Performance and nutrient utilization of cockerel finishers fed graded levels of rice milling waste

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Abstract

An experiment was conducted to investigate the effects of rice milling waste (RMW) on performance and nutrient utilization of cockerel finishers. One hundred and fifty 9-week old Black Harco cockerels were raised on five experimental diets where RMW replaced maize at graded levels and designated diet 1 (0% RMW); diet 2 (15% RMW without palm oil); diet 3 (30% RMW without palm oil); diet 4 (15% RMW with palm oil) and diet 5 (30% RMW with palm oil). The diets were formulated to be isonitrogenous and isoenergetic. Each diet was fed to a group of 30 birds for a period of ten weeks. Records were maintained on body weight gain, feed intake and mortality while digestibility trials were conducted at the end of the experiment. There was no significant difference ($P>0.05$) in weight gain between treatments, however dietary treatments had significant ($P<0.05$) effect on feed intake, feed to gain ratio and feed cost. Apparent crude protein retention and digestibilities of dry matter, ether extract, crude fibre and ash were significant for all dietary treatments. From the study it was concluded that RMW can be included in cockerel finisher diet at up to 30% level when the diet is supplemented with palm oil.

Keywords: Cockerels, rice milling waste, utilization

Introduction

Cockerel production does not appear profitable when the conventional rations utilised by other poultry stock are used for its production (Ogbonna and Adebawale, 1993). This may be due to its slow growing pattern and hence no importance was placed on its commercial production. Also in cockerel diets, the bulk of energy is supplied by either maize or sorghum that are seriously being competed for by man and livestock. The use of maize and wheat offal in ration formulation has become expensive because of their scarcity following the ban by the Federal Government of Nigeria

on the importation of grains. As a result, the usefulness of some agricultural by-products as substitutes needs to be investigated.

Earlier studies (Obioha, 1975; Olomu, 1988) estimated that about 50-65% by weight of balanced animal diets and not less than 40% of the total cost of feed ingredients are highly demanded for by humans. This had led to scarcity of cereal grains and high prices. Smith and Kabaija, (1985) and Olomu, (1988) suggested that cheap and suitable substitutes should be used to replace these grains. These authors reported that industrial by products of

grains could serve as major ingredients in poultry feed provided intensive research was conducted to estimate their nutritive values and any limitation arising from their usage..

Studies by Osei and Duodo (1988), Aina (1990) and Ogbonna (1991) reported that incorporation of cassava peel meal into chicken rations reduced the cost of production without any adverse effect on growth rate and economy of feed conversion of birds.

RMW consists of rice hulls, rice bran, rice polishings, and broken rice grains. Rice milling waste is in actual fact the total offal obtained in the milling of rice. Its crude fibre content should normally not exceed 32% but it usually does. Its protein content is low, with fat content of 5-6%. The high crude fibre content of the product and its low metabolizable energy value discourage its use in poultry and swine diets. However, when reasonably priced, it can be used in low energy holding diets for adult poultry and pigs (Olomu, 1995). The proximate composition has been shown to be 92% DM, 6% CP, 26.3% NFE, 5.3% EE, 40%

CF, 20.4% ash and metabolisable energy value of 5.24 MJ/kg (Dafwang, 1975). The author further reported that, there is variability in protein content, crude fibre and ash content between different samples. Other findings (Obeka, 1985) indicated that (RMW) has very little amino acid. In his research with laying birds, Obeka (1985) found that rice offal could replace up to 60% of maize in the conventional diets without reduction in performance and egg production. Dafwang (1995) reported that rice offal inclusion in layers diet should not be more than 20%.

The effect of dietary fibre on cockerels performance has also been the subject of studies by many workers. Delorme and Wojeik (1982) reported that dietary fibre depressed intake of utilizable food energy and essential nutrients. Recently, Adebisi (1997) reported that nutritional, physiological and metabolic effects of fibre, consistently vary with fibre types. Onifade (1993) also worked on the effect of three different dietary fibre sources on broiler chickens. It was recognised that fibrous

Table 1 *Ingredient composition of the commercial cockerel starter fed to the birds*

Ingredients	g kg ⁻¹
Maize	230
Groundnut cake	100
Soyabean meal	50
Wheat offal	280
Palm kernel cake	100
Bone meal	30
Premix	2.5
Salt	2.5
Oyster shell	5.0
Brewers waste	200
<i>Calculated analysis:</i>	
Crude Protein g kg ⁻¹	191.4
Metabolizable energy (MJ/kg ⁻¹)	9.73

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agro-industrial wastes though potentially valuable as feedstuffs, nevertheless, have the problem of lignification and associated barrier to microbial digestion to contend with.

The present study was designed to examine the effect of varying levels of rice milling waste (RMW) on performance and nutrient utilization of cockerel finishers.

Materials and methods

The rice milling waste (RMW) used for the study, was obtained from commercial rice milling factories at Ofada town in Ogun State. The rice milling used comprised rice offals, broken rice grains and a small proportion of

rice hulls. The commercial cockerel starter feed was also bought from a commercial feed miller in Abeokuta for 8 weeks feeding. Five experimental diets were formulated to contain rice milling waste (RMW) at 0, 15%, 30% RMW without palm oil (PO) and 30% RMW with palm oil (PO). The diets were made isoenergetic (9.4 MJ/kg ME). The ingredient composition of the commercial cockerel starter fed to the birds are shown in Table 1. Also the gross composition of the experimental diets are in Table 2 while proximate analysis of the test ingredient (RMW) appears in Table 3.

Table 2 Gross composition of experimental diets (g kg^{-1})

	1	2	3	4	5
Maize	450	375	300	375	300
Groundnut Cake	100	100	100	100	100
Soyabean Cake	40	40	40	40	40
Wheat offal	355	260	170	245	135
Blood meal	-	20	35	20	35
Palm oil	-	-	-	15	35
Rice Milling Waste	-	150	300	150	300
Fishmeal	12.5	12.5	12.5	12.5	12.5
Vitamin Premix ⁺	2.5	2.5	2.5	2.5	2.5
Salt	2.5	2.5	2.5	2.5	2.5
Bone Meal	22.5	22.5	22.5	22.5	22.5
Oyster Shell	150	15.0	15.0	15.0	150
<i>Calculated analysis (as fed basis)</i>					
ME (MJ kg^{-1})	9.54	9.41	9.37	9.54	9.50
Crude Protein g kg^{-1}	166.0	169.0	168.8	166.0	165.3
Crude Fibre g kg^{-1}	15.4	47.7	42.7	47.3	40.0
<i>Determined analysis (dry matter basis)</i>					
Dry matter (MJ kg^{-1})	909.8	927.7	905.8	909.9	90.6
Crude protein g kg^{-1}	186.3	165.8	174.5	164.5	154.0
Crude fibre (g kg^{-1})	11.0	78.6	61.5	106.0	52.1
Either extract (g kg^{-1})	1.2	2.2	1.9	22.0	43.1
Ash (g kg^{-1})	120	145.0	140.0	145.0	145.0
NFE (g kg^{-1})	701.5	609.4	623.1	522.5	615.8

The vitamin premix used in this study was a product of Roche. Each 1kg contained Vit A (I.U) 4,000,000; Vit D (I.U) 1,000,000; Vit E (I.U) 4,800; Folic acid (g) 0.12; Ascorbic acid (g) 20.0; Choline (g) 120.0; Mn (g) 40.0; Fe (g) 20.0

Table 3 *Proximate composition of rice milling waste and palm oil (g kg⁻¹)*

Component	Rice Milling Waste (RMW)	Palm oil
Crude protein	58	-
Either extract	52	99
Crude fibre	374	-
Ash	235	-
Dry matter	908	-
Nitrogen Free extract	281	-

Experimental birds

One hundred and fifty day-old Black Harco cockerels obtained from S & D farms, Abeokuta, were placed on commercial diets for 8 weeks. Thereafter, the birds were weighed and randomly allotted to the five dietary treatments in a completely randomized design for a period of 70 days (10 weeks). Each treatment had 3 replicates of 10 birds each. Routine vaccinations and necessary medications were given to the birds.

The birds were raised on deep litter pens with dry wood-shavings as litter materials. Each pen measured 1.2 X 3.03m. The house was a conventional open-sided building with concrete floor. The birds were fed with appropriate experimental diets and water was supplied *ad libitum* in conical metal feeders and plastic bowls respectively. Birds were allowed an adjustment period of 5 days before data collection began.

Chemical analysis

Proximate analysis of the experimental diets, droppings and rice milling waste were carried out separately using the method described by Association of Official Analytical Chemists (1990).

Data collection and analysis

Feed consumption was recorded daily and birds were weighed at weekly intervals. A record of mortality was kept as it occurred.

In the last week of the experiment, two birds were selected randomly per replicate from each of the treatments and subjected to metabolic studies. The birds were transferred into metabolic cages and adjustment period of 2 days was allowed, followed by a collection period of 3 days. All the droppings were collected on daily basis for each bird and weighed. Feed samples and droppings were oven dried for 48 hours at 65°C to constant weight to determine the moisture content.

The samples were then removed from the oven, cooled in a dessicator and weighed. All data from this study were subjected to analysis of variance (Steel and Torrie, 1980) while means separation was by multiple range test at 5% level of significance, as outlined by Duncans (1955).

Results

The effects of different dietary levels of RMW on performance of cockerel finishers are presented in Table 4. Average daily weight gain for all the treatments were not significantly different ($P>0.05$) from the control. Although, control birds had the highest weight gains (24.3g) followed by birds on treatment 5 (23.2g) i.e. 30% RMW with palm oil inclusion while birds on treatment 4 (15% RMW with palm oil inclusion) had the lowest average daily weight gain (21.7g). There were significant differences ($P<0.05$) among treatment means for both feed intake and feed to gain ratio. Birds placed on 30%

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Table 4 *Effects of dietary rice milling waste on performance of cockerel finishers*

Measurement	Treatment					SEm
	1	2	3	4	5	
Initial Weight (g/bird)	755.7	764.3	822.0	751.0	800.0	12.41
Final weight (g/bird)	2157.7	2007.8	2017.2	2068.0	2220.0	36.90
Average daily weight						
Gain (g/bird)	24.3	22.1	22.8	21.7	23.1	0.41
Feed-to-gain ratio (g/bird)	5.1 ^c	7.0 ^a	6.9 ^b	6.3 ^d	6.5 ^c	0.30 [*]
Feed cost per kg live -						
Weight gain (₦)	482.3 ^a	442.5 ^c	365.8 ^c	454.7 ^b	429.8 ^d	17.36 [*]
Average daily feed						
Intake (g/bird)	124.3 ^c	154.9 ^a	156.9 ^a	136.3 ^b	149.4 ^a	5.54 [*]

Means differently superscripted are significantly different from one another ($P < 0.05$)

SEm – Standard error of the mean difference

Table 5 *Utilization of nutrient by cockerels fed graded levels of rice milling waste (RMW) (%)*

Measurement	Treatment					SEM
	1	2	3	4	5	
Dry matter	889 ^c	913 ^b	745 ^d	997 ^a	740 ^c	49
Crude protein	796 ^a	707 ^b	639 ^c	607 ^d	522 ^c	47
Ether extract	911 ^b	917 ^c	907 ^c	992 ^a	992 ^a	167
Crude fibre	121 ^e	503 ^c	456 ^b	382 ^c	303 ^d	50
Ash	541 ^e	649 ^b	559 ^d	745 ^a	605 ^c	37
Nitrogen free extract	760 ^c	788 ^b	737 ^d	919 ^a	790 ^b	29

Means differently superscripted are significantly different from one another ($P < 0.05$)

SEm – Standard error of the mean difference

RMW without palm oil supplementation gave the highest ($P < 0.05$) feed intake while feed-to-gain ratio as measured by feed intake per unit of weight gained was poorest on treatment 2 diet (15% RMW without oil supplementation).

Dietary treatment significantly affected feed cost per kg gain ($P < 0.05$). Treatment 1 diet was the most expensive while those of treatments 2, 4 and 5 were cheaper than those on treatment 1, but the cheapest was treatment 3 diet.

Metabolic trials

The effect of dietary treatments on the utilization of the proximate fractions of the

rations is shown in Table 5. The utilization of dry matter (DM), crude protein (CP), ether extract (EE), ash and nitrogen free extracts (NFE) were significantly ($P < 0.05$) different for all treatments. The highest mean value of 99.9% was recorded for DM on treatment 4, while the lowest mean value of 74.60% was observed in treatment 5. When CP was considered, control bird had the highest mean values (79.6%) and the lowest mean value was obtained in birds fed with 30% RMW with PO (treatment 5). Furthermore, for EE digestibility, treatments 4 and 5 had the highest mean value (99.5% respectively but the lowest value was recorded in treatments 2 and 3. The CF and ash

digestibilities in this study were lowest in control birds (12.51% and 54.71% respectively). Finally, highest NFE digestibility was recorded with birds fed 15% RMW with PO while the lowest value was observed in birds fed 30% RMW without PO.

Discussion

The results of chemical analysis of the products showed that rice milling waste (RMW) is very high in crude fibre and ash but low in crude protein suggesting that it is a low protein feed material (Table 3).

The fact that significant differences were not obtained for average daily weight gain ($P>0.05$) by cockerels in all the treatments also suggest that in spite of the high crude fibre and ash content of RMW, it is still a valuable feed ingredient. This is in agreement with the report of Dafwang (1995) on the use of this product. Subramayan *et al.* (1972) reported no adverse effects on growth performance and feed efficiency when chicks were fed up to 30 - 35% rice bran. Significant differences ($P<0.05$) were obtained between treatments in daily feed intake. The least feed intake by birds on the control diet is traceable to the low fibre content of the diet. Inclusion of RMW resulted in increased feed consumption rate. This is in consonance with the work of Moran (1977) who reported that high fibre diets tend to increase feed intake in birds. Increased fibre in diet leads to reduced available energy. Birds eat to satisfy their energy requirements hence the increased feed intake of birds on the RMW diets. The best feed to gain ratio was recorded for birds on the control diet. It is known that fibre in diet of monogastrics impairs the utilization of other nutrients especially crude protein utilization (Savage *et al.*, 1980; Delorme and Wejeik, 1982). In fact, the result of the metabolic trials showed that higher level of inclusion of RMW led to lower crude protein retention.

The inclusion of palm oil in diets 4 and 5 improved feed-to-gain ratio. Oil inclusion in diets of broilers at appropriate levels are known to increase efficiency of feed utilization (Oluyemi and Roberts, 1979). Furthermore, palm oil used in this study is a good source of essentials fatty acid, containing about 373-1387mg/kg carotene which is the precursor of Vitamin A and a very concentrated source of energy 37.7mj/kg (Aduku, 1993). All these will definitely enhance the nutritional value of the palm oil supplemented diets.

Apparent utilization of nutrients

The apparent utilization of nutrient is in agreement with several authors (Savage and Zakrzewska, 1995; Onifade and Babatunde, 1996). The significantly ($P<0.05$) higher retention of crude protein obtained in birds fed the control diet could be attributed to the relatively high content of dietary protein in the diet as observed in the determined analysis. This result agrees that metabolic fecal nitrogen decreases as fermentation increases in the diets containing large particle size of dietary fibre. Higher digestibility of the other extract in treatments 4 and 5 could be attributed to the addition of oil in the diets which is as a result of high energy density from the added oil thus enhancing fat absorbability. This probably accounted for higher weight gain of cockerel fed treatment 5 diet above those fed other rice milling waste diets. Also, the high level of crude fibre digestibility obtained for birds fed RMW diets may be due to enzymatic activities in the gastrointestinal tract of the birds. This is in agreement with the results of some authors (Devegowda *et al.*; 1994; Bradley and Savage, 1995) who reported high level of crude fibre utilization in pullets when fed high fibre diets.

From the results of this study it would appear that 30% level of inclusion of RMW can be used in cockerels finishers diets without any deleterious effects on the birds especially when

the diets are supplemented with palm oil. Further research is necessary on how to increase the nutritive value of RMW for monogastric animals like cockerel finishers in view of its relative cheapness and abundance.

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