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The Effect of Thyme and Cinnamon on the Microbial Balance in Gastro Intestinal Tract on Broiler Chicks

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Abstract: This study was conducted to determine the effect of the addition of different percent levels of thyme and cinnamon, added to a standard diet, on the gastro intestinal tract. Total bacteria count, *coli form* bacteria, *lactobacilli* bacteria and fungal count were determined in different region crop, jejunum and large intestine. Two hundred fifty day-old broilers (Arbor-Acre) were divided into groups of 50 birds each and randomly assigned to the five treatment groups. Each treatment has two replicates. Experiment was as follow. A control group with no thyme and cinnamon and other four groups, with the following additives. 0.5%, 1% thyme and 0.5%, 1% cinnamon. The data showed that the additive thyme and cinnamon has statistical effect ($p<0.05$) the decrease in the total bacteria count, *coli form* in group, jejunum and large intestine compared with the control. In conclusion different levels 0.5% and 1% of thyme and 0.5%, 1% of cinnamon used as antimicrobial balance in gastro intestinal tract for broiler chicks.

Key words: Thyme, cinnamon, microbial balance, gastro intestinal tract

INTRODUCTION

Herbs and spices are well known to exert antimicrobial actions *in vitro* against important pathogens, including fungi (Dorman and Deans, 2000; Burt and Reinders, 2003; Si *et al*., 2006; Ozer *et al*., 2007). The plant family of labiates has received the greatest interest, with thyme, oregano and sage as the most popular representatives (Burt and Reinders, 2003). The antimicrobial mode of action is considered to arise mainly from the potential of the hydrophobic essential oils to intrude into the bacterial cell membrane, disintegrate membrane structures and cause ion leakage (Newton *et al*., 2002; Burt and Reinders, 2003).

Since ancient time, herbs have been known for their varying degrees of antimicrobial activity (Juven *et al*., 1994; Chang, 1995; Al-Kassie, 2008). This may be indicate that the antimicrobial action of phyto-genics should not contribute significantly to the overall efficacy of this class of feed additives.

On the other hand, some studies with broiler essential oil against *Escherichia coli* and *Clostridium perfringens* (Jamroz *et al*., 2003; Mitsch *et al*., 2004).

Plant products have been used for centuries by humans as food and to treat ailments. Natural medicinal products originating from herbs and spices have also been used as feed additives for farm animals in ancient cultures for the same length of time (Yang and Choct, 2009).

With respect to biological origin, formulation, chemical description and purity, photobiotic comprise a very wide range of substances and four subgroups may be classified.

1. Herbs (product from Howe ring, non-woody and non-persistent plants).
2. Botanical (entire or processed part of a plant, e.g. root, leaves, park).
3. Essential oils hydro distilled extracts of volatile plant compounds).
4. Oleoresins (extracts based on non-aqueous solvents), (Windisch and Kroismayr, 2006).

The active compounds of photobiotic are secondary plant constituents.

Antimicrobial activity and immune enhancement probably are the two major mechanisms by which photobiotic extra positive effects on the growth performance and health of animals compounds (photochemical) in phytobiotics are well known to have antimicrobial ability (Cowan, 1999).

In diseased chickens (either infected with avian *Mycoplasma gallisepticum* or *Eimeria* tenella), Guo and his colleagues (Guo *et al*., 2004a, 2004b, 2004c) demonstrated that plants and their extracts could improve the growth performance, reduce the populations of coli forms and/or *coli forms*. *perfringens* and enhance both cellular and humeral immune responses of chickens.

Some herbal extracts have also been shown to possess a coccidiostatic activity (Allen *et al*., 1997; Youn and Noh, 2001; Christakia *et al*., 2004).

MATERIALS AND METHODS

Two hundred fifty one day-old broilers (Arbor Acre) were divided into five treatment groups of 50 birds each and randomly assigned to five treatment diets.

The experiment was carried out 42 days. Each treatment group was further sub-divided into two replicates of 25 birds per replicate. The presence and total aerobic

bacterial count, *Coli form* bacteria count, lactobacilli bacteria count and fungi count were the main factors tested on the gastro intestinal tract.

In the control group the birds were fed a standard diet (21.49% CP and 3188 Kcal ME/kg). Two different percent levels of (0.5% and 1% thyme) and (0.5% and 1% cinnamon) added to the standard diets to generate the other four treatment groups. The diets were iso-caloric and iso nitrogenous. The ingredient and chemical composition of the diets are presented in Table 1. Were analyzed using AOAC (1990). The diet and water were provided *ad libitum*.

A photo period of 24 h/day in 4 weeks and 16 h/day in 4-6 week was maintained.

At the end of the experiment the birds are 6 weeks old. They were slaughtered by cutting the throat and the jugular vein with a sharp knife near the first vertibrum from each of replicate (10 birds group), were picked for eviscerating under sterilize condition. Sample were taken from the middle of the small intestine at the connection region of yolk sac with the small intestine (Rudimentary yolk sac stalks). A second sample was taken from crop and a third sample was taken from each sample were taken by sterilize glass bottles to the laboratory within one and half hours for easement of enter microbial test (Total bacteria, *Coli form bacteria, lactobacilli bacteria* and fungi count) according to Harrigan and McMane (1976).

Data collected were subject to analysis of variance and where significant differences were observed means were further subjected to Duncan's multiple range, SPSS for Windows:10.1, SPSS inc. (1999). The results were considered as significant when P values less than 0.5 and 0.1.

Table 1: Composition of standard % of diet

Feeds ingredients	1-42 day
Yellow corn	30.00
Wheat	32.50
Soybean meal (48% protein)	19.50
Protein concentrate (50% protein)	10.00
Limestone	0.70
Salt	0.30
Oil	0.70
Vitamins and trace premix*	0.10
Methionine	0.10
Lysine	0.10
Total	100.00
Analysis	-
Crude protein	21.49
Methionine + Cystine	0.33
Lysine	1054
ME (Kcal/kg)	3188.00
Calorie protein ratio	1:148

Source: Provime Company, Jordin, Premix (1%) provided the following (per Kilogram D_3. 50 mg Vitamin E, 4 mg Vitamin K, 3 mg Vitamin B_6, 6 mg Vitamin B_{12}, 60 mg niacin, 20 mg pantothenic acid, 0.20 mg folic acid, 150 mg choline, 4.8 mg Ca, mg Mn, 50 mg Zn, 10 mg Cu, 0.25 mg Co, 1.5 mg iodine

RESULTS AND DISCUSSION

Table 2 denotes the effects of the addition of different percent levels of thyme and cinnamon on the intestinal microbial balance on broiler chicks, that include different region of gastro intestinal tract of digestive system (crop, jejunum and large intestine at six-weeks old of experiment.

The data showed that the two additives (0.5%, 1% thyme and 1% cinnamon) treatments a significant decrease at ($p<0.05$) of total bacteria count (CFU/gm) for in crop, jejunum and large intestine, in spite there are some differences in other treatments for *coli form* count bacteria in crop, jejunum and large intestine. However, all treatments showed statically effect ($p<0.05$) of gastro intestinal tract compared with the control treatment one. This may be considered as an indication to the fact that the addition of the 0.5, 1% thyme and 1% cinnamon led to a significant decrease in the total aerobic bacteria count. These results are in good agreement with that of (Al-Kassie, 2008; Bolukbasi and Erhan, 2007). Where they pointed out the positive effect in decreasing *E. coli* in various of gastro intestinal tract in order to improve the animal health, while in jejunum the highest significant

Table 2: The effect of adding thyme and cinnamon on the microbial balance in gastro intestinal tract on broiler chicks

	Characteristic studies											
	Crop (CFU/gm)				Small Intestine (Jejunum) (CFU/gm)				Large Intestine (CFU/gm)			
Treatments	TC	CFC	LC	FC	TC	CFC	LC	FC	TC	CFC	LC	FC
T_1 Control	9.86 ±0.04^{a}	7.14 ±0.09^{c}	0.64 ±0.02	2.10 ±0.03^{a}	9.41 ±0.13^{a}	5.16 ±0.05^{a}	1.24 ±0.03	3.63 ±0.17^{a}	8.91 ±0.03^{a}	5.70 ±0.05^{a}	1.40 ±0.05^{ab}	2.40 ±0.03^{b}
T_2 Thyme (0.5%)	9.43 ±0.04^{c}	7.55 ±0.04^{a}	0.71 ±0.07	2.05 ±0.03^{a}	9.00 ±0.09^{b}	4.81 ±0.04^{c}	1.25 ±0.04	2.55 ±0.04^{ab}	8.56 ±0.04^{b}	5.32 ±0.04^{c}	1.44 ±0.06^{ab}	2.56 ±0.03^{a}
T_3 Thyme (1%)	9.55 ±0.04^{b}	7.56 ±0.04^{a}	0.75 ±0.04	2.05 ±0.03^{a}	8.96 ±0.06^{b}	5.10 ±0.04^{ab}	1.20 ±0.03	3.45 ±0.04^{ab}	8.60 ±0.05^{b}	5.61 ±0.06^{ab}	1.54 ±0.05^{a}	2.40 ±0.02^{b}
T_4 Cinnamon (0.5%)	9.58 ±0.04^{a}	7.55 ±0.07^{a}	0.76 ±0.02	1.73 ±0.06^{b}	9.02 ±0.08^{b}	5.00 ±0.12^{b}	1.25 ±0.04	3.35 ±0.07^{b}	8.87 ±0.03^{a}	5.66 ±0.03^{ab}	1.34 ±0.04^{b}	2.45 ±0.04^{b}
T_5 Cinnamon (1%)	9.66 ±0.04^{b}	7.36 ±0.03^{b}	0.71 ±0.05	2.11 ±0.04^{a}	8.95 ±0.07^{b}	4.91 ±0.06^{bc}	1.27 ±0.03	3.48 ±0.04^{ab}	8.50 ±0.05^{b}	5.55 ±0.04^{b}	1.53 ±0.04^{a}	2.36 ±0.03^{b}
Significantly	*	*	N.S	*	*	*	N.S	*	*	*	*	

*P<0.05, ^{a,b,c}Means values with different superscripts with in a row differ significantly. N.S, means not significantly

differences ($p<0.05$) in control group with 1% thyme additive compared with other treatments. In large intestine (Cecal tonsils) there is significant differences at ($p<0.05$) among control group with 2nd, 3rd and 5th treatments (CFU/gm). While, in crop treatment with 0.5% thyme lowest CFU/gm and indicate good value of thyme especially at 1% in lowering enter microbial count of pathogenic *Escherichia coil* and increasing body performance with the allowances of Bolukbasi and Erhan (2007).

Coli form bacteria were decreased in 2nd and 5th treatment with thyme in cecae area compared with control, 3rd and 4th treatments at $p<0.05$, while, in duodenum *coli form* count increased significantly in control treatment compared with 2nd and 5th treatments with none significant among 1st, 3rd and 4th treatments.

In crop region the treatments 2nd, 3rd and 4th significantly different at ($p<0.05$) among 5th treatment (1% cinnamon) and control group.

The interpretation of these data results reflex the complexity of micro flora development with the age in broiler synchronized with the addition of thyme and its active ingredients (thyme and cervical), inhibition of pathogenic bacteria such as *E. coil* 0157:H_7, *Salmonella typhimurium*, *Shigella Sonnei* and *Bacillus Subtitles* (Fan and Chen, 2001).

Coli form bacteria is an indicator tool for intestinal performance, so that thyme and cinnamon on with complex mechanisms affect pathogenic bacteria by changing cell wall bacterial permeability leading to pore formation and osmotic shock and leakage of cytoplasm and its active contents out-side the cell leading to death of them (Lee *et al*., 2004), the antimicrobial effect of thymol on these bactin played on vital membrane ions of potassium and hydrogen equilibrium pumps (Bolukbasi and Erhan, 2007).

Lactobacilli not affected by thymol and cinnamon at ($p<0.05$) in all intestine regions may be a part of micro floral motility power.

These result agree with the study of Thakare (2004); Al-Kassie (2008) in inhibition of pathogenic bacteria in broilers by thymol and caravacol: *E. coli*, *Salmonella typhimurium, Entero faecalis and faecium*.

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