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308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorijps@gmail.com

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Antibiotic Effect of Polyphenolic Compound Extracted from Tamarind (*Tamarindus indica* L.) Seed Coat on Productive Performance of Broilers

W. Aengwanich[1], M. Suttajit[2], T. Srikhun[1] and T. Boonsorn[1]
[1]Stress and Oxidative Stress in Animal Research Unit, Faculty of Veterinary Medicine and Animal Science, Mahasarakham University, Maha Sarakham 44000, Thailand
[2]School of Science and Technology, Naresuan University Prayou, Muang District, Phayao 56000, Thailand

Abstract: An experiment was conducted to evaluate the effect of tamarind seed coat extract on the average daily weight gain, feed intake and feed conversion rate of broilers. Broilers were divided into 6 groups and received polyphenols from tamarind seed extract at 0 (control), 100, 200, 300, 400 and 500 mg/kg in their diets for 21 days. The results revealed the following information: During the period of 36-42 days of age, the average daily weight gain of broilers that received tamarind seed coat extract at 100 mg/kg in their diet was significantly higher than the weight gain of broilers that received tamarind seed coat extract at 0, 200, 400 and 500 mg/kg in their diets ($p<0.05$). Throughout the experimental period, the average daily weight gain tended to be highest in the group that received tamarind seed coat extract at 100 mg/kg in their diet. The feed intake and feed conversion rate of broilers in all groups were not significantly different ($p>0.05$). This study demonstrated that tamarind seed coat extract has a property similar to antibiotic feed additives and provides slightly improved average daily weight gain.

Key words: Tamarind (*Tamarindus indica* L.), polyphenols, anthrocyanidin, productive performance, broiler

INTRODUCTION

Antibiotic feed additives have been used for more than 50 years to enhance growth performance and prevent disease in livestock feeding environments. However, the current trend is to look for alternatives to antibiotic feed additives because of public concern about antibiotic residues in animal products and the potential evolving of antibiotic resistant bacteria. As a consequence, new commercial additives of plant origin, considered to be natural products that the consumer would accept, have been proposed to animal producers (Cabuk *et al*., 2006). At present, the use of antibiotics for broilers has been limited in the European Union to only 4 antibiotics that are not associated with human treatments. They are avilamycin (AB) and flavophospholipol, as growth promoter additives and salinomicin sodium and monensin sodium as coccidiostats (Hernandez *et al*., 2004). Useful antimicrobial phytochemicals can be divided into several categories: phenolics and polyphenols, terpenoids and essential oils, alkaloids, lectins and polypeptides (Cowan, 1999).

The tamarind (*Tamarindus indica* L.) is a tree-type of plant which belongs to the Leguminosae, caesalpiniaceae family. It is indigenous to tropical Africa but has become naturalized in North and South America from Florida to Brazil and is also cultivated in subtropical China, India, Pakistan, Indochina, Philippines, Java and Spain. Initially, the fruit shows a reddish-brown color that turns black or black brown, becoming more aromatic and sour on ripening. *T. indica* L. pulp fruit is used for seasoning, as a food component and in juices. (Komutarin *et al*., 2004). Pumthong (1999) reported that tamarind seed coat was composed of polyphenols including tannins, anthrocyanidin and oligomeric anthrocyanidins. Gu *et al*. (2003) found that the seed of tamarind contained 29.32 procyanidin oligomers and 101.89 g/kg high molecular weight tannins, respectively. Moreover, Tsuda *et al*. (1994) reported that tamarind seed coat contains phenolic antioxidants, such as 2-hydroxy-30, 40-dihydroxyacetophenone, methyl 3,4-dihydroxybenzoate, 3,4-dihydroxyphenyl acetate and epicatechin. Extracts exhibit antioxidant potential by reducing lipid peroxidation in vitro (Tsuda *et al*., 1993), and anti-microbial activity (De *et al*., 1999).

Knowledge about using polyphenols in tamarind seed coat extract as a feed additive for broilers is limited. The objective of this study was to investigate the effect of polyphenols in tamarind seed coat extract on the productive performance of broilers. Results from this preliminary study would provide fundamental knowledge for using the polyphenols from natural products as feed additives in the poultry production industry.

MATERIALS AND METHODS

Chemicals: Fresh tamarind fruits were purchased from a local market in Maha Sarakham Province, in the northeastern part of Thailand. The pericarp and seeds were carefully separated from the fruit. The seeds were heated in a hot air oven at 140°C, for 45 min, cooled and cracked to separate their outside brown layer. Only brown-red seed coats were collected and these were then ground into fine powder (Komutarin *et al*., 2004).

The polyphenols in the tamarind seed coat powder were extracted one time by using 95% ethanol as a solvent (1:5, w:v). Tamarind seed coat powder and ethanol were mixed and pH adjusted to 4 by using 5% acetic acid. The mixture rested at room temperature for 72 h (was shaken every 12 h) and the upper solution was collected for further processing. The high molecular weight tannin in the extract was precipitated by using protein from non-fat milk. The protein was prepared by mixing fresh non-fat milk with 5% acetic acid (5:1, v/v). It was then held at room temperature overnight and then the supernatant was discarded. The extracts with high molecular weight tannin and protein from non-fat milk were mixed, held at room temperature overnight and the upper solution was collected. The pH of the extract was adjusted to 6 by using 3M of NaOH, rested at room temperature overnight and the upper solution was collected. The polyphenols in the solution were dried by using a spray drying method. Total phenolic compounds in each gram of tamarind seed coat extract powder were analyzed by using the Folin-Ciocalteau method (Kahkonen *et al*., 1999).

Animal and experimental design: One hundred and eighty 1 day old broilers (Ross) (*Gallus domesticus*) were obtained from a local commercial farm near the laboratory of the Faculty of Veterinary Medicine and Animal Science, Mahasarakham University. The experiments were performed from October to December, 2008. The chickens were fed a standard ration. A completely randomized design was used. When they were 28-49 days old, they were divided into six groups. Each group had 3 replications (10 broilers/ replication) and received polyphenols from tamarind seed coat extract i.e., 0 (control group), 100, 200, 300, 400 and 500 mg/kg in diets (proximate composition of diet: CP = 21.8%, ME = 3,150 kcal/kg) *ad libitum* with continuous light and water supplies. The average daily weight gain and feed intake of broilers in each group were investigated. The feed conversion rate was calculated.

Statistical analysis: Data were analyzed by using of the ANOVA procedure. Means were separated by Duncan's multiple range tests. The level of significance was determined at $p<0.05$.

RESULTS AND DISCUSSION

The average daily weight gain, feed intake and feed conversion rate of broilers that received tamarind seed coat extract at 0, 100, 200, 300, 400 and 500 mg/kg in diets during the period of 28-49 days of age are presented in Table 1. During the period of 36-42 days of age, the average daily weight gain of broilers that received tamarind seed coat extract at 100 mg/kg in their diet was significantly higher than the average daily weight gain of broilers that received tamarind seed coat extract 0, 200, 400 and 500 mg/kg in their diets ($p<0.05$). During the entire experimental period, the average daily weight gain tended to be highest in the one group that received tamarind seed coat extract at 100 mg/kg in their diet, though the difference in weight gain between the groups was not significant ($p>0.05$). Throughout the experimental period, the feed intake and feed conversion rate of broilers in all groups were not significantly different ($p>0.05$).

Daniyan and Muhammad (2008) studied the effect of crude aqueous and ethanol extract of *Tamarinus indicus* L. as antibacterial; they found that the ethanol extracts produce strong antibacterial activity against *Escherichia coli*, *Klebsiella pneumoniae*, *Salmonella paratyphi A*, and *Pseudomonas aeruginosa*, but *Staphylococcus aureus* was resistant to the extracts. Further, they hypothesized that alkaloid, flavonoids, saponin and tannin in the extract were the active ingredients of this plant. The properties of the tamarind seed coat extract in this study show similar properties to antibiotic feed additives in that during the period of 28-49 days of age, the average daily weight gain of broilers that received tamarind seed coat extract at 100mg/kg in their diet was slightly higher than other groups.

Several studies have reported that tannin in the feed of experimental animals leads to decreased growth and

Table 1: Average Dairy Weight Gain (ADG), Feed Intake (FI) and Feed Conversion Rate (FCR) of broilers that received tamarind seed coat extract at 0, 100, 200, 300, 400 and 500 mg/kg in their diets

Parameters	Day of age	0	100	200	300	400	500	SEM
		---------- mg/kg ----------						
ADG	28-35	57.05	63.96	62.43	60.86	58.00	60.52	3.57
(g/day)	36-42	78.10^{b}	90.48^{a}	78.09^{b}	84.76^{ab}	76.19^{b}	79.05^{b}	3.01
	43-49	91.43	91.43	90.48	84.76	78.10	80.95	5.40
	mean	75.52	81.95	76.99	76.80	70.76	73.50	3.01
FI	28-35	100.00	97.18	102.86	101.90	82.86	100.00	4.87
(g/day)	36-42	142.86	150.48	147.62	140.95	128.57	140.00	4.81
	43-49	163.81	169.52	163.81	171.71	151.43	160.29	8.51
	mean	135.56	139.05	136.83	138.19	120.95	133.43	5.21
FCR	28-35	1.75	1.51	1.67	1.68	1.43	1.66	0.08
	36-42	1.84	1.66	1.89	1.67	1.70	1.78	0.10
	43-49	1.80	1.86	1.60	1.96	1.94	2.02	0.13
	mean	1.80	1.68	1.73	1.77	1.69	1.82	0.06

^{a} and ^{b}within row, mean with no common superscript differ significantly ($p<0.05$); SEM = standard error of the mean; ADG = average daily weight gain; FI = feed intake; FCR = feed conversion rate

body weight gain (Bennick, 2002). Moreover, the components of polyphenols from tamarind seed extract contain high molecular weight tannin (Sudjaroen *et al*., 2005). After broilers received tamarind seed coat extract at 200, 300, 400 and 500 mg/kg in their diets, their productive performance did not differ from that of the control group; however, the group that received tamarind seed coat extract at 100 mg/kg in their diets had an average daily weight gain that was higher than the control group. This study demonstrated that polyphenols from tamarind seed extracts prepared by precipitation with protein from non-fat milk and adjusted pH could reduce the effect of high molecular weight tannin to growth and body weight gain of broilers.

Conclusion: In conclusion, tamarind seed coat extract from this study showed properties similar to antibiotic feed additives in that the extract slightly improved average daily weight gain but did not affect the feed intake and feed conversion rate in broilers.

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