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Evaluation of effect of treated water on production traits of broiler chickens

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Abstract

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The interest in water purification technologies in animal husbandry has significantly increased. This necessitates seeking and investigating different methods for processing the water for consumption in poultry farming. For this reason, our research was aimed at evaluation of the effects of different types of treated water on growth performance of broiler chickens, slaughter traits and some meat physicochemical parameters.

The experiment included 300 day-old male Ross 308 chickens, divided into 5 groups (each group with three replications with 20 chicks), and reared until 49 days of age. Depending on the type of tested water, the birds were distributed in the following groups: group I (control) received tap water; group II received water purified by reverse osmosis; group III received magnetic water; group IV – received hydrogen water; group V received alkaline water.

At the end of the experiment, a trend for higher live weight was observed in the experimental groups receiving alkaline water and reverse osmosis water, with differences compared to the control group ranging from 5.99% to 7.28%, respectively ($P = 0.054$).The effects of hydrogen and magnetically treated water on final live weight were small and insignificant ($P > 0.05$).

A significantly higher slaughter yield was reported in all experimental groups ($P < 0.05$). The groups that received water treated with osmosis, hydrogen and alkaline water had a significantly higher carcass weight. No significant differences were found in the other parameters – thigh, breast, wings, gizzard and heart. No significant between-group differences in the physicochemical properties of the meat were demonstrated throughout the experiment.

Keywords: drinking water; broiler chickens; performance; carcass characteristics; meat physicochemical parameters

Introduction

Climatic changes and the growth of livestock husbandry, in particular poultry farming as one of the most intensively developing sectors, necessitate the exploration of new methods for more ecological husbandry. In this sense, for optimal growth and production, water quality is an important but often overlooked factor in the development of this sub-sector. When birds consume low-quality or contaminated water, a decrease in bird productive performance is observed, especially in broiler chickens (Maharjan et al., 2016).

It is acknowledged that birds can survive up to three weeks without food, but only a few days without water (Lardy et al., 2008). Broiler chickens are reported to consume 1.5 to 2 times more water than feed (Amaral, 2004). Water is considered the most important nutrient for animals. It makes up over 98% of all molecules in the body and is essential for biological processes. Water plays an essential role in growth, digestion and metabolic processes, regulates body temperature and the immune system function (Lardy and Stoltenowq, 1999). El-Deeb et al. (2020) reported water as one of the main factors of great importance for the physiological processes in birds. The climatic changes and mainly high ambient temperature cause heat stress in birds, which in turn entails great production losses related to growth, feed intake and high mortality rate (Ramiah et al., 2019). These changes are among the biggest challenges in livestock husbandry (Chung et al., 2019a). Broiler chickens are much more prone to heat stress due to their higher metabolic activity (Wen et al., 2020).

Research on functional foods is currently important and extensive, but the physiological functions and benefit of water's effect on health are still not well studied (Shirahata, 2002). In recent years, the interest in technologies for purification of water used in livestock husbandry has significantly increased. Unfortunately, the information in the available literature is too scarce and contradictory. This necessitates seeking and investigating different methods for processing the water for consumption in poultry farms.

For this reason, the purpose of our research was focused on the effects on growth performance, slaughter traits and some physicochemical indicators of meat in broiler chickens consuming different types of treated water – reverse osmosis, magnetic, hydrogen and alkaline.

Material and Methods

Experimental design

The experiment was conducted in the Experimental base of the Agricultural Institute – Stara Zagora. The goal of the research was to evaluate the effect of four treated water types on growth performance, slaughter traits and some physicochemical parameters of poultry meat.

The experiment included 300 day-old male Ross 308 chickens, divided into 5 groups (each group with three replications with 20 chicks), and reared on the floor until 49 days of age. All groups received compound feed in line with the requirements of the hybrid for the respective growth period (starter, grower and finisher); microclimatic parameters were uniform for all groups. The composition and nutritional value of used compound feed is presented in table 1.

The following groups were formed depending on the type of tested water:

Group I (control) – received water from a tap water supply; group II received water purified by reverse osmosis by a Levante 3.0 direct flow reverse osmosis system without water tank; group III received water treated by MagStator™ – a magnetohydrodynamic generator. This is a permanent ferrite magnet connected to a close electro conductive circuit, with magnetic field lines perpendicular to the fluid flow with magnetic field induction of 0.1 T±2 %; group IV – received hydrogen water produced by DIO Hydrogen device connected directly to the water supply pipe; group V – received alkaline water obtained with alkaline water ionizer Chanson Miracle Max Plus. The water treatment methods used are compatible with BSS and EU drinking water standards.

Table 1. The composition and nutritional value of compound feed

Ingredients, %	Periods		
	Starter 1–10 day	Grower 11–28 day	Finisher 29–49 day
Wheat	52.29	57.67	62.87
Lupine	5.00	5.00	5.00
Soybean meal	30.00	24.00	18.00
Sunflower meal	5.00	5.00	5.00
Sunflower oil	4.00	5.00	6.00
Dicalcium phosphate	1.95	1.66	1.50
Limestone	0.60	0.60	0.66
Salt	0.20	0.20	0.20
Premix	0.20	0.20	0.20
L-Lysine-98%	0.28	0.22	0.17
Methionine	0.18	0.15	0.10
Salgard	0.20	0.20	0.20
Optizin	0.10	0.10	0.10
Calculated nutritive value			
Metabolizable energy (Kcal/kg)	2912	3018	3118
Crude protein, % Crude fat, %	22.38 5.55	20.35 6.55	18.29 7.55
Crude fiber, %	5.13	4.83	4.54
Lysine, %	1.44	1.23	1.03
Methionine+Cystine, %	0.85	0.76	0.65
Ca, %	1.01	0.90	0.85
Available P, %	0.50	0.45	0.42

[1]Composition/kg of premix: Vit. A: 6 000 000 IU; Vit D3: 2 500 000 IU; Vit. E: 45 000 mg; Vit B1: 2 000 mg; Vit B2: 4 500 mg; Vit B6: 2 500 mg; Pantothenic acid: 10 000 mg; Biotin: 125 mg; Vit. K3: 2 000 mg; Folic acid: 1 100 mg; Nicotinic acid: 32 500 mg; Vit. B12: 10 mg; Selenium: 150 mg; Manganese: 60 000 mg; Iron: 12 500 mg; Zinc: 45 000 mg; Copper: 7 500 mg; Iodine: 500 mg
Source: Authors' own elaboration

Growth performance

All broilers were provided with food and water ad libitum. The evaluated parameters were the live body weight, feed intake and feed conversion ratio. The live weight of broilers was determined by individual weighing at 10, 28 and 49 days of age in the morning, following the same order of groups. On this basis, weight gain was also determined. The feed intake was measured for the periods from 1 to 10 days of age, from 11 to 28 days of age and from 29 to 49 days of age. Feed conversion ratio was calculated on the basis of feed intake and weight gain. Water was provided through bell type drinkers, connected to a system supplying the respective water type. Treated water was charged in the system at 8-hour intervals.

Carcass analysis

At the end of the experiment at 49 days of age, 6 chickens with body weight equal to group average were selected for complete slaughter analysis and carcass cut analysis. The slaughter yield was determined as a proportion of preslaughter live weight. The weights of respective cuts – breast with bone, legs (thigh and drumstick), wings, back are presented as proportion of grill weight, whereas the edible offal (heart, liver, gizzard) – in relation to slaughter weight.

Physicochemical characteristics of meat

The pH of both muscles (breast and thigh) was determined 24 hours post mortem (pH_{24}) by means of Testo 205 pH-meter.

The physicochemical analysis of meat – colour, water holding capacity and cooking loss was performed on skinless breast (m. Pectoralis) and thigh muscles (m. Femorotibialis).

The meat colour was evaluated in the CIE L*, a*, b* colour space with a colorimeter Minolta CR-400 (Konica Minolta, Osaka, Japan), with illuminate D65 and observation angle 2°. The colour coordinates L* (lightness), a* (redness) and b* (yellowness) were measured on the 24th hour post mortem

Twenty-four hours post mortem, water holding capacity of meat was determined by the classical method of Grau et al. (1953), described by Zahariev and Pinkas (1979), and modified by Petrov (1982).

Cooking loss of meat was determined by cooking breast and thigh meat samples in a forced air convection oven at 150° C for 20 minutes. The method was based on attaining a temperature of 75–80 °C in the sample core (Patracci and Baeza, 2011).

Statistical analysis

Data were processed and analyzed with the SPSS software (ver.19.0, IBM Corp, NY). The variance homogeneity and the normality of distribution of the variables were initially tested. When the null hypothesis was rejected, the Kruskall-Wallis test was applied. Variables with equal variance and normal distribution were tested with one-way analysis of variance (ANOVA). In case of statistically significant F-value ($P < 0.05$), additional post hoc LSD test for multiple comparisons was run.

Results and Discussion

Performance

The effect of different types of water on average live weight of chickens is presented in Table 2. At the start of the experiment, the groups were uniform in terms of initial weight, which fell within a narrow range without statistically significant differences (43.63–44.07 g; $P = 0.845$; Table 2). At 10 days of age, the average live weight of broilers that drank reverse osmosis water was the highest (211.33 g), followed by groups supplemented with alkaline (206.28 g) and hydrogen water (203.05 g), which was by 6.48–10.81% higher than the weight of controls ($P < 0.05$; Figure 1). A statistically significantly lower live weight at the same age was registered in the group that received magnetic water (189.54 g) in comparison to the other experimental groups ($P < 0.05$). At 28 days of age, the live weight of birds from experimental groups was by 3.18–14.70% higher than that of controls, yet the differences were not statistically significant ($P > 0.05$). The group that received water purified by reverse osmosis demonstrated again the highest live weight (1268.78 g), followed by alkaline water (1216.82 g), hydrogen water (1188.85 g) and magnetic water (1141.26 g) groups. The lowest live weight was measured in controls (1106.09 g; $P=0.063$), which received water from an own supply (Table 2). At the end of the experiment (49 days of age), there was a tendency toward higher live weight ($P = 0.054$) in birds that drank alkaline water (3409.26 g) and reverse osmosis water (3368.15 g), with differences vs controls by 5.99–7.28%. The effects of tap water and magnetic water on the final live weight was small and inconsistent ($P > 0.05$).

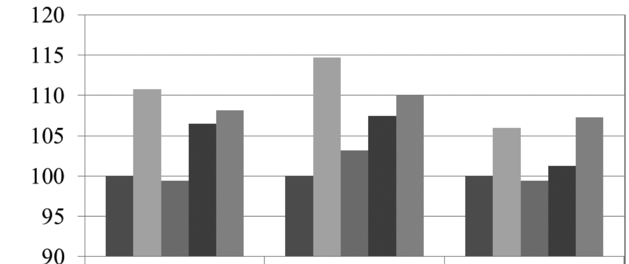
El-Deeb et al. (2020) affirmed that water is essential for poultry physiology. According to the authors, the use of magnetic water can improve the rate of digestive processes, and thus the digestibility of protein-rich feed which will affect the growth of broilers. In contrast to our results for magnet-treated water, Mohammed (2006) reported that the magnetic field improved the properties of the water, which in turn resulted in faster growth and better feed absorption. Our results are comparable with data reported from experiments with growing Peking ducks, where the birds consuming magnet-treated water showed a non-significantly increased final live weight compared to the control group (El-Katcha et al., 2017). Azad et al. (2013) reported a positive influence of hydrogen-rich water on heat-stressed broilers, through alleviation of oxidative damage and growth improvement. Other studies have found out that hydrogen-rich water can improve the antioxidant capacity of broilers (Shin et al., 2016).

Growth performance parameters of broilers receiving water treated in different ways are presented in Table 3. Dur-

Table 2. Effect of differently treated water on live weight (g) of broiler chickens

Parameters	Groups					SEM	P-value
	C	ROW	MW	HW	AW		
Live weight, g							
1 day	44.07	43.83	43.63	43.67	43.73	0.30	0.845
10 day	190.70 b	211.33 a	189.54 b	203.05 a	206.28 a	3.47	0.004
28 day	1106.09	1268.78	1141.26	1188.85	1216.82	35.72	0.063
49 day	3177.88	3368.15	3160.37	3217.71	3409.26	62.08	0.054

[a-b] – means with different letters in the row represent significant differences at P < 0.05
C – control; ROW – reverse osmosis water; MW – magnetic water; HW – hydrogen water; AW – alkaline water
Source: Authors' own elaboration



	10 day	28 day	49 day
C	100	100	100
ROW	110,81	114,7	105,99
MW	99,39	103,18	99,45
HW	106,48	107,48	101,25
AW	108,17	110,01	107,28

Fig. 1. Percentage difference in live weight of broiler chickens compared to control group
Source: Authors' own elaboration

ing the starter period (1–10 days), chickens consuming water treated with reverse osmosis had the highest average daily gain (16.75 g), followed by the alkaline water (16.26 g) and hydrogen water (15.94 g) groups, which were statistically significantly different from both the control group (14.66 g) and the magnetic water group (14.59 g; P = 0.005; Table 3). However, no statistically significant differences in average daily gain were observed during the grower (11–28 days) and finisher (29–49 days) periods (P > 0.05).

Over the entire study period, there was a trend towards the best average daily gain in the groups receiving reverse osmosis-treated and alkaline water, with differences of 6.08 – 7.40% compared to the control group (P = 0.053). In the groups receiving hydrogen and magnetic water, the differences in average daily gain compared to control birds were insignificant (Table 3). In a study by Gholizadeh et al. (2008), using magnetized water (6000 G), it was found that chickens reached the desired live weight in a much shorter time.

The use of different types of water for the broiler chickens in our experiment did not affect the average daily feed intake during the starter period (1–10 days, P = 0.719; Table 3). Feed intake during the growing period (11–28 days) was significantly higher (P = 0.039) in the groups receiving magnetic drinking water (90.74 g), followed by the group receiving reverse osmosis water (86.85 g) compared to the control group (73.40 g). No significant differences in feed intake were found between the groups receiving hydrogen and alkaline water (80.28 g) and the control group (73.40 g) (P > 0.05). During the finishing period (29–49 days), a higher feed intake was recorded in the control chickens and in the group receiving alkaline water (193.16 g; 192.78 g; P = 0.024), while there was no statistically significant difference in the amount of feed consumed between the reverse osmosis, magnetic and hydrogen water groups (P > 0.05). For the entire period (1–49 days), there were no differences in feed intake between the control and experimental groups and the values varied within a narrow range (Table 3; P = 0.173). Gholizadeh et al. (2008) and Soltan et al. (2018) reported that consumption of magnetic water increased feed intake compared to birds drinking normal water. El-Katcha et al. (2018) also reported increased feed intake in Cobb-500 broilers.

The results for feed conversion during the starter period (Table 3) demonstrated a better feed conversion ratio in the groups receiving reverse osmosis-treated, hydrogen and alkaline drinking water compared to the control and magnetic water groups (P = 0.011; Table 3). During the grower and finisher periods, feed conversion ratio of control and experimental groups were within a narrow range (P > 0.05). Feed intake per 1 kg of weight gain throughout the entire experimental period showed practically equal feed conversion in control and experimental groups (Table 3; P = 0.145). In a study with broiler chickens reared up to 32 days of age, Al-Mufarrej et al. (2005) reported no significant effect of magnetic water on growth performance, feed intake and feed conversion over the experimental period. The results

Table 3. Effect of differently treated water on broiler chicken performance

Parameters	Groups					SEM	P- value
	C	ROW	MW	HW	AW		
ADWG, g/bird							
1–10 day	14.66 b	16.75 a	14.59 b	15.94 a	16.26 a	0.36	0.005
11–28 day	50.85	58.75	52.87	54.77	56.14	1.90	0.106
29–49 day	98.66	99.97	96.15	96.61	104.40	2.18	0.130
1–49 day	63.95	67.84	63.61	64.78	68.68	1.27	0.053
ADFI, g/bird							
1–10 day	25.17	25.83	25.33	24.50	24.33	0.85	0.719
11–28 day	73.40 b	86.85 a	90.74 a	80.28 ab	80.28 ab	3.43	0.039
29–49 day	193.16 a	186.67 ab	176.11 b	173.33 b	192.78 a	4.36	0.024
1–49 day	114.23	117.18	112.37	109.25	112.58	2.05	0.173
FCR							
1–10 day	1.72 a	1.54 b	1.73 a	1.54 b	1.50 b	0.05	0.011
11–28 day	1.44	1.48	1.72	1.47	1.43	0.07	0.078
29–49 day	1.96	1.87	1.83	1.79	1.84	0.04	0.107
1–49 day	1.79	1.73	1.77	1.69	1.64	0.04	0.145

[a-b] – means with different letters in the row represent significant differences at P < 0.05

C – control; ROW – reverse osmosis water; MW – magnetic water; HW – hydrogen water; AW – alkaline water; ADWG – Average daily weight gain; ADFI – Average daily feed intake; FCR – Feed conversion ratio

Source: Authors' own elaboration

suggested that the degree of water magnetization was too low to produce any effect. In another study using magnetized water, Yusuf et al. (2022) reported a positive effect of water on growth and feed conversion in broiler chickens. Alhassani and Amin (2012) provided broiler chickens with water treated with a 500-G magnetizer. They used tap water for the control group, and water that was passed by the magnetizer device at three different speeds for the experimental groups. The experiment allowed to conclude that the observed trend associated to the magnetization power was not sufficient to produce an effect, as reported in most studies. Mahmoud et al. (2017) suggested that the varying research results in this field could be attributed to factors such as broiler genetics, the type of water magnetizer used, magnetization power and speed and many other factors. An inconsistent effect of hydrogen-rich water on live weight, average daily weight gain, average daily feed intake and feed conversion in broiler chickens was reported by Zhu et al. (2023). It was found out that hydrogen-rich water affected the caecal microbiota structure, promoting the growth of beneficial bacteria involved in butyrate production. In a study conducted to evaluate the effect of reverse osmosis treated deep sea water, Keohavong et al. (2010) found no difference in feed conversion. For the entire period of the experiment, statistically significantly (P < 0.05) better average daily feed intake, average daily weight gain and live weight was recorded in the experimental group. In relation to alkaline water, Alhassani and Amin (2012) found that chickens that consumed such water had a shorter fattening period, lower feed conversion ratio, and growth rate by 5 – 7% higher.

Slaughter yield

The results from the slaughter analysis of broiler chickens are presented in Table 4.

The established differences in the final live weight of broilers resulted also in consistent changes in the carcass weight. The groups that received reverse osmosis, hydrogen and alkaline water showed a significantly better performance (P = 0.000; Table 4). The control group and the group that consumed magnetic water had significantly lower carcass weights than the other experimental groups. The results from the table showed that the carcass yield in the experimental groups ranged within close limits: 72.54–73.65%, respectively, and was statistically significantly different from the control group – 70.63% (P = 0.000). The proportions of legs, wings and back were not significantly different between the control and experimental groups. However,the breast as a percentage of the carcass weight showed a weak tendency to increase in the groups drinking hydrogen and reverse osmosis water, reaching the limit of statistical significance (P = 0.053; Table 4). No differences were found between the groups (P > 0.05) regarding the gizzard percentage of slaughter weight.

Table 4. Effect of differently treated water on slaughter performance of broiler chickens

Parameters	Groups					SEM	P-value
	C	ROW	MW	HW	AW		
Slaughter weight, g	3180 b	3247 ab	3000 c	3203 b	3317 a	27.37	0.000
Carcass weight, g	2246 b	2381 a	2176 b	2359 a	2429 a	24.37	0.000
Carcass yield, %	70.63 b	73.34 a	72.54 a	73.65 a	73.25 a	0.65	0.020
Legs, %	31.68	30.94	31.58	30.29	30.73	0.43	0.145
Wings, %	10.57	10.77	10.74	10.39	10.94	0.24	0.558
Breast, %	36.43	37.44	36.64	38.94	36.36	0.66	0.053
Back, %	21.20	20.64	20.57	20.01	21.05	0.37	0.217
Gizzard, %	1.22	1.40	1.31	1.26	1.33	0.08	0.495
Liver, %	1.85 a	1.64 ab	1.66 ab	1.64 ab	1.51 b	0.07	0.034
Heart, %	0.35	0.40	0.39	0.37	0.36	0.02	0.190
Spleen, %	0.16 a	0.11 b	0.13 ab	0.11 b	0.12 b	0.01	0.046
Abdominal fat, %	0.70	0.78	0.45	0.57	0.49	0.10	0.157

a-c – means with different letters in the row represent significant differences at P < 0.05

C – control; ROW – reverse osmosis water; MW – magnetic water; HW – hydrogen water; AW – alkaline water

Source: Authors' own elaboration

The relative weight of the liver was the highest in the control group drinking tap water – 1.85%, and the lowest in the group drinking alkaline water – 1.51% (P = 0.034). The relative weight of the heart was within a narrow range in all groups (P > 0.05). The relative weight of the spleen was the highest in the control group (0.16%) with a significant difference between the groups receiving alkaline water (0.12%), hydrogen water (0.11%) and reverse osmosis water (0.11%). The difference between the group drinking magnetic water and control birds was small and inconsistent (0.13% vs. 0.16%; P > 0.05). It should be noted that there was no difference in the abdominal fat percentage in broilers receiving different drinking water types. Al-Mufarrej et al. (2005) found that water magnetization (500 G) did not significantly affect the individual parts of the carcass at 32 days of age, while Soltan et al. (2018) reported that magnetic water significantly improved slaughter yield but had no significant effect on other carcass traits. In a study with geese, El-Hanoun et al. (2017) found no effect (P > 0.05) of magnetized water on the relative weights of liver, heart and gizzard.

Physicochemical characteristics of meat

Table 5 presents the results from physicochemical analysis of breast and thigh meat quality parameters in the groups receiving differently treated water. In general, there were no significant differences in studied parameters between control and experimental groups.

The thigh meat pH of broiler chickens from the control and experimental groups were within a narrow range between 6.18–6.56 (P = 0.216). No significant differences in meat pH were either found for the pectoral muscle. The values between the control and experimental groups drinking different types of water ranged from 5.77 for the magnetic water to 5.81 for the control group (P = 0.907). Meat quality is significantly influenced by pre-slaughter and slaughter stress, which leads to the accumulation of lactic acid in the muscles and a subsequent decrease in meat pH. Mir et al. (2017) reported that broiler breast meat with higher pH had higher water holding capacity than meat with lower pH. Pre-slaughter stress may also lower meat pH. Colour identification serves as a simple method to determine meat pH; dark meat indicates a higher pH, while light meat suggests a lower pH (Anadon, 2002).

It is acknowledged that alkaline water reduces stress by decreasing lactic acid production at the time of slaughter. A lower level of lactic acid in muscle tissue results in higher meat pH, associated with minimum protein denaturation and higher water holding capacity of myofibrillar proteins (Lonergan and Lonergan, 2005).

Meat color is an important quality trait directly perceived by consumers (Font-i-Furnols and Guerrero, 2014). Some authors (Kralik et al., 2018; Qamar et al., 2019) reported that various external factors: genetics, slaughter age, pre-slaughter stress and many others are related to meat color and can have significant influence. The measured values of L* (lightness) serve as an indicator of the technological properties of meat. In the experiment conducted with broiler chickens receiving differently treated water, the L* values in both thigh and breast meat did not differ between the groups, indicating that the meat was of normal quality.

Regarding meat redness (a*), no significant between-group differences were observed for thigh and pectoral muscle. The range of a* values for the thigh muscle was from 7.34

Table 5. Effect of differently treated water on the physicochemical parameters of broiler chicken meat

Parameters	Groups					SEM	P-value
	C	ROW	MW	HW	AW		
Leg							
pH_{24}	6.18	6.30	6.56	6.20	6.19	0.12	0.216
L *	60.02	58.57	56.22	57.95	56.69	1.97	0.768
a *	9.63	7.34	6.86	8.19	9.92	1.16	0.310
b *	9.33	8.52	5.88	8.02	8.17	0.97	0.219
WHC, %	16.74	13.27	10.40	16.06	9.67	2.53	0.249
Cooking loss, %	23.39	22.43	20.73	21.84	21.94	1.65	0.843
Breast							
pH_{24}	5.81	5.78	5.77	5.79	5.78	0.03	0.907
L *	58.29	61.33	58.72	60.17	56.45	1.36	0.135
a *	2.77	2.48	4.56	2.47	1.30	0.78	0.075
b *	7.23	7.50	9.15	7.04	5.12	0.97	0.085
WHC, %	11.94	11.85	13.52	17.94	12.27	1.66	0.120
Cooking loss, %	23.05	26.43	25.05	19.81	22.62	2.91	0.578

$^{a-c}$ – means with different letters in the row represent significant differences at P < 0.05
C – control; ROW – reverse osmosis water; MW – magnetic water; HW – hydrogen water; AW – alkaline water; WHC – Water holding capacity
Source: Authors' own elaboration

to 9.63 (P = 0.310) and for the pectoral muscle: from 1.30 to 4.56 (P = 0.075). In the conducted experiment, the meat color in the yellow-blue spectrum (b*) showed no significant differences between the groups for both muscles. The pigment saturation of the meat in the yellow-blue spectrum (b*) for the thigh varied from 8.02 to 9.33, and for the breast: from 7.04 to 9.15, with no statistical differences observed (P > 0.05). In an experiment, Alhassani and Amin (2012) found that drinking alkaline, rain and tap water did not lead to significant differences in meat pH, L*, a* and b* values between groups.

An indirect indicator of the hydrophilic properties of meat as a raw material for storage and processing, is its water holding capacity (WHC) and thermal processing losses. The results of the conducted experiment showed no differences in the WHC of thigh muscle between the groups, with values ranging from 9.67 % to 16.74 % (P = 0.249). For the breast, this indicator was from 11.85% for reverse osmosis group to 17.94 % for hydrogen water group, but differences between the groups were inconsistent (P = 0.120; Table 5).

The reported cooking loss values did not show significant differences between the groups for both muscles (P > 0.05). This gives us reason to affirm that at this stage of the tests, different water treatments did not lead to a significant impact on the quality of the pectoral and thigh muscles.

Conclusion

The results obtained allow us to conclude that there was a tendency for a higher final live weight of chickens consuming alkaline water and water treated by reverse osmosis, with a difference of 5.99–7.28% compared to the control group (P = 0.054).The effects of hydrogen and magnetic water on the final live weight were small and insignificant (P > 0.05). A significantly higher carcass yield was observed in all experimental groups. The groups receiving water treated by osmosis, hydrogen and alkaline water had significantly higher carcass weights. Among the experimental groups, the lowest relative liver weight was recorded in the alkaline water group. No significant differences between the groups were found in the physicochemical properties of the meat during the experiment.

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Conflict of interest

We declared that no conflict of interest exists.

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