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Effect of Alternation Methods of Drinking Saline Well Water with Tap Water on Productive Performance, Hematological Parameters and Histopathology of Broilers

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Abstract

THIS STUDY aimed to determine the effects of alternation methods (AM) of drinking saline well water (SWW) with tap water (TW) on productive performance, hematological parameters and histopathology of broilers. A total number of 180 broiler chicks were randomly divided into six equal groups, the first group (control group), chicks drank TW from one-day old to the end of the experiment (36 days of age), treatment 1 (Tr1), chicks drank SWW from one-day old to the end of the experiment (EOE), Tr2, chicks drank SWW every other day alternatively with TW from one-day old to EOE, Tr3, chicks drank SWW every other week alternatively with TW from one-day old to EOE, Tr4, chicks drank TW during the first 18 days of age and drank SWW from 19-36 days of age, Tr5, chicks drank SWW during the first 18 days of age and drank TW from 19-36 days of age. Body weight, feed conversion, mortality rate, red blood cells, hemoglobin and mean corpuscular volume were significantly enhanced in AM treatments when compared with Tr1, while, there were insignificant differences between AM and control group in these traits. Histopathological scoring decreased in Tr3 and Tr5 when compared with Tr1. In conclusion, drinking SWW for broilers caused some negative effects on productive performance, hematological parameters and histopathology, therefore, it is preferable to alternately drink SWW with TW every other week, or drink SWW during the first 18 days of age, followed by TW, to enhance these negative effects.

Keywords: Chickens, Salinity, Carcass traits, Physiological responses.

Introduction

Broiler production is the most important branch of the poultry industry in Egypt, broiler chicken farms make up 89.5% of all poultry farms. Egypt produces more than 1.4 billion broilers a year [1].

In shade of the growing population in Egypt, the demand for white meat is increasing [2], the Egyptian policies refer to must increasing the investments in poultry production [3].

According to Egyptian regulations, poultry farms must be placed in desert areas, the most of the desert areas depend on groundwater as the primary source of water [4], the groundwater may be having high salinity which needs desalination or other treatments and this led an increase in poultry production costs [5].

Water is classified as good if it contains less than 2500 mg /L of total dissolved salts [6], using saline water with high salinity as the source of drinking water led to deleterious effects on the physiological and productive performance of broilers [7,8, 9].

Body weight, feed intake, growth rate and final live body weight was reduced when using salinity level (15 g salt/ L) in drinking water in broiler chickens [10], in the same trend, the increase of total dissolved salts (TDS) in the drinking water to 1849.6 mg/L led to a decline in the hematological parameters of broiler chickens [11], On the other hand, carcass characteristics, abdominal fat and liver weights were not affected by water TDS levels, but heart weight markedly increased by increasing TDS levels in drinking water [12], moreover, excess salts in drinking tap water induce severe damage to the organs and tissues, especially kidney of broiler chicks [13].

So, some studies look for an effective way to reduce the harmful effects of drinking saline water (SW) on the performance of poultry. From these ways, using the alternation of SW with tap water (TW), drinking SW every other week alternatively with TW reduced the negative effect of drinking SW on physiological and productive performance of laying hens [14] and rabbits [15].

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This study aimed to determine the effects of alternative methods of drinking saline well water with tap water on productive performance, hematological parameters and histopathology of broilers.

Material and Methods

Study area

This investigation was implemented at a private chicken's farm (Latitude 28° 50′36.6 N; Longitude 30° 59′58.5 E), Beni-Suef Government, Egypt, the experiment started in September and continue until October 2023.

Experimental design

A total of 180 unsexed commercial chicks Ross Alananny (one day old and body weight of 36.16±0.30) were randomly divided into six equal treatments (30 chicks of each) which in turn were divided into three equal replicates (10 chicks), the first group, chicks drank tap water (TW) containing 450 ppm total dissolved solids (TDS) from one-day old to 36 days of age (the end of the experiment) and were considered the control group (C). Treatment 1 (Tr1), chicks drank saline well water (SWW) containing 3100 ppm TDS from one day old to the end of the experiment, Tr2, chicks drank SWW every other day alternatively with TW from one day old to the end of the experiment, Tr3, chicks drank SWW every other week alternatively with TW from one day old to the end of the experiment, Tr4, chicks drank TW during the first 18 days of age and drank SWW from 19-36 days of age, Tr5, chicks drank SWW during the first 18 days of age and drank TW from 19-36 days of age.

Saline well water was obtained from a well near the farm, desalinate water was obtained from a desalination station and it was considered as TW because the Nile river water don't reach the area of poultry farm, SWW, and TW chemically analyzed in Animal Health Research Institute - Ministry of Agriculture and Land Reclamation, Doki, Egypt, according to Muller [16] and shown in Table 1, 2.

Management and feeding

Chickens were reared on the floor in separate pens in a closed farm and kept under the same conditions during the experimental period, chicks were fed ad-libitum on recommended standard rations according to the Ross broiler management guide (2002). Chicks were fed on a pelleted starter diet (23 % crude protein, and metabolizable energy 3010 Kcal/Kg diet) from one day to 10 days of age, chicks were fed on a pelleted grower diet (21 % crude protein, and metabolizable energy 3150 Kcal/Kg diet) from 11-28 days of age, chicks were fed on a pelleted finisher diet (19 % crude protein, and metabolizable energy 3200 Kcal/Kg diet) from 29-36 days of age (end of the experiment). The lighting program consisted of a period of 23 h light and 1 h of darkness during the experiment. The temperature was controlled and gradually reduced from 33° C to 23° C on day 36 of age. Chicks were kept under the same managerial and hygienic conditions. Chicks were healthy and treated with vaccines.

Measurements

At the end of experiment, blood samples (4 ml) were collected from wing veins of 90 birds (15 sample / treatment) which were selected randomly, samples collected into anticoagulant EDTA were treated for the determination immediately of hematological parameters, white blood cells, red blood cells, hemoglobin, hematocrit, mean corpuscular volume, mean corpuscular hemoglobin, mean corpuscular hemoglobin concentration, heterophils and lymphocytes were determined by the veterinary hematology analyzer device (CBC, Model, HA-VET, Clinding –Belgium), heterophil/lymphocytes ratio was calculated.

Live body weights were individually recorded for each chick and the average live body weights were calculated for each replicate and treatment during the experimental period. Total weight gain (TWG) was calculated for each replicate and treatment by subtracting the initial body weight (IBW) of birds from the final body weight (FBW). Total feed intake (TFI) was recorded on a weekly basis until the end of the experiment when birds were 36 days old. It was calculated from the difference between the amount of feed provided for each replicate and treatment and the residual quantity for the same replicate and treatment. Feed conversion ratio was calculated for each replicate and treatment by dividing TFI / TWG. Total water intake (TWI) and mortality rate were daily recorded from one-day old till the end of experiment.

Four chickens were randomly taken from each treatment slaughtered to determine the carcass characteristics by removing the feathers, dismembering the legs and evacuating the contents of the carcass. Measurements of the carcass, such as the weight of each heart, gizzard, liver and spleen were recorded as percent of live body weight.

Randomly selected one sample of kidney from each treatment to determine histological examination in histology laboratory in faculty of veterinary-Beni-suef University. kidney was fixed in 10% neutral buffered formalin (Sigma, St. Louis, USA), dehydrated in an alcohol series, embedded in paraffin wax, sectioned at 5 µm and stained with hematoxylin and eosin [17]for histopathological examination.

Statistical analysis

Data were analyzed by the least squares analysis of variance using the General Linear Model Procedure

of the SAS [18] program according to the following model:

$Yij=\mu + Tri + eij$

Where, Yij = observations, μ = overall mean, Tri = effect of ith treatment (i: 1-6),

eij = experimental error.

Duncan's New Multiple Range Test [19] separated differences among treatment means. Mortality rate of broilers was analyzed by Chi square analysis.

Results and Discussions

Productive performance

The effects of alternation methods on the productive performance of broiler chickens are shown in Table (3). Regarding the effect of drinking saline well water, drinking saline well water containing 3100 ppm total dissolved salts (TDS) in Tr1 led to a significant ($P \leq 0.05$) negative effect on final live body weight (FLBW), weight gain (WG), total feed intake (TFI), feed conversion (FC), total water intake (TWI) and mortality rate (MR) when compared with the control group (drinking tap water containing 450 ppm TDS), the biggest TWI and F / W ratio observed in Tr1 when compared with C and other treatments. These results may be due to the fact that give salt encourages the brain's thirst center to drink more water [20]. The consumption of water decreased as water salinity increased, which may be an adaptable system to decrease the load of salt in the body fluid balance by reducing the reabsorption of chloride and sodium in the renal tubules and increasing their excretion through urination [21]. On the other hand, Mostashari-Mohases et al. [9] returned the negative effects of drinking saline water to the decrease in FI to higher WI. High water salinity caused a rise in water output from the kidneys for the elimination of anions and cations, hence chicks drink added water and again more salts, and consequently, chicks increase their WI. Intake of feed is adversely affected by increases in WI.

These results are in agreement with [7, 11, 12, 13, 22, 23] who concluded that the productive performance of broiler chickens decreased as water salinity increased. Our findings are in agreement with those of [10] who discovered that lowering FI in broiler chicks led to a decrease in FLBW when salinity levels in water (15 g salt/L) were increased, Mostashari-Mohases et al. [9] observed a similar tendency in broiler chickens: as water salinity (3500 ppm TDS) increased, WG fell but FC and TWI increased ($P \leq 0.05$). Linh et al. [24] found that growth rate of Tre chickens could tolerant up to 0.2 % salt in drinking water. With over 0.2 % salt chicken's performance might be reduced.

Regarding effect of alternation methods, there were insignificant ($P \leq 0.05$) differences among alternation methods and C in FLBW, WG, FC and MR, on the other hand, these traits were significantly enhanced when compared with Tr1 (drinking saline well water during period of experiment). This means that the alternation method of treatments (Tr2-Tr5) led to enhancing these traits, while, alternation method in Tr3 and Tr5 recorded the best FLBW, WG and FC when compared with other alternation methods, there are significant differences among treatments in TFI, TWI and F/ W ratio.

Enhancement of results of Tr3 may be due to alternation method used to treat the negative effects of saline water by decreasing the accumulative effects of drinking saline well water. These results are in agreement with [14] and [15] who found the productive performance improved when laying hens and rabbits drank saline well water alternated weekly with tap water, respectively. While, the enhancement of alternation methods of Tr5 may be due to drinking saline water containing 3100 ppm TDS during the first 18 days of age in Tr5 cannot causes negative effects during this period when compared with drinking saline water during 19-36 days in Tr4, additionally to reduce the water consumption during this period, hence, consumed less salt in Tr5. These results are in agreement with Mirsalimi and Julian [25] who found that there was no significant difference between the BW of salt-treated and control groups up to day 21, he attributed this result to there is some evidence for a toxic threshold at about 0.14 % sodium in the drinking water in young broilers and these broilers did not reach that level until day 15.

Hematological parameters

Table (4) show effects of alternation methods on hematological parameters of broiler chickens. Regarding effect of drinking saline well water, red blood cells (RBC's), Hemoglobin (Hb) and hematocrit (Hct) were significantly ($P \leq 0.05$) decreased, while Heterophils / Lymphocytes ratio (H/L ratio) was significantly increased ($P \leq 0.05$) in Tr1 (drinking saline well water at 3100 ppm TDS) when compared with control group (C), on the other hand, There were insignificant differences between Tr1 and C in mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC) and white blood cells (WBC's).

These results may be due to the salinity of the water in Tr1 which injuries the renal tissue, resulting in a decline in the erythropoietin hormone secretion, which is secreted into the blood and moved to the bone marrow to stimulate the formation of red blood cells, resulting in a reduction in red blood cell formation. In addition to drinking saline water, it may be causing broiler stress, which leads to the secretion of corticosterone hormone from the adrenal gland which leads to an increase the H/L ratio [26]. Decreasing Hct in Tr1 may be due to hemodilution of

blood due to an increase in total body water content accompanied by an increase in water intake [27].

These results are in agreement with [14] who found that RBC's and Hb were significantly decreased, while, H/L ratio was significantly increased in laying hens drank saline well water containing 3398 ppm of total dissolved solids (TDS) when compared with laying hens drank tap water.

Regarding effect of the alternation methods, there were insignificant ($P \leq 0.05$) differences between alternation methods and C in RBC's, and Hb, on the other hand, Hct significantly decreased in alternation methods of Tr3 and Tr4 when compared with C group, while, there were insignificant differences among Tr2, Tr5 and C group.

There were insignificant ($P \leq 0.05$) differences among all treatments in MCHC, while, there were insignificant differences between alternation methods and C in MCV and MCH, WBC,s were significantly increased in alternation methods of Tr4 when compared with C. There were insignificant ($P \leq 0.05$) differences among Tr3, Tr5 and C in H/L ratio.

These results may be due to the alternation method, which works to enhance hematological parameters by using tap water after saline water to remove the harmful effects of drinking saline water and give the body a chance to recover the normal state of body conditions and short period of drinking saline water for day or a week or evenly for 18 days may not be enough to cause a negative effect on the body.

These results agree with [14] who found that laying hens alternated drank saline water with tap water every week may improve the deleterious effect of saline water on blood picture, in the same results, Morsy et al. [15] found that rabbits alternated drank saline water with tap water every week may improve the deleterious effect of saline water on blood picture.

Carcass traits

Regarding effect of drinking saline well water, table (5) shows that drinking saline well water (3100 ppm TDS) in Tr1 led to a significant ($P \leq 0.05$) increase in heart weight % (HW) when compared with control group (drinking tap water), while, there were insignificant differences between Tr1 and control group (C) in gizzard weight % (GW), spleen weight % (SW) and liver weight % (LW). These results may be due to increasing blood volume by increasing water intake (table 3). There were insignificant differences among treatments in liver weight percentage.

These results are in agreement with [9] and [12], who found that HW % was significantly ($P<0.01$) increased with increasing salinity levels (3000 ppm Na Cl) in water of broiler chickens and was not affected by LW % or GW %. In this country, Fayed et al. [28] found an insignificant effect of drinking saline water containing (1000 ppm TDS) on HW, GW and SW of broiler chickens when compared with control group.

Regarding effect of alternation methods, there were insignificant ($P \leq 0.05$) effects of alternation methods (Tr2, Tr3 and Tr5) on HW, GW, SWand LW when compared with control group (drinking tap water). On the other hand, alternation methods led to significant increase of HW, GW and SW in Tr2, Tr3 and Tr2, respectively when compared with C. these results agree with [14] who found that there was insignificant effect of alternated saline well water containing 3398 ppm TDS with tap water -weekly in organs % in laying hens when compared with control group.

Histopathology of kidney

Regarding effect of drinking saline well water on a histo-pathology of kidney of the control group showing the normal architecture of chick kidney which consisted mainly of renal corpuscles (R) with narrow Bowman's space (arrow) and renal tubules (T) lined with normal tubular epithelium (arrowhead). The renal blood vessels (V) appeared normal, while, drinking saline well water in Tr1 showed massive deterioration of the renal tissue in which the R undergo shrinkage with wide Bowman's space (arrow). The renal tubules (T1) few in number lined with normal tubular epithelium (arrowhead) on the other hand the renal tubules (T2) suffered from massive degeneration (curved arrow). The V appeared congested with hemorrhage between the renal tubules (Fig. 1).

These results agree with [13] who found that focal inflammatory cellular infiltration, necrosis of tubular epithelium, aggregation of lymphocytes and destruction of the renal corpuscles and renal tubules when using saline water containing 3000 ppm Na Cl as drinking water for broiler chickens. In rabbits, Eman, Ahmed [29] found that numerous histological changes were cortical. The tubules showed cystic dilatation, tubular degenerative changes, hemorrhage, fibroblastic proliferation and albuminous material accumulation in kidney tissue when rabbits drank saline well water (4000 ppm TDS) for 90 days.

On the other hand, alternation methods decreased the negative effects of drinking saline well water in kidney tissue. A histo-pathological picture of kidney of Tr2 showing deterioration of the renal tissue in which the R undergo shrinkage with wide Bowman's space (arrow). The renal tubules appeared few (T1) lined with normal tubular epithelium (arrowhead) on the other hand the renal tubules (T2) suffered from massive degeneration (curved arrow). The renal blood vessels (V) appeared congested with hemorrhage between the renal tubules (Fig. 1)

A histo-pathological picture of kidney in Tr3 showing the renal tissue contained R with wide Bowman's space (arrow). The renal tubules (T1) many in number lined with normal tubular epithelium (arrowhead) on the other hand the few renal tubules (T2) suffered from degeneration (curved arrow). The renal blood vessels (V) appeared congested (Fig. 1)

A histo-pathological picture of kidney in Tr4 shows deterioration of the renal tissue in which the R undergo shrinkage with wide Bowman's space (arrow). The renal tubules (T1) lined with normal tubular epithelium (arrowhead) on the other hand few renal tubules (T2) suffered from massive degeneration (curved arrow). The renal blood vessels appeared congested with hemorrhage between the renal tubules (Fig. 1)

A histo-pathological picture of kidney in Tr5 showing nearly normal renal tissue in which the normal R with slightly wide Bowman's space (arrow). The renal tubules (T) lined with normal tubular epithelium (arrowhead) on the other hand few tubular epithelium suffered from degeneration (curved arrow). The renal blood vessels (V) appeared congested (Fig. 1).

A histopathological scoring of renal tissue injury in broiler as affected by different alternation methods are shown in Table (6).

Regarding effect of drinking saline well water, a histopathological scoring of renal tissue injury in broiler chickens in Tr1 (drinking saline well water 3100 ppm TDS) ranged from 3-4 in all studies traits which refer to 51-100 tissue damage of kidney compared with control group recorded zero which refer to no change histology of kidney. Regarding a histopathological scoring of renal tissue injury in alternation methods, a histopathological scoring was decreased in Tr3, Tr4 and Tr5 when compared with Tr1 and Tr2.

Conclusion

Drinking SWW containing 3100 ppm TDS for broiler chickens caused some negative effects on productive performance, hematological parameters and histopathology, Therefore, when it is necessary to use saline water, it is preferable to alternately drink SWW with TW every other week, or drink SWW during the first 18 days of age, followed by TW, to enhance these negative effects.

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Author's contributions

All named authors have made an active contribution to the conception design, analysis, and interpretation of the data and the drafting of the paper. All have critically reviewed its content and approved the final version submitted for publication.

Conflicts of interest

The authors declare that there is no conflict of interest.

Ethical Approval

This study was conducted according to the guidelines for care and use of laboratory animals by Beni-suef University (BSU-IACUC). Approval number (022-471).

TABLE 1. Chemical analysis of tap water and saline well water.

Parameters	Tap water	Saline well water
TDS (mg/l)	450	3100
EC (µS/m)	0.236	8.42
PH	6.52	8.17
Sodium chloride (mg/l)	66	4950
Calcium (mg/l)	40	225
Bicarbonate (mg/l)	20	160
Sulphate (mg/l)	20	10
Ammonia(mg/l)	Not detected	Not detected
Nitrate(mg/l)	Not detected	0.05
Total alkalinity (mg/l)	20	160
Carbonate alkalinity(mg/l)	0	0
Hydroxide alkalinity(mg/l)	0	0
Copper (ppm)	Less than LOQ (0.008)	Less than LOQ (0.008)

TDS=Total dissolved solids; EC=Electric conductivity

TABLE 2. Methods of chemical analysis of different water samples.

Test	Instrument	Method
Ca	Digital burette	3500-Ca B. EDTA Titrimetric method
Cl	Digital burette	4500-Cl B. Argentometric
Alkalinity	Digital burette	2320 B. Titration
Conductivity	Conductivity	2510 B. Laboratory method
TDS	Meter	

TABLE 3. Effect of alternation methods on the productive performance of broiler chickens.

Traits	Treatments						±SE
	C	Tr1	Tr2	Tr3	Tr4	Tr5	
			Alternation methods				
IBW (g)	36.58	36.58	35.47	34.94	36.58	36.82	0.75
FLBW (g)	2171.7^{a}	1959.8^{b}	1955.6^{ab}	2140.9^{a}	1969.7^{ab}	2086.4^{a}	71.55
WG (g)	2135.1^{a}	1823.2^{b}	1920.1^{ab}	2105.6^{a}	1933.1^{ab}	2049.5^{a}	71.55
TFI (g)	3211.4^{a}	3069.4^{f}	3104.4^{e}	3148.6^{c}	3178.1^{b}	3128.1^{d}	1.83
FC ratio	1.48^{b}	1.69^{a}	1.64^{ab}	1.50^{b}	1.64^{ab}	1.52^{b}	0.05
TWI (ml)	6592.8^{e}	7521.5^{a}	7106.8^{c}	6818.6^{d}	7113.6^{c}	7179.4^{b}	12.53
F/W ratio	2.05^{e}	2.44^{a}	2.28^{b}	2.16^{d}	2.23^{c}	2.29^{b}	0.01
Mortality rate%	0	20	13.3	3.33	6.66	3.33	--

IBW = Initial body weight; FLBW = Final live body weight; WG = Wight gain; TFI = Total feed intake; FC (g feed/g gain) = Feed conversion ratio; TWI = Total water intake; F/W ratio=feed / water ratio; C= chicks drank tap water (TW) from one day old to the end of experiment (36 days of age). Tr1 = chicks drank saline well water (SWW) containing 3100 ppm TDS from one day old to the end of experiment, Tr2= chicks drank SWW every other day alternatively with TW from one day old to the end of experiment, Tr3= chicks drank SWW every other week alternatively with TW from one day old to the end of experiment, Tr4= chicks drank TW during the first 18 days of age and drank SWW from 19-36 days of age (end of experiment) and Tr5= chicks drank SWW during the first 18 days of age and drank TW from 19-36 days of age (end of experiment).

a, b, c,d, Means bearing different superscripts within the same row are significantly different ($P<0.05$).

TABLE 4. Effect of alternation methods on hematological parameters of broiler chickens.

Traits	Treatments						±SE
	C	Tr1	Tr2	Tr3	Tr4	Tr5	
			Alternation methods				
RBC (10^{12}/L)	3.32^{ab}	2.52^{c}	3.49^{a}	3.20^{ab}	2.80^{bc}	3.76^{a}	0.23
Hb (g/dl)	13.70^{ab}	11.47^{c}	12.28^{bc}	12.03^{bc}	12.66^{abc}	14.33^{a}	0.56
Hct (%)	35.85^{a}	31.97^{c}	33.57^{abc}	33.13^{bc}	31.75^{c}	35.42^{ab}	0.80
MCV (fl)	108.2^{ab}	128.8^{a}	96.98^{b}	105.3^{b}	114.1^{ab}	98.3^{b}	6.85
MCH (pg)	41.39^{ab}	45.99^{a}	35.31^{b}	38.29^{b}	45.31^{a}	38.69^{b}	2.08
MCHC (g/l)	38.24	35.87	36.48	36.40	39.88	40.61	1.58
WBC (10^{9}/L)	7.59^{bc}	8.77^{ab}	8.48^{abc}	7.06^{c}	9.52^{a}	7.95^{abc}	0.53
H/L ratio	0.09^{c}	0.13^{ab}	0.14^{a}	0.11^{abc}	0.12^{abc}	0.10^{bc}	0.01

RBC's = Red blood cells; Hb = Hemoglobin; Hct =Hematocrit; MCV = Mean corpuscular volume; MCH = Mean corpuscular hemoglobin; MCHC = Mean corpuscular hemoglobin concentration; WBC's =White blood cells; H/L ratio= Heterophils/Lymphocytes ratio; H/R = heterophil/lymphocyte ratio; C= chicks drank tap water (TW) from one day old to the end of experiment (36 days of age). Tr1 = chicks drank saline well water (SWW) containing 3100 ppm TDS from one day old to the end of experiment, Tr2= chicks drank SWW every other day alternatively with TW from one day old to the end of experiment, Tr3= chicks drank SWW every other week alternatively with TW from one day old to the end of experiment, Tr4= chicks drank TW during the first 18 days of age and drank SWW from 19-36 days of age (end of experiment) and Tr5= chicks drank SWW during the first 18 days of age and drank TW from 19-36 days of age (end of experiment).

a, b, c. Means bearing different superscripts within the same row are significantly different ($P<0.05$).

TABLE 5. Effect of alternation methods on organ percentage of broiler chickens.

Traits (%)	Treatments						±SE
	C	Tr1	Tr2	Tr3	Tr4	Tr5	
			alternation methods				
HW	0.47 ^{c}	1.01 ^{a}	0.63 ^{bc}	0.62 ^{bc}	0.91 ^{ab}	0.65 ^{bc}	0.08
GW	2.02 ^{bc}	2.27 ^{b}	2.23 ^{b}	2.68 ^{a}	2.02 ^{bc}	1.81 ^{c}	1.10
SW	0.17 ^{a}	0.16 ^{a}	0.11 ^{b}	0.15 ^{ab}	0.12 ^{ab}	0.17 ^{a}	0.01
LW	2.09	2.39	2.45	2.52	2.87	3.17	0.35

HW= heart weight %; GW= gizzard weight %; SW=spleen weight %; LW=liver weight %; C= chicks drank tap water (TW) from one day old to the end of experiment (36 days of age). C= chicks drank tap water (TW) from one day old to the end of experiment (36 days of age). Tr1 = chicks drank saline well water (SWW) containing 3100 ppm TDS from one day old to the end of experiment, Tr2= chicks drank SWW every other day alternatively with TW from one day old to the end of experiment, Tr3= chicks drank SWW every other week alternatively with TW from one day old to the end of experiment, Tr4= chicks drank TW during the first 18 days of age and drank SWW from 19-36 days of age (end of experiment) and Tr5= chicks drank SWW during the first 18 days of age and drank TW from 19-36 days of age (end of experiment).
a, b, c. Means bearing different superscripts within the same row are significantly different ($P<0.05$).

TABLE 6. A histopathological scoring of renal tissue injury in broiler chickens as affected by alternation methods.

Kidney	Treatments					
	C	Tr1	Tr2	Tr3	Tr4	Tr5
			alternation methods			
Degeneration of renal tubules	0	3	3	2	2	1
Atrophy of the renal corpuscles	0	3	2	1	1	0
Congestion of renal blood vessels	0	4	3	3	2	2
Hemorrhage	0	4	2	1	1	0
Piknosis	0	3	3	3	2	2
Widening of Bowman's capsule	0	4	3	2	2	2

*Histopathological scoring of tissue injury in the kidney of chicks scored in degrees as follows: 0 = no change; 1 = < 25% tissue damage; 2 = 26–50%, tissue damage; 3 = 51–75% tissue damage; 4 = 76–100% tissue damage; C= chicks drank tap water (TW) from one day old to the end of experiment (36 days of age). Tr1 = chicks drank saline well water (SWW) containing 3100 ppm TDS from one day old to the end of experiment, Tr2= chicks drank SWW every other day alternatively with TW from one day old to the end of experiment, Tr3= chicks drank SWW every other week alternatively with TW from one day old to the end of experiment, Tr4= chicks drank TW during the first 18 days of age and drank SWW from 19-36 days of age (end of experiment) and Tr5= chicks drank SWW during the first 18 days of age and drank TW from 19-36 days of age (end of experiment).

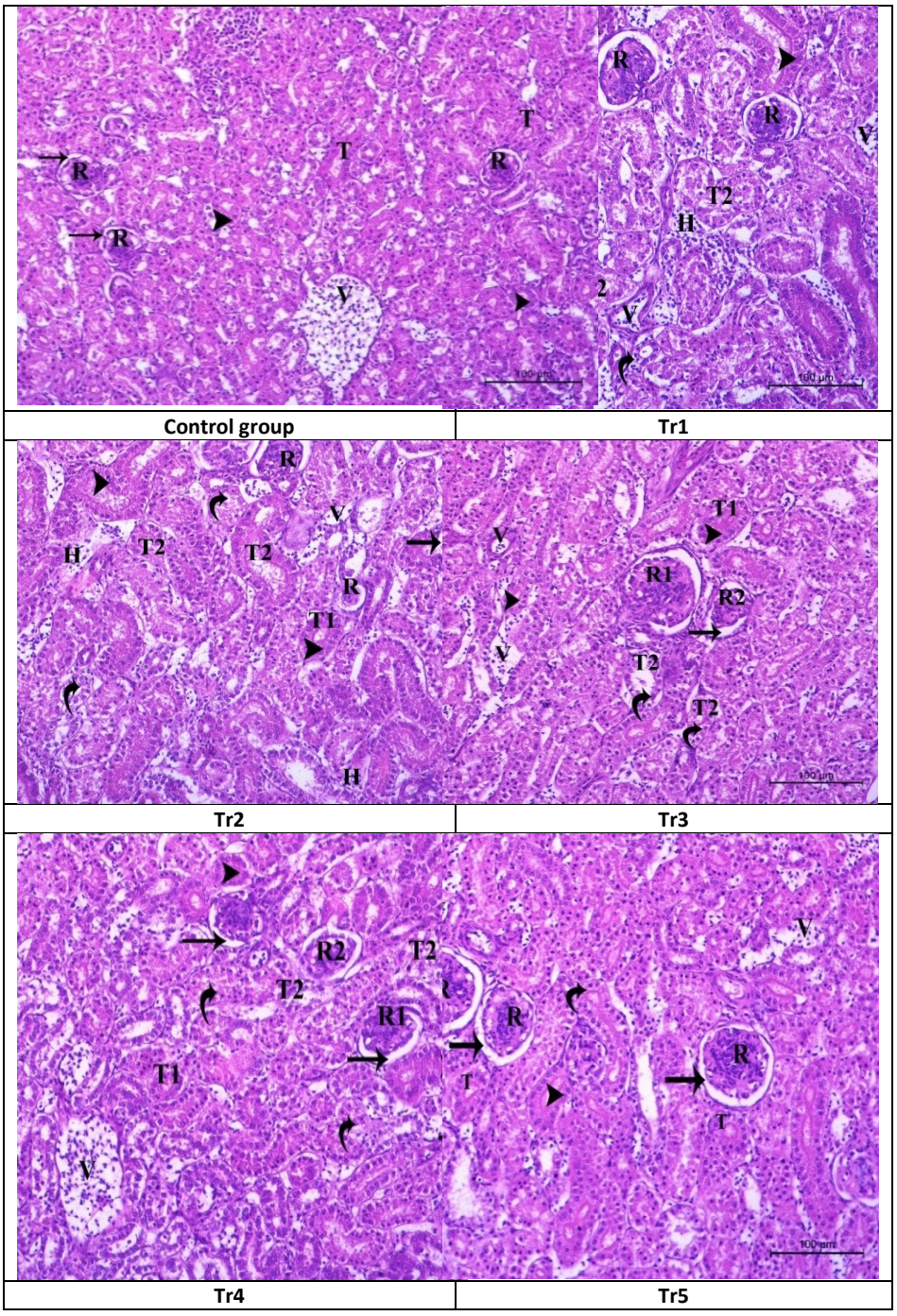

FIG. 1. A histo-pathological picture of kidney (H&E stain X200) as affected by alternation methods.

C= chicks drank tap water (TW) from one day old to the end of experiment (36 days of age). Tr1 = chicks drank saline well water (SWW) containing 3100 ppm TDS from one day old to the end of experiment, Tr2= chicks drank SWW every other day alternatively with TW from one day old to the end of experiment, Tr3= chicks drank SWW every other week alternatively with TW from one day old to the end of experiment, Tr4= chicks drank TW during the first 18 days of age and drank SWW from 19-36 days of age (end of experiment) and Tr5= chicks drank SWW during the first 18 days of age and drank TW from 19-36 days of age (end of experiment).

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تاثير طرق التناوب بين شرب مياه الابار المالحة ومياه الصنبور على الأداء الإنتاجي والمعايير الدموية والهستوباثولوجية للدجاج اللاحم

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الملخص

تهدف هذه الدراسة الى تحديد تاثير طرق التناوب بين شرب مياه الابارالمالحة ومياه الصنبورعلى الاداء الإنتاجي والمعايير الدموية والهستوباثولوجية للدجاج اللاحم .تم تقسيم 180 كتكوت تسمين عمر يوم بصورة عشوائية الى ستة مجموعات . المجموعة الاولى (مجموعة السيطرة) شربت الكتاكيت مياه الصنبور من عمر يوم وحتى نهاية التجربة (36 يوم من العمر)، المعاملة الاولى شربت الكتاكيت مياه الابار المالحة من عمر يوم وحتى نهاية التجربة، المعاملة الثانية شربت الكتاكيت مياه الابار المالحة تبادليا مع مياه الصنبور بصورة يومية من عمر يوم وحتى نهاية التجربة، المعاملة الثالثة شربت الكتاكيت مياه الابار المالحة تبادليا مع مياه الصنبور بصورة اسبوعية من عمر يوم وحتى نهاية التجربة، المعاملة الرابعة شربت الكتاكيت مياه الصنبور خلال أول 18 يوم من العمر ثم مياه الابار المالحة خلال 19- 36 يوم من العمر، المعاملة الخامسة شربت الكتاكيت مياه الابار المالحة خلال أول 18 يوم من العمر ثم مياه الصنبور خلال 19- 36 يوم من العمر. وزن الجسم، التحويل الغذائى، نسبة النفوق، عدد كرات الدم الحمراء، الهيموجلوبين، ومتوسط حجم كرات الدم الحمراء تحسنت معنويا فى معاملات طرق التناوب مقارنة بالمعاملة الاولى، بينما لا يوجد هناك فروق معنوية بين مجموعة السيطرة ومعاملات طرق التناوب فى هذة الصفات، إنخفضت الارقام المسجلة للهستوباثولوجى للكلية فى المعاملة الثالثة والخامسة عند المقارنة بالمعاملة الاولى. نستخلص من هذة الدراسة ان شرب مياه الابار المالحة تسبب بعض التاثيرات السلبية على الاداء الإنتاجي والمعايير الدموية والهستوباثولوجية للدجاج اللاحم، لذلك من المفضل إستخدام طريقة التناوب اسبوعيا بين مياه الابار المالحة ومياه الصنبور او شرب مياه الابار المالحة خلال أول 18 يوم من العمر متبوعا بشرب مياه الصنبور خلال 19- 36 يوم من العمر لتحسين هذة الاثار السلبية .

الكلمات الدالة: الدجاج، الملوحة، صفات الذبيحة، الإستجابات الفسيولوجية.