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Impact of Different Locations Water Quality in Basra Province on the Performance and Physiological Changes in Broiler Chicks

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Abstract: An experiment was conducted at the Department of Animal Resources poultry farm, College of Agriculture, University of Basra, from 27/11/2009-7/1/2010. The study aimed to determine the effect of water quality aggregated from different location from Basra province on broilers performance. A total of 120 day-old chicks were randomly distributed into four treatments with three replicated of ten chicks were given T_1 University tap water (Albdai, Thi-Qar), T_2 R.O water, T_3 Garmat Ali raw river water (North of Basra), T_4 Abou-Al-Kasseb tap water (South of Basra). pH, Salinity, Alkalinity, TDS and EC were analysied to those kinds of water. Increase in TDS ($\geq$3.086, 5.936 mg/L and salinity) water ($\geq$3.60, 4.33) in T_3 and T_4 caused decrease body weight, hematological traits, tibia length and production index and an increase in feed and water intake, feed conversation ratio, faecal moisture percentage; serum cholesterol, total protein, albumin, globulin, albumin globulin ratio, urea, AST, ALT, Sodium, potassium, chloride, tibia ash percentage and some relative weight organs. Decreasing level TDS and salinity (<0.165, 0.3, R.O. T_2) has also deteriorate some of the above traits but not as much an in T_3 and T_4. Therefore, a level of (1.385, T_1) TDS and salinity (1.08, T_1) are essential for broiler normal performance, hematological; serum biochemical traits and electrolyte levels which reflected in perfect jejunum histology and production index.

Key words: Water quality, broiler, broiler performance, blood hematology, serum biochemical, jejunum histology, production index

INTRODUCTION

Since water is required by animals in large amount, it is probably the most important nutrient for livestock. Chicken can survive for longer periods without any other nutrient than they can surive without water (Scott *et al.*, 1982). Good quality water is essential for the production of livestock and poultry, it is an essential ingredient for life, nutrient and also involved in many essential physiological functions such as, digestion, absorption, enzymatic function, nutrient transportation, thermoregulation, lubrication of joints and organs, elimination of waste and it is also an essential component of blood and tissues (Chiba, 2009). There are many fasters affected water intake such as, environmental temperature can impact, intake will increase by 6-7% for each degree above 21°C (Singleton, 2004). Water intake closely linked to feed intake and birds age. As the birds get older the demaned for water will about twice as much as feed (Alam, 1980). Water quality attributes can have a direct or indirect effect on performance. High levels of bacterial contaminants, minerals, or other pollutants in drinking water can have detrimental effects on normal physiological properties resulting in inferior performance (Blake and Hess, 2010).

Any reductions in water intake or increase in water loss can have a significant effect on the lifetime performance of chick (Kirkpatrick and Fleming, 2008). Thus, water quality can be evaluated by a number of criteria such as, Total Dissolved Solids (TDS), hardness, alkalinity, Electrical Conductinity (EC), hydrogenion concentration (pH) et. (Damron, 2002). It can be difficult, however 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 (German, 2008). In many cases, guidelines have been established based on mortability and not deficiencies in performance (Kirkpatrick and Fleming, 2008). One of the most important indicator 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 (National Academy of Science, 1974). TDS was found to be a water majer tolerance factor in pig experiments (Anderson *et al.*, 1994), which decrease digestibility and effects growth performance (McLeese *et al.*, 1992). Basra suffer from the salinity water for along time but it has become a phenomenon during the latter. There was a high mortality rate among wild birds due to water, also the farmers have been losted a lot of their domestic animals and poultry (Alattar, 2009). Therefore the aim of the present study was to assist poultry producers to assess four different locations of water quality in Basra province on the performance, hematology, biochemical traits, electrolyte levels and intestinal histology of broiler chicks.

Table 1: Some water quality criteria chemical analysis of four different locations of water quality in Basra province

Parameters	T_1 University tap water (contrl)	T_2 Reverse osmosis water	T_3 Raw alkrma river water	T_4 Abou-Al-Kaseeb tap water
pH	7.750	7.300	8.000	7.800
Salinity g/L	1.080	0.300	3.600	4.330
TDS mg/L	1.385	0.165	3.086	5.036
Alkalinity mg/L	36.000	0.000	16.000	24.000
EC ms/cm	2.127	0.252	4.748	7.748

MATERIALS AND METHODS

An experiment was conducted at poultry Research Unit, Animal Resources Department, College of Agriculture, University of Basra from 27/11/2009 to 7/1/2010. A total of 120 day old broiler chicks were purchased from a local hatchery in Basra. On arrival, they were wing-marked, weighted individually and distributed randomly into four treatments groups of 30 birds. Each treatment contain three replicate battery cages (10 birds/cage). Four different sources of water were used as follows:- Treatment (T_1) University tap water (Albdai, Thi-Qar) (Control); (T_2) Reverse Osmosis water (R.O); (T_3) Garmat Ali raw river water (North of Basra); (T_4) Abou-Al-Kasseb tap water (South of Basra) as shown in Table 1. Ten litters of water per treatment were provided to each replicate per day. Remaining water was recorded in the next day to calculate water consumption. Chicks were mainted under standard managemental conditions. They were fed starter diet from one to 21 days of age and then switched to grower diet from 22-42 days of age. The composition of these diets were shown in (Table 2). Weekly live body weights were recorded for each chick and the average live body weight were calculated for each replicate and treatment during the six weeks experimental period. Feed consumption, feed conversion ratio were also recorded weekly for each replicate. At the end of six weeks, three chicks from each replicate were taken randomly weighted and slaughtered to determine the relative weight for gizzard, heart, liver, kidney, spleen, pancreases and intestinal length. At six weeks of age blood sample were taken from biracial vein from six chicks (3 male and 3 female) from each treatment randomly. Blood samples were collected in either heparinized tubes or without heparin for analysis, Red Blood Cell (RBC) were measured according to method of Natt and Herrich (1952). Packed Cell Volumes (PCV) were measured according to Archer (1965). Hemoglobin (Hb) and Heterophil/Lymphocyte (H/L) ratio were measured according to Varley *et al.* (1980), Shen and Patterson (1983) respectively. Serum cholesterol concentration (mg/100 ml) was determined according to Richmond (1973) using commercial kits (Diamond diagnostics: El-Naser pharmaceutical chemicals Co.). Serum glucose concentration (mg/100 ml) was estimated according to the method of Trinder (1969) using commercial kit (Biolabo SA, France). Serum urea concentration (mg/100 ml) was measured according to the method of Fawcett and Scott (1960) using commercial kits (Biomerieux, France).

Table 2: Composition and calculated analysis of the experimental diets

Ingredients (%)	Starter (0-3 wks)	Grower (3-6 wks)
Yellow corn	51.00	58.00
Wheat	13.00	12.00
Soyabean meal (44%)	25.00	19.00
Protein conc. (50%)	10.00	10.00
Limestone	0.70	0.70
Salt	0.30	0.30
Total	100.00	100.00
Calculated analysis**		
ME (kcal\kg)	2900.00	3004.00
Crude protein (%)	21.84	20.37
Calorie: Protein ratio	133.00	147.50
Calcium (%)	1.15	1.14
Available phosphorus (%)	0.55	0.55
Lysine (%)	1.09	1.01
Methionine + cystine (%)	0.49	0.45

*Protein concentration used was Fabcoo Which imported from Jordan. Contain 50% C.P, 2200 kcal ME, 3% Lysine, 2.5% methionine, 8% Calcium, 3% Phosphorus. **Calculated analysis according to NRC (1994)

Total serum protein and serum albumin were determined by the Buret method (Weichselbaum, 1946) and (Doumas, 1971) respectively using the standard Randox diagnostic kits. The serum globulin fraction was calculated by subtracting the value of the albumin fraction from the total serum protein (Nnadi *et al.*, 2007). The activities of serum Aspartate Amino Transferase (AST) (I.µ/L) and serum Alanine Amino Transferase (ALT) (I.µ/L) were assayed by method Sherwin (1984), using commercial kits provided by Egption spectrum com. Serum sodium, potassium ionize were determined by flam photometer, serious (Jenway pp7), according to (AOAC, 1980) and chloride ionize by titration with $AgNO_3$ (Lacroix *et al.*, 1970). The total levels of Na^+, K^+ and Cl^- are used to calculate the serum electrolyte balance, mEq/L (Na^+, K^+ - Cl^-), (Chiba, 2009). Left tibias of these chicks were removed and dried to constant weight at 105°C for 24 h, defatted and length measurement were taken, then ashed in a muffle furnace at 550°C for 6 h in porcelain crucible and the percentage of tibia ash was determined relative to the dry weight of the tibia. Upper part of small intestine (Jejunum, 10 cm) were taken from each treatment replicates to make histological sections (Luna, 1968).

Faecal droppings were collected daily for the last three days from each replicate. Samples were weighted and dried to constant weight at 105°C for 24 h; to calculate moisture percentage. Production index was calculated according to the quation of (Naji, 2006).

Completely Randomized Design (CRD) was used to study the effect of difference treatment in all traits. Duncan (1955) multiple range test was used to compare the significant differences between means. Data were analyzed using statistical packages of social sciences (SPSS, 2001).

RESULTS AND DISCUSSION

Results of live body weight, feed consumption, feed conversation ratio, water intake and water/feed ratio in different treatments during the experimental period are illustrated in Table 3. The data showed that the were significantly ($p<0.05$) higher in broiler chicks which consumed T_1 (1235, 2112 g and T_2 1250, 1879 g) as compared with treatment T_3 (907, 1072 g) and T_4 (697, 969 g). At 4and 6 week of their age respectively. Treatment four body weight was the worse significantly ($p<0.05$) than the other treatments.

Higher significantly ($p<0.01$) feed intake was recorded by T_1 chicks (202, 4003 g) and T_2 (1846, 3351 g) as compared with T_3 (1876, 2740 g) and T_4 (1754, 2663 g) at 4 and 6 weeks of their age respectively. Better feed conversion was noticed at 4 and 6 weeks of T_1 (1.52, 1.89) and T_2 chicks (1.48, 1.78) as compared with T_3 (2.06, 2.55) and T_4 (2.51, 2.75). A similar trend in feed conversion was observed between T_1 and T_2, but T4 showed the highest value significantly ($p<0.05$) as compared with T_1, T_2 and T_3. In this experiment improved body weight and feed conversion were obtained by T_1 treatment. These source of water TDS and salinity were within the range adviced by the National Academy of Sciences (1974), that a practical (TDS) range of 1000-2999 ppm/L should normally be adequate for broiler chicks. The task force on water quality guidelines (1987) recommends a maximum of 3000 ppm TDS per litter, while the chicks provided T_2 (R.O) water had less significantly ($p<0.05$) body weight and feed consumption that those of T_1 treatment. The RO treatment (T_2) effectively removed most of the essential minerals as shown in (Table 1), thus the impact of body weight and feed consumption observed (Patience *et al.*, 2004). Drinking water should contain minimum levels of certain essential minerals (Kozisek, 2004). However water containing more than 7000 ppm/L TDS should not be offered to poultry. High levels of certain chemicals in water can lead to low body weight and feed intake by prevent absorption of nutrients from feedstuffs, items to consider are TDS, pH, Nitrates, sulfates, salinity et. (Reutor, 2010). The impact of drinking water on the growth of poultry was also described by many authors (Mitchan and Vobster, 1988; Balnave, 1993; HadZiosmanovic *et al.*, 1997; Patterson *et al.*, 2003).

Generally they all reached the same conclusions, pointing to a decline in the growth weight and productivity indicators due to the intake of saline drinking water.

Water consumption and water feed ratio were significantly ($p<0.05$) higher at 4 weeks with T_4 (122.96 ml, 1.96) as compared with T_3 (106.1 ml, 1.58), T_1 (90.64 ml, 1.25) and T_2 (85.07 ml, 1.22), but there was no significant difference between T_1 and T_2. Water consumption and water feed ratio were increased with age (at 6 weeks) and T_4 data was stilled significantly ($p<0.05$) higher (272.45 ml, 4.29) followed by T_3 (253.65 ml, 3.87); T_1 (222.37 ml, 2.37) and T_2 (203.62 ml, 2.17). Generally water consumption increased with increased water salinity. Borges (1997) reported that among several factors, water intake depends upon amount and type of salts in water, birds age, ambient temperatnre, water temperature and water pH. Borges *et al.* (2003b) observed that water intake increased by broiler chicks in order to keep plasma osmotic balance, also increased the passage rate of the digesta, thus reducing the digestibility and absorption of nutrients for growth, this observation was a greed with our results which indicated that when water feed ratio increased (Table 3), live body weight reduced with high TDS and salinity in their water consumption.

Table 3: Effect of different locations of water quality on the broiler chicks performance

	T_1	T_2	T_3	T_4	Sig.
Body wt. (g) (28 days)	1325a±16.43	1250b±13.61	907d±11.87	697c±15.26	0.01
Body wt. (g) (42 days)	2112±24.38	1879±14.80	1072±16.13	969±21.62	0.01
Feed consumed (g/birds) (1-28 days)	2026a±62.20	1846b±48.50	1876b±43.12	1754c±26.75	0.05
Feed consumed (g/birds) (1-42 days)	4003a±43.90	3351b±31.78	2750c±73.00	2663c±23.22	0.05
Feed conversion (g/feed/g body wt.) (28 days)	1.52c±0.092	1.48c±0.012	2.06b±0.083	2.51a±0.146	0.05
Feed conversion (g/feed/g body wt.) (42 days)	1.89c±0.056	1.78c±0.07	2.55b±0.05	2.75a±0.62	0.05
Water intake (ml/day) (1-28 days)	90.64c±2.30	85.07c±5.15	106.1b±6.22	122.9a±4.10	0.05
Water intake (ml/day) (1-42 days)	222.37c±6.3	203.62d±11.5	253.65b±9.2	272.45a±17.1	0.05
Water intake/feed consumption ratio m/water/g feed (28 days)	1.25c±0.06	1.29c±0.09	1.58b±0.01	1.96a±0.09	0.05
Water intake/feed consumption ratio m\water/g feed (42 days)	2.37d±0.14	2.55c±0.24	3.87b±0.16	4.29a±0.32	0.01
Faecal moisture (%)	75.63c±1.56	71.57d±1.31	79.44b±1.82	86.11a±1.01	0.05

Means having different letters in the same row are significantly different ($p\leq 0.05$). T_1: University tap water (Albdai, Thi-Qar); T_2: R.O; T_3: Garmat Ali raw river water (North of Basra); T_4: Abou-AlKasseb tap water (South of Basra). Sig. = Significances

Table 4: Effect of different locations of water quality on hematological traits of broiler chicks

	T_1	T_2	T_3	T_4	Significances
Hemoglobin (Hb) g/100 ml	9.85a±0.1	10.35a±0.48	8.93b±0.34	8.5b±0.28	0.05
Red Blood Cell (RBC) mill. Cells/ml	5.39a±0.34	5.68a±0.141	4.56b±0.132	4.42b±0.359	0.05
Packed Cell Volume (PCV)%	29.37a±1.34	31.17a±1.76	26.03b±1.66	25.67b±3.71	0.05
Heterophil/Lympho ratio (H/L)	0.53c±0.16	0.52c±0.09	0.58b±0.32	0.62a±0.29	0.05

Means having different letters in the same row are significantly different ($p<0.05$). T_1: University tap water (Albdai, Thi-Qar); T_2: R.O; T_3: Garmat Ali raw river water (North of Basra); T_4: Abou-AlKasseb tap water (South of Basra)

Table 5: Effect of different locations of water quality on serum biochemical traits of broiler chicks

	T_1	T_2	T_3	T_4	Significances
Cholesterol (mg/100 ml)	152.46b±4.50	157.39b±3.13	178.87a±2.45	174.28a±7.13	0.05
Glucose (mg/100 ml)	151.29c±3.80	155.09c±4.12	138.98b±2.33	132.12a±1.86	0.05
Total protein (gm/100 ml)	4.18b±0.13	3.93b±0.26	5.53a±0.52	5.66a±0.17	0.05
Albumin (gm/100 ml)	1.75b±0.07	1.67b±0.11	2.03a±0.09	2.25a±0.06	0.05
Globulin (gm/100 ml)	2.43b±0.10	2.26b±0.22	3.50a±0.16	3.41a±0.25	0.05
Albumin\globulin ratio	0.72a±0.65	0.74a±0.18	0.58b±0.56	0.65b±0.08	0.05
Urea (mg/100 ml)	2.840b±0.44	3.028b±0.37	3.869a±0.16	4.26a±0.51	0.05
AST (I.1μ/L)	71.72b±1.7	69.60b±2.05	75.47a±2.20	76.22a±1.55	0.05
ALT (I.μ/L)	17.61b±3.50	18.03b±3.63	22.03a±4.17	24.64a±3.11	0.05

Means having different letters in the same row are significantly different ($p<0.05$). T_1: University tap water (Albdai, Thi-Qar); T_2: R.O; T_3: Garmat Ali raw river water (North of Basra); T_4: Abou-AlKasseb tap water (South of Basra)

Significantly ($p<0.05$) high faucal moisture percentages was observed during the 6th week of age with T_4 (84.11%), followed by T_3 (79.44%), than T_1 (75.63%), while T_2 (71.57%) was recorded the lower. These results agreed with Borges *et al.* (2003a), who stated that birds fed diets with 360 mEq/kg dietary electrolyte balance presented high litter moisture. While Maenz *et al.* (1994) observed that poor quality drinking water, containing high levels of TDS, increases the incidence of scouring by pigs. There was a polynomial response source of water on faecal moisture percentage as consequence of polynomial effect observed for water intake, excess water intake and excretion resulted in increased faecal moisture (Table 3). High faecal moisture rendered management difficult and it had an adverse effect on the performance of chicks providing with a high TDS and salinity water in T_3 and T_4 treatments. Harfenist and Murray (1999) reported that albumin is the major protein responsible for the osmolarity of the plasma, increase serum albumin concentration, indicates dehydration, which would be expected if the chicks were suffering from diarrhea. This explanation may interpreted the high albumin in T_4 and T_3 treatments (Table 5) which caused a high faecal moisture.

Results on some blood characteristics have been shown in Table 4. Chicks received Abou-Al-Kasseb tap water (T_1) and Garmat Ali raw river water (T_3) had significantly ($p<0.05$) lower Hb, RBC and PCV as compared with University tap water (T_1) and Reverse Osmosis water (T_2). The decline in RBC, Hb and PCV may caused by increased the salinity and TDS in T_4 and T_3 treatments. These water quality criteria were caused by decrease production of erythroprotein hormone by kidney damaged tissue. This hormone stimulates narrow bone to produce RBC (Guyton and Hall, 2006). There was a highly correlation between RBC with Hb and PCV (Sturkie, 1986).

H/L ratio of broiler chicks provided with T_4 and T_3 water was significantly ($p<0.05$) higher than T_1 and T_2. Furthermore, T_4 recorded the highest value for this trait in comparsion with other treatments (T_1, T_2 and T_3). These result was in agreement with observation of (Senson, 1977) who reported that ducks given salinity water showed an increase in H/L ratio. Al-Daraji *et al.* (2002) reported that the H/L ratio is a good measure of chicks states, increasing H/L ratio indicated that the birds were under acute stress.

Serum cholesterol, total protein, albumin, globulin and urea levels were significantly ($p<0.05$) increased in T_4 and T_3 treatments as compared with T_1 and T_2, but glucose, albumin/globulin ratio were shown the opposite (Table 5). These results were agreed with observation of Maenz *et al.* (1994) who reported that serum glucose was reduced and total protein was elevated significantly ($p<0.05$) when high minerals water given to pigs. The significant decrease in serum glucose observed in the T_4 and T_3 treatments of chicks in the present study could be interpereted as a consequence of the increased transport of glucose and salt through membranes into tissue cells. The cellular metabolism of glucose produces energy (ATP), which is then mostly used to maintain the sodium\potassium ATP-ase. Under physiological conditions, the cells should actively release sodium and take potassium. With increased salinity intake from dringing water, the body was exposed to metabolic stress, resulting in increased energy requirements to maintain the sodium/potassium gradient, which accounts for the decreased concentration of serum glucose (Guyton and Hall, 2006). The elevation of high protein in T_4 and T_3 was related to high immunoglobulin due to high stress (Freeman,

Table 6: Effect of different locations of water quality on serum electrolyte levels of broiler chicks

	T_1	T_2	T_3	T_4	Significances
Sodium (mEq/L)	132.94b±2.65	120.27c±1.05	144.32a±2.02	150.50a±3.05	0.05
Potassium (mEq/L)	3.79b±0.13	3.09d±0.19	3.67c±0.19	4.34a±0.16	0.05
Chloride (mEq/L)	103.46a±2.42	91.88b±0.01	96.98b±3.11	95.63b±3.55	0.05
Electrolyte balance (mEq/L)	33.27c±1.02	31.48d±0.93	51.01b±2.30	59.21a±1.59	0.05
pH	7.28c±0.01	7.19d±0.01	7.39b±0.02	7.48a±0.035	0.05

Means having different letters in the same row are significantly different ($p<0.05$). T_1: University tap water (Albdai, Thi-Qar); T_2: R.O; T_3: Garmat Ali raw river water (North of Basra); T_4: Abou-AlKasseb tap water (South of Basra)

Table 7: Some carcass characteristic at 42 days of age on broiler chicks received different locations water quality

Characteristic	T_1	T_2	T_3	T_4	Significances
Liver weight (%)	2.603b±0.21	2.835b±0.18	3.354a±0.02	3.436a±0.2	0.05
Kidney weight (%)	0.531b±0.034	0.606b±0.136	1.048a±0.102	1.128a±0.099	0.05
Heart weight (%)	0.693±0.052	0.765±0.144	0.781±0.122	0.739±0.070	N.S
Pancrease weight (%)	0.146c±0.025	0.176b±0.018	0.255a±0.019	0.226a±0.033	0.05
Spleen weight (%)	0.101b±0.014	0.117b±0.061	0.138a±0.022	0.132a±0.069	0.05
Gizzard weight (%)	0.944b±0.12	1.212b±0.03	1.597a±0.16	1.821a±0.20	0.05
Intestinal length (cm)	210.3a±11.25	192.0a±10.39	171.7b±6.91sd	153.11c±9.54	0.05

Means having different letters in the same row are significantly different ($p<0.05$). T_1: University tap water (Albdai, Thi-Qar); T_2: R.O; T_3: Garmat Ali raw river water (North of Basra); T_4: Abou-AlKasseb tap water (South of Basra)

1984). High cholesterol level in T_4 and T_3 were related to high concentration of bile salts formation. As indicated by Sturkie (1986) that product will not be used by liver due to its damage Table 7.

Furthermore this elevation in serum cholesterol in T_4 and T_3 contributed in some cases to increase in some hormones secreation by cortex of the adrenal gland, which in turn causes the elevation in the secretion of fatty acid from the adipose tissues or increase of fat oxidation, which leads to the high of the level of fatty acid including serum cholesterol, (Ganong, 2005). It was observed that albumin to globulin ratio fall significantly ($p<0.05$) in T_4 and T_3. These result was agreed with Patience *et al.* (2004) who reported that the albumin/globulin ratio was high in pigs receiving R.O treated water. Urea was significantly ($p<0.05$) elevated in T_4 and T_3 as compared with T_1 and T_2. These result was agreed with Sturkie (1986) who indicated that serum urea in birds arises not by hydrolysis of arginine but by transfer of its ornithine moiety to benzoic or other aromatic acids to form dibenzoyl ornithine. Harr (2002) suggested that serum urea of the fowl arises by diffusion from the kidney. AST and ALT enzymes were highly significantly ($p<0.05$) in T_4 and T_3 (Table 5). Serum AST and ALT activities (liver enzymes) were used to evaluate liver functions, the increase in their activities are related to the degeneration of liver damage (Blackshow, 1978). Furthermore, the increased in AST and ALT activity in chicks during stress might be under the influence of higher corticosteroid level (Siegel, 1995).

In the present study, the T_4 and T_3 treatment of broiler chicks had significantly ($p<0.05$) increased levels of serum sodium, potassium and blood pH, but chloride in T_1 was higher significantly ($p<0.05$) as compared with T_2, T_3 and T_4 (Table 6). The higher levels of electrolytes could be explained by the fact that the chicks drank this sources of water containing higher concentration of these minerals as compared to control T_1 and T_2 treatments, it appears quite logical that the high amount of electrolytes in drinking water entailed their increased levels in their serum (Balnave *et al.*, 1989; Fayez *et al.*, 1994; Karadjole *et al.*, 1999).

Serum sodium, potassium, EB and blood pH in T_2 (R.O) showed significantly lower ($p<0.05$) than T_1 treatment. Robbins and Sly (1981), presumed that intake low mineral water was responsible for an increased elimination of minerals from the body and change plasma volume, baroreceptors and volume receptors in the bloodstream are activate inducing a decrease in aldosterone relase and thus an increase in sodium elimination. The German society for Nutrition reached similar conclusions, warning the public against drinking distilled water (Dgfe, 1993). Also, WHO (1980) suggested the low-mineral water acts on osmoreceptors of the gastrointestinal tract, causing an increased flow of sodium ions into the intestinal lumen and slight reduction in osmotic pressure in the portal venous.

System with subsequent enhanced release of sodium into the blood as an adaptation rssponse. There was a negative relationship between EB ($Na^+ + K^+ - Cl$ mEq/L) and chicks performance, as shown in T_3 and T_4 treatments, which had the worse performance (Table 3). These finding was agreed with Ahmad (2004) who observed that broiler chicks performance was affected by higher serum electrolyte balance. Also, Al-Daraji *et al.* (2008) reported that serum electrolyte balance was increased by kidney damage.

Blood pH was significantly ($p<0.05$) influenced by T_4 (7.48) and T_3 (7.39) treatment as compared with T_1 (7.28) and T_2 (7.19). Our results were agreed with the observation of Ahmad (2004) who indicated that pH between 7.30-7.316 considered best for optimal broiler growth, but high blood pH (7.423) and low pH (7.205) had negative marked effect on the broiler growth. While Teeter *et al.* (1985) indicated decline growth rate and feed intake when blood pH values exceeded than 7.35.

Table 8: Effect of different locations of water quality on tibia length and tibia ash percentage of broiler chicks

Treatment	Tibia length (cm)	Tibia ash (%)
T_1	9.87a±0.25	43.48b±0.26
T_2	9.1b±0.11	41.12c±0.41
T_3	7.55c±0.16	44.82a±0.56
T_4	6.73d±0.3	45.33a±0.51
Significances	0.05	0.05

Means having different letters in the same row are significantly different ($p<0.05$). T_1: University tap water (Albdai, Thi-Qar); T_2: R.O; T_3: Garmat Ali raw river water (North of Basra); T_4: Abou-AlKasseb tap water (South of Basra)

In the present study T_4 and T_3 treatments indicated a greater significantly ($p<0.05$) relative weights of liver, kidney, pancrease, spleen and gizzard than T_1 and T_2 treatments (Table 7). These result might influenced by high TDS and salinity water in T_4 and T_3 treatments. Intestinal length of T_4 and T_3 was found to be shorter ($p<0.05$) than T_1 and T_2 treatments. These result was influenced by weight, as there is a positive relationship between body weight and the length of intestinal (Al-Fayadh and Naji, 1989).

Tibia length and tibia ash percentage of broiler chicks of different locations of water quality is illustrated in Table 8. Statistical analysis of the obtained data showed there was significantly ($p<0.05$) increase in tibia length in chicks received T_1 (9.87) and T_2 (9.10) as compared with T_3 (7.55) and T_4 (6.73), while ash percentage was significantly higher ($p<0.05$) in T_4 (45.33) and T_3 (44.82) as compared with T_1 (43.48) and T_2 (41.12), but T_2 was lower than (T_1, T_3 and T_4). These finding was in agreement with those observation of Attach and Leeson (1983) who noted that providing hardness water to broiler chicks resulted shorter tibia and swollen hocks.

Overall mortality percentage results showed higher ($p<0.05$) mortality with T_4 (53.33%) followed T_3 (16.66%) than T_1 (8.33%) and T_2 (6.66%), Table 9. The high percentage of dead chicks due to a high TDS and salinity water in T_4 than T_3. The sumptoms in these cases included diarrhea, blind, muscular weakness and large kidneys. Our findings were in agreement with that's of Chiba (2009). Siegel (1995) also reported that if the stressor continues to be strong and persistent, the birds will enter the stage of exhaustion when its adrenals lose their ability to sustain glucocorticoids production and the results may be physical disability and death. Also Table 9 showed that T_1 production index (243.89) was significantly higher ($p<0.05$) than T_2 (234.59) followed by T_3 (83.42) and T_4 (39.15). The result of T_1 fit of excellent value of production index, while T_2 was very good, whereas T_3 and T_4 were bad as indicated by Naji (2006) production index values range.

Table 9: Effect of different locations of water quality on the mortality rate percentage and production index of broiler chicks

Treatment	Mortality rate (%)	Production Index (PI)
T_1	8.33c±1.36	243.89a±1.60
T_2	6.66c±1.22	234.59b±1.22
T_3	16.66b±2.41	83.42c±0.51
T_4	53.33a±2.85	39.15d±1.10
Significances	0.01	0.01

*Production index values range from 240-260 are excellent, 230-239 V. good, 220-229 good, 210-219 fair and less than 210 bad. Means having different letters in the same row are significantly different ($p<0.05$). T_1: University tap water (Albdai, Thi-Qar); T_2: R.O; T_3: Garmat Ali raw river water (North of Basra); T_4: Abou-AlKasseb tap water (South of Basra)

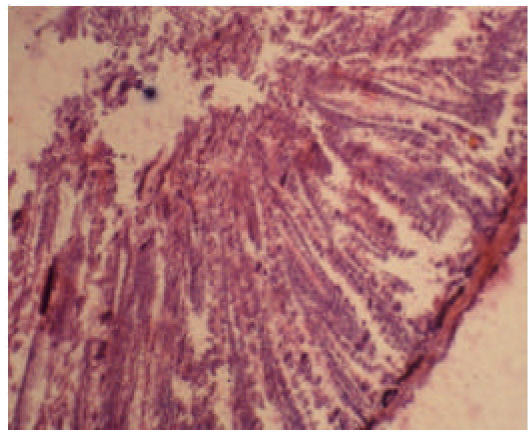

Fig. 1: (T_1) University tap water (Albdai, Th-Qar)

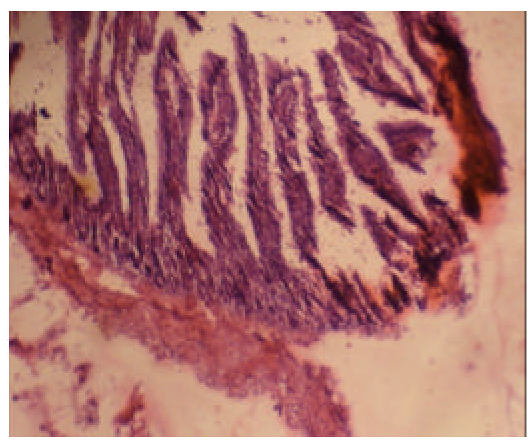

Fig. 2: (T_2) Reverse Osmosis water (R.O)

Figures 1, 2, 3 and 4 describe the histology of the intestine (Jejunum) of broiler chicks offered different locations of water quality which containing different amounts of TDS and salinity. Majeed (2010) personal Communication interpreted that histological observation on the intestine epithelium indicated morphological changes in the jejunum. Figures 3 and 4 represented T_3

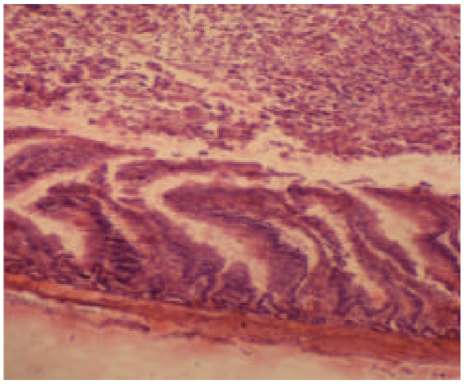

Fig. 3: (T_3) Garmat Ali raw river water (North of Basra)

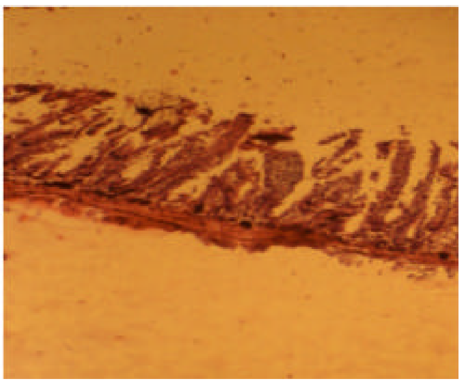

Fig. 4: (T_4) Abou -Al-Kasseb tap water (South of Basra). Magnification was 400x

and T_4, noticed that lesion more evident, mitochondrial swelling, decrease number of multivesicular bodies, reduction of lysomes and than shortening micro villi thus, that affected the digestibility and the absorption of the nutrients Al-Sadi *et al.* (1984).

T_1 treatment (Fig. 1) villi were showed moderate hights length with great epithiolization appear through with more proliferation, while T_2 (Fig. 2) villi appeared slightly longer than T_1 but were slender, less cellularity in lamina properia and more wider spaces between villi, which affected the absorption of the nutrient, thus less body weight and feed consumption were observed as compared with T_1 (Dewit *et al.*, 1987).

In conclusion, TDS equal to T_1 (1.385 mg/L) and salinity (1.08 mg/L) gave the best performance, blood hematology traits, serum biochemical characteristics, electrolyte levels and some relative weight organs which reflected a perfect jejunum histology and production index.

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