



RESEARCH PAPER

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Response of turmeric (*Curcuma longa*) extract on the growth performance and sensory evaluation of broilers

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Abstract

The widespread concern about the consumption of healthy foods from animal and plant sources directed research efforts on the utilization of herbal plants for animal feeding. The study aimed to determine the growth performance of broilers supplemented with turmeric extract at different levels as a supplement to drinking water. Two-hundred forty-head day-old chicks were distributed in five treatments replicated six times following the Randomized Complete Block Design. The different treatments were: T₀ – 2.5 ml of electrolytes per liter of water (Control); T₁ – 2.5 ml turmeric extract per liter of water; T₂ – 5 ml of turmeric extract per liter of water; T₃ – 7.5 ml of turmeric extract per liter of water and T₄ – 10 ml turmeric extract per liter of water in 35 days. The study showed that turmeric extract significantly reduced feed consumption and lower percent fat however, comparable performance was noted on the final weight, gain in weight, and feed conversion ratio.

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Introduction

Antibiotics at sub-therapeutic doses have been widely used in animal feed as growth promoters to enhance animal growth performance and production. In the presence of low levels of antibiotics, resistant cells survive and grow producing antibiotics resistant to a population in the final products. Therefore, the application of antibiotics as growth promoters in animal feed has been banned in the European Union since January 2006. As a result of this ban and growing pressure on livestock producers and other parts of the world, alternative substances and strategies for animal growth promotion and disease prevention are being investigated, among which phytogetic and herbal products have received increased attention since they have acquired more acceptability among consumers as natural additives.

Phytobiotics are substances obtained from medicinal plants and herbs that have a wide range of medicinal properties and are the best possible alternatives to antibiotics as growth promoters (Adel-Rahman *et al.*, 2014). Beneficial effects of bioactive plants in animal nutrition may include stimulating appetite and feed intake. It can also result in the improvement of indigenous digestive enzyme secretion, activation of immune responses, and antibacterial, antiviral, and antioxidant actions (Toghyani *et al.*, 2010, 2011).

Turmeric (*Curcuma longa*) is a tropical native plant and the main yellow bioactive substance isolated from the rhizomes of *Curcuma* is curcumin demethoxycurcumin and bisdemethoxycurcumin which is present to the extent of 2-3% of the total spice in turmeric powder. Curcumin is the main important bioactive ingredient responsible for the biological activity of *Curcuma*. Curcumin has been shown to have several biological effects, exhibiting anti-inflammatory, antioxidant (Nouzarian *et al.*, 2011), and hypolipidaemic (Ramirez-Tortosa *et al.*, 1999) activities. Curcumin has also been studied extensively as a chemo-preventive agent in several cancers (Duvoix *et al.*, 2005). Additionally, it has been suggested that curcumin possesses hepatoprotective, antitumor, antiviral, and anticancer

activity (Polasa *et al.*, 1991). It is used in gastrointestinal and respiratory disorders (Anwarul *et al.*, 2006). Based on chemical analysis, it contains oils including aromatic turmerone (25.3%), α -turmerone (18.3%), and curlone (12.5%). It is therefore imperative to investigate the use of *Curcuma longa* as a growth promoter for broilers.

The addition of turmeric extract in broilers did not affect the feed conversion ratio and abdominal fat content of broilers, however, turmeric extract improves the digestion and metabolism of fat leading to enhanced production of hemoglobin in broilers (Sugiharto, 2017). Higher body weight gain was found by AL-Sultan 2003 on those broilers given 0.25%, 0.5%, and 1% of turmeric than untreated birds and concluded that adding turmeric at level 0.5% enhances broilers' overall performance.

Material and methods

Two hundred forty-day-old broiler chicks were distributed at random in five treatments replicated six times following the Randomized Complete Block Design. The treatments are as follows:

T₀ - 2.5 ml of electrolytes per liter of water (Control)

T₁ - 2.5 ml of turmeric extract per liter of water

T₂ - 5.0 ml of turmeric extract per liter of water

T₃ - 7.5 ml of turmeric extract per liter of water

T₄ - 10 ml of turmeric extract per liter of water

Preparation of turmeric extract and the experimental ration

The cleaned and sliced turmeric rhizomes were extracted using an electric blender for the turmeric extract. The turmeric extract was strained in a clean cloth stocked in a clean container and stored in a refrigerator. Turmeric extract was added to plain water following the levels specific to each treatment for 35 days, and birds in the control group were provided with electrolytes.

Preparation of experimental cages and management practices

The experimental cages were cleaned by brushing the walls and flooring with soap and disinfected with the

use of disinfectant following the manufacturers' recommendation to prevent the growth and multiplication of diseases causing microorganisms. Cages were left for three days to eliminate the odor. Brooding cages were installed with an electric bulb as a source of heat during two weeks of the brooding period. Cleaned empty bags were placed at the sides of the cages to maintain the proper temperature and to prevent the birds from exposure to draft. The brooder floors were provided with rice hull as beddings and were changed every other day. Strict hygiene and sanitation were properly imposed and observed throughout the experiment.

Ad libitum feeding was employed in all treatments with pure commercial ration from brooding to 35 days old. A chick booster ration was given to the birds during the brooding period and was shifted to a starter ration thereafter. Mortality was noted from brooding to growing period.

Data gathered were analyzed using Analysis of Variance and differences among treatment means were determined using Duncan's Multiple Range Test.

Results and discussion

Growth performance of broilers

Weekly gain in weight (kg)

The weekly gain in weight of broilers is presented in Table 1. Analysis of variance revealed highly significant results on the first week gain in weight of broilers. Birds given 2.5 ml of electrolytes in the drinking water gained the highest weight (0.148 kg) than those birds supplemented with 2.5 ml (0.145 kg) of turmeric extract followed by those birds supplemented with 5 ml, 7.5 ml, and 10 ml turmeric extract. The gain in weight during the second week ranged from 0.163 to 0.175 kg. There was a slight increase in the 3rd week (0.27 kg to 0.30 kg), 4th week (0.38 to 0.42), and 5th week of age (0.42 kg to 0.51 kg).

Analysis of variance on the gain in weight of broilers revealed insignificant results. This implies that the weekly gain in weight of broilers was not significantly affected by the different levels of turmeric extract.

This indicates that the nutrient content and other bioactive compounds present in turmeric did not improve the growth rate of broilers in the second to fifth week of age.

Total gain in weight of broilers

The gain in weight of broilers is shown in Table 2. The result shows that the gain in weight ranges from 1.41 kg to 1.48 kg. Analysis of variance showed insignificant results. The result of the study contradicts the findings of Conley (1997) as cited by Herawati (2010) that ginger contains active compounds which are believed to stimulate the digestion process and conversion efficiency which increase body gain in weight.

Final weight of birds

Table 2 presents the final weight of broilers as affected by the different levels of turmeric extract. It was noted that the highest final weight was gained on those birds given 5 ml to 7.5 ml turmeric extract followed by those birds given 10 ml. However, the analysis of variance revealed insignificant results. The result indicates that the different levels of turmeric extract have not significantly influenced the final weight of broilers.

Feed consumption of birds

The feed consumption of broilers is presented in Table 3. The result shows that the birds in the control (2.5 ml electrolytes) consumed the most (2.75 kg) while the birds supplemented with 5.0 ml of turmeric extract consumed the least (2.54 kg).

Analysis of variance revealed significant results. Birds given 2.5 ml of electrolytes in the drinking water consumed significantly the highest which is comparable to those birds supplemented with 7.5 ml and 10 ml of turmeric extract. On the other hand, birds supplemented with 5 ml turmeric extract consumed the least which is significantly lower than those supplemented with 2.5 ml electrolytes and those supplemented with 7.5 ml turmeric extract but comparable to those supplemented with 2.5 ml and 10 ml turmeric extract. The result implies that the turmeric extract influenced the appetite of broilers, hence reducing feed consumption.

Table 1. Weekly gain in weight of broilers as affected by the different levels of turmeric extract in the drinking water of broilers (kg).

Treatments	Weeks				
	1**	2	3	4	5
2.5 ml electrolytes/li water	0.148a	0.163	0.29	0.38	0.45
2.5 ml turmeric extract /li water	0.145b	0.168	0.30	0.37	0.50
5 ml turmeric extract /li water	0.140c	0.158	0.27	0.42	0.42
7.5 ml turmeric extract /li water	0.140c	0.173	0.28	0.38	0.51
10 ml turmeric extract /li water	0.138c	0.175	0.27	0.41	0.46

**Means followed by the same letters are not significantly different at 0.01 levels (DMRT).

Table 2. Mean final weight and gain in weight of broilers as affected by the turmeric extract in the drinking water.

Treatments	Gain in weight (kg)	Final weight (kg)
2.5 ml electrolytes/li water	1.43	1.45
2.5 ml turmeric extract /li water	1.48	1.44
5 ml turmeric extract /li water	1.41	1.53
7.5 ml turmeric extract /li water	1.48	1.53
10 ml turmeric extract /li water	1.46	1.49

Table 3. Feed consumption and feed conversion ratio of broilers as affected by the different levels of turmeric extract in the drinking water.

Treatments	Feed consumption (kg)	Feed conversion ratio	Survival rate (%)
2.5 ml electrolytes/li water	2.75a	1.91	95.00
2.5 ml turmeric extract /li water	2.57bc	1.76	97.50
5 ml turmeric extract /li water	2.54c	1.86	97.50
7.5 ml turmeric extract /li water	2.69ab	1.78	91.25
10 ml turmeric extract /li water	2.63abc	1.80	93.75

All means followed by the same letter are not significantly different at 0.05 levels (DMRT)

Table 4. Dressing percentage and carcass characteristics of broilers as affected by different levels of turmeric extract in the drinking water (%).

Treatments	Dressing percentage (%)	Lean (%)	Fat (%)*
2.5 ml electrolytes/li water	78.43	50.68	1.26a
2.5ml turmeric extract/li water	77.97	49.77	1.15ab
5.0ml turmeric extract/li water	74.83	54.16	0.91bc
7.5ml turmeric extract/li water	78.65	55.46	0.82c
10ml turmeric extract/li water	78.40	51.59	0.85bc

*All means followed by the same letter are not significantly different at 0.05 levels (DMRT)

Table 5. Sensory evaluation of meat of broilers fed with different levels of turmeric extract in the ration.

Treatment	Characteristics				
	Eye appeal	Juiciness	Flavor	Palatability	General acceptability
2.5 ml electrolytes/li water	8.05a	7.95b	7.65	7.56	7.91abc
2.5 ml turmeric extract /li water	7.77b	7.69c	7.65	7.64	7.80c
5 ml turmeric extract /li water	7.97a	8.14a	7.78	7.68	8.01a
7.5 ml turmeric extract /li water	8.06a	7.97b	7.61	7.60	7.84bc
10 ml turmeric extract /li water	8.16a	7.74c	7.72	7.62	7.93ab

**Means followed by the same letters are not significantly different at 0.01 levels (DMRT). Legend: 8.1-9.0 (Like extremely), 7.1-8.0 (Like very much), 6.1-7.0 (Like moderately), 5.1-6.0 (Like slightly)

Feed conversion ratio

Table 3 presents the feed conversion ratio of broilers. The amount of feed to produce a kilogram gain in weight of broilers ranges from 1.76 to 1.91. Analysis of

variance revealed insignificant results. The result indicates that the amount of feed to produce a kilogram gain in the weight of broilers was not influenced or affected by turmeric extract.

Survival rate

Mortality of birds was recorded during the brooding period only which can be attributed to unavoidable circumstances. Table 3 shows the mortality expressed as survival rate. The highest survival rate of 97.50% or 2.5% mortality rate is obtained from birds given 2.5 to 5 ml turmeric extract. Analysis of variance failed to show significant differences. The mortality percentage is within the industry-acceptable level.

Dressing percentage and carcass characteristics

Table 4 presents the dressing percentage and carcass characteristics of broilers fed with varying levels of turmeric extract. The dressing percentage ranges from 74.83% to 78.65%. Analysis of variance revealed insignificant results.

In terms of carcass characteristics as reflected in percent lean, ranges from 49.77% to 55.46%. Analysis of variance revealed insignificant results. As regards percent fat, birds given turmeric extract had lower percent fat (0.82% to 1.15%) while those fed the control diet had 1.26% fat. Analysis of variance revealed significant results. It confirms the findings of Mehola and Moorthy (2008) that there was no significant impact of turmeric extract on the dressing percentage of broilers reared up to six weeks.

Comparison among treatment means on percent fat showed that birds given 5 ml to 10 ml turmeric extract registered significantly lower fat than those birds given 2.5 ml electrolytes but comparable to birds given 2.5 ml turmeric extract. The result implies that the carcass quality of birds given turmeric extract is significantly better than that of birds without turmeric.

As regards carcass quality as reflected by percent lean and percent fat, the result of the study confirms the findings of Samarasinghe, *et al.* (2003) which state that the broilers supplemented with 1 and 3 g/kg turmeric powder markedly reduced carcass fat content compared with the control group. It also confirms the findings of Emadi and Kermashasi (2006) who observed that the dietary inclusion of

turmeric powder (5 and 7.5 g/kg diet) in broilers significantly decreased abdominal fats. These results may be attributed to the role of curcumin which reduces the activity of enzymes in lipogenesis.

Sensory evaluation

The sensory evaluation was done involving 10 faculty, 10 non-teaching staff, 10 female students, and 10 male students as panel evaluators (Table 5). The member of the taste panel evaluated the cooked broiler meat and rated the product based on the Hedonic Scale.

The carcass characteristics in terms of eye appeal are presented in Table 5. Birds given 7.5 ml (8.06), 10 ml (8.16) turmeric extract, and 2.5 ml electrolytes (8.05) were rated "like extremely" while those given 2.5 ml turmeric extract (7.77) were rated "like very much". Analysis of variance revealed highly significant results. This implies that the eye appeal of the carcass of broilers supplemented with 2.5 ml electrolyte and 5 ml, 7.5 ml, and 10 ml turmeric extract are significantly better than those birds given with 2.5 ml turmeric extract.

The juiciness of the meat of broilers as affected by the different levels of turmeric extract in the drinking water is presented in Table 5. Birds given with 5ml turmeric extract (8.14) were rated "like extremely" while birds given 2.5 ml electrolytes (5.95), 2.5 ml (7.69), and 7.5 ml (7.97). 10 ml (7.74) turmeric extract was rated "like very much". Analysis of variance revealed highly significant results. The juiciness of broiler meat given with 5 ml turmeric extract was significantly better than those given with 2.5 ml electrolytes, 2.5 ml, 7.5 ml, and 10 ml turmeric extract. This implies that the best level of turmeric extract in terms of the juiciness of meat is 5 ml turmeric extract.

Table 5 presents the flavor of broiler meat given with different levels of turmeric extract. The rating based on the Hedonic scale for sensory evaluation ranged from 7.61 to 7.78, rated "like very much". Analysis of variance revealed insignificant results. It implies that

the flavor was not affected by the turmeric extract. Similarly, the palatability of broiler meat as affected by different levels of turmeric extract based on the Hedonic Scale for sensory evaluation ranged from 7.56 to 7.68 rated "like very much". Analysis of variance showed insignificant results.

Table 6. Profit above feed, medicine, and stock costs of broilers as affected by different levels of turmeric extract in the drinking water (P).

Treatments	Mean
2.5 ml electrolytes/li water	18.99
2.5 ml turmeric extract /li water	18.30
5.0 ml turmeric extract/li water	20.33
7.5 ml turmeric extract /li water	22.01
10 ml turmeric extract/li water	21.91

In terms of general acceptability, birds given 5 ml turmeric extract were rated "like extremely" (8.01) comparable to those birds given 10 ml (7.93) and 2.5 ml electrolytes (7.91) rated like very much followed by those birds given 7.5 ml (7.84) and 2.5 ml turmeric extract (7.80). Analysis of variance revealed significant results.

Profit above feed, medicine, and stock costs

The profit above the feed, medicine, and stock costs is shown in Table 6. The result shows that the profit ranged from PhP 18.30 to 22.01. Analysis of variance showed insignificant results.

Conclusion

Supplementation of turmeric extract in the drinking water of broilers significantly affects the feed consumption and carcass characteristics of broiler meat on percent fat whereas this extract did not improve the final weight, gain in weight, feed conversion ratio and profit above the feed, medicine, and stock cost of broilers. Based on the result of the study, levels of turmeric extract from 1% to 3% can be used as a supplement in the drinking water of broilers.

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