INFLUENCE OF GRADED LEVELS OF RICE OFFAL ON GROWTH PERFORMANCE AND CARCASS CHARACTERISTICS OF BROILER CHICKENS IN THE FINISHER PHASE.

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Abstract
An experiment was conducted to investigate the influence of graded levels of rice offal on growth performance and carcass characteristics of broiler chickens in the finisher phase. One hundred and fifty (150) five weeks old broiler chickens were randomly allotted to five dietary treatments at 0, 5, 10, 15 and 20% rice offal inclusion levels respectively. Each diet was replicated three times (3) with ten (10) birds per replicate in a completely randomized design arrangement. The trial lasted for three (3) weeks. There was significant difference ($P < 0.05$) in weight gain. Significant differences ($P < 0.05$) were also observed in feed intake, feed conversion ratio and feed cost. There were significant differences ($P < 0.05$) across the carcass parameters. From these findings, rice offal can be included at 15% in broiler chicken diet without detrimental effects on growth performance and carcass parameters.
***Key words**: Rice offal, Broiler finisher, graded levels, carcass*

Introduction

Rice offal is one of the by – product of rice processing mills; it contains the husks, bran, polishing and small quantity of broken rice (Dafwang and Shwarmen, 1996; Akinusi, 1999). It is been estimated that small scale rice mills processed over 80% of the rice produced in Nigeria (Awesu, Bamgbose,Oduguwa, Fanimo & Oguntona, 2002) and thus rice offal is readily available (Akinusi, 1999). It is very high in crude fibre between 30 – 44% (Dafwang and Shwarmen, 1996., Esonu, 1997 and Awesu *et al*. 2002). The high crude fibre mainly lignin and low protein contents have resulted in reduced voluntary feed intake and low utilization of rice offal in poultry feeding (Abasiekong, 1997).

Poultry do not produce enzymes required to digest fibres present in the feed. This fact is reflected in the high degree of nutrient concentration and refinement of commercial feed compositions (Svihus and Hetland, 2001). In situation where fibres cannot be digested by broiler chickens and laying hens, they are not inert. In fact, studying the digestive physiology of poultry may lead to the suggestion that fibres do have an important role to play. The anterior segment of the digestive tract is characterized by an enlargement of the oesophagus called the crop. The crop is used as a food storage organ and filling of the crop inhibits food intake. It may well be that the fibre fraction of the feed is important to the sensation of satiety, as the quality of ingested fibres affects the rate of entry and time of retention in the crop (Kalmendal, 2012).

Nigeria is currently faced with the shortage and high cost of conventional feeds for poultry. There is growing interest in the use of non – conventional ingredients in feeds, although the nutritional values of these feedstuffs have been extensively studied but incorporated at levels which result in poor quality feeds of low energy, low protein or high fibre (Maikano, 2005). With the prevailing condition, the exploitation of some agro – industrial by – products for poultry feed formulations such as maize offal, wheat offal and rice offal is necessary.

The current production of paddy rice in Nigeria is estimated at 475.52 million tonnes (NAERLS and NFRA, 2009), which has the potential of producing 190 million tonnes of rice offal. This product which is available in large quantities has hitherto been neglected for use in monogastric animal diets because of its high content of silica and fibre (Dafwang, 2006). However, Nigerian animal nutritionists have experimented widely with this product since 1987 (Oyeyiola, 1991; Dafwang and Damang, 1996; Oyawoye and Nelson, 1999; Maikano, 200; Nduaka, 2005). Their results indicate that rice offal can be added at levels of 10 – 15% in broiler starter feeds, 15 – 22% for broiler finishers, 25% in layers' diets and 40% in growing pullet rations without adverse effect on growth or egg production performance.

Rice offal holds promise as a suitable and cheap substitute for the cereals in poultry feeds (Duru and Dafwang, 2010).

The objectives of the study are:

1. To determine optimum levels of inclusion of graded levels of rice offal on growth performance of broiler chickens at the finisher phase.
2. To determine the effects of graded levels of rice offal on carcass characteristics.

Materials and Methods

Location of the study area

The research was conducted at the Poultry Research Unit of the Department of Animal Science, Ahmadu Bello University Zaria. Samples of the rice offal were analysed at the Biochemistry Laboratory of the Department.

Experimental Animals and Design of the experiment

One hundred and fifty Ross – strain broiler chickens age five weeks old were used for the experiment. The birds were randomly allotted into five dietary treatments with ten birds per replicate in a completely randomized design (CRD). The birds were reared in an open – sided wire mesh screened poultry house on a deep litter for the period of three weeks.

Experimental Diets

The composition of the experimental diets per treatment is presented on Table 1. Rice offal was included into the diets at 0, 5, 10, 15 and 20% levels. And the diets were designated I, II, III, IV and V respectively. The diets were isocaloric and isonitrogenous.

Experimental Procedure

The five weeks old birds were randomly allotted to five dietary levels of rice offal replicated three times in batches of ten birds per replicate. Feed and water were supplied ad libitum for the experimental period. Feed was weighed on weekly basis. Parameters measured were live weight, weight gain, feed intake, feed to gain ratio and feed cost per kg.

For the live weight, at the end of every week the birds were collected based on each replicate and put in a crate and placed on a standing scale (salter). And their weight was read from the scale. The total weight in grammes was recorded; this total weight was divided by the number of birds in the crate. This gave the individual bird weight. This was done for three weeks which covered the experimental period.

Weight gain was determined at weekly intervals. At the beginning of the experiment, the initial weights of the birds were taken based on the replicate in the individual treatment. At the end of every week, the total weights of the birds measured were subtracted from the initial weight of the birds recorded. This gave the weight gain. For weight gain per bird, average weight per bird was subtracted from the initial weight per bird. For the subsequent weeks, the previous weight gain per bird was added to the weight gain per bird for that week which gave the cumulative weight gain. This was done throughout the experimental period, which at the end gave the final cumulative weight of the birds.

Feed intake, specific amount of feed was weighed for each replicate in the treatment on weekly basis. This quantified feed was kept in labeled containers based on the different replicates of the respective treatments. The feeders were half filled with feed on daily basis; the essence of this was to avoid waste of feed. And was kept in front of the birds at all times, good illumination was provided for the birds to see and eat the feeds. The total feed consumed by birds per replicate was divided by the number of birds, which gave feed consumption per bird. Feed consumption per bird was divided by the number of days fed, which gave the daily feed intake in grammes per bird per day (g/b/day).

Feed to gain ratio or feed conversion ratio, this parameter gave the reflection of the performance of the birds based on the various feeds or treatments gave to the birds. The total feed consumed in grammes by the birds per week was divided by the weight gain in grammes by the birds. This gave the feed to gain ratio for that week. The same was done throughout the experimental period, which gave the cumulative feed intake in grammes and was divided by the cumulative weight gain. This gave the final feed to gain ratio. High feed to gain ratio is an indication of poor feed utilization by the birds. And the low feed to gain ratio indicates better feed utilization by the birds.

Feed cost per kilogramme weight gain is a parameter that determined the economic analysis of production. The cost of feed production was determined based on the cost of individual ingredient, which was calculated per kilogramme of feed. The cost of each ingredient was multiplied by the kilogramme of each ingredient in the feed formulation. The total kilogramme of each treatment is 100. The cost of feed in naira per kilogramme was multiplied by feed to gain ratio which gave the feed cost per kilogramme weight gain.

While mortality was recorded as it occurred. At the end of the finisher studies, two birds per replicate were randomly selected and slaughtered for carcass analysis. Birds were slaughtered by cervical dislocation, defeathered and eviscerated. The dressed percentage was determined by taken the weight of the carcass and divided by the weight of the live chicken multiplied by hundred. The liver and gizzard were weighed using the Citizon MP 600 electronic platform scale. The weight was expressed as percentage live weight. A meter rule was used to measure the length of gut and caeca. Gizzard erosion was determined by score ranges from 0 – 2, the effect was ranked as shown below: 0 – normal, 1 – moderate and 2 – severe.

Data Analysis

The computed body weight, weight gain, feed consumption, feed to gain ratio, feed cost per Kg. gain and carcass parameters were subjected to analysis of variance (ANOVA) using the general linear model (GLM) of statistical analysis software (SAS, 1999). Treatment means were separated using Duncan Multiple Range Test (Duncan, 1985). Trend analysis was carried out to determine the optimum levels of rice offal inclusion in the diets.

Results and Discussions

The effects of graded levels of rice offal on the performance of broiler finisher chickens are given in table 3. The result showed that, the inclusion of rice offal at levels up to 20% had no adverse effects on body weight and weight gain. The significant effect ($P < 0.05$) on body weight and weight gain were linear which placed the maximum level of rice offal inclusion at 5%. This is in partial agreement with the recommended dietary level of rice offal up to 15 – 22.5% (Dafwang and Damang, 1995). Feed intake and feed to gain ratio were linearly significant ($P < 0.05$). High level of rice offal in the diet increased feed intake, which result to poor feed to gain ratio. Oyeyiola (1991), Dafwang and Shwarmen (1996), Duru and Dafwang (2010) reported that rice offal contains high level of fibre which lowered the protein and energy value of the feedstuff. This may also account for the fact that even on the international scene, report of studies on the utilization of high fibre containing plant by – products by broiler chicks are scanty.

With regards to feed cost per Kg. weight gain at 20% dietary rice offal was significantly ($P < 0.05$) higher than for diets containing 0, 5, 10 and 15% rice offal. This study showed that higher levels of rice offal depressed growth and increased feed cost per Kg. gain. This was in agreement with the work of Dafwang and Damang (1995) in which they observed that higher levels of rice offal (30 – 40%) depressed growth and increased feed cost per Kg. weight gain significantly because of the poor efficiency of feed utilization.

The result of carcass evaluation is presented in Table 4. There was significant difference ($P < 0.05$) on dressing percentage. Birds fed diet 5 had the lowest dressing percentage and there was a consistent decrease with increasing levels of inclusion of the rice offal. Weight of gizzard significantly increased as the dietary levels of rice offal increased. This may be due to increasing dietary fibre as the levels of rice offal were increased; this probably stimulated the activity of the gizzard resulting in its increased musculature. This agreed with the report of Acton *et al*., 1982; Deaton *et al*., 1979 and Yakubu *et al*., 2007.

In the gizzard, the particle size of ingesta is reduced by means of grinding, while the chyme is mixed with the secretions of the proventriculus. To function properly, the gizzard requires mechanical stimulation. Here, the excitatory effect of fibrous materials on the gizzard is well documented (Rogel *et al*., 1987). Once ingested items have been ground to a critical size, the particles are moved into the small intestine. Poultry reflux digesta between various locations of the alimentary canal and fibres present in the feed are believed to influence gastro duodenal reflux of digesta in poultry (Duke, 1988).

Caecum length was significantly different ($P < 0.05$) in treatments 2 – 5 when compared to treatment 1 (control). Acton *et al*., 1982; Rompala and Madsen, 1989, Oyawoye and Nelson., 1999, Erbingerova *et al*., 1994 and Yakubu *et al*., 2007 reported that fibrous diets have been reported to increase the weight of viscera due to increased activity of the gizzard and intestine especially the caeca in handling bulky feeds. Factor responsible for this, may be probably arabinoxylans which constitute the bulk of the hemcelluloses in rice bran and offal. Beside this, the gizzard erosion increased with high levels of rice offal possibly due to high silicon nature of rice offal. That is why at 0% rice offal inclusion in the diet, the linings of the gizzard was normal, at 5 and 10% the gizzard erosion was moderate and at 15 and 20% it was severe. This concurs with the works of Yakubu *et al*., 2007 that rice offal is safe in broiler diets.

Conclusion

The conclusion that can be drawn from these experiments is that Broiler finishers can be fed up to 15% rice offal in diets formulated to supply optimum levels of energy and protein without adverse effect on growth parameters. Higher levels of rice offal inclusion in the diets had significant increase in gizzard weight, gut length and caecal length.

Recommendation

This study showed that rice offal is high in fibre which reduced the energy value of feed. Based on this, the following recommendations are made:

1. Grinding rice offal to powdered form will reduced the fibre contents and improved the energy value of the feedstuff and reduces gizzard erosion.
2. Enzyme supplementation in diets of broiler birds with rice offal will increase the level of inclusion of rice offal and improve their performance.

References

Abasiekong, S.F. (1997). Effect of termite culture on crude protein, fat and crude fibre contents of fibrous harvest residues. *Biological Resource Technology*, 62:55-57.

Acton, J.C. and Saterlee, C.D. (1982). The effect of dietary fibre constituents on the in vitro Digestibility of casein. *Journal of Food Science* 42(2): 556 – 560.

Akinnusi, O. (1999). Utilization of rice milling waste in cockerel finisher ration, Book of Proceedings: 26th Annual NSAP conference. Ilorin, 120 – 122.

Awesu, J.R., Bamgbose, A.M., Oduguwa, O.O., Fanimo, A.O. and Oguntona, E.B. (2002). Performance and nutrient utilization of cockerel finishers fed graded levels of Rice milling wastes. *Nigeria Journal Animal Production* 29: 181 – 188.

Bjornhag, G. (1989). Transport of water and food particles through the avian caeca and colon *Journal of Experimental Zoology*. 252 (S3) 32 – 37.

Dafwang, I.I. and Damang, P. (1995). Rice offal in finishing diets for broilers. *Journal of Animal Production Research* (1995 – 96) 15 & 16 (1 & 2): 131 – 139.

Dafwang, I.I. and Shwarmen, E.B.N. (1996). Utilization of rice offal in practical rations of Broiler chicks. *Nigeria Journal of Animal Production* 23 (1): 21 – 23.

Dafwang, I.I. (2006). Meat, Milk and Eggs from farm wastes. Explorations in animal nutrition Research and extension. An Inagural lecture. A publication of the University organized Lectures committee, Vice – Chancellor's office, ABU Zaria, pp. 73.

Deaton, J.N., Naughton, J.L. and Burdick, D. (1979). High fibre sunflower meal as a Replacement for Soybean in layers diets. *Journal of British Poultry Science* 20: 159 – 162.

Duncan, D.B. (1985). Multiple Range and Multiple F-tests. *Biometrics*. 11: 142-150.

Duke, G.E. (1988). Alimentary canal: Anatomy, regulation of feeding and motility. In: Sturkie, P.D. (ed). Avian physiology. 4th ed. New york, USA : Springer – verlaag.

Duru, S. and Dafwang, I.I. (2010). Effect of Maxigrain in supplementation of diets with or Without rice offal on the performance of broiler chicks. *Journal of Poultry Science.* 9(8): 761 – 764.

Erbingerova, A., Hhromadkova, I., and Berth, G. (1994). Structural and molecular properties of a water – soluble arabinoxylan – protein complex isolated from rice bran.

Esonu, B.O. (1997). Substitution value of a mixture of rice mill by-products for maize in diets of weaner rabbits. *Nigeria Journal Animal Production* 24: 21-23.

Kalmendal, R. (2012). Fibrous feeds for functional fowls. Doctoral thesis Swedish University of Agricultureal Sciences, Uppsala. Faculty of Vet. Medicine and Animal Science. Dept. of Animal Nutrition and Mgt. Uppsala.

Maikano, A. (2005). Effects of graded levels of rice offal in broiler diets. Unpublished M.Sc Thesis submitted to the Department of Animal Science, Ahmadu Bello University Zaria.

NAERLS and NFRA (2009). Agricultural Performance Survey Report of Nigeria. 2009 wet season. NAERLS, ABU, Zaria and NFRA, Abuja.

Oyawoye, E.O. and Nelson, F.S. (1999). Utilization of rice offal by laying hens. Proc. Of 4th annual conference of Animal Science Association of Nigeria held at UTA Conf. Centre Ibadan. Sept 14 – 16.

Oyeyiola, L.B.E. (1991). Utilization of rice offal by egg-type chicken. Unpublished M.Sc Thesis submitted to the Department of Animal Science, Ahmadu Bello University Zaria.

Rogel, A., Balnave, D., Bryden, W. and Annisan, E. (1987). Improvement of raw potato starch Digestion in chickens by feeding oat hulls and other fibrous feedstuffs. *Australian Journal of Agricultural Research* 38 (3): 629 – 637.

Rompala, R.E. and Madsen, F.C. (1989). Diet impact mass, functional load of animal gut. Feedstuffs 61:16 – 17.

Svihus, B. and Hetland, H. (2001). Ileal starch digestibility in growing broiler chickens fed on a wheat based diet is improved by mash feeding dilution with cellulose or whole Wheat inclusion. *Journal British Poultry Science* 42 (5): 633 – 657.

SAS (1999). Statistical Analysis Software. Guide for personal computers. SAS Institute. Inc. Cary, NC, USA.

Yakubu, B., Adebgola, T.A., Bogoro, S. and Yussuf, H.B. (2007). Effect of urea treated and Untreated rice offal on the performance of Broiler Chickens, carcass yield and Characteristics of internal organs. *Journal of Sustainable Development in Agriculture and Environment* 3: 14 – 19.

Table 1: Percentage composition of broiler finisher diets

Ingredients	1	2	3	4	5
Maize	47.85	46.45	45.05	42.35	39.55
Soy bean (Full fat)	22.70	25.10	27.50	29.70	32.00
Maize offal	22.00	16.00	10.00	5.00	-
Blood meal	3.50	3.50	3.50	3.50	3.50
Palm oil	-	-	-	0.50	1.00
Rice offal	-	5.00	10.00	15.00	20.00
Bone meal	3.15	3.15	3.15	3.15	3.15
Salt	0.30	0.30	0.30	0.30	0.30
*Premix	0.30	0.30	0.30	0.30	0.30
Methionine	0.20	0.20	0.20	0.20	0.20
Total	**100**	**100**	**100**	**100**	**100**
Calculated chemical analysis					
Crude protein (%)	19.92	19.98	20.03	19.26	20.14
M.E.Kcal\Kg.	2999.43	2974.71	2949.99	2933.03	2916.09
Lysine(%)	1.28	1.32	1.37	1.42	1.46
Methionine (%)	0.53	0.52	0.51	0.50	0.50
Calcium (%)	1.23	1.22	1.21	1.20	1.19
Phosphorous (%)	0.93	0.97	0.99	1.04	1.07
Crude Fiber (%)	4.46	5.99	7.52	9.10	10.68
Cost # /kg.	24.63	24.93	25.23	25.51	26.26

*premix supplied per kg ration: Vit. A 5,000,000 I.U; Vit. D3 800,000 I.U; Vit. E 12,000 mg; Vit. K3 1,500 mg; Vit. B1 1,000 mg; Vit. B2 2,000mg; Vit. B6 1,500mg; Niacin 12,000mg; Pantothenic acid 5,000 mg; Biotin 20 mg; Vit. B12 10.00 mg; Folic acid 300mg; choline chloride 150,000 mg; manganese 60,000 mg; iron 10,000 mg; zinc 15,000 mg; copper 800mg; Iodine 400 mg; cobalt 80mg; selenium 40mg; Growth promoter 8,000mg; Antioxidant 40,000 mg.

Table 2: Proximate Chemical Analysis of Rice offal

Parameters	Zaria – City
Dry matter (DM)	94.42
Crude protein (CP)	5.09
Crude fibre (CF)	30.39
Ether – extract (EE)	3.40
Ash	16.67
Nitrogen –free extract (NFE)	46.10

Table 3: Performance of broilers fed rice offal diets (Finisher phase)

Level of Rice offal inclusion	Body weight (g)	Weight gain (g)	Feed intake (g)	Feed : gain	Feed cost kg. gain	Mortality
0	1430.0 ^{bc}	905.0 ^{bc}	2067.3 ^{c}	2.28 ^{bc}	76.29 ^{a}	0.00
5	1570.0^{a}	1035.0^{a}	2143.3 ^{b}	2.08 ^{a}	66.82 ^{b}	0.00
10	1503.3^{ab}	971.7^{ab}	2145.7 ^{b}	2.21 ^{a}	71.07 ^{ab}	0.00
15	1413.3 ^{c}	885.0 ^{c}	2170.0 ^{b}	2.45 ^{bc}	77.80 ^{b}	0.00
20	1393.3 ^{c}	868.3 ^{c}	2202.3 ^{a}	2.54 ^{c}	78.13 ^{b}	0.00
Sig. Effects	*	***	*	*	*	
SEM	36.64	34.62	24.93	0.09	2.46	

Superscripts abcd means on the same column with different superscripts differ significantly ($P < 0.05$)

* Linear

*** Quadratic.

Table 4: Effects of graded levels of rice offal on broiler carcass characteristic

Rice offal Level of inclusion	Dressed Percentage	Weight of liver (g)	Weight of gizzard (g)	Gizzard Erosion score	Gut length (cm)	Caecum length (cm)
0	76.0[a]	32.7[a]	49.7[c]	0	213.3[c]	16.3[b]
5	75.4[a]	30.0[a]	54.0[bc]	1	222.7[bc]	18.0[ab]
10	75.0[a]	31.0[a]	58.0[ab]	1	230.7[b]	18.3[ab]
15	74.9[ab]	29.0[a]	60.0[ab]	2	235.7[ab]	18.3[ab]
20	73.6[b]	29.7[a]	62.3[a]	2	245.0[a]	19.7[a]
Sig. effects	*	*	*	_	*	*
SEM	0.44	0.72	2.50	_	6.07	0.61

NB:
Superscript abcd means on the same column with different superscript differ significantly ($P < 0.05$)
*Linear
Gizzard erosion scores rated as 0 = Normal, 1 = Moderate and 2 = Severe