



## Effect of Biodegraded Cassava Root on Carcass and Organ Characteristics of Broiler Chicken

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### ABSTRACT

A study on carcass and organ characteristics of broiler chicken fed diet containing biodegraded cassava root meal (BDCRM) was carried out using completely randomized design (CRD). Fresh rumen content was collected from the Makurdi slaughter slab from freshly slaughtered cattle. After the cassava was peeled, it was chopped into pieces weighing about 105g. The cassava was thoroughly mixed with the filtrate obtained from mixing rumen content and water at the ratio of 1:1. The mixture was hand mixed thoroughly by submerging the cassava in the filtrate to obtain homogenous mixture. The homogenous mixture was sealed up in air tight polythene bags to achieve anaerobic microbial fermentation of the cassava root for 24 hours and 48hours for T2 and T3, respectively. After fermentation, cassava was sun dried to a constant weight before milling. One hundred and fifty (150) broiler chickens were randomly allotted to three dietary treatments comprising of T1 (control), T2 and T3. Cassava root meal fermented for 24hours (T2) and 48hours (T3) was used to replace maize at 10% in broiler chicken diets. Each treatment has five (5) replicate with ten (10) birds per replicate. The result of this study showed that there was no depressive effect on dress weight, carcass cuts. In terms of organ weights significant ( $P < 0.05$ ) differences were observed in the liver, lungs, large/ small intestine and kidney weights, however, the results did not follow a regular pattern suggesting that treatments would not have accounted for these differences. It is concluded that biodegraded cassava root meal (BDCRM) fermented for 24 and 48 hours could replace maize up to 10 % in the diet of broiler chickens without compromising carcass and organ weights.

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### INTRODUCTION

In the coming years, poultry producers will definitely have to look beyond maize and other conventional sources of feed and drugs because of their low availability; cost and inability to keep pace with ever-increasing poultry production (Abang *et al.*, 2013, 2017, 2018a&b, 2023a-e; Ogana *et al.*, 2020; Adeyi *et al.*, 2021; Gyang *et al.*, 2021). Substantial efforts have been made in the past to replace cereals with cassava in poultry feeding but the response, in terms of productive

performance of chickens fed cassava products, has been widely variable (Adeyemi *et al.*, 2008, Akinfala *et al.*, 2002, Agunsiade *et al.*, 2001; Andersen *et al.*, 2000, Abang *et al.*, 2023f&g).

In order to meet poultry requirement by using other feed alternative, microbial fermented cassava root (*Manihot esculenta*) is considered as replacement for maize (energy) in broiler feed. In monogastric nutrition, cassava root has its limitations, thus it must undergo chemical, physical and microbial processing (Cardoso *et al.*,

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2005; Andersen *et al.*, 2000). The utilization of cassava root fermented with micro-organisms mentioned, has not been widely utilized in broiler feeding. The paper seeks to evaluate the carcass and organ characteristic of broiler chicken fed diet containing varying hour of biodegraded cassava root meal.

## MATERIALS AND METHODS

### Study Area

This experimental work was carried out in poultry unit at the livestock teaching and research farm of Joseph Serwuan Tarka University, Makurdi, Benue State Nigeria. Makurdi lies between latitude 7° 44' North and longitude 8° 32' East of the Benue river bank and 104 meters above sea level. It is located within the Guinea savanna region of the Nigerian agro-ecological zone with a tropical climate, with mean temperature of 23°C – 32°C and an annual mean rainfall of about 1259 – 2000 mm. the rainy period is between Aprils – October and dry period between Novembers – March.

### Processing of the Experimental Materials

Cassava root (*Manihot esculenta*) was obtained from villages around Makurdi metropolis. Fresh rumen content was collected from the Makurdi slaughter slab from freshly slaughtered cattle. Cassava is peeled, cut into pieces at an

average weight of 90- 100g. The cassava was thoroughly mixed with the filtrate obtained from mixing rumen content and water at the ratio of 1:1. The mixture was hand mixed thoroughly by submerging the cassava in the filtrate to obtain homogenous mixture. The homogenous mixture was sealed up in air tight polythene bags to achieve anaerobic microbial fermentation of the cassava root for 24 hours and other for 48 hours respectively. After fermentation, the material was subjected to open sun drying. It was sun dried to a constant weight before milling it with hammer mill. The Soybean (full fat) was uniformly toasted to destroy anti-nutritional factors associated with soy bean (soyoin and non-starch polysaccharides). Other ingredients include; maize, blood meal, fish meal, rice bran, palm oil, salt, broiler premix and bone meal. All the feed ingredients were milled according to broiler starter and finisher requirement as presented in Table 2 and 3. Isocaloric and isonitrogenous feeds (diets) were formulated for the starter and finisher phase: T<sub>1</sub>: 0%: control or reference diet, T<sub>2</sub>: 10%: cassava replacement for maize (24hours), T<sub>3</sub>: 10%: cassava replacement for maize (48hours). The feed was taken to the Laboratory for proximate analysis according to the methods of AOAC (2009).

**Table1:** Proximate analysis of cassava

Cassava Proximate Analysis (%)	24 Hours	48 Hours
Crude protein	3.06	4.38
Fat/oil	0.26	0.23
Ash	2.08	2.39
Moisture	6.97	6.72
Crude fiber.	1.55	1.32

**Table 2:** Composition of diet with biodegraded cassava root for starter broilers

INGREDIENTS	T <sub>1</sub> (%)	T <sub>2</sub> (%)	T <sub>3</sub> (%)
Maize	54.31	51.11	51.25
BDCRM	-	5.11	5.12
soy bean	22.33	22.33	22.33
Blood meal	8.81	8.37	8.34
Fish meal	5.58	5.58	5.56
Rice bran	5.00	5.00	5.00

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Palm oil	2.00	2.00	2.00
Salt	0.25	0.25	0.25
Broiler premix	0.25	0.25	0.25
Bone meal	1.00	1.00	1.00
<b>Total</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>
<b>Calculated Nutrient:</b>			
ME (Kcal/kg)	3211.67	3271.27	3276.42
CP (%)	23.79	23.65	23.67
CF (%)	3.48	3.56	4.56
EE (%)	7.90	7.79	7.8
Ca (%)	1.40	0.91	0.91
P (%)	0.80	0.89	0.79
Lysine (%)	1.40	1.40	1.40
Methionine (%)	0.32	0.31	0.24

*BDCM = Biodegraded Cassava Root Meal, ME= Metabolizable Energy, CP = Crude Protein, CF= Crude Fiber, EE = Ester Extract, Ca = Calcium, P = Phosphorus, Lys= Lysine, Meth= Methionine. T<sub>1</sub>= control treatment, T<sub>2</sub> = cassava replacement for maize (24hours), T<sub>3</sub>= cassava replacement for maize (48hours).*

**Table 3:** Composition of experimental diet with cassava meal for finishing broilers

<b>Ingredients</b>	<b>T<sub>1</sub> (%)</b>	<b>T<sub>2</sub> (%)</b>	<b>T<sub>3</sub> (%)</b>
Maize	63.75	57.25	57.41
BDCRM	-	5.73	5.74
Soy bean	17.69	18.17	18.06
Blood meal	6.63	6.81	6.77
Fish meal	4.42	4.54	4.52
Rice bran	5.00	5.00	5.00
Palm oil	1.00	1.00	1.00
Broiler premix	0.25	0.25	0.25
Bone meal	1.00	1.00	1.00
Salt	0.25	0.25	0.25
<b>Total</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>
<b>Calculated Nutrient:</b>			
ME (Kcal/kg)	3290.48	3217.33	3223.15
CP (%)	20.54	20.13	20.14
CF (%)	3.47	3.47	3.48
EE (%)	7.34	7.10	7.10
Ca (%)	1.04	1.05	1.05
P (%)	0.71	0.78	0.69
Lysine (%)	1.11	1.5	1.1
Methionine (%)	0.46	0.29	0.21

*BDCM = Biodegraded Cassava Root Meal, ME= Metabolizable Energy, Cp = Crude Protein, CF= Crude Fiber, EE = Ester Extract, Ca = Calcium, P = Phosphorus, Lys= Lysine, Meth= Methionine. T<sub>1</sub>= control treatment, T<sub>2</sub> = cassava replacement for maize (24hours), T<sub>3</sub>= cassava replacement for maize (48hours).*

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### Management of Experimental Birds

One and fifty (150) day old unsexed growers were randomly allocated to three dietary treatments; each treatment was replicated five times with ten (10) birds per replicate. The house was half wall roofed with zinc coated metal net. The birds were managed intensively in cages of three tiers. Each tier was separated with wood. Wire mesh was used for the walls and doors to allow adequate ventilation and lighting. The dimension of each tier was (1.0M<sup>2</sup> x 0.78M<sup>2</sup>). Litter materials (wood shaving) were used on the wooden floors. Each tier was equipped with adequate drinkers and feeding troughs. A floor space of about 0.007M<sup>2</sup> to 0.009M<sup>2</sup> per birds was provided. Source of lighting was provided with the use battery and light (popularly called after Nepa) to ensure adequate feed intake and Local (Abacha) stove as source of heat. Conventional management practices were adopted.

### Experimental Procedures and Data Collection

The initial body weight of the birds was taken and the birds were randomly distributed into the various experimental units. A known quantity of diet was served to the birds and the left over weighed. Feed and drinking water were given separate *ad libitum* throughout the period of experiment which lasted for eight (8) weeks. Mean daily feed consumption and weekly body weight gain were determined. At the end of the eight (8) weeks, two (2) birds were randomly selected from each replicate and slaughtered. Birds were slaughtered by cutting their jugular veins with a sharp knife and allowed to bleed. After that the carcass were weighed one after the other in the various treatment and scalded in hot water to soften the follicle of the feathers for easy removal followed by de-feathering and then evisceration. The carcass was finally cut into various parts and each part was weighed and kept separately according to treatments. Weight of cut-off parts and intestinal organs were determined using a sensitive digital scale.

$$\text{Carcass cut (\%)} = \frac{\text{carcass cut part}}{\text{dressed weigh}} \times 100$$

$$\text{Organ weight (\%)} = \frac{\text{organ weigh}}{\text{live weigh}} \times 100$$

### Chemical Analysis

Processed cassava root meal was analyzed for proximate fractions according to the method described by AOAC (2009).

### Statistical Analysis

Data collected were subjected to statistical analysis using analysis of variance (ANOVA) using SPSS statistical package and Duncan Multiple Test according to the methods of Steel and Torrie (2010) was used to separate means that different significantly (P<0.05) as included in the software package.

### RESULTS AND DISCUSSION

The effect of varying hours of biodegraded cassava root meal on the carcass cuts of broiler chicken is presented in Table 4. The dietary treatments had significant (P<0.05) effects on whole live weight and percent thigh weight. This report agreed with Adeyemi *et al.*, 2008 who reported significant (P<0.05) effect on the live weight of broiler chicken fed diet containing cassava root meal fermented with bovine rumen filtrate but contradicts with report of thigh weight. It also agreed with Olaifa *et al.* (2015) who recorded significant (P<0.05) in the live weight and thigh weight when broiler chickens were fed graded levels of cassava peel meal based diet. The live weight ranges from 1180.00 to 1460.00g. The results revealed that live weight of birds fed diet containing BDCRM fermented for 24 hours was not significantly (P>0.05) different from live weight of birds fed control diet whereas, those on diet containing BDCRM fermented for 48 hours were lower in live weight compared to those on control diet. The thigh has its highest value at T<sub>2</sub> (17.63g), followed by T<sub>1</sub> (16.75g), and least value at T<sub>3</sub> (16.14g). The result revealed that the thigh of birds fed diet containing BDCRM fermented for 24 hours was not significantly (P>0.05) different from the thigh of birds fed control diet however, birds fed 48 hours BDCM had significantly (P<0.05) lower weight when compared with those on control diet. Back, drumstick, neck, wings, shank, breast and head were not affected. Among the carcass yield expressed as percent dressed weight, drumstick, neck and shank has the highest

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value in T<sub>2</sub> (15.44g, 7.01g and 7.53g) and least in T<sub>1</sub> (14.65g, 6.52g, and 7.04g). It was observed that as bird were fed diet containing biodegraded cassava root meal fermented for 24 hours to 48 hours, the weight decreases numerically.

The utilization of varying hours of biodegraded cassava root meal as a substitute feed ingredient for maize did not suppress (P>0.05) the physiological development of the prime cuts namely; drumstick, breast, wing, back, neck, head and shank. The head contains the brain needed for the coordination of various body functions. Whole shank support and carries the weight of the chicken. The mean dressed weight is higher numerically at T<sub>1</sub> (897.70g) and T<sub>2</sub> (863.40g) than at T<sub>3</sub> (762.20g).

The mean relative organ weight of broiler chicken on the experimental diets is presented in Table 5. The experimental diet had significant (P<0.05) differences, lungs, liver, intestine and Kidney. This result disagreed with Adeyemi *et al.* (2008) who reported that there was no significant (P>0.05) effect on weight of liver and kidney of broiler chicken fed diet containing cassava root meal fermented with bovine rumen filtrate, but it agreed with Olaifa *et al.* (2015) who reported significant (P<0.05) different in the lungs, liver and intestines weight when broiler chickens were fed graded levels of cassava peel meal based diet.

The gastrointestinal tract is the path way food takes from mouth through the esophagus and stomach. The small intestine is the part of the intestine where 90% of the digestion and absorption occurs and its function is to absorb most of the nutrient from what animal eat and drink, the large intestine is to absorb water from the remaining ingestible food matter and transmit the waste materials from the body and it is about 5 feet long and about 3 inches in diameter. The higher weight of the Large/small intestine in T<sub>3</sub> of broiler chicken fed with biodegraded cassava root meal may refer to higher protein content in the

composition and increase retention time of digesta on fibrous diet. Higher protein is associated with high water which altogether increases the weight of the intestine.

There is significant (P<0.05) in the liver, lungs and Kidney. The increase in the liver and lungs weight in T<sub>3</sub> (2.09) may be as the result of the increased crude fiber and carbohydrate content in the cassava meal which may be caused by increased activity. Meanwhile, the higher weight of the kidney (0.439) in T<sub>2</sub> may be as a result of higher carbohydrate content and Hydrogen Cyanide (HCN) in the cassava meal that may lead to over-working at the process of removing waste product from the body. More so, the higher weight of the kidney (0.456) in T<sub>1</sub> may be as a result of higher ether extract (EE) content of the diet which may lead to heat stress that can increase uric acid level in the blood which can interfere with the removal of waste product from the body. The experimental diet did not however affect Bile, Pancreases, Spleen, Gizzard, Proventriculus and Heart. This implies that the replacement of maize with varying hours of biodegraded cassava root meal for 24 hours and 48 hours (10 % each) did not have any deleterious effect on the organ (Bile, Pancreases, spleen, Gizzard, proventriculus and heart) weights of broiler chicken. This report disagreed with Adeyemi *et al.* (2008), who reported that there is significant effect on Gizzard, Proventriculus and Pancrease of broiler chicken fed diet containing cassava root meal fermented with bovine rumen filtrate and Olaifa *et al.* (2015) who reported significant (P<0.05) difference in the gizzard and heart when broiler chickens where fed graded levels of cassava peel meal. For liver weight, Large/small intestine, lungs and kidney affected significantly (P<0.05) by the experimental diets among the other treatment group, there was no particular trend of variation. This suggests that the significant variation observed may not have been as a result of the dietary treatments.

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**Table5.** Effect of Biodegraded Cassava Root Meal (BDCRM) on Internal Organs of Broilers

Parameters	T <sub>1</sub> (0%)	T <sub>2</sub> (10%) 24hours	T <sub>3</sub> (10%) 48hours	SEM	LOS
Liver wt (%)	1.73 <sup>b</sup>	1.62 <sup>b</sup>	2.09 <sup>a</sup>	0.064 <sup>*</sup>	0.004
Lungs wt (%)	0.360 <sup>b</sup>	0.398 <sup>ab</sup>	0.481 <sup>a</sup>	0.020 <sup>*</sup>	0.031
Bile wt (%)	0.092	0.100	0.101	0.006 <sup>ns</sup>	0.813
Pancreases (%)	0.174	0.204	0.266	0.020 <sup>ns</sup>	0.147
Spleen (%)	0.079	0.150	0.080	0.020 <sup>ns</sup>	0.266
Gizzard (%)	3.34	3.27	3.61	0.125 <sup>ns</sup>	0.521
L/S intestine (%)	6.32 <sup>ab</sup>	5.57 <sup>b</sup>	7.18 <sup>a</sup>	0.253 <sup>*</sup>	0.028
Proventriculus (%)	0.587	0.523	0.617	0.027 <sup>ns</sup>	0.364
Heart (%)	0.402	0.355	0.436	0.020 <sup>ns</sup>	0.262
Kidney (%)	0.456 <sup>a</sup>	0.439 <sup>a</sup>	0.247 <sup>b</sup>	0.036 <sup>*</sup>	0.022

NS, not significant ( $P > 0.05$ ). a, b means within the row with different superscripts differ significantly ( $P < 0.05$ ). T<sub>1</sub> = control diet, T<sub>2</sub> = cassava root meal fermented for 24 hours, T<sub>3</sub> = cassava root meal fermented for 48 hours, SEM = standard error of mean, LOS = level of significant, BDCRM = biodegraded cassava root meal, Wt = weight, %= percent.

### CONCLUSION

The study concluded that inclusion of 10% of biodegraded cassava root fermented for 24 hours and 48hours in the diets of broiler chickens had no deleterious effect on their carcass and organs characteristics.

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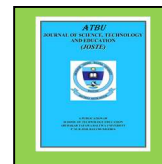
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