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# PERFORMANCE AND CARCASS CHARACTERISTICS OF BROILER CHICKENS FED CORN-COB BASED MEAL SUPPLEMENTED WITH ENZYME

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***Abstract***

*One hundred and forty-four, day old Ross 308 broiler birds were used to investigate the effect of enzyme (Maxigrain®) supplementation on growth performance and carcass characteristics of broiler chickens fed corn-cob meal (CCM). The birds were randomly allotted to 6 treatments of 8 birds to each replicate, 3 replicates per treatment, in a 3×2 factorial experimental design. The levels of CCM inclusion were 0, 25, and 50% and 2 levels of enzyme supplementation, 0g/kg and 0.1g/kg diet. Treatments 1, 2, and 3 were without enzyme while treatments 4, 5, and 6 were supplemented with the enzyme, Maxigrain®. Feed intake and body weight gain were assessed and at the end of the 4 weeks feeding trial, 2 birds per replicate were selected and sacrificed for carcass evaluation. Replacement of maize with CCM significantly ($P<0.05$) decreased FI from 1,079g/bird in T3 and 6 to 934g/bird in T2 and 5. Inclusion of CCM significantly decreased ($P<0.05$) the dressed percent from 75.29% in T1 and 3 to 70.01% in T3 and 6. Enzyme supplementation, produced no significant ($P>0.05$) effect on carcass weight across the treatments. Birds fed 25%CCM supplemented with Maxigrain, performed comparably well to birds fed diets without enzyme supplementation. Consequently, enzyme supplementation improved performance and 25%CCM is recommended to be used by farmers.*

***Keywords: Carcass yield, Corn-cob, Maxigrain®, Poultry nutrition, Ross 308 broilers***

## Introduction

Broiler production is one of the most popular livestock enterprises adopted by small and medium-scale farmers in both rural and urban areas, as it offers the highest turnover rate and quicker returns on investment outlay (Afolayan *et al.,* 2014). The high cost of feed ingredients which accounts for about 60-80% of the total cost of production, indicates that the production of cereal grains for the livestock business is grossly inadequate (Fasuyi, 2005). Maize, which is the predominantly used ingredient for energy in poultry feed in Nigeria, is very costly, because of the higher demand for it by humans for food and industrial purposes (Etuk *et al.,* 2013). According to FAO (2012), the increasing cost and decreasing supply of conventional feedstuffs, especially energy sources, are expected to limit the future expansion of the livestock and feed industry. These reports imply that the production of crops in agro-climatic zones, will either lead to surpluses in areas where there have been shortages or where there have been surpluses. Therefore, there is an urgent need for an alternative to maize in livestock feeds, to reduce the current pressure on maize as staple food for man (Adeniji and Balogun, 2002). One of such alternative for the replacement of maize in animal diets is the corn-cob meal. Corn-cob is a by-product of corn. It is produced in a very large amounts constituting about 40 - 50% of corn.

Consequently, most corn-cobs are not used effectively but are dumped indiscriminately, resulting in environmental contamination due to the occurrence of mycotoxins particularly Fumonisin and Aflatoxin. Corn-cob is cheap and discarded without being effectively used thus it might be a useful and economical alternative replacement for maize. According to Ochetim (1993), in situations where corn-cobs are readily available, high-energy feed ingredients like maize could be partly replaced by corn-cob but the level of inclusion for effective utilization and performance of birds needs to be determined. The corn-cob itself is very difficult to use as a feed ingredient due to its high fibre content. The daily body weight gain decreased in pigs when their diets were supplemented with an increased level of corncobs, because the high fibre in the corncob is resistant to the pig's digestive enzymes (Kanengoni, *et al.,* 2015). Monogastric animals also have the limiting factor of not having microorganisms in their gut to aid the digestibility of nutrients like the fibre fraction in feedstuffs. The use of feed enzymes has been reported to reduce environmental pollution and eutrophication from excess nutrients voided in faecal matter from livestock production (Ilaboya and Iyayi, 2021; Abdulrashid *et al.,* 2007; Imouokhome *et al.* (2018). It has been reported that corncob has a dry matter of 88.5 – 90.8%, crude protein of 1.7 – 3.8%, crude fibre of 28.6 – 45.7%, and ash of 1.3 – 7.7% (Donkoh *et al*., 2003; Kanengoni *et al*., 2004; Akinfemi, 2010). One of such potential sources of unconventional feedstuffs that have not been fully utilized is corn-cobs, which are generally not used for human consumption.

Corncob is a waste product and readily available in Nigeria, it is an underutilized by-product from the processing of harvested maize. The militating problem affecting the utilization of corn-cobs in chicken diets is due to high fibre content. The roles of enzymes as an additive in poultry diets are well established (Atteh, 2000; Abdulrashid *et al.,* 2007). It has been reported that enzyme addition to monogastric feed, reduced viscosity of the digesta in the intestine as opposed to a situation of association with the digestion of cereal grain (by-products) and showed a marked improvement on the various morphological effects of feeding fibrous materials to non-ruminant. Shirmohammed and Mehhri (2011), Midau *et al.* (2011), Ilaboya and Iyayi, (2021) reported the technique of incorporating multi-enzymes for enhancing the efficiency of feed utilization and digestibility in monogastric animals. Ademola *et al.* (2012), Imouokhome *et al.* (2018), fed Maxigrain in diets containing wheat offal, rice bran, and corn bran, and concluded that enzyme supplementation in feed can help ameliorate the effects of heat stress on broiler chickens in addition to maintaining their performance when compared with birds on the control diet. This study is aimed to evaluate the performance and carcass characteristics of Ross 308 broiler chickens fed varying levels of corn-cob meal with enzyme (Maxigrain®) supplementation.

## Materials and Methods

This experiment was carried out at the Teaching and Research Farm of Benson Idahosa University, Benin City, Edo state. A total of one hundred and sixty-two day-old Ross 308 chicks were used for the experiment. They were randomly selected and sub-divided into 6 dietary treatments of three replicates each, with nine birds in each replicate. The experiment was set in a 2x3 factorial design, with two levels of enzymes (with and without) and three replacement levels of corn cob for maize (0, 25, and 50%).

## Experimental Animals, Management, and Design

A total of one hundred and forty-four 1- day old Ross 308 chicks were purchased from a reputable hatchery in Edo State and used for this experiment. They were brooded for one week under similar managerial and hygienic conditions. Necessary vaccination schedules and medications were followed accordingly and the birds were supplied with feed and water *ad libitum* for 4 weeks.

**Preparation of Experimental Diets**

The corn-cobs were obtained from Santana Market, in Benin City, sun-dried for five days and subsequently milled to form the corn-cob meal (CCM) that was later incorporated into the broiler's diets at 0%, 25%, and 50% levels, replacing maize (table 1).

**Table 1: Gross Composition of Experimental Diets (G/Kg As-Fed Basis)**

| | Treatment diets | | | | | |
|---|---|---|---|---|---|---|
| | Without enzyme | | | With enzyme | | |
| INGREDIENT | T1(0% CCM | T2(25% CCM | T3(50% CCM | T4(0% CCM | T5(25% CCM | T6(50% CCM |
| Maize | 55 | 41.25 | 27.5 | 55 | 41.25 | 27.5 |
| Soyabean meal | 26 | 28.65 | 28 | 26 | 28.65 | 28 |
| Fish meal | 8 | 8 | 10 | 8 | 8 | 8 |
| Brewers dried grain | 5 | 3 | 1.65 | 5 | 3 | 1.65 |
| Corn cob meal | 0 | 13.75 | 27.5 | 0 | 13.75 | 27.5 |
| Palm oil | 2 | 2 | 2 | 2 | 2 | 2 |
| Limestone | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| Bone meal | 2.65 | 2 | 2 | 2.65 | 2 | 2 |
| Salt | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 |
| Vitamin premix* | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| Maxigrain®** | 0 | 0 | 0 | 0.005 | 0.005 | 0.005 |
| **Total** | 100 | 100 | 100 | 100.005 | 100.005 | 100.005 |
| **Calculated Nutrients** | | | | | | |
| ME (Kcal/Kg) | 3051.61 | 2703.82 | 2352.29 | 3051.61 | 2703.82 | 2352.29 |
| CP (g/kg) | 227.79 | 226.62 | 225.37 | 227.79 | 226.62 | 225.37 |

***Supplied per kg of diet -Vit A, 5000ui; Vit D 3, 800iu; Vit E, 12mg; Vit B 6, 1.5mg; Pantothenic acid, 5mg; Biotin, 0.02; Vit B12, 0.01mg; Folic acid, 0.3mg; Choline Chloride, 150mg; Manganese, 60mg; Iron, 10mg; Zinc, 15mg; Copper, 0.8mg; Iodine, 0.4mg;Cobalt, 0.08mg; Selenium, 0.04mg; Anti-oxidant, 40mg.**

****Supplied Cellulase10000iu, xylanase 10000iu, Phytase 2500FTU, Protease 4000iu**

**Data Collection**

**Feed intake and live weight changes**

The growth of the birds in response to the experimental diets was monitored by taking their pre-experimental body weights, followed by weekly weighing before feeding. Weekly feed intake was measured throughout the experimental period by subtracting the feed remaining from the feed weighed in at the beginning of the week. Weight gained was measured weekly by subtracting the final weight from the initial weight at the beginning of the week.

**Evaluation of Carcass Quality**

At the end of the 28-day feeding trial, two birds per replicate were randomly selected (based on nearness to the average group weight) for carcass evaluation. The birds were sacrificed by severing their jugular veins with a sharp surgical knife, de-feathered, washed, and weighed. The internal contents were neatly removed (evisceration), followed by the cutting of the carcass into retail parts which were also weighed. Dressing weight was recorded after evisceration. The weights were expressed as percentages of dressed weight.

## Proximate Composition Determination

Proximate analysis of the feed samples was carried out using the method described by the Association of Official Analytical Chemists (AOAC, 2004).

## Statistical Analysis

All data were subjected to analysis of variance using GLM procedures of SAS (2004) in a factorial design. Significant differences among treatment means were separated by Turkey's with probability set at P<0.05.

## Results

The proximate composition of the experimental diets is shown in table 2. There were no statistical differences (p>0.05) in all the parameters determined. However, T3 and T6 were low (1,665.4kcal/kg) in metabolizable energy and compared to a range of 2,484.7 – 2,885.1kcal/kg recorded in T1, T2, T4 and T5. The crude protein value varied from 21.6 – 24.7%, ash (4.55 – 4.79%) and the crude fibre value ranged from 2.03 – 3.22%.

**Table 2: Proximate Composition of Experimental Diets of Ross 308 Broiler Chicken**

| Parameter | T1 | T2 | T3 | T4 | T5 | T6 |
|---|---|---|---|---|---|---|
| ME (kcal/kg) | 2885.1 | 2484.7 | 1665.4 | 2885.1 | 2484.7 | 1665.4 |
| CP (%) | 23.8 | 24.7 | 21.6 | 23.8 | 24.7 | 21.63 |
| Ether Extract | 4.17 | 4.95 | 3.01 | 4.17 | 4.95 | 3.01 |
| Dry matter | 90.90 | 91.70 | 90.65 | 91.90 | 92.15 | 91.75 |
| Ash | 4.55 | 4.57 | 4.79 | 4.55 | 4.57 | 4.79 |
| Crude Fibre | 3.22 | 2.60 | 2.03 | 3.22 | 2.60 | 2.03 |

**T1= treatment 1(0%CCM), T2= treatment 2(25%CCM), T3= treatment 3(50%CCM), T4=treatment 4(0%CCM + enzyme), T5= treatment 5(25%CCM + enzyme) and T6= treatment 6(50%CCM +enzyme)**

Table 3 shows the performance characteristics of Ross 308 chicks fed Maxigrain® supplemented CCM diets There were no statistical differences (p>0.05) in the feed intake and weight gain. There was increase feed intake when CCM was fed to broilers. Enzyme supplementation of diets improved feed intake from 911 to 957g/bird and weight gain from 279.5–343.5g/bird both in treatments 2 and 5 (though values were not significantly different (P>0.05) with diet containing 25% CCM, producing similar values to birds fed the control diets. Feed intake decreased as the level of CCM increased to 50% but weight gain improved (260.8g/bird in treatment 3 to 300g/bird in treatment 6). The FCR value significantly (P<0.05) increased (4.25) at 50%CCM (T6) inclusion level. The feed conversion ratio was significantly (P<0.05) improved with 25% inclusion of CCM and supplementation of the enzyme. There was no significant (P>0.05) interactive effect of Maxigrain® and CCM on the growth performance parameters assessed. Also, the effect of the enzyme (Maxigrain®) cocktail did not significantly alter the measured feed intake and body weight gain of the birds at 0 – 4weeks.

**Table 3: Performance Characteristics of Ross 308 Chicks Fed Corn Cob Meal without or with Enzyme Supplementation**

| Parameter | T1 | T2 | T3 | T4 | T5 | T6 | SEM |
|---|---|---|---|---|---|---|---|
| Feed Intake g/day | 993 | 911 | 1133 | 1069 | 957 | 1026 | 0.56 |
| Weight gain g/day | 321.4 | 279.5 | 260.8 | 340 | 343.5 | 300 | 0.31 |
| FCR | $3.11^{a}$ | $3.33^{ab}$ | $4.25^{b}$ | $3.21^{b}$ | $2.81^{a}$ | $3.45^{ab}$ | 0.35 |

**a,b: Means within rows carrying different superscripts are significantly different (p <0.05), SEM= Standard Error of Mean, T1= treatment 1(0%CCM), T2= treatment 2(25%CCM), T3= treatment 3(50%CCM), T4=treatment 4(0%CCM + enzyme), T5= treatment 5(25%CCM + enzyme) and T6= treatment 6(50%CCM +enzyme)**

Table 4 shows the effect of CCM inclusion on growth performance parameters. There were statistical differences (p<0.05) in the feed intake. Birds on 0% (1,031g/day) and 20% (934g/day) CCM were similar (P>0.05) while birds fed 50%CCM (1,079g/day) were significantly higher (P<0.05) than that of 0% and 50% inclusion level of CCM. The weight gain of birds and FCR were not significantly (p>0.05) different. The inclusion of 25%CCM in the diets, on the other hand, reduced feed intake (934gg/day) but did not affect weight gain (311g) as compared with 50%CCM inclusion, where feed intake was increased (1,079g/day) and weight gain was reduced (280.4g).

**Table 4: Effect of Corn Cob Meal Inclusion on Performance Characteristics of Ross 308 Chicks**

| Parameter | 0%CCM | 25%CCM | 50%CCM | SEM |
|---|---|---|---|---|
| Feed Intake g/day | $1031^{a}$ | $934^{a}$ | $1079^{b}$ | 0.28 |
| Weight gain g/day | 330.7 | 311.5 | 280.4 | 0.16 |
| FCR | 3.16 | 3.07 | 3.85 | 0.18 |

**a,b: Means in the same row with different superscripts are significantly different at p<0.05**
**SEM = Standard Error of Mean, FCR = Feed Conversion Ratio, CCM=Corncob meal**

The results of the treatment on the carcass (dressed percent, breast, wing, and drumstick) were not (p>0.05) affected by enzyme supplementation as shown in table 5. There were no statistical differences (p>0.05) on the dressed, breast, wing and drumstick percentages of birds without and with enzyme supplementation. The dressing percentage varied between 70.2 and 72.7%, breast (61.7 – 66.7%), wing (56.3 – 71.6%) and the drumstick was higher (49.5%) at 0.0g/kg enzyme than 38.2% recorded in 0.1g/kg enzyme treatment.

**Table 5: Effect of Enzyme on Carcass Characteristics of Ross 308 Broiler Chickens**

| Enzyme level | Dressed% | Breast% | Wing% | Drumstick% |
|---|---|---|---|---|
| 0 (g/kg) | 70.21 | 66.67 | 71.65 | 49.47 |
| 0.1 (g/kg) | 72.65 | 61.67 | 56.33 | 38.23 |
| SEM | 2.36 | 1.60 | 0.78 | 1.18 |

**SEM= Standard Error of Mean.**

Effect of corn cob meal on carcass characteristics of Ross 308 broiler chicken is presented in table 6. There were no statistical differences (p>0.05) between birds fed 25%CCM (72.64%) and 50%CCM (70.01%) inclusion. Whereas, birds fed 0%CCM were significantly higher (p<0.05) in dressed %. Breast, wing and drumstick of birds were not affected (p>0.05) by the inclusion of CCM.

**Table 6: Effect of Corn Cob Meal on Carcass Characteristics of Ross 308 Broiler Chicken**

| CCM level | Dressed% | Breast% | Wing% | Drumstick% |
|---|---|---|---|---|
| 0% | 75.29$^{a}$ | 68.97 | 73.64 | 49.47 |
| 25% | 72.46$^{ab}$ | 66.50 | 57.44 | 38.23 |
| 50% | 70.01$^{b}$ | 68.21 | 60.01 | 48.11 |
| SEM | 2.36 | 1.60 | 0.78 | 1.18 |

**a, b: Means within rows carrying different superscripts are significantly different (p <0.05) SEM= Standard Error of Mean,**

## Discussion

The differences observed in the proximate analysis of the feed could be due to differences in maize varieties, processing methods, or soil types. The nutrient (proximate) compositions of the diets were apparently adequate and within the recommended range for broiler starter (NRC, 1994; Oluyemi and Robert, 2000). There was increase feed intake, though not significant at 50% inclusion level of CCM. Donkoh *et al.* (2003) reported a similar trend when birds were fed blood and corn cob mix yet, the growth performance and carcass yield did not differ markedly. Meanwhile, some years earlier Ochetim (1993) noted the same effects at inclusions of up to 11.6% corn-cob in broiler diets but 23.2% inclusion of corncob meal reduced significantly the weight gains, feed consumption, feed utilization, carcass yield and dressing percent of birds. This could be due to the cellulose, hemicellulose, and lignin content of corn-cob that is resistant to enzymatic breakdown as reported by Pointner *et al.* (2014). The FCR value which is the most sensitive factor in assessing performance significantly increased at the inclusion of 50%CCM, an indication of poor utilization of the enzyme-supplemented diets by the birds, Iyayi and Davies (2005) recorded the similar result.

The inclusion of 25%CCM in the diets, on the other hand, reduced feed intake but did not affect weight gain. This agrees with the work of Ochetim (1993). With the supplementation of enzyme, weight gain increased at 25%CCM inclusion. This could mean that with increased enzyme concentration, there could be further improvement in the digestibility of corn-cob and its utilization in broiler chickens though a similar effect was recorded by Malik *et al.* (2016) when they used Maxigrain® to supplement water hyacinth meal in growing pullets. The improvements in the parameters in the present study conform to the earlier assertion of Iyayi and Davis (2005); Adeola and Olukosi (2008) that enzyme supplementation improves the performance of animals. The breakdown of fibrous material in the corn-cob meal by the enzymes enables the birds to acquire more nutrients from the feed thus depositing them as tissues in the body. The results showed that birds on corn-cob meal enzyme-supplemented diets were better than those on diets without enzyme supplementation. With CCM inclusion, dressed percent compare favourably with 0% inclusion of CCM. Inclusion of enzyme increased dressed percent but reduced breast, wing, and drumstick percentages. These are similar results to those of Aguihe *et al.* (2016) though, with a different substrate (cassava peel meal), organ and carcass characteristics were improved without any adverse effects on birds.

## Conclusion

The use of enzyme-supplemented CCM with reduced levels of maize at the starter phase is of economic importance. At the starter phase 25% and 50% of the maize was spared in the diets. It means that using enzymes supplemented with agro-industrial by-products can help save the use of conventional and expensive cereal grains. Corn-cob meal at 25% inclusion level can be fed to broiler chicks with no negative effects for up to 28 days when Maxigrain enzyme are added to the feed diets. Since birds fed the 50% CCM level performed poorly, the optimum replacement level of maize with CCM could be a level between 25% and 50%.

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