

Response of broiler chickens to graded levels of maize offal

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Abstract

Wheat offal which is a by-product of wheat milling process has been a valuable source of energy and fibre for livestock, which has made it expensive. The high cost and inadequacy in its production couple with high demand as livestock feed has called for research on other alternative sources of fibre for use in poultry rations. Maize is the most grown cereal since it is grown on a range of agro-ecological environment and because of the extensive consumption of it by man, large quantity of maize offal is being generated on daily bases in maize producing and consumption areas. The use of non-conventional agricultural and agro-industrial by-product such as maize offal which are local industrial by-products obtained during the processing of maize grain, for feed might offer the alternative for the reduction of feed cost and prices of animal product. The study aimed at investigating the response of broiler chickens fed graded levels of maize offal on growth performance at both starter and finisher phase. Proximate analysis were conducted and the results reveal that maize offal contain ME -3253.11 Kcal/kg, DM - 10.46, CP - 10.98, CF - 8.68, EE - 3.10, Ash - 3.19, and NFE-72.08%. Five diets were formulated in which maize replaced wheat offal at 0, 25, 50, 75 and 100% levels designated as T1, T2, T3, T4 and T5 respectively. Throughout the experimental period, birds were fed ad libitum. Two hundred and fifty day old Anak 2000 strain of broiler chickens were used for the experiment. The birds were weighed and randomly allotted into in to dietary treatment of 16 and 17 birds per replicate, it was replicated thrice in a completely randomize design and the study lasted for eight weeks. The parameter measured where daily feed intake, daily weight gain and feed conversion ratio. At the starter phase, the daily feed intake of broiler birds ranged between 55.12 and 58.14g in treatment 5 and 3 respectively but were not statistically affected by the dietary treatments, while daily weight gain of 27.19 g observed on treatment 1 was significantly ($p > 0.05$) lower than other treatment which were similar; the highest value of 37.5g was recorded on treatment 2. Feed conversion ratio varied between 1.53 and 2.23, but did not differ significantly. At the finisher phase, the daily feed intake ranged between 123.32 and 136.25g in treatment 3 and 1 respected and daily weight gain varied from 43.80 to 62.31g, observed in treatment 1 and 5 respectively but did not differ significantly, while the lowest feed conversion ratio (2.15) was recorded in treatment 5, while the highest (3.21) was in treatment 1 which was statistically ($p < 0.05$) higher than the values observed on other treatments. However, the daily feed intake, daily weight gain and feed conversion ratio had no significant dietary influence on the overall performance of the broiler bids.. The feed cost in naira per kg and feed cost per kg decreases with increased level of maize offal. Diet 5 recorded the least feed cost of N112.09/kg and the highest cost savings of N103.60. It can therefore be concluded that, maize offal can replace wheat offal in the diets of broiler chickens at 100% level without adverse effect on performance, with a notable reduction in feed cost by 32.4 %.

Keywords: maize offal, wheat offal, growth performance, cost benefit, broiler chickens.

Réponse des poulets à griller aux niveaux gradués d'abats de maïs



Résumé

Les abats de blé, qui sont un sous-produit du processus de mouture du blé, ont été une source précieuse d'énergie et de fibres pour le bétail, ce qui les a rendus coûteux. Le coût élevé et l'insuffisance de sa production, associés à une forte demande en tant qu'aliment du bétail, ont nécessité des recherches sur d'autres sources alternatives de fibres à utiliser dans les rations de volaille. Le maïs est la céréale la plus cultivée car il est cultivé dans une gamme d'environnements agro-écologiques et en raison de sa consommation extensive par l'homme, une grande quantité d'abats de maïs est générée quotidiennement dans les zones de production et de consommation de maïs. L'utilisation de sous-produits agricoles et agro-industriels non conventionnels tels que les abats de maïs qui sont des sous-produits industriels locaux obtenus lors de la transformation des grains de maïs, pour l'alimentation animale pourrait offrir l'alternative pour la réduction du coût des aliments et des prix des produits animaux. L'étude visait à étudier la réponse des poulets à griller nourris avec des niveaux gradués d'abats de maïs sur les performances de croissance à la fois en phase de démarrage et en phase de finition. Une analyse immédiate a été menée et les résultats révèlent que les abats de maïs contiennent du ME -3253,11 Kcal/kg, DM - 10,46, CP - 10,98, CF - 8,68, EE - 3,10, Ash - 3,19 et NFE-72,08 %. Cinq régimes ont été formulés dans lesquels le maïs a remplacé les abats de blé à des niveaux de 0, 25, 50, 75 et 100 % désignés respectivement par T1, T2, T3, T4 et T5. Tout au long de la période expérimentale, les oiseaux ont été nourris à volonté. Deux cent cinquante jours de souche de poulets à griller Anak 2000 ont été utilisées pour l'expérience. Les oiseaux ont été pesés et répartis au hasard dans le traitement diététique de 16 et 17 oiseaux par réplicat, il a été répliqué trois fois dans une conception complètement randomisée et l'étude a duré huit semaines. Le paramètre mesuré où la prise alimentaire quotidienne, le gain de poids quotidien et le taux de conversion alimentaire. À la phase de démarrage, la prise alimentaire quotidienne des poulets de chair variait entre 55,12 et 58,14 g dans les traitements 5 et 3 respectivement, mais n'était pas statistiquement affectée par les traitements diététiques, tandis que le gain de poids quotidien de 27,19 g observé sur le traitement 1 était significativement ($p > 0,05$) inférieur à d'autres traitements similaires, la valeur la plus élevée de 37,5 g a été enregistrée sur le traitement 2. Le taux de conversion alimentaire variait entre 1,53 et 2,23, mais ne différait pas significativement. À la phase de finition, la prise alimentaire quotidienne variait entre 123,32 et 136,25 g dans les traitements 3 et 1 respectés et le gain de poids quotidien variait de 43,80 à 62,31 g, observé dans les traitements 1 et 5 respectivement mais ne différait pas significativement, tandis que la plus faible conversion alimentaire ratio (2,15) a été enregistré dans le traitement 5, tandis que le plus élevé (3,21) était dans le traitement 1 qui était statistiquement ($p < 0,05$) plus élevé que les valeurs observées sur les autres traitements. Cependant, la prise alimentaire quotidienne, le gain de poids quotidien et le taux de conversion alimentaire n'avaient pas d'influence alimentaire significative sur la performance globale des offres de poulets de chair. Le coût alimentaire en naira par kg et le coût alimentaire par kg diminuent avec l'augmentation du niveau d'abats de maïs. Le régime 5 a enregistré le moindre coût d'alimentation de 112,09 N/kg et les économies de coûts les plus élevées de 103,60 N. On peut donc conclure que les abats de maïs peuvent remplacer les abats de blé dans l'alimentation des poulets de chair à un niveau de 100 % sans effet néfaste sur les performances, avec une réduction notable du coût de l'alimentation de 32,4 %.

Mots-clés : abats de maïs, abats de blé, performances de croissance, rentabilité, poulets de chair.

Introduction

An advanced knowledge of poultry nutrition is not, by itself alone, an assurance that the management of poultry will be profitable. However, a fair knowledge of poultry nutrition will definitely promote the efficiency of management operations and in fact; many cases of business failure can be traced to poor feeding of the birds (Oluyemi and Roberts, 2013). Maize offal is the outer layer of maize such as wheat offal, removed during the process of milling and used as a source of dietary fibre in animal feed including poultry. The maintenance of poultry health is complex, and rely on delicate dietary fibre as a dietary compound that has influence in this regard (Varastogani and Dahlan, 2014). Poultry birds especially broilers plays a significant role in the provision of animal protein required by man to meet his daily protein intake (Maidala and Istifanus, 2012). In an underdeveloped country like Nigeria, food production has been upset by population growth (Philip and Best, 2004). Obioha, (1975) estimated the daily animal protein per head at a minimum of 28g per day, which is about 40% and average of 85.9% total daily protein intake. Daily protein intake in Nigeria is 6.5 grams per capital per day (Marquist, 1993). This value is far below the British Medical Association recommendation 28g per day. The inadequacy of animal protein in Nigeria is largely due to low production especially of grazing animals as a result of pressure on available land, maximum production of mono-gastric animals like poultry broilers, which does not require a long period of time to mature with minimum space can fill the genuine gap of animal protein deficiency as well as provision of balance diet (Alan and Khan, 2000). High cost of conventional feed stuff most especially protein and energy sources have been one of the major challenges of intensive poultry production in developing countries like Nigeria (Ani,

2008). Beutler (2013) stated that it is not recommended to feed only grains to poultry because it would not provide a complete or balance diet. The value of wheat offal in the feeding of livestock has long been recognized by earlier scientist (Morison, 1959; Ewing, 1963). According to Aduku (1993), wheat offal contain 1245kcal/kg ME and 15.6% CP. Although, for many years research into cheaper feed ingredients of good nutritive value is being intensified with the view of bringing down the cost of products in Nigeria, the cost is still on the high side. Wheat offal has been a valuable source of energy and fibre for livestock and has made it to be an expensive product (Medugu *et al.*, 2010). The high cost and inadequacy in its production couple with high demand as livestock feed called for research on other alternative sources of fibre for use in poultry ration. Whitehead, (2002) reported the nutritive value of maize offal as 2225 ME kcal/kg, 12.8% CP, 12.07% CF, 11.72% EE, 5.42% Ash and 49.91% NFE. The use of non-conventional agricultural and agro-industrial by-products obtained from the process of maize grain, for feed might offer the alternative for the reduction of feed cost and prices of animal product. The purpose of the study was to assess the replacement value of maize offal for wheat offal.

Materials and methods

Site of study

This study was conducted at the Abubakar Tafawa Balewa University Poultry Teaching and Research Farm Bauchi, Bauchi state. Nigeria. Southern and Northern limits are demarcated by latitude 9° 30' South and 12° 30' North respectively. Bauchi is located at latitude 10° 12' North and longitude 9° 49' South (Anonymous, 2012), the western and Eastern limits are bounded by longitude 8° 45' West and 11° 1' East of the Greenwich Meridian respectively. It has relatively equal period

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of dry hot and cold weather with varying ambient temperature of 21^o in December and 38-40^o in May.

Chemical analysis

A sample of maize offal was analysed for proximate composition according to the methods of the Association of Official Analytical Chemists (AOAC, 2004) for determination of ME Kcal/kg and percentage CP, Ash, EE, CF and NFE. The result is on table 3.

Experimental birds and management

Two hundred and fifty day old Anak 2000 strain broilers were used for the study. The chicks were brooded for 4 weeks and vaccinated against Gumboro and New castle diseases. At first week, the birds were

fed with commercial diet. On the 8th day, the birds were randomly allotted into 5 dietary treatments described as treatments 1, 2, 3, 4 and 5 (0, 25, 50, 75 and 100% maize offal respectively, consisting of 50 birds per treatment and each treatment had 3 replicates, consisting of 16 or 17 birds per replicate. Throughout the experimental period, feed and water were provided ad libitum.

Experimental diets

Five experimental diets were formulated, and maize offal replaced wheat offal at 0, 25, 50, 75 and 100% level called diets 1, 2, 3, 4 and 5 respectively. The ingredients used for the experiment were locally procured. The composition of starter and finisher diets are presented in tables 1 and 2.

Table 1: Ingredients and calculated analysis of starter diet (1-4 weeks)

Ingredients	Experimental DIETS (%)				
	T1 0	T2 25	T3 50	T4 75	T5 100
Yellow Maize	48.3	47.9	47.47	47.07	46.63
Full fat soyabean	22.30	22.70	23.13	23.53	23.97
Groundnut cake	10.00	10.00	10.00	10.00	10.00
Maize offal	0.00	2.50	5.00	7.50	10.00
Wheat offal	10.00	7.50	5.00	2.50	0.00
Fish meal	5.00	5.00	5.00	5.00	5.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Limestone	1.50	1.50	1.50	1.50	1.50
Salt	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25
Methionine	0.20	0.20	0.20	0.20	0.20
Lysine	0.20	0.20	0.20	0.20	0.20
Total	100	100	100	100	1000
Calculated Analysis					
Crude protein	23.00	23.00	23.00	23.00	23.00
ME (kcal/kg)	2987.56	3002.78	3017.96	4720.68	3048.35
Ether Extract	7.12	7.15	7.17	7.19	7.21
Crude fibre	3.60	2.74	3.80	3.89	4.00
Calcium	1.64	1.69	1.68	1.68	1.67
Phosphorus	0.61	0.78	0.61	0.60	0.59
Lysine	1.22	1.22	1.22	1.21	1.21
Methionine	0.40	0.40	0.39	0.40	0.40

Bio- organic broiler starter premix containing vitamin A- 10,000,000.00 mu, Vitamin D3- 2000,000.00 mu, Vitamin E- 20,000.00mg, Vitamin K3 -2,000.00mg, Vitamin B1 - 3000.mg, Vitamin B2 - 5000.00 mg, Niacin -45,000.00 mg, Calciumparatoheunate-10,000.00 mg, Vitamin. B6 - 4000.00 mg, Vitamin B12 - 20.00 mg, Choline chlorate - 300,000.00mg, Folic acid1000.00mg, Biotin 50 -.00mg Manganese; -300,000.00 mg, Iron - 120,000.00 mg, Zinc - 80,000.00 mg, Copper- 8500.00, Iodine- 1500.00 mg, Cobalt-3000.00 mg, Selenium- 120.00 mg, Anti-oxidant-120,000 mg was added.

Table 2: Ingredients and calculated analysis of finisher diets (5-8 weeks)

Ingredients	Experimental diets (%)				
	T1 0	T2 25	T3 50	T4 75	T5 100
Yellow maize	54.3	57.9	57.47	57.07	56.63
Full fat Soyabean	11.3	12.7	13.13	13.53	13.97
Groundnut cake	10	10	10	10	10
Maize offal	0	2.5	5	7.5	10
Wheat offal	15	7.5	5	2.5	0
Fish meal	5	5	5	5	5
Bone meal	2	2	2	2	2
Limestone	1.5	1.5	1.5	1.5	1.5
Salt	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25
Methionine	0.2	0.2	0.2	0.2	0.2
Lysine	0.2	0.2	0.2	0.2	0.2
Total	100	100	100	100	100
Calculated analysis					
Crude protein	20	20	20	20	20
ME (kcal/kg)	2830.48	3625.81	3031.02	3046.38	3061.55
Crude fibre	3.54	3.55	3.8	3.54	3.65
Ether extract	5.51	5.76	5.77	5.79	5.82
Calcium	1.67	1.65	1.66	1.65	1.68
Phosphorus	0.58	0.55	0.56	0.55	0.54
Lysine	0.99	1.02	0.97	0.96	0.95
Methionine	0.35	0.34	0.35	0.35	0.34

A bio-organic nutrient premix containing Vitamin A -3600,000 iu, Vitamin.D3 - 600000 iu, Vitamin .E- 400 mg, Biotin -H- 2300 mg, Vitamin B1-640 mg, Vitamin. B2- 1600 mg, Vitamin k3-600mg, panthothenic acid – 2000mg, folic acid -200mg, Cholin chloride -70000 mg, Cobalt – 80mg, Cupper – 1200mg, Iodine – 400mg,Iron -800mg, Manganese – 1600mg, Solenium – 80mg, Zinc – 12000mg,Anti-oxidant 120000mg was added.

Data collection

Data were collected on growth performance (Daily feed intake, Daily weight gain and Feed conversion ratio)

Results and discussion

Effect on growth performance

The productive performance of broiler chickens fed maize offal based diet indicated that daily feed intake and feed conversion ratio were not significantly ($p>0.05$) affected by the diets during the starter phase. The daily weight gain of 27.19g observed on birds fed diet 1 was significantly ($p>0.05$) lower compared to those fed maize offal based diet. However, daily feed intake and daily weight gain were not affected by the dietary treatments. This showed that maize offal can completely replace wheat offal at 100%.level in the diet of broiler chickens without compromising their performance. This could be attributed to the good energy value of maize offal

(Table 3), in agreement with the finding of whitehead (2002), who reported 2225kcal/kg as energy value of maize offal. The mean live weight of 2.36 kg observed is in conformity with the report of pagne and williaams (1989) who stated that broiler chickens require 5.1 kg of feed and 74 days to acquire a live weight of 2 kg. The average weight gain of 46.80g acquired by the birds is within weight gain range of 41.2 – 48.3g) when he fed broiler chickens with 50 and 85 % replacement level of maize offal as dietary fibre. The overall results on performance are shown on Table 4. The results showed that diet 5 has the average daily feed intake of 94.22g, body weight was 48.95g and 1.85 as feed conversion ratio, thereby recorded a better performance in comparison with diet 1 which has an average feed intake of 96.63g, daily weight gain of 35.50g and feed conversion ratio is 2.72. This could be as a result of the lower energy value of wheat offal (1256 kcal/kg)

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as reported by Garba *et al.* (2011). This is quite lower than the energy value of maize offal (2225 kcal/ kg ME) reported by whitehead (2002). Apart from the high energy level of maize offal (Whitehead, 2002), and effective feed utilization (Rev *et al.*, 2013), daily weight gain can be influenced by strain, age and health status of the birds (Sizemore, et at. 1993). Generally,

better daily weight gain observed on treatment 5 could be as a result of overall feed conversion ratio (1.85), which means the birds had no stress converting feed to meat at 100% level of maize offal. It was observed that birds fed died 5 had better performance than the control in terms of daily feed intake, daily weight gain and feed conversion ratio at both starter and finisher phase

Table 3: Proximate composition of maize offal

Parameters	Values (%)
Dry matter	89.54
Crude Protein	12.98
Ether extract	3.10
Crude fibre	8.68
Ash	3.19
Nitrogen Free Extract	72.05
Metabolizable Energy (Kcal/kg)	3253.11

Table 4: Performance of broiler chickens fed dietary levels of maize offal

Parameters	Experimental diets					SEM
	T1	T 2	T3	T4	T5	
Initial weight(g)	104.00	98.00	100.00	102.94	101.96	10.27 ^{NS}
Body weight at 4 th week(g)	1116.91	1131.13	1153.55	1064.71	1119.73	3383.00 ^{NS}
Final weight (g)	2333.33	2510.00	2700.00	2880.00	2760.00	0.04 ^{NS}
Total weight gain (g)	2229.33	2412.00	2600.00	2777.06	2658.04	201.90 ^{NS}
Starters Phase (1 – 4 weeks)						
Daily feed intake (g)	57.01	56.98	58.04	56.04	55.12	5.59 ^{NS}
Daily weight gain (g)	27.19 ^b	37.50 ^a	36.66 ^a	35.86 ^a	35.57 ^a	14.08 [*]
Feed conversion ratio	2.1-	1.52	1.59	1.56	1.55	0.11 ^{NS}
Mortality (Number)	0	0	1	0	1	-
Finisher Phase (5 – 8 weeks)						
Daily feed intake (g)	136.25	126.75	123.32	129.17	133.31	232.5 ^{NS}
Daily weight gain (g)	43.80	48.76	53.03	53.93	62.31	66.47 ^{NS}
Feed conversion Ration	3.11	2.60	2.33	2.39	2.14	0.21 ^{NS}
Mortality (Number)	1	1	3	2	-	-
Overall Performance (1 – 8 weeks)						
Daily Feed intake (g)	96.63	91.87	90.69	92.61	94.22	47.45 ^{NS}
Daily weight gain (g)	35.50	43.13	44.85	44.90	48.95	201.90 ^{NS}
Feed conversion ratio	2.72 ^c	1.98 ^b	1.96 ^b	2.06 ^b	1.85 ^a	0.06 [*]
Mortality (Number)	1	1	4	3	1	-

SEM = Standard Error of Mean, NS = Not Significant, ^{abc} means bearing different superscripts within same row are statistically (P>0.05) different

Table 5: Cost benefit of using maize offal as replacement for wheat offal

Parameters	Experimental diets (%)				
	T1 0	T2 25	T3 50	T4 75	T5 100
Total Feed intake (kg)	5.41	4.88	5.08	5.19	5.28
Feed Cost(₦/kg)	120.32	116.29	114.89	113.49	112.09
Total feed cost((₦)	636.00	567.50	583.64	589.01	591.84
Total weight gain (kg)	1.99	2.42	2.52	2.51	2.74
Feed cost/kg gain (₦)	319.60	234.50	231.60	234.67	216.00
Cost saving (₦)	0.00	85.10	88.00	84.93	103.60

Conclusion/recommendation

The study indicated that replacement of wheat offal with maize offal at up to 100% level improve feed utilization and did not in any way compromise performance, with a notable reduction in feed cost and feed cost per 5 kg gain, therefore can serve as a suitable replacement for wheat offal. Further study is recommended for other mono-gastric animals such as rabbit, turkey, Guinea fowl, ducks, quails and geese.

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