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The Effect of Treated Rice Milling Waste on Performance, Nutrient Retention, Carcass and Organ Characteristics of Finisher Broilers

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Abstract: One hundred and twenty 4-week old broilers were used to evaluate the effect of various treatment methods of rice milling waste (RMW) on growth performance, nutrient retention and organ characteristics of finisher broilers. Rice milling waste was treated with urea (D_2), poultry droppings (D_3) and water (D_4), while untreated waste (D_1) served as control. Urea treated RMW diet significantly ($P<0.05$) improved body weight, weight gain and dressed weight of broilers. Organ weights, dry matter intake and nitrogen free extract were not significantly ($P>0.05$) influenced by the dietary treatments. Broilers fed untreated RMW diet recorded significantly higher feed intake than broilers fed other diets. The results showed that rice milling waste, when treated with urea (fertilizer grade) and included in finisher broiler diets, could enhance their performance.

Key words: Broilers, performance, poultry droppings, rice milling waste, urea

Introduction

Much effort is being made to find the possibilities of utilizing agricultural, animal and industrial waste in poultry nutrition (Henuk and Dingle, 2003). This could lead to the reduction in the use of conventional feed ingredients such as maize and soybean (El Boushy and van der Poel, 2000) and help reduce pollution problems, decrease feed costs and increase the supply of essential mineral (Arndt *et al*., 1979).

Rice milling waste (RMW) is the by-product obtained from small-scale rice mills. The RMW obtained contains husks, bran, polishing and small quantity of broken rice (Dafwang and Shwarmen, 1996; Akinusi, 1999). It has been estimated that these small-scale rice mills process over 80% of the rice produced in Nigeria (Awesu *et al*., 2002). RMW is readily available, cheap and discarded as waste (Akinusi, 1999). It is very high in crude fibre (30-44%) as reported by 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 RMW in poultry feeding (Abasiekong, 1997).

Modern layer commercial farms has resulted in the production of large amounts of poultry droppings from battery cage units whose disposal has become an environmental problem (Bell, 2002; Nahm, 2003). Poultry manure contain high concentrations of protein and non-protein nitrogen (NPN), calcium and phosphorus, which provides incentives for the utilization of poultry manure in feeding animals (Fontenot *et al*., 1983). The major NPN in poultry manure is uric acid which is converted to urea under aerobic conditions and subsequently to ammonia (Vogels and van der Drift, 1976). Urea ammunition has been used to improve the quality and utilization of RMW for broilers (Taiwo *et al*., 1992; Amaefule *et al*., 2003). One of the ways to reduce the negative impact of poultry manure on the environment is to use it as feed component (Henuk and Dingle, 2002).

This study was therefore conducted to evaluate the effect of treated rice milling waste on the performance, nutrient retention, and carcass and organ characteristics of finisher broilers.

Materials and Methods

Experimental diets and birds: The broilers were fed a starter diet (23% CP, 3.5% CF, 3.0% EE and 10.6 MJ/kg ME) from day-old to 4 weeks. Four experimental diets were then formulated with urea, poultry dropping (PD); water treated and untreated rice milling waste (RMW), each included as 10% of the whole diet (Table 1). One kg of urea (fertilizer grade) or fresh oven-dried (60^{o}C) poultry droppings (from battery cage) was dissolved in 16 litres of water and used to completely wet 30 kg of RMW that gave 1.88 g RMW/ litre of urea liquid or dissolved poultry droppings. These were put in a black polyethylene bag, the mouth tied with a rope and kept for 24 hours. After 24 hours, the materials were spread on a waterproof cloth and sun-dried. Water treatment followed the same procedure, but without the addition of urea or poultry droppings. The untreated RMW was used as collected from the rice mill.

One hundred and twenty unsexed Anak broilers that were 4 week old were used in the experiment. They were brooded and reared together in a pen before being used for the experiment.

Table 1: Percentage Composition of the Experimental Diets

Ingredients	D_1 (Untreated)	D_2 (Urea)	D_3 (PD)	D_4 (Water)
Yellow Maize	44.00	44.00	44.00	44.00
Soybean meal	20.00	20.00	20.00	20.00
Local fish meal	4.00	4.00	4.00	4.00
Spend grain	12.00	12.00	12.00	12.00
Palm kernel meal (PKM)	6.50	6.50	6.50	6.50
Bone meal	3.00	3.00	3.00	3.00
Vitamin/Mineral Premix*	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
RMW	10.00	10.00	10.00	10.00
Total %	100	100	100	100
Calculated Composition				
Crude protein %	19.50	19.50	19.50	19.50
Crude fibre %	8.40	8.40	8.40	8.40
Crude fat (%)	4.65	4.65	4.65	4.65
ME (MJ/kg)	13.50	13.50	13.50	13.50
Determined Composition**				
Dry matter %	95.50	95.50	93.50	93.50
Crude protein %	20.63	20.63	20.56	20.56
Crude fibre %	17.00	8.20	8.90	14.80
Ether Extract %	5.50	5.00	5.00	4.00
Crude Ash %	9.25	10.00	10.50	7.75
Nitrogen free extract %	43.12	51.15	48.54	46.39

*Composition per 2.5 kg: Vitamin A 10,000,000 IU, Vit. D 2,000,000 IU, Vit E 20,000 IU, Vit. K 2250 mg, Thiamin 1750 mg, Riboflavin 5,000 mg, Pyridoxine 2750 mg, Niacin 27500 mg, Vit. B_{12} 15 mg, Pantothenic acid 7500 mg, Folic acid 7500 mg, Biotin 50 mg, Choline chloride 400 g, Antioxidant 125 g, Manganese 80 g, Zinc 50 g, Iron 20 g, Copper 5 g, Iodine 1.2 g, Selenium 200 mg, Cobalt 200 mg. ** % DM Basis. PD = Poultry dropping.

Table 2: Performance of finisher Broilers fed treated or untreated RMW Diets

Parameters	D_1	D_2	D_3	D_4	SEM
Initial body weight (g/b)	491.66	533.33	525.00	541.66	27.49
Final body weight (g/b)	2808.00^b	3137.00^a	2933.00^b	2842.20^b	56.94*
Daily weight gain (g/b)	46.73^b	50.57^a	46.23^b	46.57^b	0.07*
Daily feed intake (g/b)	121.03^a	100.20^b	95.24^c	115.49^b	0.00*
Feed conversion ratio	2.59	1.98	2.06	2.48	4.68
Mortality (%)	0.00	0.00	0.00	0 . 0 0	-

* a, b, c, means within rows with different superscripts are significantly different (P<0.05). SEM = Standard error of mean.

Management of the Broilers: The broilers in each replicate were brooded in a deep litter pen (3.00 m x 2.50 m) in the Experimental poultry house. The poultry house was an open-sided one, with sides and demarcations between individual pens covered with wire gauze. The litter material was wood shavings. Heat was provided with kerosene stoves under metal hovers. Feed and water were provided to the broilers *ad libitum* while additional light was provided at night using electricity, which enabled the birds to eat at night. The open sides of the poultry house were covered with thick polyethylene sheets during the brooding period of 3 weeks to conserve heat especially at night.

The birds were given Newcastle disease vaccine at day-old (I/O) and at 4th week, *Gumboro* disease vaccine at 9th and 21st day, broad-spectrum antibiotics and coccidiostat between the 2nd and 3rd week and between the 6th and 7th week. At four weeks, 120 broilers of the same size and uniform weight were selected and allotted to the treatment diets. They were housed in pens still in the same experimental poultry building.

Experimental design and data collection: The experimental design was completely randomized design (CRD). There were 30 broilers per treatment, which had three replications of 10 broilers each. The birds were weighed at the beginning of the experiment and subsequently on a weekly basis. The broilers were fed the treatment diets *ad libitum* and feed intake was recorded as quantity of feed offered minus leftover. Daily weight gain was calculated as final live weight minus initial live weight and feed conversion ratio as feed intake divided by weight gain. The study lasted 4 weeks.

Table 3: Carcass and Organ Characteristics of finisher broilers fed Treated or untreated RMW Diets

Parameters	D_1	D_2	D_3	D_4	SEM
Dressed weight (%)	64.36[b]	68.26[a]	65.35[b]	64.88[b]	0.94*
Head (%)	4.13	3.40	4.60	4.60	0.39
Neck (%)	4.76	4.70	5.06	5.43	0.39
Shank (%)	6.43	5.83	5.93	5.93	0.33
Heart (%)	1.33	1.00	1.06	1.16	0.10
Liver (%)	4.30	4.53	4.53	4.56	0.33
Gall bladder (%)	0.36	0.26	0.76	0.53	0.16
Empty Gizzard (%)	4.24	3.80	4.80	4.76	0.53
Spleen (%)	0.10	0.10	0.10	0.10	0.00

*a, b, c means within rows with different superscripts are significantly different (P<0.05). SEM = Standard error of mean

Table 4: Effect of treated or untreated RMW on nutrient retention of finisher Broilers

Parameters	D_1	D_2	D_3	D_4	SEM
Dry matter (%)	86.50	87.08	86.69	86.70	0.13
Crude protein (%)	69.50[c]	75.77[b]	78.18[b]	86.53[a]	0.33*
Crude fibre (%)	97.54[a]	81.30[b]	90.10[a]	82.32[b]	0.21*
Ether Extract (%)	86.19[b]	88.30[b]	90.10[a]	90.20[a]	0.15

** a, b, c, Means within rows with different superscripts are significantly different (P < 0.05). SEM = Standard error of mean.

Carcass evaluation: At 8 weeks of age, 3 broilers having live weights close to the mean from each replicate were randomly selected, starved for 24 hours, weighed, stunned with a small metal rod. They were bled completely by cutting the neck close to the head. The feathers were plucked by hand. After evisceration, the neck and shank were removed to obtain the warm dressed carcass weight, which was expressed as a percentage of the live weight. The organ weights were expressed as percentage of the dressed weight.

Nutrient retention: Two 7-week old broilers from each replicate were selected at random and put in a metabolism cage (75 cm x 35 cm) equipped with aluminum drinkers and feeders. The cages were housed in a section of the experimental block designed for metabolism studies. The birds were acclimatized for 3 days during which period they were fed their respective treatment diets. During acclimatization, the birds were given feed and water *ad libitum* but with a record of quantity of feed consumed each day. They were starved for 24 hours and then fed 90% of their *ad libitum* intake for 5 days and starved the next day. The droppings voided during the subsequent 6 days were collected using clean, smooth, rigid, aluminum trays placed under the clean wire cages housing the broilers. Feathers and scales were blown off the trays twice daily. Droppings adhering to the feathers and to the floor of the cage were carefully collected and added to the tray. The excreta were collected daily, oven-dried at 60^{o}C for 24 hours, weighed and transferred into a labeled plastic container. They were stored in a deep freezer until used for proximate analysis. Nutrient digestibility coefficients (%) were calculated as nutrient consumed minus nutrient voided, divided by nutrient consumed and multiplied by 100.

Chemical and data analysis: Samples of the experimental diets and faecal droppings were analyzed for proximate composition according to the methods of A. O. A. C. (1990). Data collected were subjected to analysis of variance (ANOVA) according to procedures described by Steel and Torrie (1980). Duncan's New Multiple Range Test (Duncan, 1955) was used to separate treatment means that were significantly different.

Results

The result of the body weight, weight gain, feed intake and feed conversion ratio (FCR) as affected by dietary treatments is presented in Table 2. Broilers fed urea treated RMW (D_2) diet had significantly higher (P<0.05) final body weight and daily weight gain than those fed other diets. There were no significant differences (P>0.05) in these two parameters between broilers fed D_1 (untreated RMW), D_3 and D_4 diets. Untreated RMW diet also significantly increased broilers daily feed intake more than D_2 and D_4, while the intake of D_3 was significantly lower (P<0.05) than the rest. There were no significant differences (P>0.05) between the broilers fed the various diets in FCR.

Results of carcass and organ characteristics (Table 3) showed significant difference only in percent dressed carcass weight of the broilers. The pattern of differences in the dressed weight of the broilers fed the treatment diets was the same with final body weight and daily weight gain. There were no significant differences in dry matter retention (Table 4), while broilers fed untreated RMW had a significantly lower (P<0.05) crude protein retention than those fed D_2 and D_3 diets. The coefficient of crude fibre utilization of untreated RMW diet was also significantly higher (P>0.05) than others. Ether extract

retention of D_1 and D_2 were similar but significantly lower ($P<0.05$) than those of D_3 and D_4 diets.

Discussion

The treatment of RMW with urea increased its nitrogen content due to the addition of non-protein nitrogen (Fontenot *et al*., 1983). This is in agreement with the reports (William *et al.,* 1984; Dias da-Silva *et al*., 1988; Taiwo *et al*., 1992; Amaefule *et al*., 2003) that urea ammunition increases the crude protein content of feed materials including RMW. Although, there was no complete degradation of fibre fraction of RMW due to urea treatment, the reduction (41.43%) in crude fibre content when compared with the untreated RMW diet (Table 1) could be considered significant.

Urea treated RMW diet improved broiler daily weight gain and final body weight more than other diets in contrast to earlier report (Amaefule *et al*., 2003) that urea treated RMW had no effect on body weight and daily weight gain of broilers. This could be due to the age of the broilers (4-week old) used in the study. The treatment of RMW with poultry droppings did not improve broiler performance, which is in line with the reports of Olorede *et al*. (1995). The difference in the performance of broilers fed D_2 and D_3 diets suggest that the source of urea used in the ammunition of RMW had significant effect on the performance of the broilers.

The untreated RMW (D_1) diet had the highest intake probably due to high crude fibre content (Moran, 1977), which may have caused the broilers to consume more of the diet to meet their nutrient requirement (Isikwenu *et al*., 2000). The low intake of D_3, which agrees with the report of Amaefule *et al*. (2003) may have been due to the presence of uric acid in the poultry droppings, which Esonu (2000) had identified as gut irritant that either depresses feed intake. This may have also been responsible for the poor daily weight gain of broilers fed D_3 diet in addition to an earlier observation that there was low utilization of RMW by poultry (Alhassan, 1984). The higher dressed carcass weight of broilers fed D_2, when compared with others, is considered a direct consequence of the better final body weight and FCR of the broilers fed D_2. It suggested that urea treated RMW was not toxic to the broilers especially when there was no significant differences in the weight of internal organs of the broilers fed the various treated and untreated RMW diets.

The result of nutrient utilization of the treatment diets by broilers did not actually reflect the observed performance of the broilers and also did not follow any regular pattern. This suggests that the effect of the treatments on RMW needs proper investigation. It was expected that urea and poultry droppings would enhance crude protein and fibre utilization of the diets since according to (Taiwo *et al*., 1992), urea ammunition increased RMW utilization and fibre fraction degradation.

The results of this study showed that rice milling waste (RMW), which is cheap and readily available, when treated with urea could be utilized in finisher broiler diet.

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