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The Effect of Dietary Inclusion of Herbs as Growth Promoter in Broiler Chickens

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Abstract: This study was undertaken to investigate the growth performances of fast growing birds fed with garlic, cinnamon and tumeric powder. Since, uses of antibiotics as growth promoter have been banned by the European Union, herbs or products containing plant extracts are using as alternative feed supplements in animal production. Garlic (*Allium sativum*), turmeric (*Curcuma Longa*) and cinnamon (*Cinnamomum verum*) have been widely used as medicinal and growth promoter purposes in animals. However, the information of the effect of these herbs on broiler production, especially under tropical environmental condition is still inadequate. About 240 days old chicks were randomly allocated to 10 treatment groups consisting of 3 replications of 8 chicks in each pen. The experimental groups were formulated consisting of non-supplemented (control) and supplemented diets. The groups were assigned to receive treatment diet as follows; garlic, turmeric and cinnamon were incorporated at three concentrations; 0.25, 0.5 and 1% into the basal diet (mash form). The overall body weight gain of broiler chickens fed with 0.25% turmeric, 0.5% garlic and 0.5% cinnamon found to be significant different compared with the control group. From the result of present study, it could be suggested that the use of powdered garlic (*Allium sativum*) as feed additive at level of 0.5% as it proved be significantly different in body weight gain and FCR compared with the control group.

Key words: Broiler chicken, cinnamon, garlic, growth performances, turmeric, Malaysia

INTRODUCTION

The use of antibiotics as Antimicrobial Growth Promoters (AGP) have been widely practised in animal production. The benefits of AGP in improving weight gain and feed efficiency of broiler chickens are well established (Feighner and Dashkevicz, 1987; Jukes and Williams, 1953; Butaye *et al*., 2003). However, the use of AGP can result in the development of drug-resistant bacteria (Alexander *et al*., 2008). Those resistant bacteria may infect humans via the food chain and thus it is a public health concern (Torres *et al*., 2010; Bekele and Ashenafi, 2010). This has led to the European Union ban of most antibiotics as AGP in animal production. Hence, an intensive search for alternatives such as organic acids, probiotics and prebiotics has started since a decade ago. Herbs and medicinal plants also present a potential alternative to AGP. Many plants have beneficial multifunctional aspects which are derived from their specific bio-active components. Herbs have been used for centuries to treat illness and improve health and still account for 80% of medical treatments in the developing world (Farnsworth *et al*., 1985). Herbs contain some complicated mixtures of organic chemicals that may vary depending upon many factors related to growth, production and processing of the herbal product. Though, herbs with antimicrobial, antipyretic, anti-inflammatory and immuno-reactive properties have been documented (Alade and Irobi, 1993; Brantner and Grein, 1994; Cowan, 1999; Guo *et al*., 2003), information on their use in poultry is lacking.

Garlic (*Allium sativum*), turmeric (*Curcuma longa*) and cinnamon (*Cinnamomum verum*) are widely used to cure and prevent diseases in human beings (Delaha and Garagusi, 1985; Somasundaram *et al*., 2002; Khan *et al*., 2003). Gujral *et al*. (2002) and Singh *et al*. (2009) reported better performances of broilers by feeding herbal products.

Findings from Fadlalla *et al*. (2010) showed that garlic at 0.3% in broiler feed resulted significant positive effect on broiler chickens' growth performance and carcass yield. Horton *et al*. (1991), Freitas *et al*. (2001) and Bampidis *et al*. (2005) has similar results in their study of broilers but they concluded that higher concentrations ranging 1 and 2% were actually more effective. At 4.5% content of commercial garlic in the chicken feed has no influence on growth and feed conversion. Doley *et al*. (2009) found that supplement of garlic and turmeric powder at 0.25% on the broilers' live weigh gain and feed intakes were not significantly differ as compared with the

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basal diet. On the contrary, Kumar *et al.* (2005) observed increased in weight gain in broiler chickens fed with turmeric at 1 g kg^{-1} of diet. However, Durrani *et al.* (2006) stated that lower supplementation of turmeric at the rate of 0.5% level resulted better feed efficiency.

A number of studies have been carried out to explore the effect of cinnamon in broiler feed. Chen *et al.* (2008) reported that broiler given cinnamon extract added diets performed better than the control. Essential oil derived from cinnamon had significant higher feed intake, body weight gain and feed conversion ratio compared with control group (AL-Kassie, 2009).

Although, many studies have been conducted with garlic, turmeric and cinnamon in broiler chicken diets, the results obtained from these studies were not consistent. Therefore, the objective of this study was to further confirm the effects of garlic, turmeric and cinnamon supplementation on the growth performance of broiler chickens raised under the hot, humid tropical condition.

MATERIALS AND METHODS

Source and preparation methods for diet: Garlic powder, dry turmeric rhizome fingers and cinnamon sticks were purchased from a local source. The turmeric rhizome fingers and cinnamon sticks were ground into powder and stored at 4°C until used.

Experimental birds and diets: The experiment was conducted on June 2010 at the Poultry Research Unit, Universiti Putra Malaysia. A total of 240 days old male broiler chicks (Cobb 500) were obtained from a local hatchery. Upon arrival the chicks were wing-banded, individually weighed and randomly assigned to 30 battery cages with wire floors in groups of eight. The cages were in a conventional open-sided house with cyclic temperatures (minimum, 24°C; maximum, 34°C). The relative humidity was between 80-90%. The area of each cage was 0.465 m^2.

Feed were provided *ad libitium* and lighting was continuous. The chicks were vaccinated against Newcastle disease on day 7th and 21st. Commencing from day 1, three cages of birds were assigned to one of the 10 dietary groups; basal diet (control), basal diet plus 0.25% garlic powder, basal diet plus 0.5% garlic powder, iv) basal diet plus 1% garlic powder, basal diet plus 0.25% turmeric powder, basal diet plus 0.5% turmeric powder, basal diet plus 1% turmeric powder basal diet plus 0.25% cinnamon powder, basal diet plus 0.5% cinnamon powder and basal diet plus 1% cinnamon powder. The chickens were fed starter (22.5% CP and 3025 kcal kg^{-1} ME) and finisher (19.5% CP and 3200 kcal kg^{-1} ME) diets from day 1-21 and 22-42, respectively. The diets were in mash form. Birds were weighed individually on day 1, 7, 14, 21, 28, 35 and 42.

Feed intake was recorded weekly and Feed Conversion Ratios (FCR) were calculated. All data were analyzed with the ANOVA procedure and differences among treatments mean were classified by Duncan's multiple range test (Version 6.0, SAS Institute Inc.) and $p<0.05$ was considered as significant.

RESULTS

Table 1 shows the body weight gain, feed intake and FCR data. During the starter and finisher phase, high feed intakes were observed at 0.25 and 0.5% garlic as compared with the broilers fed with control feed. From 1-21 days, broilers fed with 0.25 and 0.5% garlic grew faster than the broilers fed with control. In addition from 2-42 days, the chickens body weights were not affected by garlic treatment diets. Throughout the experimental period, the body weight of chickens fed with 0.5% garlic were higher than birds fed with control group. Overall, the chickens using ration supplemented with 0.5 and 1% garlic utilized their feed statistically ($p<0.05$) more efficiently than the control group.

Throughout the whole phase of experiment, chickens fed with turmeric diet has significant higher feed intake compared with control group. During the starter phase, the chicks highly consumed feed supplemented with 0.25 and 1% turmeric than chicks fed with control. The body weight of chicks fed with turmeric at 0.25 and 0.5% showed better results than 1% turmeric and control group. The chicks fed with turmeric at all three rations utilized their feed efficiently.

During the last 3 weeks of the trial, only turmeric at 0.25% has significant effect on body weight gain as compared with control group. The supplement of turmeric at all ration have no significant effect ($p<0.05$) on feed conversion ratio. From day 1 till 42 days, lowest ration of turmeric has significant effect on body weight gain as compared with control group. However, the feed conversion ration of diet containing turmeric at all ration were not affected during the whole experimental period. During the 1st 3 weeks of trial, the feed intake of chicks fed at three cinnamon rations were significantly lower than the control group. But during the last 3 weeks of trial, cinnamon at all ration have higher feed intake as compared with control group.

During the starter phase, body weight chicks grew faster with diet supplemented with cinnamon at 0.5 and 1%, however during the grower phase, only 0.25% of cinnamon has significant effect on body weight gain as

Table 1: Effects of dietary garlic, turmeric and cinnamon on feed intake, weight gain and feed conversion ratio of experimental birds

		Starter (1-21 days of age)			Grower (22-42 days)			Total phase (1-42 days of age)		
Types of herbs	Concentration (%)	Feed intake (g/bird)	Body weight gain	Feed conversion ratio	Feed intake (g/bird)	Body weight gain	Feed conversion ratio	Feed intake (g/bird)	Body weight gain	Feed conversion ratio
Garlic	0.25	956.34± 4.66^{a}	833.00± 16.43^{a}	1.15± 0.02^{b}	2879.57± 6.11^{d}	1510.52± 30.60^{b,c}	1.92± 0.04^{c-e}	3778.02± 11.80^{c,d}	2343.52± 41.17^{a-c}	1.62± 0.03^{c,d}
Turmeric		858.51± 10.60^{c,d}	760.54± 11.24^{b,c}	1.13± 0.02^{b,c}	3363.43± 59.8^{a}	1674.09± 30.06^{a}	2.01b± 0.04^{b-d}	4075.71± 41.12^{a}	2434.64± 31.96^{a}	1.68± 0.02^{c}
Cinammon		850.88± 17.11^{c,d}	741.34± 16.63^{c,d}	1.15± 0.02^{b,c}	3329.86± 32.78^{a}	1524.96± 44.08^{b,c}	2.22± 0.07^{a}	4064.86± 41.86^{a}	2266.3± 54.24^{b-d}	1.81± 0.04^{a}
Garlic	0.5	959.5± 7.44^{a}	802.63± 14.33^{a,b}	1.20± 0.02^{b}	2906.04± 52.21^{d}	1586.23± 39.03^{a,b}	1.86± 0.06^{d,e}	3667.66± 54.09^{d,e}	2388.86± 47.77^{a,b}	1.55± 0.04d
Turmeric		875.98± 8.74^{b}	760.96± 16.82^{b,c}	1.16± 0.02^{b}	3349.69± 27.96^{a}	1579.87± 32.39^{a,b}	2.14± 0.04^{a,b}	4105.01± 22.40^{a}	2340.8± 39.52^{a-c}	1.76± 0.03^{a-c}
Cinammon		842.83± 7.70^{d}	791.85± 15.54^{a,b}	1.07± 0.02^{c,d}	3396.50± 41.92^{a}	1675.20± 26.23^{a}	2.03± 0.03^{b,c}	4168.22± 17.2^{a}	2467.05± 36.12^{a}	1.69± 0.02^{b,c}
Garlic	1	835.05± 6.32^{d}	734.26± 20.2^{c,d}	1.16± 0.03^{b}	2922.78± 19.59^{c,d}	1607.87± 30.94^{a,b}	1.83± 0.03^{e}	3635.12± 6.38e	2342.13± 36.70^{a-c}	1.56± 0.02d
Turmeric		805.69± 1.93^{e}	706.05± 15.45^{d}	1.15± 0.02^{b,c}	3309.56± 81.83^{a}	1575.60± 47.56^{a,b}	2.13± 0.06^{a,b}	3910.91± 69.32^{b}	2281.65± 53.59^{b-d}	1.73± 0.04^{a-c}
Cinammon		791.71± 11.61^{e}	763.39± 16.29^{b,c}	1.04± 0.02^{c}	3097.28± 28.80^{b}	1421.13± 37.57^{c}	2.21± 0.05^{a}	3871.20± 41.30^{b}	2184.52± 47.71d	1.78± 0.03^{a,b}
Control	0	926.20± 3.26^{b}	706.24± 16.59^{d}	1.33± 0.03^{a}	2887.83± 24.14^{b,c}	1501.48± 42.17^{b,c}	2.05± 0.06^{a-c}	3874.47± 61.14^{b}	2207.71± 45.75^{c,d}	1.76± 0.04^{a-c}

$^{a-c}$Means within each column with no common superscript differ significantly ($p<0.05$)

compared with control group. Throughout the experimental period, diets supplemented with cinnamon at 0.25 and 0.5% were highly consumed by chicken as compared with control group. Chickens fed with cinnamon at 0.5% has significant high body weight gain compared with control group from day 1-42 days. Overall, the chicken fed with cinnamon at all ration did not utilized their diet efficiently as compared with control group.

DISCUSSION

As antibiotic growth promoters, herbs may control and contain the growth and colonization of various pathogenic microorganisms in the gut of chickens. This may enhance efficiency in the utilization of food and growth, concomitantly (Bedford, 2000). In the present study, the benefits of garlic, turmeric and cinnamon supplementation was more prominent during the starter phase (Table 1). According to Toghyani *et al.* (2011), nutrient requirements and utilization decreases with the age of birds. In their findings, the feed conversion ratio was calculated to be lower at 28 days period compared to feed conversion ratio at slaughter age.

The study showed that overall performances of 0.5 and 1% garlic improved body feed conversion ratios when compared to control group. This could be attributed to allicin, an organosulfur compound obtained from garlic which promotes the performances of the intestinal flora thereby enhance digestion and improved broiler growth (Pourali *et al.*, 2010). In agreement with the present study, a study reported that powdered garlic at 0.5% level may be incorporated as growth promoters in the ration of Japanese quails (Mahmood *et al.*, 2009). On the contrary, it has been reported that garlic supplementation at 0.2, 0.4, 0.6 and 1% (Freitas *et al.*, 2001; Demir *et al.*, 2003; Pourali *et al.*, 2010) had negligible influence on growth performance. Inconsistency result of our present findings and other findings (Javandel *et al.*, 2008; Demir *et al.*, 2003; Lewis *et al.*, 2003) might due to different preparation of garlic, source of garlic, diets, management and environmental condition (Pourali *et al.*, 2010).

During the starter phase, 0.25 and 0.5% turmeric chickens performed better body weight gain and high feed intake than 1% inclusion. However during the grower phase and overall period, only those fed 0.25% turmeric had greater body weight gain and higher feed intake. These findings are consistent with those of Panda *et al.* (2009) who reported that 0.25% inclusion of turmeric powder in the diet of broiler chickens significantly increased weight gain at 5 weeks.

Conversely, Shanthi *et al.* (2004) and Durrani *et al.* (2006) reported that supplementation of turmeric powder increased weight gain at 0.5%. However, irrespective of concentration, the present findings indicated that the feed conversion ratios of birds fed turmeric were not significantly different to those of controls. Similar results have been reported by Shanthi *et al.* (2004). Researchers found that 0.5% cinnamon was beneficial in improving body weight gain in overall performances when compared to controls. Similarly, Chen *et al.* (2008) and Park (2008) reported that cinnamon extract supplementation can improve the growth performance of broilers. A study done

by Toghyani *et al*. (2011) suggested that dietary inclusion of 2 g kg^{-1} cinnamon can be applied as alternative to in-feed antibiotic for broiler diets. However, the researchers used higher inclusion levels of cinnamon. The increased in body weight could be attributed to the antimicrobial properties of cinnamon that can enhance growth performance of chickens (Al-Kassie, 2009).

CONCLUSION

This study demonstrated that dietary supplementation of garlic, turmeric and cinnamon may improve the growth performance of broilers. Particularly inclusion of 0.5% garlic may have the potential to be alternative to antibiotic growth promoter for broiler chickens. Further investigations are required to determine the effect of garlic supplementation on health and well-being of broiler chickens under various conditions.

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