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EFFECT OF NETTLE ON PRODUCTIVE PERFORMANCE OF BROILERS AND ITS BIOCHEMICAL, HISTOLOGICAL, IMMUNOLOGICAL, AND ANTIOXIDANT CHARACTERISTICS

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ABSTRACT

This study was carried out to evaluate the impact of adding nettle plant to the food on the physiological and productive performance of broiler chickens. Three dietary levels (0, 1.5 and 3 g/kg) of either fermented or non-fermented nettle powder were added to broiler diets. Up to 10 days body weight and weight gain were not significantly elevated. However, the interaction of the experimental factors improved FCR ($P<0.05$). The interplay of experimental conditions resulted in a rise in FI in the nettle-supplemented groups during the 35-day trial period. Feed intake, body weight and weight gain increased ($P<0.05$) when the supplementary level of nettle increased in broiler diets. Serum lipid profile of broilers improved by nettle supplementation. Jejunum villi length and intestinal absorptive area were increased with the amount of nettle in broiler meals. Nettle fermentation significantly increased the intestinal absorptive area of broilers. The interaction of experimental factors increased the NDV and IB titers and the total antioxidant capacity (TAC) in the serum of nettle-supplemented birds. The NDV and IB titers were decreased by nettle fermentation; however, the NDV and IB titers and TAC were increased when the supplementary level of nettle increased. The activity of glutathione peroxidase (GPX), catalase, and SOD increased in nettle-supplemented broilers. Nettle supplementary level and fermentation significantly increased the GPX in broilers. The level and fermentation of nettle increased the catalase activity in the broilers. Nettle fermentation significantly increased the activity of SOD in the broiler chickens.

INTRODUCTION

Commercial poultry production is subjected to several pressures, such as those related to the environment, diet, and internal health, all of which adversely affect the health and productivity of poultry (Hasan and M'Sadeq, 2020). Production related problems including disease and various stressors were always mitigated with synthetic chemicals and antibiotics. However, under the pressure of consumers, the use of artificial feed additives has been abandoned. Several dietary solutions have been developed in the chicken industry to maintain high levels of production, health, and welfare since the application of antibiotics as agents of growth was outlawed (Righi *et al.*, 2021). Phyto biotics, Herb-derived plant preparations with bioactive secondary metabolites can be intriguing feed additive substitutes for the several growth stimulants that are typically utilized in chicken production.

Herbs extract was supplied as an unconventional feed additive to replace antibiotics and the growth promoters (Beski *et al.*, 2021). It has been discovered that

many of the edible wild plants are abundant in one or more nutrient-dense compounds, including lipids, proteins, carbs, vitamins, and minerals. Aside from the food ingredients, Additionally, some of them have significant concentrations of certain substances that are good for you, like phenolic compounds (Sir Elkhatim *et al.*, 2018). It has been suggested that plant-based bioactive compounds, vitamins, and antioxidants can improve the health of both humans and animals in stressful situations (Attia *et al.*, 2019). Several of plant compounds have been studied in the past to cure or prevent infectious diseases directly (Ganjhu *et al.*, 2015). Nettle gives broilers the nutrients and bioactive ingredients they need to grow and use feed more efficiently, as well as to strengthen their immune systems and change metabolic processes (Milosevic *et al.*, 2021). As dietary phytogenic elements were added, broiler performance was significantly improved in whole 35-day trial period as compared to the control (Mustafa *et al.*, 2022). As dietary phytogenic elements were added, broiler performance was significantly improved in whole 35-day trial period as compared to the control. Sharma *et al.* (2018) showed that adding supplemental stinging nettle at a rate of 2-4% enhanced the broiler's ability to develop and produce antioxidants. The application of stinging nettle powder as a dietary supplement to mitigate the negative consequences caused by pulmonary hypertension syndrome (Ahmadipour and Khajali, 2019). The supplemented diet with stinging nettle at a level 4% reduced the cortisol, LDL, AST, ALT, and CK levels in the serum of broilers exposed to prolonged heat stress (Mirsaiidi Farahani and Hosseinian, 2022). This experiment aims to explore how nettle quantities and administration form affect broiler chicken performance, nutritional digestibility, intestinal architecture, immunological response, and antioxidant capacity.

MATERIALS AND METHODS

Ethical Approve

Animal production department of the College of Agricultural Engineering Sciences' Animal Ethics Committee accepted the experiment (Approval No: AEC120120221).

Animal husbandry

Two hundred one-day-old broiler chicks (Ross 308), were distributed randomly into five treatments; each treatment had four duplicates, (ten birds/replicate). Nettle powder and fermented nettle in feed (0, 1.5, and 3 g/kg diet) were the treatments. The chicks were raised in floor enclosures measuring 100 by 100 centimeters. shavings from wood. Every meal is prepared in accordance with the Ross-308 broiler guide. The program for lighting was modified by Ross 308 criteria (Aviagen, 2018). For every pen, there was unlimited access to water and feed. Feed intake, body weight gain (WG), and feed conversion ratio (FCR) were evaluated as the primary performance indicators on days 10, 24, and 35.

Preparation of fermented nettle

Two grams of freeze-dried lactobacillus bacteria were mixed with 1000 ml of distilled water and 30 grams of table sugar and incubated at 39°C for 24 h. Fresh nettle plant was collected, chopped, dried, grinded and the obtained powder was collected into vacuumed bags. Thereafter, inoculated with the prepared bacteria

suspension at a level of 10 ml /kg (10% cfu/g), sealed and left for anaerobic fermentation for 48-96 hours.

Sample collection

On day 24, approximately 5 ml of blood was collected from the jugular veins of two randomly selected birds per replicate. The jugular vein was used to get five milliliters of blood. The serum was prepared by centrifuging 5 mL of clotted blood at 3000 rpm for 5 minutes and the serum was stored at -20 ℃ for serum biochemical measurements. Intestinal tissue (jejunum) was taken for morphometric examination. A sample of jejunum measuring around 1 cm was taken. Phosphate- buffered saline (PBS, pH 7.4) was used to properly clean the intestinal samples once they had been opened. For a whole day, the jejunum samples were preserved in 10% buffered formalin. For long-term storage, 70% ethanol was used instead of formalin. Days 33, 34, and 35 of the bird's life were used to gather excreta samples for each replicate. Samples were gathered, placed in plastic containers, and frozen right away before being examined.

Serum analysis

Elisa assays were used to measure the serum total antioxidant capacity (TAC), activities of, glutathione peroxidase (GPX), catalase (CAT) and superoxide dismutase (SOD) following the instructions of the corresponding commercial kits produced by Kiazist (Kiazist Life Sciences, Hamedan, Iran). The Newcastle Disease Virus (NDV) and infectious bronchitis (IBV) antibody titers were measured at 24. An automatic COBAS INTEGRA400 Plus analyzer (Cedex Bio HT Analyzer) was utilized to determine the lipid profile of serum.

Intestinal histomorphology

The tissue samples were sectioned (7 µm) and stained with hematoxylin and eosin after being fixed in paraffin wax. Sections were analyzed using a color video camera (Dinoeye Capture 2.0, ANMO Electronics Corporation, Taiwan) and light microscopy (Olympus CX41 microscope, 10×objective). The villus height and crypt depth, villous height to crypt depth ratio, and villous surface area of ten villi per bird were measured (M'Sadeq, 2019).

Statistical analysis

The General Linear Model (GLM) approach of Minitab v17 was utilized to analyze the data of the current investigation for the main effect of each of the experimental components and their interactions (Minitab Inc., Pennsylvania, PA, USA). The multiple range test ($P < 0.05$) was employed to ascertain the disparities in the mean values.

RESULTS AND DISCUSSION

Growth performance

From Table 1 we note that up to 10 days of age, feed intake was not significantly impacted by the experimental parameters or their combination. The interaction of the experimental factors improved the FCR of nettle supplemented groups; however, it was only significant ($P< 0.05$) in birds that were supplemented

with 1.5% nettle powder followed by those that were on diets supplemented with 3% fermented nettle powder.

Over the 35 days experimental period, the interaction of the level and the supplementation form increased FI in nettle supplemented groups; however, it was only significant ($P< 0.05$) in birds that were on diets supplemented with 3% of fermented nettle powder (Table 2). Regardless to the supplementation form, feed intake significantly ($P<0.05$) increased when the supplementary level of nettle increases in broiler diets. The treatments and the supplementary form of nettle had no significant effects on the body and weight gain of broiler chickens.

However, as a separate factor, rising levels of nettle significantly ($P< 0.05$) increased body weight and weight gain of broiler chickens. This was independent to the nettle supplementation form. Although of general improvement of FCR in nettle supplemented birds. Although there is a general improvement in FCR in nettle-supplemented birds, neither the experimental conditions nor their combination had a substantial impact on FCR (Table 2).

Spices and plant extracts contain qualities that are both tasty and aid in digestion (Alcicek *et al.,* 2004 and Zhang *et al.,* 2005) due to their content of biologically active compounds. These active compounds could activate the appetite sensors of birds resulting in better feed consumption and increasing the secretion and activity of digestive enzymes, which may improve the digestibility and utilization of nutrients and finally improve the productive performance of birds (Beski, 2018). In addition, herbs possess antioxidant properties that may increase the efficiency of feed utilization thereby improving the secretion of digestive enzymes such as proteases (Jafari *et al.,* 2011). Improved FCR has been obtained by Salami *et al.,* (2015) when medicinal herbs were added to broiler diets. Improvements in feed conversion were made possible by the inclusion of chamomile in the broiler diet (Alkado *et al.,* 2022) Also, Buchanan *et al.* (2008) broiler chickens reported a significant increase in body weight gain and an improvement of FCR due to dietary supplementation of plant extract blends. Aroche *et al.* (2018) demonstrated that feeding 21-day-old broilers with 0.5% of a blended powder of medicinal plants increased their feed efficiency. However the results were in contrast with those of (Paraskeuas *et al.,* 2017) who stated that dietary supplementation of phytogenic had no significant effects on body weight gain (BWG) or FI of broiler chickens.

Serum lipid profile

Table 3 shows serum lipid profile of broiler chickens given different levels and forms of nettle. No interaction was detected among experimental factors in terms of triglyceride content in serum. However, triglycerides significantly ($P< 0.05$) increased with the highest supplementary level of nettle regardless of the supplementation form.

Table (1): Effect of different levels of fermented or non-fermented nettle powder on feed intake, body weight, weight gain WG, and feed conversion ratio in broiler at 10 days of age.

Nettle Level %	Fermentation	feed intake (g)	body weight (g)	weight gain (g)	feed conversion ratio
0		264.30	269.00	214.85	1.235[a]
1.5	NO	264.05	289.55	235.75	1.121[c]
3	NO	265.80	272.20	218.80	1.215[abc]
1.5	YES	260.80	268.30	213.70	1.221[ab]
3	YES	260.500	283.7	229.75	1.136[bc]
SEM		1.17	2.84	4.69	0.013
Main effects					
Level					
0		264.30	269.00	214.85	1.2350
1.5		262.42	278.93	224.72	1.171
3		263.15	277.95	224.27	1.176
Fermentation					
	NO	264.72	276.92	223.13	1.190
	YES	261.87	273.67	219.43	1.197
Main effect and interaction (P- Value)					
Level		0.800	0.300	0.263	0.128
Fermentation		0.231	0.566	0.499	0.797
Level*Fermentation		0.645	0.077	0.062	0.044

[abc]- Mean values in a column that do not have the same letter are significantly different.

Table (2): Effect of different levels of fermented or non-fermented nettle powder on feed intake, body weight, weight gain, and feed conversion ratio in broiler at 35 days.

Nettle Level %	Fermentation	Response			
		feed intake (g)	body weight (g)	weight gain (g)	feed conversion ratio
0		2670.92[b]	1829.00	1774.85	1.504
1.5	NO	2733.00[b]	1899.00	1845.20	1.481
3	NO	2697.29[bc]	1875.25	1821.85	1.480
1.5	YES	2697.9[b]	1878.3	1823.7	1.474
3	YES	2781.7[a]	1897.87	1843.92	1.508
SEM		9.3	4.13	4.21	0.0060
Main effect					
Level					
0		2670.92[b]	1829.00[b]	1774.85[b]	1.504
1.5		2710.5[ab]	1888.63[a]	1834.4[a]	1.477
3		2739.5[a]	1886.56[a]	1832.88[a]	1.494
Fermentation					
	NO	2700.40	1867.7[a]	1813.97[a]	1.488
	YES	2713.5	1868.4[a]	1814.1[a]	1.496
Main effect and interaction (P- Value)					
Level		0.022	0.000	0.000	0.210
Fermentation		0.481	0.939	0.983	0.565
Level*fermentation		0.029	0.121	0.126	0.472

[abc]- Mean values in a column that do not have the same letter are significantly different.

As a separate effect, nettle supplementation form significantly (P< 0.05) increased the triglycerides in the serum of birds that were fed diets supplemented with fermented nettle powder compared to those on diets containing non-fermented nettle powder.

Although the effect of treatments was not significant, the cholesterol level in the serum decreased in all nettle-supplemented birds. At the same time, cholesterol levels in the serum of birds significantly (P <0.05) decreased due to rising levels of nettle in the diet irrespective to the nettle supplementation form. The concentration of HDL in the serum of broilers was unaffected by experimental factors or their interaction. Nonetheless, there was an observed significant (P<0.05) interaction between the supplementation form and level. LDL levels decreased in the serum of broilers that fed 1.5% non-fermented and 3% of fermented nettle compared to the control. Dietary fermented nettle insignificantly decreased the serum content of LDL compared to unfermented nettle powder.

Table (3): Effect of different levels of fermented or non-fermented nettle powder on the serum lipid profile of broilers at 35 days of age.

Nettle Level %	Fermentation	Response			
		Triglyceride Mg/dl	Cholesterol Mg/dl	HDL Mg/dl	LDL Mg/dl
0		57.6	127.70	77.75	22.02^{a}
1.5	NO	33.67	111.73	72.75	19.27^{b}
3	NO	66.63	125.20	76.50	25.53^{a}
1.5	YES	61.933	114.67	68.25	20.93^{ab}
3	YES	97.60	117.13	70.75	19.03^{b}
SEM		4.27	1.64	1.72	0.53
Main effects					
Level					
0		57.60^{b}	126.70^{a}	77.75	22.03
1.5		47.80^{b}	113.20^{ab}	70.50	20.10
3		82.12^{a}	121.17^{b}	73.63	20.28
Fermentation					
	NO	53.13	121.21	75.67	22.25
	YES	70.90	119.50	72.25	20.800
Main effect and interaction (P- Value)					
Level		0.021	0.018	0.241	0.250
Fermentation		0.038	0.612	0.320	0.159
Level*fermentation		0.268	0.395	0.769	0.024

^{abc}- Mean values in a column that do not have the same letter are significantly different.

The current study found that giving broiler nettle supplements enhanced their serum lipid profile. The birds who were given nettle supplements had lower cholesterol levels and a larger concentration of triglycerides in their serum (table 3), indicating that similar results were obtained by Sigolo *et al.* (2021) when nettle was offered to broiler chickens. Also, Mansour (2011) reported that dietary supplementation of 1.5% of nettle significantly reduced the concentration of cholesterol in the serum of broiler chickens. However, the results of the current study

were in contrast with those of Mansoub (2011), who stated that dietary supplementation with1.5% nettle significantly decreased the concentration of triglyceride in the serum of broiler chickens.

Safamehr *et al.* (2012) also stated the concentration of serum triglycerides significantly decreased when 1% of nettle was added to broiler diets. Nettle can inhibit key enzymes involved in the formation of lipids and cholesterol, including peroxidase and dehydrogenase, which contribute to a better lipid profile. Carvacrol and thymol work by lowering the amounts of toxic metabolites in the blood of broilers, which is why nettle-fed broilers have lower blood cholesterol and triglyceride levels. Furthermore, carvacrol promotes lactobacilli's proliferation, which is crucial for lowering blood and serum cholesterol levels. Ginger, a medicinal plant, decreased cholesterol, and triglyceride levels (Abdul-Majeed and Al-Krad, 2023) . Borradaile *et al.* (1999) mentioned that flavonoids decreased the amount of CHO molecules and total glucose, which are components of LDL. This was likely caused by a delay in the liver hepatocellular carcinoma cells' Acyl-CoA cholesterol acyltransferase activity. Because flavonoids are antioxidants, they can alter lipid metabolism by preventing the production of low-density lipoproteins. (Habibian *et al.*, 2018).

Jejunum histomorphology.

The effect of dietary treatments on jejunal morphology is shown in Table 4. Although there was no significant interaction among the experimental factors, longer villi were observed in all nettles supplemented birds compared to the control. At the same time, increasing the supplementary level of nettle in the diet significantly ($P< 0.05$) increased the jejunal villi length. Villi length was unaffected by the supplementation form of nettle. Neither experimental factors nor their interaction had any significant effects on the crypt depth or the ratio of crypt depth to villi height in the jejunum. No interaction has been recorded between experimental factors on the apparent absorptive area of villi. However, increasing the supplementary level of nettle in the diet increased the intestinal apparent absorptive area. At the same time, significantly ($P< 0.05$) higher intestinal absorptive area was observed in birds that were supplemented with fermented nettle compared to those that were on diets supplemented with unfermented nettle powder.

In this study increasing the supplementary level of nettle in the diet has positive effects on jejunum histomorphology of broiler chickens. This was in line with (Gharib *et al.,* 2012) who reported an improvement in the villi height of the jejunum and duodenum in the group treated with medicinal plants and probiotics. Moreover, the use of plant extracts and formic acid resulted in longer intestinal villi. (Garcia *et al.,* 2007), and phytogenic additive composed of oregano, cinnamon, and pepper (Jamroz *et al.,* 2005 and M'Sadeq, 2023) were offered to broiler chickens. Hedayati and Manafi (2018) proved that adding medicinal plants to chicken feed results in increased villous height. By reducing the amount of dangerous bacteria in the intestinal wall and so stopping the formation of hazardous byproducts by these bacteria, dietary supplements containing medicinal plants may preserve the intestinal morphology. (Garcia *et al.,* 2007). As a result, they stop the gut wall's epithelial cells from being destroyed or damaged (Hosseini *et al.,* 2017).

Table (4): Effect of different levels of fermented or non-fermented nettle powder on the jejunum histomorphology of broilers at 35 days of age.

Nettle Level %	Fermentation	Response			
		Villi height (µm)	Crypt depth (µm)	Villi/crypt	Area (mm^2)
0		1831.8	249.7	7.358	3.308
1.5	NO	1936.6	241.5	7.942	3.863
3	NO	2040.5	258.9	8.024	3.874
1.5	YES	2001	284.7	7.252	4.350
3	YES	2017	264.8	7.255	4.199
SEM		21.01	8.67	0.270	0.121
Main effects					
Level					
0		1831.8[b]	249.72	7.358	3.308
1.5		1973.8[a]	263.1	7.548	4.141
3		2028.9[a]	261.9	7.640	4.037
Fermentation					
	NO	1936.3	250.0	7.775	3.682[b]
	YES	1955.4	266.4	7.285	3.992[a]
Main effect and interaction (P- Value)					
Level		0.007	0.348	0.905	0.287
fermentation		0.746	0.780	0.386	0.037
Level*fermentation		0.674	0.543	0.823	0.713

[abc]- Mean values in a column not having the same letter are significantly different.

Serum titers

The level and the fermentation of nettle significantly interacted (P< 0.001) increasing the NDV and IB titers in the serum of all nettles supplemented birds compared to the control, as shown in Table 5. The interaction of the experimental factors revealed that the higher NDV and IB titers were for broilers that were on diets supplemented with 1.5% and 3% of unfermented nettle powder followed by those that were supplemented with 1.5% of fermented nettle powder. Although significant compared to the control, among all nettle supplemented groups, broilers that were supplemented with 3% of fermented nettle recorded lower NDV and IB titers.

The NDV titer increased when the supplementary level of nettle increased regardless of the fermentation. However, it was only significant (P< 0.001) in birds that received the lower level (1.5%) of nettle compared to the control. Irrespective of the fermentation, nettle supplementation levels significantly increased (P< 0.001) the IB titer compared to the control. Fermentation of nettle significantly decreased (0.001) NDV and IB titers of birds compared to those that were offered unfermented nettle powder.

The test results revealed a significant improvement in antibody titers against NDV and IB of broilers due to dietary supplementation of nettle. Plants contain polyphenolic substances such as flavonoids that have a number of advantageous benefits, one of which is their capacity to alter the body's defense mechanism. Primarily acting as antioxidants, flavonoids also have the ability to block the

production of inflammatory cytokines. (Tungmunnithum *et al.,* 2018). Plant extracts enhance humoral immune responses thereby increasing the production of antibodies, in particular IgG. In addition it possesses anti-bacterial and anti-viral properties that may indirectly improve the immune system (Kong *et al.,* 2004). Furthermore, the high vitamin C content in herbal extracts increased the phagocytic activity of immune cells (Kong *et al.,* 2004).

Table (5): Effect of different levels of fermented or non-fermented nettle powder on the NDV and IB antibody titers in the blood serum of serum broilers at 35 days of age.

Nettle Level %	Fermentation	Antibody titer	
		NDV	IB
0		355.5^{d}	551.5e
1.5	NO	3240.0^{a}	2159.5^{b}
3	NO	1294.8^{b}	2427.0^{a}
1.5	YES	1289.8^{b}	1399.5^{c}
3	YES	435.0^{c}	982.3^{d}
SEM		5.974	9.917
Main effects			
Level			
0		355.5^{b}	551^{b}
1.5		2265^{a}	1780^{a}
3		865^{b}	1705^{a}
Fermentation			
	NO	1630^{a}	1713^{a}
	YES	693^{b}	978^{b}
Main effect and interaction (P- Value)			
Level		0.001	0.001
Fermentation		0.001	0.001
Level*fermentation		0.001	0.001

^{abc}- Mean values in a column that do not have the same letter are significantly different.

Antioxidants

The interaction of experimental factors significantly (P<0.005) increased the total antioxidant capacity (TAC) in all nettles (fermented and unfermented) supplemented birds compared to control Table 6. Birds on diets supplemented with 1.5% of fermented nettle had significantly (P<0.005) lower TAC compared to other nettle supplemented groups. Irrespective to the fermentation, TAC significantly (P<0.001) increased when the supplementary level of nettle increased in broiler diets. Fermentation of nettles had no significant effects on TAC in the serum.

The interaction of experimental factors was significant (P<0.001) to increase the activity of glutathione peroxidase (GPX) in the serum of birds that received 1.5% of fermented nettle followed by those that were on diets supplemented with 3% of fermented nettle followed by those that got 3% of unfermented nettle compared to other experimental groups. Birds on diet supplemented with 1.5 of unfermented nettle recorded the lower GPX. As a separate factor, the supplementary level increased the GPX in the serum of broiler. While compared to birds whose meals were not supplemented, it was only significant (P<0.001) in birds whose diets contained 1.5%

supplement. In broiler chicks, nettle fermentation considerably (P<0.001) raised the GPX. The interaction of experimental factors revealed a significant (P<0.001) increase in the activity of catalase in birds that were supplemented with 1.5% of fermented nettle, 3% unfermented nettle and 3% fermented nettle respectively compared to control. Birds that were on diets supplemented with 1.5% unfermented nettle recorded significantly (P<0.001) the lower catalase compared to the control and other nettle supplemented groups.

Independent of nettle fermentation, catalase activity increased (P<0.001) by rising levels of nettle in the diet The serum catalase activity of broiler chickens was significantly (P<0.001) enhanced upon fermentation of nettle. There was a significant (P<0.001) interaction between experimental factors indicating the higher SOD activity in birds that were in control groups compared to nettle supplemented birds except for those that were supplemented with 1.5% of unfermented nettle in which the SOD activity was significantly higher than control.

The interaction of experimental factors revealed the lower SOD activity in birds that received fermented nettle compared to other experimental groups. Irrespective to nettle fermentation, SOD activity significantly (P<0.001) increased in birds that were on diets supplemented with 1.5% of nettle compared to those that received 3% of nettle. Nettle fermentation significantly (P<0.001) decreased the activity of SOD in the serum of broiler chickens. Antioxidants are essential for maintaining the health of animals and play a unique role in the physiology, reproduction, and productivity of animals (Abdul-Rahman et al., 2022). Dietary phytogenic compounds may have improved plasma antioxidant capacity because of their potent antioxidant-exhibiting phenolic group constituents and active ingredients. (Polat *et al.,* 2011).

Nettle plant has strong antioxidant properties due to its content of reasonable levels of vitamin E and phenolic compounds (Booth and Bradford, 1963). Furthermore, carvacrol and thymol phenolic compounds present in nettle enhance the general immune status through their antimicrobial and antioxidant properties (Gülçin *et al.,* 2004). Thymol, a bioactive compound found in most herbal plants, including nettle, has high antioxidant activity. This may be because it contains phenolic OH groups, which act as hydrogen donors to the peroxy radicals created during the initial stage of lipid oxidation, delaying the formation of hydroxy peroxide. (Farag *et al.,* 1989).The results were in line with Golshan *et al.,* (2015), who demonstrated that serum antioxidant capacity was significantly elevated by nettle or ginger. Paraskeuas *et al.,* (2017) who pointed out that the level of TAC in blood plasma significantly increased when 150g/kg of phytogenic was added to broiler diets. Also Griela *et al.,* (2021) revealed the addition of phytogenic matter consistently up-regulated the overall antioxidant response along the broiler gut, and that this response was enhanced upon reduction of dietary caloric and protein intake.

Table (6): Effect of different levels of fermented or non-fermented nettle powder on the serum antioxidants of broilers at 35 days of age.

Nettle Level %	Fermentation	TAC nmol/ml	GPX U/ml	Catalase nmol/min/ml	SOD U/ml
0		992.7^{c}	916.7^{d}	217.3^{d}	1161.4^{b}
1.5	NO	1233.1^{a}	840.3^{d}	203.0^{e}	1326.1^{a}
3	NO	1213.7^{a}	1044.2^{c}	321.2^{b}	1094.6^{c}
1.5	YES	1094.8^{b}	2011.6^{a}	334.1^{a}	1039.7^{d}
3	YES	1254.3^{a}	1502.3^{b}	275.3^{c}	1038.6^{d}
SEM		10.059	11.167	1.096	7.511
Main effects					
Level					
0		992.7^{c}	916.7^{b}	217.3^{b}	1161.0^{ab}
1.5		1163.9^{b}	1426.0^{a}	268.6^{a}	1182.0^{a}
3		1234.0^{a}	1273.3^{ab}	298.2^{a}	1066.0^{b}
Fermentation					
	NO	1146.5	935.3^{b}	247.2^{b}	1194.0^{a}
	YES	1113.9	1528^{a}	275.6^{a}	1079.9^{b}
Main effect and interaction (P- Value)					
Level		0.001	0.001	0.001	0.001
Fermentation		0.123	0.001	0.001	0.001
Level*fermentation		0.005	0.001	0.001	0.001

^{abc}- Mean values in a column that do not have the same letter are significantly different.

CONCLUSIONS

The present study illustrated that nettle supplementation effectively improved the productive performance of broiler chickens. The serum lipid profile was improved, and LDL and glucose levels were reduced in nettle supplemented birds. In addition, intestinal morphology was improved by addition of fermented and non-fermented nettle. Antioxidant indices (TAC, GPX, CATand SOD) were enhanced by nettle supplementation. Increasing nettle levels stimulates the production of antibodies against NDV and IB. Antibody production against NDV and IB was also improved by nettle supplementation to broilers. The outcomes of this study suggest that nettle would be beneficial in efficiently enhancing the performance, nutrient digestibility, gut morphology, and antioxidant indices of broilers. In addition to its growth-promoting properties, this study indicates that nettle is a potential anti-heating stressor in broiler nutrition.

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CONFLICT OF INTEREST

The authors state that there are no conflicts of interest with the publication of this work.

تأثير القراص على الأداء الانتاجي لفروج اللحم، والصفات الكيموحيوية والنسيجية والمناعية ومضادات الاكسدة

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الخلاصة

استهدف البحث تقييم تاثير نبات القراص على الأداء الوظيفي والانتاجى والفسلجي للدجاج اللاحم بمستويات ثلاثة (0 , 1.5 ,3) غم/كم بشكليه المخمر وغير المخمر، اذ تم اضافته الى علائق افراخ التسمين روز (308) على هيئة علف مجروش بعمر يوم واحد الى 35 يوم وذلك في حقول الدواجن التابعة لقسم الانتاج الحيواني لكلية الهندسة الزراعية جامعة دهوك. بعمر عشرة ايام تبين من النتائج الى زيادة غير معنوية في وزن الجسم والوزن المكتسب في الافراخ المعاملة، كما ادى تداخل العوامل التجريبية الى تحسين معامل التحويل الغذائي (أ≤0.5). بعمر 35 يوم مع زيادة مستوى القراص وبتداخل العوامل التجريبية ازداد استهلاك العلف ووزن الجسم والزيادة الوزنية (أ≤0.5). كما حسن القراص من مستوى الدهون فى مصل الدم وزاد من طول زغابات الصائم والمساحة السطحية للامتصاص في الامعاء (أ≤0.5). تخمر القراص أدى الى زيادة المساحة السطحية للامتصاص في الامعاء (أ≤0.5). مستوىNDV وIB وانزيم السعة الكلية لمضاد الاكسدة (TAC) ازداد بتداخل العوامل التجريبية فى مصل فروج اللحم التى تغذت على القراص. بالرغم من ان مستوىNDV وIB قد ازداد بزيادة مستوى القراص الا ان القراص المخمر ادى الى تقليله في مصل الافراخ. تداخل العوامل التجريبية ادى الى زيادة معنوية في تركيز الكتاليز ونشاط Glutathione peroxidase (GPX) وSOD في مصل الافراخ التى تغذت على عليقة القراص. ان مستويات القراص وتخميرها ادى الى زيادة نشاط انزيم الكتاليز معنويا كما ان عملية التخمر زادت من نشاط SOD فى في مصل دم فروج اللحم.

الكلمات المفتاحية: الأنسجة المعوية، علم وظائف الأعضاء، فروج اللحم، نبات القراص.

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