Haryana Vet. (June, 2017) **56 (1)**, 29-32

Research Article

EFFECT OF BRACKISH DRINKING WATER ON CARCASS CHARACTERISTICS, COST OF PRODUCTION AND MORTALITY OF BROILER CHICKEN

ABDUL AZIZ[1], D. KAR[1], D.S. BIDHAN[1], D.C. YADAV[1]* and ANURADHA KUMARI[2]
[1]Department of Livestock Production Management, College of Veterinary Sciences
Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar-125 004, India
[2]Department of Livestock Production Management, Faculty of Veterinary and Animal Sciences, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi-221 005, India

Received: 09.02.2017; Accepted: 17.06.2017

ABSTRACT

Day-old, vaccinated broiler chicks (n=240) were distributed into four treatments (T_1, T_2, T_3& T_4) of 60 birds with three replications of 20 birds each. Underground chloride dominated brackish water and potable drinking water was compared as a source of drinking water. In groups T_1andT_4,potable drinking water and underground chloride dominated water, respectively was provided whilein groups T_2 and T_3potable drinking water was replaced with chloride dominated brackish water after 14 and 21 day, respectively. Broilers were fed ration as per the BIS (2007) standards. The results revealed that at the end ofthe experiment i.e., six week, there was a significantly higher ($P<0.05$) amount of feather in group T_1 than groups T_2, T_3, and T_4. There was no significant difference among various treatments regarding different carcass characteristics. The total cost (in rupees) of production/kg live weight was found to be81.13 (T_1), 86.70 (T_2), 84.15 (T_3) and 90.60 (T_4). The cost of per kg live weight was higher in T_2, T_3 and T_4 than the T_1 by5.57, 3.02 and 9.47/kg, respectively. Mortality was maximum in the group T_4. It was concluded that brackish water containing bicarbonate (up to 14.9), chloride (up to 38.1), calcium (up to 5.8) and calcium+magnesium (17.0 mEq/L) with 8693 µS/cm level of EC may not suitable as drinking water for broiler production.

Key words: Broilers, brackish water, carcass characteristics, production cost, mortality.

As per estimates of 19th All India livestock census, the total poultry population in the country has increased by 12.39% and total poultry in country is 729.2 million in 2012. The domestic broiler meat demand is expected to grow at around 15-18%, while table egg demand is expected to grow at 5-7% in medium to long term (Poultry Fest, 2014).

Water is an essential component of life for all living beings. It plays an important role in maintaining and regulating life processes such as digestion, elimination of waste and body temperature etc. It makes up a large proportion of the body of the chicken from 55 to 75% (Nesheim *et al*., 1979; McDonald *et al*., 2002). Generally, the quality of ground water is measured by taste, colour, odour, pH, electrical conductivity (EC), hardness, alkalinity, salinity, and presence of cations and anions (Zimmermann *et al*., 1998)**.** For fresh water, potential salinity is used synonymously with TDS as a measure of total ions in solution. Water containing TDS between 1000 and 10,000 mg/L is classified as brackish water (Vohra, 1980). Ground water in Haryana and semi-arid regions of the country is by and large brackish. The water quality in relation to crop production of some states of India has been reported by Manchanda *et al.* (1989). According to this report, 68% of ground water of Rajasthan is of poor quality, followed by 55% in Haryana.

*Corresponding author: dc2008v18b@gmail.com

Performance problems are associated with consumption of salt in feed and water, particularly sodium, potassium and chloride (El-Badry *et al.,* 2015). Water intake is affected by the amount and type of salts present in water (Mamabolo *et al.,* 2009). Damron and Flunker (1993) found that water consumption of older hens in cooler weather was adversely affected by 50 ppm chloride. Inferior water quality has detrimental effects on broiler performance and negatively correlated with body weight as well as immune resistance (Grizzle *et al.,* 1997). Poor quality of underground water remains one of the major factors responsible for poor poultry farming adoption in rural areas of Haryana. Consequently, the current study aimed to study the effect of tap and ground drinking water sources on broiler chicken performance, carcass characteristics, cost of production and mortality pattern.

MATERIALS AND METHODS

The experiment was conducted at Poultry Farm of the Department. Two hundred and forty, day-old vaccinated broiler chicks were procured from a local hatchery and were distributed into four treatments of 60 each. Each treatment was further replicated thrice.

Experiment Design: Underground chloride dominated brackish drinking water available from tube well was used for the experimental study. Tube well as well as tap

water were analyzed for EC and major mineral contents at Water and Soil Testing Laboratory, CCSHAU, Hisar. Tube well water had average: EC 8693µS/cm, bicarbonate14.9, chloride up to 38.1 calcium up to 5.8 and calcium plus magnesium 17.0 mEq/L while potable drinking tap water had: EC 332µS/cm, bicarbonate1.5, chloride up to 1.1, calcium up to 0.9 and calcium plus magnesium 2.2 mEq/cm. Brackish water was offered to group T_4 throughout the experiment and in groups T_2 and T_3 after two and three weeks, respectively. Tap water was supplied to T_1 (control), throughout the experiment period and for T_2 and T_3, for initial two and three weeks, respectively.

Brooding and Management: The chicks were weighed and reared under circular brooders by using incandescent bulb of 100 watt hanged at a height of 15-18^0 which was adjusted according to the heat requirement of the chicks up to 2 weeks and later on Compaq fluorescent lamp (CFL) were used for light inside the pens at 6-7 height. One and quarter feet high fibre glass brooder guards ware used for 2 weeks.

The chicks were offered broiler ration (mash) formulated according to BIS (2007) specifications (Table 1). In all treatments, the birds were fed broiler pre-starter ration (2952 kcal ME/kg with 23.03 % crude protein) for the first week. From 2-3 weeks broiler starter ration (3056 Kcal ME/kg with 22.04 % crude protein) and from 4-6 weeks finisher ration (3163 Kcal ME/kg with crude protein 20.08%) was offered.

Carcass Characteristics: At the end of the experiment, six birds per treatment (two from each replicate) were randomly selected. Birds were kept off feed for 12 h prior to their sacrifice but drinking water was supplied to them. Immediately after recording their live weights, the birds were killed and allowed to bleed completely following 'halal' method. The birds were then eviscerated by removing the crop, trachea and viscera. The lungs were scrapped off and the heart, liver and gizzard constituting giblets were removed carefully from the viscera. The gall bladder was removed with care from liver to avoid its puncture. The gizzard was opened and its contents were washed out and inner epithelial lining was discarded. The heart was made free from blood and adhering vessels. The eviscerated carcass was allowed to chill in ice water for one hour and then weight of carcass was recorded.

Production Cost: Treatment wise economics was calculated at the end of sixth week. The cost of feeding was calculated on the basis of chicks survived under each treatment. The total cost of feed consumed under each treatment was added to the cost per chick survived. The information about the prices of all the feed ingredients used in feed formulation as per BIS (2007) viz. maize, soybean meal, groundnut cake, soybean oil, fish meal etc. were obtained from the Department of Animal Nutrition, LUVAS, Hisar. The prices of feed supplements were considered as per the amount used and price list of the manufacturer.

Mortality: The birds were observed daily for morbidity and mortality during the experimental period. The dead birds were sent for post-mortem examinationin the Department of Veterinary Pathology, LUVAS, Hisar, in order to ascertain the cause of death.

Statistical Analysis: Data obtained were subjected to statistical analysis as per Snedecor and Cochran (1994). Significant differences among treatment mean values were determined at 5% probability by Duncan's multiple range tests.

RESULTS AND DISCUSSION

Carcass Characteristics: There was a significantly higher ($P<0.05$) amount of feather in control group as compared to the treatment groups (Table 2). There was no significant difference among various treatments regarding different carcass characteristics such as live weight, weight after bleeding, head and legs weight, giblet weight, viscera weight, hot dressing weight, cold carcass weight and dressing percentage. Live weight was the best in the treatment group where birds were

Table 1
Ingredients and composition of ration (% DM basis) formulated for experimental broilers

Ingredient composition	Quantity		
	Pre starter (0-1 week)	Starter (1-3weeks)	Finisher (3-6 weeks)
Maize (kg)	55	55.5	60
Soybean meal (kg)	20	17	15
Groundnut cake (kg)	12.5	13.5	10
Fish meal (kg)	8	8	8
Mineral Mixture (kg)	2	2	2
Soybean oil (kg)	2.5	4	5
Spectromix (g)	10	10	10
Spectro BE (g)	20	20	20
Cocciwin (g)	50	50	50
Choline chloride (g)	50	50	50
Lysine (g)	50	50	50
DL-Methionine (g)	80	80	80
Total (kg)	100.26	100.26	100.26
Chemical composition			
Crude Protein (%)	23.03	22.04	20.08
Metabolizable Energy (Kcal/kg)	2952	3056	3163

Table 2
Effect of brackish drinking water on carcass characteristic of broilers

Carcass characteristics (g)	Treatments			
	T_1	T_2	T_3	T_4
Live wt (g)	2295.67±111.46	2094.00±118.36	2113.33±50.71	2122.67±69.39
After bleeding(g)	2220.33±109.94	2021.00±112.05	2048.83±50.44	2042.67±72.67
Feather (g)	284.83^{a}±13.67	275.00^{b}±10.62	270.83^{b}±6.92	241.67^{b}±3.56
Leg (g)	176.00±9.62	157.00±11.11	163.83± 4.86	157.33±2.04
Giblet (g)	140.33±4.72	155.67±6.14	139.67±3.57	133.33±5.05
Viscera (g)	103.50±6.11	106.67±3.68	96.33±5.25	94.33±5.28
Dressing weight (g)	1442.67±75.12	1328.67±89.85	1349.67±34.00	1356.33±54.36
Cold carcass (g)	1439.83±77.33	1309.00±89.91	1328.83±33.79	1337.50±54.40
Dressing (%)	62.65±0.49	62.31±1.08	62.88±0.65	62.93±0.67

Means bearing different superscripts differ significantly (P<0.05) row wise. T_1=Tap water (Control); T_2=Tap water for 2 weeks and then brackish water; T_3=Tap water for 3 weeks and then brackish water; T_4=Brackish water

getting potable tap water and was worst in the treatments where birds were on brackish water or shifted early (after 2 weeks) to brackish water from tap water. Similar results were obtained for live weight after bleeding. Present study was in agreement with the finding of Mitcham and Wobeser (1988) who reported that the supra orbital salt gland was active within 4 days in ducklings on drinking water containing greater than or equal to 1500 ppm of Na. This level of Na also decreased feather growth.

Other parameters viz. head and leg weight, giblet weight, viscera, dressing weight, cold carcass weight and dressing percentage were not significantly different in tap water and brackish water treatment birds. The present findings are in partial agreement with the finding of Borges *et al*. (2003) who noticed that the use of electrolytes in drinking water had no significant effect on carcass traits.

Production Cost: The cost of chicks was calculated on the basis of birds survived up to the end of experiment under each treatment. The initial cost of one-day-old broiler chicks was Rs.28.00 per chick (Table 3). Due to the death of birds in different groups, the cost of chick was 31.69 per chick in T_1, 30.00 in T_2, 31.11 in T_3 and 34.28 in T_4 treatment. Feed cost was found to be Rs. 29.73 per kg. The total cost of production/kg live weight was found to be Rs. 81.13 (T_1), 86.70 (T_2), 84.15 (T_3) and 90.60/kg (T_4), respectively. The cost of per kg live weight was higher in T_2, T_3 and T_4 than the T_1 by Rs. 5.57, 3.02 and 9.47/kg, respectively.

The feeding cost of producing one kg of broiler up to 42 days of age was the highest in the T_4 treatment. Similarly in the treatments where tap water was replaced by brackish water at 2 or 3 weeks of age, the cost of feeding was also higher due to poor growth and mortality.

Mortality: Total mortality of birds in all four treatments T_1, T_2, T_3 and $T_4$was 7, 4, 6 and 11 up to 2, 4 and 6 weeks, respectively, and the numbers of total birds died after 6 weeks of age in all four treatments were 28 (11.5%).

Post-mortem reexamination revealed ascites in birds which wereoffered brackish drinking tube well water from the beginning to the end of the experiment. This finding is in agreement with the finding of Pannuvel and Jalaludeen (1997) who suggested that water should not contain sodium more that 1000 ppm. If water contains 500 ppm Sodium then feed should have sodium

Table 3
Effect of brackish drinking water on feeding cost of broiler chickens at six weeks of age

Particulars	Treatments			
	T_1	T_2	T_3	T_4
Total no. of bird	60	60	60	60
Live body weight at 6th week of age (g/bird)	1938	1797	1855	1778
Body weight gain up to 6th weeks of age (g)	1904	1763	1822	1745
Total feed consumption up to 6th week of age (g/bird)	4223	4232	4206	4266
Feed cost (Rs.) per kg feed	29.73	29.73	29.73	29.73
Total feed cost (Rs./bird)	125.54	125.81	125	126.82
Chick cost (Rs.)	31.69	30.00	31.11	34.28
Total cost of production/bird	157.23	155.81	156.11	161.10
Total cost of production/kg live weight	81.13	86.70	84.15	90.60
Net difference (Rs.)	0	5.57	3.02	9.47

below 1500 ppm to control ascites in poultry. Kar *et al.* (2003) also reported that poultry farmers of few villages of Bhiwani district of Haryana are using brackish underground drinking water above 7000µS EC, and experiencing ascites and poor growth.

REFERENCES

BIS. (2007). Poultry Feeds - Specification. 5th Review. Bureau of Indian standards, New Delhi.

Borges, S.A., Silva, F.D., Ariki, A.V., Hooge, D.M and Cummings, K.R. (2003). Dietary electrolyte balance for broiler chickens under moderately high ambient temperatures and relative humidity. *Poult. Sci*. **82**: 301-308.

Damron, B.L. and Flunker, L.K. (1993). Broiler chick and laying hen tolerance to sodium hypochlorite in drinking water. *Poult. Sci*. **72**: 1650-1655.

El-Badry, A.S.O., Ali, W.A.H., Ali, A.A., Ahmed, M.A and El-Aasar, T.A. (2015). Effect of betaine as an alleviator of osmotic stress on pekin ducks reared on natural saline water. *Poult. Sci.* **35(4)**: 1041-1064.

Grizzle, J.M., Armbrust, T.A., Bryan, M.A., and Saxton, A.M. (1997). Water quality II: The effect of water nitrate and bacteria on broiler growth performance. *J. Appl. Poult. Res*. **6(1)**: 48-55.

Kar, D., Prasad, D. and Varma, A.K. (2003). Murgio ko kharapani ke dusprabhow se bachanay ke liye sujhaw (In Hindi). *Haryana Kheti* **5**: 27.

Mamabolo, M.C., Casey, N.H. and Meyer, J.A. (2009). Effects of total dissolved solids on the accumulation of Br, AS and PB from drinking water in tissues of selected organs in broilers. *S. Afr. J. Anim. Sci.* **39**: 169-172.

Manchanda, H.R., Gupta, I.C. and Jain, B.L. (1989).Use of poor quality waters. In: Reviews of Research on Sandy Soils in India. Int. Symposium on managing sandy soil. Central Arid Zone Research Institute, Jodhpur, India, pp. 362-383.

McDonald, P., Edwards, R.A., Greenhalgh, J.F.D. and Morgan, C.A. (2002). Animal Nutrition. (6th edn.). Pearson Prentice Hall, Harlow, England.

Mitcham, S.A. and Wobeser, G. (1988). Effect of sodium and magnesium sulphate in drinking water on mallard ducklings. *J. Wildl. Dis*. **24(1)**: 30-44.

Nesheim, M.C., Austic, R.E. and Card, L.E. (1979). Poultry Production. (12th edn.). Bailliere Tindall, London.

Pannuvel, P. and Jalaludeen, A. (1997). Ascitis possible mechanism and control measures. *Poult. Adv.* **30**: 13-14.

Snedecor, G.W. and Cochran, W.G. (1994). Statistical Methods. (8th edn.). Iowa State University Press, Iowa, USA.

Vohra, P.N. (1980). Water quality for poultry use. *Feedstuff* **52**: 24-25.

Zimmermann, N.G. and Douglass, L. (1998). A survey of drinking water quality and its effects on broiler growth performance on Delmerva. *Poult. Sci.* **77(1)**: 121.