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Effect of water and feed quality on certain mineral elements (sodium, calcium, and chloride) in the blood serum of broiler males and females.

Mohamed N. Hussein, Rahman M. Msawil Al-Shouki Nawar K. Al-Saeedi, Saja Kadhim Saber Al-Zuhairi, Marwa Q. Massad

[12345]Department of Animal Production, College of Agriculture and Marshes, University of Thi-Qar –Iraq.
E-mail: mohamed-hu@utq.edu.iq

nawarkhalid@utq.edu.iq

rahman-m@utq.edu.iq

saja-k@utq.edu.iq

marwa-q@utq.edu.iq

Abstract

The study was carried out in one of the local fields in Nasiriyah District, Dhi Qar Governorate, from October 20 to November 25, 2023. To investigate the influence of feed and water quality on the concentration of certain mineral components in the blood serum of male and female broilers, I produced 300 one-day-old, sexed chicks and divided them into six treatments, each with three replicates. The study found that drinking water with RO had significantly higher levels of sodium ($p \leq 0.05$) than other water parameters. While there was no effect of the form of food or the sex of the broilers on the experimental parameters, Magnetic and RO water significantly outperformed Tap water in terms of calcium content in broiler blood serum ($p \leq 0.05$), Feed type and sex had no effect on the results of the study. The RO water treatment outperformed magnetized and Tap water treatments ($p \leq 0.05$) in terms of chloride content in male and female broiler blood serum. The form of feed and gender had no significant effect on the above-mentioned element concentration.

Keywords: Mash, Pellet, Magnetic water, RO water, Tap water, Mineral elements, Male broilers, Female broilers.

I. Introduction

The poultry industry has advanced significantly in the last few decades, and in order to guarantee improved bird performance and excellent health, it is necessary to provide and monitor the quality of water used in production areas Aziz et al. (2013). As a result, drinking water purification methods for mother flocks, laying hens, and broilers have arisen in modern poultry areas. One of these methods is the purification of drinking water with magnetic technologies, which aids in the search for ways to raise the standard of water used in animal husbandry and agriculture generally Mustafa (2007). Reverse Osmosis (RO) technology has also evolved as an efficient technique of achieving high-quality water desalination by putting drinking water through a number of processes to reduce its excessive salt. Throughout the world, magnetic drinking water treatment technology has been widely used in poultry production regions to improve output by providing water with superior physical, chemical, and microbiological qualities without the need for chemicals Gilani et al. (2014). Water that has been magnetically treated changes the chemical and physical properties of blood and increases blood flow in veins and arteries, which affects bird production Aziz et al. (2013). In poultry operations, nutrition is frequently seen to be one of the most important factors to take into account. Its economic relevance stems

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from the fact that it accounts for 65-75% of overall production costs and has an influence on bird productivity Singh (1993). The quality of feed offered to poultry, in particular, has a significant impact on its productive performance, and the shape of the feed is one of the qualitative aspects that influences both the digestive process and the quantity of feed wasted Amerah et al. (2007). Various feed varieties are used in poultry farms, such as pulverised, tablets, and crumbs. According to Al-Zubaidi (1986), these physical forms of feed are among the factors determining feed price and production performance. The emergence of modern breeds and lines recognised for their rapid growth and excellent feed conversion efficiency is the consequence of broiler genetic improvement. At 35 days to marketing, broilers can weigh up to 2 kg on average. A number of factors, including high feed intake, ambient circumstances, nutritional density, feed physical condition, and others, might affect this growth rate Ahamed & Abbas (2013). Because of this, the chicken industry has recently demonstrated a rising interest in feed in an effort to get the best potential production performance.

Therefore, the goal of the current study was to determine how the composition of the water used for drinking and feed affected the levels of calcium, sodium, and chloride in the blood serum of broiler males and females.

II. **Materials & Methods**

The 300 chicks were purchased from a private hatchery in the Babil Governorate. They were split into male and female breeds. Male identification was made possible by inserting a plastic ring, sized for each bird, into its leg. After that, the chicks were split up into six treatments, each with three replicates, which were done in the following order:

Tap water with mash feed is the first treatment (control).

Tap water with pellet feed constitutes the second treatment (control). Magnetized water combined with mash feed is the third treatment.

Fourth treatment: pellet feed and magnetized water.

Mash feed and RO water is the fifth treatment.

Sixth treatment: pellet feed and RO water.

The cage-rearing approach was used, with 16 chickens in each cage. During the first week, they were given a chick-feeding tray and a one-liter fountain water bottle. The breeding facility was then equipped with automated feeds and water nipple drinkers. The chicks were given unrestricted access to fodder and water, as well as diets for feeding. For every stage of the trial, three different kinds of meals were provided by the Ghadeer Babel Feed Factory:

1: The starting diet offers 21% protein and 2966 kcal per kilogramme of feed for infants aged one to seven days.

2: From the age of 7 to 21 days, a growth diet contains 20% protein and 2968 kilocalories per kilogram of feed.

3: The last meal between the ages of 21 and 35 days provides 18% protein and 3000 kilocalories per kilogram of feed.

For the different experimental treatments, three different types of water were provided: strongly magnetized water (1000 Gauss), RO water, and tap water. Chemical, physical, and microbiological analyses were performed on each type of water.

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The water used in the study was analyzed chemically, physically, and microbiologically (mean, ± standard error) in Table 1.

Water / Adjectives	Tap	Magnetized Gauss (1500)	RO
pH	7.70[c] 0.02±	7.88[b] 0.01±	8.30[a] 0.06±
DO2 (mg/L)	9.10[c] 0.06±	9.48[b] 0.25±	10.13[a] 0.01±
Chlorides (ppm)	44.00[c] 3.00±	31.77[b] 0.58±	21.00[a] 1.00±
Ca (mg/L)	20.60[b] 1.80±	17.45[b] 1.25±	3.80[a] 0.60±
Na (mg/L)	300.00[b] 1.95±	297.85[b] 2.01±	15.19[a] 0.95±
K (mg/L)	15.13[b] 0.85±	14.35[b] 1.00±	1.55[a] 0.08±
Nitrate (mg/L)	1.35[b] 0.24±	1.20[b] 0.23±	0.57[a] 0.03±
EC(µs/cm)	15.40[b] 0.25±	16.20[b] 0.20±	92.03[a] 2.35±
TDS (mg/L)	5132.25[b] 80.00±	4762.83[b] 44.39±	130.45[a] 14.03±
Turbidity (NTU)	9.19[c] 0.18±	2.11[b] 0.03±	0.18[a] 0.05±
Total hardness (mg/L)	15.14±850.11[b]	14.40±801.25[b]	1.13±153.18[a]
Total bacteria $\times 10^3$ (mg/L)	28.02±200.25[b]	7.35±103.32[a]	0.95±67.14[a]

*Differing letters in the rows denote statistically significant ($p \leq 0.05$) variations in the mean.

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Physical and chemical tests of the water were carried out in the central laboratory of the College of Agriculture, University of Basra, while microbiological analyzes were carried out in the Nutrition Laboratory / Department of Animal Production / College of Agriculture and Marshes.

Calcium concentration measurement

A spectrophotometer was used to take the reading at 570 nm, as suggested by Wotton(1964), and the analysis kit was completed using the examination procedures outlined in the brochure that was included with the kit and produced by Biolabo to get a blue color in an alkaline solution, calcium was estimated using the following equation.

Calcium content in blood serum (g/100 ml) = (reading from sample) / (reading from standard solution) ×10.

Sodium concentration measurement

The analysis kit was utilized, and the examination procedures were carried out in accordance with the brochure that was produced by the Jordanian business AFCO and connected to the kit. As stated by Wotton (1964), a spectrophotometer was used to get the reading at a wavelength of 630 nm. The sodium content was then computed using the following equation:

Blood serum sodium content (g/100 ml plasma) = (sample reading) / (standard solution reading) ×150.

Chloride concentration measurement:

An analysis kit, made by a spectrophotometer was used to measure the concentration of chloride in the blood serum. The procedure for the kit's inspection was based on a booklet that was connected to it. According to Wotton (1964), the measurement was made at a wavelength of 492 nm using a spectrophotometer. The concentration of chloride was computed on... In light of the subsequent equation:

Blood serum chloride content (mmol/l) = (sample reading) / (standard solution reading) ×100.

The data was statistically examined using the statistical software SPSS (2018), and the statistical application Gen Stat 2016 was utilized to evaluate the significance of notable variations in the means in order to get the LSD value.

III. Results and Discussion

Sodium concentration

Table 2 illustrates how drinking water quality and feed type affect sodium concentrations in male and female broiler blood serum. The study found a significant ($p \leq 0.05$) correlation between drinking water quality and sodium levels in the blood serum. RO water treatment resulted in a considerable reduction compared to tap water and magnetized water treatments (120.27, 182.81, and 172.79) g/100 ml plasma, respectively these results are consistent with Yu et al. (2022), which found that the greater the concentration of sodium in water, the greater its concentration in blood serum. There was no significant difference ($p \geq 0.05$) in sodium content in blood serum between male and female broilers based on feed type consistent with Abdel-Wareth (2018), sex, or interaction between them.

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The impact of feed form and water quality on the sodium content in broiler blood serum (mg/100 ml blood serum, standard error) is displayed in Table No. (2).

Water	Feed	Sex		Interaction between water and feed
		Male	Female	
Tap water	Mash	180.25±17.05	172.51±13.01	176.38±20.19
	Pellet	195.20±6.03	183.30±16.56	189.25±18.68
Magnetized	Mash	172.11±6.25	176.31±3.82	174.21±5.54
	Pellet	173.04±17.16	169.74±10.18	171.39±15.86
RO	Mash	122.12±3.48	125.20±11.73	123.66±13.28
	Pellet	120.93±18.90	112.85±7.18	116.89±14.45
				Average water effect
intersection water and sex	Tap water	187.72±14.12	177.90±11.64	182.81±11.25
	Magnetized	172.57±12.19	173.02±12.51	172.79±13.23
	RO	121.52±10.28	119.02±11.50	120.27±12.78
				Average feed effect
intersection feed and sex	Mash	158.16±14.26	158.00±20.28	158.08±12.41
	Pellet	163.05±19.20	155.30±18.01	159.17±13.25
Average Sex		160.60±12.63	156.64±13.15	

LSD 0.05						
Water	feed	Sex	Water× feed	Water×Sex	feed×Sex	Water× feed×Sex

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31.20	NS	NS	NS	NS	NS	NS

Calcium concentration

The quality of drinking water significantly outperforms the content of calcium in the blood serum of male and female broilers ($p \leq 0.05$) as shown in Table No. (3). The RO water and magnetized water treatments were superior to the tap water treatment, with calcium concentration rates reaching (13.79, 12.89, and 11.34) g/100 ml of plasma, respectively. Magnetized water may have this advantage because it increases ion dissolution through cell membranes and the flow and mobility of calcium ions, particularly in the blood Mccreery (2004). These results were similar with what was suggested by Gilani et al. (2014) in an increase for calcium in the blood serum of broilers in the magnetized water treatment compared to the tap water treatment.

There was no significant difference ($p \geq 0.05$) in calcium content in blood serum between male and female broilers based on feed type consistent with Abdel-Wareth (2018), or sex, or interference between them.

Table No. (3) Displays the impact of feed type and water quality on the calcium content in broiler blood serum (mg/100 ml blood serum, standard error).

Water	feed	Sex		Interaction between water and feed
		Male	Female	
Tap water	Mash	11.03±1.69	11.15±0.93	11.09±1.13
	Pellet	11.95±0.07	11.23±1.20	11.59±0.79
Magnetized	Mash	12.90±1.11	12.02±0.97	12.46±1.07
	Pellet	13.20±1.65	13.45±1.08	13.30±1.25
RO	Mash	13.50±0.86	13.80±1.17	13.65±0.94
	Pellet	13.95±1.33	13.90±1.22	13.92±1.11
				Average water effect
intersection water and sex	Tap water	11.49±1.22	11.19±0.96	11.34±1.05
	Magnetized	13.05±1.27	12.74±0.93	12.89±1.11
	RO	13.72±1.16	13.85±1.69	13.79±1.20
				Average feed effect
intersection feed and sex	Mash	12.48±1.69	12.32±1.14	12.40±1.21

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	Pellet		13.03±1.13	12.86±1.28		12.95±1.02
Average Sex			12.76±1.66	12.59±1.47		
LSD 0.05						
Water	feed	Sex	feed ×Water	Sex×Water	Sex×feed	Sex×feed ×Water
0.95	NS	NS	NS	NS	NS	NS

Chloride concentration

Table No. 4 shows that there is a significant superiority (p≤0.05) for the quality of drinking water in the concentration of chloride in the blood serum of male and female broilers. The RO water treatment recorded a significant superiority in the chloride concentration compared to the magnetic water and tap water treatments, with concentration rates reaching chloride (55.70, 44.54, and 51.08) mmol/L, respectively these results did not agree with what was reported by Yu et al. (2022). The explanation may be due to the use of chlorine in the water sterilization process in excessive quantities without eliminating it after sterilization. The table did not suggest a significant difference (p≥0.05) for feed type consistent with Abdel-Wareth (2018), or sex, or interference between them.

Table No. (4) Displays the impact of feed type and water quality on the amount of chloride in broiler blood serum (mg/100 ml blood serum, standard error).

Water	feed	Sex		Interaction between water and feed
		Male	Female	
Tap	Mash	52.82±3.82	50.60±3.20	51.71±3.80
	Pellet	48.09±1.42	52.82±2.79	50.45±5.10
Magnetized	Mash	45.25±7.02	43.85±3.63	44.55±4.06
	Pellet	43.90±3.20	45.17±11.18	44.54±3.28
RO	Mash	56.38±1.02	53.40±2.27	54.89±3.29
	Pellet	55.46±1.98	57.58±2.93	56.52±1.54
				Average water effect
intersection water and sex	Tap water	50.45±5.43	51.72±1.59	51.08±7.17
	Magnetized	44.57±5.92	44.51±6.06	44.54±5.84
	RO	55.92±7.75	55.49±6.48	55.70±6.97
				Average feed effect

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intersection feed and sex	Mash	51.48±9.85	49.28±11.04	50.38±10.21
	Pellet	49.15±2.37	53.85±10.09	50.50±8.76
Average Sex		50.31±7.65	51.56±9.40	

LSD 0.05						
Water	feed	Sex	Water× feed	Sex×Water	Sex×feed	Sex×feed ×Water
4.12	NS	NS	NS	NS	NS	NS

IV. Conclusion

We deduce from the findings of this study that the concentration of certain mineral elements in the blood serum of male and female broilers is directly impacted by the quality of their drinking water. When the blood serum's elemental content is positively correlated with the quality of the water, we generate healthy broilers. Appropriate economic efficiency and robustness against illnesses.

However, there were no changes in the blood serum of broiler chickens due to the kind of sex, the type of diet, or their interactions.

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