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INFLUENCE OF TWO PLANT EXTRACTS DERIVED FROM THYME AND CINNAMON ON BROILER PERFORMANCE

G. A. M. AL-KASSIE

Department of Public Health, College of Veterinary Medicine, University of Baghdad, Iraq

ABSTRACT

This study was conducted to explore the use of essential oil (EO) in broiler nutrition as a natural growth promoter. Different levels of EO derived from thyme and cinnamon were added to a standard diet to determine its effects on feed intake, live weight gain, feed conversion ratio and blood constituents. Three hundred day-old broiler chicks (Arbor-Acres) were divided into five equal groups and treated as follows: No EO (control group), 100 ppm EO derived from thyme (group 2), 200 ppm EO derived from thyme (group 3), 100 ppm EO derived from cinnamon (group 4) and 200 ppm EO derived from cinnamon (group 5). The diets were prepared freshly each day. Experiments were carried out for 42 days. Results showed that chicks fed with 200 ppm EO derived from thyme and cinnamon had significantly higher ($P<0.05$) feed intake, body weight gain and feed conversion ratio, followed by chicks fed with 100 ppm EO derived from thyme and cinnamon compared with control group, which showed the lowest performance. Moreover, the chicks fed with ration containing EO derived from thyme and cinnamon had reduced ($P<0.05$) serum cholesterol. The total proteins increased significantly ($P<0.05$) for the groups consuming 200 ppm EO derived from thyme and cinnamon. In conclusion, EO could be considered as a potential natural growth promoter for poultry at the level of 200 ppm, depending on the kind of EO derived from herbal plants.

Key words: Cinnamon, thyme, essential oil, performance, serum biochemistry, broilers.

INTRODUCTION

Essential oils are complex compounds, and their chemical composition and concentrations of various compounds are variable (Lee *et al*., 2004). Essential oils basically consist of two classes of compounds, the terpenes and phenylpropenes, depending on the number of 5- carbon building blocks.

The exact anti-microbial mechanism of essential oils is poorly understood. However, it has been suggested that their lipophilic property (Cornner, 1993) and chemical structure (Farag *et al*., 1989a; 1989b) can play a role. It was suggested that terpenoids and phenylpropanoids can penetrate the membranes of the bacteria and reach the inner part of the cell because of their lipophilicity (Helander *et al*., 1998). Moreover, structural properties, such as the presence of the functional groups (Farag *et al*., 1989c) and aromaticity (Bowles and Miller, 1993) are also responsible for the antibacterial activity of essential oils.

Specific effects of the essential oils on chicken performance have not received much attention because poultry may not acutely respond to flavor when compared to pigs (Moran, 1982), although there is an evidence (Deyoe *et al*., 1962) that flavors could affect feed intake negligibly in chicken.

Various plant extracts, especially essential oils, have been studied for their antimicrobial abilities. Most of researches done in this area have been performed in vitro, but there have been few studies with live poultry flocks.

A recent study involving live birds showed that blends of the primary components of the essential oils could be used to control *Clostridium perfringens*, the bacterium that causes necrotic enteritis in broilers (Mitsch *et al*., 2004). Ground thyme has been shown to inhibit the growth of *S. typhimurium* when added to media (Aktug and Karapinar, 1986). The essential oil of the thyme has been shown to inhibit the growth of the *E. coli* in media (Marino *et al*., 1999).

Aromatic plants and essential oil extracted from these plants have been used as alternatives to antibiotics. For this reason, these plants are becoming more important due to their antimicrobial effects and the stimulating effect on animal digestive system (Osman *et al*., 2005).

Cinnamon extract inhibits *Helicobacter pylori* at the concentration range of common antibiotics, its antimicrobial properties are mainly related to its cinnamaldehyde content, followed by eugenol and carvacrol contents (Taback *et al*., 1999). Cinnamon oil and it constituents (cinnamaldehyde and eugenol) have antibacterial activity against *Escherichia coli*, *Pseudomonas aeruginosa*, *Enterococus faecalis*, *Staphylococcus aureus*, *Staphylococcus epidermis*, *Salmonella sp*. and Parahemolyticus (Change *et al*., 2001). Also they have inhibitory properties against

Aspergillus flavus (Montes-Belmont and Carvajal, 1998).

The effect of ground thyme and cinnamon on the performance of broilers was studied by Al-Kassie 2009), who found their effect on the live weight gain and the improvement of the health of poultry, in addition to other performance traits, feed conversion ratio and feed intake. The aim of this study was to find the effect of oil extract from thyme and cinnamon as natural growth promoting substances in broiler chicks.

MATERIALS AND METHODS

Three hundred day-old mixed sexed broiler chicks (Arbor-Acres) were used in the study. Chicks were weighed and the average of weight was recorded as day-old weight. They were assigned into 5 treatment groups. Each group was divided into 3 equal replicates of 20 chicks per replicate. The chicks were housed in floor pens (1.25 ×1.25m). Starter diets containing 22.4% crude protein (CP) and 2850 Kcal/Kg ME were offered ad-libitum from 1 to 28 days of age. Then a finisher diet contains 20.2% crude protein and 2900 Kcal/Kg ME was offered ad-libitum from 29 to 42 days of age. All diets were formulated to cover the nutrient requirements of chicken (NRC, 1994). Ingredients and the composition of the experimental diets are shown in Table 1.

Table 1: Composition of experimental diets in different periods of the experiment

Ingredient (%)	Starter (1-28 day)	Finisher (29-42 day)
Yellow corn	58.0	64.0
Soybean meal (45% protein)	38.0	32.0
*Premix	3.0	3.0
Oil	0.5	0.5
Salt	0.3	0.3
Methionine	0.1	0.1
Lysine	0.1	0.1
Total	100	100
Composition		
ME (Kcal/kg)	2850	2900
Crude protein (%)	22.4	20.2
Calcium (%)	0.13	0.23
Avail. Phosphorus (%)	0.17	0.16
Methionine + cystine	0.80	0.75
Lysine	1.22	1.15

Premix (1%) provided the following (per kg of complete diets): 1400 IU Vit. A, 3000 IU Vit. D3, 50 mg Vit. E, 4 mg Vit. K, 3 mg Vit. B6, 6 mg Vit. B12, 60 mg niacin, 20 mg pantothenic acid, 0.2 mg folic acid, 150 mg choline, 4.8 mg Ca, 3.18 mg P,100 mg Mn, 50 mg Fe, 80 mg Zn, 10 mg Cu, 0.25 mg Co and 1.5 mg iodine.

First group served as a control (0% oil extract), while groups 2 and 3 were fed diets with 100 and 200 ppm, respectively of oil extract derived from thyme. Similarly, groups 4 and group 5 were fed diets having 100 and 200 ppm of oil extract derived from cinnamon, respectively. Standard management practices of commercial broiler production were applied. Chicks were vaccinated against Newcastle disease and Infectious bronchitis. Body weight was determined through the period of starter and finisher and feed intake was recorded for the corresponding periods.

At the end of the experiment, three chicks from each replicate were randomly selected and weighted to obtain live body weight. They then were slaughtered by a sharp knife for complete bleeding, and feathers were plucked. Head, viscera and shanks were removed. Carcass was left for one hour to remove excess water and allowed for over night in a refrigerator at 4 ± 2°C then weighed. Dressing percentage was calculated without giblets (Heart, gizzard, liver and abdominal fat) and the weight of each part was calculated as percentage of the carcass weight.

Blood sample were also taken from the brachial vein with a syringe. These samples were used for the determination of various haematological parameters including PCV, WBC and RBC counts, haemoglobin (Hb) concentrations and heterophils/lymphocytes ratio.

Data were analyzed by using the General Linear Model procedure of SAS (2001). Duncan's multiple range test was used to detect the differences ($P<0.05$) among different group means (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

The effect of oil extract derived from thyme and cinnamon on the growth performance (body weight gain, feed intake and feed conversion ratio) of broiler chicks is presented in Table 2. From 1 to 6 weeks, results showed that chicks fed with oil extract had significantly higher values ($P<0.05$) for the three traits for all treatments (T2, T3, T4 and T5) compared with control group. Moreover, higher doses of extracts from both plants showed better results than low doses. These results showed that extract oil derived from thyme and cinnamon in broiler diets improved body weight gain, feed intake and feed conversion ratio, which may be due to active materials (thymol and carracerol) in these plants which are considered as digestion stimulating factors, in addition to their antimicrobial activity against bacteria found in the intestine (Cabuk *et al*., 2003). Moreover, the improvement of body weight gain and feed conversion are due to the active materials (Cinnamaldehyde and ugenol) found in cinnamon, causing greater efficiency in the utilization of feed, resulting in enhanced growth. There is an evidence to suggest that herbs, spices and various plant extracts have appetite and digestion stimulating properties and

antimicrobial effects (Kamel, 2001). These results agree with the work of Lee *et al*. (2004), who found that adding the cinnamon to the diet of broilers improved their growth performance.

Table 3 shows that different levels of oil extract derived from thyme and cinnamon also had significant effects on dressing percentage, abdominal fat and internal organs percentage (liver, heart and gizzard). Results revealed that the inclusion of oil extracts improved the performance significantly ($P<0.05$) in treatments 3 and 5 compared with control. Moreover, chicks fed with diet containing 200 ppm of oil extracts derived from thyme and cinnamon had significantly higher liver percentage and lower abdominal fat percentage compared to control. These results agree with the work of Langhout (2000), who showed that oil extracts could stimulate the digestion system in poultry, improve the function of liver and increase the pancreatic digestive enzymes. Enhancement of the metabolism of oil, carbohydrates and proteins in the major organs would increase growth rate of these organs (Mellor, 2000a; 2000b).

Table 4 shows the effects of treatments on serum cholesterol, total proteins, PCV, total WBC, RBCs, Hb and heterophil to lymphocyte ratio. The present study showed that groups fed with oil extract derived from thyme and cinnamon had significantly lower cholesterol and H/L ratio, and higher RBC, PCV, Hb and WBC compared with the control group ($P<0.05$). These observations are correlated with the data published by some authors (Abdulrahim *et al*., 1996; Mohan *et al*., 1996; Panda *et al*., 2000; Kannan *et al*., 2005; Gudev *et al*., 2008; Paryad and Mohmoudi, 2008).

Unfortunately, reports on the value of oil extracts in poultry nutrition are scarce. This study showed that the supplementation of 200 ppm oil extract derived from thyme and cinnamon in broiler diets significantly improved the live weight gain and feed conversion ratio during a growing period of 6 weeks, in addition to decreasing serum cholesterol level and H/L ratio in blood. Thus, oil extract derived from herbal plants could be considered as a potential growth promoter for poultry due to its digestive stimulating and antimicrobial effect.

Table 2: Effect of different levels of oil extract derived from thyme and cinnamon on growth performance of broiler chicks

		Derived from thyme		Derived from cinnamon	
Items	**Control (T_1)**	**100 ppm (T_2)**	**200 ppm (T_3)**	**100 ppm (T_4)**	**200 ppm (T_5)**
0-3 weeks					
Body weight gain (g/bird)	698 ± 26.5^{c}	744 ± 30.5^{b}	765 ± 27.4^{a}	746 ± 28.4^{ab}	758 ± 32.3^{ab}
Feed intake (g/bird)	1130 ± 1.27^{a}	1042 ± 9.90^{b}	1032 ± 2.91^{b}	1059 ± 6.12^{b}	1015 ± 1.32^{b}
Feed conversion ratio	1.62^{a}	1.40^{b}	1.35^{b}	1.42^{b}	1.34^{b}
3-6 weeks					
Body weight gain (g/bird)	1848 ± 46.3^{b}	1873 ± 51.2^{b}	2117 ± 64.3^{a}	1940 ± 57.2^{b}	2108 ± 53.4^{a}
Feed intake (g/bird)	3250 ± 20.4^{c}	3381 ± 14.7^{b}	3580 ± 10.3^{a}	3399 ± 13.2^{b}	3542 ± 27.3^{a}
Feed conversion ratio	1.76^{a}	1.81^{a}	1.69^{c}	1.75^{b}	1.68^{c}
1-6 weeks					
Body weight gain (g/bird)	546 ± 37.4^{c}	2617 ± 45.2^{b}	2882 ± 41.3^{a}	2686 ± 29.4^{b}	2866 ± 51.4^{a}
Feed intake (g/bird)	4380 ± 29.6^{bc}	4423 ± 41.0^{b}	4612 ± 18.5^{a}	4458 ± 32.3^{b}	3557 ± 35.4^{a}
Feed conversion ratio	1.72^{a}	1.69^{b}	1.60^{c}	1.66^{b}	1.59^{c}

Means with different superscripts in the same row differ significantly ($P<0.05$).

Table 3: Effect of different levels of oil extract derived from thyme and cinnamon on carcass characteristics of broiler chicks

		Derived from thyme		Derived from cinnamon	
Parameters	**Control (T_1)**	**100 ppm (T_2)**	**200 ppm (T_3)**	**100 ppm (T_4)**	**200 ppm (T_5)**
Dressing (%)	70.1 ± 1.25^{c}	71.4 ± 1.12^{bc}	73.3 ± 1.13^{a}	70.3 ± 1.03^{b}	74.8 ± 1.81^{a}
Liver (%)	2.38 ± 0.08^{b}	2.30 ± 0.06^{c}	2.65 ± 0.06^{a}	2.61 ± 0.09^{ab}	2.70 ± 0.07^{a}
Heart (%)	0.51 ± 0.02^{ab}	0.49 ± 0.08^{b}	0.58 ± 0.02^{a}	0.57 ± 0.06^{ab}	0.49 ± 0.01^{b}
Gizzard (%)	2.28 ± 0.08^{b}	2.31 ± 0.09^{b}	2.51 ± 0.10^{a}	2.35 ± 0.18^{b}	2.53 ± 0.09^{a}
Abdominal fat (%)	2.41 ± 0.11^{a}	2.39 ± 0.09^{ab}	2.36 ± 0.10^{b}	2.33 ± 0.06^{c}	2.37 ± 0.21^{bc}

Means with different superscripts in the same row differ significantly ($P<0.05$).

Table 4: Means of blood constituents of broiler chicks fed diets containing different levels of extract oil derived from thyme and cinnamon

		Derived from thyme		Derived from cinnamon	
Items	**Control (T_1)**	**100 ppm (T_2)**	**200 ppm (T_3)**	**100 ppm (T_4)**	**200 ppm (T_5)**
Cholesterol (mg/dl)	158.5 ± 0.76^{a}	145.6 ± 0.99^{c}	154.8 ± 0.79^{b}	148.5 ± 1.32^{c}	141.1 ± 1.07^{d}
Total Proteins (gm/dl)	4.18 ± 0.09^{c}	4.46 ± 0.08^{b}	4.25 ± 0.12^{c}	4.35 ± 0.08^{bc}	4.73 ± 0.07^{a}
PCV (%)	33.1 ± 0.51^{b}	35.2 ± 0.58^{a}	34.7 ± 0.35^{a}	34.5 ± 0.55^{a}	35.2 ± 0.38^{a}
WBC (10^3/mm^3)	22.7 ± 0.16^{c}	23.2 ± 0.23^{b}	23.6 ± 0.17^{b}	23.14 ± 0.14^{b}	24.2 ± 0.14^{a}
RBC (10^6/mm^3)	32.4 ± 0.34^{b}	33.5 ± 0.29^{a}	33.8 ± 0.19^{a}	33.4 ± 0.39^{a}	33.2 ± 0.41^{a}
Hb (gm/dl)	6.7 ± 0.13^{b}	7.2 ± 0.23^{a}	7.3 ± 0.16^{a}	7.3 ± 0.11^{a}	7.5 ± 0.12^{a}
Heterophil/lymphocytes ratio	0.72 ± 0.37^{a}	0.62 ± 0.18^{b}	0.64 ± 0.23^{c}	0.65 ± 0.31^{c}	0.63 ± 0.14^{b}

Means with different superscripts in the same row differ significantly ($P<0.05$).

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