

The effect of some feed supplements on activity of kidneys of broiler chicken

Rihab Galib Mohammad AL-Zuhairy

Dep. of Basic Science/ Dentistry College/ Babylon University

Abstract

In a poultry farm of Ibn – Elbitar secondary school at AL-Utashi / Karbalaa Governorate , this study was conducted to evaluate the effects of different levels of feed supplementation such as raw garlic (*Allium sativum*) powder , *Saccharomyces cerevisea* and *Trigonella foenum - graceum* seeds, on kidneys parameters, therefore great attention has been devoted to studying the effect of these additives in nutrition of (60) male Ross broiler chickens with an age of one week old and each weights (170 gm), these birds randomly distributed into 6 groups (5 treatment groups administered with different levels of additives were added to standard diet , and untreated control group administered with standard diet only) for 5 weeks.

Then birds were sacrificed, kidneys were kept for histological sectioning , diameters of :- renal corpuscles , glomerulus , Bowman's space, the two types of convoluted tubules were measure in addition to the height of some lining cells, by using the ocular micrometer after its calibration with stage micrometer.

Results revealed a significant decrease at ($P \geq 0.05$) in the parameters :- diameters of glomerulus with its capsule , glomerulus itself and the lumen of distal convoluted tubule when treated with 250 gm /100kg (standard diet) of *Trigonella foenum* in contrast to control group ,also the treatment with (100gm/100kg diet) of *Saccharomyces cerevisea* causes a significant decrease in the diameters of each glomeruli and distal tubules and its lumen . The same effect caused by the treatment with the two levels(300-600gm/100kg diet) of garlic on the diameters of glomeruli ,proximal convoluted tubule and its lumen, while there is an a significant increment presents in a diameter of proximal convoluted tubule and its

lumen ,when treated with(100-.500/100kg)in sequence,and the same effect show it (300gm/100kg) of garlic on the diameter of proximal convoluted tubule and its lumen , and lumen of distal convoluted tubule only at (600gm/100kg) in contrast to control group. Hight of the lining epithelia of both type of renal tubules never be affected by all of these treatments .

Introduction

The kidney in chicken is multilobulated with no separation into cortex and medulla ,the collecting tubules empty into the ureters which empty directly into the cloaca, acommon vestibule into which the digestive and reproductive tracts all empty . Uric acid is the main nitrogenous waste product excreted in birds (Riddell 2002).

I- Garlic (*Allium sativum*)well known and widely distributed and used in all parts of the world as a spice and herbal medicine for the prevention and treatment of variety of diseases (Adibmoradi *et.al.*, 2006) , also used as anticoagulant and antiplatelet by inhibition the aggregation of platelets (Apitz-Castro *et.al.*, 1983). In mammals garlic is thought to have various pharmacological properities such as its effect of hypolipidaemia and cholesterolaemia , where it can lower both serum and liver cholesterol (Mirhadi *et al.*, 1991; Qureshi,1983).

Excess dose of garlic can cause toxicity including anemia and gastrointestinal problems (Banerjee et al., 2003). Nakagawa et al., (1985) found that (5 ml/kg) dose of raw garlic juice cause death due to stomach injury , and the high doses of garlic powder (200 mg /kg) caused considerable cell injury in rat liver and administration of (1000 mg/kg) of garlic caused a necrosis in the liver of these rats (Egan – Schwind *et al.*, 1992; Banerjee *et al.*, 2001).

Supplementation of garlic in broiler chicken diet have been recognized for their strong stimulating effect on the immune system and the very rich aromatic oils enhanced digestion of birds(Gardziekwska *et. al.*, 2003).

The major active garlic components is a powerfull plant chemical called allicin which rapidly decomposes in stomach acids to release

several volatile organosulphur compounds such as diallyl sulphide and diallyl disulphide with bioactivities , other ingredients is : S- allylcysteine (Chang & Cheong , 2008) .

II -*Saccharomyces cerevisiae*, commonly known as Baker's yeast is a common environmental fungus and transient component of the normal flora of the gastrointestinal and skin . Logarithmically growing cells of *Saccharomyces cerevisiae* contained high neutral trehalase (NT) activity while stationary phase cells had high acid trehalases (AT) ATH1,NTH1 and NTH2 have been identified in *Saccharomyces cerevisiae* , ATH1 and NTH1 hydrolyze trehalose to glucose to provide energy and assist in recovery from stress (Bisswas ,1997; DeVirgilio *et.al.*,1991). Human trehalase (TREH) is expressed in the intestine and kidney and probably hydrolyses ingested trehalose in the intestine and acts as marker of renal tubular damage in kidney . Since trehalose is not present in circulation or kidney tubules, its renal effect suggests it has other yet unidentified actions(Ouyang *et. al.*,2009).

Samikkannu *et al.*, (2006) found that although chronic exposure of renal cells to high glucose has been shown to cause cell injury , the effect of acute exposure has not been elucidated , also they demonstrated that acute (10 min) exposure of human proximal tubule epithelial cells (Hptec) to high glucose (25 mM) induces a time independent dual effect consisting of an early proliferation and a late apoptosis. A significant decrease in cell growth is observed followed by apoptosis.

III-*Trigonella foenum-graceum*:- The common name is fenugreek is an annual member of the leguminosae pea family or (Fabaceae) , and the parts used is seeds which have a constituents:- arginin, beta sitosterol, coumarin, magnesium and manganese, pyridoxine, niacin, potassium, riboflavin, sulfur, thiamine and others. Fenugreek contains potent antioxidants that have beneficial effects on the liver and pancrease making it useful in the treatment of diabetes ,high cholesterol and digestive disorders (Duke,2008) . Mucilage released from the herb keep the stomach from emptying quickly ,with the result that glucose enters the

blood stream more slowly after a meal. In addition an amino acid present in fenugreek stimulates the pancreas to produce insulin.

Xue *et.al.*, (2007) investigated the general effects of *Trigonella foenum* extract on general properties such as blood glucose, blood lipids and hemorheological parameters and found that *Trigonella foenum* extract had lower blood glucose, glycated hemoglobin, triglycerides, total cholesterol and higher high density lipoprotein cholesterol (Xue, 2007; Stark & Madar, 1993), also the ethanol extract from fenugreek seeds contained hypocholesterolaemic components which appear to be saponins that interact with bile salts in the digestive system (Stark & Madar, 1993)

Nakhla, *et.al.*, (1991) were observed pathological changes happened in chicks given fenugreek saponins which caused liver fatty acids cytoplasm vacuolation and necrosis of hepatocytes with lymphocytic infiltration and epithelial degeneration of renal tubules. Also (Petit *et.al.*, 1995) shown that a f. seeds extract containing steroid saponins increased food consumption and induced hypocholesterolemia in rats.

This research aimed to demonstrate the effects of these supplements on the kidneys of the broiler chickens.

Materials & Methods

1- Materials.

1-1- Animals:-

(60) male Ross broiler chickens one week old and weights (170 gm) were obtained from commercial breed hatchery in AL-Muradia / Babylon governorate used in this study, these birds distributed randomly into six groups each of which consists of (5 replicates). These animals were reared in battery cages in an environmentally controlled room in a poultry farm at Ibn –AL-Bitar secondary school in AL-Utaishi /Karbala, feed and water were provided *ad libitum*.

1-2 – The additives (supplementations).

Allium sativum (garlic) powder , *Saccharomyces cerevisea* and *Trigonella foenum*, were obtained commercially and added to standard diet for (5) weeks and as the following treatment protocol :-

Group	The treatment
I	300 gm <i>Allium sativum</i> + 100 Kg Standard diet
II	600 <i>Allium sativum</i> +100 Kg Standard diet
III	100 <i>Saccharomyces cerevisea</i> +100 Kg Standard diet
IV	500 <i>Saccharomyces cerevisea</i> +100 Kg Standard diet
V	250 gm <i>Trigonella foenum</i> + 100 Kg Standard diet
VI	Standard diet only (control group)

2- Methods

2-1 – Histological study :- Kidneys of the (5) replicates were preserved in 10% formalin .They were sectioned and stained with haematoxylin –eosin ,stained sections were observed under microscope to measure the diameters of renal parameters by using ocular micrometer after its calibration with stage micrometer.

2-2 – Data analysis:- Results presented in the study were statistically analyzed by using ANOVA test and CRD then, the significant differences between the means of data were compared by calculating the LSD.(Schefer,1969) . The values presented as means \pm standard deviations and ($P \geq 0.05$) was considered to be significant.

Results & Discussion

The statistical analysis of the data in (table 1) reveals some significant ($P \geq 0.05$) differences, where the treatment of broiler chicks with 250 gm of *Trigonella foenum – graceum* administered with 100 Kg of standard diet shows significant decrement in the diameters of :- glomerulus with its Bowmans capsule, glomerulus, distal tubule and its lumen in contrast with control group which administered the standard diet only, this may be contributed to the toxic agents which may affect the kidney and impair its physiological functions. These effects quantifiable by cross checking the normally expected functions of the kidney in excreting the nitrogenous waste products of metabolism like urea and creatinine (Sujin *et al.*, 2009). Also the highly content of saponin as Nakhla *et. al.*, (1991) they found that saponins cause depression in body weight and the serum LDH and GOT activities and uric acid concentration were significantly elevated, in addition to epithelial degeneration of renal tubules.

Xue *et.al.*, (2007) concluded that *Trigonella foenum – graceum* extract can lower kidney/body weight ratio, due to that crude saponins caused adhesion and retention of particles within renal tubules then a regeneration and failure of the renal tubules to reabsorb and excretion of some materials such as potassium and water the causes acquired diabetes insipidus.

In regarding to the data of *Saccharomyces cerevisiae* the first level 100 gm/100 Kg showed a significant decrease in diameter of :- glomerulus, distal tubules, and significant increase in the diameter of proximal tubules lumens, while the second level 500gm/ 100Kg showed a significant increase in diameters of proximal tubules and significant decrease in distal tubules lumens in comparison with the control group, the causes may be –and- according to the research of (Sanchez-Morito *et. al.*, 1999), the contents of yeast from effective constituents such as Magnesium and Manganese which their interactions reduced the absorption in kidney possibly through the Mg-dependent regulation of divalent-cation transport activity, and this may be due to their effects on the renal parameters. This results not compatible with the results of

(Sakai,*et.al.*,2006) which they demonstrated that dietary salt depletion significantly enhances renal MAK-V/Hunk that responsible for transcription of renal cellular function kinase in distal convoluted tubule.

Also the results of present study may related to highly content of glucose resulted from the activity of the trehalases contents of *Saccharomyces cerevisea* (Bisswas ,1997; DeVirgilio *et.al.*,1991) and their demonstrations that trehalase (TREH) is expressed in the intestine and kidney and this enzyme responsible for the conversion of trehalose to glucose this mean ,the administration with yeast may rise the glucose level in the birds blood, which it considered as a diabetic effect causes an increase in proximal tubule cell injury, where increased concentration of glucose in the blood, is a major risk factor in the pathogenesis of renal disease (Samikkannu,*et.al.*, 2006).

In relation to the garlic *Allium sativum* powder the first level 300/100 Kg shows a significant increase in the diameters of proximal tubules and significant decrease in distal and their lumens ,while the second level 600/100Kg shows a significant decrease in glomerulus diameter and a significant increase in the diameter of proximal and lumens of distal tubules and the reasons of these data could be the high dose of garlic that have high chemical components:- allicin and S-allyl cysteine and their decoposition in the stomach acids (diallyl sulfide and diallyl disulfide)which they have both beneficial and toxic effects (Rosen et al.,2001).

AL-Salahy &Mahmoud(2003) found a histopathological changes of kidneys of carnivorous fish *Chrysichthys auratus* that orally administered with doses of garlic(*Allium sativum*) juice equivalent to 2g/kg b.w.,as a single dose or the same dose every 48h for 5 and 11 days, these changes represented in a vacuolation and rupture of some renal tubules, and degeneration of the parietal cells of some Malpighain corpuscles, also there is a decrease in collagenous fibers and carbohydrate content . We concluded that these supplements have deleterious effect on the activity of the broiler chicken.

References

Adibmoradi ,M.;Navidshad,B.;Seifdavati,J.and Royan,M.(2006).Effect of dietary garlic meal on histological structure of small intestine in broiler chickens.J.Poult.Sci.43:378-383.

AL-Salhy,M.B. & Mahmoud ,A.B.(2003).Metabolic and histological studies on the effect of garlic administration on the carnivory fish *Chrysichthys auratus* .Egyptian Journal of Biology.5:94-107.

Apitz-Castro ,R.; Cabrera,S.;Cruz,M.R.;Ledezma,E. & Join ,M.K.(1983). Effects of garlic extract and of three pure components isolated from it on human platelet aggregation arachidonate metabolism,release reaction and platelet ultrastructure.Thromb.Res.32:155-169.

Balch,P.A.(2002).Prescription for herbal healing

Biswas,N. & Ghosh,A.K.(1997).Possiblerole of isoaspartyl methyltransferase towards regulation of acid trehalase activity in *Saccharomyces cerevisiae*. Biochimica. Biophysica. Acta(BBA).1335:3(6).273-282.

Banerjee,S.K.;Maulik,M.;Manchanda,S.C.;Dinda,A.K.;Das,A.K.&Maulik ,S.K.(2001).Garlic-induced alteration in rat liver and kidney morphology and associated changes in endogenous antioxidant status.Food.Chem.Toxicol.39:793-797.

Banerjee,S.K.& Maulik,S.K.(2003). Garlic as an antioxidant ;The good ,the bad and the ugly.Phytotherapy.Res.17:97-106.

- Chang,K.J. &Cheong,S.H.(2008).Volatile organosulfur and nutrient compounds from garlic by cultivating areas and processing methods.Fed.Am.Soc.J.22:1108-2
- De-Virgilio ,C.; Burckert,N.;Boller,T. & Wiemken,A.(1991). A method to study the rapid phosphorylation related modulation of neutral trehalase activity by temperature shifts in yeast.Biochemica.Biophysica.Acta (BBA).291(2)21:355-358.
- Duke,J.(2000).The green pharmacy herbal handbook .Annies Remedy
- Egen-Scheind.C.; Eckard,R.&Kemper,F.H.(1992).Metabolism of garlic constituents in the isolated perfused rat liver.Planta.Medica.58:301-305.
- Gardzielewska,J.; Pudyszak,K.;Majewska,T.;Jakubowska,M.& Pomianowski,J.(2003). Effect of plant supplemented feeding on fresh and frozen storage quality of broiler chicken meat.J. Polish.Univ.6(2).
- Mirhadi,S.A.;Singh,S.&Gupta,P.P.(1991).Effect of garlic supplementation to cholesterol rich diet on development of atherosclerosis in rabbits.Indian .J.Exp.Biol.29:162-168.
- Nakhla,H.B.;Mohamed,O.S.;Abu,I.M.;Fatuh,A.L.&Adam,S.E.(1991).The effect of Trigonella foenum –graecum(fenugreek) crude saponins on Hisex-type chicks. Vet.Hum.Toxicol.33(6):561-4.
- Ouyang,Y.;Xu,Q.;Mitsui,K.;Motizuki,M. & Xu,Z.(2009). Human trehalase is a stress responsive protein in *Saccharomyces cerevisiae* .Biochem.Biophys.Res.Comm.379(2):621-625.

Petit,P.R.;Sauvaire,Y.D.;HillaireBuys,D.M.;Leconte,O.M.;Baissac,Y.G.; Ponsin,G.R.& Ribes,O.M.(1995).Steroid saponins and pharmacological investigation on feeding behavior and plasma cholesterol.Steroids.60(10):674-80.

Qureshi ,A.A.;Abuirmeileh,N.;Din,Z.Z.;Elson,C.E. & Burger,W.C.(1983).Inhibition of cholesterol and fatty acid biosynthesis in liver enzymes and chicken hepatocytes by polar fractions of garlic.Lipids.18:343-348.

Riddell ,C.(2002). Comparative anatomy,histologyand physiologyof the chicken.2nded. Kanada.

Rosen,R.T.;Hiserodt,R.D.;Fukuda,E.K.;Ruiz,R.J.;Lech,Z.J.;Rosen,S.L.& Hartman,T.G. (2001).Determination of allicin,S-allylcysteine and volatile metabolites of garlic in breath,plasma or simulated gastric fluids.J.Nutr.(131):9685-9715.

Sakai,M.;Tamura,K.;Tsurumi,Y.;Tanaka,Y.;Koide,Y.;Mastuda,M.;Ishigami,I.;Yabana,M.;Tokita,Y.;Hiroi,Y.& Umemura ,S.(2007).Expression of MAK-V/Hunk in renal distal tubules and its possible involvement in proliferativesuppression.Am.J.Physiol.Renal.Physiol.292(13):1526-1536.

Samikkannu,T.;Thomas,J.J.;Bhat,G.J.;Wittman,V.&Thekkumkara,T.J.(2006).Acute effect of high glucose on long-term cellgrowth: arole for transient glucose increase in proximal tubules cell injury.Am.J.Physiol.Renal.Physiol.291(7):162-175.

Sanchez-Morito,N.;Planells,E.;Aranda,P.&Liopis,J.(1991).Magnesium-Manganese interactions caused by Magnesium deficiency in rats.J.Am.Colle.Nutr.18(5):475-480.

Santin,E.;Maiorka,A.;Macari,M.;Grecco,M.;Sanchez,J.C.;Okada,T.M.& Myasaka,A.M.(2001). Performance and intestinal mucosa development in broiler chickens fedration containing *Saccharomyces cerevisea* cell wall.J.Appl.Poult.Res.10:236-244.

Sujin,R.M.;Subin,R.M.;Mahesh,R.&May,V.J.(2009).The effect of Anti-diabetics in kidney of rats.Ethnobotanical.Leadlets.13:689-701.

Xue,W.L.;Li,X.S.;Zhang,J.;Lie,Y.H.;Wang,Z.L.&Zhang,R.J.(2007).Effect of *Trigonella foenum –graecum* (fenugreek) extract on blood glucose ,blood lipid hemorheological properities in streptozotocin-Induced diabetic rats.Asia.Pac.J.Clin.Nutr.16(1):422