnetized water groups than the control group, with the groups on 2000 gauss exhibited the lowest water intake and those on 3000 and 4000 gauss exhibited the lowest water/ feed ratio. The results showed that no significant differences between groups on survival ratio, the group exposed to 3000 gauss magnetized water was the highest in the survival ratio.

2- Egg quality traits

The Effect of different strength of magnetized water on egg quality for Gimmizah developed hens are presented in table (3). The results indicated that albumin weight significantly increased in groups supplemented with 2000 and 3000 gauss compared with the control group while no significant between magnetized water groups. Yolk weight significantly increased in group supplemented with 3000 gauss compared with the control group only. Shell thickness increased in group on 4000 gauss water compared with control group only without significant between magnetized water groups. There were no significant effect of magnetic water on yolk color, shell weight and Haugh unit score.

3- Blood Characteristics

a) Blood Biochemical Parameters

Effect of different strengths of magnetized water on some blood characteristics for Gimmizah developed hens are presented in table (4). The results showed that blood glucose and globulin were significantly increased in groups offered 2000 and 3000 gauss water compared to control and group supplemented with 4000 gauss water, but groups on magnetized water significantly decreased albumin/ globulin ratio compared with control. There were no significant differences in serum total protein and albumin.

Serum total calcium concentration and Ca/ P ratio were not significantly affected by different water treatments. However, serum P was significantly higher of magnetized water groups than the control. Triiodothyronine significantly increased in the magnetized water groups compared with control while groups received 2000 gauss were significantly higher than the 3000 and 4000 groups.

c) Blood Hematological

Table 6 demonstrates the influences of magnetized water on red blood cell traits for Gimmizah developed hens. The results showed that RBCs increased

significantly in groups supplemented with 2000 and 3000 gauss water compared while groups offer 4000 gauss water was intermediate. The superiority of 2000 and 3000 gauss groups in RBC resulted in increased in Hgb concentration compared with other groups. There were no significant between groups in PCV, MCV, MCH and MCHC. Blood pH was significantly increased towards alkalinity in groups offer different strength of magnetized water compared with control.

DISCUSSION

Water quality is essential for life and responsible for improving health status, thus for productive and reproductive performance of animals. However, when exposed to magnetic field lead to improve water quality with low cost compared to chemical and physical treatments (Attia et al., 2015). There were considerable changes in water properties due to magnetic treatment, which turn water into very fertile and active, causing high oxygen ratio, velocity of dissolved salts and amino acids in water (El-Hanoun et al., 2017 a; b). Increasing both the electric conductivity and the dielectric constant of water was documented (Batmanghelidj, 2005; Khudiar and Ali, 2012 and Al-Nuemi et al., 2015). Water solution passes through magnetic field acquire finer and more homogeneous structures, which increases the fluidity, dissolving capability for various constituents like minerals and vitamins and consequently improves the biological activity of solutions and affecting positively the performance of animals (Al-Mufarrej et al., 2005; Khudiar and Ali, 2012).

In the present study, laying hens received 2000 and 3000 gauss magnetic trap water improved productive performance. The enhancing effect of magnetic treatment on animal performance could be attributed to enhance the oxidant-antioxidant balance such as the decrease in MDA and nitric oxide and the increase in the superoxide dismutase activity in the heart, kidney and liver, which decreases oxidative stress (Wagh and Lippes, 1993; Wang et al., 2002; Raymond–Whish et al., 2007). Since the disturbing role of free radicals and oxidative stress in female reproduction has been proven (Khan et al, 2012; Attia et al., 2016). Thus, it could be assumed that the potential reduction of oxidative stress well result in improving the productive and reproductive of laying hens offered water exposed to different magnetic field found herein (Agarwal et al., 2012; Naher et al., 2013). In accordance with the improvement found herein in laying performance and feed utilization because of magnetized water and lack of comparable results with laying hens, studies with broilers indicates that magnetic drinking water increased growth rate by 5-7% and improved flavor and tenderness of meat and shorted of the fattening period (Rona, 2004; Shamsaldain and Al Rawee, 2012). In addition, Alhassani and Amin (2012) demonstrated that Cobb-chicks given magnetic water significantly increased feed intake on 1^{st} and 4^{th} week of age compared with control group received nonmagnetic water. Indeed, magnetic field increased body weight compared to chickens received nonmagnetic water (Mustafa, 2012).

Groups offered water exposed to different strengths of magnetic field improved the physiological response as indicated by the increase in blood serum globulin, the specific immune protein, phosphorus, an essential mineral for energy metabolism, T_3, an important hormone for bio reactions. In addition, there were an

improvement in blood hematology such as RBCs and Hgb concentration due to offering magnetized water, suggesting an improvement in health status of animals. The beneficial of magnetized water could be attributed to the changes in the water properties such as the reduction in the surface tension, density and viscosity of water leading to improve blood picture and increase the blood ions concentration and therefore the speed of biological reactions (Saeed and Al-Shidede, 2013; El-Hanoun et al., 2017a;b). Similarly, Shacir et al. (2011) found that magnetically- supplemented water (500, 1000 and 1500 gauss) lead to highly significant increase in RBCs, PCV, Hgb concentration compared with control group, with 1500 gauss resulted in superior results than 500 and 1000 gauss. The improvement in blood haematology may be due to magnetic field improves blood flow in the blood vessels and increases the processing the oxygen and nutrients, which necessary for cells to perform their function (Hussen, 2002).

The present results are in agreement with those by Attia et al. (2015), who found that serum albumin and glucose and increased RBCs, Hgb and PCV were significantly increased due to exposure of well water and tap water magnetic fields. In addition, magnetized water enhanced physiological aspects as manifested by a significant elevation in serum glutathione concentration and total proteins concentrations (Khalisa and Aous, 2012). In addition, Rajkovic et al. (2003) who found that rats exposed to 50 HZ electromagnetic field of 20 mT for 18 hours increased level of circulating thyroxine (T_4) and thyroid stimulating hormone (TSH), thus the elevated T_3 and T_4 levels can be explained by the increasing level of TSH. The increase in glucagon and cortisol may explain the increase found herein in glucose of laying hens on 2000 and 3000 gauss treatments (Gorezynska and Wegrzynowies, 1991). In addition, rates exposed to electromagnetic field showed simulative effect on thyroid gland; this effect will naturally result in augmentation of synthesis and secretion activity of thyroid gland and probably increased amount of thyroid hormone (Rajkovic et al., 2006).

The improvement in egg shell quality of hens particularly shell thickness of hens offered magnetic water coincided with the increased in blood pH towards alkalinity which favorable for Ca deposition in shell gland and this may be due to improve metabolism of mineral for eggshell formation. Several studies indicate that electromagnetic fields have positive influence on cellular mechanism development and growth especially in the reproductive system (Iorio et al., 2011; Roychoudhury et al., 2009; Ma et al., 1992).

However, most of the collected evidences supported the theory that magnetic water improved animal performance and physiological status, there were contradictorily results showing that magnetic water did not positively affect animal performance, carcass composition, blood glucose, urea, N_2, K, Mg and P in blood of lambs and goats (Patterson and Chestnutt, 1994; Sargolzehi et al., 2009). In addition, magnetization of water using 500 gauss power with speed of 5, 10 and 15 min for 10 liter of drinking water did not significantly affect performance of broiler chickens (Alhassani and Amin, 2012). The contradictions among different results cited above could be attributed to the strength of magnetic field, exposure period, type of water, and

strains and animal species (El-Hanoun et al., 2017a; b).

Based on the former results, it could be concluded that productive performance, physiological response and shell quality of Gimmizah chicken were improved due to offering magnetized water with 2000 gauss was adequate to provide the beneficial effects.

Table (1): Ingredient and chemical composition (g/kg) of the experimental diet for laying hens.

Ingredients	**%**
Yellow corn	66.33
Soybean meal (48%CP)	24.2
Limestone	7.50
Di-calcium phosphate	1.32
Vit+Min Premix[1]	0.25
NaCl	0.25
DL-methionine	0.15
Total, kg	100
Calculated composition,%	
ME, k. cal/ kg diet	2777
Protein, %	17
C/P ratio	163.4
Methionine, %	0.39
Methionine + Cystine,%	0.67
Lysine, %	0.8
Calcium, %	3.1
Phosphorus available, %	0.37
Analyzed values[2]	
Dry matter, %	90.73
Crude protein, %	16.97
Crude fat, %	2.45
Crude fibre, %	3.96
Ash, %	6.37
Nitorgen free extract, %	60.98

[1]Vit+Min mixture provides per kilogram of diet: vitamin A, 12000 IU; vitamin E, 10 IU; menadione, 3 mg; Vit. D_3, 2200 ICU; riboflavin, 10 mg; Ca pantothenate, 10 mg; nicotinic acid, 20 mg; choline chloride, 500 mg; vitamin B_{12}, 10 μg; vitamin B_6, 1.5 mg; vitamin B_1, 2.2 mg; folic acid, 1 mg; biotin, 50 μg. Trace mineral (milligrams per kilogram of diet): Mn, 55; Zn, 50; Fe, 30; Cu, 10; Se, 0.10;Anti oxidant, 3 mg.

[2] AOAC, 2004

Table (2): Effect of different strengths of magnetized water on productive characteristics of Gimmizah developed hens.

Parameter/ strength	Control	Magnetic water strength, gauss			SEM	P value
		2000	3000	4000		
Egg production, %	49.6	56.3	56.7	56.2	4.61	0.061
Egg weight, g	47.7^{b}	49.6^{a}	49.9^{a}	49.4^{a}	0.042	0.0001
Egg mass, g/hen/day	23.5^{b}	27.7^{a}	28.2^{a}	27.8^{a}	1.40	0.009
Feed intake, g	119^{b}	120^{b}	133^{a}	131^{a}	3.79	0.0001
Feed conversion ratio, g feed/g egg	5.22^{a}	4.41^{b}	4.78^{b}	4.83^{b}	1.47	0.073
Water intake, cm^3	230^{a}	202^{c}	210^{b}	212^{b}	4.31	0.0001
Water/feed ratio	2.12^{a}	1.84^{b}	1.71^{c}	1.73^{c}	0.001	0.0001
Survival ratio, %	93.8	93.8	96 .3	93.8	6.62	0.844
Initial body weight, g	1578	1579	1578	1577	2.6	0.759
Final body weight, g	1869^{b}	1932^{a}	1928^{a}	1876^{b}	7.84	0.004
Body weight gain, g	291^{b}	353^{a}	349^{a}	299^{b}	1.80	0.006

^{a,b,c} Means in the same row with different superscripts are differ significantly ($p \leq 0.05$).

Table (3): Effect of different strengths of magnetized water on egg quality of Gimmizah developed hens.

Parameter/ strength	Control	Magnetic water strength, gauss			SEM	P value
		2000	3000	4000		
Albumin weight, g	29.06^{b}	30.55^{a}	30.51^{a}	29.61^{ab}	1.52	0.015
Yolk weight, g	15.57^{b}	16.01^{ab}	16.39^{a}	16.19^{ab}	0.43	0.032
Yolk color score	6.50	6.64	6.69	6.81	0.153	0.350
Shell weight, g	5.24	5.28	5.33	5.45	0.271	0.937
Shell thickness, µm	359^{b}	364^{ab}	370^{ab}	375^{a}	117	0.005
Haugh unit score	94.25	95.37	95.80	96.47	1.84	0.937

^{a,b} Means in the same row with different superscripts are differ significantly ($p \leq 0.05$) .

Table (4): Effect of different strengths of magnetized water on biochemical parameters of Gimmizah developed hens.

Parameter/ strength	Control	Magnetic water strength, gauss			SEM	P value
		2000	3000	4000		
Glucose, mg/dl	190[b]	206[a]	206[a]	190[b]	3.72	0.003
Total protein, g/dl	5.29	5.59	5.69	5.25	0.071	0.176
Albumin, g/dl	3.54	3.58	3.65	3.37	0.505	0.583
Globulin, g/dl	1.75[b]	2.01[a]	2.04[a]	1.88[b]	0.019	0.048
Alb/ Glo ratio	2.02[a]	1.78[b]	1.79[b]	1.79[b]	0.003	0.041
Calcium, mg/dl	23.52	24.16	24.09	24.08	0.109	0.123
Phosphorus, mg/dl	6.79[b]	7.48[a]	7.49[a]	7.38[a]	0.064	0.014
Ca/ P ratio	3.46	3.23	3.22	3.26	0.019	0.113
T3, ng/ml	0.095[c]	0.169[a]	0.148[b]	0.136[b]	0.0010	0.0001

[a,b,c]Means in the same row with different superscripts are differ significantly (p≤ 0.05). Alb/ Glo ratio = Albumin/ Globulin; Ca = calcium; P = phosphorus; T3 = Triiodothyronine.

Table (5): Effect of different strengths of magnetized water on blood hematological parameters of Gimmizah developed hens.

Parameter/ strength	Control	Magnetic water strength, gauss			SEM	P value
		2000	3000	4000		
RBCs×10^6 cell/mm^3	1.44[b]	1.70[a]	1.74[a]	1.56[ab]	0.011	0.007
Hemoglobin, g/dl	11.71[b]	12.52[a]	12.29[a]	11.76[b]	0.135	0.047
PCV, %	31.33	34.66	33.8	32.89	2.34	0.106
MCV, fl/cell	126.03	126.4	129.16	129.54	7.36	0.332
MCH, pg	45.7	46.96	47.31	46.91	0.882	0.287
MCHC, %	36.22	37.53	37.04	36.22	0.834	0.254
pH blood	7.42[b]	7.54[a]	7.58[a]	7.59[a]	0.002	0.023

[a,b,c] Means in the same row with different superscripts are differ significantly (p≤ 0.05).
RBCs = Red blood cell; PCV = Packed cell volume; MCV = Mean cell volume; MCH = Mean corpuscular hemoglobin; MCHC = Mean corpuscular hemoglobin concentration.

REFERENCES

Agarwal, A.; Aponte-Mellado, A.; Premkumar, B. J.; Shaman, A.; and Gupta, S. 2012. The effects of oxidative stress on female reproduction: a review. Reprod. Bio. Endocrinol 10-49.

Al-Fadul, M. F. M. 2006. The effect of magnetically treated water and diet on the performance of the broiler chicks. MSC. in Poultry Production, Fac. Anim. Prod., University of Khartoum, Sudan.

Alhassani, D. H; and Amin, G. S. 2012. Response of Some Productive Traits of Broiler Chickens to Magnetic Water. International Journal of Poultry Science, 11 (2): 158-160.

Al-Mufarrej, S.; Al-Batshan, H. A.; Shalaby, M. I.; and Shafey, T. M. 2005. The effects of magnetically treated water on the performance and immune system of broiler chickens. International Journal of Poultry Science, 4:96-102.

Al-Nuemi, S. H.; Al-Badry, K. I.; Atteyh, A. J.; Al-Sabeea, W. S.; Ibrahim, F. F.; and Rajab, B. A. 2015. Effect of magnetic water drinking on testis dimension, scrotal circumferen and blood parameters of holstein bulls born in Iraq. Adv. Anim. Vet. Sci., 3(7):413-417.

Association of Official Analytical Chemists (AOAC), 2004. Official methods of analysis of the Association of Official Analytical Chemists, 18th edn. Washington, D.C., USA.

Attia, Y. A.; Abd El Hamid, A. E.; Al-Hanoun, A. M.; Al-Harthi, M. A.; Abdel- Rahman, G. M.; and Abdella, M. M. 2015. Responses the fertility semen quality, blood constituents, immunity and antioxidant status of rabbit buck to type and magnetizing of water. Ann. Anim. Sci., Vol. 15 (2):387-407.

Attia, Y. A.; Burke, W. H.; Yamani, K. A.; and Jensen, L. S. 1995. Energy allotments and performance of broiler breeders. 2-females. Poult Sci., 74: 261–270.

Attia, Y. A.; Bovera, F.; Abd El-Hamid, A. E.; Tag El-Din, A. E.; Al-Harthi, M. A.; and El-Shafy, A. S. 2016. Effect of zinc bacitracin and phytase on growth performance, nutrient digestibility, carcass and meat traits of broilers. J. Anim. Phys. Anim. Nutr., 100: 485–491.

Batmanghelidj, F. 2005. Diamagnetic water. Is it just water? Biomagnetizer biophysics institute. Canada.

Coles, E. H. 1974. Veterinary Clinical Pathology. P.P. 211–213. W. B. Sounders company, phaldelphia, London, Toronto.

Doumas, B. T.; Watson, W. A.; and Briggs, H. G. 1971. Albumin standard and measurement of serum albumin with bromocresol green. Clin. Chem. Acta., 31:87-96.

Eilers, R. I. 1967. Notification of final adaptation of an international method and standard solution for haemoglobin omety: specific for preparation of standard solution. Am. J. Clin. Path., 47: 212-314.

El-Hanoun, A. m.; Wesam, A. F.; and Attia, Y. A. 2017a. Effect of magnetized wall water on Blood components, Immune indices and Semen quality of Egyptian male geese. Egyptian Poultry Science, 37 (I):91-103.

El-Hanoun A. M.; Attia, Y. A.; AL-Harthi, M. A.; Habiba, H. I., and Oliveira, M. C. 2017b. Magnetized drinking water improves productivity and blood parameters in geese. Rev Colomb Cienc Pecu, 30:209-218.

Gholizadeh, M.; Arabshahi, H.; Saeidi, M. R.; and Mahdavi, B. 2008. The Effect of Magnetic Water on Growth and Quality Improvement of Poultry. Middle-East J. Sci. Res., 3:140-144.

Gorezynska, E.; and Wegrzynowies, R. 1991. Glucose hemostasis in rats exposed to magnetic fields. Inves., Radial.,26:1095-1100.

Hafizi-Lotfabadi, L.; Sazgarnia, A.; Mousavi-Far, N.; Karimi, M.; Ghorbani, S.; and Kazemi, M. 2014. The Effect of Extremely Low Frequency Pulsed Electromagnetic Field on In-Vitro Fertilization Success Rate in NMRI Mice. Cell J., 15:310-315.

Helal, M. H. 2002. Magnetism, Developments, Technique and benefits in Agriculture, irrigation and environment. National center for research-Advison on magnetic researches project in Egypt.

Henry, R. J. 1974. Clinical Chemistry, Principles and Techniques. 2nd Edn., Harper and Row, Hagerstown, MD, USA.,525.

Hepler, O. E. 1966. Manual of clinical laboratory methods. Thomas, sparing field. Illinois, USA.

Hollander, C. S.; and Shenkman, L. 1974. Thyroxine and Triiodothyronine. In Methods of Hormone Radioimmunoassay Edited by Jaffe, M. B. and Behrman, H. R. Academic Press. York, San Francisco, London, 161-171.

Hussen, M. A. 2002. Magnetic water treatment is an attractive option. (http://www.1st- in-wellness.com).

Ibrahim, H. 2006. Biophysical properties of magnetized distilled water. Egypt J. Sol., 29:2.

Iorio, R.; DelleMonache, S.; Bennato, F.; Di Bartolomeo, C.; Scrimaglio, R.; and Cinque, B. 2011. Involvement of mitochondrial activity in mediating ELF-EMF stimulatory effect on human sperm motility. Bioelectromagnetics, 32:27.

Khalisa, K. K.; and Aous, M. A. 2012. Effect of magnetic water on some physiological aspects of adult male rabbits. Proceeding of the Eleventh Veterinary Scientific Conference, 120-126.

Khan, T.; Mazid, M.; and Mohammad, F. 2012. A review of ascorbic acid potentialities against oxidative stress induced in plants. J. of Agr. 28, (2), 97–111.

Khudiar, K.; and Ali, A. 2012. Effect of Magnetic Water on Some Physiological Aspects of Adult Male Rabbits Proceeding of the Eleventh. Veterinary Scientific Conference, 120-126.

Lam, M. 2001. Magnetic Water. (www.DrLam.com).

Ma, Y. L.; Ren, H.; Ren, S.; Zhen, E. K.; Hao, G.; and Zhao, Y. W. A. 1992. Study of the effect of magnetized water on enzyme activities by potentiometric enzyme electrode method. J. Tongji. Med. Univ., 12:193-196.

Mustafa, M. G. H. 2012. Effects of magnetically treated water on male sexual traits in broiler breeder during hot climate in summer. Journal of Agriculture Elrafeden, Vol.40 (4):151-161.

Naher, Z. U.; Ali, M.; Biswas, S. K.; Mollah, F. H.; Fatima, P.; and Hossain, M. M. 2013. Effect of oxidative stress in male infertility. Mymensingh Med. J., 22:136-142.

Oyngi, D. O.; Cucherousset, J.; Baker, D. J.; and Britton, J. R. 2012. Effect of temperature on the foraging and growth rate of juvenile common carp, Cyprinuscarpio. J. Thermal Biol., 37(1):89-94.

Patterson, D. C.; and Chestnutt, D. M. B. 1994. The effect of magnetic treatment of drinking water on growth, feed utilisation and carcass composition of lambs. Animal Feed Science and Technology, 46:11-21.

Rajkovic, V.; Matavulj, M.; and Johansson, O. 2006. Light and electron microscopic study of the thyroid gland in rats exposed to power–frequency electromagnetic fields .J. Exp. Biol., 209:3322-3328.

Rajkovic, V.; Matavulj, M.; Gledic, D.; and Lazetic, B. 2003. Evaluation of rat thyroid gland morphophysiological status after three months exposure to 50 Hz electromagnetic field. Tissue Cell 35, 223–231. doi:10.1016/S0040-8166(03)00029-6.

Raymond–Whish, S.; Mayer, L. P.; O`neal, T.; Martinez, A.; Sellers, M. A.; and Christian, P. J. 2007. Drinking Water With uranium below the US. EPA water standard causes estrogen receptor-dependent responses in female mice. Environ Health Perspect, 115:1711-1716.

Rona, Z. 2004. Magnetized water is not mystery. Encyclopedia of Natural Healing, PP:405 (internet).

Roychoudhury, S.; Jedlicka, J.; Parkanyi, V.; Rafay, J.; Ondruska, L.; and Massanyi, P. 2009. Influence of a 50 hz extra low frequency electromagnetic field on spermatozoa motility and fertilization rates in rabbits. J. Environ. Sci. Health A. Tox. Hazard Subst. Environ. Eng., 44:1041-1047.

Saeed, A. A.; and Shayma'a, M. J. Al-Shidede 2013. Effect of magnetized water on weight gain, daily weight gain and feed conversion rate of common carp (CyprinuscarpioL) Modern and traditional journal Science 1:(2) 187–180.

Sargolzehi, M. M.; Rezaee, Rokn-Abadi M.; and Naserian, A. A. 2009. The effects of magnetic water on milk and blood components of lactating Saanen goats. Inter. J. Nutr. Metab., 1:20–24.

SAS, 2009. SAS/STAT User's guide statistics. SAS institute INC., Cary. NC, USA.

Shacir, H.; Abd, A.; Elshamary, K.; and Mosa, G. 2011. Effect using the magnetic water drinking on some hematological traits of broiler chickens The Ministry of Science and Technology.

Shah, D.; and Nagarajan, N. 2013. Luteal insufficiency in first trimester. Indian J. Endocrinol. Metab, 17:44-49.

Shamsaldain, Q. Z.; and Al Rawee, E. A. 2012. Effect of magnetic water on productive efficiency of Awassi sheep. Iraqi Journal of Veterinary Science, Vol., 26(2):129-135.

Tietz, N. W.; Pruden, E. L.; and Siggaard-Andersen, O. 1986. Electrolytes. In: Textbook of Clinical Chemistry. Tietz, N.W. (Editor). W.B. Saunders Co. Philadelphia, 1235-1238.

Tietz, N. W. 1970. Fundamentals of clinical chemistry. W.B. Saunders Company, Philadelphia, 632-633.

Vuilleumier, J. P. 1969. The roche yolk color fan: An instrument for measuring yolk colour. Poult. Sci.; 48: 767-707.

Wagh, P. V.; and Lippes, J. 1993. Human oviductal fluid proteins. V. Identification of human oviductin-I as alpha-fetoprotein. FertilSteril, 59:148-56.

Wang, Y. C.; Lu, J. F.; Mao, Y. X.; Yang, Y.; Shi, Y. X.; and Zhou, Q. H. 2002. Influence of Magnetized Water on the Experimental Hyperlipemia and Atherosclerosis in Rabbits. Shanghai Lab. Anim. Sci., 20:45-51.

Yacout, M. H.; Hassan, A. A.; Khalel M. S.; Shwerab, A. M.; and Abdel-Gawad, E. I. 2015. Effect of Magnetic Water on the Performance of Lactating Goats. J. Dairy Vet. Anim. Res., 2(5):00048. DOI: 10.15406/jdvar.2015.02.00048.

الملخص العربي

تأثير تعريض مياه الشرب لدرجات مختلفة من القوة المغناطيسية على بعض الصفات الإنتاجية والفسيولوجية لإناث دجاج الجميزة المستنبط

صابر شحاته حسن[1] ويوسف عبد الوهاب عطية[2،1] وعلي محمد الشيخ[3] وعبد القادر مبروك عبد القادر[3]

[1]قسم الإنتاج الحيواني والداجني - كليه الزراعة - جامعة دمنهور- مصر

[2]قسم زراعة المناطق الجافة- كلية الارصاد والبيئة وزراعة المناطق الجافة-جامعة الملك عبد العزيز- السعودية

[3]محطة بحوث الدواجن بالصبحية- معهد بحوث الإنتاج الحيواني- مركز البحوث الزراعية-مصر

وزعت 120 دجاجة من سلالة الجميزة عمر 28 أسبوع في تصميم عشوائي تام بالتساوي بين أربع مجموعات بكل مجموعة ثلاثة مكررات وبكل مكررة عشرة دجاجات. ومثلت المجموعة الأولى الكنترول والمجموعات الثلاثة الأخرى تناولت الماء الممغنط بشدة 2000 و3000 و4000 جاوس على الترتيب. وسكنت الدجاجات في عشش أرضية مساحة (2 م × 1.2 م × 2 م) مفروشة بتبن القمح، ودرست الصفات الإنتاجية والفسيولوجية وجودة البيض في الفترة من 28-49 أسبوع من العمر.

وعلى الرغم من عدم وجود فروق بين المجموعات في معدل الحيوية ونسبة النفوق إلا أن المجموعة المعرضة للماء الممغنط بشدة 3000 جاوس كانت الأفضل في نسبة الحيوية مقارنة بالمجموعات الأخرى. زادت كمية العلف المستهلكة وتحسن معدل التحويل الغذائي خاصة مع المجموعات المعاملة بشدة 3000 و4000 جاوس. زاد وزن الألبيومين معنوياً في المجموعات المعاملة بشدة مغناطيس مقدارها 2000 و3000 جاوس مقارنة بمجموعة الكنترول فقط. وزاد سمك القشرة في المجموعة التي شربت مياه معرضة لشدة 4000 جاوس مقارنة بالكنترول فقط. زاد تركيز الجلوكوز للمجموعات التي تناولت مياه معرضة لشدة 2000 و3000 جاوس مقارنة بالكنترول، وزادت نسبة الجلوبيولين مع المجموعة التي تناولت مياه عرضت لشدة 4000 جاوس مقارنة بالكنترول، وانخفضت نسبة الألبيومين للجلوبيولين للمجموعات التي شربت الماء الممغنط مقارنة بالكنترول. زادت نسبة الفوسفور والأس الهيدروجيني مع كل المعاملات مقارنة بالكنترول. زادت نسبة هرمون التراي أيودوثيرونين T3 بشكل معنوي في المجموعات التي شربت مياه ممغنطة مقارنة بالكنترول وخاصة المجموعة التي شربت مياه معرضة لشدة 2000 جاوس مقارنة بجميع المجموعات. زاد عدد خلايا الدم الحمراء والهيموجلوبين بشكل ملحوظ في المجموعات التي تناولت مياه معرضة لشدة 2000 و3000 جاوس مقارنة بالكنترول. ومن ذلك يمكن استنتاج تعرض مياه الصنبور للمجال المغناطسي بشدة 2000 و3000 جاوس أدت إلى تحسن الأداء الإنتاجي وجودة القشرة والاستجابة الفسيولوجية للدجاج المحلي من سلالة الجميزة مع اعتبار تعرض المياه لمجال مغناطيسي قوة 2000 جاوس كافي.