

## GROWTH PERFORMANCE OF BROILER CHICKENS FED FERMENTED MAIZE GRAIN RESIDUE AND THE DECANTED WATER AS PROBIOTIC SOURCES

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### ABSTRACT

This experiment aimed to evaluate the growth performance traits of broiler chickens through supplementation of fermented maize grain residue (FMGR), and its decanted water (DWMGR), locally called *èrì* and *omíidùn* respectively, as sources of probiotics in their feeds. The experiment was carried out at the Teaching and Research Farm, Ekiti State University, Ado-Ekiti, Ekiti State, Nigeria. A total of 180 day-old-chicks, divided into six treatments, namely: positive control, negative control, 1% FMGR, 2% FMGR, 1% DWMGR in water, and 2% DWMGR in water was used. Each treatment had 30 chicks each, replicated thrice. The birds were fed the respective treatment diets for eight weeks. The average daily feed intake (ADFI), average daily body weight gain (ADWG), protein efficiency ratio (PER), and feed conversion ratio (FCR) were calculated. The result indicated that all parameters measured, except the FCR exhibited significant ( $p < 0.05$ ) differences among the treatments. The ADFI was significantly higher ( $p < 0.05$ ) for the positive control ( $48.33 \pm 4.04$ g), and similar to 1% FMGR, while birds on 1%, and 2% DWMGR ( $37.67 \pm 0.58$ g and  $37.33 \pm 2.50$ g respectively) had the lowest and similar ( $p > 0.05$ ) values. The ADWG recorded was higher ( $p < 0.05$ ) for birds on positive control diet, while those given 2% DWMGR had the lowest value ( $14.00 \pm 1.13$ g). The PER followed the trend observed for ADWG. Conclusively, the result obtained in this study shows both FMGR and DWMGR are potential local sources of alternatives to antibiotics. However, I recommend that higher inclusion rate be used in further study, perhaps a better result could be obtained.

**Keywords:** Probiotics, Fermented Maize Residue, Growth Performance, Broiler

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### INTRODUCTION

The world population is projected to reach 8.5 billion in the year 2030, 9.7 billion in 2050, and 10.4 billion by 2100. Nigeria is projected to be among 8 countries to be responsible for more than half of the population of the world by 2050 (UN, 2022). The poultry industry has been recognized as one of the fastest growing enterprise of the agricultural sector due to its tremendous growth during the past few decades. This is because of increase in the consumption rate of egg and meat, as well as ease of availability, coupled with relatively inexpensive cost and being rich in all essential nutrients required for healthy living (Dhama *et al.*, 2015).

The critical roles that gut health plays in the nutrition and wellbeing of the animals is of importance as it elucidates quite a number of metabolic activities that plays critical roles in the wellbeing of the animals because the gut is the site where nutrients are broken down (Rinttila and Apajalahti, 2013). It is also the organ next to the skin, which is exposed to large variety and number of environmental pathogens (Yegani and Korver, 2008). Despite its obvious and great benefits, the use of antibiotics in poultry has been widely queried due to the increase in resistance to antibiotics by pathogens (Tiwari *et al.*, 2014.).

Probiotics which have been defined by FAO/WHO (2001) as 'living microorganisms which when administered in adequate amounts confer health benefits on the host' has been reported severally as effective alternative to antibiotics. Probiotics function by sticking to the gastrointestinal tract of the host, with the ability to survive difficult conditions, and then bring beneficial effect to the host by protecting the intestinal ecosystem (Markowiak and Śliżewska, 2018).

It has been reported that most often, probiotic microorganisms supplemented in animal feeds are Gram-positive bacteria belonging to the following Geni: *Bacillus*, *Enterococcus*, *Lactobacillus*, *Pediococcus*, *Streptococcus* (Anadón *et al.*, 2006). Whereas, the major microorganisms implicated in fermentation of maize products include lactic acid bacteria (LAB) such as *Lactobacillus fermentum*, *Lactobacillus reuteri*, *Lactobacillus rhamnosu*, *Lactobacillus casei*, *Lactobacillus plantarium*, *Lactobacillus bulgaricus*, *Lactobacillus acidophilus*, *Lactobacillus alimentarius*, *Lactococcus lactis*, *Enterococcus faecium*, *Leuconostoc mesenteroids* and *Pediococcus spp* as well as yeasts (Muyanja *et al.*, 2003). Therefore, fermented maize waste (*èrì*) and *omíidùn* may become a veritable probiotic source and for use in animals and human.

## MATERIALS AND METHODS

### Experimental Site

The experiment was carried out in the Poultry Unit of the Teaching and Research Farm, Faculty of Agricultural Sciences, Ekiti State University, Ado-Ekiti, Ekiti State, Nigeria on latitude 7.712°North, longitude 5.251°East, with a rainfall capacity of 1450mm/annum.

### Preparation of Probiotics

The probiotic *Lactobacillus spp* was obtained from two sources, namely; fermented maize grain residue (*èrì*) and its decanted water (*omiidùn*). The maize grain variety used was *sammaz* produced by WACOT. These two substrates were added as inoculants in De Man-Rogosa-Sharpe (MRS) agar to culture and quantify the beneficial microbes in the test materials. This was carried out in the Microbiology Laboratory of Ekiti State University, Ado-Ekiti using the serial dilution method. In which  $6.2 \times 10^4$  cfu/ml of lactic acid bacteria was obtained from the decanted water (FMGRDW) locally called *omiidùn*, and  $5.3 \times 10^4$  cfu/g from the fermented maize grain residue (FMGR) called *èrì*. It was soaked for 131 hours, 30 minutes, after which it was ground and sieved to give *èrì*, while the decanted water was obtained 95 hours after sieving through muslin cloth.

### Experimental Diet Formulation

The feed was formulated as iso-nitrogenous, and iso-caloric, each of the test materials namely (FMGR) *èrì* and (FMGRDW) *omiidùn* were added at 1% and 2% in the feed and 1% and 2% in the water respectively as additives. The experimental feed components were purchased and milled into a meal mixture at a reputable feed mill in Ado-Ekiti, Ekiti State. Single phase feeding was adopted, and the determined proximate composition is presented in Table 1.

**Table 1: Determined Proximate Composition of Experimental Diet**

Component	Quantity (%)
Crude Protein	20.12
Fat	7.24
Ash	9.27
Crude Fibre	12.20
Carbohydrate	42.72
Moisture	8.45
Total	100

### Procurement of Day-old-Chicks

One hundred and eighty (180) day-old chicks (Arbor Acre strain) were obtained from a reputable hatchery in Oyo State, Nigeria.

### Duration and Management of Experimental Birds

A total of 180 day-old-broiler chicks (Arbor Acre strain) was used were weighed, randomly allotted to the different replicates on the deep litter. They were served the experimental diets with stress stoke as an anti-stress in their water. They were brooded using fossil fuel as a source of heat for a period of 21 days. On day 7, the Newcastle disease vaccine was administered orally in the drinking water, after which multivitamins were given orally for the enhancement of vaccine effectiveness. Coccidiostat (Adacox) was administered from day 9-11, followed by oral administration of multivitamins. On day 14, the infectious bronchitis disease (Gumboro) vaccine was administered orally in the drinking water followed by the administration of the multivitamins. Feed was made available *ad libitum*, as well as water. The litter was changed once every week. The experiment lasted for 56 days.

### Experimental Design

The experiment was carried out using a Completely Randomised Design (CRD). The test materials fermented maize grain residue (FMGR) were added as additive at 1% and 2% of the diets and the FMGRDW at 1% and 2% in the drinking water to make four treatments. The trial had a positive control and negative control to make a total of 6 treatments in all. Each treatment was replicated thrice and contained 10 broiler chickens per replicate

### Data Collection

Data were collected on growth performance by measuring the average daily feed intake (ADFI) and the average daily live weight gain (ADWG). The feed conversion ratio (FCR) values were obtained by calculating the feed to weight gain ratio. The protein efficiency ratio (PER) values were also calculated as the ratio of the weight gained to protein intake.

## RESULTS AND DISCUSSION

The result of the growth performance traits is presented in Table 2. The average final body weight gain and the feed conversion ratio values were not significantly ( $p>0.05$ ) affected by the use of the test materials as sources of probiotics. However, the average daily feed intake (ADFI), the average daily weight gain (ADWG), and the protein efficiency ratio (PER) were significantly influenced ( $p<0.05$ ) by the treatments. The ADFI was highest for broiler chickens fed the positive control (48.33±4.04g) and similar to treatment groups fed the FMGR both at 1 and 2% inclusion levels while these values were significantly higher than the other groups fed FMGRDW ( $p<0.05$ ). The ADWG and the PER followed the same pattern with the positive control group of broiler chickens recording higher values for ADWG value of 18.33±2.08g for ADWG and 0.91±0.10 as the PER. Broiler chickens fed 2% FMGRDW had the lowest values of 14.00±1.13g and 0.69±0.08 for ADWG and PER respectively. Despite obtaining the highest ADFI, and ADWG from the positive control group, the FCR across the groups were similar. This indicates that the group fed probiotics could perhaps have done better if the availability of the probiotic organism in the test material is more than observed.

Table 2: Growth Performance Traits Broiler Chickens Fed Èrí and Omíídùn

Parameters	Positive Control	Negative Control	Èrí (1%)	Èrí (2%)	Omíídùn (1%)	Omíídùn (2%)	P-Value
IBW (g)	62.42±2.86	64.09±5.13	60.21±3.30	62.75±5.26	63.27±2.60	62.94±3.07	0.88
FBW (g)	1981.4±117.9	1002.8±49.6	928±193	856.4±111.3	868±12	828±90.5	0.09
AFI/Bird(g)	48.33±4.04 <sup>a</sup>	42.67±2.08 <sup>ab</sup>	45.33±7.51 <sup>a</sup>	41.67±2.89 <sup>ab</sup>	37.67±0.58 <sup>b</sup>	37.33±2.50 <sup>b</sup>	0.03
ADWG/Bird(g)	18.33±2.08 <sup>a</sup>	16.67±0.58 <sup>ab</sup>	16.33±3.22 <sup>ab</sup>	14.33±2.88 <sup>b</sup>	14.33±0.58 <sup>b</sup>	14.00±1.13 <sup>b</sup>	0.10
FCR	2.60±0.10	2.53±0.12	2.78±0.21	2.83±0.40	2.60±0.10	2.63±0.15	0.52
PER	0.91±0.10 <sup>a</sup>	0.82±0.03 <sup>ab</sup>	0.81±0.16 <sup>ab</sup>	0.71±0.10 <sup>b</sup>	0.71±0.03 <sup>b</sup>	0.69±0.08 <sup>b</sup>	0.11

abc means along the same row with different superscripts differ significantly ( $p<0.05$ )

AFI- Average Feed Intake, DWG- Daily Weight Gain, FCR- Feed Conversion Ratio, PER- Protein Efficiency Ratio

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