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Effect of adding artichoke (*Cynara scolymus* L.) extract to the water or the diet on the production performance and physiological traits of broilers

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Abstract: The experiment was carried out in the poultry field of the Department of Animal Resources Sciences/College of Agriculture/University of Diyala for the period from 4/9/2021 to 14/10/2021, to study Effect of adding artichoke extract to water and diet as an antioxidant in broiler chickens and its effect on physiological and carcass traits, 225 unsexed Ross 308 hybrid broiler chicks were used at the age of one day. The chicks were randomly distributed from the first day of their reception to five experimental treatments with three replications for each treatment (15 birds/repeat), and the experimental treatments were T1 = (treatment The control) provided a standard diet without addition, T2 = a standard diet to which 75 mg/l artichoke extract was added, T3 = a standard diet to which 150 mg/l artichoke extract was added, T4 = a standard diet to which 2g/kg was added to an artichoke leaf extract. Artichoke, T5 = a standard ration to which 3 g/kg of artichoke extract is added. Comparing the results of the experiment with a significant effect when adding different levels of artichoke leaf base to water and Ross 308 broiler for 1-2 days in the weight of the normal and cleaned carcass with the third treatment T3 better for weight compared to the treatment treatment as well as the results have a significant effect. When different levels of artichoke leaf powder were added to Ross 308 broiler broiler feed and water for 42-1 period in the humoral level, it was significantly superior to treatment T5 ($P < 0.05$) and the highest volume level and treatment against Newcastle disease was recorded at 4,606.25. The results also showed that there were statistically significant differences regarding the volumetric standard of antibodies to bronchitis disease, where T5 treatment excelled in recording the highest volumetric standard of antibodies, thus 6105.50.

Key words: Broiler Chicken, Artichoke Leaf Extract, Carcass Traits Physiological Traits

Introduction

The poultry industry has developed rapidly in recent years and has become based on modern scientific foundations as a result of the rapid development in all areas of animal production. The importance of poultry lies in the fact that it produces materials of high nutritional value, such as eggs and meat, which are among the main sources of animal protein in human food. Therefore, we find that poultry projects are of special importance, given the increasing demand for their products, and their diet is an important factor as poultry feed formulations greatly affect its development, well-being and quality. Therefore, the search for feed additives that simultaneously provide better performance and low cost use has become And ensuring animal welfare and product safety, a priority for the poultry industry (Al-Tamimi and Al-Tamimi, 2019 and Carvalho and others, 2021). The total production of Iraq from broilers for the private sector was estimated at 2,148 thousand tons for the year 2020 and increased by 8.38 thousand tons from the total production of Iraq for the year 2019 It was 4.109 thousand tons and increased by 35.5% (Central Organization for Statistics / Iraq, 2020).

It was found that there is a negative correlation coefficient, production, graph, production, drawing, production, sketch, message, message, sign, sign, sign, sign, sign, sign, sign, sign, sign, meal and that is the reason for the increase in radical oxidative stress Free, Which Contributes to Increased Oxidative Stress, Causative, Cause, Protective Antioxidants Received Much Attention Email, Ink, Email, Email, Email, Oxidation, Free Air (Al-Tamimi and Al-Zuhaire) , 2017 and Daoui and Onis, 2021), Due to the fact that many medicinal plants are known for their production of effective compounds, the interest in them has increased due to their great importance in the field of the pharmaceutical industry. These plants are

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characterized by their antioxidant property. Based on the foregoing, there is a trend at the present time towards commercial feed additives of plant origin, including some medicinal plants. Which are included in the plant feed additives, as they are plant extracts that have an anti-and inhibiting effect on the growth of pathogenic microorganisms because they contain compounds and natural antibiotics that reduce or eliminate pathogenic bacteria. They are alternatives to antibiotics to maintain the good production of poultry birds. They are cheaper in price and loaded with many minerals and vitamins And phytochemicals such as: alkaloids, saponins, flavonoids, phenols (Alagbe et al., 2020) in addition to their anti-growth properties of pathogenic microorganisms, as it was found that some of them have antioxidant properties, improve digestion, animal palatability for feed and many other productive indicators, this is what made them among modern strategies. For feed additives because their use gives more benefits compared to With common commercial antibiotics, adding it is safer in terms of its effect on both humans and animals and does not cause collateral damage to the body (Varel, 2002), and the artichoke is among the medicinal plants whose extract has been used as an antioxidant and a growth stimulator for broilers, and it has an important role It is very useful in improving the poultry industry, because it is a feed additive with positive effects to improve animal production and the quality of meat products (Zaker-Esteghamati et al., 2021), and many studies have shown that artichoke extract has some beneficial effects such as ridding the body of metabolic waste and free radicals and reducing Blood urea, LDL cholesterol and triglycerides in broilers (Fallah et al., 2013), improvement of productive and immune performance and lower cholesterol level in local Egyptian chicken eggs, oxidative stability and meat quality in Japanese quail (Abbasi et al., 2014) and enhancement of body immunity in broilers (Tajodini, 2015).

Given the importance and benefits of artichoke and its content of antioxidants and compounds that contribute to strengthening the body's immunity and raising the productive performance of broilers, the current study aimed to know the effect of its use in water and diets at different levels on the characteristics of the carcass and the physiological characteristics of broilers.

Materials and Methods

Experiment date

The experiment was carried out in the poultry field of the Department of Animal Production/College of Agriculture/University of Diyala for the period from 4/9/2021 to 14/10/2021, to study the effect of adding artichoke extract to broiler ration as an antioxidant and its effect on productive, physiological and immune performance for birds.

Experiment design.

In the experiment, 225 unsexed Ross 308 broiler hybrid chicks were used at the age of one day. The chicks were randomly distributed from the first day of receiving them to five experimental treatments with three replications for each treatment (15 birds/repeat), and the experimental treatments were as follows:

T1 = (control treatment) standard diet without addition, T2 = Standard diet supplemented with artichoke extract at a level of 75 mg/L of water, T3 = Standard diet supplemented with artichoke extract at a level of 150 mg/litre, T4 = standard diet supplemented with artichoke extract at a level of 2 g/kg of feed ,T5 = Standard diet supplemented with artichoke extract at a level of 3 g / kg of feed.

Source and specifications of artichoke leaf extract.

The source of the artichoke leaf powder was obtained from the company that produced it (Prescribed For Life in America (French origin), the weight of the product is 1 kg, and this product is a fine-grained powder, with a dark brown color, kept at room temperature and away from moisture .

Preparing experiment relationships

The birds were fed a starter diet from the age of 1-14 days, a growth diet from the age of 15-28 days, and a final diet from the age of 29-42 days, as shown in Table 1, and the extract of artichoke leaves was added to the diets by mixing it manually with a small amount of The feed, then the quantity was increased with good mixing until reaching the required homogeneity, it was added to the quantities of feed allocated weekly for each treatment, and after the mixing was completed, it was filled in sealed and labeled bags according to each treatment for the purpose of maintaining the effectiveness of the additives.

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Table (1) components and chemical analysis of the diets used in the experiment.

Final bush (29-(42 days	Growing bush (15-28 days)	Starter bush (1-14 days)	Feed material (%)
57.5	55	52	yellow corn
33	36	41	*soybean meal
2.5	2.5	2.5	**premix
5	4.5	3	Sun flower oil
1	1	1.5	Dicalcium Phosphate
1	1	0	limestone
100	100	100	total summation
			*** Calculated Chemical Analysis
20.1	21.25	23.16	Crude protein(%)
3168	3095	2983	Energy represented kilocalories/kg
0.52	0.58	0.56	methionine (%)
0.86	0.92	0.94	Methionine and cysteine (%)
1.19	1.40	1.39	Lysine(%)
0.8	0.87	0.87	Calcium(%)
0.38	0.49	0.44	Available phosphorous(%)

*** The soybean meal used of Argentine origin contains 44% of crude protein and 2230 calories/kg of energy.**

****Ingredients of premix 2.5 AH produced by WAFI International Company, containing protein 29.50%, energy 1817 kcal/kg, lysine 11.70%, methionine 10.40%, methionine + cysteine 10.46%, available phosphorous 12.90%, sodium 5.30%, calcium 6.40 %, with a group of vitamins and minerals.**

*****According to the chemical composition according to the analysis of the feed materials contained in the reports of the US National Research Council N.R.C (1994).**

Carcass quality characteristics.

Carcass quality characteristics were measured at the end of the experiment at 42 days of age, after the birds fasted for 4 hours, and four birds (2 males and 2 females) were taken from each treatment at random. The uneaten internal viscera were removed from the carcass in the manner mentioned by Al-Fayyadh and Naji (1989), when the heart was removed from the carcass after removing the viscera for not being in contact with it, then the liver, and gizzards. The spleen was separated from the rest of the viscera, the carcass was thoroughly cleaned, washed with water and weighed individually. The netting ratio (without edible viscera) was calculated on the basis of live weight by applying the following equations:

$$\text{1-Clearance Ratio (\%)} = \frac{\text{Cleaned carcass weight (gm)}}{\text{live weight (gm)}} \times 100$$

$$\text{2- Drainage ratio with edible offal (\%)} = \frac{\text{The weight of the cleaned carcass + the weight of the edible entrails (gm)}}{\text{(live weight (gm)}} \times 100$$

In order to calculate the proportions of the carcass cutting, the cutting process (neck, wings, thighs, chest and back) was carried out on the carcass according to the method mentioned by Al-Fayyad and Naji (1989).

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And the thoracic vertebrae and by pulling back and cutting the meaty muscles of the neck with the knife, the cervical vertebrae will separate from the thoracic and lift the neck easily to separate from the carcass. Which connects the wing to the chest area, and the same process is repeated for the other wing, as for the thighs, the skin that connects the thigh bone with the abdominal area is cut, then the foot is bent back and it is separated from the carcass from the joint that connects the thigh bone to the pelvic bone by turning the knife around the joint to cut the connecting muscles After completing the separation of the thigh and to separate the chest area from the back, this is done by cutting the ribs area and connecting them to the joint in the shoulder area, then raising the chest and preaching M the chest to the back to cut all the adenoid muscles and complete the process of separating the chest from the back. The percentage of each piece was calculated as follows:

$$\text{3-Carcass Piece Percentage (\%)} = \frac{\text{Piece Weight (gm)}}{\text{Cleaned carcass weight (gm)}} \times 100$$

Measurement of humoral immunity

Newcastle disease and infectious bronchitis are among the most common viral diseases that affect broilers in Iraq, so the enzyme-linked immunosorbent assay (ELISA) was used, according to AI-Mayah (2009), using a special measurement kit to measure the volumetric criterion of antibodies For the Infectious Bronchitis Antibody Titer, the TEST-KIT for the measurement of the Newcastle Disease Antibody Titer, all of these standard kits are produced by the American company Synbiotics, which consists of:

1- Microliter tray.
2-Positive Control
3- Negative Control
4- Horseradish peroxidase
5- Substrate
6- Substrate diluent
7- Stop solution

Statistical Analysis

Statistical analysis was conducted using the Complete Randomized Design (CRD) and the arithmetic averages were compared using Tukey's test (Al-Rawi and Khalaf Allah, 2003) at a significance level of 0.05. The ready-made statistical analysis program SPSS (2011) was used to analyze the data

Results

Carcass quality characteristics

1- The weight of the carcass and the percentage of dressing %.

The results of Table (2) showed that there was no significant effect when adding different levels of artichoke leaf extract powder to Ross 308 broiler water and diets for 42 days in live weight. ,While treatment T1, 4 T and 5T recorded the lowest carcass weight of 2420.00, 2457.50 and 2475.00 g/fowl, respectively, and treatment T3 was distinguished in recording the highest weight of the cleaned carcass of 2255.00 g/fowl, while treatment T1 recorded the lowest weight of the cleaned carcass of 2039. 50, and treatment T3 excelled in recording the highest weight of carcass with viscera amounting to 2414.50 g/fowl, while treatments T1, 4 T and 5T recorded the lowest weight of carcass with viscera amounting to 2189.50, 2170.00 and 2200.00 g/fowl, respectively, and treatment 2T and T5 recorded significant superiority The highest clearance without viscera was recorded at 76.42 and 76.06%, while treatment T1 recorded the lowest clearance without viscera amounting to 71.87%, and treatments T2, T3, T4 and T5 excelled in recording the highest clearance with viscera amounting to 79.75, 75.52 and 79.08 And 79.78%, respectively, %, while the treatment T1 recorded the lowest clearing percentage with Visors amounted to 77.16%.

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2- Major and minor pieces.

The results of Table (3) showed that there was no significant effect when adding different levels of artichoke leaf extract powder to Ross 308 broiler water and diets for 42 days in the main and secondary cuts among all treatments for broilers.

Table (2) Effect of adding leaf extract of artichoke (*Cynara scolymus* L.) at two different levels to water or ration on the dressing ratio and carcass cut ratios for broilers from 1 day to 42 days old (mean ± standard error).

morale	treatments					adjectives
	T5	T4	T3	T2	T1	
N.S	2757.50 105.94±	2743.75 88.63±	3036.25 101.80±	2852.50 79.62±	2837.50 89.85±	live weight cloud/bird
*	c 2475.00 103.08±	c 2457.50 80.54±	A 2758.25 103.57±	b 2552.50 120.09±	c 2420.00 69.88±	carcass weight cloud/bird
*	c 2097.50 56.33±	c 2070.00 78.42±	a 2255.00 63.44±	b 2180.00 81.55±	D 2039.50 51.61±	carcass weight cleaner cloud/bird
*	c 2200.00 57.88±	c 2170.00 78.42±	A 2414.50 68.92±	b 2275.00 85.49±	C 2189.50 77.55±	carcass weight with viscera cloud/bird
*	a 76.06 0.92±	ab 75.44 1.43±	Ab 74.27 0.41±	a 76.42 0.81±	B 71.87 0.72±	Clearance Ratio without %viscera
*	a 79.78 1.01±	a 79.08 1.44±	A 79.52 0.88±	a 79.75 0.83±	B 77.16 0.37±	Clearance Ratio %with viscera

-*The different letters within the same column indicate that there are significant differences at the level (p<0.05)

-N.S- Indicates that there are no significant differences between the treatments.

T1-control treatment (without addition), T2, T3 (150.75 mg/l artichoke extract) and T4, T5 (2.3 g/kg fodder artichoke extract).

Table (3) Effect of adding leaf extract of artichoke (*Cynara scolymus* L.) at two different levels to water or ration on main and secondary cuts of broilers from 1 day to 42 days old (mean ± standard error)

morale	treatments					adjectives	
	T5	T4	T3	T2	T1		
N.S	38.73 1.65±	37.18 1.66±	41.12 0.86±	37.32 1.83±	37.93 1.20±	chest	Pieces to master
N.S	23.55 1.55±	0.66± 22.9	25.60 1.73±	24.49 0.82±	26.71 0.28±	thighs	
N.S	18.91 1.93±	21.13 0.18±	17.83 1.45±	18.36 1.98±	17.82 0.42±	back	minor pieces
N.S	9.41 0.23±	8.00 0.66±	9.28 0.47±	10.21 1.00±	9.49 0.68±	flank	
N.S	5.80 0.35±	5.16 0.42±	4.59 0.24±	5.13 0.44±	4.40 0.16±	neck	

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***The different letters within the same column indicate that there are significant differences at the level (p<0.05)**

-N.S- Indicates that there are no significant differences between the treatments.

T1-control treatment (without addition), T2, T3 (150.75 mg/l artichoke extract) and T4, T5 (2.3 g/kg fodder artichoke extract).

Discuss the qualitative characteristics of the carcass

The results of Table (3) showed that there was no significant effect when adding different levels of artichoke leaf extract powder to Ross 308 broiler water and diets for a period of 42 days in the main and secondary cuts among all treatments for broilers. The reason may be due to the low concentrations used. In the experiment, the broiler's need for nutrients was not satisfied, and these results are consistent with the results reached by Al-Masari and Al-Hamdani (2021) when the extract of artichoke leaves was added to water and the broiler's diet for 1-3 weeks in cuts and also with the findings of Karimi and others (2020) in his study the effect of adding aqueous extract of artichoke plant on carcass characteristics (carcass weight, breast weight, thigh weight) the control treatment (without addition) and the addition treatment of artichoke extract at a ratio of 0.5 and 1 g/kg.

The results also showed a significant effect when adding different levels of artichoke leaf extract powder to broiler water and broiler diets Ross 308 for a period of 42 days in the dressing ratio among all treatments for broilers. To the rise of the villi in the intestine, which plays a key role in the effectiveness of absorption processes. The role of the villi is to increase the surface area of the intestine, which enhances the absorption of nutrients and then improves growth performance and thus increases the percentage of clearing. 30,000 mg improves the performance of broilers and thus increases the clarification rate due to the action of the high phenolic content, which acts as an antioxidant in broilers (Ferioli et al., 2022).

Humoral Immunity

The results of Table (4) showed a significant effect when adding different levels of artichoke leaf extract to Ross 308 broiler diet or water for 42 days in humoral immunity, as T5 was significantly superior (P<0.05) and recorded the highest volumetric standard of antibodies directed against Newcastle disease, as It was 4606.25, while treatments T3 and T4 recorded the lowest volumetric criterion for antibodies against N.D. virus, which amounted to 2617.00 and 2659.50, respectively, which outperformed the two treatments T2 and control, which recorded the lowest volumetric criterion for antibodies directed against N.D disease, which amounted to 1365.50 and 1381.50, respectively, as the results of the same table showed the presence of Significant differences between the experimental treatments for the volumetric criterion of antibodies directed against infectious bronchitis disease, and treatment T5 excelled in recording the highest volumetric criterion of IB antibodies, which amounted to 6105.50. 648.50.

Table (4) The effect of adding extract of leaves of artichoke plant (Cynara scolymus L.) at two different levels to water or ration on the humoral immunity of broilers from 1 day to 42 days old (mean ± standard error).

adjectives		treatments
Volumetric antibody to bronchitis virus	Volumetric antibody to Newcastle virus	
c 648.50 122.50±	C 1381.50 10.50±	T1
b 2340.75 271.58±	C 1365.50 258.99±	T2
b 2728.25 221.39±	B 2617.00 420.60±	T3
b 3581.75	B 2659.50	T4

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293.00±	**255.11±**	
a **6105.50** **606.59±**	**A** **4606.25** **533.43±**	**T5**
**	**	**morale**

The different letters within the same column indicate that there are significant differences at the level (p<0.05)

-N.S- Indicates that there are no significant differences between the treatments.

T1-control treatment (without addition), T2, T3 (150.75 mg/l artichoke extract) and T4, T5 (2.3 g/kg fodder artichoke extract).

Discuss the characteristics of humoral immunity of broilers.

The results of Table (4) showed a significant superiority in humoral immunity, as the treatment T5 with a concentration of 3% of broiler ration of artichoke leaf extract recorded a significant superiority in the volumetric criterion of antibodies against Newcastle virus and the volume criterion of antibodies to bronchitis virus. The reason for this may be due to The reason for the moral superiority in the characteristics of the humoral immunity of broilers may be due to the role of the extract of the leaves of the artichoke plant in containing biologically active substances such as apigenin and luteolin, which work to remove free radicals due to their antioxidant properties. It has a dual effect on beneficial bacteria, as the artichoke plant is considered as a prebiotic because it contains inulin, which is a complex sugar consisting mainly of fructose units and contains glucose terminal units (Costabile et al., 2010 and Zeaiter et al., 2019) and due to the presence of glycosidic bonds, inulin becomes It is resistant to digestive enzymes and is not hydrolyzed by these enzymes, making it indigestible and therefore passes through the upper part of the digestive system It reaches the large intestine unchanged, which undergoes the fermentation process in the large intestine by beneficial bacteria known as lactic acid bacteria. This leads to an increase in the production of short-chain fatty acids, which reduces the pH in the intestine as a result of fermentation (Van den Abbeele et al., 2020), and that the increase in the number of these bacteria - Bifidobacterium and Lactobacillus leads to the microbial balance in the intestine by reducing the number of causative bacteria species For diseases through competitive exclusion, which represents competition for the adhesion sites of the intestinal mucous membranes and in this way prevents pathogenic bacteria from sticking to the mucous membranes and thus leads to a decrease in their number and elimination and competition for nutrients and thus prevents the growth of pathogens by reducing or inhibiting the quantities of toxic receptors generated by bacteria and thus improves Corrected by Patterson (and Burkholder, 2003), The addition of artichoke extract increases the beneficial bacteria Bifidobacterium and Lactobacillus and improves the intestinal flora environment of the digestive system, which has a positive effect on increasing the body's immunity to diseases and that Bifidobacterium and Lactobacillus bacteria have the ability to produce natural antibiotics such as helveticin, curvacin, nisin and bifidocin And Lactocin has a wide activity. These antibiotics called Bacteriocin inhibit the growth of bacteria, the most important of which is E-coli (Lagha) E-coli et al., 2017, and Hernández-González et al., (2021). Also, the extract of artichoke leaves is a rich source of natural antioxidants and vitamins. It is an important source of polyphenols such as Cynarin and its derivatives vitamins Table (4), which play an important role as oxidizing factors that remove free radicals to increase the immunity of broilers, in addition, which have an important protective role in the liver and the components of the plant make it used as an antibiotic (Esteghamati) - Zaker et al., 2020) agree These results are in line with the findings of Al-Masari and Al-Hamdani (2021) when the extract of the leaves of the artichoke plant was added to water and blackberry. Broilers from 1-3 weeks

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