

THE PERFORMANCE OF BROILER CHICKS FED ON DIETS CONTAINING RICE OFFAL AND CASHEW NUT (*ANACARDIUM OCCIDENTALE* LINN) REJECT MEAL

PRODUCTIVIDAD DE POLLOS BROILER ALIMENTADOS CON RESIDUOS DE ARROZ Y
HARINA DE RESIDUOS DE ANACARDO (*ANACARDIUM OCCIDENTALE*)

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ADDITIONAL KEYWORDS

Digestibility. Blood parameters. Birds.

PALABRAS CLAVE ADICIONALES

Digestibilidad. Composición sangre. Aves.

SUMMARY

The effects of replacing rice offal (RO) with cashew nut reject meal (CNM) on the performance of broiler chickens were determined in a 56-day study using 300 Arbor Acre strains. The birds were randomly allocated into four dietary treatment groups with three replications of 25 birds each. The diets were formulated to contain 20 percent RO and 0 percent CNM, 15 percent RO and 5 percent CNM, 10 percent each for both RO and CNM, and 5 percent RO and 15 percent CNM for diets 1 to 4, respectively. Feed intake, weight gain and final weight gain were lowest ($p>0.05$) in diet 1 while the highest performance indices were observed in diet 4. The best feed/gain of 3.27 was also recorded in diet 4. Protein efficiency ratio increased with increasing CNM inclusion. Dietary treatments had no significant ($p>0.05$) on nutrients digestibility. The mortality recorded was not due to treatment effects. There was no significant ($p>0.05$) effect of the diets on creatinine while total protein, albumin, globulin and uric acid levels were significantly ($p<0.05$) influenced. The quality of protein in the diets significantly ($p<0.05$) influenced the comparable haematological values obtained across treat-

ments. Dietary treatments had no significant ($p>0.05$) effect on nutrient digestibility. Cost of feed per kg increased from \$0.34 in diet 1 to \$0.36 in diet 4 while the total cost of feed consumed per bird increased from \$1.90 for diet 1 to \$2.14 for diet 4. Cost of feed per kg weight gain also showed no significant ($p>0.05$) difference. Diet 2 recorded the lowest cost (\$1.18) of feed consumed/weight gain. It was then concluded that 15 percent CNM could replace 5 percent RO in the diets of broiler chickens if yield per unit feed consumed is considered.

RESUMEN

Los efectos de sustituir residuos del arroz (RO) por harina de residuos de anacardo (CNM) sobre la productividad de pollos broiler fueron determinados en un estudio de 56 días usando 300 individuos Arbor Acre. Las aves fueron asignadas aleatoriamente a cuatro grupos dietéticos con tres réplicas de 25 aves por cada tratamiento. Las dietas fueron formuladas para contener: 1) 20 p.100 RO y 0 p.100 CNM, 2) 15

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p.100 RO y 5 p.100 CNM, 3) 10 p.100 de RO y 10 p.100 CNM, y 4) 5 p.100 RO y 15 p.100 CNM. La ingestión de alimento, el aumento de peso y el aumento final del peso fue más bajo ($p>0,05$) en la dieta 1, mientras que los más altos índices de rendimiento fueron observados en la dieta 4. La mejor pienso/ganacia de 3,27, también fue registrada en la dieta 4. El cociente de eficacia de la proteína aumentó con el aumento de la inclusión de CNM. Los tratamientos dietéticos no tuvieron ningún efecto significativo ($p>0,05$) en la digestibilidad de los alimentos. La mortalidad registrada no fue debida a los efectos del tratamiento. No hubo efecto significativo ($p>0,05$) de las dietas en la creatinina mientras que la proteína total, la albúmina, la globulina y los niveles de ácido úrico ($p<0,05$) fueron influenciados perceptiblemente. La calidad de la proteína en las dietas ($p<0,05$) influyó perceptiblemente los valores hematológicos comparables obtenidos en los tratamientos. Los tratamientos dietéticos no tuvieron ningún efecto significativo ($p>0,05$) en la digestibilidad de los nutrientes. El coste de alimentación por kilogramo aumentó a partir de 0,34 \$ en la dieta 1 a 0,36 \$ en la dieta 4 mientras que el coste total de alimentación consumida por ave aumentó a partir de 1,90 \$ para la dieta 1 a 2,14 \$ para la dieta 4. El coste de alimentación por kg de aumento del peso tampoco mostró diferencia significativa ($p>0,05$). La dieta 2 registró el costo más bajo (1,18 \$) de alimento consumido/aumento del peso. Se concluyó que el 15 p.100 CNM podría sustituir al 5 p.100 RO en las dietas de broilers si se considera la producción por unidad de alimento consumido.

INTRODUCTION

The future livestock production systems will rely not only on maximizing the productive rate of a given animal species but on helping to meet the demands of society for the necessities of life (FAO, 1995). These needs will

have to be met for their main part with feed resources such as the by-products and residues of cropping systems designed to optimize production of biomass with minimal external inputs. Cashew nut reject meal (CNM) has been found to be an excellent feed resource in poultry diet (Fetuga *et al.*, 1973; Onifade *et al.*, 1999 and Sogunle *et al.*, 2005).

Full-fat cashew nut (*Anacardium occidentale* Linn) is a processed cashew nut whose oil is retained. The processing of the raw nut reveals that 60-65 percent is of commercial value while the rest is often discarded either as broken or scorched kernels (Fetuga *et al.*, 1973). The discarded nuts contain a significant quantity of high-protein material which is particularly useful for feeding monogastric animals (Fetuga *et al.*, 1973). The proximate composition of the discarded nut is (in an air-dry basis): 95.61 percent, dry matter; 20.36 percent, crude protein; 2.10 percent, crude fibre; 45.49 percent, ether extract; 3.65 percent, ash and 28.40 percent nitrogen-free extract (Sogunle *et al.*, 2005).

Rice offal (RO) has been reported to contain growth-depressing anti-nutritional factors such as silica (Oyeyiola, 1999) but may take part as an ingredient in the diets of broiler chickens within some limits. Wudiri (1991) reported that RO makes up 40 percent of parboiled rice. Nigeria produces about 20,000 metric tones of rice offal from 500,000 metric tones of rice produced annually in Nigeria. The proximate composition of RO was said to be (in an air-dry basis) 5.71 percent, CP; 5.01 percent, EE; 23.38 percent, NFE; 44.94 percent, CF; 20.97 percent,

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ash and dry matter of 91.60 percent (Dafwang and Shwarmen, 1996).

The study was carried out to determine the performance, economic benefits and biochemical indices of broiler chickens fed on diets based on maize and containing significant amounts of CNM and RO.

MATERIALS AND METHODS

The study was carried out in the poultry unit of the Teaching and Research Farm, University of Agriculture, Abeokuta, Nigeria (7° 15' N, 3° 25' E). The CNM used in the experiment was obtained from the Cashew nut Processing Unit, University of Agriculture, Abeokuta. The RO used in the experiment was obtained from a nearby market in Abeokuta, Nigeria. A total of 300 day-old Arbor acre strains of broiler chicks were obtained from Obasanjo Farms Nigeria limited, Ogun State, Nigeria. The 300 chicks were randomly allotted to 12 groups of 25 birds each and then brooded for 2 weeks using coal pots as sources of heat. Each treatment was assayed in 3 groups of 25 birds each. Diets 1 to 4 contained 20 percent, 15 percent, 10 percent and 5 percent, respectively of RO and 0 percent, 5 percent, 10 percent and 15 percent, respectively of CNM (**table I**). The contents of soyabean meal and maize of the diets were altered to confine the protein and energy values within the recommended range (NRC, 1994). The diets were fed to the birds from day-old to the 56th day of life.

At the 49th day of the experiment, 3 birds were randomly selected from

each replicate and transferred into the metabolic cage for digestibility trials. Three days acclimatization period was observed followed by a day fasting before the commencement of the trial. Feed intake and total faecal output were recorded for 4 days while the wet faecal outputs were oven dried to constant weight. The proximate compositions of feed and dried faecal outputs were determined by the methods of A.O.A.C. (1990). The procedure of Vogtmann *et al.* (1975) was used in calculating the percent age digestibility of protein, fat, crude fibre and nitrogen-free extract. This was done by multiplying the proximate composition of the feed by the digestion coefficient.

Also, at the 56th day of the experiment blood samples (2ml each) were collected by cardiac puncture after euthanization from 3 birds per replicate group into ethylene diamine tetra-acetate (EDTA) bottles for biochemical and haematological analyses. Packed cell volume (PCV), Haemoglobin concentration (Hb) and red blood cell (RBC) were determined using Wintrob's microhaematocrit, colorimetry-cyanomethaemoglobin method and improved Neubauer haemocytometer, respectively (Jain, 1986). Serum total protein, albumin and globulin were analyzed colorimetrically using diagnostic reagent kit (Reanal Diagnosztikai Reagents, Keszlet, Hungary).

The market costs of the ingredients at the time of the study was used to calculate the cost of feed kg⁻¹ diet (\$), cost of feed consumed bird⁻¹ (\$) and the cost of feed consumed/ weight gain (\$)

All data were analyzed by One-

Table I. Composition (percent) of the experimental diets varying in rice offal and cashew nut reject meal offered to growing chicks. (Composición (p.100) de las dietas experimentales con residuos de arroz y harina de residuos de anacardo ofrecidas a pollos en crecimiento).

Ingredient	Diets			
	1	2	3	4
Maize	43.00	46.00	49.00	52.00
Rice offal	20.00	15.00	10.00	5.00
Cashew nut reject meal	-	5.00	10.00	15.00
Soyabean meal	24.25	21.25	18.25	15.25
Fish meal (72 percent CP)	2.50	2.50	2.50	2.50
Blood meal	5.00	5.00	5.00	5.00
Bone meal	3.00	3.00	3.00	3.00
Oyster shell	1.00	1.00	1.00	1.00
Vititamin/Mineral premix	0.25	0.25	0.25	0.25
Methionine	0.50	0.50	0.50	0.50
Lysine	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00
Determined analysis				
Dry matter (percent)	92.05	91.50	91.50	90.50
Crude protein (percent)	22.75	22.45	21.56	21.50
Crude fibre (percent)	4.05	4.00	3.57	3.25
Ether extract (percent)	2.65	2.87	2.95	3.01
Nitrogen free extract (percent)	56.54	57.86	60.78	61.64
Metabolizable energy (MJ/kg)* 12.83	13.05	13.38	13.52	
Phosphorus (percent)*	0.87	0.87	0.87	0.87
Calcium (percent)*	1.21	1.21	1.21	1.21

Premix contained the following: (Univit, 15 Roche) 1500 I.U, Vit. A, 1500 I.U, Vit. D, 3000 I.U, Vit. E, 3.0 g, Vit. K, Vit. B₂ 0.3 g, Vit. B₆, 8.0 mg, Vit. B₁₂, 8.0 g, Nicotinic Acid, 3.0 g, Ca-Pantothenate, 50 mg, Fe, 10.00 g, Al, 0.2 g, Cu, 3.5 mg, Zn, 0.15 mg, I, 0.02 g, Co, 0.01 g. *Calculated values.

way ANOVA (Nosis, 1999). A probability of $p < 0.05$ was required for statements of significance. Significant ($p < 0.05$) means were then established using Duncan's Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

The proximate composition of the

diets is presented in **table I**. The dry matter, crude protein and crude fibre contents decreased slightly from diets 1-4 with increasing CNM inclusion while, ether extract, nitrogen-free extract and metabolizable energy increased from diets 1-4. However, the crude protein content of the diets did not follow any specific trend.

The performance of the birds fed experimental diets is presented in **table**

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Table II. Performance characteristics and economic benefits of birds fed diets varying in rice offal and cashew nut reject meal (75 birds/ diet). (Características de rendimiento y beneficios económicos de aves alimentadas con dietas con residuos de arroz y residuos de harina de anacardo (75 aves por dieta)).

Parameters	Diets				SEM
	1	2	3	4	
Initial weight (g/bird)	88	85	88	90	1
Final weight (g/bird)	1520	1763	1680	1880	76
Weight gain (g/bird)	1432	1678	1592	1790	76
Feed intake (g/bird)	5570	5640	5550	5850	69
Feed: gain	3.88	3.36	3.49	3.27	0.13
Protein Efficiency ratio	1.13 ^e	1.32 ^b	1.33 ^b	1.42 ^a	0.03
Cost of feed/kg (\$)	0.34 ^d	0.35 ^c	0.36 ^b	0.37 ^a	0.006
Cost feed consumed/bird(\$)	1.90 ^e	1.97 ^b	1.98 ^b	2.14 ^a	0.05
Cost feed consumed/ wt.gain(\$)	1.33	1.18	1.25	1.20	0.13
Mortality (percent)	9.70	8.33	2.90	2.90	1.80

^{abcd}Means within the same row with different superscripts differ significantly ($p < 0.05$). \$ 1.00= N 139.5.

II. The values were not significantly ($p > 0.05$) different except for protein efficiency ratio ($p < 0.05$). The highest final weight and weight gain were obtained in diet 4 (5 percent RO and 15

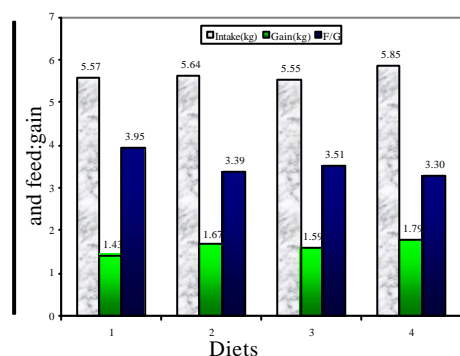


Figure 1. Graph of performance indices of birds fed diets varying in rice offal and cashew nut reject meal. (Índices de rendimiento de aves alimentadas con residuos de arroz y de harina de residuos de anacardo).

percent CNM) while diet 1 (20 percent RO and 0 percent CNM) recorded the lowest. The highest feed intake (5850 g) was recorded in diet 4 (5 percent RO and 15 percent CNM) while the lowest (5550g) was obtained in diet 3 (10 percent RO and 10 percent CNM). **Figure 1** also showed the level of fluctuations in the weight gain, feed intake and feed: gain. There was significant ($p < 0.05$) difference in the protein efficiency ratio across treatments. The highest value was recorded in diet 4 (5 percent RO and 15 percent CNM) while the lowest value was recorded in diet 1 (20 percent RO and 0 percent CNM). This supported the study of Oyawoye and Nelson (1999) who reported poor efficiency of feed utilization at high level of rice offal fed to young cockerels. Also, the best feed: gain ($p < 0.05$) of 3.27 was recorded in diet 4. The cost/kg of feed increased

Table III. Blood parameters of birds fed diets varying in rice offal and cashew nut reject meal (3 birds/diet). (Parámetros de la sangre de aves alimentadas con dietas con residuos de arroz y residuos de harina de anacardo (3 aves por dieta)).

Parameters	Diets				SEM
	1	2	3	4	
Haematological indices					
Packed cell volume (p.100)	30.0 ^{bc}	28.0 ^c	32.0 ^b	38.0 ^a	0.50
Haemoglobin (g/dl)	9.50 ^c	9.00 ^d	10.80 ^b	12.30 ^a	0.04
White blood cell (x10 ³ /ml)	30.5 ^b	29.1 ^c	32.0 ^a	28.3 ^c	0.24
Red blood cell (x 10 ⁶ /ml)	1.50 ^b	1.10 ^c	2.40 ^a	2.20 ^{ab}	0.06
Biochemical indices					
Total protein (mg/dl)	55.7 ^d	71.2 ^b	72.9 ^a	64.3 ^c	0.17
Albumin (mg/dl)	27.20 ^b	25.30 ^c	28.10 ^a	28.10 ^a	0.03
Globulin (mg/dl)	28.5 ^d	45.9 ^a	44.8 ^b	36.2 ^c	0.19
Uric acid (mg/dl)	2.16 ^b	2.40 ^a	1.80 ^c	2.10 ^b	0.03
Creatinine (mg/dl)	1.20	1.50	1.30	1.50	0.06

^{abcd}Means within the same row with different superscripts differ significantly ($p < 0.05$).

($p < 0.05$) with increasing levels of CNM. The highest cost was recorded in diet 4 (5 percent RO and 15 percent CNM) while the diet 1 (20 percent RO and 0 percent CNM) recorded the lowest value. The cost of feed /kg showed that it economically viable to feed diet 1. However, from the findings of Brown and McCartney (1977), it is obvious that diet 4 gave the best result in terms of yield per unit feed consumed.

Table III shows that the blood parameters measured were significantly ($p < 0.05$) influenced by the treatments except creatinine. The total protein and albumin and globulin contents were significantly ($p < 0.05$) affected by the dietary treatments. However, the values were within the normal ranges reported by Jain (1986). The values obtained for uric acid significantly fluctuated across the dietary treatments. The similar quality

of proteins in the diets could be responsible for the comparable ($p < 0.05$) WBC values across treatments. These values were within the normal range obtained for birds. (Mitruka and Rawnsley, 1977).

The nutrient utilization and digestibility presented in **table IV** revealed that different levels of inclusion of RO and CNM had significant ($p < 0.05$) effects on the nitrogen output (g day^{-1}), nitrogen retained (g day^{-1}) and nitrogen retention (percent). Diet 4 gave the lowest (2.12 g) nitrogen output and the highest (63.3 percent) nitrogen retention, indicating that the inclusion of 5 percent RO and 15 percent CNM in a diet based on maize and soyabean meal enhances the utilization of nitrogen in the birds. Onifade (1993) reported similar result. The digestible nutrients were not affected ($p > 0.05$) by the treatment effects. The increase

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Table IV. Nutrient utilization and digestibility of birds fed diets varying in rice offal and cashew nut reject meal (3birds/diet). (Utilización de nutrientes y digestibilidad en aves alimentadas con dietas con residuos de arroz y residuos de harina de anacardo (3 aves por dieta)).

Parameters	Diets				SEM
	1	2	3	4	
Nitrogen intake day ⁻¹ (g)	6.12	6.04	5.80	5.78	0.08
Nitrogen output day ⁻¹ (g)	2.41 ^a	2.53 ^a	2.21 ^b	2.12 ^b	0.09
Nitrogen retained day ⁻¹ (g)	3.71 ^a	3.62 ^b	3.59 ^c	3.66 ^b	0.03
Nitrogen retention day ⁻¹ (p.100)	60.6 ^{ab}	59.9 ^b	61.9 ^{ab}	63.3 ^a	0.75
Digestible dry matter (p.100)	64.5	57.11	64.94	56.84	2.2
Digestible crude protein (p.100)	69.9	63.2	68.7	62.7	1.9
Digestible crude fibre (p.100)	68.4	61.9	66.2	56.9	2.5
Digestible ether extract (p.100)	61.59	52.92	60.81	52.32	2.5
Digestible NFE (p.100)	70.9	64.4	71.6	65.56	1.8

^{abcd}Means within the same row with different superscripts differ significantly (p<0.05).

might be due in part to reduced rate of passage and less excretion of nutrients. Recent experiments (Cao *et al.*, 1998) in poultry have shown a beneficial effect of insoluble fibre on digestibility. The results showed that 20 percent inclusion level of RO was a tolerable level for broiler chickens. This negated the findings of Dafwang and Shwarmen

(1996) that 10 percent RO could be tolerated by broiler chickens at the starter level when RO replaced 27.5 percent maize.

From the results obtained, up to 15 percent RO could be replaced by CNM to obtain the best yield per unit feed consumed without any deleterious effect on the blood chemistry.

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