EVALUATION OF BROILER CHICKENS FED GRADED LEVELS OF PROCESSED UMUCASS 36 CASSAVA FOLIAGE MEAL

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ABSTRACT

One hundred and fifty (150) week old Abor Acre broiler chickens were used to evaluate the performance of broiler chickens fed graded levels of processed UMUCASS 36 cassava foliage meal. The cassava leaves and tender stems (soft apical part) were harvested at twelve months old from the National Root Crops Research Institute farm. The leaves and tender stems were mixed in ratio 4:1 after oven drying at 70ºC. The birds were randomly assigned to 5 treatment diets replicated into three with 10 birds per replicate in a Completely Randomized Design. Five diets were formulated, D1 being the control while D2 to D5 had the inclusion of foliage meal at 2.5%, 5%, 7.5% and 10%. Broilers on diet D2 performed best in growth performance, carcass characteristics and organ proportions. Cost per kilogram weight gain and gross margin of broilers on diet D2 (₦280.64 and ₦1447.10;$ 0.84 and $4.34) proved best among all. Broilers on diet D2 digested the feed better than all others. Diet D2 gave the best result in this study and is therefore recommended for feed millers and poultry farmers.

Keywords: *performance, carcass, UMUCASS 36, cassava foliage meal, broiler chickens*

INTRODUCTION

Poultry, particularly chickens are the most widely and numerously kept animal species in the world (Moreki *et al*., 2010). Chickens are widely distributed in rural and peri-urban areas where they play the important roles of income generation and food production (Moreki *et al*., 2010). The importance of chicken production cannot be over-emphasized as it promotes and supports the fast-growing human population with high-quality protein because of its low contents of fat and cholesterol. Consumers also acknowledge the relatively low price and the lack of religious restriction against its consumption (Jaturasitha, 2008). Chicken production is also important because of other divergent roles it plays. Poultry farmers get financial returns from the sale of eggs, frozen and live birds in urban and rural markets.

There is therefore need for commercial poultry farmers to increase their level of production, to meet the supply of animal products for consumption in Nigeria in the next 20 to 50 years to improve nutritional well-being and economic development (Nkwocha *et al.,* 2010).

The scarcity of conventional raw materials for the feed mill industry has caused a continuous rise in the cost of production, resulting in an unreasonable increase in the unit cost of animal products. Thus, these conventional raw materials have become inaccessible to poultry farmers, especially soybean meal which is the main protein source in poultry feed.

This has necessitated a search for alternative feed material that is readily available, cheap and its consumption compete less with human. Cassava foliage is a potential protein source for poultry production in Nigeria. It is widely grown in Nigeria and can serve as an alternative protein source.

Cassava is one of the most drought-tolerant crops and can be successfully grown on marginal soils, giving reasonable yields where other crops cannot do well (Cassava Master Plan, 2006). Out of more than 228 million tons of cassava produced worldwide, Nigeria produces 50 million tons of cassava yearly (Iwere, 2013). Nigerian cassava production is by far the largest in the world; producing a third more than Brazil and almost double the production of Indonesia and Thailand (FAO, 2004). Therefore, cassava foliage offers tremendous potentials as a cheap alternative feed resource for broilers. This research work, therefore, aims to evaluate cassava foliage meal as an alternative to soybean in broiler diets.

MATERIALS AND METHODS

Experimental site

The research was conducted at the Poultry Unit of the Teaching and Research Farm of Michael Okpara University of Agriculture, Umudike, Abia State. The area is located at latitude 05^{o} 29^{1} North and longitude 07^{o} 32^{1} East with an elevation of 122 m above sea level and is located in the rainforest zone of Nigeria. It has a maximum and minimum daily temperature of 27-36^{o}C and 20-26^{o}C respectively and relative humidity of 50 -95%. It is therefore, in a humid tropical environment, where the temperature and relative humidity are significant for agricultural production (N.R.C.R.I, 2017).

Experimental birds and management

A total of one hundred and seventy-five (175) Abor Acre strains of broiler chicks were purchased from Agrited Farms Ibadan, Oyo State and raised at the Poultry Unit of Teaching and Research farm of Michael Okpara University of Agriculture, Umudike, Abia State. The birds were housed in a deep litter brooding pen at day-old. The chicks were brooded for one week and reared to eight weeks of age by conforming to standard management procedures. The birds were fed and watered *ad libitum* with a commercial starter diet (crude protein, 23%; metabolizable energy of 3000kcal/g) from day-old to one week of age before introducing the test diets. Proper sanitation and routine medication were maintained to forestall any outbreak of disease.

Experimental procedure

One hundred and fifty (150) birds were assigned in a Completely Randomized Design to five treatments with three replicates of ten birds per replicate. The formulated straight broiler diets were used for a period of seven weeks. Table 1 shows the composition of the experimental diets that were used.

Cassava foliage meal

The leaves and tender stems of UMUCASS 36 cassava were collected at the point of harvest from the cassava farm of the National Root Crops Research Institute (NRCRI). They were then chopped into smaller sizes of three centimeters long (3cm) and then oven-dried at 70^{0}C until it has a crispy texture before using hammer mill to mill and sieved with sieve of two millimeter (2mm) screen. The cassava foliage meal was packed into a polythene bag at room temperature ready for use.

Experimental diets

The processed cassava foliage meal was used to formulate five diets, at 0, 2.5, 5, 7.5 and 10% levels designated D1, D2, D3, D4 and D5 respectively to replace soya bean meal. The foliage meal had cassava leaf meal and cassava tender stem at ratio 4:1 proportion. The ingredients and composition of the experimental diets are as shown in Table 1 below:

DATA COLLECTION

Determination of growth parameters

Data were collected for seven weeks. The following parameters were measured:

Initial body weight: this was assessed by weighing the birds at the beginning of the experiment using a single pan electronic balance (Scientech Single Pan Electrical Balance) (3 decimal places in grammes) to weigh the chicks.

Final body weight: this was assessed by weighing each bird in each replicates at the end of the experimental period using a triple beam balance (Ohaus) (kg).

Feed intake/bird/day (g)

$$= \frac{\text{Quality of feed given - Quantity not eaten}}{\text{No. of birds} \times 49 \text{ days}}$$

Daily weight gain/bird (g)

$$= \frac{\text{Final live weight - Initial weight}}{\text{No. of birds} \times 49 \text{ days}}$$

Feed conversion ratio

$$= \frac{\text{Quantity of feed consumed}}{\text{Weight gain}}$$

$$\% \text{ Mortality } = \frac{\text{Number died}}{\text{No. stocked}} \times 100$$

Carcass characteristics and organ proportions

The carcass characteristics and organ proportions were determined by slaughtering three birds per treatment at the end of the feeding trial. The birds slaughtered were fasted for 24 hours to empty the digestive tract but water was supplied *ad-libitum*. Slaughtering was done by a clean cut across the jugular vein and the birds were allowed to bleed for at least three minutes. The birds were de-feathered by dipping into boiling water for one and a half minutes and then the feathers were removed. The carcass was cut into parts and the organs separated according to the procedure described by Ojewola and Longe (1999). All parts (breast, drumstick,

Table 1: Percentage composition of experimental diets containing graded levels of processed UMUCASS 36 cassava foliage meal fed to broiler chickens

	Diets				
Ingredients (%)	**D1 (0%)**	**D2 (2.5%)**	**D3 (5%)**	**D4 (7.5%)**	**D5 (10%)**
Maize	40.50	40.50	40.50	40.50	40.50
SBM	35.00	34.12	33.25	32.37	31.50
CFM	-	0.88	1.75	2.63	3.50
Maize offal	16.80	16.80	16.80	16.80	16.80
Blood meal	1.50	1.50	1.50	1.50	1.50
Palm oil	0.50	0.50	0.50	0.50	0.50
Fish meal	2.00	2.00	2.00	2.00	2.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Salt	0.25	0.25	0.25	0.25	0.25
*Premix	0.25	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10	0.10
Total	100	100	100	100	100
Calculated	**Composition**				
Metaboilzable energy (kcal/g)	2853.89	2833.79	2813.77	2793.67	2773.64
Crude protein	22.29	22.09	21.89	21.68	21.48
Energy : Protein	128 : 1	128 : 1	128 : 1	128 : 1	129 : 1

SBM – Soya bean meal, CFM-Cassava foliage meal ;**To provide the following per Kg. of feed: Vitamin A 10,000iu; Vitamin D3, 2000iu; Vitamin B1 0.75mg; Nicotinic acid, 2.5mg; vitamin E, 2.5mg; cobalt, 0.40mg; Biotin, 0.50mg; Folic acid, 1.00mg; Cholin chloride, 2.5mg; Copper, 8.00mg; Manganese, 64mg; Iron, 32mg; Zinc, 40mg; Iodine, 0.8mg; Flavomycin, 100mg; Spiromycin, 5mg; DL – methionine, 56mg; L. Lysine, 120mg and Selenium, 0.16mg.*

thigh, wings and back cut) were weighed and expressed as percentage dressed weight. Organs like liver, heart, gizzard, kidneys were also weighed and expressed as a percentage of live weight.

ECONOMICS OF DIET

This was carried out as described by Ojewola *et al.* (2005).

Cost/kg of feed

$$= \frac{\text{total cost of producing 100kg of feed}}{100}$$

Cost of feed consumed

$$= \frac{\text{Cost}}{\text{kg of feed}} \times \text{total feed consumed}$$

Cost/kg weight gain

$$= \frac{\text{cost of feed consumed}}{\text{Total weight gain}}$$

Cost of production

$$= \frac{\text{Cost}}{\text{kg of feed}} \times \text{total feed consumed}$$

Revenue

= price of 1kg of meat x mean weight gain

Gross margin

= Revenue – cost of production

EXPERIMENTAL DESIGN AND STATISTICAL ANALYSIS

The experimental design was a Completely Randomized Design using five treatments with three replicates of ten birds each. All data collected were subjected to analysis of variance (Steel and Torrie, 1980), and significant differences between treatments means were separated using Duncan's multiple range test (Duncan, 1955). The model of the design was:

$$Y_{ij} = \mu + T_i + e_{ij}$$

Where

Y_{ij} = single observation ie j^{th} observation on the ith treatment.

μ = overall mean

T_i = the effect of the i^{th} level of treatment

e_{ij} = experimental error.

RESULTS AND DISCUSSION

Table 2 revealed the determined proximate composition and gross energy of processed UMUCASS 36 foliage meal fed to broiler chickens. The crude protein and energy content of diets met the standard for straight diet for broiler production as recommended by NRC (1984). As the level of inclusion of cassava foliage meal increases the crude protein and energy level decreased probably because of the increasing levels of the fiber content.

Table 3 showed the growth performance of broiler chicken fed graded levels of processed UMUCASS 36 foliage meal. There were significant differences ($P<0.05$) in the final weight, total weight gain, average weight gain and feed conversion ratio while there were no observable

Table 2: Determined proximate composition and gross energy of graded levels of processed UMUCASS 36 foliage meal fed to broiler chickens

	DIETS				
Parameters (%)	D1 (0%)	D2 (2.5%)	D3 (5%)	D4 (7.5%)	D5 (10%)
Dry matter	90.76	90.66	90.10	90.30	90.20
Crude protein	22.54	22.33	22.12	21.91	21.70
Crude fibre	3.77	3.79	7.14	7.21	7.24
Ether extract	3.64	3.57	3.84	4.02	3.97
Ash	7.05	6.84	9.15	9.30	9.80
NFE	53.76	54.13	47.85	47.86	47.49
Gross Energy (kcal/g)	4.014	4.009	4.023	3.919	3.931

differences (P>0.05) in the initial weight, total feed intake, average feed intake and mortality. The final weight of broilers on diet D1 (2007.00g) and diet D2 (2127.67g) are comparable but significantly (P<0.05) different from other diets. Broilers on diet D3 (1730.00g) ranked second while broilers on diets D4 and D5 followed with comparable weights.

Broilers on diet D2 had the best total weight gain followed by broilers on diets D1, D3, D4 and D5 with weights of 2008.67g, 1888.00g, 1612.00g, 1468.33g and 1345.00g respectively. The average weight gain of broilers on diets D1 and D2 are comparable; broilers on diets D3 and D4 are comparable too while broilers on diet D5 had the least weight gain. Broilers on diet D2 had the least and best (numerically) feed conversion ratio of 2.11; though it was comparable to broilers on diets D1 and D3. Broilers on diet D5 had the highest and worst feed conversion ratio of 3.51. It could be deduced that broilers on diet D2 (2.5%) level of inclusion performed better than other diets even the control. This is in line with the result of Ahaotu *et al.* (2009) who stated that broiler placed on 2.5% inclusion level of cassava leaf meal performed better in the body weight gain than others on higher cassava levels. lheukwumere *et al*. (2007) equally observed that as the level of inclusion of cassava leaf meal increased the growth performance decreased which was observed in this experiment. There were no significant differences (P>0.05) in the final weight gain, feed intake and feed conversion efficiency of the finisher broiler fed 0, 5, 10 and 15% cassava leaf replacement (Okorie *et al.,* 2011). The progressive decrease in performance could be due to the increase in fibre level. This agreed with the submission of lheukwumere *et al*. (2007) who said that the depressed body weight gain of broilers at 10% and 15% leaf meal might be because feed intake was low due to the high bulk or fibre content of the leaf meal resulting in insufficient consumption of digestible nutrients particularly protein and energy required to sustain rapid growth. This result is also in line with the observations of Esonu *et al.* (2002) that leaf meals from *Microdesmis puberula* depressed feed utilization efficiency in chickens. The pattern of mortality does not reflect the effect of the diet.

Table 4 reveals the carcass characteristics of broiler chicken fed graded levels of processed UMUCASS 36 foliage meal. There were significant (P<0.05) differences in the carcass characteristics of broiler chicken fed graded levels of processed UMUCASS 36 foliage meal. The live weight, bled weight, de-feathered weight and dressed weight followed the same pattern. The live weight, bled weight, de-feathered weight and dressed weight of broilers on diet D2 was the most superior followed by broilers on diet D1 then broilers on diet D3, broilers on diet D4 and lastly broilers on diet D5.

Table 3: Growth performance of broiler chickens fed graded levels of processed UMUCASS 36 foliage meal

	DIETS					
Parameters	**D1 (0%)**	**D2 (2.5%)**	**D3 (5%)**	**D4 (7.5%)**	**D5 (10%)**	**SEM**
Initial wt. (g)	119.00	119.00	118.00	118.33	118.33	0.71
Final wt. (g)	2007.00^{a}	2127.67^{a}	1730.00^{b}	1586.67^{c}	1480.00^{c}	38.69
Total. wt. gain (g)	1888.00^{b}	2008.67^{a}	1612.00^{c}	1468.33^{d}	1345.00^{e}	34.77
Total feed intake (g)	4600.02	4225.92	4239.97	4377.17	4663.49	139.47
Ave. feed intake/bird/day (g)	93.82	86.25	86.53	89.33	97.14	3.37
Ave. wt. gain (g)	38.51^{a}	40.93^{a}	34.81^{b}	29.97^{b}	27.45^{c}	0.83
Feed Conversion Ratio	2.43^{c}	2.11^{c}	2.49^{c}	2.98^{b}	3.51^{a}	0.12
Mortality (%)	10	10	3.33	10	3.33	5.58

Means within the same row with different superscript ($^{a-e}$) are significantly (P< 0.05) different. SEM-Standard Error of Mean

The dressing percentage of broilers on diet D2 was the best with 76%; followed by broilers on diet D1 (70.92%) which was comparable to broilers on diet D3 (67.56%). The dressing percentage decreases with an increase in the percentage of foliage meal. This observation is in line with Awojobi and Adekunmisi (2002) who submitted that increasing levels of CLM significantly (P<0.05) decreased dressing percentage and was associated with a hypertrophy of all visceral organs. The cut parts which were expressed as a percentage of dressed weight differed significantly (P<0.05). The breast of broilers on diets D2 (38.11%) and D3 (38.52%) were similar but different from broilers on diets D1 (32.83%), D4 (36.51%) and D5 (35.07%) which were equally similar. The percentage breast weight decreased with an increase in the inclusion level of foliage meal. The drumstick of broilers on diets D1 and D2 were similar but differed from others while those on diets D3, D4 and D5 were comparable. There were no significant differences (P>0.05) in the thigh weights across the diets. The wings of broilers on diets D4 (14.45%) and D5 (14.73%) were superior to others while those on diets D1 (16.35%), D2 (10.20%) and D3 (11.43%) were similar. The back cut does not have a particular pattern that could be attributed to the effect of the test ingredient. The cut part did not follow a particular pattern but it was observed that there was a reduction in weights as the inclusion level of foliage meal increased. This was because the chicken ate more feed to gain less weight (the feed was not well utilized). This finding is in line with the observation of Esonu *et al.* (2002) and Nwoche *et al*. (2006) that said depressed weights of the carcass cut parts may be as a result of low digestibility hence the inability of the birds to convert the feed into meat. With broilers on diet D2 having superior values of live weight, bled weight, de-feathered weight, dressed weight, percentage dressed weight and drumstick it could be concluded that 2.5% replacement of soybean with UMUCASS 36 foliage meal would give a good carcass characteristics.

Organ proportion of broiler chicken fed graded levels of processed UMUCASS 36 foliage meal expressed as percentage live weight is as shown in Table 5 There were significant (P<0.05) differences in the spleen, heart, liver, gizzard, kidney, proventriculus, pancrease, abdominal fat and lengths of both small and large intestine. There were no observable differences in the values of lungs, weight of small and large intestine and crop. There was a progressive increase in

Table 4: Carcass characteristics of broiler chicken fed graded levels of processed UMUCASS 36 foliage meal

	DIETS					
Parameters	**D1 (0%)**	**D2 (2.5%)**	**D3 (5%)**	**D4 (7.5%)**	**D5 (10%)**	**SEM**
Live wt.(g)	1883.33^{b}	2076.67^{a}	1700.00^{c}	1530.00^{d}	1443.33^{e}	36.79
Bled wt. (g)	1833.33^{b}	2030.00^{a}	1666.67^{c}	1513.33^{d}	1393.33^{d}	38.93
De-feathered wt. (g)	1733.33^{b}	1940.00^{a}	1566.67^{c}	1413.33^{d}	1293.33^{e}	37.36
Dressed wt. (g)	1336.67^{b}	1530.00^{a}	1133.33^{c}	1013.33^{c}	880.00^{d}	41.55
% Dressed wt.	70.92^{b}	76.10^{a}	67.58^{b}	64.14^{c}	60.98^{d}	0.99
Cut parts or	Prime cuts					
Breast	32.83^{b}	38.11^{a}	38.52^{a}	36.51^{b}	35.07^{b}	1.28
Drumstick	17.33^{a}	18.23^{a}	14.22^{b}	13.16^{b}	15.07^{b}	0.61
Thigh	16.35	15.31	16.10	15.111	16.23	1.03
Wings	11.41^{b}	10.20^{b}	11.43^{b}	14.45^{a}	14.73^{a}	0.50
Back cut	20.80^{a}	18.65^{ab}	16.88^{b}	19.73^{a}	17.00^{b}	0.73

Means within the same row with different superscript ($^{a-e}$) are significantly (P< 0.05) different.
SEM-Standard Error of Mean

the percentage values of heart, gizzard, kidney, weights of the small and large intestine and their lengths and abdominal fat. This probably could be due to the increase in fibre levels and anti-nutrients contained in the diets. These agreed with the work of Akinmutimi (2006) who reported that weight of organs increased as level of fibre increased.

The decreased cost of feed per kilogram observed in this work was reported by Ngiki *et al.* (2014) when the inclusion level of cassava leaf meal increased. The cost of feeding broilers on diets D3, D4 and D5 were higher than diet D2 probably because the birds tend to eat more to satisfy their body requirements. Broilers on diet D2 were preferred among others because of the least cost of production and best revenue and gross margin. This implies that D2 is more economically viable than others.

CONCLUSION AND RECOMMENDATION

From the results above, it could be concluded that the performance of broilers fed diet D2 (2.5% level of inclusion) was better than the rest of the diets considering the growth performance, carcass quality, organ proportion and economics of production and it is therefore recommended. Farmers can comfortably replace 2.5% of the soya bean meal with cassava foliage meal thereby reducing their cost of production which had been a major challenge in animal agriculture.

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Table 6: Economics of production of broiler chicken fed graded levels of processed UMUCASS 36 foliage meal

	DIETS					
Parameters	D1 (0%)	D2 (2.5%)	D3 (5%)	D4 (7.5%)	D5 (10%)	SEM
Spleen (%)	0.15^{a}	0.19^{a}	0.12^{bc}	0.09^{c}	0.08^{c}	0.02
Heart (%)	0.58^{b}	0.57^{b}	0.63^{ab}	0.67^{ab}	0.69^{a}	0.03
Liver (%)	2.03^{ab}	1.87^{b}	2.06^{ab}	2.14^{a}	2.16^{a}	0.08
Gizzard (%)	1.96^{ab}	1.89^{b}	2.00^{ab}	2.04^{ab}	2.09^{a}	0.06
Kidney (%)	0.75^{ab}	0.72^{b}	0.78^{ab}	0.80^{ab}	0.86^{a}	0.03
Lungs (%)	0.74	0.79	0.69	0.76	0.77	0.05
Small intestine (%)	2.92	2.24	2.93	3.08	3.37	0.21
Length of small intestine (cm)	201.33^{b}	188.33^{b}	206.67^{b}	209.67^{b}	257.67^{ab}	7.23
Large intestine (%)	0.54	0.52	0.55	0.57	0.58	0.03
Length of large intestine (cm)	56.33^{bc}	53.00^{c}	57.67^{b}	58.00^{b}	63.67^{a}	1.26
Proventriculus (%)	0.42^{b}	0.47^{ab}	0.45^{ab}	0.46^{ab}	0.48^{a}	0.02
Crop (%)	0.61	0.61	0.55	0.57	0.59	0.03
Pancrease (%)	0.32^{ab}	0.25^{b}	0.31^{ab}	0.41^{a}	0.37^{ab}	0.04
Abdominal fat (%)	0.45^{d}	0.33^{e}	0.61^{c}	0.71^{b}	0.85^{a}	0.03

Means within the same row with different superscript ($^{a-e}$) are significantly (P< 0.05) different.
SEM-Standard Error of Mean

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