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Effects of Cinnamon (Cinnamomum zeylanicum) Bark Powder on Growth Performance, Carcass Fat and Serum Cholesterol Levels of Broiler Chicken

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Abstract: Objective of this study was to determine the effects of dietary cinnamon bark powder (CNPW) on growth performance, carcass fat and serum cholesterol levels of broiler chicken. Giving a completely randomize design, ninety broiler chicks in 30 pens received broiler finisher diets containing either 0% (control), 0.1, 0.2, 0.3 0.4 or 0.5% CNPW *ad libitum* from day 23-43. Dietary CNPW tend (p=0.09) to increase the feed intake and feed conversion ratio (FCR) but had no effects on final live weight, weight gain, visceral organ weight, and gizzard, cloaacl and total fat contents or serum cholesterol level. Dietary CNPW at 0.1 and 0.4% increased the abdominal fat content compared to control. It was concluded that dietary CNPW used has no growth promoting or fat reducing effects in broiler chicken.

Keywords: Broiler, cinnamon, growth, fat, cholesterol

Introduction

With the ban on the use of antibiotic as growth promotants, poultry industry is looking for alternatives. Meanwhile, due to the health risks associated with animal fat, consumers demand carcasses and poultry meat with less fat contents. In these circumstances, search for safe growth promotants and carcass modifiers has become a priority research area. Herbs, spices, and various plant extracts have been received particular attention as possible alternatives to antibiotic growth promotants (AGP), since they are considered natural products (Henandez *et al*., 2004). A range of phytogenic feed additives including thyme (*Thymus vulgaris*), clove (*Syzygium aromaticum*), turmeric (*Curcuma longa*), black pepper (*Piper nigram*), oregano (*Oregano vulgar*), garlic (*Alum sativa*), cinnamon (*Cinnamomom ceylanicum*), and Fenugreek (*Trigonella foenum graecum*) have been studied as phytogenic feed additives in poultry production.

Cinnamon (*Cinnamomum* zeylanicum) is a valued spice used all over the world. *C zeylanicum* is indigenous to Sri Lanka. In Ayurvedic and ethno-medicine various parts of the cinnamon are widely used. The main chemical constituents of Cinnamon in cynamaldehyde and euginol. Recent studies showed cinnamon powder, cinnamaldehyde alone or in combination with other essential oils have a wide array of beneficial effects in poultry. Some of those effects include increased feed intake (Al-Kassie 2009), improved performance and feed efficiency (Isabel and Santos,2009; Al-Kassie 2009 and Kamel, 2001), increased pancreatic and intestinal lipase activity (Kim *et al.,* 2010), increased breast meat yield (Isabel and Santos, 2009), improvement in health status (Al-Kassie, 2009 and Kamel 2001), protection against pathogens such as *Escherichia coli*, *Pseudomonas aeruginosa, Enterococus faecalis, Staphylococcus aureus, Staphylococcus epidermis*, *Salmonella sp*. *Helicobacter pylori* and *Parahemolyticus* (Chang *et al*., 2001 and Taback *et al*., 1999). Even in Sri Lanka, the world highest cinnamon producing country, cinnamon oil and cinnamaldehyde are too expensive to be used as a feed additive. Since cinnamon bark is relatively cheap and easily available, the present experiment evaluated the growth promoting and fat reducing effects of CNPW in broiler chicken.

Materials and Methods

Table 1. Ingredient composition and calculated nutrient contents of the basal diet

Ingredient	g/kg
Yellow maize	588
Rice bran	62
Soya bean meal	249
Coconut oil	35
Fish meal	39.5
DCP	12.3
$CaCo_3$	9
D Methionine	1
Salt	2
Vit min mix	2
Calculated nutrient contents	
CP %	199
ME (Kcal/kg)	3 106
Ca	9.0
Non phytase phosphorus	3.5
Lysine	11
Methionine + Cystein	7.7
Methionine	3.6
Crude fibre	37.7

Chicks were brooded on an electrical brooded for 10 days. Until day 22, Chicks were fed a commercial broiler starter diet. On day 22, 90 chicks were allocated into 30 floor pens (70cmx70cmx75cm) so that live weight variation among the pens are minimum. Pens were randomly allocated into replicates of five dietary treatments. Each pen had a feeder and a drinker. From day 23-43, birds were fed one of the five experimental diets containing either 0 (control), 0.1, 0.2, 0.3, 0.4 or 0.5% cinnamon bark powder *ad libitum*. Cinnamon bark was purchased from a local cinnamon peeler and ground. Except for energy (3100 Kcal ME/kg), control diet met the nutrient requirements as set out in NRC (1994) (Table 1). Daily feed and water intakes were taken. Serum cholesterol contents of six randomly selected birds from each pen were determined using a commercial assay kit (SPINREACT, S.A. Spain), on day 42. One randomly selected bird from each pen was killed by cervical dislocation on day 43 and dissected to determine internal organ weights and gizzard, abdominal, cloacal and total fat contents of the carcass. Data were analyzed as a completely randomize design with six replicates, using SAS. Significant means were compared using DMRT procedure.

Results and Discussion

Live weight on day 43 was not affected by dietary CNPW. Feed intakes of the broilers fed CNPW were tend to be (p=.0.09) higher than that of control group (Table 2). However, improved feed intake did not improve the FCR. The best FCR was reported by the birds fed CNPW free control diet. Furthermore, FCRs of the broilers fed CNPW were tend to be higher than the control group. While maintaining the weight gain more or less similar across the treatment, increased feed intake resulted in higher FCRs and vise versa. This observation clearly suggests that dietary CNPW used in this experiment had no positive effects on digestion and absorption process and/or nutrient utilization efficiency as shown by a number of other studies (Kamel, 2001) and Hernandez, et al. (2004).

In general, performance parameters of this study are contradictory to those of Al-Kassie, (2009) and Lee et al. (2004) who found improved performance in broilers fed diets supplemented with Cinnnamaldehyde. However it must be noted that both of the above studies used pure cinnamaldehyde whereas the present study used cinnamon powder. The effects of a feed additive depend on a range of factors including it's dose and the duration of the treatment. It may be a possibility that the CNPW levels or the duration of the feeding might not have been the optimum.

1. As a percentage of empty carcass Park (2008) showed that 3% but not 2 or 4 or 5% dietary CNPW improved the performance in broiler chicken. Meanwhile, Toghyani, (2011) has reported that 0.2 % dietary CNPW improved the performance of broilers when fed at least for four weeks. Feeding of higher levels of CNPW such as 2% may not be financial feasibility. Therefore, further research are needed to determine growth promoting effects of lower dietary levels given for longer period.

None of the visceral organ weights was affected by the dietary CNPW levels. Toghyani, (2011) Barreto et al. (2008) and Hernandaze et al. (2004) have also shown that dietary CNPW had no effects on internal organ weights.

Even though there was no effect on the cloacal, gizzard and total fat contents, the abdominal fat contents were affected by the dietary CNPW. Similarly, Rasika and Atapattu, (2012) have reported that dietary curry leaf powder had different effects on the fat deposition in different regions of the broiler carcass. However, the dietary CNPW levels used in this experiment increased the abdominal fat content. The abdominal fat content was lowest when birds were fed CNPW free diet. Meanwhile, birds fed 0.1% CNPW gave significantly higher abdominal fat content than those fed 0, 0.2 and 0.3 dietary CNPW fed birds. In contrast to above findings, Isabel and Santos (2009) have found no effect of feed additive containing cinnamaldehyde on abdominal fat contents. Interestingly, Though not significant, the total fat content of the broilers fed dietary CNPW was higher than control group

Rasika and Atapattu (2013) have also shown that dietary curly leaf powder at, 0.5, 1, 1.5 and 2% increased the total fat contents of the broiler carcass, compared to control birds.

Therefore, results of this experiment suggest that CNPW levels used in this experiment had no fat lowering effects in broiler chicken. However, as in the case with performance parameters, it would be interesting to investigate whether other doses and treatment durations have favorable effects on carcass fat.

In contrast to the findings of Ak-Kessie, (2009) the serum cholesterol levels were also not affected by the dietary CNPW.

It was concluded that dietary CNPW used in this experiment had no growth promoting or fat lowering effects in broiler chicken.

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Table 2
Effects of dietary cinnamon powder on growth performance, visceral organ weight, carcass fat and serum cholesterol contents of broiler chicken

Parameter	Level of dietary cinnamon						Pooled SEM	p value
	0	0.1	0.2	0.3	0.4	0.5		
Feed intake (g)								
23 - 43d	2144 b	2575 a	2338 ab	2573 a	2423 ab	2228 ab	122.44	0.09
Live weight (g)								
23d	817	812	797	808	827	791	17.48	0.73
43d	2101	2140	2090	2172	2237	2106	60.14	0.51
Weight gain (g)								
23 - 43d	1284	1328	1292	1363	1410	1314	56.35	0.62
Feed conversion ratio								
23 - 43d	1.67 b	1.93 a	1.82 ab	1.89 ab	1.72 ab	1.69 ab	0.08	0.09
Carcass parameters [1]								
Dressing %								
	78.5	84.33	75.66	81	78.83	82.5	3.00	0.39
Gizzard %								
	2.8	2.2	3.03	2.55	2.55	2.4	0.28	0.34
Liver %								
	2.65	3.08	3.17	3.06	3.05	2.85	0.25	0.71
Pancreas %								
	0.22	0.21	0.24	0.21	0.19	0.2	0.02	0.56
SI weight (g)								
	3.68	3.84	3.72	4.39	4.26	4.06	5.72	0.66
SI length								
	11.65	10	11.42	11.15	9.31	10.41	9.66	0.31
Gizzard fat %								
	0.97	1.12	1.46	2.55	1.03	0.72	0.22	0.27
Abdominal fat %								
	0.20 c	0.43 a	0.27 bc	0.28 bc	0.37 ab	0.33 abc	0.04	0.01
Cloacal fat %								
	1.81	2.23	2.11	2.07	2.12	2.31	0.21	0.66
Total fat %								
	2.99 a	3.79 a	3.85 a	3.20 ab	3.53 ab	3.37 ab	0.24	0.13
Serum cholesterol (mg/dl)								
	121	115	125	129	118	127	13.63	0.45