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EFFICACY OF NEPHROLYTE® IN TREATMENT OF EXPERIMENTALLY INDUCED GOUT IN CHICKENS

BY

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ABSTRACT

Effects of excess intake of Na bicarbonate concentrations (SB) at 1%, 2% and 5% in drinking water on the induction of visceral gout and the efficacy of treatment with commercially available medicament (Nephrolyte®) and Allopurinol in chickens were studied. Two hundred, 48 day- old, healthy chickens were randomly divided into four groups (G1 control contained 20 birds, G2 (given 1%SB), G3 (given 2%SB) and G4 (5%SB) for one week; G2, G3 and G4 each contained 60 birds). After gout induction birds in G2, G3 and G4 were equally subdivided into GA, GB and GC subgroups during treatment. Subgroup A in all groups were administered SB with the same concentrations for another one week while, subgroup B in all groups was treated with 2ml/ liter Nephrolyte, and birds in subgroup C were treated with 40mg/kg body weight Allopurinol in the drinking water for one week. All birds were subjected to clinical and pathological examination. After gout induction, clinical signs of gout showed high mortalities and significant decrease of body weight in all exposed groups. Birds of the G2 (1%SB) and G3 (2% SB) groups developed gross picture of visceral gout, while birds of G4 (5% SB) group showed acute kidney damage without manifesting visceral urate deposition. Uric acid and creatinine levels were increased in the exposed birds and serum levels of uric acid were increased with the increased dose of SB. Microscopic examination revealed significant renal changes in birds manifesting visceral gout. From this study, we can conclude that excess intake of sodium bicarbonate (SB) concentrations induced hyperuricaemia in chickens (typical visceral gout). Administration of Nephrolyte (2ml/ liter drinking water) for one week had a highly effect in treatment of gout. While, the medication with allopurinol (40 mg/kg body weight) in drinking water for one week is not effective in treatment of gout.

Key words: **Gout, Sodium bicarbonate, Nephrolyte, Allopurinol, chickens**

INTRODUCTION

Gout is a common metabolic disorder that results in abnormal accumulation of urates in domestic birds. It occurs as two distinct forms, namely visceral and articular gout. Visceral gout has been reported in various caged and aviary birds from different parts of the world. It is among the most commonly diagnosed causes of mortality in poultry **(Riddell, 1997).**

Visceral gout is readily recognized by its distinctive lesions which are characterized by white chalk-like deposits covering the surface of various abdominal organs as well as the heart sac**.** If gout does occur in a flock, mortality can be reduced by increasing the acidity of the urine to dissolve existing kidney stones or to prevent formation of additional kidney stones **(Bernie, 2014)**.

Toxopathology of gout induced in laying pullets by sodium bicarbonate toxicity was studied by **Mubarak and Sharkawy (1999)** who showed the exposed birds received an excess of sodium bicarbonate (SB) in their drinking water for 35 days. SB overdosing has been incriminated in some outbreaks of visceral gout in poultry **(Davison and Wideman, 1992).**

The practical significance of this work comes from the fact that gout is a common finding during necropsy of domestic birds with various disease conditions **(Riddell, 1997).** Several studies were performed to both treatment and prevention of gout **(Ahmed, 2006 and Aworh et al., 2012)**.

The purpose of the present study was to investigate the clinical and pathological effect of gout induced in chickens by SB toxicity. Then, the efficacy of both Nephrolyte and Allopurinol in treatment of experimentally induced gout was studied.

MATERIALS AND METHODS

1- **Experimental chickens:** A total of 200, one day old, male, white Hy-Line chicks were supplied by Misr Company for Poultry Production. All birds were reared in cages, kept in strictly hygienic and isolated room. The feed and water were provided ad-libitum to all the birds. Lighting was provided for 24 hr throughout the experimental period. The diet contained normal calcium and normal crude protein (1% Ca& 20% CP) **(Table, 1).**

2- **Medications:**

A. Nephrolyte®: Nephrolyte was kindly provided by AM Trading Company, Egypt produced by Univet, Ireland with batch no. L33710. It was used in a dose of 2ml per liter of drinking water for 7 days (as recommended by manufacturer). Nephrolyte is a

balanced formula of electrolytes and vitamins. It contains dextrose, sodium chloride, potassium chloride, potassium citrate and vitamin B1, B6 and C.

B. Zyloric®: Zyloric® (Allopurinol) was kindly provided by GlaxoSmithKline company El-Salam City, Cairo, Egypt with batch no. CP 330/02. It was used in a dose of 40 mg/kg body weight in the drinking water for 7days **(Czarnecki et al., 1987).**

3- Chemicals:

A- Sodium bicarbonate (NaHCO3): Sodium bicarbonate was produced and purchased from Algomhouria company for chemicals, Egypt, batch no. 26022013.

B- Kits for determination of uric acid, creatinine calcium and phosphorus were kindly provided by Diamond Diagnostic Company, Egypt .

4- Clinical and post mortem examinations: All freshly dead and sacrificed chickens were subjected for postmortem examination in Department of Poultry Diseases, Faculty of Veterinary Medicine, Mansoura University. The clinical findings were recorded.

5- Blood collection and analysis: The blood samples were obtained and centrifuged to obtain sera. The sera were collected for determination of uric acid, creatinine, calcium and phosphorus by using vitro enzymatic colorimetric method using kits (Spinreact) **(Young, 2001).** A Cobas Bio Spectrophotometric Auto-analyzer was used to measure the blood parameters.

6- *Grouping and Experimental design* (Table, 2):

Two hundred, 48 day- old chickens were classified into four groups (G1, G 2, G 3 and G4), G1 was served as control group containing 20 chicks while G2 to G4 containing 60 chicks each. All chicks were fed ration contained calcium (1% Ca) and normal crude protein (20% CP) over the experimental period for 30 days. G1 chickens were clinically healthy (no gout induction and non-medicated) and fed on balanced ration, G2 given 1% SB (10gm/L) and G3 given 2% SB (20gm/L) while, G4 given 5% SB (50gm/L) in the drinking water for one week. After gout induction, birds in G2 to G4 were subdivided (equally) to 3 subgroups (G2A, G2B, G2C; G3A, G3B, G3C and G4A, G4B G4C). Chickens in G2A, G3A and G4A subgroups received SB with the same concentration for another one week and non-medicated. Chickens in G2B, G3B and G4B subgroups were given Nephrolyte®(2ml per / liter) in drinking water for one week while, G2C, G3Cand G4C subgroups were administered Allopurinol (40 mg/kg B.W) for one week in the drinking water. The vaccination of all experimental chicks against Newcastle disease was carried out at 7 (Hitchner-IB) and 18 (LaSota) day-old, via intraocular method. Also, all groups were vaccinated against Gumboro disease at 14 day-old, via intraocular method.

Serum samples were collected at 48, 55, 62 and 79 days-old. Uric acid, Creatinine, Calcium and Phosphorous levels were estimated from all serum samples. The clinical findings, mortalities, gross lesions and lesion scores were recorded. At 48, 55, 62 and 79 days-old, body weight of all groups was recorded. Three birds from each group were sacrificed at the 55^{th} & 79^{th} days-old and their kidneys were collected for histopathological examination.

7- Efficacy of the tested medicaments:

A- Clinical symptoms, post-mortem lesions and mortality rate: Chickens in all groups were continuously examined all over the experimental period for recording the clinical symptoms, post-mortem lesions and mortality rate.

B- Lesions score: The severity of kidney gross lesion was evaluated to determine the induction of gout and the efficacy of drugs according to **Mubarak and Sharkawy (1999)**.The score was adopted between 0 and + 4.

C- Evaluation of growth performance: Body weights for all groups were recorded to evaluate the effect of the drugs during the induced gout in chickens.

8- Histopathological examination: specimens from kidney of chickens from all groups taken and performed according to the method described by **Lillie and Fulman (1976)**.

9- Statistical analysis: The obtained data in the present study were statistically analyzed for analysis of variance (ANOVA) and least significant difference (LSD) as described by **Snedecor and Cochran (1981)**.

RESULTS AND DISCUSSION

Gout problem was observed in both broiler and layer flocks and this may be attributed to several causes. Thus, this experimental work has been conducted to study the influence of different concentrations of SB in the drinking water for gout induction. Then, the evaluation of both Nephrolyte and Allopurinol in treatment of the experimentally induced gout was studied.

1- Clinical findings and mortalities:

After gout induction, one week post-exposure to SB, birds of groups 2–4 were depressed and their water intake was increased while their feed intake was decreased and they had watery droppings. The most obviously depressed and emaciated birds were those of group 4**.** Birds of group 1 (control group) manifested no clinical signs and their feed and water intake was relatively normal. No mortality was recorded in group 1 **(Table, 3).** In G2 showed

0% mortality while, 50% in G3 and 60% in G4 (5% SB). No clinical signs or mortalities were recorded among the control birds **(Table, 3). After treatment,** subgroup G2A showed 100% mortality while, 0% in G2B and 63.2% in G2C. In subgroup G3A showed 100% mortality, while 0% in G3B and 100% in G3C. In subgroup G4A showed 100%, while 0% in G4B and 100% in G3C. By the 9th day post-exposure, all birds in G4A 5% were dead. Cumulative mortalities during experimental period were recorded. No cumulative mortality was recorded in group 1 (Table, 3). G2 showed 51.7% mortality, while, 83.3% in G3 and 86.7% in G4. Similar results were obtained by **Mubarak and Sharkawy (1999)** who showed that by the tenth day post-exposure, all birds in group 4% SB either had died or were necropsied for very bad health condition. Similarly, **Ahmed (2006)** stated that all experimental chickens of induced gout had clinical signs in the form of general signs of an illness and specific signs in the form of inability to walk, lameness, reduction in body , uneven feathers, increased water consumption and whitish chalky diarrhea.

2- P.M. lesions and lesion score:

After gout induction, Almost dead birds from G2 (1%SB) and G3 (2%) showed gross lesions of visceral gout. These birds had chalky whitish urate deposits in the kidneys. White chalky urate was also detected on the serous surfaces of liver, heart, and lung. Kidneys of the gouty birds were pale and swollen. Ureters were distended with urates. G3 (2%SB) showed pictures of both visceral and articular gout. These birds had also whitish chalky material deposited on the articular surfaces beside the visceral urate deposits. None of group 4 birds (5% SB) showed visceral urate deposition. Control birds revealed no gross abnormalities. Similar results were obtained by **Mubarak and Sharkawy (1999)** who stated that death of birds due to SB (5%) may be attributed to acute renal failure. Birds which received 1 % and 2% SB survived longer and hence they developed picture of gout. In the present study, birds which received 1% SB manifested visceral urate deposition while in previous studies **(Mirsalimi and Julian, 1993)** broiler chickens did not show visceral gout at the same level of SB. It is speculated that this contradiction may be related to differences between meat-type chickens and laying birds concerning the renal function of both (**Mubarak and Sharkawy, 1999)**. **After treatment**, GB subgroups treated by Nephrolyte showed no gross lesion and normal kidneys. While, GC subgroups treated by Allopurinol, in addition to mortalities showed pale-colored kidneys with urate deposits. On the same ground, **Ahmed (2006)** showed that the post mortem examination of all dead and sacrificed chickens after gout induction revealed enlargement of kidneys with distended ureters with urates. Also, he added that some chickens revealed urates deposition on serosal surfaces of the body. Meanwhile, chicks of the treated groups with vitamin A or Allopurinol showed the same lesions of untreated groups but with mild intensity. But chicks of control group showed no gross lesions.

Table 3 showed scoring for the gross renal pathological lesions in the exposed birds **(Mubarak and Sharkawy, 1999)**. G2& G3 showed score 4 while GB subgroups treated with Nephrolyte showed lesion score 0.0 as well as G1 (control) group while, GC subgroups treated with Allopurinol showed 3 and also G4 group showed lesion score 3. Since kidney is essential regulator of Na+ and K+ levels, disturbance of their serum levels showed considerable renal damage. It was found that all renal functions in birds and mammals exposed to SB toxicity were greatly compromised **(Tietz et al., 1986; Davison and Wideman, 1992).** Mortalities in the present study are most likely attributed to renal failure and also to respiratory failure as a result of tetanic spasms of the respiratory muscles as reported in cases of alkalosis. The development of gout in birds because of SB toxicity is probably related to the resultant state of metabolic alkalosis which may be associated with over biosynthesis of uric acid **(Guyton, 1986).**

3- Body weight of experimental birds:

The effects of the induced gout and tested medicaments on average body weight of experimental chickens were summarized in **Table (4).** The mean average body weight of chickens at 48 day-old before gout induction was nearly similar, indicating that all groups were homogenous. While, **after gout induction**, the average body weights in groups G2, G3 and G4 were significantly decreased 270, 210 and 226, respectively at 55 days of age (one week post exposure to SB) in comparison with control group (G1) (340). **After treatment,** the average body weight at 62 days of age (one week post treatment), revealed a significant increase in G2B, G3B and G4B subgroups treated with Nephrolyte, 496, 477 and 498, respectively when compared with G2C, G3C and G4C subgroups treated with Allopurinol, 416, 300 and 335, respectively. The average body weight at 79 days of age (nearly three week post treatment) revealed a significant increase in G2B subgroup treated with Nephrolyte (**802)** when compared with G2C subgroup treated with Allopurinol (**620)**. Non significant differences of the mean average body weight at 62 & 79 day-old were recorded between G1control group and GB subgroups treated with Nephrolyte **(Table, 4)**. These results agree with that recorded by **Ahmed (2006)** who found that average body weight of chickens after gout induction with high levels of calcium di phosphate (4% and 5%) were very lower than average body weight of chickens fed ration containing low levels of calcium di phosphate. Also, he added that the chickens fed ration contaminated with aflatoxin B_1 300ppm and medicated with both vitamin A and allopurinol showed higher average body weight than chickens fed ration contaminated with aflatoxin 300 ppm without any medication.

4- Analysis of uric acid, creatinine, Calcium and phosphorous in collected sera:

After gout induction, serum level of **uric acid** was increased in all exposed birds at 55 days-old, uric acid levels were significantly increased in G4 group (41.0) when compared with G3(25.0), G2 (10.6) and G1control group (5.6). After treatment, in GB subgroups treated with Nephrolyte, uric acid levels decreased to normal level (6.62) than GA subgroup (14.7). While, GC subgroups treated with Allopurinol decreased (5.96) then increased again (10.2). Also, after gout induction, serum level of creatinine was increased in all exposed birds at 55 days-old, creatinine levels were significantly increased in G4 group (1.17), G3 (1.15), G2 (1.11) when compared with G1 group (control) (0.63). After treatment, GB subgroups treated with Nephrolyte, creatinine levels decreased (0.83) than GA subgroup (1.02). While, GC subgroups treated with Allopurinol remained with high concentrations (0.97 &1.47). After gout induction, serum level of **calcium** was not significantly differed in all exposed birds at 55 days-old, when compared with G1 (control) group. After treatment, in GB &GC subgroups treated with Nephrolyte & Allopurinol, calcium levels significantly increased (11.5&11.3 respectively) than GA subgroup (non-medicated) (8.8). After gout induction, serum level of **phosphorus** was not significantly differed in all exposed birds at 55 days-old when compared with G1 (control) group. After treatment, serum level of phosphorus in GB subgroups treated with Nephrolyte significantly increased than GC subgroup treated with Allopurinol while non significant changes were recorded in serum level of phosphorus between GB subgroups and G1 (control) group. These results were confirmed by ***Harison and Harison (1986)*** who stated that affected chickens with gout, uric acid levels in blood can reach 44mg / 100 ml as compared to 5-7 mg/100 ml in normal chickens. **Abdul-Rahman (2006)** revealed that severity score of kidney tissues was positively correlated with serum levels of uric acid and calcium in the group that was fed high calcium diet. It was also correlated with uric acid and calcium in group that was fed high urea diet. However, levels of serum urea, creatinine, phosphorous or manganese were not correlated with severity score. **Kurtoglu et al. (2007)** stated that supplementation of diet with SB in laying hens (0.38%, 1.5%) did not affect plasma uric acid and Ca concentrations between control and treatment groups. However, Pi, Mg, Cl, Na, K and total protein differed statistically among groups due to the diet supplementations. **Ansar et al. (2004)** showed that the birds fed on high dietary calcium and low phosphorus revealed hypercalcaemia and hypophosphataemia in their sera. **Aworh et al. (2012)** reported that the serum creatinine levels were statistically significant in the diclofenac-treated birds. Elevations of serum urea and creatinine levels are indicators of nephrotoxicity. Serum uric acid level differs slightly in the tested groups when compared with the control group. The present intoxicated birds manifested hyperuricaemia where serum level of uric acid was increased in dose- and time-related patterns. The recorded hyperuricaemia was probably the result of overproduction of uric acid (primary metabolic) and latter exacerbated

because of under-excretion of uric acid. It is postulated that uric acid overload causes renal tubular damage **(Riddell, 1987). Mubarak and Sharkawy (1999)** showed that serum levels of Na+ in all exposed birds were increased compared with that of control birds. At any time post-exposure, serum level of Na+ in birds of group 4% SB was higher than that of the other exposed birds. Serum level of uric acid was increased in all exposed birds. The measured blood pH values in all exposed birds were shifted towards the alkaline side and ranged from 6.7 to 8.1. **Ahmed (2006)** found that biochemical analysis of uric acid, creatinine of sera collected from chickens fed ration containing high levels of calcium di phosphoate (4% and 5%) showed higher levels in comparison to sera of chickens fed ration containing normal and low levels of calcium di phosphoate.

5- Histopathological findings:

Plate (I) showed the histopathological findings of kidneys of sacrificed birds at 79 days of age of control group as normal histological structure of kidney which normal renal glomeruli and normal renal tubules **(Fig1)**. Group G4 (5%SB, one week post-exposure) showed crystalline eosinophilic needle like-crystals of urates in interstitial tissue surrounded by heterophils **(Fig2)**. Group G3 (2%SB, one week post-exposure) showed also crystalline eosinophilic needle like-crystals of urates in renal tubules surrounded by heterophils **(Fig3)**. Group G2 (1%SB, one week post-exposure) showed fibrocollagenous bundles forming thick septa in renal parenchyma **(Fig4)**. Group G4B (3 weeks post-treatment with Nephrolyte) showed marked granulomatous inflammation with giant cell formation (**Fig5)**. Group G3B (3 weeks post-treatment with Nephrolyte) showed massive hemorrhage replacing renal parenchyma (**Fig6)**. Group G2B (3 weeks post-treatment with Nephrolyte) showed kidney showing diffuse fibrous tissue proliferation (renal fibrosis) (**Fig7)**. Group G2C (3 weeks post-treatment with Allopurinol) showed kidney showing hyperplasia in mesangial cells (thick arrow), with mild degeneration in renal tubules (thin arrow) (**Fig8)**. These findings were supported by **Mubarak and Sharkawy (1999)** who revealed significant renal changes by microscopical examination in kidneys of birds manifesting visceral gout and these changes included urate deposits associated with tubular necrotic changes. Some birds in the third group (2%SB) developed urate granulomas in the renal interstitium. Similar results were obtained by **Ahmed (2006)** who stated that the higher levels of protein resulted in hyperuricemia followed by severe renal damage manifested by extensive destruction of renal parenchyma beside hyperemia of inter tubular blood capillaries. The remaining renal tissues showed hemorrhages, necrosis, cystic dilatation and chronic inflammation due to intense leukocytic aggregations mainly lymphocytes, heterophils and macrophages around ureters. Also, histopathological picture of chickens fed ration containing higher levels of animal concentrates (20% and 30%) and medicated with vitamin A 100.000 IU/ bird daily **or**

allopurinol 40 mg/kg body weight daily revealed **minor improvement.** On a similar ground, **Aworh et al. (2012)** recorded that the effect of allopurinol on diclofenac-induced toxicity in chickens resulted in moderate congestion and hemorrhages in the kidneys.

CONCLUSION

From this study we can conclude that excess intake of sodium bicarbonate (SB) concentrations induced hyperuricaemia in chickens (typical visceral gout). Administration of Nephrolyte (2ml/ liter drinking water) for one week had a highly effect in treatment of gout. While, the medication with allopurinol (40 mg/kg body weight) in drinking water for one week is not effective in treatment of gout.

Table (1): Components of the diet in this study

Ingredients	Contents
Yellow corn	62
Soybean meal (48%)	26
Corn gluten	5
oil	3
limestone	1.5
Di calcium Phosphate	1.7
Vitamin & premix[1]	0.25
Salt	0.3
DL. methionine	0.12
DL. lysine	0.1
Calculated composition	
CP%	20%
ME (kcal/kg)	3135
Ca %	1%
Available P %	0.45%

[1] Supplied per lb feed: Vit A-1, 740,000 IU; Vit D3. 440,000 ICU; Vit E 1,200 IU; Vit B12.,1.6 mg; Riboflavin, 800 mg; Pantothenic acid, 1000 mg; Niacin, 6,000 mg; Menadione, 135 mg; Choline, 500 mg; Thiamine, 135 mg; Folic acid, 45 mg; Pyridoxine,180 mg; d-biotin, 0.15 mg; Ethoxyquin, 2.5 □g; Manganese, 2.5%; Zinc, 92.4 mg; Selenium, 120 ppm; Zinc, 2.00%; Choline, 50,000; Copper sulfate 2,000 ppm; Iodine 1.145 ppm; Iron 1.8%.

Table (2): Grouping and Experimental design:

Groups of induced gout		No. of chicks	Amount, Time and Duration of induced gout	Groups of treatment		Dose, Time and Duration of gout treatment
G1	**Control**	**20**	**----------**	**G1**	**Control**	**--------**
G2	**1%SB**	**60**	**10 gm /liter from day 48 of chicken life for one week**	**G2A**	**1%SB**	**SB with the same concentration still added another one week**
				G2B	**Nephrolyte**	**One week treatment** 2ml per liter of drinking water
				G2C	**Allopurinol**	**One week treatment** 40 mg/kg body weight in the drinking water
G3	**2%SB**	**60**	**20 gm /liter from day 48 of chicken life for one week**	**G3A**	**2%SB**	**SB with the same concentration still added another one week**
				G3B	**Nephrolyte**	**One week treatment** 2ml per liter of drinking water
				G3C	**Allopurinol**	**One week treatment** 40 mg/kg body weight in the drinking water
G4	**5%SB**	**60**	**50 gm /liter from day 48 of chicken life for one week**	**G4A**	**5%SB**	**SB with the same concentration still added another one week**
				G4B	**Nephrolyte**	**One week treatment** 2ml per liter of drinking water
				G4C	**Allopurinol**	**One week treatment** 40 mg/kg body weight in the drinking water

Table (3): Mortality percentages before and after treatment of induced gout in experimental chickens received different concentrations of sodium bicarbonate in the drinking water

Groups/Mortality percentages of induced gout before and after treatment											
Groups of induced gout	No. of birds	After induced gout			Groups Of treatment	No. of birds	After treatment			Cumulative mortalities during experimental period	
		dead	%	Lesion score (n=3)			dead	%	Lesion score (n=3)	Dead/total	%
G1	20	0	0%	0.0	Control	20	0	0%	0	0	0%
G2 (1%SB)	60	0	0%	3	G2A	19	19	100%	4	31/60	51.7%
					G2B	19	0	0%	0		
					G2C	19	12	63.2%	3		
G3 (2%SB)	60	30	50%	4	G3A	10	10	100%	4	50/60	83.3%
					G3B	10	0	0%	0		
					G3C	10	10	100%	3		
G4 (5%SB)	60	36	60%	3	G4A	8	8	100%	3	52/60	86.7%
					G4B	8	0	0%	0		
					G4C	8	8	100%	3		

Gross scoring: 0=negative; 1=congested kidneys; 2=swollen and pale kidneys; 3=pale-colored kidneys with urate deposits; 4= urate deposits in kidneys and distention of ureters with urates associated with visceral urate deposits.

Table (4): Average body weight of induced gout in experimental chicks received different concentrations of sodium bicarbonate in the drinking water before and after treatment. n=5

Groups /Age of weighing per day					
Groups of induced gout	48	55	Groups of treatment	62	79
G1	330± 3.3	340±7.4[a]	G1	500±9.3[a]	815 ±23.2[a]
G2 (1%SB)	308±2.9	270±7.7[b]	G2A	385±12.0[b]	ND
			G2B	496±18.0[a]	802±21.0[a]
			G2C	416±13.0[b]	620±12.0[b]
G3 (2%SB)	310±4.7	210±9.4[c]	G3A	ND	ND
			G3B	477±20.0[a]	790±14.2[a]
			G3C	300±11.0[c]	ND
G4 (5%SB)	312±5.9	226±5.6[c]	G4A	ND	ND
			G4B	498±10.0[a]	788±15.2[a]
			G4C	335±12.2[c]	ND

Means within the same column bearing different superscripts are significant at $p<0.05$
ND= not done

Table (5): Serum monitoring for uric acid, creatinine, calcium and phosphorus before and after treatment of induced gout in experimental chickens received different concentrations of sodium bicarbonate in the drinking water. n=5

Groups		Age of serum monitoring in days															
		Uric acid levels mg/dl				Creatinine levels mg/dl				Calcium levels mg/dl				phosphorus levels mg/dl			
		48	55	62	79	48	55	62	79	48	55	62	79	48	55	62	79
G1	Control	6.3± 0.06	5.6± 0.05^{d}	6.5± 0.04^{c}	6.77± 0.08	0.7± 0.01	0.63± 0.02^{b}	0.80± 0.01^{b}	0.77± 0.03^{b}	12.6± 0.44	12.3± 0.16	12.0± 0.91^{a}	11.7± 0.21	10.7± 0.32	9.0± 0.12	8.4± 0.26^{a}	11.0± 0.22^{a}
G2 1% SB	G2A	6.9± 0.07	10.6± 0.80^{c}	14.7± 1.80^{a}	ND	0.8± 0.03	1.11± 0.04^{a}	1.02± 0.03^{a}	ND	12.5± 0.64	11.8± 0.41	8.8± 0.22^{b}	ND	9.3± 0.24	9.3± 0.24	5.6± 0.42^{b}	ND
	G2B			7.8± 0.60^{b}	5.13± 0.07			0.83± 0.05^{b}	0.73± 0.09^{b}			11.5± 0. 43^{a}	11.7± 0.32			8.3± 0.32^{a}	7.9± 0.22^{b}
	G2C			5.96± 0.05^{c}	10.2± 0.67			0.97± 0.02^{a}	1.47± 0.01^{a}			11.3± 0.33^{a}	12.5± 0.62			5.6± 0.42^{b}	10.6± 0.22^{a}
G3 2% SB	G3A	6.1± 0.06	25.0± 0.21^{b}	ND	ND	0.7± 0.05	1.15± 0.08^{a}	ND	ND	12.1± 0.67	12.2± 0.35	ND	ND	9.9± 0.72	9.8± 0.26	ND	ND
	G3B			6.62± 0.09^{c}	5.39± 0.06			0.89± 0.08^{b}	0.78± 0.04^{b}			11.0± 0.45^{a}	12.4± 0.94			9.3± 0.91^{a}	8.6± 0.22^{b}
	G3C			5.42± 0.02^{c}	ND			0.80± 0.02^{b}	ND			12.4± 0.21^{a}	ND			5.5± 0.21^{b}	ND
G4 5% SB	G4A	6.7± 0.04	41.0± 0.28^{a}	ND	ND	0.7± 0.04	1.17± 0.03^{a}	ND	ND	12.3± 0.62	12.3± 0.46	ND	ND	10.2± 0.37	10.2± 0.82	ND	ND
	G4B			8.03± 0.40^{b}	5.33± 0.08			0.86± 0.01^{b}	0.70± 0.07^{b}			11.9± 0.12a	11.7± 0.94			9.5± 0.32^{a}	7.7± 0.22^{b}
	G4C			6.87± 0.08^{c}	ND			1.33± 0.06^{a}	ND			12.0± 0.91^{a}	ND			6.7± 0.92^{b}	ND

Means within the same column bearing different superscripts are significant at $p<0.05$

ND= not done

Plate (I) showed the histopathological lesions as follows:

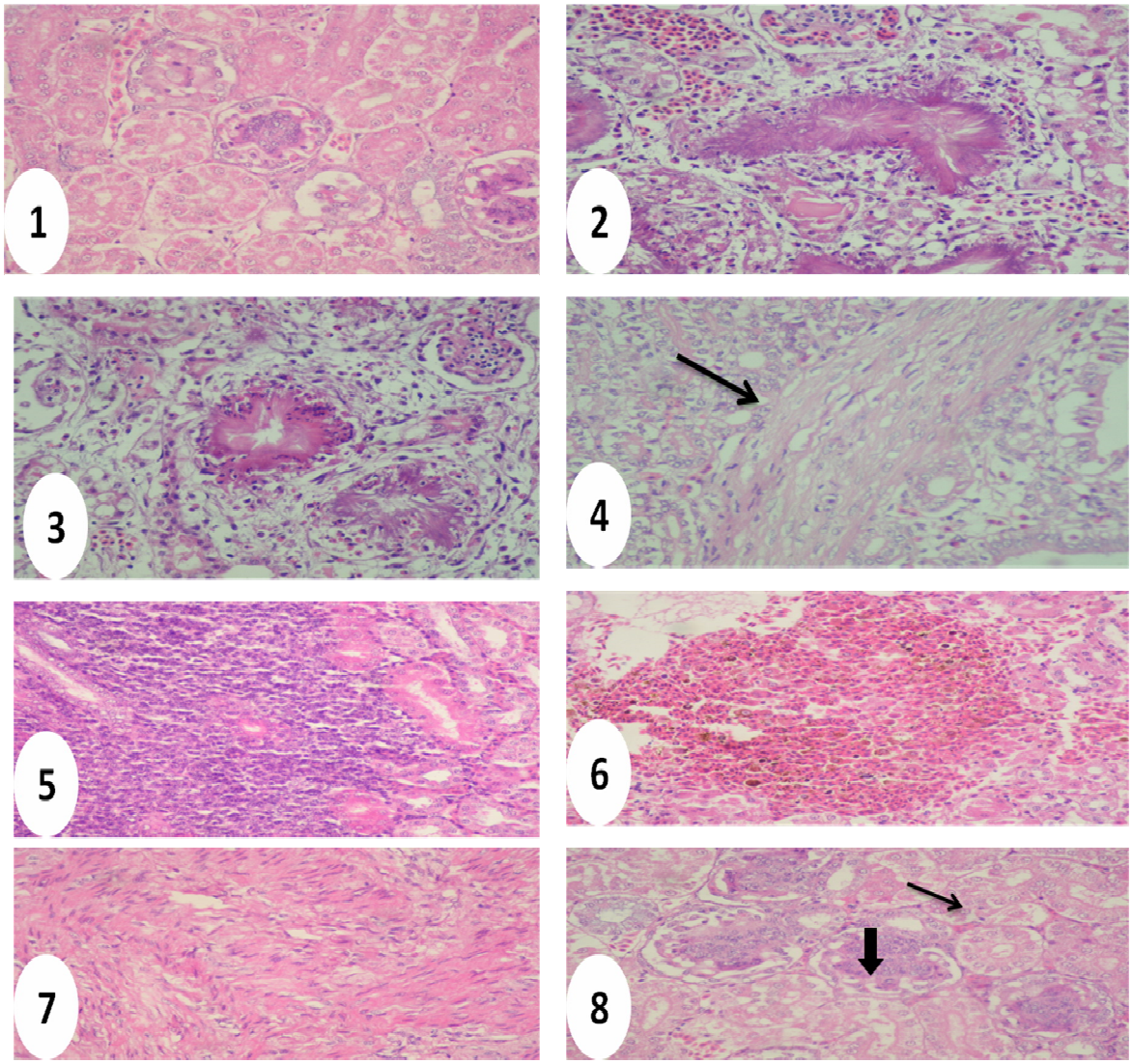

Fig1:G1 (Control) group showed normal renal glomeruli and normal renal tubules. (HE, 400x).

Fig2: G4 (5%SB, one week post-exposure) showed crystalline eosinophilic needle like-crystals of urates in interstitial tissue surrounded by heterophils. (HE, 400x).

Fig3:G3 (2%SB, one week post-exposure) showed Crystalline eosinophilic needle like-crystals of urates in renal tubules surrounded by heterophils. (HE, 400x).

Fig4:G2 (1%SB, one week post-exposure) showed fibrocollagenous bundles forming thick septa in renal parenchyma. (HE, 400x).

Fig5: G4B (3 weeks post-treatment with Nephrolyte) showed marked granulomatous inflammation with giant cell formation. (HE, 400x).

Fig6:G3B (3 weeks post-treatment with Nephrolyte) showed massive hemorrhage replacing renal parenchyma (HE, 400x).

Fig7: G2B (3 weeks post-treatment with Nephrolyte) showed kidney showing diffuse fibrous tissue proliferation (renal fibrosis) (HE, 400x).

Fig8: G2C (3 weeks post-treatment with Allopurinol) showed kidney showing hyperplasia in mesangial cells (thick arrow), with mild degeneration in renal tubules (thin arrow). (HE, 400x)

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الملخص العربى

فاعلية النفرولايت في علاج النقرس المحدث معمليا فى الدجاج

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أجريت هذه الدراسه لمعرفة مدي فاعلية مركب النفرولايت لعلاج النقرس المسبب (المحدث) في الدجاج (٢٠٠ دجاجة عمر ٤٨ يوم) باستخدام بيكربونات الصوديوم(بتركيزات مختلفة) بالمقارنة بعقار الالوبيورينول . تم تقسيم الدجاج المستخدم الي أربع مجموعات رئيسية علي النحو التالي : المجموعة الاولي: عدد ٢٠ طائر وتركت كمجموعة ضابطة (بدون احداث النقرس وبدون علاج). المجموعة الثانية : عدد ٦٠ طائر وقد اعطيت بيكربونات الصوديوم (١٪) لمدة أسبوع لإحداث النقرس . المجموعة الثالثة: عدد ٦٠ طائر وقد اعطيت بيكربونات الصوديوم(٢٪) لمدة أسبوع لإحداث النقرس . المجموعة الرابعة: عدد ٦٠ طائر وقد اعطيت بيكربونات الصوديوم(٥٪) لمدة أسبوع لإحداث النقرس . بعد حدوث النقرس وظهور أعراضة و تسجيل النافق تم تقسيم الطيور المتبقيه بالتساوي بالمجاميع الثانية و الثالثة و الرابعة إلي ثلاث مجاميع فرعية عند العلاج علي نحو أ وب وج بكل مجموعة. المجموعات الفرعيه أ في كل مجموعة استمرت فى تناول بيكربونات الصوديوم بنفس التركيزالسالف الذكر لمدة أسبوع اخر،ثم المجموعات الفرعيه ب بكل مجموعة تم اعطائها ٢مللي / لتر من ماء الشرب نفرولايت لمدة أسبوع ،بينما المجموعات الفرعيه ج بكل مجموعة تم اعطائها ٤٠ مجم / كجم من وزن الطائر فى ماء الشرب ألوبيورينول لمدة أسبوع. تم فحص الطيور اكلينيكيا وباثولوجيا. بعد حدوث النقرس ، تم ملاحظة كل أعراض النقرس ،وحصر الوفيات العاليه وسجل انخفاض كبير فى وزن الجسم فى كل الطيور المصابه. لقد أظهرت الطيور فى المجموعات الثانية (١٪) & الثالثة (٢٪) الصفه التشريحيه للنقرس الحشوى ولكن المجموعه الرابعة (٥٪) أظهرت الفشل الكلوي الحاد دون اظهار لترسب اليورات الحشوية. تم ملاحظة زيادة مستويات حمض اليوريك و الكرياتينين في الطيور المصابه. وقد سجل زيادة مستويات حمض اليوريك مع زيادة تركيزبيكربونات الصوديوم المعطاة . وقد كشف الفحص المجهري تغييرات كبيرة في الكلى وأظهر النقرس الحشوي فى الطيور المصابه

والخلاصة : أن تناول تركيزات عاليه من بيكربونات الصوديوم فى الدجاج تسبب زياده مفرطه فى حمض اليوريك فى الدم والتى أدت الى حدوث النقرس الحشوى النموذجى. لذلك لاينبغى أن تتجاوز الكميات الموصى بها فى الاستخدام. بعد العلاج بالنفروليت كمدر للبول لم تظهر أعراض النقرس أو أي وفيات وتحسنت الأوزان الحيه وكذلك لاتوجد صفات تشريحيه للنقرس وأيضا مستوي طبيعى لحمض اليوريك فى الدم بالمقارنه مع تلك التى لوحظت فى مجموعات الاختبار الأخرى. بينما استخدام الألوبيورينول ربما لايكون مثاليا فى علاج النقرس المستحدث ببيكربونات الصوديوم عند استخدامه فى ماء الشرب لمدة أسبوع لوجود وفيات وكما أن الصفات التشريحيه كانت شديده.