ASSESSMENT OF GROWTH PERFORMANCE OF FINISHED BROILER CHICKENS FED SUPPLEMENTED GINGER MEAL AS A PHYTOBIOTIC FEED ADDITIVE

[1]NDAMS, Samuel Shehu, [2]DARE, Theophilus Aderemi and [2]ELAIGWU, Sunday
[1]Department of Animal Science, Ahmadu Bello University, Zaria, Nigeria.
[2]College of Agriculture and Animal Science, Ahmadu Bello University, Mando Road, Kaduna, Nigeria.

Corresponding Author: Ndams, S. S. Department of Animal Science, Ahmadu Bello University, Zaria, Nigeria. **Email:** samuelndams@gmail.com **Phone:** +234 808 618 3938

Received *May 14, 2024;* ***Revised*** *May 31, 2024,* ***Accepted*** *June 01, 2024*

ABSTRACT

A 28-day experiment was conducted to examine the effect of additive ginger meal (GM) as a phytobiotic in the diets of broiler chickens in terms of feed intake (FI), body weight gain (BWG) and feed conversion ratio (FCR). 96 four-weeks-old broiler chickens were assigned randomly to four dietary treatments each replicated thrice (eight birds per replicate). Four experimental diets were formulated with the control (D1) without GM (0%). Bird's group on diets D2, D3 and D4 were fed with GM supplemented at 0.1, 0.2 and 0.3% levels respectively. The FI of birds fed a 0.2% GM-supplemented diet was significantly higher (p<0.05) compared to birds fed 0, 0.1 and 0.3% GM-supplemented diets The BWG of birds fed a 0.2% GM-supplemented diet was significantly higher (p<0.05) compared to those on 0, 0.1 and 0.3% GM-supplemented diets. The BWG of birds fed 0.1 and 0.3% GM-supplemented diets were similar (p>0.05) but significantly lower (p<0.05) compared to control. The FCR of birds fed 0.2% GM-supplemented was statistically better (p<0.05) compared to those fed 0, 0.1 and 0.3% GM-supplemented diets. The FCR of birds fed 0.1% and 0.3% GM-supplemented diets were similar (p>0.05) but significantly (p<0.05) lower compared to the control diet. Feed cost (₦) per kg gain increases with increased levels of GM supplementation in the diets. It is concluded that the feeding of broiler finisher chickens with GM supplemented at 0.2% improves performance and can be a viable alternative to antibiotic feed additives in the diets of broiler finisher chickens.

Keywords: Antibiotic, Finished broiler, Feed intake, Feed conversion ratio, Feed cost, Ginger meal, Body weight gain, Phytogenic additive

INTRODUCTION

The use of in-feed antibiotics in many countries has been confined in recent years, and this has fueled the interest in the search and use of alternative products. The cognizance of numerous research today, therefore, has been on a group of natural products known as "phytobiotics" (Jacela *et al*., 2010). Phytobiotics or phytogenics are groups of natural growth promoters or non-antibiotic growth promoters used as feed additives derived from herbs, spices or other plants (Murugesan *et al.*, 2015). They have been known to potentially improve animal performance. Aside from having antimicrobial activity, the products have been identified to provide antioxidative effects, enhanced palatability, improve gut functions and promote growth (Murugesan *et al*., 2015). The natural and consumer-accepted phytobiotics feed additives used in the diets of farm animals include ginger, garlic, turmeric and Negro pepper (Azodo *et al.,* 2021).

Karangiya *et al.* (2016) observed significant improvement in both feed intake (FI) and body weight gain (BWG) of broiler chickens

when ginger and garlic were fed at a 1% level of inclusion in the diet compared to the control at the end of the finisher phase. Tekeli *et al.* (2011) observed improved BWG in broiler chickens fed ginger meal (GM) at the rate of 120, 240 and 360 ppm, while Zhang *et al.* (2009) did not find any significant difference in the average daily BWC of broiler chickens fed GM at 5 g/kg of diet. Therefore, the objective of this study was to examine the effect of GM-fed as a phytobiotics feed additive on the overall performance of broiler chickens at the finishing phase.

MATERIALS AND METHODS

Experimental Site: The research was conducted at the Poultry Unit of the Teaching and Research Farm, College of Agriculture and Animal Science, Ahmadu Bello University, Mando, Kaduna (110 10′ N, 07038′E with elevation of 632 m above sea level). Mando, Kaduna has an annual rainfall of 1200 mm with 95% falling between April and October, and is located in the Northern Guinea Savannah Zone of Nigeria (Abaje *et al.,* 2015).

Sources and Processing of Ginger Rhizomes: The ginger rhizomes used in this study were procured raw, from Kawo Market, Kaduna, Nigeria. The raw ginger rhizomes were cleaned, cut into smaller pieces with a pen knife and sun-dried to a constant weight. Furthermore, the dried ginger pieces were finely ground into powder and sieved through a 1 mm mesh sieve. The resulting powder (Ginger meal - GM) was used for the experiment.

Experimental Birds and Dietary Treatments: In a four-week feeding trial, the performance of broiler finisher birds was determined by supplementing GMs in the diets of broiler chickens as a phytobiotics feed additive during the finisher phase. There were four iso-nitrogenous (20% CP) and iso-caloric diets formulated for the broiler chicken finishers: Diet 1 (D1), the control, had 0% GM, Diet 2 (D2) contained GM at 0.1% level, Diet 3 (D3) had GM at 0.2% level, while Diet 4 (D4) contained GM at 0.3% level of inclusion.

Broiler Finisher Phase (5 – 8 weeks): For a finisher phase, a total number of 96 mixed-sex broiler chickens, four weeks of age were used for the experiment. They were allotted into four treatments of three replicates each containing eight birds. The diets were allocated according to treatments into the broiler pens in metallic conical feeders placed on concrete flooring with wood shavings serving as litter materials. The experimental birds in D1 were fed a conventional diet (without ginger), while birds in D2, D3, and D4 were fed formulated diets supplemented with 0.1, 0.2 and 0.3% ginger, respectively. The dietary ingredients and the finisher diets were analyzed for their proximate compositions (Table 1).

The birds were provided with feed and water *ad libitum.* Feed quantities were weighed and given daily, while leftover feeds were collected and weighed. The initial weights of birds were taken at the commencement of the experiment and weekly intervals. The records of FI and mortality were kept. While FCR, average daily BWG and feed cost per kg BWG were calculated for the experimental period.

Data Analysis: Data obtained were subjected to one-way analysis of variance (ANOVA) using Analyse-It for Microsoft Excel (3.03). Significant means were separated using the Duncan Multiple Range Test (Duncan, 1995) with $p<0.05$ as the level of significance.

RESULTS AND DISCUSSION

The results of the effect of nutritional supplementation of GM in the diets of broiler chickens at the finishers phase on the performance are shown in Table 2.

Feed Intake and Body Weight Gain: The FI of birds fed 0.2% GM-supplemented diet was significantly higher ($p<0.05$) compared to that of birds fed 0.0, 0.1 and 0.3% GM-supplemented diets. The FI of birds fed 0.1 and 0.3% GM-supplemented diets were statistically similar ($p>0.05$), but significantly lower ($p<0.05$) compared to the control diet.

Table 1: Ingredient composition of broiler chickens fed supplemented ginger meal at the finisher phase (5 – 8 weeks)

Ingredients (%)	Diets			
	D1 (0.0% Ginger)	D2 (0.1% Ginger)	D3 (0.2% Ginger)	D4 (0.3% Ginger)
Maize	55.00	55.00	55.50	55.50
Maize offal	8.00	8.00	8.00	8.00
Ground nut cake	18.00	18.00	18.00	18.00
Soya bean cake	8.50	8.50	8.50	8.50
Fish Meal	6.00	6.00	6.00	6.00
Bone Meal	2.00	2.00	2.00	2.00
Limestone	1.00	1.00	1.00	1.00
Methionine	0.25	0.25	0.25	0.25
***Vitamin-mineral premix**	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Palm oil	0.75	0.75	0.75	0.75
Total	100.00	100.00	100.00	100.00
Ginger	0.00	0.10	0.20	0.30
Calculated Nutrients				
Crude protein (%)	20.29	20.30	20.31	20.30
Metabolizable energy (Kcal/Kg)	3000.64	2987.54	2977.54	2884.14
Ether extract (%)	4.48	4.48	4.48	4.48
Crude fibre (%)	4.40	4.40	4.40	4.40
Calcium (%)	1.28	1.28	1.28	1.28
Available phosphorus (%)	0.64	0.64	0.64	0.64
Lysine (%)	1.10	1.10	1.10	1.10
Methionine + cysteine (%)	0.78	0.78	0.77	0.78
Feed cost (₦/Kg)	324.00	577.90	831.13	1084.30

** Vitamin/Mineral Premix (Agridom Premix) supplied per kg of feed. Vitamin A 30,000,000 IU, Vitamin D 60,000,000 U, Vitamin E 30,000 IU, Vitamin B123,000.00 mg, Vitamin C 30.00 g, Niacin 40,000.00 mg, Pantothenic acid 12,000.00 mg, Vitamin B_6 1,500 mg, Vitamin B_{12} 10,000.00 mg, Folic acid 1,000.00 mg, Biotin 400.00 mg, Chloride 3,000,000.00 mg, Antioxidant 125,000 mg, Manganese 70,000 g, Iron 40,000 g, Copper 8000mg, Iodine 1,200 mg, Selenium 250mg, Cobalt 250 mg*

Table 2: Performance of broiler birds fed supplemented ginger meal diets at finisher phase (5 – 8 weeks)

Parameter	Diets			
	D1 (0% Ginger)	D2 (0.1% Ginger)	D3 (0.2% Ginger)	D4 (0.3% Ginger)
Average initial weight (g/bird)	700.10 ± 24.92	700.60 ± 24.90	700.10 ± 24.92	700.10 ± 24.92
Average final weight (g/bird)	1500.00 ± 48.71^{b}	1400.00 ± 45.46^{c}	1600.00 ± 51.95^{a}	1420.00 ± 46.11^{c}
Body weight gain (g/bird)	799.90 ± 30.32^{b}	699.40 ± 26.51^{c}	900.00 ± 34.11^{a}	719.90 ± 27.29^{c}
Average daily gain (g/bird)	28.60 ± 1.06^{b}	25.00 ± 0.93^{c}	32.18 ± 1.20^{a}	25.80 ± 0.96^{c}
Total feed intake (g/bird)	3712.10 ± 157.51^{b}	3481.80 ± 147.74^{c}	4111.80 ± 174.47^{a}	3488.80 ± 148.04^{c}
Daily feed intake (g/bird)	132,58 ±186.02^{b}	124.35 ± 5.28^{c}	146.85 ± 6.24^{a}	124.60 ± 5.29^{c}
Feed-to-gain ratio	4.64 ± 0.10^{b}	4.97 ± 0.11^{c}	4.56 ± 0.10^{a}	4.88 ± 0.11^{c}
Feed Cost (₦/Kg)	324.00 ± 25.61^{a}	577.90 ± 45.68^{b}	831.13 ± 65.70^{c}	935.80 ± 73.97^{d}
Mortality (%)	0.00	0.00	0.00	0.00

^{abcd} = Means within rows with different superscript letters differ significantly ($p<0.05$). SEM = Standard Error of Mean, D = diets, g = gram, Kg = kilogram

The significant FI observed in broiler chickens in this study may be a result of improvement in palatability associated with GM supplementation. Tekeli *et al*. (2011) reported that 240 ppm of ginger powder fed to birds had a significant effect on feed consumption compared to birds fed the control diet. On the contrary, Onu (2010) observed that the addition of GM at 0.25% in the basal diet of broiler chickens did not have any effect on FI. Similarly, Zhang *et al*. (2009) did not find any significant difference in daily FI when GM was fed at the rate of 5 g/kg to broiler chickens.

In terms of BWG, birds fed a 0.2% GM-supplemented diet were significantly higher ($p<0.05$) compared to birds fed 0.0, 0.2 and 0.3% GM-supplemented diets. The BWG of birds fed 0.1 and 0.3% GM-supplemented diets were similar ($p>0.05$), but significantly ($p<0.05$) lower than those on the control diet. Onu (2010) reported that the addition of GM at 0.25% to the diet of broiler chickens resulted in higher body weight, while Zhang *et al.* (2009) did not find any significant difference for the average daily BWG of broiler chickens fed GM at 5 g/kg.

Feed Conversion Ratio: The FCR of birds fed 0.2% GM-supplemented diet was significantly higher ($p<0.05$) and the best when compared to birds fed other GM-supplemented diets. The FCR of birds fed 0.1 and 0.3% GM-supplemented diets were similar ($p>0.05$) but significantly ($p<0.05$) lower compared to birds fed the control diet. The reason for better performance of broiler birds fed GM-supplemented diets over the control (0%) has been attributed by researchers to improvement in palatability and the enhanced digestive effect of ginger (Khan *et al.*, 2012). Herawati (2010) attributed the improved performance of broiler birds on supplemented ginger meals over the control to the effect of two digestive enzymes (protease and lipase) associated with ginger.

Feed Cost of Broiler Produced: A trend was observed in feed cost (₦) per kg of broiler produced. Feed cost (₦) per kg gain increases with increased levels of GM in the diets. This was expected due to the high cost of fresh or dried-ginger rhizomes in the Nigerian market today. Feed cost (₦) per kg gain for birds fed 0.3% diet was significantly ($p<0.05$) the highest compared to those for birds fed other treatments (0, 0.1 and 0.2% GM-supplemented diets), while the feed cost of birds fed the control diet was significantly ($p<0.05$) the lowest. Al-Khalaifah *et al.* (2022) reported increased feed costs with increased levels of GM in the diets in their study on the effect of ginger powder on production performance, antioxidant status, haematological parameters, digestibility and plasma cholesterol of broiler chicken. There was neither mortality nor toxic characteristics observed among birds across the different dietary treatments throughout the finisher phase. This was contrary to the findings of Herawati (2010) who reported that broilers fed diets containing 0.5, 1.0 and 1.5% red ginger exhibited oedema, necrosis and inflammation in the muscles.

Conclusion: From the results obtained in this study, GM supplementation at 0.2% in the diets of broiler finisher chickens resulted in significant improvement ($p<0.05$) of daily BWG and better FCR compared to birds fed other diets. It is concluded that GM when added at 0.2% improves performance and can be a viable alternative to antibiotic feed additive in the diets of broiler finisher chickens. Arising from the above, the supplementation of GM as a phytobiotic agent at 0.2% in the diet of finisher broiler chickens is recommended for better performance in BWG and FCR without fear of any toxic effect.

ACKNOWLEDGEMENTS

The authors acknowledge with gratitude the assistance of Mr Abraham Boka and Mrs Salaha Ibrahim, staff of the Poultry Farm Unit, College of Agriculture and Animal Science, Ahmadu Bello University, Mando, Kaduna, for attending to the birds during the study period.

REFERENCES

ABAJE, I. B., SAWA, B. A., IGUISI, E. O. and IBRAHIM, A. A. (2015). Assessment of rural communities' adaptive capacity to climate change in Kaduna State, Nigeria. *Journal of Environment and Earth Science*, 5(20): 14 – 23.

AL-KHALAIFAH, H., AL-NASSER, A., AL-SURRAYAI, T., SULTAN, H., AL-ATTAL, D., AL-KANDARI, R., AL-SALEEM, H., AL-HOLI, A. and DASHTI, F. (2022). Effect of ginger powder on production performance, antioxidant status, hematological parameters, digestibility, and plasma cholesterol content in broiler chickens. *Animals*, 12(7): 901. https://doi.org/10.3390/ani12070901

AZODO, N. L., JIWUBA, P. D. C., MBAH, N. T. and EZEOKE, F. C. (2021). Effect of feeding broilers with phytogenic feed additives containing diets on blood biochemical and haematological constituents. *Agraarteadus – Journal of Agricultural Science,* 32(2): 195 – 203.

DUNCAN, D. B. (1955). Multiple range and multiple F-tests. *Biometrics*, 11: 1 – 42.

HERAWATI, H. (2010). The effect of feeding red ginger as a phytobiotic on body weight gain, feed conversion and internal organs condition of broiler. *International Journal of Poultry Science,* 9(10): 963 – 967.

JACELA, J. Y., DEROUCHEY, J. M., TOKACH, M. D., GOODBAND, R. D., NELSSEN, J. L., RENTER, D. G. and DRITZ, S. S. (2010). Feed additives for swine: Fact sheets – prebiotics and probiotics, and phytogenics. *Journal of Swine Health and Production*, 18(3): 132 – 136.

KARANGIYA, V. K., SAVSANI, H. H., PATIL, S. S., GARG, D. D., MURTHY, K. S., RIBADIYA, N. K. and VEKARIYA, S. J. (2016). Effect of dietary supplementation of garlic, ginger and their combination on feed intake, growth performance and economics in commercial broilers. *Veterinary World*, 9(3): 245 – 250.

KHAN, R. U., NAZ, S., NIKOUSEFAT, Z., TUFARELLI, V. Z. O., JAVDANI, M., QURESHI, M. S. and LAUDADIO, V. (2012). Potential applications of ginger (*Zingiber officinale*) in poultry diets. *World's Poultry Science Journal*, 68(2): 245 – 252.

MURUGESAN, G. R., SYED, B., HALDAR, S. and PENDER, C. (2015). Phytogenic feed additives as an alternative to antibiotic growth promoters in broiler chickens. *Frontiers in Veterinary Science*, 2: 21 – 25.

ONU, P. N. (2010). Evaluation of two herbal spices as feed additives for finisher broilers. *Biotechnology in Animal Husbandry*, 26(5-6): 383 – 392.

TEKELI, A., KUTLU, H. R. and CELIK, L. (2011). Effects of *Z. officinale* and propolis extracts on the performance, carcass and some blood parameters of broiler chicks. *Current Research in Poultry Science*, 1(1): 12 – 23.

ZHANG, G. F., YANG, Z. B., WANG, Y., YANG, W. R., JIANG, S. Z. and GAI, G. S. (2009). Effects of ginger root (*Zingiber officinale*) processed to different particle sizes on growth performance, antioxidant status, and serum metabolites of broiler chickens. *Poultry Science*, 88(10): 2159 – 2166.