SOME HAEMATOLOGICAL AND BIOCHEMICAL EFFECTS OF GARLIC ON BROILER CHICKEN

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ABSTRACT

This study was conducted to investigate the effects of adding raw garlic in the diets on certain hematological and serum biochemistry of broiler chicken. Total of (40) birds (one day old) were used for this study. The birds divided randomly and equally into (4) treatment groups which fed on one of the following for 56 days: group (1) was fed on 10% raw garlic with basal diet, group (2) was fed on 5% raw garlic with basal diet, group (3) fed on basal diet and antibiotic (Ampicillin) which was added to the drinking water and group (4) fed on basal diet only (control group)

The results showed that there were no significant alteration in PCV and RBCs in the group which fed on 10% raw garlic compared with the control one, however these group showed significant ($p<0.01$) reduction in HbC, MCV, MCHC and MCH. The addition of 5% raw garlic to the diet of bird caused significant ($p<0.01$) reduction in MCH and MCV only where as other haematological parameters (PCV, RBCs count, HbC and MCHC) have not affected significantly compared with the control group. The group which received antibiotic showed significant reduction ($p<0.01$) in HbC and MCHC. On the other hand, all treatment groups have not altered the total WBC and differential leucocytic counts. The coagulation time was prolonged significantly in groups that fed on both levels of garlic. The biochemical analysis of the serum has not any significant changes in serum total protein and glucose levels in all treatment groups. However, the serum cholesterol levels of birds fed on both levels of garlic (10% and/or 5%) reduced significantly ($p<0.01$) as compared with the control group

INTRODUCTION

Garlic (*Allium sativum*) has been known and utilized as spice and herbal remedy for more than 4000 years and most likely originated from Central Asia **(1).** In fact, in Iraqi veterinary folic medicine, garlic was used for treatment of bird suffering from different microbial diseases.

Today many pharmacological properties are attributed to garlic or its ingredients. Garlic has been shown to reduce risk factor of cardiovascular diseases ranging from improving blood circulation **(2),** inhibition of blood coagulation **(3-5)**, stimulates fibrinolytic activity and stimulates the phagocytotic function of macrophage and lymphocyte proliferation **(6)**, reducing the level of serum cholesterol and triglyceride **(7-9)** and regression of atherosclerosis **(10,11).** However, little information about the effects of garlic on the profile of blood of chickens was present. Hence, this study aimed to examine the effect of garlic on some haematological and biochemical parameters of blood of broiler chicken.

MATERIALS AND METHODS

Birds and Diets: One day old FAWBRO chicks were obtained from local market. Birds were randomly assigned to four cages (2×1×1m) with (25) chicks per cage. Each group (25 birds) were given for (56 days) one of the following treatments: group (1) fed with 10% raw garlic. This was obtained by grounding (100gm) raw garlic mixed with (900gm) basal diet, the grounding and mixing was carried out daily and immediately before feeding the birds, group (2)

fed with 5% raw garlic (as group 1), group (3) fed on basal diet and Ampicillin (Ampivet 20%, Doxal Italia spa, Italy) was added to drinking water, and group (4) fed on basal diet only (control group).The grounding and mixing of garlic was carried out daily and immediately before feeding the birds.

Birds were housed in a room with continuous lighting and maintained at a temperature of (32C∘) initially which reduced gradually to (25C∘) in 5 weeks and where it remained for the rest of feeding period. Chicks had free access to feed with starter diets which composed of corn 40%, wheat 15%, barley 15%, soybean 18%, animal protein 12%, NaCl 0.5% and vitamins/minerals 0.5%. At 35 days old, the starter diet was replaced by grower diet which composed of corn 40%, wheat 15%, barley 15%, soybean 20%, animal protein 10%, NaCl 0.5% and vitamins/minerals 0.5%.

Blood and serum samples: After 56 days post treatments, blood (5ml) was taken randomly from (10 birds) from jugular vein and placed into two test tubes, one of them (2ml) was placed into test tube containing anticoagulant (EDTA) for hematological studies, while the second one (3ml) was placed into tube (without anticoagulant) which left obliquely till coagulation and the clot was taken out gently from the test tube by glass rod. The serum was divided into three test tubes, which stored at 20C∘. These serum samples were used for biochemical analysis.

Haematological studies: The packed cell volume (PCV) estimated by spinning about 0.7 ml from each blood sample in heparinized capillary tubes in a haematocrit centrifuge for 5min. The total red blood cell count (RBC) was determined using improved Neuber haemocytometer. The haemoglobin concentration (HbC) was estimated using cyanomethaemoglobin method. The mean corpuscular haemoglobin concentration (MCHC), mean corpuscular haemoglobin (MCH) and the mean corpuscular volume (MCV) were calculated by applying the equations (HbCx100)/ PCV, (HbCx10)/ RBCs (millions) and (PCVx10)/RBC (millions) respectively **(12)**. The blood coagulation time was carried out by using nonheprinized capillary tube filled directly from wing vein and the tube was broken each 5 sec until appearance of the thread between the two broken peaces. Total WBC count was carried out by using haemcytometer, while differential WBC count was done by preparing blood smear stained with Wrights stain as descried by **(12)**

Biochemical studies: The total serum protein concentration was determined by colorimetric procedure by using Buriet solution (Randox Laboratories Comp.) **(13)**. Glucose concentration was detected by using enzymatic colorimetric technique by using GOD-PAP (Randox) **(14).** The estimation of cholesterol level in the serum, the enzymatic technique was used **(15)**.

Statistical analysis: Data were analysis by using analysis of variance and LSD test were then performed by using (SPSS/1998).

RESULTS

Addition of 10% raw garlic to the basal diet for 56 days had no significant effect on PCV% and RBCs count of the birds, while HbC, MCHC, MCH and MCV were reduced significantly (P<0.01) as compared with the control group (Table 1). The group of birds that fed 5% raw garlic with basal diet, only MCH and MCV were reduced significantly while other haematological parameters (PCV, RBCs count, HbC and MCHC) failed to reach significant differences compared with the control group. On the other hand, the feeding of birds with 10% garlic caused significant (P<0.01) reduction on HbC and MCHC compared with the group of birds which fed on 5% raw garlic with basal diet, but other parameters did not changed significantly. The group of birds that received antibiotic the HbC and MCHC reduced significantly (P<0.01) and other haematological parameters did not reduced significantly as compared with control group (Table 1).

As shown in Table (2), the addition of both levels of garlic to the diet or antibiotic have not effect significantly on the total WBCs count nor and differential count.

The coagulation time was significantly increased when the birds fed on both levels of garlic (Table 3).

The total serum protein and glucose levels has not changed significantly in all treated groups, but the addition of garlic (both levels) cause reduction (p<0.01) in cholesterol level in the serum compared with control and antibiotic treated groups Table 4).

Table 1: Hematological parameters (Mean ±SE) of broilers fed varying dietary levels of garlic (n=10).

Diets	PCV %	RBC (10^6/ mm^2)	HbC (g/10ml)	MCHC (pg)	MCH (pg)	MCV
10%Garilc +Basal diet	28.55 ±0.67	2.23 ± 0.08	10.85ab ±0.58	37.98b ±1.82	48.92b ±2.36	128.97b ±2.21
5%Garilc +Basal diet	30.20 ±0.63	2.37 ±0.07	12.30a ±0.52	40.59a ±1.11	51.79b ±1.37	127.75b ±1.69
Antibiotic +Basal diet	28.50 ±1.09	2.24 ±0.13	9.80b ±0.48	34.45b ±1.21	44.17a ±1.23	129.03a ±3.81
Control Basal diet only	28.05 ±0.49	2.18 ±0.06	12.60a ±0.83	45.21a ±3.36	58.55a ±4.64	129.02a ±0.53

Means with differencing superscript in the same column are significantly different (p<0.01).

Table 2:Total WBC count and differential leukocytic counts of broilers chicken fed on garlic.

Diets	Total W.B.C. %	Neutrop-hils %	Lymphoc-ytes%	Monoc-yte%	Eosinplil %	Basophil %
10%Garilc +Basal diet	25.41 2.77±	27.30 0.7±	59.10 0.71±	5.0 0.78±	2.30 0.37±	1.8 0.33±
5%Garilc+ Basal diet	27.85 1.01±	26.30 1.22±	58.40 0.87±	4.5 0.50±	2.2 0.36±	1.6 0.27±
Antibiotic +Basal diet	24.37 2.27±	27.90 1.19±	57.60 1.33±	4.6 0.54±	2.1 0.35±	2.0 0.26±
Control Basal diet only	25.50 1.34±	27.40 0.58±	58.60 0.76±	4.4 0.49±	2.00 0.37±	2.1 0.41±
Statistical analysis	NS	NS	NS	NS	NS	NS

Table 3: Effect of two doses of garlic on coagulation time (n=10).

Diets	Coagulation time (seconds)
10%Garilc+Basal diet	108.0a ±10.33
5%Garilc+Basal diet	92.0a ±12.67
Antibiotic +Basal diet	50.8b± 8.22
(Control)Basal diet only	49.0b± 4.99

Values are means ±SE,
Means with differencing superscript in the same column are significantly
different (p<0.01).

Table 4: Serum total protein, glucose and cholesterol levels as affected by garlic supplementation (n=10).

Diets	Total protein(g/dl)	Glucose (mg/dl)	Cholesterol (mg/dl)
10%Garilc+Basal diet	5.37 0.40±	198.10 4.86±	97.80a 3.30±
5%Garilc+Basal diet	5.21 0.37±	201.90 4.88±	116.40a 2.49±
Antibiotic +Basal diet	5.28 0.34±	211.50 8.69±	147.31b 3.18±
Control	5.54 0.31±	172.10 9.33±	146.48b 3.36±

Values are means ± SE,
Means with differencing superscript in the same column are significantly
different (p<0.01).

DISCUSSION

The degree of anemia is determined by HbC, PCV, and RBCs count, while the characterization of anemia is aided by calculated red cell indices (i.e. MCV, MCH and MCHC) **(16).** In the present study, as shown from the results, the addition of 10% raw garlic to the diet of broilers PCV and RBCs count did not decrease significantly but HbC and other haematocrit parameters (MCV, MCHC and MCH) decreased significantly. MCHC, indicates the concentration of hemoglobin per unite volume of RBCs, it provides similar information as the MCH but considered to be more accurate **(17)**. A low MCHC is usually accompanying hypochromic microcytosis which is seen in iron deficiency **(18).**The iron deficiency anemia is usually associated with ulcer or inflammatory bowel diseases **(19)**. Nakagawa *et al.* **(20)** found that raw garlic juice at a dose 5ml/kg has resulted in death at rats due to stomach injury. Similarly Augusti, **(21)** found prolong feeding of high levels of raw garlic in rats have resulted in anemia **(22)**. Another explanation one can suspect that garlic may interfere with copper absorption which is required feroxidase enzyme system, deficiency block iron use, that result an iron deficiency anemia **(19).**The PCV and total protein are determined simultaneously because a decrease in both values seen in cases of blood loss anemia **(16),** however this profile not present in this study. The group of bird fed on 5% raw garlic did not show sign of anemia. These results were accordance with other study in human patients with sickle cell anemia that found there

were no significant changes in PCV, HbC and RBCs count when giving aged garlic extract for four weeks.

The coagulation time in present study was significantly prolonged (about two folds) due to feeding raw garlic. In another experimental study also revealed effect in enhancing the fibrinolytic activity after receiving garlic for 13 weeks (**3**). While Luley *et al.* (**23**) found that dried garlic powder not increased in fibrinolytic activity. Actually, several investigators emphasized that feeding raw garlic causes prolongation in coagulation time (**24, 25**). Researchers in Kuwait found that daily ingestion of 3g garlic for 6 month resulted in an 80% decrease in serum thromboxane B2(**26**). *Alluim sativum* may be considered natural anti-clotting agent that may have fibrinolytic activity and can suppress platelet aggregation (**25**)

On the other hand the results showed that garlic did not affect glucose level significantly in blood of birds compared with the control group. Actually many researchers found that garlic has hypoglycemic effect and proposed that garlic can act as anti-diabetic agent by increasing either the pancreatic secreation of insulin from beta cells or its release from bound insulin (**27**). The principal active ingredients are believed to be allyl propyl disulphide and diallyl disulphide oxide (allicin). Although other constituents such as flavonoid may play a role as well. Some experimental evidence suggests that allyl propyl disulphide lower glucose levels by competing with insulin for insulin-inactivating sites in the liver. This result an increase an increase of free insulin (**28**). However, another investigator noticed that garlic could not decrease the level of glucose in blood in nondiabetic normal animals (**29**). Grodsky*, et al.* (**30**) found that substances that cause antagonist between garlic and natural insulin, such action may occur in this experiment as there was slight nonsignificant elevation in the glucose level in bird fed on raw garlic.

It is clear from the results that garlic (both doses) reduced the cholesterol level in the blood of chicken (about two folds), Similarly, garlic extract have been shown to lower plasma lipid and cholesterol in chicken (**31,32**). Bordia (**11**) reported that lipids concentrations are favorably altered in normocholesterolemic subjects taking garlic. On average one half to one clove of garlic per day reduced hypercholesterolemia by about 10% of initial value. Also Change and Johnson (**33**) found that administration of garlic in hypercholesterolemic rats induced by high-cholesterol diet significantly reduced serum cholesterol. Previous studies by other investigators have show that the lipid-lowering effects of various garlic extracts were accompanied by depressed activities of lipogenic and cholesterologenic enzymes (**31,32,34,35**). Yeh and Liu (**9**) reported that the hypocholesterolemic action of garlic in part from inhibition of hepatic cholesterol synthesis. In contrary some studies on human (**36**), dogs (**37**) and normal rabbit (**38**) found when garlic was given caused elevation in the cholesterol level in the blood then after 4-5 months decreased. Those researchers attributed this finding to the effect of garlic on gradual releasing of cholesterol from its storage places which lead to the elevation of cholesterol level in blood, then decreased when the storage is exhausted.

From the above discussion it may be concluded that garlic at 5% of basal diet has beneficial effects to broiler.

بعض التأثيرات الدموية و الكيموحيوية للثوم على دجاج اللحم

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الخلاصة

أجريت هذه الدراسة لمعرفة مدى تأثير إضافة الثوم في علف دجاج اللحم على بعض فحوصات الدم وبايوكيميائية المصل. استخدمت في هذه الدراسة أربعون فروج لحم بعمر يوم واحد حيث قسمت عشوائيا إلى أربعة مجاميع: المجموعة الأولى غذيت على 10 %من الثوم العلف الأساسي الطازج مع العلف الأساسي والمجموعة الثانية غذيت على 5%من الثوم مع العلف الأساسي والمجموعة الثالثة غذيت على العلف الأساسي وأعطيت المضاد الحيوي (الأمبسلين) الذي أضيف إلى ماء الشرب أما المجموعة الرابعة فقد غذيت على العلف الأساسي فقط (مجموعة السيطرة.)

أظهرت النتائج بعدم وجود فروقا معنوية في كريات الدم المرصوصة (PVC) وعدد الكريات الحمر (RBC) في المجموعة التي غذيت على 10% من الثوم مقارنه مع مجموعة السيطرة. مع هذا فان هذه المجموعة أظهرت انخفاضاً معنويا (P<0.01) في تركيز الهيموكلوبين(HbC) ومعدل تركيز هيموكلوبين الكرية (MCHC) وهيموكلوبين الكرية (MCH) ومعدل حجم الكرية(MCV. أما إضافة 5% من الثوم إلى غذاء الطيور فقد سبب انخفاضا معنويا في معدل هيموكلوبين الكرية (MCH) ومعدل حجم الكرية(MCV) فقط مقارنة مع مجموعة السيطرة بينما بقية المعايير الدموية (HbC وRBC وPVC وMCHC) لم تتغير مقارنتا مع مجموعة السيطرة. بينما إضافة الضاد الحيوي للطيور سبب انخفاض معنوي في تركيز الهيموكلوبين HbC في الدم وكذلك معدل تركيز هيموكلوبين الكرية(MCHC). ومن جانب آخر فأن العدد الكلي والعدد ألتفريقي للكريات البيض في كل المجاميع لم يتأثر بشكل معنوي. وأظهرت النتائج بأن الطيور التي غذيت بكلتا المستوين من الثوم قد أطال زمن تخثر الدم بشكل معنوي (P<0.01) . أما التحاليل البايوكيميائية للمصل فأظهرت عدم وجود فروقا معنوية في مستوى البروتين و الكلوكوز بين المجاميع، ولكن مستوى الكولوستيرول في الطيور التي غذيت على كلتا المستوين من الثوم (5% و 10%) قد أنخفض معنوياً مقارنة مع مجموعة السيطرة

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