Nigerian J. Anim. Sci. 2018, 20 (2): 140-145

Performance, Blood Chemistry and Serum Electrolytes of Broilers Given Water from Different Sources

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Target Audience: *Farmers, Researchers and Policy makers*

Abstract

The role of water sources in broiler performance was assessed using 168 Abor Acre broiler birds. The birds were randomly allotted to 4 treatments (Treatment 1(T1) - tap water, Treatment 2 (T2) – bore-hole water, Treatment 3 (T3) – well water and Treatment 4 (T4) – river water), with 6 replicates each in a completely randomized design. The initial weight was measured at hatch and subsequently on weekly basis till the final week of study. Feed intake and conversion ratio were recorded and computed, while rectal temperature was obtained using a clinical thermometer inserted into the rectum of the broiler chicken. On day 42, blood was collected via the jugular vein into sample bottles for hematological and serum electrolyte assay. Data obtained were analyzed and means separated using Duncan Multiple Range Test (DMRT). Water source was observed to significantly influence rectal temperature at the 4th week, with birds served borehole water having higher rectal temperature than birds served river water. Source of water offered to the birds was also observed to influence ($p<0.05$) serum levels of sodium, calcium, potassium and phosphorus. Sodium level was significantly higher in birds offered river water, while borehole water resulted in significantly higher phosphorus level in broiler chicken.

Keywords: *Water source, broilers, serum electrolytes, rectal temperature*

Description of Problem

Water play some essential roles as it softens food and carries it through the body, aids in digestion and absorption, and cools the body as it evaporates through the bird's lungs and air sacs. Water helps remove waste, lubricates joints (1) and is a major component of blood, and a necessary medium for many chemical reactions that help form meat and eggs (2). While several elements can cause poor water quality, the interaction between elements is more significant in water quality problems than the simple fact of their presence (2). Water quality takes on an increasingly valuable role as public concern over antibiotic use in animal feed shifts in the poultry industry away from the use of antibiotics (3). In broiler chicken, the pH, hardness, and total dissolved solids (TDS) can all have an effect on consumption patterns even though it can be difficult to describe good quality drinking water for poultry because many of the standards have been derived from recommendations for other species of animals or from human standards (4). One of the most important indicators of water quality is the concentration of TDS, but appropriate concentration of TDS in drinking water for poultry have not been well defined. Drinking water containing TDS less than 1000 mg/L is safe for many species of animals (5). Any reduction in water intake or increase in water loss can have a significant effect on the lifetime performance of chick. Water intake is closely linked to feed intake and bird's age. As the birds get older the demand for water will be about twice as much as feed (6). Preventive measures and also solutions to problems that already exist must be the aim of every person (7). In preventing disease outbreak in the poultry house, farmers may want to control the quality of the ingested water, which will certainly minimize costs and increased profit, which are nowadays the main aims of animal production (7). This study evaluated the impact of different water sources on haematological indices and serum electrolytes of broilers chicken.

Materials and Methods

This experiment was carried out at the Teaching and Research farm, University of Ibadan, Oyo State. One hundred and sixty eight (168) Abor Acre broiler birds were utilized for the study. The birds were purchased from a reputable hatchery in Ibadan, Oyo State. The experimental pen were thoroughly washed, disinfected and fumigated. Birds were tagged, weighed and allotted into 4 treatments of 6 replicates per treatment and 7 birds per replicate. Treatment 1(T1) were served tap water, while Treatments 2 (T2), Treatment 3 (T3) and Treatment 4 (T4) consist of birds served bore hole, well and river water respectively in a completely randomized design. Feed and water were served *ad libitum* during the experiment. Other routine management was strictly followed throughout the study period. Initial weight was measured on the first day of the experiment and subsequent weight gained on weekly basis.

Water was measured into the drinking trough using a measuring cylinder daily and the left over was measured after 24 hours. Evaporative water loss was taking care of my placing a measured amount of water in the watering trough at four different locations in the house and the difference in water was measured after 24 hours. The pooled average difference was subtracted from the amount of water consumed by the birds to get the actual amount of water taken by each bird. Feed conversion ratio was computed as weight gain in gram per unit feed intake in gram.

Rectal temperatures were obtained by inserting a clinical thermometer into the rectum of the broiler at the beginning of the fourth and sixth week. Blood (5ml) was collected from 2 birds per pen from each replicate on day 42, by puncturing the jugular vein. Two (2mls) was separated into sample bottles containing ethylene diamine tetra acetic acid (EDTA) for haematological analysis. The packed cell volume (PVC) and haemoglobin (Hb) were determined using the micro-haematocrit method and cyanmethloglobin method respectively as described (8). Erythrocyte count (RBC) and Leukocyte count (WBC) were determined using the improved Neubauer haemocytometer after the appropriate dilution (9). Differential leukocyte counts were determined by scanning Giemsa's stained slides in the classic manner (9). The remaining 3 mls, was centrifuged and serum separated for serum electrolyte analysis. Calcium, phosphorus and other minerals were determined using commercial colorimetric kits (QuimicaClinicaAplicada S A Amposta, Spain). Data obtained was subjected to analysis of variance of the SAS software package. Mean differences were separated using Duncan's Multiple Range Test (DMRT).

Results and Discussion

There were no significant ($p>0.05$) differences observed in the final weight, feed intake, weight gain, feed conversion ratio and water intake of birds served water from different sources. However, birds served tap water had higher final weight, weight gain, feed intake, and water consumption followed by river water, well water and borehole water. Significant differences were however observed in rectal temperatures at the 4th week with birds served borehole water having higher rectal temperature, while birds served tap water, well water , and river water showed no significant (p>0.05) differences in rectal temperature. Though this effect was not sustained up till week 6 where there was no observed significant effect of water source on rectal temperature in the broiler chicken. In the same vein, haematological assessment revealed no significant influence of water source (table 4). This finding is contrary to reports (11, 12) for WBC values in birds served different water sources, although the WBC values obtained in this study are within the normal range 9.76-31.00(10^3ul) as reported (8, 12) for normal birds. This is an indication that the birds were perhaps generally free from infection or have built immunity against such infection. Serum electrolytes values (Table 5) revealed no significant differences (p<0.05) in serum Magnesium and Chloride. However, there were significant differences (p<0.05) observed in serum sodium, calcium, potassium and phosphorus on the experimental birds. Higher serum sodium and calcium level were recorded in birds served river water, while birds served borehole had higher value for serum potassium and phosphorus. Water sources had no influence on magnesium and chloride values. This result was in agreement with the findings of (13) in plasma sodium in birds served Nile river water. Disparity in results obtained could be due to geographical location. The significant differences (p<0.05) in serum sodium, potassium and phosphorus was in agreement with the findings (13), for plasma sodium, potassium and phosphorus. It was also reported (13) that water source influences plasma magnesium levels. Also, the result showed significant differences (p<.05) in serum calcium. This was also contrary to the findings of (13) in plasma calcium of birds exposed to different sources of water. This disparity could be as a result of soil mineral contents due to geographical location.

Conclusion and Applications

1. The study showed that different water sources did not have negative effect on the health status of broiler chicken, though alteration in circulating serum levels of electrolytes such as sodium, calcium, potassium and phosphorus were observed.
2. Offering these different water sources did not elicit any deleterious effect on the overall performance of birds.
3. In the tropics, water from the following sources pipe-borne (tap), bore-hole, well and river can be given to broilers successfully.

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Table 1: Gross Composition of Diets Fed to Experimental Birds

Ingredients	Starter	Finisher
Maize	58.00	56.50
Groundnut cake	33.00	9.50
Soya bean meal	4.60	-
Wheat bran	-	10.00
Full fat soya	3.00	20.00
Fish meal 72	0.50	0.30
Oyster shell	0.50	1.00
Di-calcium phosphate	2.50	1.95
Salt	0.25	0.25
DL-Methionine	0.15	0.15
L-Lysine	0.25	0.10
Broiler premix[1]	0.25	0.25
Total	100	100
Calculated analysis		
Metabolizable energy (kcal/kg)	3000.31	3000.39
Crude protein (%)	23.11	19.72
Crude fiber (%)	3.82	3.79
Ether extract (%)	3.86	5.51
Calcium	1.02	1.12
Available phosphorus	0.55	0.45

[1] Provided per kg of Diet: Selenium-250 µg; Vitamin A-8,250 IU; Vitamin D3-2,750 IU; Vitamin A-17.9 IU; Menadione- 1.1 mg; Vitamin B12-12 µg; Biotin-41 µg; Choline-447 mg; Folic acid-1.4 mg; Niacin-41.3 mg; Pantothenic acid-11 mg; Pyridoxine-1.1mg; Riboflavin-5.5 mg; Thiamine-1.4 mg; Iron-282 mg; Magnesium-125 mg

Table 2: Performance of Broiler Chickens Served Different Water Sources

Parameters (g/bird)	T1 (Tap)	T2 (Bore)	T3 (Well)	T4 (River)	SEM
Initial weight	39.23	39.50	39.22	39.41	0.20
Final weight	1228.81	1016.46	1050.76	1227.22	39.17
Weight Gain	1189.58	976.96	1011.54	1187.81	56.61
Feed intake	2773.33	2501.34	2373.13	2578.42	83.75
FCR	2.33	2.56	2.25	2.17	0.08
Water intake/bird (L)	5.72	5.67	5.39	5.72	0.08

SEM: Standard Error of Mean FCR: Feed Conversion Ratio.
T1–Tap water T2–Borehole water T3-Well water T4- River water

Table 3: Effect of Different Water Sources on Rectal Temperature of Broiler Chickens

Week	T1 (Tap)	T2 (Bore)	T3 (Well)	T4 (River)	SEM
Week 4	41.26^{ab}	41.62^{a}	41.38^{ab}	41.20^{b}	0.06
Week 6	41.33	41.59	41.48	41.23	0.61

$^{a, b}$ Means with different superscripts are significantly ($P<0.05$) different.
SEM: Standard Error of Mean FCR: Feed Conversion Ratio.
T1–Tap water T2–Borehole water T3-Well water T4- River water

Table 4: Effect of Different Water Sources on Haematology Indices of Broiler Chickens

Parameters	T1 (Tap)	T2 (Bore)	T3 (Well)	T4(River)	SEM
PCV (%)	31.00	31.61	29.83	27.40	0.82
H.B (g/dl)	10.30	10.57	9.90	8.80	0.29
RBC (10^6ul)	3.27	3.49	3.09	3.03	0.10
WBC (10^3 ul)	19.91	22.42	21.59	21.91	0.67
LYMP (%)	60.17	63.33	61.33	62.60	1.93
HETERO (%)	32.67	29.67	33.50	32.20	1.98
MONO (%)	3.50	2.83	2.17	2.00	0.34
EOS (%)	3.17	3.83	3.33	3.00	0.33
BASO (%)	0.50	0.33	0.17	0.20	0.10
PLATELET x10^3/mm^3	205	222	219	259	14.21

$^{a, b}$ Means with different superscripts are significantly ($P<0.05$) different
SEM: Standard Error of Mean FCR: Feed Conversion Ratio
T1–Tap water T2–Borehole water T3-Well water T4- River water
PCV-Packed cell volume H.B-Haemoglobin RBC-Red blood cells
WBC-White blood cells LYMP-Lymphocytes HETERO-Heterophyils
MONO-Monocytes EOS-Eosinophil BASO-Basophils

Table 5: Effect of Different Water Sources on Serum Electrolyte Levels of Broiler Chickens

Parameters	T1 (Tap)	T2 (Bore)	T3 (Well)	T4 (River)	SEM
Sodium (mEq/L)	134.03^{b}	143.49^{b}	138.01^{b}	173.90^{a}	3.94
Calcium (mg/dl)	5.50^{b}	6.42^{ab}	6.72^{ab}	7.11^{a}	0.24
Potassium(mEq/L)	2.41^{b}	3.54^{a}	2.84^{ab}	3.16^{ab}	0.17
Magnesium(mg/dl)	1.32	1.20	0.71	0.77	0.11
Phosphorus(mg/dl)	11.03^{b}	27.89^{a}	9.09^{b}	12.86^{b}	2.17
Chloride(mg/dl)	67.54	66.02	64.78	61.73	1.91

$^{a, b}$ Means with different superscripts are significantly (P<0.05) different

SEM: Standard Error of Mean FCR: Feed Conversion Ratio

T1–Tap water T2–Borehole water T3-Well water T4- River water