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REPLACEMENT OF SOYBEAN MEAL AND MAIZE OFFAL WITH BAMBARA GROUNDNUT OFFAL IN BROILER DIETS.

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ABSTRACT

One hundred and fifty day-old Anak broilers were used to evaluate the effect of replacing Soybean meal and maize offal with Bambara groundnut offal (BGO) in starter and finisher broiler diets in a completely randomized design (CRD). There were five treatments, each replicated three times with ten broilers per replicate. The inclusion level of BGO in the starter diets (Experiment1) were 0, 5, 10, 15 and 20%. In the finisher diets (Experiment 2), the inclusion levels were 0, 10, 20. 30 and 40%. Parameters measured in both experiments were final live weight. weight gain, feed intake, feed conversion ratio (FCR), protein efficiency ratio (PER) and feed cost. The results of Experiment 1 showed that there were no significant differences ($P>0.05$) in all the parameters measured except protein intake. Daily feed cost and feed cost per kg live weight gain of the broilers were also not significantly affected ($P>0.05$). In Experiment 2, 20, 30 and 40% BGO diets significantly ($P<0.05$) reduced final live weight and live weight gain of the broilers. The broilers fed the different levels of BGO diets showed no significant ($P>0.05$) differences in feed intake, FCR and PER. In terms of cost, BGO diets significantly ($P<0.05$) affected only feed cost per day. In conclusion, BGO is a valuable feedstuff in broiler diets and could be included up to 20% in starter broiler and 10% in finisher broiler diets.

INTRODUCTION

The price of soybean meal, which is a major source of protein in poultry diets, has continued to increase, especially now that it is being imported into the country due to its short supply. There is also the stiff competition between the industrial processors and human consumers for soybean and soybean meal. This has resulted in high cost of finished feed with serious consequences for the poultry industry in Nigeria.

Bambara groundnut (*Voandzeia subterranean Thourara*) offal is produced in large quantities in most major farming Nigerian communities. It is a by-product of bambara groundnut processing to obtain the flour for human consumption. The offal or waste has no human food value and no industrial use as at now. It is very cheap and available

Table 2: Percentage Composition of the Experimental Finisher Broiler Diets.

	Treatments[a]				
Feedstuffs	1	2	3	4	5
Bambara Offal meal	0	10	20	30	40
Local Fishmeal	5.00	5.00	5.00	5.00	5.00
Maize Offal	45.00	38.70	32.50	26.20	20.00
Soybean meal	18.00	14.30	10.50	6.80	3.00
Spent Grain	15.00	15.00	15.00	15.00	15.00
Palm kernel meal	13.50	13.50	13.50	13.50	13.50
Bone meal	3.00	3.00	3.00	3.00	3.00
Vitamin Premix*	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Total (%)	100	100	100	100	100
Cal. Composition					
CP (%)	21.04	20.73	20.39	20.08	19.74
ME (MJ/Kg)	12.37	12.41	12.46	12.50	12.55
CF (%)	5.18	5.31	5.43	5.56	5.68
Avail. Ca (%)	1.17	1.17	1.17	1.17	1.17
Avail. P (%)	0.69	0.69	0.69	0.69	0.69

*Contains per kg: Vit. A, 10,000 iu; Vit. B, 2,000 iu;Vit. E, 13,000 iu; Vit.K, 1,500 iu; Vit. B12. 10mg; Riboflavin, 5000mg;Pyridoxine, 1,300mg; Panthotheinc acid,8,000mg; Nicotinic acid, 28,00mg; Folic acid,500mg; Biotin, 40mg; Copper,7.00mg Manganese,48,000mg,Iron,58,00mg; Zinc,58,000mg; Selenium,120mg; Iodine,60mg Cobalt,300mg Choline,275,000mg. a 1, 2, 3, 4 & 5 = 0, 5, 10, 15 & 20% BGO diets, respectively.

2. In both Experiments 1 and 2, diet 1 was the control.

Experimental Birds and Their Management

One hundred and fifty day-old unsexed Anak broiler chicks were used for the two experiments. The day-old chicks were brooded using kerosene stoves under metal hovers and electric bulbs as sources of heat and light in a deep litter house. The house was a tropical type, with dwarf walls and open sides covered with wire gauze. The birds were randomly allotted to the five treatment diets and brooded separately in different pens.

There were 30 birds in each treatment and three replicates of 10 birds per replicate. Feed and water were provided *ad libitum*.

Health management practices included the administration of Newcastle disease vaccine i/$_0$ at day-old, infectious bursa disease (*Gumboro*) vaccine at 9th

and 21st day, Newcastle disease vaccine (*Lasota*) at 4 weeks, coccidiostat at 3rd, 6th and 9th weeks. Antibiotics and vitamin-mineral supplements were also administered through drinking water at weeks 1, 3 and 5. The starter phase of the study lasted for 5 weeks. At the finisher phase, 120 birds from the starter phase were selected, pooled together and randomly allotted to five treatments with each treatment having 3 replicates of 8 birds per replicate. The finisher phase lasted for 5 weeks.

Data Collection

The experimental design was completely randomized design (CRD). The broilers were weighed at the beginning and subsequently on a weekly basis up to the end of each experiment. Weight gain was obtained by subtracting initial live weight from final live weight. Feed intake was obtained as quantity of feed offered minus quantity not consumed. The weighing of birds and feed was done using a top loading 20kg capacity weighing scale. Weighing of birds was in groups of 10 birds during the first two weeks and subsequently on individual basis in the morning hours (8 9 am) each week. Feed conversion ratio was determined by dividing feed intake by weight gain. Protein efficiency ratio was calculated as weight gain divided by protein intake, while cost per kg weight gain was calculated as FCR x Cost/kg feed.

Chemical and Data Analyses

The proximate composition of the diets was determined using the Kjeldhal method for crude protein, while Soxhlet extractor was used for ether extract and ashing furnace for ash (A.O.A.C., 1990). The data collected were subjected to analysis of variance (ANOVA) as described by Steel and Torrie (1980) while differences among treatment means were determined using Duncan's New Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

The proximate composition of experimental starter and finisher diets and that of BGO is presented in Tables 3 and 4. The crude protein content of 19.22% for the offal is lower than the value of 24% obtained for the seed by

Table 3: Proximate Composition of Experimental Starter Broiler diets and BGO (%DM Basis).

	Treatments[a]					
Component	1	2	3	4	5	BGO
Dry Matter (%)	86.00	84.20	83.75	85.40	85.00	86.10
Crude Protein (%)	21.84	21.41	21.44	21.88	21.78	19.22
Crude Fibre (%)	5.00	5.50	5.56	5.68	5.75	5.40
Ether extract (%)	3.50	2.50	2.94	2.32	2.25	2.36
Ash (%)	8.70	8.00	8.25	8.00	8.76	2.00
NFE (%)	46.96	46.76	45.56	47.52	46.46	57.12

BGO = Bambara groundnut offal. **a 1, 2, 3, 4 & 5 = 0, 5, 10, 15 & 20% BGO diets, respectively.**

Table 4: Proximate Composition of Experimental Finisher Broiler Diets (% DM Basis).

Component	Treatments[a] 1	2	3	4	5
Dry Matter (%)	86.80	85.40	85.85	86.50	85.85
Crude Protein (%)	21.31	20.97	20.97	20.03	19.72
Crude Fibre (%)	5.50	5.00	6.35	6.39	6.60
Ether Extract (%)	3.18	3.02	3.40	2.11	2.40
Ash (%)	6.80	6.70	7.00	6.20	7.50
NFE. (%)	50.01	49.71	48.13	51.77	49.63

a 1, 2, 3, 4 & 5 = 0, 5, 10, 15 & 20% BGO diets, respectively.

Poulter (1981), which may have been due to loss of some protein during processing and higher than 16% CP reported by FAO (1982), probably due to differences in the variety of seeds used. The lower value of ether extract (2.36%) compared to 6% obtained by FAO (1982) and Elegbede (1998) may have been due to the removal of the greater proportion of the edible portion during processing.

Experiment 1

Performance

The performance of starter broilers fed different levels of Bambara offal diet is presented in Table 5. There were no significant differences (P>0.05) in final live weight, average daily

Table 5: Performance of Starter Broilers fed different levels of Bambara offal diet.

Parameters	Treatments[a] 1	2	3	4	5	SEM
Initial live weight (g/b)	40.00	40.50	40.20	40.00	40.30	0.00
Final Live weight (g/b)	676.67	596.67	626.67	546.67	546.67	42.09
Daily weight Gain (g/b)	18.19	15.89	16.76	14.48	14.47	1.20
Daily Feed Intake (g/b)	42.99	45.43	41.43	42.23	43.65	0.00
FCR	2.36	2.86	2.47	2.92	3.02	0.20
Total protein Intake(g/b)	330.40^{b}	345.98^{a}	312.60^{e}	315.72^{d}	323.30^{c}	0.09*
Daily Protein intake(g/b)	9.44^{b}	9.89^{a}	8.93^{e}	9.02^{d}	9.24^{c}	0.00*
PER	1.93	1.61	1.88	1.61	1.57	0.13
Mortality%	6.67	3.33	3.33	3.33	6.67	

a - eMeans in the same row followed by different superscripts are significantly different (P< 0.05).
SEM = standard error of mean. FCR = Feed Conversion ratio; PER = Protein efficiency ratio.
1, 2, 3, 4 & 5 = 0, 5, 10, 15 & 20% BGO diets, respectively.

weight gain, feed intake, feed conversion ratio (FCR) and protein efficiency ratio (PER) of the broilers fed the different levels of bambara groundnut offal (BGO) and control diets.

The feed intake results of this experiment agree with that obtained by Onwudike and Eguakun (1994), while the daily weight gain is lower than what they obtained using raw or heattreated Bambara groundnut meal.

Cost

The cost of feeding BGO diets to broiler starters is presented in Table 6. The replacement of soybean meal and maize offal with BGO reduced the cost per kg feed with further reductions obtained as the percent inclusion level of BGO in the diets increased from 5 to 20%. Although there were no significant differences ($P>0.05$) in total feed cost and feed cost per kg live weight gain, the slight reductions in feed cost is expected to increase the farmers income and profit from broilers produced using BGO diets.

Table 6: Cost of feeding Bambara offal meal diets to Starter Broilers.

	Treatments[a]					
Parameter	**1**	**2**	**3**	**4**	**5**	**SEM**
Cost/kg feed (₦)	27.98	27.42	26.86	26.30	25.73	
Feed cost per day (₦)	1.20	1.25	1.11	1.11	1.12	0.00
Total Feed Intake(g/b)	1504.54	1589.98	1449.89	1478.09	1527.87	0.00
Total feed cost (₦)	42.11	43.61	38.96	38.89	39.31	0.00
Total weight Gain (g/b)	636.67	556.17	586.47	506.67	506.37	42.09
Feed cost/kg weight gain (₦)	67.39	78.74	67.04	76.77	79.31	5.38

SEM = Standard Error of Mean. a 1, 2, 3, 4 & 5 = 0, 5, 10, 15 & 20% BGO diets, respectively.

Experiment 2

Performance

The results of feeding different levels of BGO as a partial replacement for soybean meal and maize offal in finisher broilers diets are presented in Table 7. The final live weight of broiler finishers fed the control diet was not significantly different ($P>0.05$) from that of broilers fed 10% BGO diet (T_2) but were significantly higher ($P<0.05$) than the final live weight of broilers fed 20, 30, and 40% BGO diets. It was also observed that the differences in final live weight of broilers fed the different BGO diets were non-significant ($P>0.05$). Live weight gain followed exactly the same pattern with the final live weight as shown in Table 7. The poor performance of broilers fed the BGO diets could be attributed to lower amino acid availability (Onwudike and Eguakun, 1994) since the offals were from raw seeds. It is equally possible that the presence of low levels of trypsin and haemagglutinating inhibitors and other anti-nutritional substances in the

raw Bambara groundnut offal (Apata and Ologhobo, 1997) negatively affected the performance of the broilers. The broilers fed 30% BGO diet had significantly lower ($P<0.05$) protein intake than the control (T_1) and 10% BGO diets. This can be attributed to the lower feed intake of the broilers fed the 30% BGO diet as shown in Table 7. There were no significant differences ($P>0.05$) between the broilers fed the control and BGO diets in feed intake, FCR and PER. The non-significant difference ($P>0.05$) in the performance of broilers fed control and 10% BGO diets suggest that the replacement level is too low to cause major differences in the growth and performance of broilers. The decrease in the finisher broiler performance with increase in the level of the BGO in the diets is in agreement with the reports of Oluyemi *et al.* (1976); Onwudike and Eguakun (1992) and Onwudike and Eguakun (1994).

Table 7: Performance of Finisher Broilers fed different levels of Bambara offal meal diet

	Treatments[a]					
Parameter	**1**	**2**	**3**	**4**	**5**	**SEM**
Initial live weight (g/b)	599.60	598.76	597.67	598.86	596.80	0.00
Final live weight (kg/b)	1.86[a]	1.70[ab]	1.50[b]	1.65[b]	1.55[b]	0.063*
Daily weight Gain (g/b)	36.11[a]	31.56[ab]	25.78[b]	30.03[b]	27.14[b]	1.796*
Daily feed intake (g/b)	89.70	89.33	84.78	79.75	89.11	2.371
F C R	2.48	2.83	3.29	2.66	3.28	0.193
Total protein intake (g/b)	660.56[a]	648.13[a]	605.05[ab]	560.46[b]	615.65[ab]	16.788*
Daily protein intake (g/b)	18.87[a]	18.52[a]	17.29[ab]	16.01[b]	17.59[ab]	0.480*
P E R	1.91	1.70	1.49	1.89	1.54	0.120
Mortality (%)	8.33	4.17	4.17	8.33	4.17.	

a e Means in the same row followed by different superscripts are significantly different ($P<0.05$).
SEM = standard error of mean. FCR = Feed Conversion ratio; PER = Protein efficiency ratio.
a 1, 2, 3, 4 & 5 = 0, 5, 10, 15 & 20% BGO diets, respectively.

Cost

The cost implication of including BGO in broiler diets is presented in Table 8. The control diet had the highest (unanalyzed) cost per kg of feed (N27.03) while 40% BGO diet had the lowest (N22.68). The cost per kg feed continued to decrease with increase in the percent inclusion level of BGO in the diets from 10 to 40%.

Table 8: Cost of Feeding Bambara groundnut offal meal Diets to Finisher Broilers.

	Treatments[a]					
Parameters	**1**	**2**	**3**	**4**	**5**	**SEM**
Feed cost per day (₦)	2.42[a]	2.32[a]	2.11[b]	1.90[c]	2.02[bc]	0.057*
Total feed intake (g/b)	3139.58	3126.49	2967.27	2791.08	3118.73	82.99
Total feed cost (₦)	84.88[a]	81.17[a]	73.78[b]	66.36[c]	70.73[bc]	2.012*
Total weight Gain (g/b)	1263.73[a]	1104.57[ab]	902.33[b]	1051.14[b]	949.87[b]	62.88*
Feed cost/kg weight gain (₦)	67.61	73.57	82.25	64.46	74.62	4.683

a e Means in the same row followed by different superscripts are significantly different (P< 0.05).

SEM = standard error of mean. a 1, 2, 3, 4 & 5 = 0, 5, 10, 15 & 20% BGO diets, respectively.

For broilers fed the control diet, feed cost per day was not significantly different (P>0.05) from that of broilers fed 10% BGO diet but significantly higher (P<0.05) than that of broilers fed 20% BGO diet which, was in turn significantly (P<0.05) higher than the feed cost per day of birds fed 30% BGO diet. The differences in total feed cost may be attributed to differences in the cost per kg feed and differences in feed intake. Feed cost per kg live weight gain of the broilers were not significantly different (P>0.05) among the treatment diets, although the minor differences may mean much financially to a broiler farmer.

CONCLUSION

This study has shown that Bambara groundnut offal (BGO) could be a valuable protein feedstuff for broilers and that it could replace part of soybean meal and maize offal, constituting 20% of the diet of starter and 10% of the diet of finisher broilers.

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