The Effect of Cinnamon Powder and Cinnamon Extract on Performance, Blood Parameters and Microbial Population of Broiler Chicks

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Abstract

The experiment was conducted to evaluate the effects of different levels of cinnamon (Satureja hortensis L.) powder (SP) and cinnamon extract (SE) on the performance, blood parameters and microbial population of broilers. One hundred fifty Ross 308 strain day old broiler in a completely randomized design with five treatments (three replicates per treatment and each replicate had 10 chicks) were categorized. Treatments included group 1: no additive (control), group 2: 1.5% cinnamon powder in feed, group 3: 3% cinnamon powder in feed, group 4: 200 ppm cinnamon extract in drinking water, group 5: 300 ppm cinnamon extract in drinking water. for six weeks. Data analysis was performed using SAS software and mean comparison was conducted by Duncan method. The results determined that using different levels of cinnamon has significant effects on feed intake, average daily gain and feed conversion ratio blood parameters ($P<0.05$) but the glucose concentration in the experimental treatment was not significantly different ($P>0.05$). The results also determined that amount of Lactobacilli and Escherichia Coli was significantly influenced by experimental treatments ($P<0.05$).

Key words: Blood parameters- Broiler chicks- Cinnamon- Microbial population- Performance

الخلاصة

أجريت التجربة لتقييم الآثار المترتبة على استخدام مستويات مختلفة من مسحوق القرفة (Satureja hortensis L.)(SP) ومستخلص القرفة (SE) على الأداء، مكونات الدم و بكتريا الامعاء لفروج اللحم. مائة وخمسون فروج من سلالة روس 308 بعمر يوم واحد تم استخدامها في تصميم عشوائي كامل بخمسه معاملات و بثلاثة مكررات لكل معاملة بحيث كان كل مكرر يحتوي علي 10 فراخ. اشملت المعاملات علي : المعامله الاولي: تناولت عليقه بدون اضافه القرفه (السيطرة)، المعامله الثانيه: تناولت عليقه تحتوي علي1.5٪ مسحوق القرفة ، المعامله الثالثه: تناولت عليقه تحتوي علي 3٪ مسحوق ، المعامله الرابعه: تناولت 200 جزء في المليون من مستخلص القرفة في ماء الشرب ، المعامله اخامسه: تناولت 300 جزء في المليون من مستخلص القرفة في ماء الشرب. لمدة ستة أسابيع. تم تحليل البيانات باستخدام برنامج SAS و أجريت مقارنة المتوسطات بطريقة Duncan. اظهرت النتائج أن استخدام مستويات مختلفة من مسحوق القرفة لها آثار معنويه كبيرة على استهلاك العلف، معدل الزياده الوزنيه اليوميه والتحويل الغذائي و معايير الدم اليومية ($P <0.05$) ولكن تركيز الكلوكوز في المعاملات التجريبيه لم يختلف معنويا ($P> 0.05$). كما بينت النتائج أن للمعاملات التجريبيه تاثير كبير علي كمية بكتريا باسليس الحليب (Lactobacilli) و الإشريكية القولونيه (*Escherichia coli*) حيث كان هذا التاثير معنويا ($P <0.05$).

الكلمات المفتاحية: المعايير الدمية، فروج اللحم، القرفة، المجتمعات المكروبية، الاداء الانتاجي.

Introduction

For many years Anti-microbial compounds used in poultry production to improve poultry performance and health by reducing or modifying the bacterial population in the digestive tract (Fairchild *et al.*, 2001) .Moreover, the new production and husbandry systems due to lack of contact newborn chickens with the feces of mother and chicks cannot get the mother Antigen to develop their immune system (Fuller, 1989). In order to compensate for this lack and improve microbial flora in the digestive system of animals different growth promoters should be used. The action of antibiotics, are stop or inhibit the

growth of bacteria or killing them (Leeson and ummers 2001). This compounds of common food additives in poultry diets as growth promoters improves performance by reducing the pathogen factors (Leitner *et al.,* 2001*)*

The using of antibiotics as growth promoters in the diet gradually declined, while other growth stimulants or promoters are used a lot. Growth promoter's compounds such as Antibiotics improved intestinal microorganisms (Golian, 1999). The compounds such as probiotics, prebiotics, enzymes, organic acids and medical herbs that can be used as a feed additive in various forms in poultry diets or water in order to increase performance improve or reduce the spread of disease and as a good alternative to antibiotics. Wherever the medicinal plants and there extracts play a significant role (Charis, 2000; Botsoglou, 2002 *)* Medicinal plants as a plant, Plant extracts and/ or essential oils mixed in different proportions with each other or used separately in the diet. The family of Cinnamon is Lauracea, Cinnamon one of the oldest medicinal plants used as a medicinal plant with unique properties including anti-oxidant, anti-diabetic, anti-septic, local anesthetic, rubefacient (warming and smoothing), tensit the skin and other tissues, anti inflammatory, anti-fungal, antiviral, raised blood purifier and help aid in the digestion by increase the motility of the intestinal tract as well as increasing gastro-intestinal enzyme secretions . The specific antioxidant activity of cinnamon due to presence of phenolic and polyphenolic compounds that attributes (Faixová and Faix. 2008). In one study it was found that essential oil of cinnamon extract inhibited H. pylori at concentration range of common antibiotics. Complete inhibition in vitro was achieved by 50 µg/ml in solid medium (egg yolk emulsion agar) and by 15 µg/ml in liquid medium (supplemented brain heart infusion broth) and this action due to antimicrobial properties, mainly in relation to the content of cinnamaldehyde, eugenol and methyl chavicol in this plant (Taback *et al.,* 1999). The bark of young branches of Cinnamon containing 0.5-2.5 % is essential oils. In addition, there are other compounds in cinnamon bark such as Mucilage, starch, and calcium oxalate. The amount of essential oil in cinnamon as cinnamaldehyde which the main component forms about 60-75% (Lee *et al.,* 2004a). It is also contains phenolic compounds 10.4% (mainly eugenol) and hydrocarbons (such as α- pinene and caryophyllene) and small amounts Ketones, alcohols and esters.

Materials and Methods

The experiment location was located in Rasht a center of Guilan province (Islamic Republic of Iran). The experiment was conducted for 42 days in 2015 (from 10 julay to 23 augest 2015). Using scaffoldings, cages with dimensions 1.5 × 1 meters and a height of 1 meter installed, and each cage was assigned to a repeat. 150 one-day-old chicks of Ross 308 were purchased and transferred to the experiment place. The average weight of broilers was 42.13 g and breeders were 38 weeks of age. The temperature of each breeding farm was supplied by three gasoline rocket heater and was controlled by three thermostat that were installed in different parts of the farm building. In order to provide moisture, the water spray to floor was used, so that moisture was retained during this period between 50 to 60 percent. During the first two weeks of rearing, one plastic trays feeding per each cage were used. Starting the third week, all the trays feeding were collected and were replaced by proper feeding. For sanitation, all drinkers daily regularly washed twice with fresh clean water and were filled until is prevented water from being contaminated with feces and thus microbial and viral contamination. Vaccination program was conducted based on farm

veterinarian in accordance with table 1, vaccines were used to drinking practices which in order to ensure optimal use of the vaccine on all chicken and 2 hours before giving the vaccine to chickens was thirsty. Also to reduce the stress caused by vaccination 24 hours before and after vaccination, of multi-electrolyte solution compared to 1 in 1000 was used in drinking water .

Studied treatments were included:

T1: Control treatment included standard diet.

T2: Standard diet + 1.5% Cinnamon powder

T3: Standard diet + 3.0% Cinnamon powder

T4: Standard diet + 200 ppm Cinnamon extract

T5: Standard diet + 300 ppm Cinnamon extract.

The live weights of the birds were measured at the beginning of the experiment, then at weekly intervals. Feed intake, growth rate and FCR were determined according to the procedures of McDonald *et al*. (2011).

Collected samples for microbial culture

For measuring the microbial population in the day 42, a chicken was selected from each experimental unit and slaughtered. The contents of ileum sections collected for microbial cultures in discharged containers and passing microbial culture.

Measuring microbial population

In this study, Colony Forming Unit (CFU) method was used. At first, the collection tubes were labeled. Treatment and the number of iterations were determined. Then they were weighed individually, and their weights were recorded. Collecting tubes wrapped into aluminum sheet and were autoclaved for sterling. The culture mediums were prepared and 24 hours before collecting samples were poured into the petri dish. MRS agar (Man Rogosa Sharpe agar, 1.10660.500) to culture Lactobacilli , Eosin methylene Blue (EMB ,1.01347.0500) to culture *Escherichia coli*. Samples were transferred to the laboratory in the listed tubes and again weighed and their weights were recorded. The amount of sample in each tube was calculated from the difference between these two values. Tubes were shaken for approximately half an hour. The action was performed for bacteria isolated from gastrointestinal contents and preparation of suspension. 1 ml was removed from the prepared suspension and was added into 9 ml buffer phosphate saline (PBS) in the other tube. So the concerned suspension was prepared from dilutions $10^{-1}$and serial dilution were done (10^{-2}, 10^{-3}, 10^{-4}, 10^{-5} and 10^{-6}). 100 µl was removed from (10^{-4}, 10^{-5} and 10^{-6}) dilutions and had been poured into the petri dish that had already been prepared and containing the medium and completely distributed to all parts of the medium. Under certain conditions, incubation was performed for growth of Bacteria Lactobacilli bacteria incubation at 37° C in anaerobic conditions within 72 hours. Counting Bacteria in petri dishes was done by colony counter. Calculate the number of Bacteria was adjusted to 1 g sample.

Plasma collection and blood parameters

To evaluate the effects of using Cinnamon in the diet on blood serum parameters in 42^{nd} day, before slaughtering the chickens were taken blood and then slaughtering was done. Blood samples were then immediately transferred to the laboratory and samples were centrifuged at 3000 rpm for 20 min and plasma was separated and kept in the temperature -20 ° C followed by defrost by spectrophotometer model UNICO 2100 Vis made in South

Korea were tested. In order to measure glucose, cholesterol, Triglyceride, HDL and uric acid in blood plasma samples, enzymatic methods using commercial kits of Pars (Tehran-Iran) was tested.

Statistical design and data analysis

This study was conducted in a completely randomized design with five treatments and three replicates and ten observations at each of replications. For data analysis related to the immune system and intestinal microorganisms, SAS software, using the GLM procedure and Duncan test at 5% level of statistical comparison was used.

Results and discussion

The effect of Cinnamon powder and Cinnamon extract on the growth performance (Average daily gain, feed intake and feed conversion ratio) of broiler chicks is presented in Table 1. According to the results of this study, the feed intake, average daily gain and feed conversion ratio in the experimental treatment was significantly different ($P<0.05$). In 1-21 days the highest feed intake days was related to 200 ppm Cinnamon extract treatment and the lowest feed intake was related to 1.5% Cinnamon powder treatment. In 22-42 days the highest feed intake days was related to control treatment and the lowest feed intake was related to 1.5% Cinnamon powder treatment. In 1-42 days the highest feed intake was related to control treatment and the lowest feed intake was related to 1.5% Cinnamon powder treatment. In 22-42 days the highest average daily gain was related to 200 ppm Cinnamon extract treatment and the lowest average daily gain was related to 300 ppm Cinnamon extract treatment. In 22-42 days the highest average daily gain was related to 3.0% Cinnamon powder treatment and the lowest average daily gain was related to control treatment. In 1-42 days the highest average daily gain was related to 300 ppm Cinnamon extract treatment and the lowest average daily gain was related to control treatment. In 1-42 days the highest feed conversion ratio was related to 300 ppm Cinnamon extract treatment and the lowest feed conversion ratio was related to 1.5% Cinnamon powder treatment. In 22-42 days the highest feed conversion ratio was related to control treatment and the lowest feed conversion ratio was related to 1.5% Cinnamon powder treatment. In 1-42 days the highest feed conversion ratio was related to control treatment and the lowest feed conversion ratio were related to 1.5% Cinnamon powder and 300 ppm Cinnamon extract treatments. These results showed that extract oil derived from cinnamon in broiler diets improved body weight gain, feed intake and feed conversion ratio, which may be due to active materials (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) found in cinnamon, causing greater efficiency in the utilization of feed, resulting in enhanced growth. These results agree with the work of Lee *et al*. (2004b), who found that adding the cinnamon to the diet of broilers improved their growth performance.

Table 1. Effect of Cinnamon powder and Cinnamon extract on performance of broiler chicks (mg/dl)

Treatment	Control	1.5%	3.0%	[1] 200 ppm	300 ppm	SEM
Total feed intake, g/bird						
1-21 days	1064.33^{ab}	1035.67^{b}	1100.33^{ab}	1138.67^{a}	1096.67^{ab}	25.27
22-42 days	3457.33^{a}	3254.67^{b}	3383.33^{ab}	3262.33^{b}	3303.00^{ab}	51.39
1-42 days	4521.67^{a}	4290.33^{b}	4483.67^{ab}	4401.00^{ab}	4399.67^{ab}	58.00
Average daily gain, g/day/bird						
1-21 days	38.01^{b}	36.87^{b}	38.27^{ab}	38.54^{ab}	40.66^{a}	0.77
22-42 days	73.42^{a}	75.76^{a}	76.31^{a}	75.93^{a}	75.85^{a}	1.56
1-42 days	55.72^{a}	56.31^{a}	57.29^{a}	57.23^{a}	58.26^{a}	0.81
Feed conversion ratio, g/g						
1-21 days	1.18^{a}	1.17^{a}	1.21^{a}	1.23^{a}	1.15^{a}	0.03
22-42 days	2.45^{a}	2.10^{b}	2.17^{b}	2.14^{b}	2.13^{b}	0.04
1-42 days	1.81^{a}	1.64^{b}	1.69^{b}	1.68^{b}	1.64^{b}	0.01

Means with the same letter are not significantly different (P<0.05).

Based to the results of this study, the cholesterol concentration, triglyceride concentration, HDL concentration, LDL concentration and acid uric concentration in the experimental treatment was significantly different (P<0.05) but the glucose concentration in the experimental treatment was not significantly different (P>0.05). According to the results of this study, the glucose concentration in the experimental treatment was not significantly different (P>0.05). Lowest glucose was related to consumed 300 ppm Cinnamon extract treatment 1st to 42nd day and the highest amount of glucose were related to 200 ppm Cinnamon extract treatment. According to the results of this study, the cholesterol concentration in the experimental treatment was significantly different (P<0.05). Lowest cholesterol was related to 1.5% Cinnamon powder treatment and the highest amount of cholesterol were related to control treatment. According to the results of this study, the triglyceride concentration in the experimental treatment was significantly different (P<0.05). Lowest triglyceride was related to treatment consumed 300 ppm Cinnamon extract and the highest amount of triglyceride were related to control treatment. According to the results of this study, the HDL concentration in the experimental treatment was significantly different (P<0.05). Lowest HDL was related to control treatment and the highest amount of HDL was related to 300 ppm Cinnamon extract treatment. According to the results of this study, the LDL concentration in the experimental treatment was significantly different (P<0.05). Lowest LDL was related to treatment consumed 1.5% Cinnamon powder treatment and the highest amount of LDL were related to control treatment. According to the results of this study, the uric acid concentration in the experimental treatment was significantly different (P<0.05). Lowest uric acid was related to consumed 1.5% Cinnamon powder treatment and the highest amount of uric acid were related to control treatment. These observations are correlated with the data published by some authors (Panda *et al*., 2000; Kannan *et al*., 2005; Gudev *et al*., 2008).

Table 2. Effect of Cinnamon powder and Cinnamon extract on blood parameters of broiler chicks (mg/dl)

Treatment	Glucose	Cholesterol	Triglyceride	[1] HDL	LDL	Uric Acid
Control	153.33^{ab}	181.00^{a}	109.66^{a}	63.00^{b}	96.06^{a}	2.36^{a}
1.5% Cinnamon powder	149.00^{ab}	140.33^{c}	95.00^{ab}	70.66^{ab}	50.66^{c}	1.41^{b}
3.0% Cinnamon powder	162.00^{a}	170.33^{ab}	95.66^{ab}	64.33^{b}	86.86^{ab}	1.64^{b}
200 ppm Cinnamon extract	166.33^{a}	164.66^{b}	88.00^{bc}	69.66^{ab}	77.40^{b}	1.83^{ab}
300 ppm Cinnamon extract	140.66^{b}	144.00^{c}	75.00^{c}	74.66^{a}	54.33^{c}	1.62^{b}
SEM	5.34	3.75	4.49	2.95	3.63	0.17

Means with the same letter are not significantly different (P<0.05).

According to the results of this study, Lactobacilli and Escherichia Coli in the experimental treatment was significantly difference (P<0.05). Table 2 showed mean comparison of Lactobacilli in ileum which was significantly difference (P<0.05). The highest rate was related to 300 ppm Cinnamon extract treatment and the lowest mean was related to control treatment. The results from mean comparison of Escherichia Coli in ileum in was significantly difference (P<0.05). The highest rate was related to control treatment and the lowest mean was related to 1.5% Cinnamon powder treatment. Thus, Cinnamon extract derived from herbal plants could be considered as a potential growth promoter for poultry due to its digestive stimulating and antimicrobial effect.

Table 3. Effect of Cinnamon powder and Cinnamon extract on microbial population of broiler chicks (log 10)

Treatment	Lactobacilli	E.coli
Control	6.54^{c}	8.50^{a}
1.5% Cinnamon powder	7.61^{abc}	6.00^{c}
3.0% Cinnamon powder	7.39^{bc}	7.04^{b}
200 ppm Cinnamon extract	7.90^{ab}	6.62^{bc}
300 ppm Cinnamon extract	8.68^{a}	6.68^{bc}
SEM	0.34	0.27

Means with the same letter are not significantly different (P<0.05).

Reference

Botsoglou, N. A., Florou-Paner, P. Christaki, E. Fletouris, D. J and Spais, A. B. (2002). Effect of dietary oregano essential oil on performance of chickens and on iron-induced lipid oxidation of breast, thigh and abdominal fat tissues. British Poultry Science, 43: 223-230.

Cabuk, M., A. Alcicek, Bozkurt and N. Imre, 2003. Antimicrobial properties of essential oils isolated from aromatic plants and using possibility as alternative feed additives. 11. National Animal Nutrition Congress, pp: 184-187.

Charis, K. (2000). A novel look at a classical approach of plant extracts. Feed Mix (special issue on Nutraceuticals), 19-21.

Chickens, Physiol Res. 57: 12-3.

Fairchild, A.S., J.L. grimes, F.T. jones, M.J. wineland, F.W.Edens and A.E. Sefton. 2001. Effects of hen age, bio-mos. and flavomycin on poult susceptibility to oral Escherichia coli challenge. Poult. Sci. 80: 562-571.

Faixová, Z., S. Faix. 2008. Effect of Cinnamomum zeylanicum on oxidant status in broiler

Fuller, R. 1989. Probiotics in man and animals. J. Appl. Bacteriology. 66: 365-378.

Golian, A., and Salarmoeini, M. 1999. Poultry nutrition, Department of Agriculture, Economic Research and Training Unit of Kowsar.

Gudev, D., S. Popova-Ralcheva1, P. Moneva1 and M. Ignatova, 2008. Effect of the probiotic "Lactona" on some biological parameters and non specific resistance in neonatal pigs. Biotec. Anim. Husb., 24(1-2): 87-96.

Helicobater pylori. J. Ethnopharmacol. 67: 269-277.

Kannan, M., R. Karunakaran, V. Balakrishnan and T. G. Prabhakar, 2005. Influence of prebiotics supplementation on lipid profile of broilers. Intern. J. Poult. Sci., 4(12): 994-997.

Lee, K. W., Everts, H and Beyen, A. C. (2004a). Essential oils in broiler nutrition. International Journal of Poultry Science, 3(12): 738-752.

Lee, K. W., H. Everts, H. J. Kappert, H. Wouterse, M. Frehner and A. C. Beynen, 2004b. Cinnamonaldehyde, but not thymol, counteracts the carboxymethyl cellulose-induced growth depression in female broiler chickens. Intern. J. Poult. Sci., 3: 608- 612.

Leeson, S. and J. D. Summers., 2001. Nutrition of the chicken. University Books , Guelph, Canada.

Leitner, G., R. Waiman, and E. D. Heller. 2001. The effect of apramycin on colonization of pathogenic Escherichia coli in the intestinal tract of chicks. Vet. Q. 23:62–66.

McDonald, P., Edwards, R.A., Greenhalgh, J.F.D., Morgan, C.A., Sinclair, L.A. & Wilkinson, R.G., 2001. Animal Nutrition. Seventh ed., Prentice Hall, London.

Panda, A. K., M. R. Reddy, S. V. Rama Rao, M. V. L. N. Raju and N. K. Paraharaj, 2000. Growth, carcass characteristics, immunocompetence and response to *Escherichia coli* of broilers fed diets with various levels of probiotic. Archive fur Geflugelkunde, 64: 152 - 156.

Taback, M., R. Armon., and I. Neeman.1999. Cinnamon extracts inhibitory effect on