

Utilization of rice milling waste (RMW) in local turkey diets: effect on haematological indices and blood chemistry

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Abstract

One hundred Local Turkey Poults brooded on commercial broiler starter mash for four weeks were utilized in a Completely Randomized Design Experiment to evaluate the effect of feeding varying levels of Rice Milling Waste (0%, 25%, 50%, 75% and 100%), on the haematological and blood chemistry indices of grower and finisher turkeys. Five grower and finisher diets were respectively formulated such that rice-milling waste was substituted for maize at 0%, 25%, 50%, 75% and 100%. The poults were randomly assigned to the five experimental diets, having 20 poults per treatment. Each treatment group was replicated twice with 10 poults per replicate at the grower and finisher phases. Feed and water were provided ad-libitum. The study lasted 20 weeks covering a growing period of 16 weeks and finishing period of 4 weeks. Haematological indices of interest (Hb, PCV, WBC, RBC) and blood chemistry measurement (Creatine, Urea, Alkaline phosphate, Albumen and Globulin) were measured. Results obtained showed that substituting maize with 50% RMW produced superior blood quality in terms of Hb counts, white blood cell and red blood cells at the grower and finisher phases. Considering the biochemical values, 50% substitution also proved superior to other treatment groups in terms of Albumen, Globulin and Total protein concentration, at the grower and finisher phases. It was concluded that, substituting maize with 50% rice milling waste enhanced the haematological values and serum biochemical indices in grower and finisher turkeys, which in turn led to, enhanced biological performance of the turkeys placed on this diet.

Key words: Local turkeys, Haematological indices, blood chemistry and rice milling waste.

Introduction

The escalating cost of conventional feed ingredients such as maize, wheat and sorghum has been the prime stimulant for continuing search for alternative feed stuffs to reduce feed cost and resulting cost of animal products (Akinmutimi, 2001). Rice milling waste is a non-conventional feedstuff, which has the potential of being used in poultry industry to meet this need. Rice milling waste is a by-product resulting from industrial rice milling. Presently, it is discarded as waste and has no human dietary or commercial demand. Utilization of rice milling waste in poultry industry has been reported to reduce the production cost, produce lean meat and supply nutrients like vitamins and minerals and other unidentified factors, which improve growth. (Ojewola and Ewa 2005).

It is a known fact that poultry industry is built mainly on chicken at the expense of other species like turkey. Turkey is a class of poultry that has large size, fast growth rate and excellent meat quality. It is widely accepted in Nigeria as gifts during festive periods. Diversifying poultry industry to other species like Turkey production using rice milling waste might go a long way to bridge the gap of animal protein short fall in Nigeria. However, before any meaningful work can be done to achieve this purpose, the blood constituents of the birds, especially turkey need be studied in details (Okey *et al.*, 2001). The various blood functions are made ible by the individual or collective actions of its constituents such as haematological and biochemical indices. These blood constituents are affected by the quality, quantity and toxicity of the feed

taken by the animal (Robert *et al.*, 2003). Blood constituents are vital for monitoring flock health, clinical and diagnostic evaluation of various types of diseases in animals (Hall, 1979; Taiwo and Anosa, 1995). It is against this background that this study was undertaken to investigate the effect of utilization of rice milling waste on the Haematological indices and blood chemistry of local turkeys.

Materials and Methods

Experimental Birds and Handling

This study was conducted at the poultry unit of the Teaching and Research Farm, Michael Okpara University of Agriculture, Umudike. A total of one hundred day-old

local turkey poults brooded on commercial broiler starter mash for four weeks were randomly assigned to five treatment groups designated as T₁, T₂, T₃, T₄, T₅. Each group of 20 poults was replicated twice thus having 10 birds per replicate.

Experimental Diets and Design

The experiment was arranged in a Completely Randomized Design. Five experimental grower and finisher diets were respectively formulated by substituting maize with rice milling waste at 0%, 25%, 50%, 75% and 100% (Tables 1 and 2). Feed and water were provided *ad libitum*. The experiment lasted twenty weeks (grower and finisher phases).

Table 1: Percentage composition of experimental diets fed to grower 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
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 (MJ/kg)	12.61	11.80	10.78	9.76	7.89
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(MJ/kg)	0.016	0.014	0.013	0.012	0.010

* Composition per 25 kg (Bio premix) Vit. A 4,000 iu; Vit. D 800,000 iu; Vit. E1 500 mg; Niacin 10,000 mg; Panthotenic acid 3,500 mg; Biotin, 15 mg; Vit. B 10mg; Folic acid 200 mg; Chlorine chloride, 130,000 mg; Manganese, 60,000 mg; Iron 15,000; Zinc 15,000 mg; Copper 800 mg; Iodine 400 mg; Cobalt, 80 mg; Selenium, 400 mg; Antioxidant 40,000 mg.

Table 2: Percentage composition of experimental diets used in finishing local turkeys (16-20 weeks)

Ingredients	T ₁ (0%)	T ₂ (25%)	T ₃ (50%)	T ₄ (75%)	T ₅ (100%)
Yellow maize	62.00	46.50	31.00	15.50	0.00
Rice milling waste	-	15.50	31.00	46.50	62.00
Soya bean meal	30.00	30.00	30.00	30.00	30.00
Fish meal (72% CP)	1.20	1.20	1.20	1.20	1.20
Palm oil	3.00	3.00	3.00	3.00	3.00
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
Calculated Analysis					
Crude protein (%)	20.07	20.95	19.82	19.70	19.58
Crude fibre (%)	3.46	7.65	11.88	15.94	20.31
ME(MJ/kg)	13.32	12.05	11.20	10.35	8.25

Determined Percent Composition

Crude Protein (%)	21.03	20.82	20.72	20.50	20.42
Ether Extract EE (%)	9.20	9.56	7.86	7.50	6.85
Crude fibre (%)	4.34	9.85	13.76	17.85	22.30
Total ash (%)	10.60	14.80	16.00	20.20	20.00
Nitrogen Free Extract (NFE) (%)	54.83	45.97	41.66	33.95	30.43
Gross Energy (MJ/g)	0.017	0.015	0.014	0.013	0.010

* Composition per 25 kg (Bio premix) Vit. A 4,000 iu; Vit. D 800,000 iu; Vit. E1 500 mg Niacin 10,000 mg Panthotenic acid 3,500 mg; Biotin, 15 mg Vit. B 10mg; Folic acid 200 mg; Chlorine chloride, 130,000 mg; Manganase, 60,000 mg; Iron 15,000; Zinc 15,000 mg; Copper 800 mg; Iodine 400 mg; Cobalt, 80 mg; Selenium, 400 mg; Antioxidant 40,000 mg

Determination of Blood Constituents**Haematological indices**

At the end of the grower and finisher phases (age 16, and 20 respectively). Two birds were randomly selected from each replicate, blood samples collected from the selected birds were used for the determination of haematological indices and blood chemistry. The blood samples were collected into labeled sterile universal bottles containing anti-coagulant (EDTA Ethyl diamine tetra acetic acid powder). These samples were used to determine

values of haematological indices like the size of red blood cells, white blood cells, haemoglobin and packed cell volume. Values obtained were used to calculate the mean corpuscular volume (MCV), mean corpuscular Haemoglobin (MCH) and mean corpuscular Haemoglobin concentration (MCHC).

Blood Chemistry

Some blood samples were collected into labeled sterile bottle, without anti-coagulants for the determination of biochemical indices such as Total protein, Albumen, Serum alkaline phosphate,

serum creatinine and urea. The haematological indices and blood chemistry measurements were determined as described by Dacie and Lewis (1991).

Results and Discussion

Haematological indices Results of the haematological indices of local turkeys fed varying levels of rice milling waste at the grower and finisher phases are shown in tables 3 and 4 respectively.

Table 3: Haematological indices, for local turkey poults fed varying levels of rice milling waste (grower phase)

Haematological Indices	T ₁ (0%)	T ₂ (25%)	T ₃ (50%)	T ₄ (75%)	T ₅ (100%)	SEM
Hb(g/100ml)	9.00 ^a	8.40 ^a	9.10 ^a	8.35 ^a	7.00 ^b	0.92
PVC (g)	30.00 ^a	25.00 ^d	28.00 ^b	26.00 ^c	21.00 ^c	1.48
WBC (10 ⁶ /mm)	6.60 ^a	5.50 ^b	6.90 ^a	5.00 ^b	4.60 ^c	0.87
RBC (g10 ⁶ /mm)	2.60 ^a	2.50 ^a	2.70 ^a	2.40 ^b	1.80 ^b	0.28
MCV (u/m ³)	115.38 ^a	100.00 ^c	103.70 ^b	108.33 ^b	116.66 ^a	6.70
MCH (%)	34.61 ^b	33.60 ^b	33.70 ^b	34.79 ^b	38.88 ^a	1.50
MCHC (%)	30.00 ^c	33.66 ^a	32.50 ^b	32.11 ^b	33.84 ^a	1.33

abcde: means along the same row with different superscripts are significantly different (P<0.05)

Table 4: Haematological indices for local turkey poults fed varying levels of rice milling waste (finisher phase)

Haematological Indices	T ₁ (0%)	T ₂ (25%)	T ₃ (50%)	T ₄ (75%)	T ₅ (100%)	SEM
Hb (g/100ml)	9.50 ^a	9.00 ^a	10.00 ^a	8.50 ^b	8.00 ^b	1.25
PCV (%)	24.60 ^c	24.00 ^c	30.00 ^a	27.00 ^b	20.00 ^d	0.80
WCB (10 ⁶ /mm ³)	6.90 ^a	5.80 ^b	7.25 ^a	5.60 ^b	5.00 ^c	0.51
RBC (X10 ⁶ /mm)	2.00	2.20	2.60	2.30	1.70	0.98
MCV (u/m ³)	125.00 ^a	109.05 ^b	115.35 ^a	117.39 ^a	117.52 ^a	1.28
MCH (%)	35.00 ^c	31.81 ^d	33.45 ^c	36.73 ^b	47.57 ^a	1.23
MCHC (%)	39.58 ^a	37.52 ^b	33.33 ^c	33.33 ^c	40.00 ^a	1.57

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

At the growth phase, the Hb, WBC and RBC were optimized at the control and 50% substitution level. The control diet also showed higher values of PCV and MCV compared with other treatment groups. At the finisher phase, similar trend was observed in that, the control diet (0%) and 50% levels showed the highest values of Hb and WBC. PCV was also optimized at 50% (T₃) level of inclusion. Turkey poults placed on T₅ (100%) substitution level, showed the poorest values of Hb, PCV, PBC and RBC at the grower and finisher phases.

However, at the finisher phase, an increasing trend of WBC and Hb was observed generally for all the diets when compared with the grower phase. This indicates that WBC and Hb increased with age, suggesting that, the more matured the birds become, the higher the chances of microbial infection which actually triggers white blood cell production. WBC has been reported to be an organelle that provides a defense against diseases (Robert *et al.*, 2003). Increased values of WBC observed in poults fed diet 3 (50%) indicated that birds fed with this diet has good ability to

fight diseases and foreign bodies. This observation upholds the report of Wayne *et al.* (1988) who showed that production of WBC is a response, which provides defensive mechanism against diseases. Similarly, the high values of Hb observed in diet substituted with Rice milling waste to the tune of 50% at the grower and finisher phases suggested good ability of these birds to transport oxygen, which enhances tissue respiration (Solomon *et al.*, 1998).

The enhanced PCV (30.00) observed at 50% level of substitution at the finisher phase is a function of the RBC. Substituting rice milling waste for maize to the tune of 50% led to a non-significant ($P>0.05$) numerical rise in red cells (2.60). Further substitution, up to 100% resulted in a fall in PCV value (20.00). Oladele *et al.* (2006) reported the range of 24.39 and above for healthy birds while Ross *et al.* (1978) reported the range of 25-45 for poultry. However, all the haematological indices considered, fall within the established range by Ross *et al.* (1978) with the

exception of the PCV and RBC of T₅ (100%) group, which fall below the established range (21.00 and 1:80) at the grower phase and (20.00 and 1.70) at the finisher phase. The abnormal range of MCH could be as a result of poor ratio of red blood cells to haemoglobin concentration. According to Wayne *et al.* (1988), abnormal range of MCH implies anaemic conditions, particularly hypochromic anaemia, which becomes pronounced at a very high level of fiber substitution (100%).

The increase in numerical values of haemoglobin concentration, WBC and RBC observed in turkeys fed 50% rice milling waste indicate that rice milling waste can be used as a substitute for maize to the tune of 50% in growing and finishing local turkeys.

Blood Chemistry

The blood chemistry indices of the local turkeys are shown in tables 5 and 6.

Table 5 Blood chemistry of local turkey poult fed varying levels of rice milling waste (grower phase).

Measurement	T ₁ (0%)	T ₂ (25%)	T ₃ (50%)	T ₄ (75%)	T ₅ (100%)	SEM
Creatinine (mg/dl)	1.01 ^a	1.09 ^c	0.90 ^d	1.12 ^b	1.25 ^a	1.01
Urea (mg/dl)	21.50 ^c	22.02 ^c	21.69 ^c	23.40 ^b	25.50 ^a	1.10
Alkaline phosphate (u/l)	380 ^c	400 ^c	378.00 ^c	545.00 ^b	625.00 ^a	50.00
Albumen (g/l)	21.00 ^b	21.40 ^b	23.00 ^a	19.00 ^c	18.50 ^c	1.17
Globulin (g/l)	16.00 ^a	15.54 ^a	15.80 ^a	15.00 ^b	14.54 ^c	0.54
Total protein (g/l)	37.00 ^a	36.94 ^b	38.80 ^a	34.00 ^c	33.04 ^c	1.51

abcde: means along the same row with different superscripts are significantly different ($P<0.05$)

Table 6: Blood chemistry of local turkey poult fed varying levels of milling waste (finisher phase).

Measurement	T ₁ (0%)	T ₂ (25%)	T ₃ (50%)	T ₄ (75%)	T ₅ (100%)	SEM
Creatinine (mg/dl)	1.00 ^b	0.85 ^c	0.70 ^c	1.10 ^b	1.15 ^a	0.01
Urea (mg/dl)	15.50 ^c	16.00 ^c	14.05 ^d	18.62 ^b	25.00 ^a	0.51
Alkaline Phosphate (u/l)	250.00 ^c	305.00 ^b	248.05 ^c	300.00 ^b	400.00 ^a	10.22
Albumen (g/l)	18.05 ^a	17.45 ^b	18.50 ^a	16.50 ^c	16.00 ^c	0.84
Globulin (g/l)	18.30 ^a	17.30 ^b	18.00 ^a	16.00 ^c	12.01 ^d	0.54
Total protein (g/l)	36.35 ^a	34.75 ^b	36.50 ^a	32.50 ^c	28.02 ^d	0.54

abcde: means along the same row with different superscripts are significantly different ($P<0.05$)

The results indicated significant differences ($P < 0.05$) among the treatment mean values. The highest creatinine, urea and alkaline phosphate values were recorded in birds fed T₅ (100%). Birds fed T₃ (50%) recorded generally the highest Albumen, Globulin and Total protein concentrations, which were comparable to the control. Serum biochemical values for Albumen, Globulin and Total protein were lowest in birds fed T₅ (100%) at the grower and finisher phases.

High values of creatinine, urea and Alkaline phosphate observed in treatment 5 at the grower and finisher phases were indication of poor quality feed. Creatinine makes birds prone to muscular wastage. The lower the creatinine concentration the better the protein value, as evidenced in treatment 3 which showed lowest value of creatinine concentration with the highest protein value. This observation is in agreement with the report of Akinmutimi (2004) which showed that reduction in creatinine concentration of broiler birds led to better protein values.

High urea values suggest poor metabolism of protein. Similarly, lower values of Albumen Globulin and Total protein observed in treatment 5 suggest lower ability of the blood to clot, hence poor prevention of hemorrhage, poor tissue deposition and low ability to fight foreign bodies or diseases.

The enhanced values of Albumen, Globulin and total protein concentrations observed in treatment 3 (50%) proved it is superior to other treatment groups, suggesting that the blood of local poult placed on this diets has ability to clot, prevent haemorrhage, and high ability to fight diseases. This observation is in consonance with the findings of Robert *et al.* (2003) who proved that birds exhibiting high levels of Albumen, Globulin and Total protein showed high biological performance with

very low mortality. This further confirms the recommendation of 50% rice milling waste substitution for growing and finishing local turkey poult.

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