EFFECTS OF FEEDING VARYING LEVELS OF RICE MILLING WASTE ON THE PERFORMANCE, NUTRIENT RETENTION AND PRODUCTION ECONOMY OF GROWING LOCAL TURKEYS.

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ABSTRACT

A feeding trial was undertaken to evaluate the potential feeding values of Rice Milling waste as a substitute for maize in the diet of growing turkeys, the optimal substitution level for maize, and economic efficiency of substituting maize with rice milling waste, in the diets of growing turkeys. Five experimental diets were formulated by substituting maize with rice milling waste at 0%, 25%, 50%, 75% and 100% levels respectively. One hundred local turkey poults brooded with commercial broiler starter mash were randomly assigned to the five treatment diets. Each treatment group was replicated two times having 10 poults per replicate. The trial was arranged in a completely randomized design (CRD). Feed and water were provided ad libitum. The experiment lasted sixteen weeks. Parameters measured include economic indices, efficiency of feed utilization and growth performance (weight changes, feed intake, feed conversion ratio and percentage mortality). Results obtained showed that feeding growing turkeys with 50% rice milling waste produced enhanced performance that was next to the control in terms of mean final weight, final weight gain, best economic benefit and nutrient utilization efficiency while 100% substitution level gave the poorest value.

KEY WORDS: Turkey poults, nutrient utilization, economic appraisal, and rice-milling waste.

INTRODUCTION

The recent increase in the prices of conventional feedstuffs and the non availability of these grains have adversely affected animal production sector in bridging the existing animal protein gap in a developing country like Nigeria (Onwudike and Omole, 1994). As a result, most Nigerian farmers have abandoned animal production; others have scaled down operation in order to cope with the rising cost of production. There has been competing demand on the available grains between the poultry industry and other sectors of the economy; hence emphasis should be shifted from the use of conventional feedstuff to unconventional feed sources like rice milling waste. Rice milling waste is the by-product resulting from industrial rice milling. This by-product is readily available, cheap, attracting no competition with man and requiring minimal processing to enhance its utilization by poultry. It is usually discarded as waste product by burning to reduce pollution (Iheukwumere *et al.,* 2001).

Utilization of rice milling waste in poultry diet has been reported to produce lean meat, reduce production cost, supply nutrients like vitamins and minerals and reduce carcass fat and dietary energy wastage, which is associated with the production of excess fat. Therefore, emphasis need be placed on evaluation of the potential feeding values of rice milling waste, which is an unconventional agro- by-product that is cheap and readily available. It is also necessary to note that, limiting poultry production to chicken alone at the expense of other poultry species makes it impossible to meet the animal protein need of the nation. There is need to diversify to other species of poultry like turkey production. Turkey is a class of poultry that has large size, fast growth rate and excellent meat quality. It is generally cherished as good gift during festive periods like Christmas, Easter, Sallah. Incorporation of rice milling waste in the diets of growing turkeys which are often regarded as bigger birds with a better capacity to handle fibrous feedstuff will help to bridge the existing animal protein short fall in Nigeria.

This study was undertaken to investigate the nutritive values of rice milling waste, define the optimal

substitution level of rice milling waste for maize, the efficiency of nutrient utilization in the diets and production economy using growing local turkeys.

MATERIALS AND METHODS

Proximate Composition of Rice Milling Waste and diets

The rice milling waste used for this study was obtained from a rice mill industry at Bende in Abia state. Samples of the rice milling waste were collected, milled and analyzed for proximate composition according to AOAC (1990). Thereafter the rice milling waste was used to formulate diets for the turkeys at 0%, 25%, 75%, and 100%substitution levels respectively (Table 1). The crude protein of both the test ingredient and the respective feeds were determined using the micro-kjeldahl method, while the Soxhlet Extraction Method was employed for ether extraction. The gross energy contents of the test ingredient and the feed sample were also determined using the Adiabatic Oxygen bomb calorimeter.

Table 1: Percentage composition of Experimental Diets fed to Growing Local Turkeys (4 - 16 weeks)

Ingredients	T_1 (0%)	T_2 (25%)	T_3 (50%)	T_4 (75%)	T_5 (100%)
Yellow maize	50.00	37.50	25.00	12.50	0.00
Rice milling waste	-	12.50	25.00	37.50	50.00
Soyabean meal	36.00	36.00	36.00	36.00	36.00
Fish meal (72% Cp)	8.20	8.20	8.20	8.20	8.20
Palm oil	2.00	2.00	2.00	2.00	2.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Oyster shell	1.00	1.00	1.00	1.00	1.00
Vit Mineral premix*	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10	0.10
DL-Methionine	0.20	0.20	0.20	0.20	0.20
Total	100.00	100.00	100.00	100.00	100.00
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Calculated Analysis					
Crude protein (%)	25.85	25.75	25.65	25.55	25.45
Crude fibre (%)	3.63	7.03	10.42	13.82	25.45
ME (Kcal/kg (%)	3014.52	2820.02	2575.52	2332.02	1886.52
Determined Composition					
Crude protein (%)	27.80	27.63	27.25	27.22	27.10
Ether Extract EE (%)	7.30	5.80	5.40	5.00	4.80
Crude fibre (%)	9.03	12.24	16.50	20.00	7.84
Total ash (%)	10.20	14.85	16.50	18.60	21.50
Nitrogen Free Extract (NFE)(%)	51.48	42.69	38.61	32.68	26.60
Gross Energy (Kcal/g)	4.01	3.48	3.30	3.05	2.25

* Composition per 25kg (Bio premix) Vit. A 4,000 iμ; Vit. D 800,000 iμ; Vit E_1 500 mg; Niacin 10,000 mg; Panthotenic acid 3,500 mg; Biotin, 15mg; Vit B 10 mg; Folic acid 200 mg; Chlorine chloride 130,000 mg; Manganese 60,000 mg; Iron 15,000 mg; Zinc 15,000 mg; Copper 800 mg; Iodine 400 mg; Cobalt, 80 mg; Selenium, 400 mg; Antioxidant 40,000 mg.

Mineral Composition of Rice Milling Waste

Samples of the rice milling waste and their respective feeds were subjected to wet digestion with hydrochloric acid and nitric acid for the determination of mineral concentrations following the digestion. The

selected mineral elements, calcium, potassium and sodium contents were determined by flame photometry (AOAC, 1975), while magnesium and iron contents were determined by Atomic absorption spectrophoto meter (AOAC, 1975).

Fibre Components and Anti-nutritional Factor of Rice Milling Waste

The fibre components of the rice milling waste and their respective feeds were determined using Van Soest and Mc Queen (1973) method of analysis. The selected anti-nutritional factors, phytic acid and tannic acid were measured using the procedure described by Lola and Markakis (1975) for phytic acid while Tannic acid was determined according to the procedure of Maga (1982).

Experimental Birds and Design

A total of 100 local turkey poults procured from a commercial hatchery farm at Owerri, Imo State Nigeria was used for the study. The birds were raised with commercial broiler starter mash for 4 weeks and thereafter, they were randomly allotted to five experimental diets formulated by substituting rice milling waste for maize at 0%, 25%, 50%, 75% and 100% respectively. Each treatment group of 20 poults was replicated two times having 10 poults per replicate in a completely randomized design(CRD). Feed and water were provided *ad libitum*. Parameters measured included daily feed intake, weekly weight changes and mortality.

Nutrient Digestibility: At the end of fifteen weeks, six turkey growers in each treatment group were randomly selected and placed in individual metabolic cages for nutrient balance trial. The birds were fed *ad-libitum* and allowed free access to water. Faecal droppings were collected whole every 24 hours for 3days. And thereafter, dried and analyzed for proximate composition. Estimation of metabolism was carried out according to the procedure described by McDonald *et al*.(2000).

Economic Analysis: Economics of producing the grower turkeys fed varying substitution levels of rice milling waste was also evaluated. All data generated were subjected to statistical analysis of variance (Snedecor and Cochran, 1980). Least significant difference (LSD) was employed to separate means found to be statistically significant among the treatments.

RESULTS AND DISCUSSIONS

Proximate composition

Table 2: Proximate composition of rice milling waste used for the trial.

Proximate	Levels
Dry matter (%)	90.50
Crude protein (%)	6.80
Ether Extract (%)	8.52
Ash (%)	15.00
Crude fibre (%)	29.60
NFE (%)	40.08
Gross Energy (Kcal/kg)	1480

The percent crude protein obtained (6.80) was above 4.00 and 4.50 reported by Nutrient Master Plan Pfizer (1990) and Bath *et al* (1986) respectively but close to 6.00 reported by Aduku (2005). The Ether Extract (8.52), fell within the range 2.8 9.00 reported by Nutrient Master Plan (1990), Aduku (2005) and Bath *et al.* (1986) respectively. The ash content (15.00) was close to the range 16.6 19.1 reported by Bath *et al* (1986), and Aduku (2005) while the fibre content and the gross energy (29.6 and 1480) respectively were close to 30.00 and 1400

reported by Nutrient Master Plan Pfizer (1990). However, Variations in the values of proximate components of the rice milling waste used for the study compared to the reports of other researchers may be traceable to differences in the soil nutrients status on which the rice was grown, storage conditions and processing methods employed.

Mineral Components

Considering the mineral components (Table 3) Calcium and phosphorus values (0.20 and 0.12) fall within the range 0.17 - 0.21 and 0.08 - 0.49 respectively, documented by Aduku (2005), and Bath *et al* (1986). Other mineral components, P, Mg, K, Na and Fe showed low values. This confirms the assertion of Leng (2006), that cereal grains (rice milling waste inclusive) are deficient in minerals and some nutrients.

Analysis of the mineral components of the rice milling waste based diet, showed that, all the mineral components selected (Ca, P, Mg, k, Na and Fe) (Table 4) followed a downward pattern, indicating that, the higher the substitution level, the lower the mineral content of the feed. This could be traceable to the low mineral contents of rice milling waste, and high fibre substitution, which neutralized the mineral components.

Table 3: Mineral Composition of Rice Milling Waste

Constituents	Levels
Calcium (mg/g)	0.20
Phosphorus (mg/g)	0.12
Magnesium (mg/g)	0.13
Potassium (mg/g)	0.15
Sodium (mg/g)	0.02
Iron	0.001

Table 4: Mineral Composition of Rice Milling Waste-Based Grower Diets (mg/g)

Mineral components	T_1 (0%)	T_2 (25%)	T_3 (50%)	T_4 (75%)	T_5 100%)	SEM
Calcium	2.50^a	2.20^b	2.10^b	1.98^c	1.65^d	0.12
Phosphorus	0.68^a	0.56^b	0.52^c	0.42^d	0.36^e	0.10
Magnesium	0.54^a	0.47^b	0.45^c	0.40^d	0.34^e	0.01
Potassium	0.91^a	0.89^b	0.84^c	0.82^d	0.70^e	0.01
Sodium	0.86^a	0.72^b	0.68c	0.65^d	0.60^e	0.02
Iron	0.06^a	0.05^b	0.04	0.03^d	0.02^e	0.002

^{abcde} Means along the same row with different superscripts are significantly different ($P<0.05$)

Crude Fibre Components:

The crude fibre components of rice milling waste under study showed high values (Table 5). This was reflected in their respective feeds, which also exhibited high values. (Table 6).

Table 5: Crude fibre components and anti-nutritional factors in Rice milling waste.

Fibre Constituents (%)	Levels
Neutral detergent fibre (NDF) (%)	60.24
Acid detergent fibre (ADF) (%)	35.85
Acid detergent lignin (ADL) (%)	2.98
Hemicellulose (%)	32.45
Cellulose (%)	27.55
Phytic acid	0.50
Tannic acid (Tannin)	0.40

Table 6: Crude Fibre Components of Rice Milling Waste-Based Diets fed to Growing Local Turkeys

Fibre Fractions (%)	T_1 (0%)	T_2 (25%)	T_3 (50%)	T_4 (75%)	T_5 (100(%)	SEM
Neutral detergent fibre	32.02^{e}	40.00^{d}	46.00^{c}	48.10^{b}	50.01^{a}	1.03
Acid detergent fibre (%)	17.82^{e}	22.15^{d}	26.45^{c}	28.32^{b}	31.25^{a}	1.05
Acid detergent lignin (%)	3.12^{e}	5.27^{d}	6.01^{c}	5.85^{b}	7.21^{a}	0.26
Hemicellulose (%)	15.25^{e}	19.45^{d}	23.03^{c}	25.17^{b}	28.30^{a}	2.08
Cellulose (%)	11.30^{e}	16.00^{d}	20.02^{c}	22.51^{b}	25.35^{a}	1.00

abcde Means along the same row with different superscripts are significantly different (P<0.05).

The result followed an increasing trend, as the substitution levels of rice milling waste for maize increased from 0% to 100%, all the fibre components of the diets also increased. This could be a reflection of the high fibre component of the rice milling waste under study, indicating that, there is a direct relationship between the fibre components and the substitution levels.
Performance of the grower turkeys is shown in table 7.

Table 7: Performance of local Turkey poults fed varying levels of Rice Milling waste. (4-16 weeks)

Parameters	T_1 (0%)	T_2 (25%)	T_3 (50%)	T_4 (75%)	T_5 100(%)	SEM
Mean initial weight (g)	340.00	342.00	340.00	344.00	345.00	6.00
Mean final weight (g)	3000^{a}	2750.00^{c}	2905.00^{b}	2374.00^{d}	2286.00^{d}	186.10
Mean final weight gain (g)	2660.00^{a}	2408.00^{c}	2565.00^{b}	2030.00^{d}	1941.00^{e}	105.00
Mean daily weight gain (g)	31.66^{a}	28.66^{c}	30.50^{b}	2416.00^{d}	23.23^{c}	1.86
Mean total feed intake (g)	4592.00^{d}	4686.00^{c}	4529.00^{e}	4798.00^{b}	4908.00^{a}	100.38
Mean daily feed intake (g)	54.65^{d}	55.78^{c}	53.91^{c}	57.11^{b}	58.42^{a}	0.38
Feed Conversion ratio	1.72^{e}	1.94^{c}	1.76^{d}	2.36^{b}	2.51^{a}	0.10
Mortality %	10.00^{c}	10.00^{c}	10.00^{c}	20.00^{b}	30.00^{a}	0.41

abcde Means along the same row with different superscripts are significantly different (P<0.05).

Turkeys fed diets whose maize was substituted with 50% rice milling waste to the tune of 50% showed significantly (P<0.05) higher mean final weight: (2905.00) final weight gain (2565.00) and daily weight gain (30.50) that was next to the control, followed by those placed on T_2 (25%), while those fed 100% rice milling waste had the least values. (2286.00, 1941.00 and (23.23) respectively. Mean total feed intake and daily feed intake were significantly (P<0.05) highest in T_5 (100%) group (4908.00 and 58.42) and lowest in 50% group (4529.00 and 53.91).

The depressed performance observed in turkeys fed 100% rice milling waste may not be unconnected with the high proportion of phytic acid, which might have inhibited the absorption of iron and calcium resulting to growth depression. This is in agreement with the assertion of Aletor and Fasuyi (1997) that high levels of phytic acid may lead to growth depression, due to the binding effect of digestive enzymes and dietary protein by forming complexes that are not readily digested.

The high feed intake observed in turkeys placed on 75% and 100% substitution levels could be traceable to the high fibre contents of the diets. This is in agreement with Adelsamane *et al* (1983) who showed that high fibre diets enhanced feed intake, so as to allow birds meet their requirements for some dietary components other than energy.
The better performance observed in grower turkeys fed 50% rice milling waste could be due to the fact that this level of substitution makes for a balance in calorie: protein ratio which in enhanced better utilization and improved performance.

Nutrient utilization

Nutrient utilized by the turkeys was optimized at the control (0%) in terms of Dry matter, CP, EE and Ash. This was followed closely by birds placed on T_3 and T_2, while T_5 showed the poorest response, (Table 8).

Table 8: Nutrient utilization by growing Turkeys fed varying levels of Rice milling waste (4-16 weeks)

Percent nutrient/utilized	T_1 (0%)	T_2 (25%)	T_3 (50%)	T_4 (75%)	T_5 100(%)	SEM
Dry matter	70.99[a]	69.85[a]	68.67[a]	67.28[b]	52.03[c]	1.24
Crude protein	79.51[a]	74.64[b]	77.01[a]	71.62[c]	58.31[d]	1.84
Crude fibre	69.51[a]	74.23[b]	76.94[a]	70.86[c]	54.19[d]	2.00
Ether Extract	77.84[a]	78.85[a]	77.15[a]	78.98[a]	70.04[b]	1.95
Ash	66.64[a]	66.64[a]	63.15[b]	60.22[b]	50.26[c]	1.70
NFE	65.15[a]	65.38[a]	64.93[a]	60.48[b]	55.75[c]	1.52

[abcde]- Means along the same row with different superscripts are significantly different (P<0.05).

The reduction in nutrient utilization respectively observed in grower turkeys fed 75% and or100% rice milling waste could be due to nutrient imbalance resulting from very high level of fibre substitution which might have led to poor nutrient intake and utilization. The observation is in agreement with Trait and Wright (1990) who asserted that high fibre diets seem to decrease digestibility of crude protein and other nutrients. This explains the reason for the relatively poor performance of birds placed on T_4 (75%) and T_5 (100%). 50% substitution, could be the level where the nutrients are better balanced which in turn led to better nutrient utilization and enhanced performance of the birds.

Economic Analysis

Results of the economic analysis are shown in Table 9.

Table 9: Production Economy of Growing Local Turkeys fed varying Levels of Rice Milling Waste

Economic indices	T_1 (0%)	T_2 (25%)	T_3 (50%)	T_4 (75%)	T_5 100(%)	SEM
Feed cost kg (₦)	11.20[a]	9.39[b]	7.57[c]	5.76[d]	3.95[e]	0.41
Feed cost per bird (₦)	612.19[a]	523.00[b]	408.17[c]	328.95[d]	230.75[c]	8.55
Cost of 4wks old turkeys (₦)	500.00	500.00	500.00	500.00	500.00	0.00
Operational cost (₦)	60.00	60.00	60.00	60.00	60.00	0.00
Cost of production (₦)	1172.00[a]	1083.00[b]	968.17[c]	888.95[d]	790.75[e]	5.47
Cost/kg bird (₦)	390.66[a]	393.81[a]	333..85[d]	375.08[b]	346.82[c]	4.10
Revenue per bird (₦)	2625.00[a]	2406.25[c]	2537.90[b]	2073.75[d]	1995.00[e]	6.24
Benefit (₦)	1453.00[b]	1323.25[c]	1569.73[a]	1184.80[c]	1204.25[d]	10.23
Cost saving (%)	-	7.59[d]	17.40[c]	24.15[b]	32.29[a]	1.85

abcde Means along the same row with different superscripts are significantly different (P<0.05).

Feed cost /kg (N), Feed cost per bird (N), and cost of production (N) were significantly (P<0.05) higher in T_1, this is followed by Poult fed T_2 and T_3 while Turkeys fed T_5 (100%) showed the poorest values. Revenue accruing from the sales of the birds was highest for the control, followed by 50% group and lowest at T_5 (100%). Benefit was highest at T_3 (50%), followed by the control and lowest at T_4 (75%). The high feed cost observed in the control group (T_1) could be due to the high cost of maize (N150.00/kg) which is a conventional feed stuff compared to the rice milling waste which was purchased for N5/kg as at the period of the study.

The results obtained from this study show that the rice milling waste can be used as a substitute for maize to the tune of 50% in diets of growing local turkeys.

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