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EFFECT OF ADDING DIFFERENT LEVELS OF ONION *(Allium cepa linn)* POWDER TO BROILER DIETS ON THE PHYSIOLOGICAL CHARACTERISTICS

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ABSTRACT

Between October 15, 2021, and November 26, 2021, this study was carried out in the broiler field at the College of Agricultural Engineering Sciences, University of Baghdad in Abu Ghraib to examine the effects of adding various dosages of onion powder, *"Allium cepa linn"*, to broiler chicks' diets on the physiological characteristics. The experiment employed 225 unsexed (Ross 308) one-day-old broiler chicks with an average weight of 40g. A total of 225 chicks were divided into 5 treatments by three replicates in each treatment with 15 chicks per replicate randomly. The experimental treatments were as follows: The chicks were first fed starter ration from one day old to 21 d old, after which they were fed a finisher diet from 22 to 42 d old. The treatments were described as T1 (control treatment): basal diet without onion powder addition, T2: basal diet with 2g/kg of onion powder/kg of feed, T3: basal diet with …….. 4g/kg of feed of onion powder as part of the T3 treatment. Both the T4 treatment and the T5 treatment added onion powder at rates of 6g and 8g per kilogram of feed, respectively. The experiments findings suggested the following: There was a significant decrease (P<0.05) in the level of serum cholesterol concentration for the T2 treatment compared to that of the T1 controlled treatment. However, the T2 treatment did not differ significantly with the T3, T4 and T5 treatments. When comparing the level of the liver enzymes AST and ALT for the T5 treatment to that of the T1 controlled treatment, there was a significant improvement (P<0.05). While there was little difference between the T5 treatment and the T2, T3, and T4 treatments.

Key words: Broiler, Onion powder, Physiological traits, Liver enzymes.

تأثير إضافة مستويات مختلفة من مسحوق البصل الى علائق فروج اللحم في بعض الصفات الفسلجية

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الخلاصة

أجريت هذه الدراسة في حقل الطيور الداجنة التابع لكلية علوم الهندسة الزراعة/ جامعة بغداد في أبي غريب للفترة من 2021/10/15 ولغاية 2021/11/26 لدراسة تأثير إضافة مستويات مختلفة من مسحوق البصل *Allium Cepa linn* الى علائق فروج اللحم في بعض الصفات الفسلجية، استخدم في التجربة 225 فرخ لحم سلالة (Ross 308) غير مجنس بعمر يوم واحد وبمعدل وزن ابتدائي (40) غم وزعت الافراخ عشوائيا على 5 معاملات كل واحدة شملت 3 مكررات وبواقع 15 فرخا للمكرر الواحد، غذيت الافراخ على عليقة البادئ من عمر يوم ولغاية 21 يوما وعليقة النهائي من عمر 22 لغاية 42 يوما و كانت معاملات التجربة كما يلي : T1 معاملة السيطرة من دون اضافة مسحوق البصل و T2 اضافة مسحوق البصل بنسبة 2 غم/كغم علف و T3 اضافة مسحوق البصل بنسبة 4 غم/كغم علف و T4 اضافة مسحوق البصل بنسبة 6 غم/كغم علف و T5 اضافة مسحوق البصل بنسبة 8 غم/كغم علف، وأشارت نتائج التجربة الى ما يلي: حصول انخفاض معنوي (P<0.05) في مستوى تركيز كولسترول مصل الدم لمعاملة الاضافة T2 مقارنة مع معاملة

السيطرة T1 ولكنها لم تختلف معنويا مع معاملات الاضافة T3 ، T4 و T5، كما لوحظ وجود زيادة معنوية (P<0.05) في مستوى انزيمات الكبد AST, ALT لمعاملة الاضافة T5 عند المقارنة مع معاملة السيطرة T1، في حين لم تختلف معنويا مع معاملات الاضافة T2 ، T3 و T4.

الكلمات المفتاحية: فروج اللحم ، مسحوق البصل ،الصفات الفسلجية، انزيمات الكبد.

INTRODUCTION

There is currently an international risk to both animal and human health as a result of the prolonged and unchecked use of antibiotics and the growing demand for animal products (**Roth *et al*.,2019**). Poultry is one of the businesses that employs the most antibiotics to stimulate growth since it is the primary source of animal protein in the world (**Van Boeckel *et al*., 2015**). The European Union's ban on the sub-therapeutic use of antibiotics and consumers' growing awareness of the fatalistic effects of antibiotic resistance as well as residues in animal products prompted a greater focus on the search for effective in-feed antibiotic substitutes without sacrificing animal productivity or product quality (**Kim *et al.*, 2019**). However, the biggest problems of raising chicken without using antibiotics include the birds' inferior production and development, as well as their higher rates of disease and mortality (**Cheng *et al.*, 2014**). Numerous research that provide light on practical and economical alternatives to antibiotics for hens have been published recently (**Wang *et al.*,2016**). Recently, there has been a lot of interest in plant-derived feed additives as more sustainable alternatives for chicken diets (**Habibi & Ghahtan.,2019**). An effective plant-derived additive is anticipated to increase feed intake, improve digestive enzyme secretions, activate the immune system, regulate gut microbiota, and/or have antibacterial, antiviral, antioxidant, and/or anti-inflammatory effects in poultry (broiler chickens, layer chickens, and quails) (**Toghyani *et al.*,2011**). Given that it includes a variety of bioactive chemicals, including sugars called fructo-oligosaccharides (FOS), polyphenols, saponins, and organosulfur compounds (OSCs), allium has a lot of potential in this area. The Allium genus, which belongs to the Amaryllidaceae family, has 850 species, making it one of the most intensively studied medicinal plants (**Ahmed *et al.*, 2015**). There is a lot of knowledge on the medicinal advantages of *"Allium cepa linn*" for humans, but there is little evidence supporting its usage in poultry.

The onion *"Allium cepa linn*" plant, is produced extensively practically everywhere in the globe, particularly in China, India, and the USA. It is utilized both as a food and medicinal plant (**Ebesunun *et al.*, 2007**). With shown antioxidant, antibacterial, and hypolipidemic action, onions include flavonoids, phenolic acids, cholesterol, saponins, sugars, and essential oil components mostly composed of sulfur compounds (**Melvin *et al.*, 2009**). There are few studies on the advantages and proper dosage of supplementing with onions (**Aditya *et al.*, 2017**). The goal of the current study was to ascertain how different onion powder dosages affected the broilers' physiological parameters.

MATERIALS AND METHODS

Birds, Experimental Design, and Treatments:

This study was carried out at the poultry farm, College of Agricultural Engineering Sciences, University of Baghdad (Abu Ghraib) for a period of 42 d. The study included the effect of adding different levels of onion powder "*Allium cepa linn*", in broiler diets, on the physiological characteristics of broiler chickens. Specifically, analyzing the prominent effects of the onion powder on the concentration of glucose, cholesterol, triglycerides, total protein, albumin, globulin, A/G ratio, high-density lipoproteins (HDL) and low-density lipoproteins (LDL) in the blood serum of broilers.

In this experiment, 225 unsexed broiler chicks of the Ross 308 breed, which were prepared by the Al-Shukr Al-Ahly hatchery, located in Abu Gharib, with an average initial weight of 40g per chick were used. The chicks were divided to 5 treatments, each treatment content 3 replicates with 15 chicks for each replicate. The chicks of each replicate were located in the bin with dimensions (1.6 length × 1.25 width) meters. The nutritional treatments were as follows:

1- T1 treatment, a control treatment free of any additional onion powder.
2- T2 treatment, adding 2 g/kg of onion powder to broiler diets.
3- T3 treatment, adding 4 g/kg of onion powder to broiler diets.
4- T4 treatment, adding 6 g/kg of onion powder to broiler diets.
5- T5 treatment, adding 8 g/kg of onion powder to broiler diets.

Feeding chicks

The chicks were fed on two diets. The first, starter diet from 1 to 21 d of age, and the second of the growth diet of 22 to 42 d. The diets were mixed and prepared in the laboratory of the Faculty of Agricultural Engineering Sciences, Abu Ghraib. Onion powder was added to the treatments according to the required, and the components of the diets used in the experiment were shown in (Table 1). and the nutrient requirements were calculated according to the chemical analysis of the experiment's diets based on the recommendations of the NRC (1994).

Table (1): Percentages and chemical composition of the starter and final diets from (1-42) d for broilers.

Ingredients	1-21 d Diet	Diet finisher 22-42 d
yellow corn	50	45
Wheat	12	22
Crude protein*	5	5
Soybean meal*	30	24
limestone	1	1
Sunflower oil	1	2
Dicalcium Phosphate	1	1
Total	100	100

* Crude protein meal from the Netherlands has 40% crude protein, 2117 kcal/kg of protein metabolic energy, 5% crude fat, 5.00% crude fiber, 2.81%, calcium 3.14, phosphorus 2.65, lysine 3.85, methionine 3.70, methionine plus cysteine 4.12, tryptophan 4%, and threonine 1.8%. Valine 1.69 percent, arginine 2.48 percent, and leucine 1.45 percent It includes a variety of vitamins and minerals that experts believe birds require.
* Soybean meal 48% .

Blood samples

Blood was collected at the end of the experiment, at 42 d of age, from 6 birds, 3 male and 3 female, for each treatment. The blood was taken from the humeral vein with a 5 mL syringe, then placed in a 6 mL glass V tube that did not contain anticoagulant. The tubes were numbered and pre-marked with a black wax pen such that it is not affected by blood or fluids. The tubes were tilted in a way to ensure that the blood does not coagulate. Then they were placed in a centrifuge at a speed of 3500 revolutions per min for 15 min, for the purpose of separating the blood serum. The serum was then placed in new tubes at a temperature of -20°C, until the tests are performed in the laboratory. The blood serum analysis was then carried out in

a private laboratory using an automatic device to analyze blood chemistry produced by the Korean company, XIAN YIMA company. The devices are equipped with reagent testing kits that fit with the examinations to be performed for blood serum samples. The analyses were: glucose, total protein, albumin, globulin, cholesterol, Triglycerides, high-density lipoprotein HDL, low-density lipoprotein LDL, liver enzymes ALT, AST.

Total cholesterol in blood plasma (mg/100mL) cholesterol concentration

The method of enzymatic analysis of cholesterol was done by using a kit manufactured by XIAN YIMA company, which is an enzymatic method that read the absorbance with a spectrophotometer at a wavelength of 500 nanometers, where the cholesterol concentration was calculated according to the following equation **Richmond (1973**)

Measurement of the triglyceride concentration (mg/100mL)

The concentration of triglycerides in the blood serum was estimated using the same kit manufactured by XIAN YIMA company an enzymatic method. The absorbance was read by a spectrophotometer at a wavelength of 546 nm. The concentration of triglycerides was calculated according to the following equation **Toro & Ackermn (1975**)

High density lipoprotein (mg/100mL) (HDL)

The concentration of high-density lipoprotein was estimated by following the method of enzymatic hydrolysis using a kit manufactured by company XIAN YIMA, an enzymatic method that read the absorbance with a spectrophotometer at a wavelength of 500 nm and the high-density lipoproteins were estimated according to the following equation **Warinch &Wood (1995**):

Low density lipoprotein (mg/100mL) (LDL)

Low-density lipoprotein was estimated by enzymatic hydrolysis using a same kit manufactured by XIAN YIMA company (**Grundy *et al.*, 2004**).

Total protein (g/100mL)

The concentration of total proteins in serum was estimated using a kit of analyzes manufactured by company XIAN YIMA company, which uses an enzymatic method that recorded the absorbance readings in a spectrophotometer at a wavelength of 546 nm . The Biuret method was adopted to measure the amount of protein in the blood plasma. This method depends on the interaction of the carbonyl group directly with alkali copper solution to form a violet-colored compound according to the following equation (**Varley *et al.*, 1980):**

Protein concentration (g/100mL) = sample reading/standard solution reading × 6 × solution concentration

Total albumin (gm / 100 mL)

The concentration of albumin in blood serum was estimated using a kit manufactured by XIAN YIMA company which uses an enzymatic method that recorded absorbance readings in a spectrophotometer at a wavelength of 628 nanometers, and the concentration of albumin was calculated according to the following equation (**Henry *et al.*, 1974**):

Albumin concentration (g/100mL) = sample reading/standard solution reading × 5 × solution concentration

Total globulin in blood serum (g/100 mL)

The concentration of globulin in the blood plasma was estimated by the equation mentioned by **Al-Omari (2001)**:

Globulin concentration (g/100ml) = total protein concentration - albumin concentration

Glucose in the blood serum (mg/100mL)

The total glucose concentration in the serum was estimated using a kit manufactured by XIAN YIMA company using a spectrophotometer at a wavelength of 505 nm . The absorbance

of each sample was measured and the glucose concentration was calculated according to the following equation **Coles (1986**) .

Measurement of the level of the enzyme (AST) in the blood serum. Aspartate Amino Transferase

The effectiveness of the enzyme level (AST) in the blood serum was estimated using a kit supplied by XIAN YIMA company and the analyses were carried out according to what was indicated by the supplier company. The absorbance of the sample and the standard solution was measured in a spectrophotometer at a wavelength of 500 nm. The enzyme activity was measured by reading the absorbance on a graph attached to the kit (**Reitman &Frankel, 1975**).

Measurement of the enzyme level (ALT) in the blood serum: Alanin Amino Transferase

The effectiveness of the enzyme level (ALT) in the blood serum was estimated using a kit supplied by (XIAN YIMA) and the analyzes were carried out according to what the company indicated. The absorbance of the sample and the standard solution was measured using a spectrophotometer at the wavelength 500 nm. The enzyme activity was measured by reading the absorbance on a graph attached to the kit (**Reitman &Frankel, 1975**).

Statistical analysis

Multiple range tests were employed to assess the significant differences between means, and a completely randomized design (CRD) was utilized to study the effects of various treatments on all attributes (**Duncan, 1955**). Statistical analysis software was used to analyze the data **(SAS, 2012)**. The P-value for statistical significance was set at ($P<0.05$).

RESULTS AND DISCUSSION

The blood serum's concentration of lipids, glucose, and cholesterol according to (Table 2). The level of blood cholesterol concentration for the T2 treatment, which was (103.56) mg/100 mL, was substantially lower ($P<0.05$) than it was for the T1 controlled treatment, but not statistically different from it for the T3, T4, and T5 added treatments. According to the findings, there were no appreciable changes between the experimental treatments at 42 d of age for the levels of glucose, triglycerides, total protein, albumin, globulin, G/A ratio, high-density lipoproteins (HDL), and low-density lipoproteins (LDL) in the serum.

Table (2): Effect of adding onion powder on glucose, cholesterol, triglycerides, total protein, albumin, globulin, A/G ratio, high-density lipoproteins (HDL), and low-density lipoproteins (LDL) concentrations is shown in. (LDL) in the blood serum of broilers (mean ± standard error).

Treatment	Physiological paraments								
	Glucose	Cholesterol	Triglycerides	Protein	Albumin	Globulin	A/G	HDL	LDL
T1*	144.89 ± 4.43	128.39± 12.79 a	93.37 ± 7.19	6.38± 0.30	4.16± 0.13	2.22± 0.39	1.87± 0.42	31.24± 4.52	66.52± 6.77
T2*	144.69± 4.15	103.56 ± 5.08 b	100.22 ± 7.17	6.16± 0.28	4.38± 0.43	1.78± 0.33	2.46± 0.81	29.27± 3.71	54.24± 7.21
T3*	140.67± 6.88	108.22 ± 4.52 ab	99.00 ± 15.78	6.18± 0.24	4.18± 0.14	2.00± 0.26	2.09± 0.33	32.13± 1.51	56.29± 5.30
T4*	144.14± 3.97	120.33 ± 7.45 ab	87.41 ± 3.80	6.30± 0.36	3.91± 0.20	2.40± 0.40	1.63± 0.35	32.13± 1.20	71.58± 6.76
T5*	146.56± 3.18	105.64 ± 3.93 ab	93.70 ± 4.16	6.16± 0.24	3.89± 0.19	2.27± 0.30	1.18± 0.34	35.01± 2.00	51.89± 4.86
Significant	N.S	*	N.S	N.S	N.S	N.S	N.S	N.S	N.S

Means with different letters in the same column differ from one another substantially at significance level (P< 0.05) . N.S. : no significant differences between treatments.
*T1 treatment, a control treatment free of any additional onion powder. T2 treatment, adding 2 g/kg of onion powder to broiler diets. T3 treatment, adding 4 g/kg of onion powder to broiler diets. T4 treatment, adding 6 g/kg of onion powder to broiler diets. T5 treatment, adding 8 g/kg of onion powder to broiler diets.

Determination of the enzyme level of Aspartate amino transferase (AST) and Alanine amino transferase (ALT) in the liver:

The results of the statistical analysis of the effect of adding different levels of onion powder to broiler diets for AST enzyme in (Table 3) showed a significant superiority (P<0.05) for the addition treatment T5 (331.74) at 42 d of age compared with the T1. While it did not differ significantly with the T2, T3 and T4 treatments . The results also showed a significant (P<0.05) superiority (P<0.05) in the level of ALT enzyme for the T5 treatment (323.01) compared with the T1 controlled treatment. However it did not differ significantly with the T2 T3 and T4 treatments, at 42 d of age.

Table (3): Effect of adding onion powder to broiler diets on the level of Aspartate amino transferase (AST), Alanine amino transferase (ALT) in the blood serum of broilers (mean ± standard error)

Treatments	**Liver Enzymes**	
	AST	ALT
T1*	99.91 ± 28.56 b	95.48 ± 33.52 b
T2*	171.69 ± 27.73 ab	208.55 ± 68.98 ab
T3*	251.23 ± 59.39 ab	71.78 ± 19.86 b
T4*	291.00 ± 92.13 ab	71.78 ± 14.30 b
T5*	331.74 ± 89.79 a	323.01 ± 126.48 a
Significant	*	*

*: mean with different letters within the same column are significantly different from each other at significance (**P<0.05**) N.S: no significant between treatments.
*T1 treatment, a control treatment free of any additional onion powder. T2 treatment, adding 2 g/kg of onion powder to broiler diets. T3 treatment, adding 4 g/kg of onion powder to broiler diets. T4 treatment, adding 6 g/kg of onion powder to broiler diets. T5 treatment, adding 8 g/kg of onion powder to broiler diets.

The outcomes were consistent with what **Bakhiet & Mohmed (2008**) discovered when they added onion powder in proportions of 5 percent and 10 percent to the diets of hybrid laying hens. They discovered a significant drop in serum cholesterol levels (209.6, 168.9, and respectively, from (256.5) mg/100 mL in the control treatment.

The results of this study were also in agreement with what the researcher **Al-Jubouri (2013)** found that there was a significant decrease (P<0.05) in the concentration of serum cholesterol for T8 and T10 treatments when adding onion oil at levels (300, 500) mg/kg feed at the age of 21 d.

This research also agreed with what **Mohammed (2018)** discovered when he added onion powder to Ross308 broiler rations in the amounts of 1, 2, and 3 g/kg of feed. At 42 d old, all addition treatments significantly improve the level of the AST enzyme, but there was no discernible effect in the quantity of glucose, protein, globulin, triglycerides, high-density lipoproteins (HDL), or low-density lipoproteins (LDL).

The fact that onion powder contains organosulfur compounds may be the cause of the lower level of serum cholesterol in the second treatment (2 g/kg of feed) at 6 weeks of age as

compared to the control treatment. Such compounds oxidize with thiol that are freely present or bound with lipoproteins and phosphates, lowering cholesterol. Adenine dinucleotide (NADPH), which is necessary for the synthesis of fats from cholesterol may also play a role in lowering the level of cholesterol in the blood (**Sebastian *et al.*, 1979**) **; Beylot (2005**) indicated that the fructans present in onions play an important role in lowering serum cholesterol by stimulating the liver to synthesize bile acids from cholesterol, thus reducing the level of cholesterol in the blood.(what about the other parameters that you have been studied in this study) you need to add more discussion related to the aspect that didn't discussed. As for the apparent increase in the for in liver enzymes AST and ALT in the fifth treatment (8 g/kg of feed) compared to the control treatment at the end of the trial period is that onion powder may reduce toxic free radicals in the liver by acting as an antioxidant, which reduces bile acids which are secreted from the liver, which helps to increase the level of these enzymes in the blood serum, or perhaps the high level of these enzymes is due to the increase in metabolic rates, as the increase in The high plasma activities of ALT and AST is associated with a disruption of the normal structure of the liver and the consequent leakage of these enzymes with tissues damaged blood circulation and replacing it with new ones, as it works to reduce liver damage by maintaining the integrity of hepatocytes and getting rid of reactive oxygen compounds (ROS), thus regulating the level of lipid peroxides in the liver (Ige *et al*., 2011 ; Seif El-Din *et al.*, 2014).

CONCLUSION

The inclusion of onion in the broiler diet at level 2 g/kg feed resulted in decreasing the serum cholesterol concentration. Adding onion at level 8 g/kg feed led to improvement in the level of liver enzymes AST and ALT. Also, onion did not affect the other physiological traits.

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