IMPACT OF GINGER MEAL AS AN ALTERNATIVE/SUPPLEMENT TO SYNTHETIC PREMIX ON GROWTH PERFORMANCE AND ECONOMIC RETURNS OF BROILER CHICKENS

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ABSTRACT
This research aimed to assess the impact of incorporating ginger meal (Zingiber officinale) in broiler chicken diets as a substitute to synthetic premix on both growth performance and the economy of production. One hundred and twenty day-old Arbor Acres broiler chicks were randomly allocated into five treatment groups: T1, T2, T3, T4 and T5. Each treatment consisted of twenty four birds further subdivided into three replicates of eight birds each. Over an eight-week period, the birds were fed one of five formulated diets containing ginger powder at levels ranging from 0.00 to 0.20g/100kg, following a completely randomized design. At the ***CONCLUSION*** *of the study, three birds per treatment were selected to assess growth performance and economic factors. The findings indicated that substituting synthetic premix with ginger meal, particularly at a moderate inclusion rate (T3: 0.1g/100kg), led to significant improvements (P < 0.05) in growth parameters such as weight gain per kg, enhanced feed conversion efficiency and was more cost-effective.*
Keywords: Broiler chicken, Ginger meal, Synthetic premix, Growth performance, Feed cost benefit

INTRODUCTION

In the last decade, herbs and phytogenic compounds have attracted a lot of attention for their potential role as alternatives to antibiotic growth promoters in monogastric animals (Onunkwo *et al*., 2021). The interest to use the medical plants such as ginger is mainly due to its safety, healthy for human, less cost of herbs compared with synthetic chemical drugs and some of them decrease the level of serum lipids and lead to improve immune function in humans and animals.

The main important compounds in ginger are gingerol, gingeriol and gingerdione which could stimulate digestive enzymes, attack the microbial activity and having anti oxidative activity (Onunkwo *et al*., 2021) when used in broiler diets. Ginger, one of such comparable natural alternatives, is a perennial herb belonging to the family *Zingiberaceae*. Ginger is used as an alternative for antibacterial growth promoting substances and it has been revealed that ginger is advantageous for the greater productiveness of poultry, improved appetite and palatability of feed, nutrient absorption and facilitates gastric enzymes flow (Ukoha *et al*., 2016). Researchers have observed improved weight gain and feed conversion in broilers fed ginger-supplemented diets. This was attributed to enhanced enzyme activity and microbial modulation, leading to better nutrient absorption. This study investigated the growth performance of broilers fed ginger as an alternative/supplement to synthetic premix and evaluate its economic impact on broiler chicken production.

MATERIALS AND METHODS

This study was conducted at the Poultry section of the Teaching and Research Farm of Michael Okpara University of Agriculture, Umudike which is located on Latitude 5^0 28' N and Longitude 7^0 32' E and lies at an altitude of 122 meters above sea level (NRCRI, 2023). A total of 150-day-old broiler chicks were purchased from a reputable hatchery in Ibadan, Oyo State, Nigeria for this experiment. Broiler chicks were allotted to five (5) dietary treatments: T_1, T_2, T_3, T_4, and T_5. The peeled ginger was washed, dried (air and sun-dried) and later ground and sieved. The meal was then incorporated into the diets. The birds were fed diets with ginger meal at 0.00, 0.05, 0.10, 0.15 and 0.20 g/100kg which was supplemented with the synthetic vitamin-mineral premix at 0.25, 0.20, 0.15, 0.10 and 0.05 kg/100 kg, respectively (Table 1). The experimental design used for the experiment was

a Completely Randomized Design. At the end of the experiment, 3 birds were randomly selected from each replicate and weighed. The birds were stunned and slaughtered. All the growth performance data collected were subjected to analysis of variance (ANOVA) and means were separated using Duncan's multiple range Test (Duncan, 1955).

Table 1: Composition of diets containing varying levels of Ginger meal (GM)

Ingredients	**T_1**	**T_2**	**T_3**	**T_4**	**T5**
Maize	54.5	54.5	54.5	54.5	54.5
Soya bean meal	21.00	21.00	21.00	21.00	21.00
PKM	12.00	12.00	12.00	12.00	12.00
Rice bran	8.50	8.50	8.50	8.50	8.50
Ginger meal	0.00	0.05	0.10	0.15	0.20
Vitamin mineral premix	0.25	0.20	0.15	0.10	0.05
Bone meal	3.00	3.00	3.00	3.00	3.00
Methionine	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25
Common salt	0.25	0.25	0.25	0.25	0.25
Total	**100**	**100**	**100**	**100**	**100**
Calculated composition					
Crude protein %	22.25	22.25	22.25	22.25	22.25
ME (Kcal/g)	2840	2832	2826	2816	2810
Ca	1.7	1.7	1.7	1.7	1.7
Ph	0.6	0.6	0.6	0.6	0.6
Total	100	100	100	100	100

Vitamin A (Iμ) 15,000.00; Vitamin D3 (IU) 13,000; Thiamine (mg) 2; Riboflavin (mg) 6; Niacine (mg) 40; Cobalanine (g) 0.05; Pyridoxine (mg) 4; Choline chloride (g) 0.05; Biotin (mg) 0.08; Manganese (g) 0.096; Iron (g) 0.024; Zinc (g) 0.06. Copper (g) 0.06g; Iodine (g) 0.014, Cobalt (g) 0.024, Selenium (mg) 0.24, Antioxidant (g) 0.125

RESULTS AND DISCUSSION

Results of the impact of ginger meal as a premix diet supplement on growth performance of broiler chickens are presented in Table 2. The birds on the treatment with 0.00g ginger inclusion level voluntarily consumed significantly ($P<0.05$) higher quantity of the feed compared with the birds placed on ginger replacement diet at various inclusion levels. The reduced voluntary feed intake ($P>0.05$) recorded in the ginger groups could be due to depressed appetite as the ginger concentration was increased. The birds in the ginger groups T_3 and T_4 significantly ($P<0.05$) gained more weight than birds on T_1 whereas birds on T_2 and T_5 recorded the least significant weight gain. It could be suggested that ginger replacement diet had significant effects on body weight gain of the broiler chickens. There was a significant ($P<0.05$) difference in the average weight gain in birds on T_1 which was higher than that of birds on T_2 and T_5. The improvement in weight achieved by birds in the ginger group over the control indicates that ginger meal had a positive impact on the growth of the birds. It was observed that birds in T_3 gained an average weight of 1g by consuming 1.80g of the 0.10 g/100kg ginger replacement diet while birds in T_4 group consumed about 2.50g of the 0.15 g/100kg ginger replacement diet to gain an equivalent of 1g of body weight. However, the birds in T_2 and T_5 compared with those in T_1 consumed a range of 3.31-3.32g of their respective feed to gain 1g of body weight. This suggests that ginger replacement diet at 0.10 and 0.15 g/100kg inclusions elicited significantly ($P<0.05$) better FCR compared with other inclusion groups and the control. This agrees with the results of Tekeli *et al*. (2011); George *et al.* (2013) who reported that feed conversion ratios were significantly higher in ginger diets than in control thereby indicating better feed conversion efficiency. This could be due to the accumulation of the active ingredients in ginger which gives rise to the formation of more stable intestinal flora and improved feed conversion efficiency because of better digestion (Tekeli *et al*., 2011). The result of this study was also supported by the findings of Conley (1997) who observed that ginger acts as a stimulant for feed digestion and conversion which increase body weight gain. Onimisi *et al.* (2005) and Ademola *et al.* (2009) also observed that ginger

increased body weight when up to 2% level were included in broiler diet. Garcia *et al*. (2007) also found an increase in weight gain of broiler chickens when fed 2% and 6% ginger.

Table 2: Growth performance of broiler chickens fed diets supplemented with ginger meal

Parameters	T_1	T_2	T_3	T_4	T_5	SEM
Initial body weight (g)	37.0	37.0	37.0	37.0	37.0	0.00
Final body weight (g)	1275.3^{c}	1178.3^{d}	1950.0^{a}	1416.67^{b}	1100.0^{d}	81.40
Average weight gain (g)	1238.3^{c}	1141.3^{d}	1913.0^{a}	1379.67^{b}	1063.0^{d}	81.40
Average daily weight gain (g)	22.1^{c}	20.4^{d}	34.2^{a}	24.64^{b}	18.9^{d}	0.52
Feed conversion ratio	3.1^{a}	3.3^{a}	1.8^{c}	2.50^{b}	3.3^{a}	0.16
Mortality	12.5^{ab}	75.0^{a}	33.4^{b}	0.00^{c}	16.7^{ab}	7.44
Total feed intake (g)	3907.0^{a}	3793.7^{ab}	3462.3^{b}	3447.0^{b}	3518.7^{ab}	0.18
Average feed intake (g)	69.8^{a}	67.7^{ab}	61.6^{b}	61.7^{b}	62.8^{ab}	0.39

Note: Means with different superscripts in the same row are significantly (P<0.05) different. S.E.M: Standard Error of mean. T_1: 0.00 g/100 kg (control); T_2: 0.05 g/100 kg; T_3: 0.10 g/100 kg ; T_4: 0.15 g/100 kg ; T_5: 0.20 g/100 kg

The feed cost benefit result (Table 3) showed that total feed intake per bird and the cost per 100 kg of feed were higher in T_1 than in the ginger groups whereas birds in T_4 significantly (P<0.05) consumed the least quantity of feed with the least cost per feed conversion ratio compared to other ginger groups. However, the weight gain per kg per bird, the cost per weight gain, the revenue generated, and the gross margin realized from the sale of these broilers at the end of the feeding trial were significantly (P<0.05) higher in birds in T_3 than in those in T_2, T_4, and T_5. This suggest that the replacement diet with ginger at 0.1g/100 kg was significantly more productive and efficient with significantly low cost of production than replacement at 0.05 g, 0.15 g, and 0.2g/100 kg. The recommended dose of ginger in the diets for chickens was found to be about 1% level (Eltazi, 2014; Bamidele and Adejumo, 2012) while increasing the dose over 1% can increase the cost of feeding (Karangiya *et al.,* 2016). From this study, there is an indication that the cost of supplementing or replacement of feed component with 0.1g/100kg can considerably decrease the cost of production of broilers while yielding higher growth performance, better profits and higher revenue generation and gross margin. Similar studies reported by Nasir and Grashorn (2010) and Attia *et al.* (2014) supported this finding.

Table 3: Feed cost-benefit ratio of broiler chickens fed diets supplemented with ginger.

Values are presented as Mean. SEM: Standard error of Mean. Means with different superscripts across rows are significantly

	Ginger inclusion level (g)					
Parameters	**T1**	**T_2**	**T_3**	**T_4**	**T_5**	**SEM**
Total feed intake (g/bird)	3907.0^{a}	3793.4^{b}	3462.2^{d}	3447.0^{e}	3518.4^{c}	50.34
Cost/kg feed (₦)	189.2	188.7	188.3	188.5	188.2	0.11
Weight gain/bird (g)	1238.4^{c}	1141.2^{d}	1913.0^{a}	1379.4^{b}	1063.0^{e}	80.73
Cost/weight gain (₦)	909.3^{b}	817.2^{d}	1246.3^{a}	897.3^{c}	702.1^{e}	48.54
Revenue (₦)	1275.0^{c}	1178.0^{d}	1950.0^{a}	1416.0^{b}	1100.0^{e}	80.74
Gross margin	365.4^{e}	360.5^{d}	703.4^{a}	518.2^{b}	397.7^{c}	34.83

different at p<0.05. T_1: 0.00 g/100 kg (control); T_2: 0.05 g/100 kg; T_3: 0.10 g/100 kg; T_4: 0.15 g/100 kg; T_5: 0.20 g/100 kg.

CONCLUSION

The result of the study showed that replacing some vitamins with ginger meal at moderate (T3: 0.1 g/100 kg) inclusion level significantly improved the growth parameters and carcass characteristics evaluated in this study better than the low (T2) and higher (T4, T5) inclusion levels. The moderate inclusion level also generated higher revenue and gross margin profit as a result of the significantly higher weight gain per kg. This could be attributed to increased feed efficiency and utilization in birds

in T_3 due to increased activity of digestive enzymes such as trypsin, chymotrypsin and amylase which increased the digestibility of the nutrients contained in the formulated feed.

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