



## RESEARCH PAPER

## OPEN ACCESS

## Powdered turmeric (*Curcuma longa*) as feed supplement for broilers: its effect on growth parameters and meat acceptability

Medelyn A. Aglipay<sup>\*1</sup>, Cynthia M. Rodriguez<sup>2</sup>, Lydia P. Libunao<sup>2</sup>, Pepito V. Hufalar<sup>2</sup>, Eufemio O. Sagun<sup>2</sup>

<sup>1</sup>Research Unit, Don Mariano Marcos Memorial State University-North La Union Campus, Bacnotan, La Union, Philippines

<sup>2</sup>College of Agriculture, Don Mariano Marcos Memorial State University-North La Union Campus, Bacnotan, La Union, Philippines

**Key words:** Phytobiotics, Turmeric, Broiler, Growth enhancer, Performance, Alternative, Feed conversion ratio

<http://dx.doi.org/10.12692/ijb/21.4.142-148>

Article published on October 20, 2022

### Abstract

The study determined the growth performance and meat sensory evaluation of broilers using different levels of turmeric (*Curcuma longa*) powder as feed supplement. Analysis of Variance in Randomized Complete Block Design (RCBD) was used to determine significant differences among treatment means and further tested using Duncan's Multiple Range Test (DMRT). Four treatments consisted of T<sub>0</sub> – pure commercial ration + 2.5ml electrolytes added to the drinking water; T<sub>1</sub> - 1% turmeric powder per kg of commercial feeds; T<sub>2</sub> – 2% turmeric powder; and T<sub>3</sub> – 3% turmeric powder, were administered to 160 day-old broiler chicks. Different levels of turmeric powder (1%, 2% and 3%) significantly increased the final weight, gain in weight, feed conversion ratio and lower percent fat in the carcass, while other parameters were found comparable with the birds given commercial ration. Sensory evaluation of broiler meat in terms of eye appeal, juiciness, palatability and general acceptability rated “like very much” which ranged from 7.10 to 8.0. Supplementation of turmeric powder in the broiler diet at a rate of 1 to 3% per kilogram of feeds can be used as growth enhancer for broilers.

\* Corresponding Author: Medelyn A. Aglipay ✉ [maglipay@dmmmsu.edu.ph](mailto:maglipay@dmmmsu.edu.ph)

## Introduction

Big challenge to poultry scientist today is to find out new alternatives to antibiotic as growth enhancer with no side effects that could be as effective against harmful microorganisms, promote faster growth, improve feed conversion rate, enhance immunity of poultry but still have safe for human consumption. Phytobiotics are substances obtained from herbs and spices are the best possible alternatives to antibiotics as growth promoter (Adel-Rahman *et al.*, 2014). Several studies indicate that herbs are important in sustainable poultry production because they are cost-effective, easily available and with no residual effect. The beneficial effects of those herbs on poultry production is to improve the performance because of the natural health benefits including anti-microbial, anti-parasitic, anti-viral, anti-oxidant properties and stimulate the immune system (Odoemelam *et al.*, 2013). Some of those herbs that contain active compounds that help improve the growth performance of poultry production is turmeric.

Turmeric (*Curcuma longa*) belongs to family Zingiberaceae a bright yellow-orange (so-called curcumin) spice commonly used in curries and sauces (Khan *et al.*, 2012). The spice has been used for its medicinal, anti-inflammatory and anti-oxidant (Tayyem *et al.*, 2006). Turmeric can be fed to animals as well as human because of its anti-oxidant, pain relieving, anti-viral and anti-bacterial content. It is the most active compound and scientifically proven as one of the most effective nutritional supplement (<https://www.turmericlife.com.au/>). Because of its antioxidant content, antibacterial, anti-inflammatory and antiviral properties, turmeric is an excellent feed additive used for animal nutrition (Dono, 2013).

Supplementation of turmeric rhizome powder in broiler ration reduced the mortality rate due to ascites and serum on blood pH, pO<sub>2</sub>, no effect on heart weight, right ventricle, left ventricle and all relative to total live weight (Daneshyar *et al.*, 2012).

Compared to commercial antibiotic, turmeric is natural, non-toxic and used as food additives which consist of carbohydrates (69.4%), protein (6.3%), fat

(5.1%), minerals (3.5%) and moisture (13.1%). It is also a good source of phenolic compounds (curcumin, demethoxycurcumin, bisdemethoxy curcumin and tetrahydrocurcumin metabolites (Sandur *et al.*, 2007). Mondal *et al.* (2015) reported that the inclusion of turmeric powder enhances the growth performance of broilers in terms of body weight, gain in weight, improves the feed consumption, survivability, slightly increases the carcass traits, decreases (p<0.01) abdominal fat pad and significantly increases (p<0.05) dressing yield. The use of turmeric and ginger at 1.5% level improved the general health status, specifically the hematological values. Further, the level of stress of broilers was reduced (Maksudi *et al.*, 2020). Similarly, Salah *et al.* (2019) concluded that dietary curcumin increases the body weight and carcass yield and meat of heat-stressed broilers. Broilers given herbal combination (curcumin, carvacrol, thymol, cinnamaldehyde) have shown an improved meat quality, lower bacterial and coccidial load (Galli *et al.*, 2020).

The present study tested turmeric as feed supplement to broilers in terms of growth performance and feed conversion ratio.

## Materials and methods

The study was conducted following the Randomized Complete Block Design (RCBD). The four treatments were laid out randomly and replicated four times.

T<sub>0</sub>–Commercial Ration + 2.5ml of commercial antibiotic /liter of water (Control)

T<sub>1</sub>–Commercial Ration + 1% turmeric powder/kg of feeds

T<sub>2</sub>–Commercial Ration + 2% turmeric powder/kg of feeds

T<sub>3</sub>–Commercial Ration + 3% turmeric powder/kg of feeds

### *Preparation and Administration of Turmeric Powder*

Turmeric rhizomes were cleaned of debris, washed, sliced and sundried for 3-5 days. After drying, these were powdered and stored properly in a polyethylene bag. Turmeric powder was added to the commercial ration of broilers following the amount specified in each treatment. The experimental rations were given to the birds from brooding until 35 days old.

Birds in control group were provided with pure commercial ration and 2.5 ml electrolytes as drinking water during brooding period.

#### *Broiler Ration*

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

#### *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 disease-causing microorganisms. Cages were left for three days to eliminate the odor of disinfectant. Brooding cages were installed with electric bulbs to provide heat during the entire two weeks of brooding period. Clean empty bags were placed at the sides of the cages to maintain 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 was properly imposed and observed throughout the experiment.

Data gathered were the following:

*Initial weight (kg)*: This was taken by weighing the birds at day one before placing them in their respective cages.

*Final weight (kg)*: This was taken by weighing the birds at 35<sup>th</sup> day.

*Gain in weight (kg)*: This was taken by subtracting the initial weight of birds from the final weight.

*Feed Consumption (kg)*: This was obtained by summing up the daily feed intake of broilers from day one to 35<sup>th</sup> day.

*Water Consumption (li)*:

This was taken by summing up the total amount of water consumed from brooding to 35<sup>th</sup> day.

*Mortality Rate (%)*:

This was computed by dividing the total number of dead birds by the total number of birds at the start of the study multiplied by 100%.

*Dressing Percentage (%)*:

This was obtained by dividing the dressed weight by the birds' live weight, multiplied by 100%.

$$DP (\%) = \frac{\text{Dressed Weight (kg)}}{\text{Live weight (kg)}} \times 100\%$$

*Feed Conversion Ratio (FCR)*:

This was computed by dividing the total amount of feed consumed by the total gain in weight.

*Leaf Fat (%)*:

This was obtained by dividing the total leaf fats by total dressed weight, multiplied by 100%.

*Percent Lean Meat (%)*:

This was obtained by dividing the total leaf fats by total dress weight multiplied by 100%.

*Profit above feed, supplement and stock cost*:

This was taken by subtracting the cost of feed, medicine, and stock cost from the sale value of birds at the end of the study.

*Statistical analysis*

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

## **Results**

### *Growth performance*

#### *Gain in Weight*

For the gain in weight of broilers (Table 1) the highest gain in weight was obtained by birds fed with 3% turmeric powder with a mean of 1.57kg while the lowest was obtained by broilers fed with the control diet (no turmeric powder) 1.41kg. Analysis of variance revealed significant results.

#### *Final Weight*

Birds given 3% turmeric powder obtained the highest final weight with a mean of 1.60kg while the birds fed with the control ration obtained the lowest final weight (1.46kg) (Table 1).

Analysis of variance revealed significant results. Comparison of treatment means (DMRT) showed that the final weights of birds fed with 1% to 3% turmeric powder are comparable with each other.

**Table 1.** Final weight and gain in weight of broilers fed with different levels of turmeric powder (kg).

Treatment	Total Gain in Weight (kg)*	Final Weight (kg)*
Pure commercial ration	1.41 <sup>b</sup>	1.46 <sup>b</sup>
1% Turmeric powder	1.48 <sup>ab</sup>	1.52 <sup>ab</sup>
2% Turmeric powder	1.50 <sup>a</sup>	1.55 <sup>a</sup>
3% turmeric powder	1.57 <sup>a</sup>	1.60 <sup>a</sup>

\*Means followed by the same letter are not significantly different at 0.05 levels (DMRT).

#### Feed Consumption

Table 2 shows that the feed consumption of broilers ranges from 2.61 to 2.84kg. Analysis of variance revealed insignificant result indicating that turmeric powder did not affect the palatability of the feeds.

**Table 2.** Feed consumption, feed conversion and profit of broilers fed with different levels of turmeric powder.

Treatment	Feed Consumption (kg)	Feed conversion ratio *	Profit (P)
Commercial ration	2.84	2.01 <sup>a</sup>	18.75
1% Turmeric powder	2.61	1.67 <sup>b</sup>	17.73
2% Turmeric powder	2.78	1.85 <sup>ab</sup>	20.05
3% turmeric powder	2.83	1.92 <sup>ab</sup>	20.95

\*Means followed by the same letter are not significantly different at 0.05 levels (DMRT).

#### Feed Conversion Ratio

Table 2 shows that the best feed conversion ratio was obtained by broilers fed with 3% turmeric powder (1.67) while the poorest was registered by birds fed with the control ration (2.01). Analysis of variance revealed significant result.

#### Profit above Feed, Supplement and Stock Cost

The profit above feed, supplement and stock cost ranged from Php 17.73 to Php 20.95 (Table 2). Analysis of variance revealed insignificant results which implies that the profit was not significantly influenced by the different levels of turmeric powder.

#### Dressing Percentage and Carcass Characteristics

The dressing percentage ranges from 77.58% to 82.52% (Table 3). Analysis of variance revealed insignificant result.

In terms of carcass characteristics as reflected in percent lean and percent fat, birds fed with turmeric had higher percent lean (59.62% to 61.04%) than the control diet (55.69%) and significantly lower percent fat (0.87% to 1.13%) than those birds fed with no turmeric added (1.40%). Analysis of variance on both percent lean and percent fat revealed significant result.

**Table 3.** Dressing percentage and carcass characteristics of broilers fed with different levels of turmeric powder.

Treatment	Dressing %	Lean % *	Percent fat **
Commercial ration	77.58	55.69 <sup>b</sup>	1.40 <sup>a</sup>
1% turmeric powder	83.06	60.70 <sup>a</sup>	1.13 <sup>ab</sup>
2% turmeric powder	82.47	59.62 <sup>a</sup>	0.92 <sup>b</sup>
3% turmeric powder	82.52	61.04 <sup>a</sup>	0.87 <sup>b</sup>

\*Means followed by the same letters are not significantly different at 0.05 levels (DMRT).

#### Sensory Evaluation

The sensory evaluation was done involving 10 faculty members, 10 non-teaching staff, 10 female students and 10 male students as panel evaluators. The members of the taste panel evaluated the cooked broiler meat and rated the product based on Hedonic Scale. Table 4 presents the sensory evaluation of meat of broilers fed with different levels of turmeric powder. Result showed that the meat of broilers in all the experimental birds had a mean score ranging from 7.10-7.19 with a description rating of "like very much" on eye appeal. On the juiciness of meat, result showed that birds given 1% to 3% turmeric powder had mean scores ranging from 7.18-7.27 and a description rating of "like very much". Meat of broilers with no turmeric powder had a description rating of "like moderately" and mean score of 6.84. In terms of flavor, broilers given 1% turmeric powder obtained a mean of 7.08 with a descriptive rating of "like very much" Broilers given 1%, 2% and 3% turmeric powder had mean scores ranging from 6.62

to 6.90 had a descriptive rating of “like moderately”. On palatability of meat, broilers fed with 3% turmeric powder and pure commercial ration were rated “like moderately”, with mean scores ranging from 6.88 to 6.94. The meat of broilers fed with 1% and 2% turmeric powder were rated “like very much”. In terms of general acceptability, evaluators preferred the meat of broilers given 2% and 3% turmeric powder with a mean score of 7.33, followed by the birds fed with 1% turmeric powder and birds fed with commercial ration (7.08) were rated “like very much”, respectively. Although numerical differences can be noted, the analyses of variance were found comparable.

**Table 4.** Sensory Evaluation of meat of broilers fed with different levels of turmeric powder in the ration.

Treatment	Characteristics				
	Eye Appeal	Juiciness	Flavor	Palatability	General Acceptability
No Turmeric	7.10	6.84	6.62	6.94	7.08
1% TP	7.14	7.26	7.08	7.07	7.24
2% TP	7.41	7.27	6.90	7.02	7.33
3% TP	7.19	7.18	6.75	6.88	7.33

Legend:

8.1-9	Like Extremely
7.1-8	Like Very Much
6.1-7	Like Moderately
5.1-6	Like Slightly
4.1-5	Neither Like/Dislike
3.1-4	Dislike Slightly
2.1-3	Dislike Moderately
1.1-2	Dislike Very Much
1.0-1	Dislike Extremely

## Discussion

The study revealed that the gain in weight of broilers fed with 2% and 3% turmeric powder was significantly higher than those fed with the control diet. The result implies that the gain in weight of broilers was improved by the inclusion of 2% and 3% of turmeric powder in broiler ration. The result conforms with the findings of Durrani *et al.* (2006) that the inclusions of 5g turmeric powder per kg of feed significantly increase the body weight of broilers. The significant improvement of the gain in weight of broilers may be attributed to the antioxidant activity of curcuma longa at level 2% and 3% of turmeric that improved the protein synthesis through enzymatic system.

Similarly, the final weight of birds fed with 2% and 3% turmeric powder is significantly higher than the control diet (no turmeric powder). As reported by Baghban *et al.* (2016), supplementation of turmeric, cinnamon and their combination improved the performance of broilers in terms of body weight and feed intake under heat stress by reducing lipid peroxidation. Gouda *et al.* (2018) mentioned that turmeric meal as supplementation enhanced the growth rate and body weight of broilers. Al-Suntan (2003) found out that birds fed with 0.5% turmeric meal gained higher weight followed by 0.25% and 1 % level.

Feed conversion ratio of broilers showed that the amount of feeds to produce a kilogram gain weight fed with 3% turmeric powder was significantly better than those fed with the control ration; however, it is comparable to those birds fed with 1% and 2% turmeric powder. The result implies that turmeric powder at 3% level improved the feed conversion ratio of broilers. The result confirms the findings of Lawhavit *et al.* (2010) reported that the improved feed conversion ratio of birds fed with turmeric powder could be attributed to the claim that turmeric exhibited a potential to prevent some of the pathogenic bacteria on chicken. Hence, like antibiotics, yellow ginger could limit and control the growth and colonization of numerous pathogenic and non-pathogenic species of bacteria in chicken gut resulting to balanced gut, a microbial ecosystem which leads to better and improved feed conversion ratio.

The feed consumption of broilers was similar to the findings of Hosseini-Vashan *et al.* (2012) that dietary turmeric rhizome powder did not affect the feed intake of broilers and dressing percentage. However, the dietary levels of turmeric rhizomes extract (TRE) fed with corn-soybean basal diet supplemented with 100, 200 and 300mg/kg turmeric rhizome extract had a better FCR and reduced abdominal fat as compared to the control group and enhanced antioxidant capability, growth performance and breast muscle weight ratio as mentioned by Wang *et al.* (2015). Comparison among treatment means showed that the percent lean and percent fat of

broilers fed dietary turmeric powder were comparable with each other but significantly lower than those fed no turmeric. The result implies that the carcass qualities of birds fed with turmeric are better than those birds without turmeric. Regarding carcass quality as reflected by percent lean and percent fat, the result of the present study confirms the findings of Samarasinghe *et al.* (2003) that broilers supplemented with 1 and 3g/kg of turmeric powder reduced carcass fat content as compared with the control group.

Emadi and Kermashasi (2006) recorded that the dietary inclusion of 5 and 7.5g/kg of turmeric powder in the diet significantly lessened or reduced the abdominal fats of broilers. Sugiharto *et al.* (2020) reported that administration of herb like turmeric can improve carcass and meat quality of broilers thus, reduced abdominal fat deposition. These results may be attributed to the role of curcumin which reduces the activity of enzymes in lipogenesis, wherein the molecule participates in converting lipid for storage fat.

### Conclusion

In conclusion, significant effect of turmeric powder at a rate of 1-3% as supplement to commercial ration can improve the gain in weight, better feed conversion ratio and carcass characteristics of broilers.

### Acknowledgement

The authors acknowledge the Don Mariano Marcos Memorial State University, thru the Office of the Vice-President for Research and Extension, for funding this research.

### References

**Abdel-Rahman HA, Fathallah SI, Helal AA, Abdel-Nafeaa A, Zahran IS.** 2014. Effect of turmeric (*Curcuma longa*), fenugreek (*Trigonella foenum-graecum* L.) and/or bioflavonoid supplementation to the broiler chicks' diet and drinking water on the growth performance and intestinal morphometric parameters. *Global Veterinaria* **12(5)**, 627-635.

**Al-Sultan SI.** 2003. The effect of *Curcuma longa* (Turmeric) on overall performance of broiler chickens. *International Journal of Poultry Science* **2(5)**, 351-353.

**Baghban Kanani P, Daneshyar M, Najafi R.** 2016. Effects of Cinnamon (*Cinnamomum zeylanicum*) and Turmeric (*Curcuma longa*) powder on performance, enzyme activity and blood parameters of broiler chickens under heat stress. *Poultry Science Journal* **4(1)**, 47-53.

**Daneshyar M, Kermanshahi H, Golian A.** 2012. The effects of turmeric supplementation on antioxidant status, blood gas indices and mortality in broiler chickens with T<sub>3</sub>-induced ascites. *British Poultry Science* **53(3)**, 379-385.

**Dono ND.** 2013. Turmeric (*Curcuma longa* Linn.) supplementation as an alternative to antibiotics in poultry diets. *Indonesian Bulletin of Animal and Veterinary Sciences* **23(1)**, 41-49.

**Durrani FR, Ismail M, Sultan A, Suhail SM, Chand N, Durrani Z.** 2006. Effect of different levels of feed added turmeric (*Curcuma longa*) on the performance of broiler chicks. *Journal of Agricultural and Biological Science* **1(2)**, 9-11.

**Emadi M, Kermanshahi H.** 2007. Effect of turmeric rhizome powder on immunity responses of broiler chickens. *Journal of Animal and Veterinary Advances* **6(7)**, 833-836.

**Galli GM, Gerbet RR, Griss LG, Fortuoso BF, Petrolli TG, Boiago MM, Souza CF, Baldissera MD, Mesadri J, Wagner R, da Rosa G, Mendes RE, Gris A, Da Silva AS.** 2020. Combination of herbal components (curcumin, carvacrol, thymol, cinnamaldehyde) in broiler chicken feed: Impacts on response parameters, performance, fatty acid profiles, meat quality and control of coccidia and bacteria. *Microbial Pathogenesis* 139. DOI: 10.1016/j.micpath.

**Hosseini-Vashan SJ, Golian A, Yaghobfar A, Zarban A, Afzali N, Esmaeilinasab P.** 2012. Antioxidant status, immune system, blood metabolites and carcass characteristic of broiler chickens fed turmeric rhizome powder under heat stress. *African Journal of Biotechnology* **11(94)**, 16118-16125.



- Khan RU, Naz S, Javdani M, Nikousefat Z, Selvaggi M, Tufarelli V, Laudadio V.** 2012. The use of turmeric (*Curcuma longa*) in poultry feed. *World's Poultry Science Journal* **68(1)**, 97-103.
- Lawhavinit O, Kongkathip N, Kongkathip B.** 2010. Antimicrobial activity of curcuminoids from *Curcuma longa* L. on pathogenic bacteria of shrimp and chicken. *Agriculture and Natural Resources* **44(3)**, 364-371.
- Maksudi M, Manin F, Wigati S, Insulistyawati A, Aziz N, Rahayu P.** 2020. Effect of curcumin (*Curcuma longa*) and red ginger (*Zingiber officinale*) on hematology values of broilers. *Agricultural Science* **2(2)**, 178-178.
- Manjunath GM, Bhandary YP.** 1998. Natural antibiotic effect of turmeric in poultry management. In: Annual Symposium, Nottingham (UK): Nottingham University Press **273**, p. 291.
- Mondal MA, Yeasmin T, Karim R, Siddiqui MN, Nabi SM, Sayed MA, Siddiky MNA.** 2015. Effect of dietary supplementation of turmeric (*Curcuma longa*) powder on the growth performance and carcass traits of broiler chicks. *SAARC Journal of Agriculture* **13(1)**, 188-199.
- Odoemelam VU, Etuk IF, Ndelekwute EK, Ekwe TCICC.** 2013. Herbs and spices: Options for sustainable animal production. *Journal of Biology, Agriculture and Healthcare* **3(7)**, 116-124.
- Salah S, Mahmoud MA, Ahmed-Farid OA, El-Tarabany MS.** 2019. Effects of dietary curcumin and acetylsalicylic acid supplements on performance, muscle amino acid and fatty acid profiles, antioxidant biomarkers and blood chemistry of heat-stressed broiler chickens. *Journal of Thermal Biology* **84**, 259-265.
- Samarasinghe K, Wenk C, Silva KFST, Gunasekera JMDM.** 2003. Turmeric (*Curcuma longa*) root powder and mannan oligosaccharides as alternatives to antibiotics in broiler chicken diets. *Asian-Australasian Journal of Animal Sciences* **16(10)**, 1495-1500.
- Sandur SK, Pandey MK, Sung B, Ahn KS, Murakami A, Sethi G, Limtrakul P, Badmaev V & Aggarwal BB.** 2007. Curcumin, demethoxycurcumin, bisdemethoxycurcumin, tetrahydrocurcumin and turmerones differentially regulate anti-inflammatory and anti-proliferative responses through a ROS-independent mechanism. *Carcinogenesis* **28(8)**, 1765-1773.
- Sugiharto S, Pratama AR, Yudiarti T, Wahyuni HI, Widiastuti E, Sartono TA.** 2020. Effect of acidified turmeric and/or black pepper on growth performance and meat quality of broiler chickens. *International Journal of Veterinary Science and Medicine* **8(1)**, 85-92.
- Tayyem RF, Heath DD, Al-Delaimy WK, Rock CL.** 2006. Curcumin content of turmeric and curry powders. *Nutrition and Cancer* **55(2)**, 126-131.
- Wang D, Huang H, Zhou L, Li W, Zhou H, Hou G, Liu J, Hu L.** 2015. Effects of dietary supplementation with turmeric rhizome extract on growth performance, carcass characteristics, antioxidant capability, and meat quality of Wenchang broiler chickens. *Italian Journal of Animal Science* **14(3)**, 3870.