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Research Article

EFFECT OF BRACKISH DRINKING WATER ON GROWTH, FCR, FEED AND WATER CONSUMPTION OF BROILER CHICKEN

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ABSTRACT

Present experiment was conducted to study the effect of brackish drinking water on the growth performance of broiler chicken up to six weeks of age. Two hundred and forty, day-old, vaccinated broiler chicks were distributed into four treatments (T_1, T_2, T_3 & T_4) of 60 each, having three replications of 20 birds each. Underground chloride dominated brackish water and potable water was compared as a source of drinking water in the experimental birds. In control (T_1,) potable drinking water was provided, in T_4 underground chloride dominated water, in T_2 and T_3 potable drinking water was replaced after 14 and 21 day with chloride dominated brackish water. At the end of the experimental period, there was a significantly ($P<0.05$) better cumulative body weight gain in T_1 followed by T_3,T_2 and T_4. There was significant ($P<0.05$) reduction in feed intake at six weeks of age in treatments in comparison to control. Water intake was significantly higher in treatments as compared to control. Significantly ($P<0.05$) better FCR was found in T_1 and T_3 than in T_4 and T_2. The feed conversion ratio was lowest in T_4 followed by T_2 and T_3. It was concluded that brackish water dominated by bicarbonate, chloride, calcium and calcium + magnesium is less suitable as drinking water than tap water for broiler production.

Key words: Body Weight, Brackish water, Broilers, Feed Conversion Ratio, Feed intake

Poultry production in India during the last few decades has taken a shape of industry (Panwar *et al.*, 2016). Water makes up a large proportion of the body of the chicken, from 55 to 75 per cent (Mc Donald *et al.*, 2002). 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). High salt content of fishmeal in feed with chloride dominated brackish drinking water will adversely affect the poultry production (Kar *et al.*, 2001).

Work has been carried out at Lala Lajpat Rai University of Veterinary and Animal Sciences (LUVAS) poultry farm to find out the maximum tolerance level of reconstituted brackish water on broilers (Kar *et al.*, 2000; Tyagi *et al.*, 2006). For young chicks, the requirement of water is less and water of lower electrical conductivity (EC) can be transported from a nearby tube well which is safer in respect to growth of commercial broilers at early age.

Chloride is present in all natural waters, mostly at low concentrations. It is highly soluble in water and moves freely with water through soil and rock. In ground water, the chloride content is mostly below 250 mg/L except in cases where in land salinity is prevalent in coastal areas. BIS (Bureau of Indian Standard) have recommended a desirable limit of 250 mg /L of chloride in drinking water; this concentration limit can be extended to 1000 mg/L of chloride in case no alternative source of water with desirable concentration is available for human consumption. However, ground water having concentration of chloride more than 1000 mg /L is not suitable for drinking purposes (Jha, 2010).

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MATERIALS AND METHODS

The present trial was undertaken to study the effect of underground chloride dominated drinking water on the performance of broiler up to 6 weeks of age. The experiment was conducted at poultry farm of Department of Livestock Production Management (LPM), College of Veterinary Sciences, LUVAS, Hisar. Two hundred and forty, day old vaccinated broiler chicks were procured from a private hatchery located at Hisar. On the basis of body weight, day old chicks were distributed into four treatments of 60 each. Each treatment was further distributed into three replications.

Experiment Design

Underground chloride dominated brackish drinking water was available from tube well adjoining to the poultry shed of the Department of LPM, LUVAS. Tube well as well as tap water were analyzed for EC and major mineral contents, from water and soil testing lab of Chaudhary Charan Singh Haryana Agricultural University (CCS HAU), Hisar (Table 1 and 2). Underground chloride dominated water was offered to treatment T_4 throughout the experiment period and in treatment T_2 and T_3 after two and three weeks, respectively. Tap water was supplied to treatments T_1 (as control) throughout the experiment

Table 1
Tube well water quality parameters

Weeks	EC (µS/cm)	HCO_3^- mEq/L	Cl^- mEq/L	Ca^{++} mEq/L	$Ca^{++} + Mg^{++}$ mEq/L
0	9930	16.0	35	7.0	20
1st	8700	18.0	36	6.0	16
2nd	7250	16.8	34	4.0	15
3rd	9280	16.4	38	8.0	18
4th	9552	16.0	35	6.6	19
5th	7450	14.2	32	5.2	14
Average	8693	16.2	35	6.1	17

Table 2
Tap well water quality parameters

Weeks	EC (µS/cm)	HCO_3^- mEq/L	Cl^- mEq/L	Ca^{++} mEq/L	$Ca^{++} + Mg^{++}$ mEq/L
0	355	1.8	1.2	1.0	2.2
1st	387	1.8	1.0	1.0	2.2
2nd	259	1.0	0.8	0.8	2.1
3rd	332	1.8	0.8	1.0	2.2
4th	352	1.6	1.4	1.0	2.5
5th	314	1.2	1.0	0.8	2.0
Average	333	1.5	1.0	0.9	2.2

period and for T_2 and T_3, for initial two and three weeks, respectively.

Housing and management

Twelve pens of shed were cleaned and sprayed with disinfectant, the chicks were wing banded, weighed and put under brooders. Wheat straw was used as bedding material, which was covered with newspaper inside the brooder. One foot long linear chick feeders were used up to 2 weeks of age and later 3 feet long linear feeder were used up to 4 weeks and thereafter round feeders were used. The round feeders were kept at shoulder height of chicks to prevent feed wastage during 4-6 weeks. For 2 weeks, 3 litres capacity chick waterers were used followed by bigger size waterers (earthen "Matka" and "Thali") of 10 litre capacity.

Brooding and rearing

Through circular brooder, heat was provided by using incandescent bulb of 100 watt hanged at a height of 15-18″ which was adjusted according to the heat requirement of the chicks up to 2 weeks and later on Compact fluorescent lamp (CFL) bulbswere used for light inside the pens at 6-7′ height. One and quarter feet high fibre glass brooder guards were used for 2 weeks.

Feeding and watering

The chicks were offered broiler ration (all mash), formulated according to BIS (2007) specifications (Table 3). In all treatments, the birds were fed broiler pre starter ration (2952 kcal ME/kg with 23.03 % crude protein) for

Table 3
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

the first week. From 2-3 weeks, broiler starter ration (3056 Kcal ME/kg with 22.04% crude protein) and from 4-6 weeks of age, finisher ration (3163 Kcal ME/kg with crude protein 20.08%) were offered.

Observation recorded

Initial and biweekly body weight of individual bird of each treatment was recorded up to six weeks of age. The body weight was taken in the morning with the help of 5kg capacity electronic pan type balance. Daily mortality record was maintained if any, during the experiment period. The dead birds were immediately sent for post-mortem examination in 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) using Completely Randomized Design (CRD). Analysis was done to estimate mean body weight, body weight gain etc. by using statistical package (SPSS version 20). Significant differences among treatment mean values were determined at 5% probability by Duncan's multiple range tests.

RESULTS AND DISCUSSION

Body weight

Body weight was significantly ($P<0.05$) reduced after 14, 28 and 42 days of experiment when the broilers were offered chloride dominated brackish tube well water

Table 4
Effect of drinking water type on body weight (g) of broilers

Treatment	Live body weight (Mean±SE) (g)			
day	T_1	T_2	T_3	T_4
0	33.6± 0.34	33.50± 0.31	33.47± 0.29	33.45± 0.28
14	294.19^{a}± 6.84	285.76^{a}± 6.04	299.97^{a}± 4.66	258.76^{b}± 40.51
28	954.05^{a}± 20.59	901.67^{ab}± 19.08	911.79^{ab}± 19.89	873.58^{b}± 20.86
42	1938.19^{a}± 44.81	1797.34^{b}± 41.61	1855.87^{ab}± 41.34	1778.90^{b}± 45.03

Mean bearing different superscripts differ significantly ($p<0.05$)

as a source of drinking water (Table 4). At 42 days of age, the body weight was significantly different in tap water and tube well water treatment group, body weight gain was less in tube well drinking water offered treatment. The present study is in agreement with the control study where reconstituted chloride dominated brackish water has been recommended safe up to 6000 µS/cm EC in terms of body weight gain by Tyagi *et. al.* (2006). Similar report has been given by Krista *et. al.* (1961) where 7000 ppm sodium chloride in water was found to reduce the growth of broilers. Kar *et. al.* (2003) reported that poultry farmers of few villages of Bhiwani district of Haryana are using underground brackish water having EC above 7000 µS/cm due to non availability of potable tap water which affects the broiler growth. Body weight gain was reduced significantly when the broilers were offered tube well water after 2 weeks of age rather than three weeks of age after an initial source of tap water up to 2 and 3 weeks, respectively. When broiler were shifted to tube well water from tap water after three weeks of age, then the body weight gain was less affected. Present finding is in agreement with the finding of Mirsalimi and Rechard (1993) who concluded that broilers become more resistant to saline water containing 0.20% sodium chloride after three weeks of age.

In the present study, it has been found that the body weight gain after 42 days was significantly less in the treatment group where tap water was completely replaced by the tube well water from an early age i.e. after 14 days rather than after 21 days, or completely reared on tube well water.

Body weight gain

There was a significant ($P<0.05$) decrease in cumulative body weight gain from beginning up to 14 days of age in the treatment where birds were drinking brackish tube well water in comparison to three other treatments receiving tap water (Table 5). On 28th day, in the treatment where tap water was offered broilers performed significantly

Table 5
Effect of drinking water type on cumulative body weight gain (g) of broilers

Treatment	Body weight gain (Mean±SE) (g)			
(days)	T_1	T_2	T_3	T_4
0	33.6± 0.34	33.50± 0.31	33.47± 0.29	33.45± 0.28
0-14	260.59^{a}± 6.82	252.59^{a}± 5.95	266.50^{a}± 4.58	225.82^{b}± 5.47
0-28	920.51^{a}± 20.59	868.12^{b}± 19.06	878.47^{b} ± 19.84	863.06^{b}± 20.88
0-42	1904.89^{a}± 44.77	1763.80^{b}± 41.60	1822.46^{ab}± 41.31	1745.43^{b}± 43.03

Means bearing different superscripts differ significantly ($P<0.05$)

better than the treatment groups replaced by brackish tube well water on 2 and 3 weeks and in the treatment offered exclusively tube well water from the very beginning. On day 42, there was a significantly better cumulative body weight gain observed in the tap water offered treatment than tap water followed by tube well water treatment birds at early age (14 day) as well as with the exclusively offered tube well water treatment birds. However, the treatment where the tap water was replaced by tube well water after 21 day performed similar to the tap water receiving treatment birds in relation to cumulative body weight gain. Present findings are somewhat in agreement with the findings of Koreleski *et. al.* (2011) who reported that during the starter period, body weight gains and feed conversion ratio were positively affected by the dietary chloride content when increased from 2.11 to 2.95 g. On the other hand Illian *et. al.*, (1981) reported that brackish water having 3000 ppm salt did not adversely affect the overall performance of broiler either at 4 or 6 weeks of age and differences in body weight gains were also not significant.

Feed intake

There was a significant ($P<0.05$) drop in feed intake after 42 days of age in the tube well water treatment birds in comparison to tap water and 2 or 3 weeks tap water replaced tube well treatments birds (Table 6). On 28 day, the tap water receiving bird's intake was higher than the bird receiving brackish water in T_2, T_3 and T_4. Present study is in agreement with the findings of Solanke (1982) who reported reduced feed intake in broiler when the sodium chloride in feed was 2 percent and 2000 ppm or higher in water. He also observed similar result in different seasons of the year. On the other hand, Illian *et. al.* (1981) observed that when the broiler pullets were given brackish water containing about 3000 ppm of dissolved solids, feed consumption and ratio of water to feed intake were not adversely affected when compared to pullets receiving soft

Table 6
Effect of drinking water type on feed consumption (g) of broilers

Treatment	Feed intake (g)			
(weeks)	T_1	T_2	T_3	T_4
0-14	435.18^{ab}± 14.00	436.80^{ab}± 12.18	452.33^{a}± 10.35	413.84^{b}± 3.86
0-28	1847.33^{a}± 30.68	1741.98^{b}± 8.09	1770.42^{ab}± 16.89	1766.66^{ab}± 33.51
0-42	4423.17^{a}± 42.63	4232.89^{b}± 43.23	4206.52^{b}± 15.93	4266.41^{b}± 59.41

Means bearing different superscripts differ significantly (P<0.05)

Table 7
Effect of drinking water type on water consumption of broilers

Treatment	Water consumption (Mean±SE) (ml)			
(weeks)	T_1	T_2	T_3	T_4
0-14	853.89^{b}± 38.31	873.60^{b}± 24.37	861.17^{b}± 14.69	966.34^{a}± 11.24
0-28	3001.66^{b}± 5.78	3279.28^{a}± 84.46	3302.61^{a}± 95.01	3290.66^{a}± 56.62
0-42	6801.93^{b}± 274.62	7407.40^{a}± 18.83	7415.53^{a}± 103.31	7445.53^{a}± 32.39

Means bearing different superscripts differ significantly (P<0.05)

water (361 ppm).

Water consumption

Water intake was significantly (P<0.05) high in the treatment where the bird received tube well water from beginning till the end of the experiment in comparison to other groups. On 28 day, the water consumption significantly (P<0.05) increased in all the three brackish water treatment birds in comparison to birds receiving tap water. Similar trend was observed up to 42 day of the experiment (Table 7). Present study was in agreement with the findings of Krista *et. al.* (1961) also reported the increased water consumption in chicks and laying hens given water having 4000 ppm sodium chloride. Dai *et. al.* (2009) found similar results where addition of KCl and NaCl in drinking water enhanced water intake. However, Damron and Flunker (1993) reported reduced water consumption in broilers experiments of 21 days duration given 100 ppm chloride drinking water.

Feed conversion ratio

It was observed that up to 14 days of age there was better FCR in the tap water receiving treatment birds than the chloride dominated brackish tube well water receiving treatment birds (Table 8). On day 28, there was no difference in FCR among the treatments, however it was marginally higher in the exclusively tube well water receiving

Table 8
Effect of drinking water type on feed conversion ratio of broilers

FCR (weeks)	FCR (Treatments)			
	T_1	T_2	T_3	T_4
0-14	1.67^{a}±0.05	1.73±0.04	1.69^{a}±0.03	1.69^{a}±0.03
0-28	2.00±0.03	2.00±0.00	2.01±0.01	2.10±0.03
0-42	2.32^{b}±0.02	2.44^{a}±0.02	2.30^{b}±0.08	2.44^{a}±0.03

Means bearing different superscripts differ significantly (P<0.05)

treatment. At 42 days of age significantly (P<0.05) better FCR was obtained in the tap water receiving treatment as well as in tap water replaced by brackish water after 21 days (3 weeks) than birds reared throughout on brackish water and tap water replaced by tube well water after 14 days (2 weeks). From the present finding it is clear that FCR is least affected when brackish water was offered after three week of broiler age and therefore this practice can be utilized by the farmers for broiler farming where the underground water is brackish and chloride dominated. Above findings are in agreement with the findings of Mushtaq *et. al.* (2005) who reported that under subtropical summer conditions there was no effect of dietary chloride (0.5%) on water and feed consumption, water/feed consumption ratio, weight gain, feed conversion ratio or mortality rate of broiler chicks. Present finding is in consonance to the findings of Reddy *et. al.* (1982) who reported that feed efficiency was best in situation where there is low dietary salt (0.38%) with 0.10 and 0.15 percent in water given to broilers.

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