Response of Broiler Chicken to Different Levels of Replacement of Boiled Bambara seeds (*Vigna Subterranean verdc*) for Super-Concentrate.

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Abstract

The objective of the study was to assess the response of broiler chicken to different levels of replacement of boiled Bambara seeds (*Vigna Subterranean verdc*) for Super-Concentrate. Growth performance and carcass characteristics were studied. Two hundred one-day-old un-sexed Ross (308) chicks were used in a completely randomized design. Bambara seeds replaced Super-Concentrate (0, 25, 50, 75, and 100%). Chicks were randomly divided into five dietary treatments, each of them was further divided into 4 replicates of 10 birds each. The chicks were reared from one-day-old to six week of age in 20 pens (1x1 m) with wood shavings litter. The experiment was conducted in an open- sided poultry house. Five isocaloric and isonitrogenous starter and finisher diets were formulated according to National Research Council (NRC, 1994). Feed intake (FI), body weight gain (BWG), feed conversion ratio (FCR) and Protein efficiency ratio (PER) were determined weekly on a pen basis.The results regarding chemical composition of Bambara seeds indicated positive nutritional components as it includes relatively high protein (16%). Feed intake and body weight gain during starter phase were significantly ($P\leq0.05$) decreased with the increased of boiled Bambara seeds. On the other hand, finisher and overall feed intake for birds on 25% replacement were not significantly ($P\geq0.05$) different when compared to control. Dressing% was significantly ($P\leq0.05$) reduced for birds at 75% and 100% replacement versus those fed other diets. Based on the current findings, it could be concluded that only 25% super-concentrate can be replaced by boiled Bambara without any deleterious effects on FI, FCR, PER and dressing%.

Keywords: Bambara seeds, broiler performance, carcass.

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Introduction

The rapid increase in the world population and acute protein shortage particularly in developing countries has necessitated the urgent need for means of increasing food production especially cheap and good source of protein. Rich sources of quality protein for the body are mainly animal sources such as poultry (Oloyede *et al*., 2007).

The poultry industry in developing countries has suffered the problem of inadequate supply of feed stuff more than any other sector of the livestock industry. Poultry feed account for 70 – 80% of the total cost of production (Acamovic, 2001).). To reduce the high cost of poultry feed production research has now been directed at exploring the use of cheaper and nutritionally sound unconventional feed resources which can yield similar result and at the same time cost effective. Grain legumes are sources of dietary protein and energy. Grain legumes especially soybeans and groundnut cake have played major roles in the feeding of birds and animals. However, these two commodities in recent times are becoming expensive and scarce because of dwindling local production. Hence, there is need to investigate other under-utilized grain legumes. Raw grain legumes have been reported to contain some anti-nutrients which are capable of exerting deleterious effects on body organs, and inhibiting the growth of chickens when fed in the raw form (Metayer *et al*., 2003). In considering the use of any feed stuff as replacement for the other one, parameters like availability, nutritive value, ease of processing, low cost and the absence or ease of removal of toxi/anti nutritional factors should be considered. One of such alternative feedstuff is Bambara seeds (*Vigna subterraneanverdc*). The Bambara groundnut is member of the family fabaceae. The plant originated in West Africa. Still it is a traditional food plant in Africa. It is highly nutritious and has been termed a complete food (Poulter, 1981). Bambara seeds (*Vigna subterranean verdc*) have been reported to contain about 49%-63.5% carbohydrate and 15%-25% protein (Murevanhema and Jideani, 2013). Being a legume antinutrional factors (ANFs) have been reported to be present in Bambara. Like most grain legumes, Bambara seeds contain toxic compounds such as heamagglutinin and trypsin inhibitor. On the other hand, Bambara has been reported to contain high amounts of tannin, phytate and oxalate especially in the hulls (Akanji, 2002). Higher inclusion levels of Bambara seeds in poultry diets can be used after the removal of the anti-nutritional factors. There is an urgent need to investigate alternative protein sources suitable for poultry. Therefore, the objective of this study was to study the effect of graded replacement of boiled Bambara seed for super-concentrate on broiler performance and carcass characteristics.

Materials and Methods

Chickens and treatments: An experiment was carried out using one-day-old unsexed broiler chicks of a commercial strain (Ross 308) in a completely randomized design. Two hundred broiler chicks were used to evaluate different levels of Bambara replacement (0, 25, 50, 75, and 100%). Chicks were randomly divided into five treatment groups, each of them was further divided into four replicates of ten birds each. The chicks were reared from one-day-old to six week of age in 20 pens (1x1 m) with wood shavings litter. The experiment was conducted in an open- sided poultry house in the Poultry Unit, Department of Animal Production, University of AlNeelain. Five isocaloric and isonitrogenous starter and finisher diets were formulated according to National Research Council (NRC, 1994). Bambara seeds were cleaned, washed, and boiled at 100ºC in tap water for 25 minutes, sun dried for 72 hours and milled. Boiled Bambara seeds replaced super concentrate at 0, 25, 50, 75 and 100% in starter and finisher diets.The composition of starter and finisher diets in the experiment is shown in Tables (1) and (2).

Feed intake, body weight and body weight gain were determined weekly on a pen basis. Mortality was recorded daily as it occurred to adjust feed intake. From the records of feed intake and weight gain, feed conversion ratio (FCR) was calculated as feed intake per weight gain. Protein efficiency ratio (PER) was calculated as weight gain per protein consumed. At the end of the experiment, liver, heart, gizzard, intestine, abdominal fat were weighed. The dressing percentage on hot base was calculated as hot carcass weight to live weight.

Statistical analysis: The experiment was arranged in a completely randomized design (CRD). Data was analyzed by one-way analysis of variance using the General I near Model of SAS (SAS Institute, 2003). Significant differences between treatments means were separated by Duncan's multiple range tests (Steel and Torrie, 1980).

Table 1. Composition of experimental broiler starter diets containing partial replacement levels of boiled Bambara for Super-concentrate.

	Replacement levels of Bambara for Super concentrate, %				
Ingredients, %	**0 (A)**	**25 (B)**	**50 (C)**	**75 (D)**	**100 (E)**
Sorghum	63.80	63.33	60.22	59.61	60.40
Ground nut cake	21.00	20.00	22.60	23.33	22.87
Bambara	0.00	1.25	2.50	3.75	5.00
Sesame cake	4.00	5.00	3.00	3.50	3.00
Wheat bran	0.60	0.60	2.00	1.00	0.78
Super-concentrate*	5.00	3.75	2.50	1.25	0.00
Nacl	0.30	0.30	0.30	0.30	0.30
Limestone	1.17	0.95	0.96	0.99	0.90
Dical phosphate	0.07	0.53	0.96	1.40	1.83
L-Lysine	0.14	0.30	0.44	0.59	0.77
DL-Methionine	0.12	0.17	0.23	0.28	0.35
Choline chloride	0.20	0.20	0.20	0.20	0.20
Mycotoxin binder	0.20	0.20	0.20	0.20	0.20
Vegetable oil	3.30	3.32	3.75	3.50	3.30
Premix	0.10	0.10	0.10	0.10	0.10
Calculated analysis					
ME* *(kcal/kg)	3181	3192	3194	3195	3199
CP%	22.88	22.67	22.92	23.21	22.77
Crude fiber%	4.17	4.18	4.41	4.41	4.34
Ca%	1.05	1.0	1.0	1.0	1.0
Av. Phosphorous%	0.44	0.45	0.45	0.45	0.45
Lysine%	1.1	1.1	1.1	1.1	1.1
Methionine%	0.57	0.58	0.57	0.58	0.59
Meth. + Cysteine%	0.79	0.80	0.79	0.80	0.80
Determined analysis					
CP%	20.6	18.1	19.6	19.3	21.1
Crude fiber%	3.9	6.0	5.1	7.2	5.7
EE%	7.0	8.1	8.1	8.4	7.9

Ash%	7.3	7.4	7.3	6.4	7.3

* Cp 40%, ME 2000 kcal/kg, C.fiber 3%, EE 3%, Ash 34%, Ca 8%, Av. P 1.38%, Lysine 12%, Methionine 3%, Methionine+Cystine 3.5%. Vitamin A 250000 IU/Kg, Vitamin D3 50000 IU/Kg, Vitamin E 500Mg/Kg, Vitamin K3 60 Mg/Kg, Vitamin B1/ Thiamin 20 Mg/Kg, Vitamin B2/ Riboflavin 100 Mg/Kg, Niacin Vitamin PP 600 Mg/Kg, Pantothenic acid/ Vitamin B3 160 Mg/Kg, Vitamin B6/ Pyridoxine 40 Mg/Kg, Vitamin B12 300 Mcg/Kg, Biotin/ Vitamin H 2000 Mcg/Kg, Choline 10000 Mg/Kg, Vitamin C 4000 Mg/Kg, Folic Acid 30 Mg/Kg, Iron 800 Mg/Kg, Manganese 1400 Mg/Kg, Copper 120 Mg/Kg, Zinc 1000 Mg/Kg, Iodine 6 Mg/Kg, Cobalt 12 Mg/Kg, Selenium 3 Mg/Kg. ** ME Calculated according to equation of Lodhi*et al*. (1976).

Table 2. Composition of experimental broiler finisher diets containing partial replacement levels of boiled Bambara for Super-concentrate.

	Replacement levels of Bambara for Super concentrate,%				
Ingredients, %	**0 (A)**	**25 (B)**	**50 (C)**	**75 (D)**	**100 (E)**
Sorghum	66.40	67.50	66.90	68.90	67.10
Ground nut cake	15.00	15.00	14.90	14.69	15.38
Bambara	0.00	1.25	2.50	3.75	5.00
Sesame cake	2.70	2.60	3.10	3.50	3.20
Wheat bran	4.71	3.75	3.46	1.41	2.09
Super-concentrate*	5.00	3.75	2.50	1.25	0.00
Nacl	0.30	0.30	0.30	0.30	0.30
Limestone	1.22	1.45	1.40	1.35	1.31
Dical phosphate	0.00	0.00	0.41	0.87	1.30
L-Lysine	0.08	0.25	0.41	0.57	0.72
DL-Methionine	0.09	0.15	0.19	0.24	0.30
Choline chloride	0.20	0.20	0.20	0.20	0.20
Mycotoxin binder	0.20	0.20	0.20	0.20	0.20
Vegetable oil	4.26	3.50	3.40	2.67	2.80
Premix	0.10	0.10	0.10	0.10	0.10
Calculated analysis					
ME (kcal/kg)	3196	3195	3198	3197	3196
CP%	20.24	20.1	20.1	20.01	20.05
Crude fiber%	4.09	4.01	4.02	3.85	3.96
Ca%	1.0	1.0	1.0	1.0	1.0
Av. Phosphorous%	0.43	0.35	0.35	0.35	0.35
Lysine%	1.0	1.0	1.0	1.0	1.0
Methionine%	0.51	0.52	0.51	0.51	0.52
Meth. +Cysteine%	0.71	0.71	0.71	0.70	0.71
Determined analysis					
CP%	17.7	17.8	16.7	19.5	16.6
Crude fiber%	4.5	4.5	4.2	4.6	3.4
EE%	8.2	7.0	7.1	8.4	8.4

Ash%	8.0	8.0	7.6	7.8	7.4

*As shown in Table 1.

Results and Discussion

Data on response of broiler chicken to different levels of replacement of boiled Bambara seeds (*Vigna Subterranean verdc*) for Super-Concentrate growth performance are presented in Table (3) and (4). Feed intake during starter phase was significantly (P≤0.05) poorer for birds fed on 50, 75 and 100% level of replacement versus control diet. Likewise, body weight gain was significantly (P≤0.05) decreased with the increased levels of boiled Bambara seeds. However, FCR was significantly (P≤0.05) deteriorated only for birds fed 100% level of replacement. On the other hand there was a significant (P≤0.05) improvement for birds fed 50% for the Protein efficiency ratio. During finisher phase (4-6 week), body weight gain, feed intake and protein efficiency ratio were significantly (P≤0.05) higher for birds fed on control diet. However birds fed 75% and 100% boiled Bambara recorded poorest FCR and PER.

Overall feed intake for birds fed 25% level of replacement was not significantly (P≥0.05) different when compared with control. However, overall feed intake of 50, 75 and 100% level of replacement was significantly (P≤0.05) lower compared to control. On the other hand, overall body weight gain was significantly (P≤0.05) reduced with the increased levels of replacement versus control. Likewise, Oloyede *et al*. (2010) demonstrated inferior feed intake and body weight gain for birds fed bambara seeds compared to control. This could be due to antinutrients that cause reduced growth (Martinez *et al*., 1995) and low digestibility (Pustazi *et al*., 1995). Birds fed 75 and 100% level of replacement revealed significantly (P≤0.05) poorest FCR and PER versus control. This finding is disagreed with Bang (2015) who used de-hulled Bambara groundnuts, and agreed with Balaiel (2009) who reported that birds fed 5% level of cowpea were not significantly (P≥0.05) different when compared with control. Furthermore, this agreed with Oloyede *et al*. (2010) who reported poor FCR of birds fed bambara seeds versus control. This could be attributed to insufficient nutrients utilization by birds fed bambara seeds. Carcass characteristics and Absolute abdominal fat Dietary treatments are presented in Table4. Dressing% was significantly (P≤0.05) reduced for birds fed 75 and 100% versus others. This result might have been due to the presence of anti-nutritional factors (Ogunbode and Shittu, 2020). Relative abdominal fat was not significantly (P≥0.05) different. Poor performance of birds fed 50, 75 and 100% level of replacement versus control may due to some anti-nutritional factors present in bambara and richness of super-concentrate in vitamins, mineral and amino acids.

Conclusion

The results of the present results concluded that 25% super-concentrate can be replaced by boiled Bambara without any negative effects on FI, FCR, PER and dressing%.

Table 3. The effect of partial replacement of boiled Bambara seeds for Super-concentrate on broiler growth performance.

	Replacement levels of Bambara for Super-concentrate, %					
Parameter	0 %(A)	25% (B)	50% (C)	75% (D)	100% (E)	±SEM
0-3 wk						
Feed intake	$1034.3^{a}\pm24.4$	$989.8^{ab}\pm44.8$	$951.4^{b}\pm24.9$	$870.3^{c}\pm85.6$	$691.5^{d}\pm12.7$	23.2
Body wt gain	$724.2^{a}\pm8.3$	$659.3^{b}\pm28.9$	$673.8^{b}\pm15.8$	$553.2^{c}\pm53.3$	$292.9^{d}\pm15.4$	14.5
FCR	$1.43^{bc}\pm0.04$	$1.50^{bc}\pm0.03$	$1.41^{c}\pm0.02$	$1.58^{b}\pm0.15$	$2.36^{a}\pm0.15$	0.05
PER	$3.06^{b}\pm0.09$	$2.93^{bc}\pm0.06$	$3.36^{a}\pm0.04$	$2.75^{c}\pm0.24$	$1.86^{d}\pm0.12$	0.06
4-6 wk						
Feed intake	$2762.1^{a}\pm53.1$	$2606.6^{ab}\pm61.7$	$2432.1^{b}\pm109.5$	$2025.0^{c}\pm299.1$	$1156.0^{d}\pm97.7$	76.7
Body wt gain	$1443.6^{a}\pm57.7$	$1275.4^{b}\pm93.1$	$1148.3^{b}\pm162.9$	$663.5^{c}\pm74.2$	$372.4^{d}\pm17.4$	47.1
FCR	$1.91^{b}\pm0.05$	$2.05^{b}\pm0.14$	$2.14^{b}\pm0.26$	$3.05^{a}\pm0.31$	$3.10^{a}\pm0.21$	0.11
PER	$2.45^{a}\pm0.10$	$2.43^{a}\pm0.16$	$2.34^{a}\pm0.26$	$1.65^{b}\pm0.17$	$1.61^{b}\pm0.10$	0.08
Overall						
Feed intake (g/bird)	$3796.4^{a}\pm44.1$	$3596.4^{ab}\pm77.9$	$3383.5^{b}\pm128.8$	$2895.2^{c}\pm358.4$	$1847.5^{d}\pm93.9$	89.9
Body wt gain	$2167.7^{a}\pm57.2$	$1934.6^{b}\pm113.5$	$1822.1^{b}\pm174.6$	$1216.6^{c}\pm123.4$	$665.3^{d}\pm25.5$	55.9
FCR (g feed /g Bwt gain)	$1.75^{c}\pm0.03$	$1.86^{c}\pm0.09$	$1.87^{c}\pm0.14$	$2.38^{b}\pm0.24$	$2.77^{a}\pm0.04$	0.06
PER (Bwt gain/protein consumed)	$2.62^{a}\pm0.07$	$2.58^{a}\pm0.11$	$2.64^{a}\pm0.18$	$2.02^{b}\pm0.20$	$1.71^{c}\pm0.02$	0.06

Values are means of 4 replicates per treatment (10 birds/ replicate). ^{ab} Means ± SD with different superscripts in the same row were significantly different ($P \leq 0.05$). SEM: Standard error of the means from ANOVA d.f 15.

Table 4. Carcass characteristics of broilers as influenced by partial replacement of boiled Bambara seeds for Super-concentrate.

	Replacement levels of Bambara for Super-concentrate,%					
Parameter	0 %(A)	25% (B)	50% (C)	75% (D)	100% (E)	±SEM
Dressing%	73.6^{a}±1.5	72.4^{a}±2.1	71.5^{a}±1.7	67.9^{b}±3.5	64.9^{c}±3.8	1.35
Absolute abdominal fat wt. (g)	46.4^{a}±14.9	43.4^{a}±11.0	42.5^{a}±13.6	33.7^{a}±14.9	13.2^{b}±8.6	6.4
Relative abdominal fat wt.	2.7±0.9	2.9±0.9	3.0±0.8	3.3±1.3	2.7±1.2	0.53

Values are means of 4 replicates per treatment.

^{ab} Means ± SD with different superscripts in the same row were significantly different ($P \leq 0.05$).

SEM: Standard error of the means from ANOVA d.f 15.

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