EFFECT OF SUPPLEMENTATION FENUGREEK OIL TO THE DIET ON THE PHYSIOLOGICAL, ANATOMICAL AND HISTOLOGICAL TRAITS OF BROILERS

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ABSTRACT

This study was aimed to evaluate the effect of supplementing fenugreek seed oil to the diet on the physiological, anatomical and histological characteristics of broilers. A total of 200 chicks one day-old of (Ross308) were used in this study and divided into 4 treatments, 5 replicate for each treatment by 10 chicks in each replicate. The treatments were T1(control diet) = without additives (basal diet), T2 = basal diet + 0.25 ml fenugreek oil / kg, T3 = basal diet + 0.50 ml fenugreek oil / kg and T4 = basal diet + 0.75 ml fenugreek oil /kg. The results showed Fenugreek oil inclusion at levels 0.50 ml/kg exhibited significant decrease (P <0.05) in jejunum and ileum relative weight, villi height and increasing (P <0.05) heart relative weight for T3 compare with the other groups. T4 showed significant increased (P <0.05) in lactic acid bacteria count compare with control group (T1). Supplemented 0.25 ml/ kg of fenugreek oil resulted in increasing villi height, thickness and Epithelium thickness for duodenum as compared with control group. It was observed that adding 0.25 ml/kg and 0.50 ml/kg feed fenugreek oil to the broiler chicken diet could be optimum level to enhance the productivity and histological characteristics of broiler.

Keywords: small intestinal parameters, body weight, bacterial counts , fenugreek oil, broiler.

مجلة العلوم الزراعية العراقية -2023 :54(1):106-113 عزت

تأثير اضافة زيت الحلبة الى العليقة في الصفات الفسلجية و التشريحية و النسيجية لفروج اللحم

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المستخلص

هدفت الدراسة إلى تقييم تأثير إضافة زيت الحلبة الى العلائق في الصفات الفسلجية والتشريحية والنسيجية لفروج اللحم. استخدم 200 فرخ (Ross308) بعمر يوم واحد في الدراسة وتم تقسيمها إلى 4 معاملات، 5 مكررات لكل معاملة بواقع 10 طير في كل مكرر. وكانت المعاملات T1 (معاملة السيطره) = بدون إضافات (عليقة اساسية) ، T2 = عليقة اساسية + 0.25 مل من زيت الحلبة / كغم، T3 = عليقة اساسية + 0.50 مل من زيت الحلبة / كغم ، T4 = عليقة اساسية + 0.75 مل من زيت الحلبة/كغم. أظهرت النتائج اضافة زيت الحلبة بنسبة 0.50 مل/ كغم سجل انخفاضًا معنويًا (P <0.05) في الوزن النسبي للاثني عشر واللفائفي، وارتفاع الزغابات وزيادة الوزن النسبي للقلب (P <0.05) للمعاملة الثالثة T3 مقارنة مع المعاملات الأخرى. أظهرت المعاملة الرابعة T4 زيادة معنوية (P <0.05) في اعداد بكتيريا حامض اللاكتيك مقارنة مع معاملة السيطره (T1). ان اضافة 0.25 مل/ كغم من زيت الحلبة الى العليقة ادت إلى زيادة في ارتفاع الزغابات وسمكها وسماكة ظهارة الاثني عشر مقارنة بمعاملة السيطره. لوحظ أن اضافة 0.25 مل/كغم و 0.50 مل/كغم من زيت الحلبة الى عليقة فروج اللحم هو افضل مستوى لتحسين أداء النمو والخصائص النسيجية للفروج.

الكلمات المفتاحية: قياسات الامعاء الدقيقة، وزن الجسم، اعداد البكتريا، زيت الحلبة، فروج اللحم.

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INTRODUCTION

Antibiotics and growth regulators are commonly used in poultry diets to increase productivity (18), but it attended to used less due to their negative effects on human and animal health (14). However, immoderate usage of antibiotics in poultry nutrition has increased concerns regarding the progression of antibiotic-resistant bacteria. Also, the traces of antibiotic residue in animal products pose direct health implications on the consumer (25,10,4). In this regard, many attempts have been made by nutritionists to reach the use of natural feed additives that are harmless and do not have negative side effects on human and animal health. As well as, to improve growth performance and health maintenance for poultry safety through their work as growth promoters. Therefore, various herbs and plant extracts are used for feed additives because it contains some compounds which have an effective effect on the human and animal bodies including soaps, volatile oils and flavonoids (8,16,19). Fenugreek is a legume natural plant. The scientific name of fenugreek is *Trigonella foenum – graecum* found cultivated all over the world. It's one of the herbs that have multiple qualities and functions because it offers a good source of protein in the diet and consumed by humans and animals (13). It contains about 20-30% protein, 45-65% carbohydrates and 10% fiber (5). Fenugreek conceder a good source of vitamins A and D (24),and high capacity of antioxidant (27). Fenugreek is one of the medicinal plants that used in diabetes treatment because of its active work to reduce blood sugar levels (20).it's also, has a role as an antibacterial function (5). Fenugreek oil has been used in animal diets and the results were an encouragement, but still, there is a paucity of information about the effect of fenugreek oil on the growth performance, physiological and histological parameters in broilers. So, the goal of the current work was to know the effect of fenugreek oil addition to the broiler diet on growth performance, physiological aspects and gut histomorphology.

MATERIALS AND METHODS

This study was conducted at the poultry farm of the Animal Production Department of the College of Agricultural Engineering Sciences / University of Baghdad to study the effect of using fenugreek oil on physiological, anatomical and histological characteristics of broilers. In this study, about 200 chicks one day-old (Ross308) were used from a local hatchery with 38 to 40 g initial weight. Chicks were distributed randomly among pens (10 chick for every pen) and divided into four treatments, 5 replicates with1.2 x 1.8 meters for each pen. Chicks fed a balanced diet with energy and protein. Feed and water were provided *ad-libidum* to the chicks. Table (1) shows the chemical composition of the diet, and the treatments are distributed as follows: T1 control diet, T2 Add fenugreek oil 0.25 ml / kg, T3 Add fenugreek oil 0.50 ml / kg, T4 Add fenugreek oil 0.75ml/kg. The fenugreek oil chemical analysis was conducted in the laboratories of the Ministry of Science and Technology (Table 2). At the end of the experiment, 5 birds were slaughtered from each treatment, and tests were performed on them. Histological parameters and bacteriological were performed as indicated (1, 12 , 21, 22).

Table 1. Proportion of feed material used in feed and its chemical composition.

Components	Starter diet %	Finisher diet %
Wheat	29	24.2
Soybean 48 %	30.5	25.3
Corn	30.5	39
Protein Concentrated	5	5
Sun flower Oil	2.9	4.2
D.C.P 18%	0.7	0.9
NaCl	0.3	0.3
Limestone	0.9	0.9
Minerals and Vitamin mixture	0.2	0.2
Total	100	100
*chemical compositions		
Protein (%)	22.82	20.49
Metabolism Energy(Kilogram/Kilocalorie)	3041.75	3166.86
P %	0.46	0.50
Ca %	0.84	0.80
Meth + Cy %	0.86	0.77
Meth %	0.50	0.47

*Chemical composition of feeding diet calculated according to 17

Table 2. Fenugreek oil chemical analysis

Name	Concentration
Total flavonoid content (mg Rutin / 100 gm)	71.5
Total phenolic content (mg gallic / 100 gm)	120.6
Total saponins %	12.4
Total glycoside %	25.9
Linolic %	10.0
a-linolenic %	8.25
Oleic %	7.59
Palmatic %	4.12
Arachidonic %	1.09
Stearic %	2.02
Ca (ppm)	13.6
P %	0.8
Na (ppm)	15.9
Mg (ppm)	32.6
Zn (ppm)	51.4
Fe (ppm)	69.8
Mn (ppm)	23.9

Statistical analysis

The data was analyzed statistically by SAS program (23) following a completely randomized design (CRD) with 5 replicates. The differences between the means were examined using Duncan multiple range tests (7), and statistical significance was carried out at $P \leq 0.05$.

RESULTS AND DISCUSSION

Data in the Table (2) refers to no significant differences between treatments in body weight, while refers that significant differences ($P < 0.05$) in carcass weight for T2 and T3 compared with other treatments, and when calculating the clearance percentage, the results indicated that Significant differences between transactions, where treatment T3 Surpassed the other of the treatments. The results showed that adding fenugreek seed oil led to an improvement in body weight average. These results on agreement with (2) who show that fenugreek seeds addition to broiler diets increased average of live body weight compared with the control group. This increasing may be due to presence of fatty acids or stimulation effects on broilers digestive system. Fenugreek seeds addition to broiler diets make increased the average live body weight of these birds compared with the control treatment, and this may be due to the presence of fatty acids or to the effect of stimulation on the digestive system of broilers (15).

Table 2. Effect of adding different levels of fenugreek oil to the diet on the average body weight, carcass weight and dressing ratio for broiler (average ± standard error)

Treat	Body weight	Carcass weight	Dressing percentage
T1	1801.67±99.18	1325.00±67.88^{ab}	73.57±0.46^{ab}
T2	1921.67±34.20	1413.33±29.20^{a}	73.57±1.56^{ab}
T3	1901.67±97.99	1411.67±75.13^{a}	74.22±0.50^{a}
T4	1712.00±11.06	1210.00±16.07^{b}	70.67±0.51^{b}
	N.S	*	*

N.S refers to no difference among the treatments.

*** different letters indicated to the significantly different between the treatment**

T1 Control group, T2 inclusion 0.25 ml/kg (v/w) fenugreek oil, T3 inclusion 0.5 ml/kg (v/w) fenugreek oil, T4 inclusion 0.75 ml/kg (v/w) fenugreek oil

In Table (3) The results show that no significant differences in relative weight of liver and gizzard for all treatments compared with control group (T1), while refers that significant differences (P<0.05) in relative weight of heart for T3 compared with other treatments

Table 3. Effect of adding different levels fenugreek oil to the diet on the relative weight (%) of Internal organic of broilers (average ± standard error)

Treat	Heart	Gizzard	Liver
T1	0.52±0.03^{ab}	1.89±0.19	2.22±0.19
T2	0.45±0.01^{b}	1.60±0.11	2.59±0.26
T3	0.59±0.04^{a}	1.65±0.05	2.16±0.12
T4	0.55±0.05^{ab}	1.65±0.08	2.15±0.04
	*	N.S	N.S

N.S refers to no difference among the treatments.

*** different letters indicated to the significantly different between the treatment**

T1 Control group, T2 inclusion 0.25 ml/kg (v/w) fenugreek oil, T3 inclusion 0.5 ml/kg (v/w) fenugreek oil, T4 inclusion 0.75 ml/kg (v/w) fenugreek oil

Data in Table (4) shows that a significant decreasing (P<0.05) in jejunum relative weight for T3 compared with other treatments, and no significant differences relative weight of duodenum, ileum, ceca and large intestine

Table 4. Effect of adding different levels fenugreek oil to the diet on the relative weight (%) of broiler intestine parts (average ± standard error)

Treat	Duodenum	Jejunum	Ileum	Ceca	Large intestine
T1	1.09±0.05	2.53±0.28^{a}	1.72±0.03^{ab}	1.03±0.01	0.19±0.02
T2	1.00±0.05	2.40±0.18^{a}	2.10±0.23^{a}	0.73±0.06	0.21±0.06
T3	1.11±0.25	1.20±0.21^{b}	1.33±0.05^{b}	0.69±0.05	0.16±0.01
T4	0.97±0.07	2.17±0.04^{a}	1.66±0.19^{ab}	0.89±0.22	0.20±0.03
	N.S	*	*	N.S	N.S

N.S refers to no difference among the treatments.

*** different letters indicated to the significantly different between the treatment**

T1 Control group, T2 inclusion 0.25 ml/kg (v/w) fenugreek oil, T3 inclusion 0.5 ml/kg (v/w) fenugreek oil, T4 inclusion 0.75 ml/kg (v/w) fenugreek oil

The results refers to significant increasing (P <0.05) in length of the jejunum for T4 compared with T1 and T3 treatment, where there is no differences between treatments and control groups in duodenum, ileum, ceca and large intestine length

Table 5. Effect of adding different levels fenugreek oil to the diet on the relative weight (%) of broilers gut parts lengths (average ± standard error)

Treat	Duodenum	Jejunum	Ileum	Ceca	Large intestine
T1	28.33±1.20	79.67±1.86^{bc}	77.33±4.48^{ab}	28.45±5.67	8.00±1.53
T2	28.33±1.20	82.00±0.58^{ab}	84.00±0.58^{a}	33.00±1.53	6.00±0.58
T3	28.33±0.33	77.00±1.15^{c}	73.67±1.86^{b}	34.33±1.20	7.63±0.13
T4	27.67±0.88	84.67±1.45^{a}	79.00±0.58^{ab}	35.67±1.20	8.83±0.44
	N.S	*	*	N.S	N.S

N.S refers to no difference among the treatments.

*** different letters indicated to the significantly different between the treatment**

T1 Control group, T2 inclusion 0.25 ml/kg (v/w) fenugreek oil, T3 inclusion 0.5 ml/kg (v/w) fenugreek oil, T4 inclusion 0.75 ml/kg (v/w) fenugreek oil

Data in Figure (1) refers to a significant increasing (P <0.05) in lactic acid bacteria count for T4 compared with the control group and no significant differences were noticed between treatments when performing the bacterial count for coliform bacteria compared with control group.

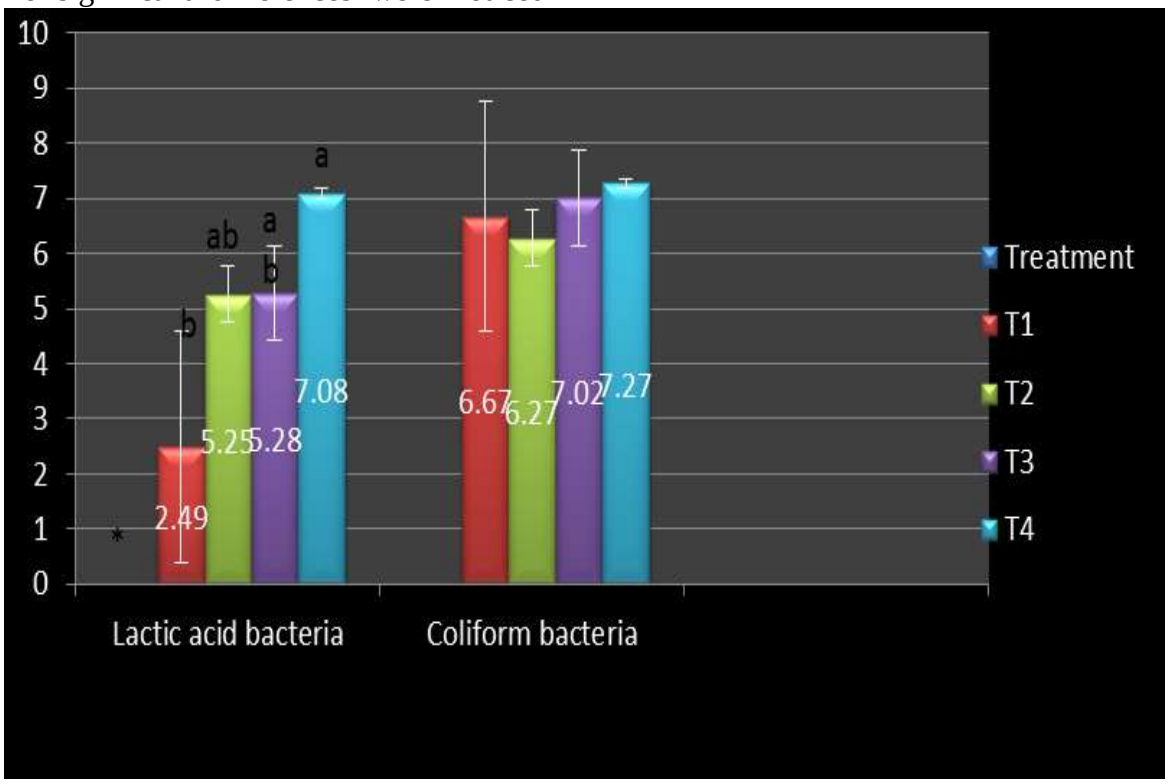

Figure 1. Intestinal bacterial count (cfu/g) affected by presented fenugreek oil at different levels in broiler diet.

(a, b) different letters indicated to the significantly different between the treatment

T1 Control group, T2 inclusion 0.25 ml/kg (v/w) fenugreek oil, T3 inclusion 0.5 ml/kg (v/w) fenugreek oil, T4 inclusion 0.75 ml/kg (v/w) fenugreek oil.

Table (6) shows significant increasing (P <0.05) in microvilli height for T2 and T3, microvilli thickness for T2, Epithelium thickness for T2 and T3 for duodenum compared with the control group. significant increasing (P <0.05) in mucosal layer thickness for T2 and T3, microvilli height for T3, microvilli thickness forT2 and T3,crypt for T2, Epithelium thickness for T2 and T3 for jejunum. Significant decreasing (P <0.05) in microvilli height for T4, Significant decreasing (P <0.05) in Villi thickness and Crypt for T3, and for T2 and T3 in Epithelium thickness, significant increasing (P <0.05) for T2 and T3 in Villi height and Significant decreasing (P <0.05) in Villi thickness for T3 and T4compared with control group.

Table 6. Effect of Fenugreek oil addition in small intestinal parameters

Treatment / Parameter	T1	T2	T3	T4	Significant
Duodenum					
Mucosa layer thickness	1570.00±41.38^{ab}	1770.00±44.30^{a}	1800.00±22.36^{a}	1290.00±187.18^{b}	*
Villi height	1055.00±25.50^{c}	1350.00±57.55^{b}	1530.00±26.69^{a}	1150.00±66.61^{c}	*
Villi thickness	230.00±9.35^{b}	315.00±25.74^{a}	160.00±16.96^{c}	250.00±7.91^{b}	*
Depth of Crypts of Lieberkuhn	98.00±6.63^{ab}	122.00±14.97^{a}	86.00±4.00^{b}	118.00±9.17^{a}	*
Epithelium thickness	29.50±1.22^{b}	44.00±2.03^{a}	47.50±1.11^{a}	24.00±1.27^{c}	*
Jejunum					
Mucosa layer thickness	1145.00±41.38^{c}	1265.00±40.44^{b}	1565.00±31.22^{a}	1230.00±28.94^{bc}	*
Villi height	9258.00±22.36^{b}	1002.00±32.66^{ab}	1110.00±62.05^{a}	930.00±42.87^{b}	*
Villi thickness	220.00±14.58^{c}	600.00±39.53^{a}	390.00±28.06^{b}	295.00±22.41^{c}	*
Depth of Crypts of Lieberkuhn	108.00±5.83^{bc}	166.00±6.78^{a}	92.00±3.71^{c}	116.00±7.48^{b}	*
Epithelium thickness	29.50±1.22^{b}	44.00±2.03^{a}	47.50±1.11^{a}	24.00±1.27^{c}	*
Ileum					
Mucosa layer	1337.00±22.23^{a}	1435.00±30.21^{a}	1450.00±26.22^{a}	965.00±78.50^{b}	*
Villi height	1337.00±22.23^{a}	1435.00±30.21^{a}	1450.00±26.22^{a}	965.00±78.50^{b}	*
Villi thickness	964.00±84.83^{b}	910.00±45.14^{b}	1185.00±31.22^{a}	955.00±16.58^{b}	*
Depth of Crypts of Lieberkuhn	185.00±20.31^{c}	235.00±16.96^{c}	450.00±20.92^{a}	300.00±7.91^{b}	*
Epithelium thickness	430.00±1.46^{a}	47.00±1.22^{a}	16.50±1.27^{c}	30.00±1.58^{b}	*
Villi height	102.00±6.63^{c}	132.00±9.70^{b}	160.00±5.48^{a}	120.00±9.49^{bc}	*
Villi thickness	430.00±1.46^{a}	47.00±1.22^{a}	16.50±1.27^{c}	30.00±1.58^{b}	*

*** different letters indicated to the significantly different between the treatment**

T1 Control group, T2 inclusion 0.25 ml/kg (v/w) fenugreek oil, T3 inclusion 0.5 ml/kg (v/w) fenugreek oil, T4 inclusion 0.75 ml/kg (v/w) fenugreek oil

These improvements in gut parameters and bacterial contents and villi height and thickness and epithelium crypt of liberkuhn may due to digestion improvements. A significant increase in duodenum parameters refers to high digestion activity that cause improvement in feed conversion ratio (3). Because small intestinal is the main part of digestion and absorption (26) because increasing in villi height and thickness make increasing in absorption area while the improvements in epithelium crypt of liberkuhn make to releasing more enzymes from it then increasing in digestion ratio (11,18). Significant increase in mucosa layer for jejunum and ileum compared with other parameters. This results agree with (28 , 29) who showed that increasing in small intestinal components led to increase in intestinal functions and feed intake then increasing in feed conversion.

CONCLUSION

The results of this study was indicated that the addition of fenugreek seed oil to the broiler diet at a ratio 0.25 ml/kg and 0.50 ml/ kg improved growth

performance and histological characteristics of broiler.

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