Available online at http://bjas.bajas.edu.iq
https://doi.org/10.37077/25200860.2024.37.2.13
College of Agriculture, University of Basrah

Basrah Journal of Agricultural Sciences

ISSN 1814 – 5868 Basrah J. Agric. Sci., 37(2), 165-176, 2024 E-ISSN: 2520-0860

The Effect of Water Magnetization of Different Locations in Basrah Province on the Productive and Physiological Performance of Local Ducks

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Received 29th May 2024; Accepted 1st November 2024; Available online 31st December 2024

Abstract: The objective of this study is to evaluate the impact of water magnetization technology from various locations in Basrah province on the productive and physiological performance of local ducks. A total of 105 one-day-old, unsexed local ducks were randomly distributed into seven treatments with three replicates per each (5 birds per replicate). The control treatment used reverse osmosis (RO) water. The treatments were: T1: tap water from Zubair city; T2: magnetized tap water from Zubair city; T3: tap water from Ashar City; T4: magnetized tap water from Ashar City; T5: tap water from Qurna city; T6: magnetized tap water from Qurna city. The results showed a significant improvement in overall body weight, weight gain, feed intake, and feed conversion ratio in both the second and control treatments. The second treatment also recorded the highest overall drinking water consumption. Additionally, higher values of red blood cells (RBC), hemoglobin concentration (Hb), packed cell volume (PCV) were observed. The control treatment recorded a lower value of heterophils/ lymphocyte ratio (H/L) compared to other treatments. Mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), and mean corpuscular hemoglobin concentration (MCHC) were unaffected by variations in water treatments. The use of magnetic water treatment led to a decrease in the concentration of cholesterol, urea, aspartate aminotransferase (AST), and alanine aminotransferase (ALT) enzymes in the blood serum. Conversely, the use of magnetic water led to a significant ($p \leq 0.05$) increase in the glucose, total protein, albumin, and globulin concentrations. In conclusion, the utilization of magnetic treatment in drinking water improved the productive and physiological performance of domestic ducks.

Keywords: Ducks, Magnetic water, Productive, Physiological, Performance.

Introduction

Water pollution has become one of the most urgent issues in the world and in Iraq in recent years due to factors such as excessive rainfall, high salinity, environmental pollution, and factory waste being dumped into rivers and lakes. Consequently, the Basrah province is the most affected area in Iraq. Understanding the water quality utilized in poultry processing is essential, as it affects the overall well-being and productivity of the birds (Jacobs *et al*., 2020). Given that clean water is essential for growth and boosts the economic value of poultry products, one issue with water quality is the concentration of

pollutants in the water (Al-Hilali, 2018; Hussain & Al-Salhie, 2022a, b). Water is the most vital substance on the earth, accounts for 80% of animal and plant weight, that supports all their internal processes (Ali & Kavakebian, 2014). It is considered one of the most vital management factors and is crucial as a nutrient. Chemically, it is one of the most significant inorganic compounds in the bodies of the birds. Water is required for the normal functioning of vital activities in the body and primary compound of all cells and tissues in a living bird (Yusuf, *et al*., 2022). Animals regularly consume water, which is the most significant substance for their survival. It is important to analyze the water and understand the pollutants that affect the growth performance of domestic birds such as acidity, alkalinity, smell, color, turbidity, salinity, electrical conductivity, cruelty and the presence of positive and negative ions, pesticides, bacteria, fungi, and algae, high nitrate levels, and harmful microorganisms (Gumus & Gelen, 2023). To provide safe water for poultry, water purification methods had to be developed. The use of chemicals in water purification can negatively impact the health and productivity of the birds, leading to a shift towards more advanced methods of water purification that avoid such negative effects and instead have positive effects on public health and the productivity of animals (Ebrahim & Azab, 2017). Magnetically treated water is a scientifically based technique that has begun to invade many countries of the world and is considered by some as a “magic recipe” due to its benefits by raising the capabilities of the immune system and accelerating the growth of poultry. Drinking magnetically treated water is one of the most important principles of magnetic therapy because water plays a critical role in organizing and activating all vital processes that take place inside the body, which positively affect the performance of animals. The use of magnetically treated water in drinking domestic birds has yielded positive results including increased production performance, reduced mortality and disease, and a reduction in economic costs (Gilani *et al*., 2016). Such study is important because of the declining water quality and increasing its salinity in Basrah province, which has a significant negative effect on physiological and productive performance of farms animals in general, including ducks that live in aquatic environments. So, the current study aimed to determine the impact of water magnetization in three different locations in Basrah province (Zubair, Ashar, and Qurna) on the physiological and productive performance of local ducks.

Materials & Methods

A Study area and birds’ management:

This study was conducted in the duck field of the Department of Animal Production at the College of Agriculture, University of Basrah. A total of 105 one-day-old, unsexed domestic ducklings were used. The birds were randomly distributed into seven treatments with three replicates each (5 birds per replicate) based on completely randomized design. The control treatment supplied reverse osmosis (R.O) water. The treatments were T1: tap water from Zubair city, T2: magnetized tap water from Zubair city. T3: tap water from Ashar City. T4: magnetized tap water from Ashar City. T5: tap water from Qurna city. T6: magnetized tap water from Qurna city. The hall was divided into pen-shaped metal wire partitions, each with an area of 1.20 m2. Each pen was supplied with a plastic feeder and a 5-liter hand fountain. Gas incubators were installed in the hall during the breeding period to maintain a temperature of 32 °C for

the first week of the experiment, then the temperature was gradually reduced at a rate of 2 °C per week to reach 22 °C by the fifth week. Puller fans installed at the top of the hall were used for ventilation. A continuous lighting system (24 hours/ day) was used in this study.

Source of magnetized water:

A specialized apparatus created by the Ministry of Science and Technology's Water Treatment Department was used to prepare the 1500 gauss magnetically treated water. Chemical testing of water from various locations in the Basrah province are presented in Table1.

Table 1: Chemical testing of water from various locations in the Basrah province

pH: power of hydrogen, Salinity: the amount of dissolved salts in water, TDS: total dissolved solids, EC: electrical conductivity, K: Potassium, Cl, Chloride, Na: Sodium.

	Treatments			
Parameters	(RO) Reverse Osmosis	Al-Zubair	Al-Ashar	Qurna
PH	7.32	7.38	8.04	7.76
Salinity $g.l^{-1}$	0.325	1.262	3.774	2.407
TDS $mg.l^{-1}$	0.172	1.415	4.055	2.705
Alkalinity $mg.l^{-1}$	0	23	19	27
EC ms/cm	0.275	1.655	5.825	4.2
K (mg. l^{-1})	0	0.325	0.396	0.365
Cl (mg. l^{-1})	0.601	318	543	434
Na (mg. l^{-1})	0	182	235	202

Birds feeding

Two diets were provided to the domestic ducklings: a starter diet (crude protein 19.42% and 2840.2 kcal/kg metabolizable energy) during days 1-21, and a finisher diet (protein 16.12% and 2750 kcal/kg metabolizable energy) during days 22-42. Table 2 shows the composition and chemical analysis of diets.

Table (2) Diet composition and chemical analysis

Ingredients	Starter ration	Grower ration
Yellow Corn	56.3	51
Barley	9.5	20.8
Wheatgrass bran	0	5
Soybean Meal (44%)	30	19
Limestone	1.2	1.2
Mineral and Vitamin premix	3	3
total	100	100
Crude protein%	19.42	16.12
ME Kcal/kg diet	2840.2	2750
Crude fibre (%)	5.75	4.52
Crude fat (%)	3.21	3.42
Lysine (%)	0.823	0.654
Methionine (%)	0.435	0.343
Ca (%)	0.65	0.60
P (%)	0.26	0.22

Data collection

The water was treated magnetically once a day. Water samples were analyzed to determine their physical, chemical properties, including the presence of negative and positive ions. Additionally, qualitative characteristics such as pH, salinity, total dissolved solids (TDS), alkalinity, electrical conductivity (EC), K (mg. l-1), chloride (Cl) (mg. l-1) and sodium (Na) (mg. l-1) were estimated. Overall body weight (g), total weight gain (g), cumulative feed intake (g), and feed conversion ratio were calculated according to Akomah et al. (2021). Six birds from each treatment were used at the end of the experiment for blood sample collection. Blood was taken from the Achilles vein of the birds using two types of blood collection tubes. The first type without the anticoagulant EDTA was used for serum collection. The second type, containing an EDTA anticoagulant, was used to estimate some hematological parameters. The serum was kept at a temperature of -20 °C to estimate the biochemical parameters such as: cholesterol, glucose, total protein and albumin. These parameters were estimated by using commercial kits purchased from Biolabo SAS, a French company. Serum globulin was measured by subtraction albumin concentration from total protein. The activities of ALT and AST enzymes were measured by using the method described by Tietz (1999). According to Campbell (1995), the hematological parameters included RBC, Hb, PCV, H/L ratio, MCV (fl), MCH (pg), and MCHC (g. l^{-1}) were estimated .

Statistical Analysis

Data were examined using the statistical analysis software SPSS (2019), with a completely randomized design (CRD). The differences between the treatments were tested for significance at the ($P \leq 0.05$) level using Duncan's test (1955).

Results & Discussion

Table (3) shows the effect of water magnetization on the productive performance of local ducks. The results indicate statistically significant differences in overall body weight, final weight gain, cumulative feed intake, cumulative feed conversion efficiency, and cumulative water intake. A significant decrease ($p \leq 0.01$) in final body weight and final weight gain was recorded in treatments T1, T3, and T5 compared to the control treatment (RO), while treatments T2, T4 and T6 recorded the highest rates in these parameters. The lower level of TDS in the control treatment (RO) (table 1) may explain the higher weight and weight gain in ducks. Magnetically treated water is more active than untreated water, which enhances anabolic processes inside the cells and reduces the percentage of catabolism inside the body. This activity in magnetized water may be the cause of the superiority in the treatments of providing water that has been magnetically treated (Gilani *et al*, 2014). On the other hand, the magnetic treatment of water results in decrease surface tension of water, increased surface tension and enhanced permeability in cells. The increased surface tension allows the gut to expand, thereby enhancing absorption nutrient (El-Sabrout & El-Hanoun, 2019). The results of current study are in agreement with the findings of Mahmoud *et al*. (2017), who reported that supplementing of magnetically treated water to broilers led to increased weight gain compared to the control group (normal drinking water) by increasing the activity of the pituitary gland on the release of thyroid-stimulating hormone, which works to secrete thyroxin. The results showed that the

ducks given magnetized water had better feed intake compared to those given non-magnetically treated drinking water. Table (3) shows a significant increase ($p \leq 0.01$) in the final feed intake of the second treatment, which did not differ significantly with the control treatment (RO). The findings are consistent with those of Khalilipour *et al*. (2019), who observed a decrease in feed intake with a high level of TDS in Japanese quails' drinking water. The treatment using (RO) water and magnetized water recorded a significant improvement in feed conversion efficiency compared to the treatments using non magnetized water, indicating that there are significant differences ($p \leq 0.01$) in feed conversion efficiency based on the quality of water used. The high permeability of magnetized water, which aids in nutrient decomposition and subsequently improves nutrient absorption, is the reason for the improvement in feed conversion efficiency rates in the treatment using magnetized water (El Sabry *et al*. 2024). This improvement may be attributed to the fact that magnetized water improves nutrient absorption and feed utilization by increasing the amount of oxygen that reaches the cells and by lowering water surface tension. Drinking water with high level of salinity reduces body weight and feed consumption and worsens feed conversion efficiency due to poor anion and cation balance, which lowers metabolic rate activities in the body (Honarbakhsh *et al*., 2007). Table (3) demonstrates a significant ($P \leq 0.05$) relationship between the quantity of water consumed and the quality of the water used for drinking, with the treatments using magnetized water (T3 and T6) significantly outperforming those using non-magnetized drinking water. The reason for this superiority of the two magnetized water treatments may be attributed to the fact that the passage of water through the magnetic field will reduce the number of associated groups in the water molecule, which facilitates its passage through the membranes of the living cells of the body.

Hematological parameters of local ducks with or without water magnetization are presented in Table 4. When comparing various treatment groups, there was a significant difference ($p \leq 0.05$) in the RBC, PCV, Hb, and heterophils/lymphocytes ratio (H/L). Significantly higher levels ($p \leq 0.05$) of RBC, PCV, and Hb were found in the control and second treatments compared to other treatments. On the other hand, treatments T5 and T4 showed a significant reduction ($p \leq 0.05$) in these indicators. Erythropoietin stimulates RBC production in the bone marrow, however, high TDS and salinity content in water, which reduces the secretion due to renal tissue damage, resulting in decreased in stimulation of erythrocyte synthesis (Scanes & Dridi 2021).

El-Hanoun, *et al*. (2017a) discovered that magnetized water increases erythrocytes and hemoglobin due to enhanced iron attraction from the blood. They also discovered that magnetized water decreases blood viscosity, thereby increasing the movement of red blood cells to transport oxygen to cells and improving Hb mobility.

The release of corticosterone hormone from the adrenal gland is induced by an increase in TDS levels in drinking water, which stresses birds and causes an increase in heterophils, a decrease in lymphocytes, and an increase in the H/L ratio (Scanes & Dridi, 2021)

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Table (3): Effect of drinking water magnetization on the productive performance of local ducks (Mean± SE)

Performance	Treatments							P. Value
	Control	T1	T2	T3	T4	T5	T6	
Initial body weight (gm/bird)	50.00 ±1.00	50.67 ±1.33	51.33 ± 1.20	50.67 ±1.45	50.33 ±1.45	49.33 ±1.20	50.33 ±0.88	0.950
Final body weight (gm/bird)	1483.33^{a} ±2.19	1264.73 ^{d} ±3.18	1423.33^{b} ±2.73	880.33^{f} ±3.28	1270.07^{d} ±1.76	1084.73^{e} ±2.40	1342.33^{c} ±2.33	0.000
Total Body weight gain (gm/bird)	1433.33^{a} ±1.76	1214.03 ^{d} ±2.08	1372.23^{b} ±1.53	829.67^{f} ±1.86	1220.33 ^{d} ±2.03	1035.33^{e} ±1.45	1292.33^{c} ±2.40	0.000
Total feed intake (gm/bird)	2894.73^{a} ±8.31	2584.53 ^{b} ±5.09	2820.53^{a} ±6.34	1812.93^{f} ±6.79	2506.95^{c} ±4.64	2215.33^{e} ±3.33	2646.13^{b} ±6.36	0.000
Total Feed conversion ratio	2.020^{a} ±0.010	2.129^{b} ±0.000	2.055^{a} ±0.003	2.185^{b} ±0.003	2.054^{a} ±0.003	2.140^{b} ±0.000	2.047^{a} ±0.050	0.000
Total water intake (ml/bird)	6262.83^{c} ±18.74	6011.93 ^{d} ±12.15	6533.53^{a} ±13.15	4546.73^{g} ±29.69	5829.63 ^{e} ±6.62	5285.63^{f} ±36.25	6456.95^{b} ± 25.84	0.000

The treatments were: The control treatment used reverse osmosis (RO) water. T1: tap water from Zubair city; T2: magnetized tap water from Zubair city; T3: tap water from Ashar City; T4: magnetized tap water from Ashar City; T5: tap water from Qurna city; T6: magnetized tap water from Qurna city.

The current results agreed with Al-Hilali (2018) who reported that magnetic water treatment for Japanese quails resulted in a significant rise in RBC, Hb, and PCV. The results of Table (4) did not reveal any differences in MCV, MCHC, or MCH between the various experimental treatments. This finding was consistent with that of Abdalla *et al*. (2023), who discovered that the use of magnetic treatment of broiler drinking water had no discernible impact on MCV, MCHC, or MCH.

Table (5) shows the effect of water magnetization on some biochemical serum parameters of domestic ducks. According to the table's findings, both the RO water treatment and the magnetized water treatment significantly reduced the concentration of cholesterol compared to the untreated water. This decrease is attributed to magnetized water's ability to lower blood cholesterol levels by increasing the activity of thyroid gland, which is responsible for secreting thyroxine necessary for the metabolism (Attia *et al*., 2015).

The significant rise in cholesterol levels in the blood serum of birds not given magnetic treatment, it was connected to a lot of salinities. High levels of fatty acids and cholesterol in the blood serum are caused by the high salinity and TDS in the water, that stress birds and increase the secretion of some hormones from the adrenal cortex (Mohammed, 2011). These hormones also lead to elevated fatty acids and fat oxidation in the body.

Table (4): Effect of magnetized water on the hematological traits of local ducks (Mean± SE).

parameters	Treatments							P. Value
	Control	T1	T2	T3	T4	T5	T6	
RBC ($\times 10^6$ /mm^3)	4.70^{a} ± 0.01	4.48^{b} ± 0.01	4.66^{a} ± 0.02	3.57^{f} ±0.02	4.22^{d} ± 0.01	3.73^{e} ± 0.03	4.37^{c} ± 0.03	0.000
Hb (gm/100 ml)	11.29^{a} ±0.01	10.86^{b} ± 0.03	11.42^{a} ± 0.02	9.47^{d} ± 0.03	10.73^{b} ± 0.02	9.86^{c} ± 0.04	10.96^{b} ± 0.03	0.000
PCV (%)	34.26^{a} ± 0.23	32.29^{c} ± 0.30	33.89^{b} ± 0.53	27.37^{g} ± .31	30.48^{e} ± 0.21	29.68^{f} ± 0.61	32.08^{d} ± 0.17	0.000
H/L	0.43^{d} ± 0.003	0.46^{c} ± 0.007	0.44^{cd} ± 0.003	0.55^{a} ± 0.009	0.47^{c} ± 0.008	0.51^{b} ± 0.012	0.47^{c} ± 0.018	0.000
MCV (fl)	74.83 ± 3.16	74.15 ± 2.29	72.77 ± 4.47	76.17 ± 3.55	74.17 ± 2.29	79.67 ± 5.45	73.47 ± 4.46	0.068
MCHC ($g.l^1$)	24.02^{d} ± 0.03	24.27^{cd} ±0.03	24.54^{bcd} ± 0.61	26.55^{a} ± 0.08	25.41^{b} ± 0.14	26.47^{a} ± 0.29	25.09^{bc} ±0.23	0.072
MCH (pg)	32.97 ± 2.04	33.64 ± 1.12	33.71 ± 1.71	34.61 ± 2.15	33.23 ± 2.18	35.22 ± 2.06	34.16 ±3.09	0.155

The treatments were: The control treatment used reverse osmosis (RO) water. T1: tap water from Zubair city; T2: magnetized tap water from Zubair city; T3: tap water from Ashar City; T4: magnetized tap water from Ashar City; T5: tap water from Qurna city; T6: magnetized tap water from Qurna city.

These findings are consistent with those of El-Hanoun, *et al*. (2017a), who found that Egyptian whey from treatments using magnetically treated water contained less cholesterol than that from well water, the control treatment. Additionally, duck serum glucose concentration in various treatments decreased significantly (P≤ 0.05) compared to the RO and magnetically treated water treatments. The second treatment recorded the highest rate of glucose concentration. The concentration of glucose in the duck's serum in magnetized water treatments is superior because the magnetically treated water stimulates both aerobic and anaerobic metabolic decomposition processes, which lead to a high level of energy production within living cells and a decreased process of protein catabolism due to the rise in blood sugar and protein levels (Hassan *et al*., 2018). For non-magnetically treated water parameters, the glucose concentration is significantly lower (P ≤0.05). Consuming large amounts of saline water puts the body under metabolic stress, increasing the energy required to maintain sodium/potassium gradient and lowering serum glucose concentration (Hassan *et al*., 2018). The treatments using magnetized water and RO water were significantly superior compared to the untreated water treatments in terms of the total protein, albumin, and globulin concentration in duck serum. Table (5) demonstrates a significant effect (P≤0.05) of water quality on total protein, albumin, and globulin levels. Magnetized water plays a significant role in the process of protein synthesis and contributes to a decrease in the

process of protein catabolism, which may account for the superiority of treatments using magnetized water (El-Hanoun *et al*., 2017a). Since lymphocytes are responsible for producing this protein, which is an indicator of the activation of the immune system, an increase in the concentration of globulin in the blood serum led to an improvement in the parameters of the birds that drank magnetically treated water. These findings corroborated those of Soliman *et al*. (2021), who found that the treatment using magnetized water had higher total protein concentration than regular water treatments. High salinity and TDS of the water, stress birds and cause increased secretion of the hormone corticosterone, which breaks down protein for energy production, leading to a significant decrease in total protein, albumin, and globulin in the untreated water treatments (Mohammed, 2011). These findings are consistent with those of Hussain & Al-Salhie, (2022b), who discovered that using saline water in broiler resulted in decreased serum total protein, albumin, and globulin concentration. Because salinity water restricts the ability of amino acids to fuse together, thus protein synthesis is decreased (Emam *et al.*, 2017). Table (5) also shows a significant decrease ($P \leq 0.05$) in serum uric acid levels in ducks treated with RO water and magnetically treated water. The reason for the low level of uric acid in the magnetically treated water treatments is due to the high concentration of total protein in the blood serum. High TDS level is evidenced by the decrease in protein concentration and rise in non-protein nitrogen (uric acid and creatinine) levels in the blood serum of groups given untreated water, as well as changes in serum levels of glucose, protein, and uric acid. Saline stress, which increase corticosterone levels, leads to formation of glucose from increased protein catabolism by the process of gluconeogenesis (Mohammed, 2011). These findings are consistent with those of Attia et al. (2015) and El-Hanoun *et al*. (2017a) who reported that using magnetically treated water reduced the amount of uric acid levels in male geese serum compared to untreated water. Table (5) also shows a significant decrease ($P<0.05$) in the activities of enzymes ALT and AST in the serum of local ducks treated with magnetized water and RO water. According to El-Hanoun *et al.* (2017b) suggested that the function of these two enzymes transfer the amino group of amino acids to keto acids. In serum, ALT and AST enzyme activity were found to be negatively correlated with total protein concentration (Kaplan,1985). The reason for the significant increase ($P<0.05$) in the level of these enzymes in the non-magnetically treated water can be attributed to the elevated level of corticosterone hormone resulting from the salt stress experienced by these groups (Emam *et al.,* 2019). These findings are consistent with those of Hussain & Al-Salhie (2022b), who found that high concentration salinity and TDS water caused a significant rise in the levels of the enzymes ALT and AST in the broiler serum

Table (5) Effect of water magnetization on blood serum parameters of local ducks (Mean± SE)

parameters	treatments							P. Value
	Control	T1	T2	T3	T4	T5	T6	
Cholesterol (mg.100 ml.$^{-1}$)	161.67^{c} ±0.98	174.67^{a} ± 1.20	165.67^{b} ± 1.08	177.67^{a} ± 1.32	167.33^{b} ± 1.76	176.00^{a} ± 1.00	168.67^{b} ± 1.92	.000
Glucose (mg/100 ml.$^{-1}$)	149.00^{b} ± 0.58	146.00^{b} ± 1.45	152.67^{a} ± 0.88	130.33^{e} ± 0.95	142.67^{c} ±1.34	135.67^{d} ± 1.09	148.33^{b} ± 1.45	0.000
Total protein (gm/100 ml.$^{-1}$)	5.43^{ab} ± 0.08	5.25^{b} ± 0.11	5.59^{a} ± 0.10	4.86^{c} ± 0.06	5.05^{bc} ± 0.08	4.27^{d} ±0.05	4.64^{c} ± 0.06	0.012
Albumin (gm/100 ml.$^{-1}$)	2.18^{a} ± 0.04	2.17^{a} ± 0.03	2.24^{a} ± 0.06	1.90^{bc} ± 0.05	1.96^{b} ± 0.05	1.80^{c} ± 0.06	1.88^{bc} ± 0.09	0.017
Globulin (gm/100 ml.$^{-1}$)	3.24^{b} ± 0.04	3.17^{b} ± 0.06	3.34^{a} ± 0.04	2.95^{e} ± 0.04	3.08^{c} ± 0.08	2.43^{f} ± 0.05	2.74^{d} ± 0.06	0.005
Uric Acid (mg/100 ml.$^{-1}$)	2.73^{f} ± 0.01	2.98^{e} ± 0.02	2.72^{f} ± 0.02	3.96^{a} ± 0.03	3.37^{c} ± 0.02	3.57^{b} ± 0.03	3.12^{d} ± 0.04	0.000
AST (UI.L^{-1})	61.33^{d} ± 0.33	66.33^{bc} ± 0.67	61.67^{d} ± 0.89	72.67^{a} ± 1.21	64.67^{c} ± 1.28	68.33^{b} ± 0.88	61.33^{d} ± 0.66	0.005
ALT (UI.L^{-1})	24.13^{c} ±0.19	27.33^{b} ± 0.67	23.67^{c} ± 0.67	34.00^{a} ± 1.00	24.33^{c} ± 1.20	28.00^{b} ± 1.15	23.33^{c} ± 0.33	0.010

The treatments were: The control treatment used reverse osmosis (RO) water. T1: tap water from Zubair city; T2: magnetized tap water from Zubair city; T3: tap water from Ashar City; T4: magnetized tap water from Ashar City; T5: tap water from Qurna city; T6: magnetized tap water from Qurna city.

Conclusion

According to the current study's findings, providing domestic ducks with magnetized water improved their growth performance by increasing final body weight and feed conversion efficiency. Additionally, it improved the hematological and biochemical parameters of the blood, and improved liver function as demonstrated by a decrease in AST and ALT enzyme activity.

Acknowledgements

We would like to extend our gratitude to the University of Basrah, particularly the College of Agriculture and poultry field management team for providing the essential resources and support to conduct this research.

Contributions of Authors

S.K.M.A., carried out the experiment in the field and collected the data.

K.C.K.A., constructed the idea and hypothesis for research; planned the methodology; project administration.

S.M.A., data analysis; wrote the manuscript.

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Conflicts of interest

The authors declare no conflicts of interest.

Ethical approval

All ethical guidelines related to Fish and care issued by national and international organizations were implemented in this report.

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تأثير مغنطة الماء لاماكن مختلفة من محافظة البصرة في الأداء الإنتاجي والفسلجي للبط المحلي

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المستخلص: هدفت الدراسة الحالية الى تقييم استخدام تقنية مغنطة الماء من مواقع مختلفة في محافظة البصرة في الاداء الانتاجي والفسيولوجي للبط المحلي. استخدم 105فرخاً من افراخ البط المحلي بعمر يوم واحد، غير مجنسة وزعت بشكل عشوائي على سبع معاملات بواقع ثلاث مكررات ولكل مكرر 5 طيور. وكانت معاملات الدراسة كالاتي: معاملة السيطرة اعطيت الطيور مياه (R.O) . T1: مياه الاسالة المأخوذة من مدينة الزبير، T2: مياه الاسالة المأخوذة من مدينة الزبير بعد مغنطتها. T3: مياه الاسالة المأخوذة من مدينة العشار. T4: مياه الاسالة المأخوذة من مدينة العشار بعد مغنطتها. T5: مياه الاسالة المأخوذة من مدينة القرنة. T6: مياه الاسالة المأخوذة من مدينة القرنة بعد مغنطتها. أظهرت النتائج تحسنا معنوياً ($p \leq 0.05$) في وزن الجسم الحي، والزيادة الوزنية الكلية، وكمية العلف المستهلك، وتحسن كفاءة التحويل الغذائي في المعاملات الثانية والسيطرة. كما سجلت المعاملة الثانية أكبر كمية ماء متناوله. سجلت المعاملتين الثانية والسيطرة ارتفاعاً معنوياً ($p \leq 0.05$) في عدد خلايا الدم الحمراء وتركيز الهيموغلوبين وحجم خلايا الدم المرصوصة فضلاً عن تسجيل معاملة السيطرة اقل نسبة للخلايا المتغايرة الى اللمفاوية مقارنة بالمعاملات الأخرى. لم تتأثر MCV وMCH وMCHC باختلاف نوعية المياه. أدى استخدام مغنطة المياه إلى انخفاض معنوي ($p \leq 0.05$) في تركيز الكوليسترول وحامض اليوريك وإنزيمات AST وALT في مصل الدم. من ناحية أخرى، أدى استخدام الماء الممغنط إلى زيادة معنوية ($p \leq 0.05$) في تركيز الكلوكوز والبروتين الكلي والألبومين والجلوبيولين. يمكن الاستنتاج بإن استخدام تقنية مغنطة مياه الشرب تؤدي الى تحسن الأداء الإنتاجي والحالة الفسيولوجية للبط المحلي.

الكلمة المفتاحية:

الكلمات المفتاحية: البط، الماء الممغنط، الاداء الانتاجي، الاداء الفسلجي.