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Effect of Cinnamon (*Cinnamomum zylenicum*) supplementation on the intestinal selected bacterial population in Japanese quail

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Abstract

The present experiment was conducted to investigate the effects of adding graded levels (0, 1.0 and 1.5%) of Cinnamon **(***Cinnamomum zylenicum*) in the basal diet on the intestinal bacterial population of the Japanese quail. Sixty Japanese quail were randomly distributed into 3 groups. Each treatment contained four replicates (5 birds/replicate). The results showed significant (P<0.05) improvement in lactobacillus of birds fed 1.5% cinnamon. Total bacterial count, *coli form* and fungi count was significantly (P<0.05) lower compared to the control. In conclusion, 1.5% level of cinnamon may be used for antimicrobial balance in gut for Japanese quail.

Key words: *Cinnamomum zylenicum*, Quail, Bacteria, Population

Introduction

A number of feed additives including antibiotics have been widely employed in the poultry industry for several decades. A manipulation of gut function and microbial habitat of domestic animal with feed additives has been recognized as an important tool for improving growth performance and feed efficiency (Collington et al., 1990) Approximately 80% of domestic animals have been fed synthetic compounds for the purpose of either medication or growth promotion (Lee et al., 2001). Recently, the concerns about possible antibiotic residues and antibiotic resistance have aroused great caution in the usage of antibiotics in the animal industry. The banning of the use of antibiotics as feed additives has accelerated and led to investigations of alternative feed additives in animal production. As one of the alternatives, herbal extracts are already being used as feed supplements to improve growth performance under intensive management systems (William and Losa, 2001).

Plant extracts and spices as single compounds or as mixed preparations can play a role in supporting both performance and health status of the animal (Skrabka-Blotnicka et al., 1997; Gill, 2000; Manzanilla et al., 2001). Beneficial effects of herbal extracts or active substances in animal nutrition may include the stimulation of appetite and feed intake, the improvement of endogenous digestive enzyme secretion, activation of immune response and antibacterial, antiviral, antioxidant and antihelminthic actions.

Isoprene derivatives, flavonoids, glucosinolates and other plant metabolites may affect the physiological and chemical function of the digestive tract. The stabilizing effect on intestinal microflora may be associated with intermediate nutrient metabolism (Horton et al., 1991; Baratta et al., 1998; Jamroz et al., 2003). The pharmacological action of active plant substances or herbal extracts in humans is well known, but in animal nutrition the number of precise experiments is relatively low. *Cinnamomum zylenicum* is commonly used in the food industry because of its special aroma. Additionally, it has strong antibacterial properties, anticandidial. Antiulcer, analgesic, antioxidant and hypocholesterolaenic activities (Suhr and Nielsen, 2003). In the present study, Japanese quail were supplemented with graded levels of *Cinnamomum zylenicum* to evaluate the effect of cinnamon on intestinal micro flora.

Materials and Methods

The present experiment was conducted in the Department of Animal Resources of the College of Agriculture, Tikrit University during the period of 15th November 2010 to 15th February 2011. The basal experimental starter was formulated according to NRC (1994) to meet the broiler requirements Table 1. Clean pure cinnamon was bought from local market, prepared

by drying in shadow for three days and then ground. Cinnamon powder was added to the basal experimental diets in graded levels (0.0, 1.0 and 1.5%). Zero level served as the control treatment.

A total of 60 (23 weeks old) Japanese quail were selected. The birds fed the control diets for two weeks as adaptation period. Water and feed were provided *ad libitum*. The experimental birds were randomly assigned to the 3 dietary treatments (20 birds/treatment). Each treatment consisted of 4 replicates.

For determination of some selected micro-organisms in intestinal digesta from 16 birds (4 birds per treatment and pen), the contents of the distal part of the small intestine (2 cm anterior to the junction with ileumand ceacum) and whole caeca of two birds per replicate per pen were separately collected, cooled and used for microbial assays.

Table 1: Composition of standard of diet

Ingredients (%)	Diets (%)
Yellow corn	12
Wheat	47.70
Soybean meal	20
Protein concentrate*	10
Lime stone	7
Oil	3
Sodium chloride	0.3
Calculated content**	
Crude protein (%)	21.05
Metabolisable energy (Kcal/kg)	2888
Total calcium (%)	3.60
Methionine (%)	0.35
Lysine (%)	1.00
Cystine (%)	0.27
Available phosphorus (%)	0.30

*Golden protein concentrate provided per kg: : 2500 ME/kg; 40% crude protein; 9% crude fat; 4.5% crude fiber; 9% calcium; 2.3% available phosphorus; 2.3% lysine; 1.25 methionine; 1.8% methionine + cystine; 100000 IU vit A; 10 mg vit B1; 100 mg vit B12; 20 mg vit K3; 50 mg copper; 700 mg manganese; 2 mg selenium; 200 mg vit E; 0.5 mg biotin; 5 mg folic acid; 200 mg niacin; 80 mg pantothenic acid; 10 mg iodine; 25000IU vit D3; 500 mg iron; 10 mg cobalt; 600 mg zinc; 10 mg vit B6; **Calculated composition was according to NRC (1994)

The populations of total bacterial count, *Escherichia coli,* fungi count and lactobacillus (LAB) were then estimated as CFU per gram. Sterilized PBS (99 ml) was added (1:100) to 1 g of fresh material, and then subsequent dilutions were prepared. *E. coli* was cultured on MacConkey agar (Merck, Germany) at 37°C for 24 hours, and the presence of *E. coli* then determined. LAB was enumerated on MRS (Merck, Germany) agar after incubation under anaerobic condition for 72 hours at 37°C.

Statistical Analysis

Data were analyzed by the ANOVA analysis, using the general linear model of the Statically Analysis System (SAS, 2001). Significant treatment differences were evaluated using Duncan's multiple-range test (Duncan, 1955). All statements of significance are based on the 0.05 level of probability.

Results and Discussion

The results in table 2 and 3 denotes the effects of the addition of different percent levels of cinnamon on the intestinal microbial balance of Japanese quail, that include different region of gastrointestinal tract of digestive system (ileum and ceacum). The data showed that the two additives (0.1% and 1.5% cinnamon) caused a significant decrease ($P<0.05$) in total bacterial count, *E.coli* and fungi count and increased lactobacillus (CFU/gm) in ileum and ceacum. While the results showed significant ($P<0.05$) decrease of total bacterial, *E.coli* and fungi count in 3rd treatment (1.5% cinnamon) with control in ileum and cacecum, *E.coli* bacteria were decreased in treatment 2 and 3 with cinnamon in ileum and ceaceum compared with control. While, in ileum and cacecum, lactobacillus increased significantly in treatment 2 and 3 compared to control (table 2 and 3).

The study showed that the decrease in total bacterial, *E.coli* and fungi count and increase in lactobacillus were related to cinnamon treatments. This may be due to its essential oil containing both antifungal and antibacterial properties that can prevent food spoilage due to bacterial contamination (Fabio et al., 2003). Cinnamon oil has proven to be particularly effective against some species of toxicogenic fungi (Juglal et al., 2002) and some of the plant constituents have proven value against bacteria and fungi (McCann, 2003; Gruenwald, 2004). In earlier studies (Jamroz et al., 2003), significant reduction of *E.coli* number has been obtained following an application of natural plant extract. These results are in good agreement with that of Al-Kassie (2010).

In conclusion, using cinnamon in Japanese quail feed resulted in a significant positive effect on microbial balance. The optimum inclusion rate of cinnamon for improvement in lactobacillus and lower total bacterial count, *coli form* and fungi count was found to be at the level of 1.5%.

Table 2: The effect of supplemented cinnamon in ileum of Japanese quail

Treatments	Total bacterial ($CFU\times10^6/g$)	Lactobacillus ($CFU\times10^6/g$)	*E. coli* ($CFU\times10^6/g$)	Fungi count ($CFU\times10^6/g$)
Control (0.0%)	45.0 ± 9.55^{a}	4.42 ± 2.21^{c}	14.75 ± 1.31^{a}	63.5 ± 13.05^{a}
Cinnamon (0.1%)	26.0 ± 7.62^{b}	5.82 ± 2.10^{b}	11.20 ± 1.14^{ab}	50.5 ± 11.11^{ab}
Cinnamon (1.5%)	21.5 ± 5.10^{c}	7.82 ± 1.80^{a}	9.12 ± 1.06^{b}	43.2 ± 10.10^{b}

$^{a,-c}$Values within rows followed by different letters differ significantly ($P<0.05$)

Table 3: The effect of supplemented cinnamon in caecum of Japanese quail

Treatments	Total bacterial ($CFU\times10^6/g$)	Lactobacillus ($CFU\times10^6/g$)	*E. coli* ($CFU\times10^6/g$)	Fungi count ($CFU\times10^6/g$)
Control (0.0%)	123.50 ± 12.55^{a}	18.22 ± 2.88^{b}	35.02 ± 1.31^{a}	68.72 ± 12.25^{a}
Cinnamon (0.1%)	107.50 ± 11.62^{b}	21.10 ± 2.22^{ab}	24.00 ± 1.14^{b}	63.06 ± 11.86^{ab}
Cinnamon (1.5%)	93.25 ± 11.10^{c}	28.25 ± 2.02^{a}	23.23 ± 1.06^{b}	59.82 ± 11.05^{b}

$^{a,-c}$Values within rows followed by different letters differ significantly ($P<0.05$)

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