THE EFFECT OF PARTIAL REPLACEMENT OF MAIZE WITH ACHA (*Digitaria exilis)* OFFAL ON PERFORMANCE OF BROILER CHICKENS

[1]Sudik, S. D., [1]Bagudu, I. A., [1]Maidala, A., [1]Lawan, A., 2Agbede, J. O., and [2]Igbasan, F. A.
[1]Department of Animal Science, Federal University, Gashua, Yobe State, Nigeria
[2]Department of Animal Production and Health, Federal University of Technology, Akure, Ondo State, Nigeria
Corresponding author: davidsudik@fugashua.edu.ng Mobile No: +2348065633451

Abstract
An experiment was conducted to determine the performance of broiler chickens fed diets with acha offal (AO) replacing maize. A total of two hundred and forty (240) day-old broilers were randomly allotted into six dietary treatments with AO at 0%, 5%, 7.5%, 10%, 12.5% and 15% with forty birds per treatment. Each treatment had four replicates with 10 birds each in a completely randomized design. Feed and drinking water were served ad libitum throughout the experiment which lasted for 42 days. The results showed that at the starter phase only feed conversion ratio (FCR) was significantly (p<0.05) affected by treatment while others parameters were not significantly different from each other. Chicks fed 12.5% AO had best FCR (1.59) while those fed 0%, 5%, 7.5%, 10% and 15% AO had poor (2.05, 2.08, 2.03 and 2.02, respectively). At finisher phase, final weight (FW), total weight change (TWC), daily weight gain (DWG) and FCR were significantly (p<0.05) affected by treatment. Chickens fed 7.5% - 15% AO had higher FW, TWC and ADG than 0% AO while birds fed 5% AO had lower compared with those fed 0% AO. However, those fed 15% AO had best FCR (2.26) while those fed 0% and 5% had poor (2.46 and 2.33, respectively). It can be concluded that AO can replace maize in broilers' diets by 12.5% at starter phase and 15.0% at finisher phase without adverse effect on performance.

Keywords: Broiler, Acha offal, Maize, Feed intake, Performance,

Introduction

Globally, the aim of any poultry farmer is to have flock with efficient feed utilization, uniform growth rate, and low cost of production. This can be achieved in parts through the use of standard feed produced from low cost ingredients (NRC, 1994). In developing countries, where competition on conventional feedstuff between man and livestock exist, a careful selection of agro industrial by-products stand as means of reducing cost of feed (Makinde *et al*., 2014). Many agro industrial by-products including brewers dried grains, broken rice, cottonseed cake, groundnut cake, maize bran, millet hulls, oat hulls, palm kernel cake, peanut hulls, rapeseed hulls, sunflower meal, rice bran, rice hulls, sesame hulls, soybean hull, wheat bran have been well reported as alternative ingredients (Mottet *et al*., 2017). However, many others are yet to be exploited, one of which is acha offals.

Acha (also called white fonio) is a small annual, herbaceous plant that belongs to the family *Poaceae* and the genus *Digitaria* (Cruz *et al*., 2016). It grows to the height of 30-80 cm (Cruz *et al*., 2016). It is grown in the Central Zone of Nigeria and many West African countries as staple food (Cruz *et al*., 2016). Acha offal (AO) is a by-product obtained from dehulling acha grains by pounding with a pestle in a mortar to crack the hulls or using machines (NRC, 1996). A 100g of AO contains 5.74% total ash, 10.16% crude protein, 4.70% crude fat, 7.82% crude fibre, 2.65g/16N methionine and 2.89g/16N lysine (Sudik, 2016). By implication AO is rich in essential nutrients. The objective of this study is to determine the effect of partial replacement of maize with acha (*Digitaria exilis)* offal on performance of broiler chickens.

Materials and Methods

The experiment was conducted at the Teaching and Research Farm Federal University of Technology Akure, Nigeria. Akure lies on latitude 7^0 15' N and longitude 5^0 12' 0" E and within the rainforest zone of Nigeria. Its annual average rainfall is usually1524 mm, average atmospheric temperatures ranges between 28^0C and 31^0C, and mean annual relative humidity is usually about 80% (Ajibefun, 2011).

The acha (*Digitaria exilis*) offal was purchased in Bokkos local Government Area of Plateau State, Nigeria. Maize grains and other ingredients were purchased from a feed miller in Akure town, Ondo

State, Nigeria. A basal diet (0% AO) that meets nutrient requirements of broiler chickens (NRC, 1994) was formulated. Thereafter, 5 other diets with 23% CP (Starter) and 20% CP (Finisher) were formulated with AO replacing maize at 5%, 7.5%, 10.0%, 12.5% and 15% (Table 1 and 2).

Table 1: Gross composition and calculated values of starter

Ingredients	**Diet 1 0%AO**	**Diet 2 5%AO**	**Diet 3 7.5%AO**	**Diet 4 10%AO**	**Diet 5 12.5%AO**	**Diet 6 15%AO**
Maize	50.00	47.50	46.25	45.00	43.75	42.50
Acha offal	0.00	2.50	3.75	5.00	6.25	7.50
Soybean meal	27.00	27.00	27.00	27.00	27.00	27.00
Groundnut cake	10.10	10.10	10.10	10.10	10.10	10.10
Fish meal	5.00	5.00	5.00	5.00	5.00	5.00
Dicalcium phosphate	3.10	3.10	3.10	3.10	3.10	3.10
Premix	0.25	0.25	0.25	0.25	0.25	0.25
Lysine	0.15	0.15	0.15	0.15	0.15	0.15
Methionine	0.15	0.15	0.15	0.15	0.15	0.15
Salt	0.25	0.25	0.25	0.25	0.25	0.25
Soy oil	4.00	4.00	4.00	4.00	4.00	4.00
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Calculated						
Crude protein	23.00	23.00	23.10	23.10	23.20	23.20
Crude fibre	3.18	3.28	3.38	3.47	3.57	3.66
ME (kcal/kg)	2967.51	2960.22	2943.18	2921.43	2881.56	2816.15
Calcium	1.10	1.10	1.10	1.10	1.10	1.10
Average phosphorus	0.50	0.50	0.50	0.50	0.50	0.50
Lysine	1.14	1.14	1.15	1.15	1.16	1.16
Methionine	0.54	0.54	0.55	0.55	0.56	0.56

AO = Acha offal

Two hundred and forty (240) day-old Abor-Acre broiler chicks were purchased from Chi Farm, Ibadan, Nigeria. They were randomly allotted to six dietary treatments. Each treatment had forty birds and four replicates with ten birds per replicate in a completely randomized design (CRD). The birds were raised on deep litter and heat was provided by charcoal and electricity. Feed and water were provided *ad libitum* throughout the 42 days of the experiment. Gumboro disease vaccine 1st and 2nd dose was administered on day 7th and 21st, respectively while Newcastle disease vaccine on day 14th and 28th and routine management practices were strictly adhered to.

At the start of the experiment, the birds were weighed to determine initial weight thereafter, on weekly basis to determine the body weight chance (BWC) and daily weight gain (DWG) was calculated by dividing the cumulative weights by number of days considered. The left over feed of each diet was subtracted from supply to determine the feed consumed. Dividing the cumulative total feed intake (TFI) by number of day under consideration gave daily feed intake (DFI). Feed conversion ratio (FCR) was calculated as feed intake/weight gain.

Table 2: Gross composition and calculated values of finisher diets

Ingredients	Diet 1 0%AO	Diet 2 5%AO	Diet 3 7.5%AO	Diet 4 10%AO	Diet 5 12.5%AO	Diet 6 15%AO
Maize	58.00	55.10	53.65	52.20	50.75	49.30
Acha offal	0.00	2.90	4.35	5.80	7.25	8.70
Soybean meal	20.00	20.00	20.00	20.00	20.00	20.00
Groundnut cake	12.20	12.20	12.20	12.20	12.20	12.20
Fish meal	3.00	3.00	3.00	3.00	3.00	3.00
Dicalcium phosphate	2.50	2.50	2.50	2.50	2.50	2.50
Premix	0.25	0.25	0.25	0.25	0.25	0.25
Lysine	0.15	0.15	0.15	0.15	0.15	0.15
Methionine	0.15	0.15	0.15	0.15	0.15	0.15
Salt	0.25	0.25	0.25	0.25	0.25	0.25
Soy oil	3.00	3.00	3.00	3.00	3.00	3.00
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Calculated						
Crude protein	20.00	20.30	20.30	20.40	20.40	20.40
Crude fibre	4.31	2.28	3.42	3.46	3.49	3.53
Metabolizable energy (kcal/kg)	3021.12	3001.34	2989.08	2909.27	2887.16	2857.57
Calcium	1.04	1.04	1.04	1.05	1.05	1.05
Average phosphorus	0.78	0.78	0.78	0.78	0.78	0.78
Lysine	1.03	1.03	1.05	1.05	1.06	1.06
Methionine	0.41	0.41	0.41	0.42	0.42	0.43

AO = Acha offal

Data generated were subjected to Analysis of Variance (ANOVA) using the computer software SAS (2010). Significant means were separated with Duncan multiple range test at 5% level of probability.

Results

Feed conversion ratio (FCR) was only significantly ($p<0.05$) affected at 21-day (Table 3). Birds fed 12.5% AO had better FCR (1.59) than those on 0% AO (2.05) while birds fed 5%-10% and 15% AO had poor FCR (2.08, 2.03, 2.03 and 2.02, respectively) comparable to those fed 0% AO. At the finisher phase FW, BWC, DWG and FCR were significantly ($p<0.05$) affected (Table 4). Birds fed 7.5% - 15% had higher FW (2057.50 g, 2070.00 g, 2093.75 g and 2132.50 g, respectively), BWC (2016.25 g, 2028.50 g, 2052.00 g, and 2091.25 g, respectively) and DWG (48.01 g, 48.30 g, 48.86 g and 49.79 g, respectively) than those fed 0% AO (FW (1906.76 g), BWC (1865.26 g) and DWG (44.41 g)) while those fed 5% AO had lower (FW (1863.75 g), BWC (1822.25 g) and DWG (43.39 g)) compared with 0% AO. The birds fed 15% had better FCR (2.26) while those fed 0% and 5% AO had poor (2.46 and 2.33, respectively).

Discussion

The better FCR observed in birds fed 12.5% AO indicates that the optimum level to use AO for younger birds is at 12.5% and their high performance over those fed control means that the diet might have contained nutrients probably deficient in the control. The decline in FCR at 15% AO demonstrates that the birds could not tolerate AO beyond 12.5% probably due to high fibre because high fibre in diet interferes with the nutrients availability. This observation confirms the results of Makinde *et al*. (2014) that high fibre content in diet limit nutrients available for birds to grow.

At the finisher stage the higher gain and better FCR in birds fed diets with 7.5% -15% AO means that AO can be tolerated by older birds up to 15% which probably might have not interfered with the nutrients availability. This finding confirms the results of Ezieshi *et al*. (2011) that older birds tolerate fibre diet at certain levels than young ones.

In comparison with other offals the optimum level recorded for AO in this experiment is in agreement with 15% rice offal reported by Maikano (2007) for broilers. However, Makinde *et al*. (2014) reported that higher levels of 20-30% rice offal could be used with enzyme supplementation.

Table 3: Performance of broiler chickens fed diets with acha offal (21 days of age)

Parameters	Diet 1 0%AO	Diet 2 5%AO	Diet 3 7.5%AO	Diet 4 10%AO	Diet 5 12.5%AO	Diet 6 15%AO	±SEM
Initial weight	41.50	41.50	41.25	41.50	41.75	41.25	0.03
Final weight	765.00	758.75	778.75	785.00	790.25	799.00	8.84
Body weight change	723.50	717.25	737.50	743.50	749.50	757.75	8.84
Daily weight gain	34.45	34.16	35.12	35.40	45.61	36.08	0.42
Total feed intake	1483.65	1493.52	1498.56	1507.80	1520.61	1528.38	1.08
Daily feed intake	70.65	71.12	71.36	71.80	72.41	72.78	0.24
Feed conversion ratio	2.05[a]	2.08[a]	2.03[a]	2.03[a]	1.59[b]	2.02[a]	0.05

Values are average of 40 birds, AO = Acha offal, ±SEM = Standard Error of Mean,
Means with differing superscripts in the same columns are significantly ($p<0.05$) different.

Table 4: Performance of broiler chickens fed diets with acha (42 days of age)

Parameters	Diet 1 0%AO	Diet 2 5%AO	Diet 3 7.5%AO	Diet 4 10%AO	Diet 5 12.5%AO	Diet 6 15%AO	±SEM
Initial weight	41.50	41.50	41.25	41.50	41.75	41.25	0.03
Final weight	1906.76[b]	1863.75[b]	2057.50[a]	2070.00[a]	2093.75[a]	2132.50[a]	22.85
Body weight change	1865.26[b]	1822.25[b]	2016.25[a]	2028.50[a]	2052.00[a]	2091.25[a]	23.00
Daily weight gain	44.41[b]	43.39[b]	48.01[a]	48.30[a]	48.86[a]	49.79[a]	0.55
Total feed intake	4584.72	4638.30	4683.32	4697.26	4701.00	4729.66	89.19
Daily feed intake	109.16	110.44	111.51	111.84	111.93	112.61	4.50
Feed conversion ratio	2.46[a]	2.55[a]	2.32[b]	2.32[b]	2.29[c]	2.26[c]	0.13

Values are average of 40 birds, AO = Acha offal ±SEM = Standard Error of Mean,
Means with differing superscripts in the same columns are significantly ($p<0.05$) different.

Conclusion and Recommendation

It can be concluded that birds fed 12.5% AO at the starter phase and 15.0% AO at the finisher phase had outstanding performance over those fed 0% AO. Therefore, 12.5% AO and 15.0% AO are recommended for starter and finisher broiler chickens, respectively.

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