

# EFFECT OF ENZYME SUPPLEMENTATION OF PALM OIL FORTIFIED WET MAIZE MILLING WASTE AND CASSAVA ROOT SIEVIATE ON GROWTH PERFORMANCE AND HEMATOLOGICAL PROFILE OF BROILER CHICKS

Onwujiariri, E.B.<sup>1</sup>, Okah, U.<sup>2</sup>, Mmerole, Adaeze<sup>1</sup>, Chukwu, Oko U.<sup>1</sup> and Okechukwu, S.O.<sup>1</sup>

<sup>1</sup>Department of Animal Production Technology, Federal College of Agriculture, Ishiagu, Ebonyi State.

<sup>2</sup>Department of Animal Production and Management, College of Animal Science and Animal Production, Michael Okpara University of Agriculture, Umudike Abia State

## ABSTRACT

A 4- week study was carried out to investigate the effect of enzyme supplementation of oil fortified wet maize milling waste (WMMW) and cassava root sieviate (CRS) on performance and haematology of broiler chicks. Four diets were formulated to contain 0, 15, 30 and 45% of the 58% maize in the control diet. One hundred and eight (108) seven weeks old Anak broiler chicks were randomly assigned to four treatment diets in a completely randomized design (CRD). Data were collected on body weight gain, feed intake and feed conversion ratio. Wet maize milling waste and cassava root sieviate were analyzed. WMMW was found to contain 13.97% CP, 7.20%CF, 0.95%EE, 4.82% ash and 63.21%NFE, while CRS was found to contain 2.10%CP, 18.66%CF, 0.48%EE, 2.68% and 61.82%NFE. The chicks fed 15 and 30% enzyme supplemented palm oil fortified WMMW and CRM gain higher ( $P<0.05$ ) weight than those fed control diet and diet containing 45% WMMW and CRS. The birds fed the control diet consumed less feed ( $P<0.05$ ) than birds feed the diets with 30 and 40% WMMW and CRS. The birds 15% experimental diet had superior feed conversion ratio than those feed 30 and 40% WMMW and CRS diets. The haematological indices revealed significant ( $P>0.05$ ) differences among the treatments groups in

packed cell volume, haemoglobin, white blood cells and mean corpuscular volume. However, all the haematological parameters measured fall within the normal range for avian species. The cost of feeding the birds was cheapest (N141.00) in treatment 2 including in control. The best values of net revenue was observed in treatment 2 (N892.60) followed by treatment 3 (N770.37) compared to control. The lowest value of net revenue was obtained by broilers chicks fed 45% test ingredients. The replacement of dietary maize in broiler chicks' diet with 15% and 30% palm oil fortified WMMW and CRS supplemented with exogenous enzyme showed superior performance characteristics and economic value to control.

## INTRODUCTION

In developing countries like Nigeria, meat production as a source of animal protein for man's consumption has drastically reduced, as 35g per caput per day of the total protein should be of animal origin (FAO, 2004). Recent report indicates that animal protein consumption in Nigeria is about 3.245g per caput (Abubakaret *al.*, 2003). Poultry production especially broiler has been adjudged to have the quickest and fastest rate of turn-over, hence it is a viable means of bridging protein deficiency (Akiramutimi, 2004). According to

to Smith, (2001), poultry has been found to be highly prolific and very efficient in converting feed nutrients into high quality animal protein. However, maize which constitute a major source of energy in poultry ration, has become a multipurpose farm product in Nigeria, serving not only as a staple food for a large proportion of Nigerians, but also as a major raw material in brewing industries, among other uses consequently, its price has continued to rise since its national production level is below the demand. This has obviously and significantly, contributed to the current high cost of poultry feed in the country and accompanying high cost of poultry production (Fanimu, 2005), It has been reported that feed alone accounts for up to 80% of the total cost of production (Olugbemi *et al.*, 2011). The general objective of poultry nutrition is to maximize the economic production performance (Uchegbu *et al.*, 2007). Therefore, the recent rise in the cost of poultry feed ingredients, particularly cereals, which constitute the major sources of energy in poultry ration, has made it imperative to harness local resources that have hitherto been considered as wastes in agro-industries as components of compounded rations for birds. In Nigeria, diets based on cereals, specifically maize are very expensive therefore, there is need to look for alternative or unconventional feedstuffs which are cheaper, abundant and readily available. Such alternative feed stuffs include cassava sieviate (CS) and wet maize milling waste (WMMW). Cassava sieviate constitutes between 10 – 13% of the tuber by weight (Tewe, 1986), and which have found wide use as a supplement for domestic sheep and goat feeding in cassava producing area of southern Nigeria.

Cassava sieviate is obtained from the processing of cassava into garri (Atteh, 2002). Wet maize milling waste is a product from local processing of maize into edible starch. This by-product can be economically used in compounding of poultry diets. One of the major draw backs to the utilization of cassava and its products in animal nutrition is that they contain varying proportion of cyanogeneticglucosides (linamarin and lotaustralin) which readily break down to give hydrocyanic acid (McDonaled *et al.*, 1995), which can be reduced by sun-drying (Mangu *et al.*, 1997). It has been reported that palm oil has the efficacy of reducing, removing or detoxifying the glucosides (Obioha *et al.*, 1981; Okeke *et al.*, 1985) in cassava sieviate based diets for monogastric animals. Both cassavasieviate and Wet maize milling waste have low level of metabolizable energy, and palm oil has a high energy value of 8300kcal/kg to boost the energy levels of both ingredients in the diets (Atteh, 2002). In addition, palm oil is useful in reducing the dustiness of cassava sieviate and wet maize milling waste based diet which can cause respiratory problem to birds. Utilization of cassava sieviate and wet maize milling waste may be limited due to their fibrous nature and low digestibility in monogastric animals. Ordinarily, poultry cannot digest or utilize high fibre diets because it lacks the digestive frame-work to handle large amount of fibre (Ani and Omeje, 2007). To avert the problem of high fibre in the diet and enhance proper utilization, the use of exogenous feed enzymes becomes imperative, because they have the ability to render the non-starch



polysaccharides utilizable by monogastric animals. The enzyme being considered in the present study is Roxazyme G. This is an enzyme complex derived from *Trichoderma viride* with glucanase and xylanase activity. Reports by Bedford *et al.* (1992) and Acromovic (2001) revealed that the enzyme has shown to increase digestibility of feed ingredients by disrupting the plant cell walls and by reducing the viscosity of the gut contents thereby enhancing nutrient absorption.

The health status of an animal on feeding trial is of paramount importance. Blood parameters have been shown to be of major indices of physiological, pathological and nutritional status of an organism and changes in the constituent compound of the blood when compared with the normal values could be used to interpret the metabolic state of an animal as well as quality of feed (Babatunde *et al.*, 1992). Therefore, a readily available and fast means of assessing clinical and nutritional health status of an animal on feeding trial may be the use of blood analysis (Olabanji *et al.*, 2007). The present study therefore is to investigate the effect of enzyme supplementation of palm oil fortified cassava sieviate and wet maize milling waste on growth performance, haematology and economy of production of broiler chicks.

## **MATERIALS AND METHODS**

### **Experimental site**

The study was conducted at the poultry unit of the practical and research farm of the Department of Animal Production Technology, Federal College of Agriculture, Ishiagu Ebonyi State. The area lies between latitude 5°55' North and longitude 77° 31' East with annual rainfall of

### **Experimental Materials and Processing**

The experimental materials used for the study were cassava root sieviate (CRS), wet maize milling waste (WMMW) palm oil and the exogenous enzyme, Roxazyme – G. CRS was obtained from the cassava processing unit of federal college of Agriculture Ishiagu. The wet maize milling waste was procured locally from maize starch producers, the palm oil was procured from a local market in Ishiagu. Also the enzyme, Roxazyme –G was procured from a reputable veterinary shop in Enugu, Enugu state both the CRS and WMMW were bought wet. They were sun-dried then milled to break the crumbs.

### **Experimental Birds and Diets**

One hundred and twenty (120) 2-weeks old chicks of Anak broiler breeds were used for the study. The birds were randomly divided into four treatment groups and assigned to different experimental diets in a completely randomized design (CRD) of thirty (30) birds. Each treatment group was further sub-divided into three replicates of ten birds each. Experimental diets were formulated such that palm oil fortified cassava sieviate and maize milling waste and enzyme were included in the diet to replace maize at 0, 15, 30 and 45%.

### **Management of Experimental Birds**

Before the arrival of the birds, the brooding pen was washed, disinfected and allowed to dry. On arrival, the chicks were inspected and

housed in a pre-heated brooding pen of concrete floor, covered with wood shavings as litter material. During the brooding period, the birds were fed commercial feed. After brooding for two weeks, the birds were grouped and randomly assigned to the experimental diets. Each replicate of 10 birds was housed in a 1.2m x 1.2m deep litter of fresh wood sharing pen. Experimental diets and water were given *ad libetum* throughout the period of the experiment. Other management practices like vaccination, routine medication and good sanitation were observed to prevent disease outbreak. The study lasted 4 weeks.

#### **Data collection**

The record of initial body weight was obtained by weighing birds in each replicate individually at the beginning of the experiment subsequently on a weekly basis. The final body weight was obtained by weighing the bird at the end of the experiment. Average body weight gain was obtained by subtracting the initial body weight from the final body weight. Daily feed intake of each treatment was determined by the difference between the feed supplied and the left over. All measurements were carried out between 6.30am – 8.00am each day. Feed conversion ratio was determined as the quantity (grams) of feed consumed per unit (grams) weight gained.

#### **Blood sample collection and Analysis.**

Blood samples were collected from two birds in each replicate, the collection was done between 6am –7am to avoid excess bleeding 2ml of blood sample was collected from each bird through the wing vein puncture (Franson, 1986) using needle and syringe into a labeled sample bottle containing an anti-coagulant,

ethylene diimine tetra-acetic acid (EDTA). The following haematological indices were determined Haemoglobin (Hb) concentration, packed cell volume (PCV), Red blood cells (RBC) and white blood cells (WBC) were determined according the methods of Jain (1986). Mean corpuscular volume (MCV), Mean corpuscular (MCH), Mean corpuscular haemoglobin concentration (MCHC) were determined as described by Lamb, (1981).

#### **Economic of Production**

The economics of production of starter chicks using the test ingredients was considered based on the prevailing market prices of the ingredients at the time of the study.

#### **Statistical Analysis**

All data collected were subjected to one-way analysis of variance (ANOVA) according to Steel and Torrie (1990), and differences among treatment means were separated using Duncan's New Multiple range as described by Obi (2002).

### **RESULTS AND DISCUSSION**

The proximate composition of wet maize milling waste and cassava root sieviate are presented in Table 2. T1 which contain no test ingredients is the control diet. Other treatment groups, treatments 1, 2,3 and 4 contain inclusion levels of 15, 30 and 45% respectively replacing maize in each treatment. The increased metabolizable energy of 3172.12 kcal/kg and 3076.94 kcal and 2981.77kcal/kg recorded in treatment 1, 2 and 3 respectively more than the control could be the result of Palm oil in the diets which may have boosted the energy level of the diets (Atteh, 2002). The



lower metabolizable energy of treatment 1 compared to treatments 2 and 3 may be due to high fibre content of the diet (6.98%). The higher crude protein of control diet (23.21%)

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 compared to treatments 2,3 and 4 is expected due to low protein content of wet maize milling waste and cassava root sieviate.

**Table 1: Proximate composition of Wet Maize Milling Waste and Cassava Root Sieviate**

Parameters	WMMW	CRS
Moisture (%)	9.85	14.26
Dry matter (%)	90.15	85.74
Crude protein (%)	13.97	2.10
Crude fibre (%)	7.20	18.66
Ether extract (%)	0.95	0.48
Ash(%)	4.82	2.68
Nitrogen free extract (%)	63.21	61.82

**Table 2: Composition of the experimental diets fed starter chicks**  
 Dietary treatments

Ingredients (%)	T1	T2	T3	T4
Maize	58.00	43.00	28.00	13.00
FWMMW/ CRS	-	15.00	30.00	45.00
Grand nut meal	12.00	12.00	12.00	12.00
Soya bean meal	15.50	15.50	15.50	15.50
Fish meal	3.50	3.50	3.50	3.50
Blood meal	4.00	4.00	4.00	4.00
Bone meal	4.00	4.00	4.00	4.00
Oyster shell	2.00	2.00	2.00	2.00
Salt	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
*Vit/min. Premix	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00

**Calculated analysis**

Crude protein	23.21	22.47	22.21	21.96
Crude fibre	2.85	3.70	5.35	6.98
Ether extract	3.80	11.98	16.16	20.34
ME (k cal/ kg)	2947.02	3172.12	3076.94	2981.77
Lysine	1.46	0.43	1.41	1.39
Calcium	1.67	1.66	1.66	1.66
	1.10	1.09	1.08	1.08

Supplied Vit.A -10,000,000 1  $\mu$ ; Vit. D3 -2,000,0001  $\mu$ ; Vit. E - 20,000 1  $\mu$ ; Vit k -2,250mg; Thiamme - 175mg; R boflavin - 5,000mg; Pyridoxin - 2,750mg; Niacin - 27,500mg; Vit. B12 - 15mg; Pantothenic acid - 7,500mg; Folic acid - 7,500; Biotin - 50mg; Cholin chloride - 400g; Antioxidant - 125g; Manganese -80g; Zinc - 50g; iron - 20g; Copper - 5g; Iodine - 1.5g; Selenium - 200mg and Cobalt 200mg.

The growth performance of broiler chicks fed enzyme supplemented palm oil fortified wet maize milling waste (WMMW) and Cassava root sieviate is presented in Table 3. There were no significant ( $P>0.05$ ) difference among treatments in average final body weight and body weight gain. The average daily weight gain of chicks in treatment 4 were significantly highest compared to chicks on the other treatment groups. Numerically, bird fed 15% WMMW and CRS based diets recorded the highest value of 1115.75g than chick placed on T1, T3 and T4. The marginal higher body weight gain of broiler chicks in treatments 2 and 3 could be the result of enzyme supplementation of high fibre diets which enhanced digestion and utilization of nutrients. It has been reported that roxazyme complements the endogenous enzymes of poultry to enhance the digestion and utilization of non-starch polysaccharides in cereals and their by-products (McNab and Smitherland (1992). Furthermore, Okorie *et al.* (2011) adduced that exogenous enzyme

improves endogenous enzyme activities, working as booster to the endogenous enzyme activities to improve the utilization of higher fibre diets and therefore enhancing the gaining ability of birds. Also palm oil with high metabolizable energy may have boosted the low energy level of wet maize milling waste and cassava root sieviate (Attah, 2002). The relatively low weight gain of birds on 45% palm oil fortified WMMW and CRS might be due to very high fibre and non-starch polysaccharides in the diet (Ani and Omeje, 2007) which the digestive frame work of the chicks could not handle. This is because high dietary fibre tends to limit the amount of intake of available energy by birds and correspondingly leads to excessive nutrient excretion (Kung and Grueling, 2000). The present study agrees with the earlier reports by Okorie (2005) and Okorie *et al.* (2011). Chick fed 15% palm oil and enzyme fortified diet recorded significantly ( $P<0.05$ ) lowest (1916.79g) feed intake than chicks on the other treatment groups, followed by chicks on control



diet which recorded (1958.23g). Treatments 3 and 4 recorded higher feed intake of 2370.95g and 2390.17g respectively.

The observed decrease in feed intake of chicks fed 15% test diet is in line with the reports of Ani and Omeje (2007) and Samarasinghe *et al.* (2000). The feed intake may have been lowered due to addition of enzyme, as the birds fulfilled their nutrient requirement and thereby ate less quantity of feed. However, the present study disagrees with the reports of Augeloricora and Michlik (1997) and Davey *et al.* (1998) that increase in digestibility of nutrients and higher degradation of the cell wall of feed emanating from enzyme inclusion culminated to improved feed intake. The high feed consumption observed in birds fed T3 and T4 might suggest that the replacement levels of test ingredients were high that the enzyme supplement could not influence digestion and proper energy utilization to meet the chicks' requirement. This agrees with Hetland *et al.* (2004) who adduced that there is always increased feed intake by birds as a result of low metabolizable energy value of the diet which influences them to eat more to acquire the metabolizable energy required for maintenance, growth and reproduction.

There were significant ( $P > 0.05$ ) variations among treatment groups in feed conversion ratio (FCR). Chicks on treatments 1, 3 and 4 had comparable ( $P > 0.05$ ) FCR values and these except T1 were significantly ( $P > 0.05$ ) higher than the FCR values of chicks on treatment 2. Enzyme supplementation reduced ( $P < 0.05$ ) FCR value significantly at 15% inclusion of test materials which therefore enhance the efficiency of feed conversion and

*International Journal of Agriculture Management and Technology* utilization by the birds (Boz and Frigg, 1990; Tuleum *et al.*, 2001). The poor FCR observed in birds on treatment 3 and 4 is an indication of poor absorption and utilization of the treatment diets (Okorie *et al.*, 2011). There was a high degree of conversion of the experimental diet of chick on 15% which is confirmed by the final weight of the broilers.

The results of haematological indices of chicks fed enzyme supplemented palm oil fortified WMMW and CRC are presented in Table 4. Apart from RBC, MCH and MCHC, all other haematological indices were significantly. Treatments 2 was significantly ( $P < 0.05$ ) higher than treatments 3 and 4 but significantly ( $P > 0.05$ ) similar to treatment 1 in PVC and Hb. The result of RBC did not show significant ( $P > 0.05$ ) variation among the treatments groups. Marginally, RBC values were 3.30, 3.20, 2.70 and 2.57  $\times 10^6 \text{mm}^3$  respectively for T1, 2, 3 and 4. The values obtained from PVC, Hb and RBC in all the treatment groups fall within the normal range as reported by Mitruka and Rawnsley (1979), Vollmerhaus (1992) and Benerjee (1998). The present result agrees with Okorie (2011) who fed enzyme fortified brewers grain to broilers.

The result indicates that the birds were assumed to be healthy, and the ability of the diets to support life. It is suggestive that the addition of exogenous enzyme aided absorption and utilization of nutrients with the resultant build of blood. Birds fed 15% of the experimental diet maintained significantly ( $P < 0.05$ ) lower WBC than chicks in other treatment groups. The WBC values were 29.50, 20.50, 25.50 and 27.67  $\times 10^6 \text{mm}^3$  for treatments 1, 2, 3 and 4

espectively. The values obtained fall within the normal range ( $9-31 \times 10^6 \text{mm}^3$ ) established by Benerjee (1998) for avian species. This suggests an enhanced immune system of the chicks fed the experimental diets, hence there is no fear of imminent hazard that may be associated with the use of palm oil fortified WMMW and CRS. The red cell indices, MCH, MCV and MCHC provide detail information on the volume and haemoglobin content of red blood cell and are used to determine the type of anaemia present. The values obtained in the present study were within the range reported by Jain (1989). The result showed that the chick did not suffer anaemia.

The cost effectiveness of enzyme supplementation of palm oil fortified WMMW and CRS is shown in Table 3. Cost of feed per kg, cost of feed consumed, cost of feed per kg live weight and revenue per bird did not follow any particular trend. The cost effectiveness of the diets indicated a decline in the cost of feed in treatment 2 compared to other treatments. At 15% dietary replacement of maize with palm oil fortified WMMW and CRC supplemented with enzyme, the cost of feed/kg weight was less than the same weight in the control. This is suggestive of reduced cost of production and subsequently higher revenue from the treatment group.

**Table 3: Performance characteristics of starter broilers fed enzyme supplemented palm oil fortified WMMW and CRS Dietary treatments**

Parameters	T1	T2	T3	T4	SEM
Av. Initial body weight(g)	212.22	214.22	212.96	217.78	3.37
Av. Final body weight(g)	912.96 <sup>b</sup>	1115.75 <sup>a</sup>	962.96 <sup>a</sup>	886.67 <sup>b</sup>	57.12
Av. Total body weight gain (g)	700.74	901.53	750.0	668.89	38.84
Av. Daily weight gain (g)	25.02 <sup>b</sup>	32.20	26.78 <sup>b</sup>	23.89 <sup>a</sup>	1.39
Av. Total feed intake (g)	1958.23 <sup>a</sup>	1916.79 <sup>a</sup>	2370.95 <sup>b</sup>	2390.17 <sup>b</sup>	88.17
Av. Daily feed intake (g)	69.94 <sup>a</sup>	68.46 <sup>a</sup>	84.68 <sup>b</sup>	85.36 <sup>b</sup>	3.20
Feed conversion ratio (g)	2.90 <sup>ab</sup>	2.12 <sup>b</sup>	3.16 <sup>a</sup>	3.61 <sup>a</sup>	0.18
Mortality (%)	0.00	0.00	0.00	0.00	0.00
<b>Economic Evaluation</b>					
Cost of feed kg (₦)	81.88	73.60	84.93	90.14	1.68
Cost of feed consumed (₦)	160.34	141.08	201.36	215.45	3.10
Cost of feed/kg weight gain (₦)	237.45	156.03	268.38	325.41	101.42
Revenue per bird (₦)	730.37	892.60	770.37	709.34	89.63

a,b Means within the same row with different superscript differ significantly ( $P < 0.05$ )

**Table 4: Haematological characteristics of starter broilers fed the experimental diets Dietary treatments**

Parameters	T1	T2	T3	T4	SEM
Packed cell volume (%)	29.70 <sup>ab</sup>	32.70 <sup>a</sup>	28.50 <sup>b</sup>	27.30 <sup>b</sup>	0.70
Haemoglobin (g/dl)	9.90 <sup>ab</sup>	10.90 <sup>a</sup>	9.50 <sup>a</sup>	9.10 <sup>b</sup>	1.16
Red blood cells ( $\times 10^6 \text{mm}^3$ )	3.30	3.20	2.70	2.57	0.15
White blood cells ( $\times 10^6 \text{mm}^3$ )	29.50 <sup>a</sup>	20.50 <sup>b</sup>	25.50 <sup>a</sup>	27.67 <sup>a</sup>	0.23
Mean corpuscular haemoglobin (Pg)	29.50	43.67	34.50	31.50	2.54
Mean corpuscular volume (ft)	90.00 <sup>b</sup>	140.00 <sup>a</sup>	131.67 <sup>ab</sup>	54.50 <sup>c</sup>	9.88
Mean corpuscular haemoglobin concentration (g/100)	33.33	34.38	31.51	31.48	0.08



## CONCLUSION

The present study has shown that broiler chicks can utilize palm oil fortified wet maize milling waste and cassava root sieviate supplemented with enzyme without deleterious effect on growth performance and haematology. However, the performance indices evaluation were most outstanding in chicks fed 15% enzyme supplemented palm oil fortified wet maize milling waste and cassava root sieviate.

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