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# UTILIZATION OF RICE OFFAL IN PRACTICAL RATION OF BROILERS.

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**Abstract**
Rice offal obtained in Zaria, Kaduna state contained proximate chemical composition of 94.42% dry matter, 5.09% crude protein, 30.39% crude fibre, 3.40% ether-extract, 16.67% ash and 46.1% nitrogen free-extract. Effects of various graded levels of rice offal diets on broilers were investigated in two experiments, a starter phase and a finisher phase. In each experiment, rice offal was fed at graded levels of 0, 5, 10, 15 and 20% in a completely randomized design. In experiment one (starter phase) day old chicks were fed with starter diets from 0-4 weeks. Results showed that rice offal could be fed at levels up to 15% without adverse effect on growth performance. In experiment two (finisher phase), broilers were fed with the finisher diets from 5-8 weeks and tolerated 15% rice offal inclusion in their diets with significant growth. In all experiments there was increase in feed intake as the level of rice offal increased.

**Key words**: Rice offal, chicken diets, starter phase, finisher phase.

## Introduction:

Broiler production does not appear profitable when the conventional rations utilized by other poultry stock are used for its production (Ogbonna and Adebowale, 1993). In broiler diets, the bulk of energy is supplied by either maize or sorghum that are seriously being competed for by humans 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 of that, the usefulness of some agricultural by-products as substitute 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 humans. This had led to scarcity of cereal grains and hitherto 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. Olomu (1988) states that when using non- conventional feed ingredients, one should keep an open mind when formulating balanced poultry rations. There is nothing like "this is the formula".

Rice milling waste (rice offal) consists of rice hulls, rice bran, rice polishing and broken rice grains. Rice milling waste (RMW) in actual fact is the total offal obtained in the milling of rice. It has been estimated that small-scale rice mills process over 80% of the rice produced in Nigeria. Since rice offal makes up 40% of par boiled , Nigeria has the potential to produce about 1,032,993.6 metric tones of rice offal from the 2,582,484 metric tones of rice produced annually in Nigeria as at 2004 (NAERLS and PCU 2004).

Obeka (1985) indicated that rice offal has very little amino acids, in his research with laying birds, he found that

rice offal could replace up to 60% of maize in the conventional diets without reduction in performance and egg production. Dafwang (1995) recommended that rice offal inclusion in layers diet should not be more than 20%.

The present study was designed to examine the effect of varying levels of rice offal on growth performance of broilers at starter and finisher phases.

**Materials and Methods:**

The rice offal used for this study was obtained from commercial rice milling factories at Zaria-city in Kaduna State. Five experimental diets were formulated to contain rice offal or RMW at 0, 5, 10, 15 and 20%. The diets were made to be isocaloric and isonitrogenous. The gross composition of the experimental diets are in table 1 and 2 while the proximate analysis of the test ingredient (rice offal) appears in table 3.

**Experimental birds.**

One hundred and eighty day-old Ross-strain broiler chicks of mixed sexes were purchased from Agritted Ibadan. The chicks were weighed at day-old and randomly allotted to five dietary treatments in a completely randomized design for a period of 28 days (4 weeks). Each treatment had 3 replicates of 12 birds each. Routine vaccinations and necessary medication were given to the birds. At the fifth week all birds were given a common ration and randomized before introducing the finisher rations. The five weeks old chicks were randomly allotted to five treatments , replicated three times in batches of ten chicks per replicate in a completely randomize design for a period of 28 days (4 weeks).

The birds were raised on deep litter pens with dry wood shavings as litter materials. 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 flat and conical metal feeders and plastic bowls respectively. Kerosene lanterns and stoves were used as source of heat and the birds were kept under constant light to encourage feed consumption.

**Chemical analysis**

Proximate analysis of the fresh rice offal was carried out using the method described by Association of Official Analytical Chemist (1995).

**Table 1: Percentage composition of broiler starter diets**

| | Diets | | | | |
|---|---|---|---|---|---|
| Ingredients | 1 | 2 | 3 | 4 | 5 |
| Maize | 50.20 | 48.20 | 45.20 | 39.70 | 34.70 |
| Soyabean (Full fat) | 38.00 | 37.00 | 37.00 | 35.50 | 33.50 |
| Maize offal | 5.00 | 2.50 | - | - | - |
| Blood meal | 3.00 | 3.50 | 4.00 | 4.50 | 5.00 |
| Palm oil | - | - | - | 1.50 | 3.00 |
| Rice offal | - | 5.00 | 10.00 | 15.00 | 20.00 |
| Bone meal | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |
| 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 (%) | 23.6 | 22.5 | 22.4 | 22.01 | 21.4 |
| M. E. kcal/kg | 3262.5 | 3182.1 | 3102.0 | 3052.3 | 3002.6 |
| Lysine (%) | 1.62 | 1.62 | 1.65 | 1.64 | 1.62 |
| Methionine (%) | 0.55 | 0.54 | 0.53 | 0.53 | 0.52 |
| Calcium (%) | 1.15 | 1.15 | 1.15 | 1.15 | 1.15 |
| Avail. Phosphorous (%) | 0.86 | 0.90 | 0.95 | 1.00 | 1.06 |
| Crude Fibre | 3.75 | 5.42 | 7.11 | 8.88 | 10.64 |
| Cost N/kg feed | 29.63 | 28.85 | 28.27 | 29.04 | 29.71 |

*Premix supplied per Kg ration: Vit. A 5,000,000 I. U; Vit. $D_3$ 1,000,000 I. U; Vit. E 20,000 mg ; Vit. $K_3$ 1,000 mg ; Vit. $B_1$ 1,200 mg ; Vit. $B_2$ 2,400 mg ; Vit. $B_6$ 2,400 mg ; Niacin 16,000 mg ; calcium pantothenate 4,000 mg ; Biotin 32 mg ; Vit $B_{12}$ 10 mg; Folic acid 400 mg; chloline chloride 120,000 mg; manganese 40,000 mg; iron 20,000 mg; zinc 18,000 ; copper 800 mg ; Iodine 620 mg ; cobalt 100 mg ; selenium 40 mg.

## Table 2: Percentage composition of broiler finisher diets

| | Diets | | | | |
|---|---|---|---|---|---|
| Ingredients | 1 | 2 | 3 | 4 | 5 |
| Maize | 47.85 | 46.45 | 45.05 | 42.35 | 39.55 |
| Soyabean (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 |
| Avail. Phosphorous (%) | 0.93 | 0.97 | 0.99 | 1.04 | 1.07 |
| Crude Fibre | 4.46 | 5.99 | 7.52 | 9.10 | 10.68 |
| Cost N/kg feed | 24.63 | 24.93 | 25.23 | 25.51 | 26.26 |

*Premix supplied per Kg ration: Vit. A 5,000,000 I. U; Vit. $D_3$ 800,000 I. U; Vit. E 12,000 mg ; Vit. $K_3$ 1,500 mg ; Vit. $B_1$ 1,000 mg ; Vit. $B_2$ 2,000 mg ; Vit. $B_6$ 1,500 mg ; Niacin 12,000 mg ; Pantothenic acid 5,000 mg ; Biotin 20 mg ; Vit $B_{12}$ 10.00 mg; Folic acid 300 mg; chloline chloride 150,000 mg; manganese 60,000 mg; iron 10,000 mg; zinc 15,000 ; copper 800 mg ; Iodine 400 mg ; cobalt 80 mg ; selenium 40 mg ; Growth promoter 8,000 mg ; Antioxidant 40,000 mg.

## Table 3: Proximate analysis of rice offal from Zaria city

| Parameter | Percentage |
|---|---|
| Dry Matter | 94.42 |
| Crude Protein | 5.09 |
| Crude Fibre | 30.39 |
| Nitrogen Free-Extract | 46.10 |
| Ether Extract | 3.40 |
| Ash | 16.67 |

Source: Maikano (2005)

**Data collection and analysis**

Mortality was recorded daily, weighing of birds and feeds was done weekly. Live weight, weight gain, feed intake, feed conversion ratio and feed cost per kg weight gain were determined at weekly intervals during the experimental periods.

All data collected were subjected to the analysis of variance. Significance difference was determined by applying least significant difference across the treatment means (Snedecor and Cochran, 1980). Regression analysis was also carried out to determine the optimum level of inclusion (Draper and Smith, 1966). The SAS computer software package (1988) was used for all statistical analysis.

**Results**

The results of chemical analysis of the products showed that rice offal is very high in crude fibre and ash but low in crude protein suggesting that it is a low protein feed material as presented in Table 3. The effects of different dietary levels of rice offal on performance of broiler starter are presented in table 4, which showed that the inclusion of rice offal at levels of up to 15% in broiler starter diets had no adverse effects on body weight and weight gain. The results of the broiler finisher phase are shown on table 5, which showed that the inclusion of rice offal at levels of up to 15% in finisher diets had no adverse effects on body weight. The inclusion of palm oil in diets 4 and 5 was to 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).

Results of this study suggests that there is need to explore cheaper and suitable alternatives for nutrient balancing (protein and energy) in order for rice offal to be used to greater advantage for broilers and other monogastric animals.

**Table 4: Performance of broilers fed rice offal diets (Starter phase)**

| % Rice offal | Body weight (g) | Weight gain (g) | Feed intake | Feed/Gain | Feed Cost/ kg. Gain | Mortality % |
|---|---|---|---|---|---|---|
| 0 | $413.8^{ab}$ | $367.5^{ab}$ | $692.0^{b}$ | $1.89^{a}$ | $55.90^{c}$ | 2.8 |
| 5 | $437.2^{a}$ | $390.3^{a}$ | $794.3^{ab}$ | $2.04^{a}$ | $58.95^{bc}$ | - |
| 10 | $447.8^{a}$ | $401.4^{a}$ | $704.4^{b}$ | $1.76^{a}$ | $49.67^{bc}$ | 2.8 |
| 15 | $428.8^{a}$ | $382.4^{a}$ | $779.1^{ab}$ | $2.04^{a}$ | $59.24^{b}$ | 2.8 |
| 20 | $379.2^{b}$ | $333.0^{b}$ | $850.8^{a}$ | $2.56^{b}$ | $76.16^{a}$ | 2.8 |
| Sig. Effects | *** | *** | * | * | * | - |
| SEM | 13.33 | 13.24 | 32.99 | 0.15 | 4.91 | - |

Superscript abcd means on the same column with different superscript differ significantly ($p<0.05$).

* Linear- continuous increase up to a point

** Cubic-increase up to a point and then falls back and rise up again

*** Quadratic-increase up to a point and then falls back

**Table 5: Performance of broilers fed rice offal diets (Finisher phase)**

| % Rice offal | Body weight (g) | Weight gain (g) | Feed intake (g) | Feed/Gain Kg. | Feed Cost/ Gain | Mortality % |
|---|---|---|---|---|---|---|
| 0 | 1673.3$^{a}$ | 966.7$^{a}$ | 1841.7$^{d}$ | 1.91$^{a}$ | 47.0$^{c}$ | - |
| 5 | 1630.0$^{a}$ | 923.3$^{a}$ | 1967.4$^{cd}$ | 2.15$^{b}$ | 53.6$^{c}$ | 3.3 |
| 10 | 1603.7$^{a}$ | 897.0$^{a}$ | 2064.4$^{bc}$ | 2.30$^{bc}$ | 58.0$^{bc}$ | 3.3 |
| 15 | 1585.2$^{a}$ | 878.5$^{a}$ | 2201.9$^{ab}$ | 2.51$^{c}$ | 64.1$^{b}$ | 3.3 |
| 20 | 1460.0$^{b}$ | 753.3$^{b}$ | 2293.3$^{a}$ | 3.05$^{c}$ | 80.1$^{a}$ | - |
| Sig. Effects | * | * | * | * | * | - |
| SEM | 40.04 | 40.05 | 90.09 | 0.22 | 12.90 | - |

Superscript abcd means on the same column with different superscript differ significantly ($p < 0.05$)
* Linear
** Cubic
*** Quadratic

## Discussion

The inclusion of rice offal at levels of up to 15% in broiler starter diets had no adverse effects on body weight and weight gain. Dafwang and Shwarmen (1996) recommended that rice offal can be fed at dietary level of 10% to broiler starter chicks without adverse effects on growth. Average body weight gain for all the treatments were not significantly different ($P>0.05$) from the control. Although, birds at treatment 3 (10% rice offal) had the highest weight gain (401.4g) followed by birds on treatment 2 (390.3g). while birds on treatment 5 (20% rice offal) had the lowest weight gain (333.0g). The significant effects ($P<0.05$) on body weight and weight gain showed a quadratic function in which the 15% rice offal diet even out performed the control. There were significant differences ($P<0.05$) among treatment means for both feed intake and feed to gain ratio. Birds placed on 20% rice offal diets gave the highest feed intake while feed to gain ratio as measured by feed intake per unit weight gained was poorest on treatment 5 (20% rice offal). Dietary treatment significantly affected feed cost per kg gain ($P<0.05$). Feed cost per kg gain at 20% dietary rice offal was significantly higher than for diets containing 0 – 15% rice offal.

The results of the broiler finisher phase showed that the inclusion of rice offal at levels of up to 15% had no adverse effects on body weight. The significant effect ($P<0.05$) on body weight and weight gain were linear which placed the maximum level of rice offal inclusion at 15% in broiler diets. This is in partial agreement with the recommended dietary level of rice offal of up to 15 – 22.5% (Dafwang and Damang, 1995). Feed intake and feed gain ratio were linearly significant ($P<0.05$). The higher the level of rice offal , the higher the feed intake and the poorer the feed to gain ratio. With regards to feed cost per kg gain, the results showed that feed cost per kg gain at 20% dietary rice offal was significantly ($P<0.05$) higher than for diets containing 0 – 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 gain significantly because of the poor efficiency of feed utilization.

Palm oil used in this study is a good source of essential fatty acids, 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.

The use of rice offal led to significant reductions in the quantity of maize used in the diets as shown on tables 1 and 2. At the recommended levels of 15% rice offal in broiler feeds, the average savings on quantity of maize used in the diets were 11.5% and 5.5% for starter and finisher diets respectively. These significant savings on maize utilization can now be reverted to human food which is paramount in the tropics where population growth is in excess of agricultural production.

It may be concluded that in the starter and finisher phases, rice offal can be fed at levels up to 15% without detrimental effects on growth performance, and the use of rice offal led to appreciable reductions in the quantity of maize used for ration formulation. In view of the relative abundance of rice offal in rice growing areas, there is need for further studies to ascertain economical ways of improving the nutritive value of rice offal in feeding monogastric diets.

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