EFFECTS OF FEEDING GRADED LEVELS OF BAOBAB (*Adansonia digitata*) PULP SEED MEAL ON APPARENT NUTRIENTS DIGESTIBILITY AND CARCASS CHARACTERISTIC OF BROILER CHICKENS

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ABSTRACT

The experiment was conducted to evaluate the nutrients digestibility and carcass characteristics of broiler chickens fed graded levels of baobab (Adansonia digitata) pulp meal (BPSM). Three hundred broiler (Anak) chickens were allotted to five treatments replicated thrice with 20 birds per replicate in a completely randomized design (CRD). The inclusion levels of the BPSM in the diets were 0, 10, 20, 30 and 40% for treatment 1 (Control), 2, 3, 4 and 5 respectively. The experiment lasted for four weeks each for the starter and finisher respectively. Data collected were subjected to analysis of variance and significant differences among treatment means were compared using the Dunnet Test. Nutrient digestibility increased with increasing levels of BPSM in broiler chickens diet up to 20% BPSM and then slightly declined afterward and the significant (P<0.05) increase in carcass characteristic was the total reflection of live weight which was significantly higher in birds fed diets containing BPSM

Keywords: Baobab pulp seed meal, Carcass, Digestibility, Nutrients, Broiler chickens

Introduction

The logical solution in meeting meat scarcity in Nigeria is to increase broiler production (Babatunde, 1990). Isiaka (2006) reported that poultry is strategic in addressing animal protein intake shortage in human nutrition because of its high fecundity, fast growth rate, short generation interval and parallel competence in nutrient transformation to high quality animal protein. The total dependence on cereal as a principal energy source in poultry diets is the major problem militating against the expansion of poultry industry. Medugu *et al.* (2011) reported that the tremendous decrease in poultry production is as a result of high cost of protein and energy feedstuffs especially cereal grains (maize) which form the bulk of energy in poultry feeds and are in short supply as a result of industrial and human needs. This has resulted in competition between human and animals for the available feed resources coupled with constant drought. Hence, the high cost of poultry feed has continued to be the major problem in developing countries as feed cost is about 65 – 75% (Nworgu *et al*., 1999) of the total cost of production compared to about 50 – 60% in developed countries (Tackie and Flenscher, 1995). Therefore, all reasonable and practical options deserve thorough

consideration. This has necessitated the renewal of interest in exploring the feasibility of incorporating neglected or underutilized energy feedstuff. Not much has been done in evaluating the potential feed value of some multipurpose tree products such as baobab *(Adansonia digitata).* Baobab fruit contains 50% more calcium than spinach and high in anti-oxidant (NRC, 1994) hence necessitating this research in a bid to seek for an alternative to the inadequate and expensive conventional feedstuffs.

MATERIALS AND METHODS

Source of Baobab Fruit: Baobab fruits used for this experiment were harvested at mature stage which was indicated by the hard brown colour of the ectoderm from the trees using locally made equipment aroundMamudo, Danchuwa, Alaraba and Mele in Potiskum Local Government area of Yobe State, Nigeria.

Processing: Dried baobab fruits were processed by cracking open the hard shell of the baobab fruits using a small hammer to remove the inner contents (epicarp), and pounded using a mortar and pestle while the seed and pulp were separated using a sieve. The pulp were slightly milled and separated from the unwanted coarse material using a fine mesh.

Experimental design and management: Three hundred (300) broiler chicks (Anak) were purchased from Zarm Farm. The birds were vaccinated against Newcastle disease (intra ocularly) on the day of arrival and brooded together for three days using kerosene stoves and electricity bulbs as sources of heat and light. They were fed a common diet during this period. The birds were subsequently weighed and allotted to five dietary treatments. The birds were housed in a deep litter system in a completely randomized design. The treatments were replicated three times with twenty chicks per replicate. The feeding trial lasted for eight weeks comprising of first four weeks (starter phase) and last four weeks (finisher phase). Both experimental materials and compounded rations were taken to the laboratory for proximate analysis before commencement of the experiment. Birds were vaccinated against Newcastle and Gumboro diseases. Feed and water were provided *adlibitum.*.

Experimental diets: The composition and calculated analysis of the experimental diets are presented in Tables 1 and .2 respectively. The test ingredient was included at 0, 10, 20, 30 and 40% representing 1 (control), 2, 3, 4 and 5 respectively for both the starter and finisher phases respectively. The starter (23% CP; 2900 Kcal/Kg) and finisher (20% CP, 2950 Kcal/Kg) were isonitrogenous and isocaloric and met the recommended crude protein and metabolisable energy requirements as stated by (NRC 1994)

Experimental Site*:* The study was conducted at the Teaching and Research farm (Poultry Unit) of the Department of Animal Science, Faculty of Agriculture, Ahmadu Bello University Zaria. Zaria is located within the Northern Guinea Savannah of Nigeria with an average

annual rainfall, relative humidity and temperature of 1,100 mm, 75% and 24.4^{O} C respectively, on Latitude 11^{o} 12'N and Longitude 7^{o} 33'E on an altitude of 610m above sea level (Ovimap, 2014).

Digestibility trials: At the end of the of the experiment (56th days), 9 birds per treatment of an average weight (3 birds per replicate) were selected from the five treatment groups for digestibility trial and caged individually, after an adjustment period of seven days. The droppings were collected on a daily basis for seven days while feed intake over the period was recorded. The dropping sample was oven dried at a temperature of about 105^{0}C for 18 hours to reduce the moisture content and to bring the faeces to a constant weight. The total daily collections were pooled, weighed and ground and representative samples of the faeces and experimental diets were taken to the laboratory for proximate analysis according to the procedure of AOAC (1990). They were assayed for apparent digestibility of crude protein, ether extract, crude fiber, and nitrogen free extract. The result was used to calculate the digestibility.

Nutrient digestibility = $\frac{Nutrient\ intake - Nutrient\ in\ feaces \times 100}{Nutrient\ intake}$

Carcass measurement: At the end of the experiment (56th days), three birds representing the average weight were selected from each replicate (nine birds per treatment), labeled and then starved overnight but water was provided. The weights of the birds were recorded in the morning before slaughter. Birds were defeathered by dipping into hot water for few minutes to soften the feather for easy removal. The defeathered birds were eviscerated. The parameters measured were carcass weight, dressing percentage, prime cut and organs weighed were expressed as percentages of carcass weight.

Data Analysis: All data collected were subjected to analysis of variance (ANOVA) using the General Linear Model Procedure of SAS 9.2 (2002). Significant differences among treatment means were compared using Dunett multiple ranged in the SAS Package.

The model for this design was as follows:

$X_{ij} = \mu + t_i + e_{ij}$

Where: Xij = any observation made in the experiment,

μ = the population mean,

t_i = Effect due to treatment added or treatment effect,

Eij = Experimental error.

RESULTS AND DISCUSSION

Apparent nutrients digestibility

The nutrients digestibility ranged from 81.53 –88.68%, 77.60 – 84.48%, 68.81 – 80.06%, 80.06 – 86.94%, 70.42 – 77.92% and 88.78 – 92.50% (Table 3) for the Dry matter, Crude protein, Crude fibre, Ether extract, Ash and Nitrogen free extract respectively. Birds fed 20% BPSM was found to significantly ($P<0.05$) different from all treatments groups in the mention parameters except for the dry matter, ether extract and nitrogen free extract digestibility which were found to be similar ($P>0.05$) with treatment 1 (0% BPSM) and 2 (10% BPSM). Treatment 5 (40% BPSM) was significantly ($P<0.05$) lower in most nutrients digestibility than all the treatment groups though found to be insignificantly ($P>0.05$) different from treatment 4(30%BPSM), this implies that nutrient digestibility increased with increasing levels of BPSM in broiler chickens diet up to 20% BPSM and then slightly declined afterward. This result agrees with the report of Rafiu *et al*, (2012) who reported higher nutrient digestion in diets containing BPSM in feeding broiler chicken with baobab seed when compared with the control diet. Similar finding was reported by Sola-Ojo *et al*, (2013) in feeding broiler with BPSM though reported insignificant ($P>0.05$) differences in the digestibility of all the nutrients with slightly higher values was recorded in the diet containing higher levels of BPSM. This result shows that BPSM inclusion up to 40% is possible in the broiler diet without any detrimental effects on nutrient digestibility. These was supported by the work of Proll *et al*. (1998) who found that baobab pulp and seed to have high digestibility, biological value (BV), and net protein utilization (NPU) among unconventional tropical crop. This high digestibility, BV, and NPU of baobab pulp and seed could be attributed to the low levels of trypsin inhibitor phytic acid and tannin and the excellent amino acid profile.

Carcass characteristics

The average live weights were 2000g, 2233.33, 2266.70, 2173.30 and 2000.0g (Table 4) for treatment 1 (0% BPSM) control, 2, 3, 4, and 5 respectively (Table 4). Significant ($P<0.05$) higher slaughter weight 2233.33, 2266.70 and 2173.30g were recorded in birds fed 10% BPSM, 20% BPSM, 30% BPSM respectively while significantly ($P<0.05$) lower values 2000.00g and 2000.00g were recorded in birds fed 0% BPSM and 40% BPSM respectively. Carcass weight, dressing percentage and prime cut followed similar trends as the live weight. This result agrees with the work of Sola-ojo *et al*. (2013) who reported that, live weight differed ($P<0.05$) significantly among varying level of BURBSM in the diet of broiler chickens. The internal organs such as heart, gizzard, liver kidney and gastro intestinal tract

length ranged from 0.58 0.55%, 2.94 - 3.34%, 2.35 - 2.64%, 0.46 - 0.52% and 218.83 – 253.83cm respectively. Significantly (P<0.05) higher heart values 0.54% and 0.55% were recorded in birds fed 10% BPSM and 20% BPSM while significantly (P<0.05) lower values 0.51, 0.50 and 0.50% were recorded in birds fed 0% BPSM, 30% BPSM and 40% BPSM. Significantly (P<0.05) higher gizzard values 3.34, 3.25 and 3.20% were recorded in birds fed 20% BPSM, 30% BPSM and 40% BPSM while significantly (P<0.05) lower values 2.94% and 3.08% were recorded in birds fed 0 and 10% BPSM. Significantly (P<0.05) higher liver values of 2.62 and 2.64% were recorded in birds fed 30 and 40% BPSM while significantly (P<0.05) lower value of 2.35% was recorded in birds fed 0% BPSM. No significant (P<0.05) differences were observed in values of 2.48 and 2.49% recorded in birds fed 0 and 10% BPSM. The values recorded for kidney followed a similar trend as liver while significantly (P<0.05) higher gastro intestinal tract length values of 253.83cm and significantly (P<0.05) lower values of 218.83cm were recorded in birds fed 30 and 0% BPSM respectively. The significant increase in carcass characteristic was the total reflection of live weight which was significantly higher in birds fed diets containing BPSM. This study agrees with the findings of Kutlu and Forbes, (1993) who reported that supplemental ascorbic acid (250/kg) increased performance and yields better carcass quantity and quality in birds reared under heat stress condition and also Sola-ojo *et al,* (2011) who reported a significant increase in carcass components as the DURBSM increased in the broiler chicken diets.

Conclusion

Higher apparent nutrients digestibility and best carcass characteristics were recorded in birds fed 20% BSPM. But It can be included in broiler chicken diets up to 40% without detrimental effects on carcass characteristics of broiler chicken.

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Table 1: Composition and calculated analysis of the experimental diet (starter)

	Inclusion levels baobab pulp-seed meal (% BPSM)				
Ingredient (%)	**0**	**10**	**20**	**30**	**40**
Maize	56.95	47.95	38.50	29.50	20.45
BPSM	0.00	10.00	20.00	30.00	40.00
G/nut cake	20.00	19.00	18.00	17.00	16.50
Soybean meal	19.00	19.00	19.00	19.00	19.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Limestone	0.30	0.30	0.30	0.30	0.30
Salt	0.30	0.30	0.30	0.30	0.30
Methionine	0.20	0.20	0.20	0.20	0.20
*Pre-mix	0.25	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00	100.00
Calculated					
ME (Kcal/Kg)	2899.95	2912.98	2904.09	2913.25	2935.20
Crude protein	23.13	23.21	23.23	23.30	23.56
Crude fibre	3.84	4.16	4.46	4.78	5.14
Calcium	1.18	1.28	1.28	1.38	1.25
Av. Phosphorus	0.66	0.64	0.62	0.61	0.59
Lysine	1.02	1.12	1.21	1.31	1.42
Methionine	0.55	0.55	0.53	0.50	0.48
Cost (₦/Kg)	91.00	82.77	78.41	73.07	69.49

*Bio-mix: starter, unit/kg: Vit.A = 25.00IU, Vit.D_3 = 0.500IU, Vit.E = 5.75mg, Vit.K_3 = 0.50mg, Vit.B_1 = 0.45mg, Vit.B_2 = 1.375mg, Niacin = 6.875mg, Panthothenic Acid = 1.875mg, Vit.B_6 = 0.75mg, Vit.B_{12} = 0.038mg, Folic Acid = 0.188mg, Biotin H2 = 0.015mg, Choline = 0.25mg, chloride=7.50mg, Cobalt = 0.05mg, Copper = 0.75mg, iodine = 0.25mg, Iron = 5.00mg, Manganese = 10.00mg, Zinc = 7.50mg, Selenium = 0.05mg, Anti-oxidant = 0.313mg, BPSM = Baobab pulp-seed meal, G = Ground, Av = Available

Table 2: Composition and calculated analysis of the experimental diet (finisher)

	Inclusion levels of baobab pulp-seed meal (% BPSM)				
Ingredient (%)	**0**	**10**	**20**	**30**	**40**
Maize	60.00	52.18	41.95	32.95	24.18
BPSM	0.00	10.00	20.00	30.00	40.00
G/nut cake	20.00	20.00	20.00	20.00	20.00
Soybean meal	15.95	14.00	14.00	13.00	12.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Lime stone	0.30	0.30	0.30	0.30	0.30
Salt	0.30	0.30	0.30	0.30	0.30
Methionine	0.20	0.20	0.20	0.20	0.20
*Pre-mix	0.25	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00	100.00
Calculated					
ME (Kcal/Kg	2934.98	2956.92	2958.38	2970.35	2982.31
Crude protein	21.95	21.57	21.94	21.93	21.91
Crude fibre	3.80	4.17	4.57	4.95	5.33
Ether extract	4.13	4.91	5.67	6.44	7.21
Calcium	1.08	1.08	1.18	1.28	1.28
Av.phosphorus	0.64	0.62	0.60	0.59	0.57
Lysine	1.07	1.09	1.10	1.18	1.26
Methionine	0.53	0.50	0.48	0.46	0.44
Cost (₦/Kg)	91.00	82.77	78.41	73.07	69.49

*Bio-mix finisher supplied/kg: Vit.A = 21.25IU, Vit.D3 = 0.375IU, Vit.E = 2.50mg, Vit.K_3 = 0.50mg, Vit.B_1 = 0.375mg, Vit.B_2 = 0.40mg, Niacin = 1.00mg, Panthothenic Acid = 5.00mg, Vit.B_6 =1.25mg, Vit.B_{12} = 0.375mg, Folic Acid = 0.025mg, Biotin H2 = 0.125mg, Choline 0.225mg chloride = 4.375mg, Cobalt = 0.05mg, Copper = 0.75mg, iodine = 0.25mg, Iron = 5.00mg, Manganese = 10.00mg, Zinc =7.50mg, Selenium = 0.05mg, Anti-oxidant = 0.313mg, BPSM = Baobab pulp-seed meal, G = Ground, Av. = Available

Table 3: Apparent nutrients digestibility of broiler chickens fed graded levels of BPSM .

	Inclusion levels of baobab pulp meal (% BPSM)					
Parameter	**0**	**10**	**20**	**30**	**40**	**SEM**
Dry matter	87.38^{ab}	86.56^{ab}	88.68^{a}	86.23^{b}	81.53^{c}	0.49
C/ protein	81.12^{c}	82.76^{b}	84.48^{a}	77.11^{c}	77.60^{d}	0.40
Crude fibre	75.45^{b}	80.66^{a}	78.42^{a}	68.81^{c}	65.88^{d}	1.37
Ether extract	86.94^{a}	84.02^{b}	86.75^{a}	82.78^{b}	80.06^{c}	1.24
Ash	73.94^{b}	77.01^{a}	77.62^{a}	73.96^{b}	70.42^{c}	1.23
NFE	91.48^{a}	92.06^{a}	92.50^{a}	90.14^{b}	88.78^{c}	5.73

^{abcd} = Means within row with different superscript differed significantly (P<0.05).
NFE = Nitrogen Free Extract. C = Crude

Table 4: Carcass characteristic of broiler chickens fed graded levels of baobab pulp-seed.

	Inclusion levels of baobab pulp meal (% BPSM)					
Parameter	**0**	**10**	**20**	**30**	**40**	**SEM**
L/Wt (g)	2000.00^{b}	2233.33^{a}	2266.70^{a}	2173.30^{a}	2000.00^{b}	18.10
C/wt (g)	1458.33^{b}	1750.00^{a}	1783.33^{a}	1711.33^{a}	1450.00^{b}	14.05
Dressing %	72.90^{b}	78.36^{a}	78.66^{a}	78.74^{a}	72.50^{b}	0.72
%Organs						
Neck	4.99^{b}	5.75^{a}	6.00^{a}	5.65^{a}	5.20^{b}	0.25
Breast	26.31^{b}	27.01^{b}	27.71^{a}	26.81^{b}	25.85^{c}	0.33
Wing	9.46^{b}	10.01^{a}	10.06^{a}	10.15^{a}	9.24^{b}	0.18
Thigh	13.88^{b}	14.51^{a}	14.96^{a}	14.70^{a}	14.09^{b}	0.23
Drum Stick	12.24^{c}	13.36^{a}	13.38^{a}	13.10^{a}	12.12^{c}	0.35
Back	18.12^{b}	18.75^{a}	18.99^{a}	18.98^{a}	17.72^{b}	0.25
Heart	0.51^{b}	0.54^{a}	0.55^{a}	0.50^{b}	0.50^{b}	0.01
Gizzard	2.94^{b}	3.08^{b}	3.34^{a}	3.25^{a}	3.20^{a}	0.10
Liver	2.35^{c}	2.48^{b}	2.49^{b}	2.62^{a}	2.64^{a}	0.04
Kidney	0.46^{b}	0.45^{b}	0.46^{b}	0.51^{a}	0.52^{a}	0.01
GIT (Cm)	218.83^{b}	248.33^{a}	249.67^{a}	253.83^{a}	244.67^{a}	6.68

^{abc} = Means within row with different superscript differed significantly (P<0.05).
L = Live; C = Carcass; W= Weight; GIT = Gastro intestinal length.