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Effect Of Supplemented Biodegraded Cassava Root Meal On The Organoleptic Properties Of Broiler Chickens

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ABSTRACT
An experiment to assess the organoleptic properties of broiler chickens fed biodegraded cassava root meal was conducted in the Poultry Unit of the Livestock Teaching and Research Farm, Joseph Sarwuan Tarka University, Makurdi, Benue State. A total of 150 one-week-old (Ross 308) broiler chicks were used for the experiment. The birds were assigned randomly into three (3) treatments and each treatment was replicated five times with ten (10) birds per replicate. The chicks in each replicate were housed in disinfected separate pens in a completely randomized design (CRD). All routine management practices, including recommended vaccinations were strictly observed throughout the period of the study which lasted for 56days. Feed and water were served ad libitum throughout the experimental period. Upon completion of the feeding trial, fifteen birds (one per replicate) with the mean weight of the various replicates were slaughtered and processed. Sensory evaluation was done using thigh muscle meat samples from the processed broiler chickens. The prepared meat was cooked in separate pots to a temperature of 1000C for 15 minutes. Thereafter, the cooked meat samples were coded and served at room temperature (270C) to panelists comprising of both staff and students of Joseph Sarwuan Tarka University, Makurdi. Sensory assessment was adjudge using a 9-point hedonic scale for colour, juiciness, tenderness, flavour and overall acceptability. The panelists received each sample separately, rinsing their mouth in-between samples with water. Effect of supplemented biodegraded cassava root meal on organoleptic properties of broiler chickens showed significant ($p<0.05$) differences in the colour. The meat colour of broiler served control diet was slightly dark, whereas, that of broilers fed T2 and T3 was slightly light. Other parameters such as flavour, texture, tenderness, juiciness and overall acceptability were not significantly ($P>0.05$) affected by the dietary treatments. It can be concluded that 10 % inclusion of biodegraded cassava root meal (BCRM) at both 24 hours and 48 hours of fermentation does not affect the organoleptic properties of broiler chicken except the colour.

Keywords: *Biodegraded cassava root, maize, broiler chicken, sensory assessment, 9-point hedonic scale*

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INTRODUCTION

Poultry industry in Nigeria occupies a prominent position as a major source of animal protein supply to the citizen. Over the years, the growth of poultry industry has followed a pattern closely dictated by the economic fortunes of countries. Processed chicken products' consumption has dramatically increased over the last decades [1]. Poultry meat is a very popular food commodity around the world due to its low cost of production as compared to meat products as beef, lamb or pork, low fat content, high nutritional value and distinct flavour[2]. Meat quality may be affected already by manipulation of animal feeding [3].

The continuous increase in cost of conventional energy sources caused by inadequate supply and stiff competition between human, animals and various industries for many decades has resulted to the need to source for suitable, readily available and cheap energy sources for poultry production globally [4]. One such alternative is cassava which is now found in abundance in most tropical countries with Nigeria as the leading producer. Due to lack of excellent post-harvest technologies, large quantities of cassava are wasted. The use of cassava as an alternative to conventional energy feed stuffs like maize could help to reduce feed costs [5]. However, cassava root meal has not been fully adopted by the animal feed industry due to inconsistencies in animal response when it is included in diets. Over the years, various techniques, such as soaking, sun drying, boiling, ensilage and fermentation, have been employed to improve the nutritional value of cassava root meal with varying degrees of success achieved. However, none of these methods has

successfully eliminated all the nutritional deficiencies inherent in this staple crop to make it possible for the root to be added at a 100% replacement of maize in poultry diet. Currently, cassava can only be added at levels of 30–40% in nutritionally balanced, pelleted diets. There is a great need to identify more effective processing techniques to improve the material for animal feeding [6]. An increased use of cassava in poultry feeding will go a long way to reduce this wastage and also reduce the high cost of poultry feed. Bovine rumen content found in abattoirs scattered all over Nigeria are not put into any immediate use after the animals are slaughtered. The rumen content disposal is not correctly done and the beneficial microorganisms not utilized thereby constituting environmental pollution. Thus proper management and handling of these materials will enhance feed value. This will replace dietary maize, save cost and boost animal protein availability. This research was aimed, therefore, at determining the effect of supplemented biodegraded cassava root meal (BCRM) on the organoleptic properties of broiler chickens.

MATERIALS AND METHODS

Experimental Site

The experiment was conducted at the Experimental Poultry unit of the Teaching and Research Farm of Joseph SarwuanTarka University Makurdi, Benue State of Nigeria. Makurdi is the Capital of Benue State located on central Nigeria along the Benue River. It lies within the geographical coordinates of Latitude $7^0$44` North, and Longitude $8^0$20` East. The area is warm with a minimum temperature range of 22.71±3.43°C and a maximum range of 39.98± 2.43^{0}C [7]. It is characterized by two seasons, the dry and wet. The wet season also known as rainy season starts from April to October with minimum break at July under normal basis. The total annual rainfall is estimated from 1371-1321mm, characterized by warm climate with average temperature and relative humidity [7].

Sourcing of Test Ingredient

The experimental test ingredient was biodegraded cassava root meal. The cassava root was obtained from local markets around Markurdi metropolis. The rumen content was obtained from the abattoir in North Bank Makurdi in the early hours of the day. It was collected from three different cows and mixed thoroughly to obtain a homogeneous mixture.

Processing of test ingredient

The cassava roots were hand-peeled using kitchen knife (making sure that dirt was avoided) and chopped into smaller pieces of about 90 - 100 grams. Meanwhile, the rumen content was mixed with water at a ratio of 1:1 (i.e 1kg of rumen content to 1 litre of water) to obtain a filtrate. The filtrate was mixed with the chopped cassava root and packed into air tight bags. The bags were kept under shade with their open ends tied tightly and labelled accordingly. After 24 hours of fermentation, the bags labelled "24" were poured on a concrete floor for sun-drying while this was repeated for the remaining bags at the end of the 48th hour. The biodegraded cassava pieces were dried to a moisture level below 10 percent and was crushed into biodegraded cassava root meal (BCRM). A fraction was taken for proximate analysis [8]

Preparation of Experimental Diets

A total of three (3) experimental diets were formulated. Milled biodegraded cassava root meal was included in the diets at 0%, 10% (24 hours) and 10% (48hours) to give diets T1(control) T2 and T3 respectively to replace maize in both the starter and the finisher formulations. Feed were analyzed according to the methods of[8]

Management of Experimental Birds

A total of 150 Arbor-acre one-day-old chicks were obtained from the hatchery's area distributors in Makurdi Benue State and were brooded together for a period of one week. During this period, commercially formulated feeds were given for acclimatisation which lasted for one week. In the second week, the birds were assigned randomly into three (3) treatments and each treatment was replicated five times with ten (10) birds per replicate. The chicks in each replicate were housed in disinfected separate pens. The experimental design was completely randomized design (CRD). All routine management practices, including recommended vaccinations and medications, were strictly observed throughout the period of the study which lasted for 49days. Other drugs that were given to the birds include: Panteryl(antibiotics) and vitaminolyte (vitalite). Feed and water were served *ad libitum* throughout the experimental period.

Organoleptic Test

Upon completion of the feeding trial, fifteen birds (one per replicate) with the mean weight of the various replicates were slaughtered and processed. Sensory evaluation was done using thigh muscle meat samples from the processed broiler chickens. The prepared meat was cooked in separate pots to a temperature of 100^{0}C for 15 minutes. Thereafter, the cooked meat samples were coded and served at room temperature (27^{0}C) to panelists comprising of both staffs and students of Joseph SarwuanTarka University. Sensory assessment was adjudge using a 9-point hedonic scale forcolour, juiciness, tenderness, flavour and overall acceptability according to Cross*et al.*[9]. The panelists received each sample separately, rinsing their mouth in-between samples with water. The scale has a maximum score of nine, with the worst condition receiving the lowest score of-1[10].

Data Analysis

Data collected were subjected to one-way Analysis of Variance (ANOVA) using Special Package for Social Science (SPSS) version 22.0 statistical software. Significant means were also separated using Duncan's Multiple Range Test of the same package at 5% probability level[11].

RESULTS AND DISCUSSION

The results of the organoleptic properties of broiler chicken fed diet supplemented with biodegraded cassava root meal (BCRM) are presented in Table 4. There was significant difference ($P<0.05$) observed in the colour of the meat of the broiler chicken. T2 had the highest score of 6.44 which was significantly different ($P<0.05$) from T1 but the same level with T3. Other parameters such as flavour, texture, tenderness, juiciness and overall acceptability were not significantly ($P>0.05$) affected by the dietary treatments. However, in the overall acceptability, all treatments fell within the score of 7.00 to 7.97 points for T1 and T2 respectively. Hence, the overall acceptability was moderately liked. There is dearth of data on the organoleptic properties of broiler chicken using cassava root fermented with rumen filtrate. However, this result agrees with the findings of [12] who reported non-significant difference in the organoleptic properties of broiler chickens fed hydrolyzed cassava peel-based diet and alsoin sensory evaluation of organically raised broiler chickens. In addition, [13] also noted that feeding rumen filtrate fermented shea nut meal had no significant influence on the roasted and cooked broiler meat. It also corresponds with the findings of [14] where the sensory attributes of the chicken meats were not significantly ($P > 0.05$) affected by the inclusion of fermented mixture of grated cassava roots and palm kernel cake at 25%, 50%, 75% and 100% as replacement for maize. The significant ($P < 0.05$) difference observed in colour could be as a result of the effect of higher concentration of carotenoids and xanthophylls present in yellow maize that was used in the control diet [15]. In broilers, zeaxanthin influences the yellow value in all tissues and the skin [16]. T2 and T3 did not differ significantly in colour which conforms to the findings of[17], when cassava root was subjected to submerge fermentation for 24 to 96 hours. A reduction in the concentration of these carotenoids in T2 and T3 as a result of BCRM supplementation has caused these treatments to reflect lighter meat colour.

Table 1: Proximate Analysis of Biodegraded Cassava Root Meal

Proximate analysis (%)	**24 hours**	**48 hours**
Crude protein	3.06	4.38
Ether extract	0.26	0.23
Ash	2.08	2.39
Moisture	6.97	6.72
Crude fibre	1.55	1.32

Table 2: The composition of Broiler Starter Diet.

Ingredients	T1 (Control)	T2 (24 Hours)	T3 (48Hours)
Maize	54.31	51.11	51.25
BCRM	-	5.11	5.12
FFSB	23.50	22.33	22.23
Rice bran	5.00	5.00	5.00
Bone meal	1.00	1.00	1.00
Blood meal	8.81	8.37	8.34
Fish meal	5.88	5.58	5.56
Palm oil	1.00	1.00	1.00
Salt	0.25	0.25	0.25
Min./Vit. Premixes	0.25	0.25	0.25
Total	100	100	100

Premix supplied per kilogram $Vit_{A, : 100000001U.,}$ Vit D_3 : 200000., Vit K_3 2000mg., Vit B1: 3000mg., Vit B_2 5000mg., Niacin: 45000mg., Calcium panthothenate: 10000mg., Vit B6:4000mg., Vit B_{12}: 20mg., Choline chloride: 300000., Folic acid: 1000mg., Biotin: 50mg., Manganese: 300000mg., Iron: 120000mg., Zinc: 80000mg., Copper: 8500mg., Iodine: 1500mg.,Cobalt: 300mg., Selenium: 120mg., Antioxidant: 120000mg. BCRM=Biodegraded cassava root meal; FFSB= Full fat Soybean; ME = Metabolizable energy; T_1 = Control diet; T_2 = 24 hours BCRM T_3 = 48 hours BCRM.

Calculated Analysis:

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	7.80
Ca (%)	1.40	0.91	0.91
P (%)	0.8	0.89	0.79
Lysine (%)	1.40	1.40	1.40
Meth (%)	0.320.31	0.24	
Ash	3.36	2.64	1.91

Premix supplied per kilogram $Vit_{A, : 100000001U.,}$ Vit D_3 : 200000., Vit K_3 2000mg., Vit B1: 3000mg., Vit B_2 5000mg., Niacin: 45000mg., Calcium panthothenate: 10000mg., Vit B6:4000mg., Vit B_{12}: 20mg., Choline chloride: 300000., Folic acid: 1000mg., Biotin: 50mg., Manganese: 300000mg., Iron: 120000mg., Zinc: 80000mg., Copper: 8500mg., Iodine: 1500mg.,Cobalt: 300mg., Selenium: 120mg., Antioxidant: 120000mg. BCRM=Biodegraded cassava root meal; FFSB= Full fat Soybean; ME = Metabolizable energy; T_1 = Control diet; T_2 = 24 hours BCRM T_3 = 48 hours BCRM.

Table 3: The Composition of Broiler Finisher Diet

Ingredients	T1 (Control)	T2 (24 Hours)	T2 (48 Hours)
Maize	63.75	57.25	57.41
BCRM	-	5.73	5.74
FFSB	17.69	18.17	18.06
Blood Meal	6.63	6.81	6.77
Fish Meal	4.42	4.54	4.52
Bone Meal	1.00	1.00	1.00
Rice Bran	5.00	5.00	5.00
Palm Oil	1.00	1.00	1.00
Salt %	0.25	0.25	0.25
Premix	0.25	0.25	0.25
Total	100	100	100

Calculated Analysis:

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	1.50	1.10
Meth.%	0.46	0.29	0.21
Ash	3.36	2.64	1.91

Premix supplied per kilogram $Vit_{A, : 100000001U.,}$ Vit D_3 : 200000., Vit K_3 2000mg., Vit B1: 3000mg., Vit B_2 5000mg., Niacin: 45000mg., Calcium panthothenate: 10000mg., Vit B6:4000mg., Vit B_{12}: 20mg., Choline chloride: 300000., Folic acid: 1000mg., Biotin: 50mg., Manganese: 300000mg., Iron: 120000mg., Zinc: 80000mg., Copper: 8500mg., Iodine: 1500mg.,Cobalt: 300mg., Selenium: 120mg., Antioxidant: 120000mg. BCRM=Biodegraded cassava root meal; FFSB= Full fat Soybean; ME = Metabolizable energy; T_1 = Control diet; T_2 = 24 hours BCRM T_3 = 48 hours BCRM.

Table 4: Effect of supplemented biodegraded cassava root meal on organoleptic properties of broiler chickens

Organoleptic Properties	**T1**	**T2**	**T3**	**SEM**
Colour	4.00[b]	6.44[a]	6.02[a]	0.98*

Flavour	6.44	5.44	6.00	1.24^{NS}
Texture	5.77	5.77	5.11	0.92^{NS}
Tenderness	6.33	6.00	5.77	1.06^{NS}
Juiciness	6.11	7.22	6.88	0.77^{NS}
Overall acceptability	7.00	7.90	7.17	0.92^{NS}

Keys ab = means with different superscripts are significantly different.
T1 = Control diet
T2 = Diet containing biodegraded level of cassava root meal at 24 hours of fermentation.
T3 = Diet containing biodegraded level of cassava root meal at 48 hours of fermentation
SEM = Standard error of mean.

CONCLUSION

The study concluded that 10 % inclusion of biodegraded cassava root meal (BCRM) at both 24 hours and 48 hours of fermentation does not affect the organoleptic properties of broiler chicken except the colour. Moreover, the inclusion of BCRM at 24 hours fermentation gave a more appealing meat colour that was preferred to the control.

Ethical Approval: All authors hereby declared that "Principles of laboratory animal care" (NIH publication No. 85-23, revised 1985) were followed as well as specific national laws where applicable. All experiment have been examined and approved by the appropriate ethics committee.

Conflict of Interest Statement:
Authors have declared that no competing interest exist.

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