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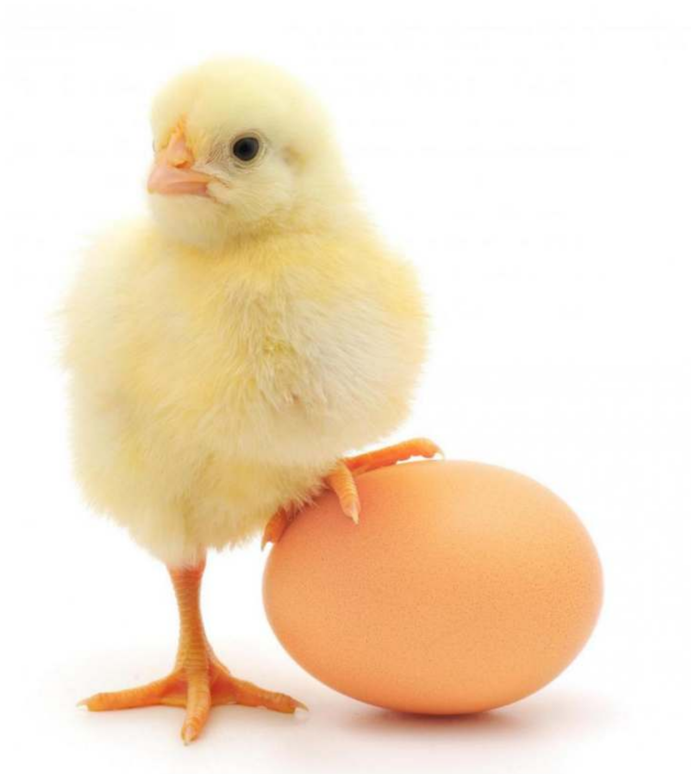

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Carcass Characteristics, Organ Weights and Organoleptic Qualities of Broiler Finisher Birds Fed Potash Boiled Bambara Groundnut [*Voandzeia subterranea* (L) Thour] Meal as a Replacement for Soyabean Meal

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Abstract: Two hundred and twenty five (225) 28 day-old Anak broilers were randomly assigned to five treatment diets of 45 birds per treatment and replicated three times with 15 birds per replicate. Soyabean meal (full fat) was replaced with Potash Boiled Bambara Groundnut Meal (PBBGM) at 0, 25, 50, 70 and 100% levels. The diets were formulated to be isonitrogenous and isocaloric to provide 20% crude protein and 3000 kcal/kg metabolizable energy. At the end of the 4th week, one bird per replicate (3 birds per treatment) were randomly picked, fasted over night and slaughtered for carcass evaluation. The thighs of one bird per replicate were deboned and the tendons removed for organoleptic quality assessment. The results of the carcass characteristics indicated no significant differences ($p>0.05$) among the treatments for the weights of the various parts measured. On the cut-up parts, the percentage weights of the breast, back, drum-stick and thigh, showed significant differences ($p<0.05$) in all the treatment groups. There were significant differences ($p<0.05$) in the percentage weights of the spleen and gizzard; lengths of the proventriculus and the large intestine. The juiciness, flavour and overall acceptability of the broiler meat were not significantly ($p>0.05$) influenced by the treatments, thought the tenderness significantly ($p<0.05$) varied among the treatments.

Key words: Potash boiled bambara groundnut, soyabean, carcass quality, organ weights and organoleptic qualities of broiler finisher birds

INTRODUCTION

In Nigeria, the poultry industry is known to be among the fastest growing subsector of the livestock industry. As a result, there is keen competition between man and livestock over the available feed materials. This has resulted in a steady rise in the price of soyabean and soyabean by-products. Consequently, the cost of poultry products is out of reach of many which is the reason for the low level animal protein consumption in Nigerian (Tewe, 1986).

Ani *et al*. (2009), Nwambe and Elechi (2009) and Nwambe *et al*. (2008) advocated that the solution to rising costs and scarcity of crude protein and energy sources for monogastric farm animals, is to seek for alternative feed materials such as bambara groundnut which is cheaper and less competitive. Bambara groundnut is extensively cultivated in most ecological zones in Nigeria. The availability of cheaper alternative feed materials will help to reduce the cost of feed production for the livestock industry.

Aletor *et al*. (1998) highlighted that, apart from changes in nitrogen balance and biochemical parameters, nutrition or dietary manipulation exert several influence on the development of carcass traits, organs and certain muscle in broilers. Any quality feedstuff should be able to support fast growth rate, good health and good quality meat from the broilers. This study is therefore, designed to determine the effect of replacing soyabean meal with potash boiled bambara groundnut meal on the carcass characteristics, organ weights and the organoleptic quality of broiler meat.

MATERIALS AND METHODS

The study was conducted at the Poultry Research Unit of the Department of Animal Science, Delta State University, Asaba Campus.

Processing of the nuts: The raw bambara groundnut was picked free of chaff, put in boiling water containing 20% of trona and boiled for 20 min. It was thereafter sun dried for 3 days and milled to obtain bambara groundnut meal which was used to replace soyabean meal on protein equivalent basis. Five isonitrogenous and isocaloric diets were formulated to provide 20% crude protein and 3000 kcal/kg metabolizable energy. The test ingredient was used to replace soyabean meal (full fat) at 0, 25, 50, 75 and 100 levels in the formulated diets (Table 1).

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Table 1: Compositions of experimental broiler finisher diets

	Dietary treatments				
	100 SBFF 00 PBBGM	75 SBFF 25 PBBGM	50 SBFF 50 PBBGM	25 SBFF 75 PBBGM	00 SBFF 100 PBBGM
Ingredients	1 (Control)	2	3	4	5
Maize (Yellow)	59.00	57.60	55.50	53.75	51.80
SBFF	23.00	17.25	11.50	5.75	-
PBBGM	-	7.15	15.00	22.50	30.20
Fish meal	2.50	2.50	2.50	2.50	2.50
Blood meal	4.50	4.50	4.50	4.50	4.50
Wheat offal	5.30	5.30	5.30	5.30	5.30
Bone meal	3.00	3.00	3.00	3.00	3.00
Oyster shell	1.50	1.50	1.50	1.50	1.50
Premix (starter)*	0.50	0.50	0.50	0.50	0.50
Methionine	0.20	0.20	0.20	0.20	0.20
Salt	0.50	0.50	0.50	0.50	0.50
Calculated analysis	100.00	100.00	100.00	100.00	100.00
Crude protein (%)	20.10	20.00	20.05	20.02	20.05
Crude fibre (%)	3.00	2.82	2.83	2.83	2.81
Metabolizable Energy (ME) (kcal/kg)	3049.80	3047.95	3045.18	3042.87	3040.30

SBFF = Soyabean (Full Fat), PBBGM = Potash Boiled Bambara Groundnut Meal.

Each 2.5 kg vitamin-mineral premix provided the following: A, 8000IU; D_3, 1800IU; E, 20 IU; K, 2.0 mg; B1, 1.55 mg; B2, 4.4 mg; B6, 2.35 mg, Biotin, 0.042 mg; Niacin, 2.50 mg, Panthotenic, 6.50 mg; Folic, 0.65 mg; Mn, 75.0 mg; Zn, 45 mg; Fe, 20 mg; Cu, 5 mg; I, 1.0 mg; Se, 0.01 mg; Co, 0.02 mg, HBT, 90 mg; Enthoxquin, 33 mg; Choline, 150 mg

Management of the birds: Two hundred and twenty five (225), 28 day-old Anak broilers were randomly assigned to five treatment diets of 45 birds per treatment and replicated three times with 15 birds per replicate. Each deep litter pen measured 2.8 m x 3.5 m. The experimental diets and water were provided *ad libitum* for four weeks to the birds. Routine vaccination as outlined by Obioha (1992) was followed.

Carcass measurement: At the end of the experiment, one bird per replicate (3 birds per treatment) were randomly picked, fasted over night weighed and slaughtered for carcass measurement. Their weights after defeathering, dressing and evisceration were also taken. The eviscerated carcass was cut into: thighs, drumsticks, shanks, wing, neck, back, breast and head. The cut-up parts were weighed and expressed as Percentage of the Eviscerated Weight (PEW). The following organs were also weighed: the heart, liver, spleen and gizzard and were expressed as percentage of dressed weight. The length of the colon, small and large intestine, proventriculus and caeca were measured in centimentres and expressed in cm/100 g dressed weight.

Organoleptic quality assessment: The thighs of one bird per replicate were deboned and the tendons removed. The muscles were then cut into 15 parts, each weighing 2 g. The parts were then dipped into a saturated brine solution for 5 sec, packaged in double layered small polythene bags, tied properly and boiled for 20 min. The post-cooked weight was obtained and the parts presented in dishes. A trained 15-man panel was used to determine the tenderness, juiciness, flavour and overall acceptability using a 9 point Hedonic scale. Warm water was provided for the panelists to rinse their month after testing each sample.

Table 2: Chemical composition of bambara groundnut

Components	Raw	Boiled with potash
Dry matter (%)	96.64	90.84
Crude protein (%)	22.35	20.65
Ether extract (%)	12.26	12.25
Crude fibre (%)	3.80	3.20
Ash (%)	2.40	2.66
NFE (%)	55.83	52.08
Gross energy (kcal/kg)	3457.20	3526.25

Statistical analysis: The proximate composition of the experimental diets (Table 1) and test ingredient (Table 2) were determined according to AOAC (1990). Data collected were subjected to analysis of variance and means were separated by Duncan Multiple range test (Duncan, 1955) using SPSS 10.0 package.

RESULTS

The results of the carcass characteristics (Table 3) showed that there were no significant differences ($p>0.05$) between the treatments for the weights of the various parts of the birds measured, as the level of the test ingredient increased.

However, there was a slight but progressive increase in the mean plucked weight, dressed weight and

Table 3: Carcass quality characteristics of broiler birds fed the experimental diets

Characteristics	Treatments 100 SBFF 00 PBBGM	75 SBFF 25 PBBGM	50 SBFF 50 PBBGM	25 SBFF 75 PBBGM	00 SBFF 100 PBBGM
Live weight (kg)	2.38±0.27	2.40±0.06	2.33±0.12	2.43±0.19	2.44±0.03
Plucked weight (kg)	2.12±0.27	2.18±0.04	2.19±0.16	2.20±0.18	2.19±0.06
Dressed weight (kg)	1.90±0.21	1.97±0.06	1.92±0.12	2.03±0.16	1.95±0.06
Dressed WT (% LW)	52.91±0.22	55.02±0.83	57.45±7.08	56.65±0.58	53.19±1.54
Eviscerated WT (kg)	1.61±0.23	1.65±0.29	1.67±5.59	1.62±0.13	1.58±0.06
Eviscerated WT (% LW)	42.29±1.60	43.65±0.22	45.67±5.59	41.67±0.34	40.41±1.12
Cut parts					
Head weight (g)	56.10±13.18	49.53±2.05	56.87±3.31	51.67±6.30	52.73±5.99
Shank weight (g)	90.18±20.51	75.00±6.43	99.20±1.11	75.83±9.79	77.87±5.09
Breast weight (g)	481.24±59.53	435.19±19.19	402.31±34.07	440.66±46.80	416.87±87
Breast WT (% EW)	17.28±0.54[a]	15.33±0.55[b]	14.19±0.12[b]	15.81±0.77[ab]	15.25±0.21[a]
Back weight (% EW)	12.66±0.34[a]	14.67±0.88[a]	14.17±0.14[ab]	14.47±0.62[a]	15.27±0.19[a]
Drum-stick WT (% EW)	9.53±1.40[a]	7.91±0.11[a]	9.43±0.05[ab]	8.22±0.51[ab]	7.99±0.33[b]
Thigh weight (% EW)	9.35±0.25[abc]	9.79±0.11[ab]	10.24±0.06[a]	9.13±0.37[bc]	8.69±0.47[c]
Wing weight (% EW)	7.06±0.16	6.99±0.40	6.96±0.20	6.72±0.22	7.71±0.91
Neck weight (% EW)	4.02±0.19	3.65±0.08	4.99±0.97	3.88±0.26	3.56±0.04

Means within the same row bearing different superscripts are significantly different ($p<0.05$). EW = Eviscerated Weight

Table 4: Organ weight of broiler birds fed experiment diets at finisher phase

Organs	100 SBFF 00 PBBGM	75 SBFF 25 PBBGM	50 SBFF 50 PBBGM	25 SBFF 75 PBBGM	00 SBFF 100 PBBGM
Heart weight (% DW)	0.29±0.20	0.33±0.05	0.32±0.03	0.31±0.01	0.29±0.01
Liver weight (% DW)	1.51±0.36	1.52±0.14	1.36±0.11	1.38±0.08	1.63±0.04
Spleen weight (% DW)	0.13±0.03[a]	0.07±0.01[b]	0.10±0.04[ab]	0.09±0.01[ab]	0.16±0.03[a]
Gizzard Wt (PDW)	1.54±0.09[a]	1.13±0.08[b]	1.19±0.10[b]	1.27±0.18[ab]	1.30±0.11[ab]
Abdominal fat (PDW)	1.49±0.61	1.55±0.46	1.68±0.19	1.77±0.44	1.78±0.52
Small intestine (CM/100 g dressed WT)	12.62±1.55[a]	11.45±0.56	11.49±0.35	11.75±1.16	12.21±0.54
Large intestine (CM/100 g dressed WT)	0.79±0.09[a]	0.65±0.04[b]	0.65±0.04[b]	0.64±0.06[b]	0.74±0.01[ab]
Provenriculus (CM/100 g DWT)	0.29±0.02[ab]	0.33±0.03[a]	0.27±0.02[b]	0.27±0.02[b]	0.26±0.01[b]
Caeca (CM/100 g DWT)	1.18±0.12	1.15±0.05	1.15±0.09	0.91±0.019	0.98±0.20

Means with different superscripts in the same row are significantly different ($p<0.05$) different. PDW = Percentage of Dressed Weight, DWT = Dressed Weight

Table 5: Organoleptic quality assessment scores of broiler birds at finisher level

Meat qualities assessed	Treatments 100 SBFF 00 PBBGM	75 SBFF 25 PBBGM	50 SBFF 50 PBBGM	25 SBFF 75 PBBGM	00 SBFF 100 PBBGM
Tenderness	7.00±0.58[b]	7.67±0.88[a]	7.00±0.58[b]	7.00±0.58[b]	7.00±0.58[b]
Juiciness	7.33±1.20	7.00±0.58	7.00±0.58	7.00±0.58	7.00±0.58
Flavour	7.00±0.58	7.00±0.58	7.00±0.58	6.67±0.88	7.00±0.58
Overall acceptability	7.33±0.88	7.33±0.69	8.00±0.58	8.00±0.58	7.66±0.88

SEM = Standard Error of the Mean. Means within the same row having different superscripts are significantly different ($p<0.05$). 9 Point Hedonic Scale Used: 1 = Extremely tough, dry, unflavoured, unacceptable; 2 = Very tough, dry, unflavoured, unacceptable; 3 = Moderately tough, dry, unflavoured, unacceptable; 4 = Slightly tough, dry, unflavoured, unacceptable; 5 = Neither tender nor tough, h = juicy nor dry, flavoured nor unflavoured, acceptable nor unacceptable; 6 = Slightly tender, juicy, flavoured, acceptable; 7 = Moderately tender, juicy, flavoured, acceptable; 8 = Very tender, juicy, flavoured, acceptable; 9 = Extremely tender, juicy, flavoured, acceptable

eviscerated weight, with increase in the test ingredient in the diet.

The results of the cut-up parts on the percentage weights of the breast, back, drum-stick and thigh showed significant differences ($p<0.05$) among the treatment means. The birds placed on 50% PBBGM had the highest ($p>0.05$) percentage head, shank, thigh and neck weights.

On the organ weights, there were significant differences ($p<0.05$) in the weights of the spleen and gizzard; lengths of the large intestine and proventriculus among the treatment means (Table 4).

The organoleptic quality scores presented in Table 5, indicated no significant differences (p>0.05) in all parameters tested except on the tenderness where the meat from the birds placed on 25% of the test diet was adjudged to be the most tender (7.67±0.88).

DISCUSSION

The carcass quality parameters in Table 3 were similar in all the dietary treatments and in line with the findings of Ogbonna *et al.* (2000); Akpodiete *et al.* (2004); Iheukwumere *et al.* (2004) and Nwokoro and Obasi (2006). The similarity in carcass measurements for all the treatment groups indicated that potash boiled bambara groundnut and soyabean (full fat) are nutritionally similar and capable of tissue synthesis in broiler finishers under the same environment.

The results of the cut-up parts on breast, back, drum-stick and thigh weights, though significantly different, fell within the levels reported by Isikwenu *et al.* (2010) and Njoku (1986). The highest (p>0.05) percentage weights of the head, shank, neck and (p<0.05) weight of the thigh as recorded by the broilers placed on 50% of potash boiled bambara groundnut meal is a good indication that tissue synthesis for those parts were at its best at that particularly dietary level.

The organ weights of the heart and liver were similar at all dietary levels. This indicates that the increase of the test ingredient did not create any additional metabolic stress or toxicity for the birds. The significant differences recorded by the control diet in weights of the spleen and gizzard; lengths of the proventriculus and the large intestine could be because the diet induced a greater level of physiological activities in the broilers. The values of the organs obtained generally are in-line with the findings of Fanimo *et al.* (2005) and Isikwenu *et al.* (2010), who noted no morphological changes nor histopathological manifestations in the organs of birds fed diets compounded from other ingredients.

The organoleptic values were not significantly influenced in the juiciness, flavour and general acceptability among the treatment levels. This indicates that the difference in the experimental diets did not interfere with the organoleptic qualities of the broiler birds. This is also a confirmation that the muscle composition, ageing before cooking, heat coagulation of muscle, fibre proteins and partial hydrolysis of the connective tissues, which in turn, is dependent on the internal temperature and duration of heating (Joseph *et al.*, 1998) were the same across the groups. However, the significant difference in the tenderness of the broiler meat among the dietary treatments could not be attributed to any reason.

Conclusion: Based on the similarity in carcass measurements, organ weights and the organoleptic quality assessments of the birds, it can be inferred that potash boiled bambara groundnut meal and soyabean meal are nutritionally similar. This, therefore, means that the test ingredient can replace soyabean meal up to 100% level without any deleterious effect on broilers at finisher level.

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