EFFECT OF SOME HERBS AS FEED ADDITIVES ON PERFORMANCE, DIGESTIBILITY, CARCASS CHARACTERISTICS AND BLOOD PARAMETERS OF BROILERS

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SUMMARY

Two hundreds and sixteen one-day-old Coob-500 chicks were fed various diets for 6-weeks period and were equally divided into 6 treatment groups of 36 birds each, (3 replicates per group, of 12 birds each), using a completely randomized design, for 42 days. The diets included a control diet (without any additives) while the other five diets contained sweet basil (*Ocimum basilicum L*), fennel (*Foeniculum vulgare*),cinnamon (*Cinnamomum Zeylanicum*), oregano (*Origanum vulgare L*.) and there blend at 1% level as feed additives (10 g/kg feed). The results revealed that herb mixture treatment birds significantly increased the live body weight by 9% followed by the oregano treatment by 4.9% then the fennel treatment by 2.8% compared to the control group. However, the dietary herbs significantly improved the feed conversion ratio for Basil and Fennel treatments by the same value 5.6%, Cinnamon by 6.2, Oregano by 7.7 and for mixture treatments by 9.2% compared to the control group. Basil significantly decreased the abdominal fat by 53% and the liver weight by 7% compared to the control group. The mixture and oregano treatments significantly decreased the gizzard weight by 35.3% and 34.2% respectively, compared to the control group. Basil significantly decreased the total blood serum cholesterol by 17.2 % compared to the control group. The fennel and oregano significantly increased the A/G ratio at the same value by 29% compared to the control group. Cinnamon significantly improved the CP digestibility by 3.15 % compared to the control group. It can be concluded that the mixture of basil, fennel, cinnamon and oregano at the level of 1% significantly increased most growth performance parameters followed by oregano, cinnamon, basil and fennel.

Keywords: *Herbs, broiler, growth performance, carcass quality, digestibility and blood parameters.*

INTRODUCTION

Because of increasing antibiotic resistance, medicinal plants considers the most popular natural alternatives and are currently gaining more importance for poultry and animal production. Such novel therapeutic strategy involves the use of natural antioxidant, antibacterial, anti-diarrheal, antimicrobial and anti-inflammatory activities, anticarcinogenic, antiaging, antihistaminic, antiarthritic, antifungal, and antiviral compounds (Khanna, 2005).

Sweet basil, *Ocimum basilicum L* (*Lamiaceae*) commonly known as "Holy basil", is one of the most important wildly used spices and has been shown to have antioxidant (Dasgupta *et al.*, 2004), antibacterial, and anti-diarrheal activities (Lu Y *et al.*, 2014) as well as anti-inflammatory activities in acute and chronic inflammation (Rodrigues *et al.*, 2017). The dominant or major phytochemical constituents of dry leaf are geraniol (*S*aha *et al*., 2012), linalool, methyl-chavikol (Estragol), methyl cinnamate, linolen, rosmarinic acid, citral, eugenol, and geraniol (Lalko and Api 2006), thyrsiflora (Avetisyan *et al.*, 2017) and camphor (Schulz *et al.*, 2003), which have specific functions and using various secondary metabolic pathways (Avetisyan *et al.*, 2017).

Cinnamon , *Cinnamomum Zeylanicum* (*Lauraceae*) have principle components cinnamaldehyde possessed metal ion chelating lipo-protective, antibacterial and anti-proliferative activities (Erdogru *et al.*, 2003), antiinflammatory (Han and Parker 2017) and have eugenol acting as antioxidant (Pandey *et al.*,

2012) which acting with cinnamic acid and cineol component to neutralize free radicals to hence they mitigate their harmful effects indicating their usefulness in food and pharmaceutical sector (Sharma *et al.*, 2016) as well as provides protection against allergens causing atherosclerosis (Nayak *et al.*, 2017).

Oregano, *Origanum vulgare L* (Lamiaceae), Origanum perennial herbaceous aromatic plant grows in worldwide (Lagouri *et al.*, 1993). About 50% of oregano oil consists of phenolic compounds (primarily carvacrol and thymol) and also contains P-cymene, caryophyllene, and 3-carene (Han *et al.*, 2017), sesquiterpene, terpinene, terpineol alcohol, flavonoids, and other compounds (Arcila-Lozano *et al.*, 2004) which provides evidence for antioxidant proprieties (Botsoglou *et al.*, 2004).

Fennel, *Foeniculum vulgare L* (Umbelliferae), as an aromatic nature and flavour in culinary and traditional applications is widely cultivated in the tropical and temperate regions of the world (Goswami and Chatterjee 2014) has antioxidant proprieties (de Marino.,2007), hepatoprotective (Ozbek *et al.*,2003), antimicrobial (Kaur and Arora 2009), oestrogenic (Albert 1980), acaricidal (Kim *et al.*, 2002), antihirsutism (Javidnia *et al.*, 2003), antidiabetic and anti-inflammatory (Choi and Hwang 2004) and antithrombotic (Tognolini *et al.*, 2007).

Our theoretical hypnosis that both sweet basil (Akbarian *et al.*, 2016) and fennel (Botsoglou *et al.*, 2005) share the secretion of ghrelin that can suppress appetite and glucagon-like peptide while both cinnamon (Tabak *et al.*, 1999) and oregano (Giannenas *et al.*, 2016) inhibit the free urease in chicks that inhibit the undesirable intestinal microflora leading to improve digestion and accordingly growth performance. Therefore this study aimed to evaluate the effect of sweet basil, fennel, cinnamon, oregano and there blend at the 1% levels as feed additives on broilers performance, carcass characteristics, blood parameters and digestibility.

MATERIALS AND METHODS

This experiment was carried in Nubaria research and production station, National Research Centre and was conducted to study the effect of sweet basil, fennel, cinnamon, oregano and there blend at the 1% level as feed additives in Coob-500 chick's diets on broilers performance, carcass characteristics, blood parameters and digestibility. A total of 216 unsexed one- week-old broiler chicks were randomly and equally divided into 6 treatment groups of 36 birds each, (3 replicates per group, of 12 birds each).

All chicks were brooded floor pens and kept in temperature controlled and similar management conditions. The light regimen at 1 day age was 24day/ light which this being maintained until the end of the study. Feed and water were offered *ad-libitum* access to both feed and water throughout the study period of 42 d. The diet was formulated to cover the nutrient requirements according to NRC (1994). All the medicinal plants used were sun dried and grinded. All chicks were fed commercial diet during the first week of age before receiving the experimental diets. The feeding program contained a starter and finisher diets that were fed from 1-day to 3 weeks with 3100 Kcal ME/Kg and 23 % CP and from 4 to 6 weeks with 3200 Kcal ME/Kg and 20 % CP as basal diet respectively (Table 1). The medicinal plants used in this study were dried grinded leaves of sweet basil, fennel and oregano, while the cinnamon was the dried park. A basal diet with no additives was used as control diet (T1) while, the other 5 groups (T2;T6) were generated by adding sweet basil, fennel, cinnamon, oregano and there blend, respectively, at 1% of feed to the basal diet.

Blood samples were collected in tubes from the brachial vein) 5 chick/ group), and centrifuged at 3000 rpm for 15 minutes to separate clear serum which stored at 20ºC for determination of some blood serum constituents as total protein (TP), albumin (AL), globulin (GL), total lipids (TL), cholesterol (CHO), aspartate transaminases (AST) and alanine transaminase (ALT) by spectrophotometer using available commercial kits. At the end of the experimental period, all birds in feeding trials were used in digestibility trials over period of 7 days to determine the nutrient digestibility coefficients and nutritive values of the tested diets. Feed intake of experimental rations and weight of feces were daily recorded

Data were analyzed using general linear model (GLM) procedure of statistical system (SPSS, 1997). Duncan's multiple range test (Duncan, 1955) was used to separate means when the dietary treatment effect was significant. At the end of the experiment 9 birds per treatment (three birds per pen) were randomly selected to process carcass quality.

Table (1): Composition and calculated analysis of the experimental diets.

Ingredient%	Starter	Finisher
Yellow corn	48.48	55.38
Soybean meal (44%)	40.00	30.60
Corn gluten meal (62%)	2.00	3.90
Vegetable oil	5.90	6.60
Di-calcium phosphate	1.70	1.80
Limestone	1.20	1.00
Sodium chloride	0.30	0.30
Vit. Min. Pre mix*	0.30	0.30
Dl-methionine	0.12	0.12
Total	100	100
Calculated analysis**		
Crude protein%	23.01	20.06
ME Kcal/kg	3102	3230
Lysine %	1.24	1.10
Methionine%	0.45	0.45
Cystine%	0.37	0.34
Calcium%	0.96	0.89
Available-p%	0.46	0.45

**Vitamins and minerals premix were free from folic acid: each kg contains vit A 12000 Iu, vit.D3 3000 Iu, vit. E 12 mg, vit. K 1mg, vit B12 0.02mg, vit B1 1mg, vit B2 4mg, vit B6 5mg, Nicotinic acid 20 mg, Biotin 0.05 mg, Choline chloride 0.16 mg, cupper 3 mg, iron 30 mg, manganese 40 mg,.zinc 45 mg and selenium 3 mg.,.*

*** According to NRC (1994).*

RESULTS AND DISCUSSIONS

Digestibility:

Dietary cinnamon significantly improved the CP digestibility in broiler by 3.15 % compared to the control group (Table 2).This result may be due to the cinnamaldehyde beneficial effect on the enzymes secretions and gut health as in weaning pigs (Cho *et al.*, 2006 and Yan *et al.*, 2012). Dietary basil, fennel, oregano or it's there mixture treatments slightly improved the CP digestibility in broiler compared to the control group (Table 2).These digestibility improvements in broiler chickens may stem from phytogenic properties to enhance digestion via the enhancement of digestive secretions (Brenes and Roura, 2010 and Lee *et al.*, 2004). Moreover, all herbs treatments and their mixture improved (P>0.05) OM, CP, EE, CF and NFE digestibility compared to control.

Table (2): Digestibility of broiler as affected by herbs plants.

Item	Control (T1)	Basil (T2)	Fennel (T3)	Cinnamon (T4)	Oregano (T5)	Mix (T6)	Overall mean ±SE
OM%	68.44	71.42	72.36	72.96	69.75	72.63	71.26±0.92
CP%	77.38 ^{b}	82.12 ab	82.96 ^{ab}	85.53^{a}	79.82^{ab}	83.78 ^{ab}	81.93±0.01
EE %	65.64	73.52	72.25	67.46	73.97	71.02	70.64±1.73
CF%	33.70	32.11	43.01	36.53	30.07	42.22	36.27±2.15
NFE%	67.56	69.18	69.86	71.14	67.41	70.26	69.24±0.91

a,b,c,d: In each column means having different superscripts are significantly different (p<0.05).

Broilers performance:

Dietary herb mixture treatment birds (T6) significantly increased the live body weight by 9% followed by the oregano treatment (T5) by 4.9% and the fennel treatment (T3) by 2.8% compared to the control group (Table 3). The result of the mixture treatment (T6) may be due to the stimulation of the growth and the improving at the intestinal microbial balance (including reduction of coliform bacteria and an increase in *Lactobacillus spp*. Counts) as reported by Cetin *et al.* (2016). The result of oregano treatment (T5) may be due to its beneficial effect on prevention of coccidiosis in broilers as reported by Mohiti and

Ghanaatparast (2015) and by Giannenas *et al.* (2016) in broilers and by Forte *et al.* (2017) in pigs. The result in fennel treatment (T3) may be due to the appetite stimulation beneficial effects of its essential oils including the improvement of endogenous digestive enzyme secretion and immune response activation (Botsoglou *et al.*, 2005). Results at Table (3) showed significant improve of feed conversion ratio in basil, fennel, cinnamon, oregano and mixture treatments by 5.6, 5.6, 6.2, 7.7 and 9.2% respectively, compared to the control group. These results may be due to the ability of these herbs on the reactive and bring about oxidation effect of bio-molecules of proteins, lipids and nucleic acids which are associated with many degenerative diseases (Sharma *et al.*, 2016). There were gradually satisfactory while insignificant decreasing in feed intake by (4.2,3.6,3.1,3.0 and 0.8%) for cinnamon, basil, fennel, oregano and mixture treatments, respectively, compared to the control group (Table 3). The result in cinnamon treatment (T4) may be due to the intestinal antimicrobial effect of clindamycin that inhibit the free urease in chicks (that catalyzes the hydrolysis of urea into carbon dioxide and ammonia) than on whole cell urease (Tabak *et al.*, 1999 and Shahverdi *et al.*, 2007). The result in basil treatment (T2) may be due to the high fiber and mucilage 10%–15% (Akbarian *et al.*, 2016) or to its secretion of ghrelin that can suppress appetite and glucagon-like peptide that can enhance postprandial satiety time (Karhunen *et al.*, 2010) which occupying stomach and decreasing food glysemic index (Koocheki *et al.*, 2007). The result in fennel treatment (T3) may be due to its effect in decreasing hunger, less prospective food consumption, and increased feelings of fullness as shown in women (Bae *et al.*, 2015).The result in oregano treatment (T5) may be due to the lower palatability that decreased feed intake through a positive-feedback reward mechanism (Yeomans *et al.*, 1996).

Significant improvement in feed conversion values were recorded for the mixture treatment by 9%, the oregano treatment by 4.9% and the fennel treatment by 2.8%, compared to the control group (Table 3). These results may be due to the repetitive exposure to spice odor that gradually increase the odor pleasantness within the framework set by the chemical characteristics of the aroma compounds as well as the familiar odors that mostly rated as pleasant (Knaapila *et al.*, 2017).

Table (3): Broiler performance as affected by herbs plants.

Item	Control (T1)	Basil (T2)	Fennel (T3)	Cinnamon (T4)	Oregano (T5)	Mix (T6)	Overall mean ±SE
Body weight:							
At 1 week	94.97	94.53	94.64	94.75	94.53	94.86	94.71± 0.15
At 3 Week	840.73^{c}	865.98^{bc}	873.85^{bc}	870.90^{bc}	900.94^{b}	959.87^{a}	885.38± 10.18
At 6 Week	1730.4^{d}	1768.5^{cd}	1779.3^{bc}	1764.9^{cd}	1816.0^{b}	1886.1^{a}	1790.9± 12.88
Body weight gain:							
1-3 Week	745.75^{c}	771.46^{bc}	779.21^{bc}	776.15^{bc}	806.41^{b}	865.01^{a}	790.66± 10.18
4-6 Week	889.69^{b}	902.49^{bc}	905.46^{bc}	893.96^{b}	915.03^{bc}	926.24^{a}	905.48± 4.20
1-6 Week	1635.4^{d}	1674.0^{cd}	1684.7^{bc}	1670.1^{cd}	1721.4^{b}	1791.3^{a}	1696.1± 12.89
Feed intake:							
1-3 Week	1266.6^{b}	1243.8^{b}	1267.1^{b}	1267.6^{b}	1288.7^{b}	1441.1^{a}	1295.8± 19.69
4-6 Week	1925.2^{a}	1832.8^{ab}	$1825.\ 7^{ab}$	1790.0^{ab}	1808.8^{ab}	1725.9^{b}	1818.1± 23.42
1-6 Week	3191.8	3076.7	3092.8	3057.6	3097.5	3166.9	3113. 9±24.16
Feed conversion:							
1-3 Week	1.70^{a}	1.61^{ab}	1.63^{bc}	1.63^{bc}	1.60^{c}	1.67^{ab}	1.64± 0.01
4-6 Week	2.16^{a}	2.03^{ab}	2.01^{ab}	2.00^{ab}	1.98^{b}	1.86^{b}	2.01± 0.028
1-6 Week	1.95^{a}	1.84^{b}	1.84^{b}	1.83^{b}	1.80^{b}	1.77^{b}	1.84± 0.02

a,b,c,d: In each column means having different superscripts are significantly different ($p<0.05$).

Carcass characteristics:

The sweet basil treatment (T2) significantly decreased the abdominal fat by 53% compared to the control group (Table 4). This result may be due to its ability to suppress endogenous glucose release, inhibit glycogenolysis and/or stimulate glycogenesis (Ezeani *et al.*, 2017) or may be due to that basil inhibited α-amylase and intestinal sucrase and maltase (El-Beshbishy and Bahashwan 2012). However, the basil treatment significantly increased the liver weight by 7% compared to the control group (Table 4). This result is agreement with the previous of decreasing the abdominal fat which may be due to the enhanced effect of basil of glucose mobilization by stimulating hepatic glycogen synthesis by the increase in liver glycogen content that explane its capablability of decreasing glucose entering portal vein from the gut or glucose production from starch (Matsui *et al.*, 2001). The mixture (T6) and oregano (T5)

treatments significantly decreased the gizzard weight by 35.3% and 34.2% respectively, compared to the control group (Table 4). These results may be attributed to the oregano bioactive compounds, carvacrol and thymol in suppressing the growth of undesirable intestinal microflora, and concomitantly improve nutrient absorption (Visek, 1978) via including a reduction of coliform bacteria and an increase in Lactobacillus spp. Counts) as reported in chickens by Cetin *et al.* (2016).

Table (4): Carcass characteristics as affected by herbs plants.

Item	Control (T1)	Basil (T2)	Fennel (T3)	Cinnamon (T4)	Oregano (T5)	Mix (T6)	Overall mean ±SE
Carcass yield %	69.46^{ab}	68.45^{b}	70.78^{ab}	73.63^{a}	69.48^{ab}	72.65^{ab}	70.47±0.66
Abdominal fat %	0.66	0.31	0.72	0.47	0.58	0.49	0.54± 0.08
Gizzard %	2.95^{a}	2.84^{a}	2.82^{a}	2.53^{ab}	1.94^{bc}	1.91^{c}	2.50± 0.12
Liver %	2.46	2.62	2.39	2.39	2.42	2.17	2.41± 0.07
Hart %	0.60^{ab}	0.54^{ab}	0.69^{a}	0.48^{b}	0.50^{b}	0.48^{b}	0.54±0.03
Spleen %	0.19	0.19	0.24	0.25	0.23	0.18	0.21±0.02
Edible parts %	77.00^{ab}	76.48^{ab}	78.69^{ab}	81.04^{a}	76.09^{b}	79.21^{ab}	78.09±0.63

a,b,c,d: In each column means having different superscripts are significantly different (p<0.05).

Blood parameters:

Dietary basil (T2) significantly decreased the total cholesterol in blood broiler by 17.2 % compared to the control group (Table 5). These results may be attributed to the effect of basil in stimulating insulin secretion that improves the action of lipoprotein lipase enzyme and/or by sensitization of target organs such as adipose tissue to insulin action as reported in mice by Eddouks *et al.* (2003). The fennel and oregano treatments (T3&T5) significantly increased the A/G ratio at the same value by 29% compared to the control group (Table 5). These results may be due to the appreciable anti-inflammatory and immunomodulatory that including inhibitory effects on lymphocyte activation, suppression of cellular and humoral immunity and induction of apoptosis (Amirghofran 2010).

Table (5): Blood parameters of broiler as affected by herbs plants.

Item	Control (T1)	Basil (T2)	Fennel (T3)	Cinnamon (T4)	Oregano (T5)	Mix (T6)	Overall mean ±SE
Total Protein%	4.17	3.95	3.88	3.80	3.80	4.28	3.97±0.14
Albumin %	0.99	0.95	1.10	0.96	1.09	0.95	1.01± 0.04
Globulin %	3.18	2.99	2.78	2.84	2.71	3.33	2.97± 0.12
A/G ratio %	0.31^{b}	0.32^{ab}	0.40^{a}	0.34a^{b}	0.40^{a}	0.30^{b}	0.34± 0.01
T. Lipids %	0.27	0.35	0.30	0.31	0.34	0.33	0.31±0.01
Cholesterol %	158.33	141.10	157.10	135.50	158.20	138.03	148.04±4.34
AST %	22.60	24.13	25.90	24.57	23.43	23.83	24.08±0.61
ALT %	11.04^{ab}	12.78^{ab}	14.17^{a}	10.92^{ab}	9.92^{b}	11.62^{ab}	11.74±0.53

a,b,c,d: In each column means having different superscripts are significantly different (p<0.05).

CONCLUSION

It may be concluded that added 1% of basil, fennel, cinnamon, oregano and mixture to the diet improved broiler performance.

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تاثير بعض الأعشاب كإضافات غذائية على الأداء الإنتاجى و معاملات الهضم و بعض صفات الذبيحة وقياسات الدم لبدارى التسمين

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أجريت هذه التجربة لدراسة تأثير بعض الأعشاب الطبيه كإضافات غذائية على الآداء الإنتاجى لبدارى التسمين حيث تم إستخدام عدد (216 كتكوت) " Cobb 500 " عمريوم قسمت عشوائيا إلى 6 معاملات تجريبيه (36 كتكوت/معامله). وقسمت كل معامله إلى ثلاث مكررات (12 طائر/مكرر) وأستمرت التجربة لمدة 42 يوم. غذيت المعاملة الأولى على عليقة مقارنة T1(بدون إضافات) وتم تغذية المعاملات الخمس الأخرى على عليقة تحتوى على 1% ريحان حلو، شمر، القرفة، البردقوش أو مخلوط من هذة الأعشاب.(T2, T3, T4, T5, T6) على الترتيب كإضافات غذائية إلى عليقة المقارنه.

أوضحت النتائج زيادة معنويه فى وزن الجسم للمعاملة المغذاه على عليقة تحتوى على 1% مخلوط الأعشاب (T6) تليها المجموعة المغذاه على عليقة تحتوى على البردقوش (T5) ثم الشمر(T3) مقارنة بعليقة المقارنه (T1) أدت إضافة الأعشاب إلى العلائق إلى تحسن ملحوظ فى معامل التحويل الغذائى للطيور مقارنة بعليقة المقارنة . كما أدت إضافة الريحان (T2) للعليقة إلى إنخفاض معنوى بنسبة 53% فى وزن دهن البطن و7% فى وزن الكبد مقارنة بعليقة المقارنة كما أدت إضافة المخلوط أو البردقوش إلى إنخفاض معنوى فى وزن القونصة. كما إنخفض محتوى الدم من الكوليسترول الكلى بنسبة 2ر17% مع إضافة الريحان الحلو. كما أدت إضافة كلا من : الشمر أو البردقوش إلى زيادة معنوية فى نسبة الألبيومين إلى الجلوبيولين فى الدم. و لوحظ تحسن معنوى بنسبة 15ر3% فى معامل هضم البروتين بإضافة القرفة مقارنه بعليقة المقارنة.

بصفة عامه أدت إضافة كلا من : الريحان الحلو، الشمر، القرفة، البردقوش أو مخاليطهم إلى تحسين ملحوظ فى الأداء الإنتاجى لبدارى التسمين لذلك يوصى بإضافة هذه الأعشاب لعلائق دجاج التسمين بنسبة 1%.