PERFORMANCE OF GROWING PULLETS FED CASSAVA PEEL MEAL DIET SUPPLEMENTED WITH CASHEW NUT REJECT MEAL

RENDIMIENTO DE POLLOS EN CRECIMIENTO ALIMENTADOS CON HARINA DE PELADURAS DE MANDIOCA Y HARINA DE RESIDUOS DE SEMILLA DE ANACARDO

Sogunle,O.M.[1]*, A.O. Fanimo[1], S.S. Abiola[1] and A.M. Bamgbose[2]

[1]Department of Animal Production and Health. University of Agriculture. Abeokuta. Ogun State. Nigeria.
[2]Department of Animal Nutrition. University of Agriculture. Abeokuta. Ogun State. Nigeria.
*Corresponding author: jidesogunle@yahoo.com

ADDITIONAL KEYWORDS

Growing pullets. Haemoglobin concentration.

PALABRAS CLAVE ADICIONALES

Pollos en creciomiento. Concentración de hemoglobina.

SUMMARY

The performance and blood constituents of growing pullets fed cassava (*Manihot esculenta Crantz*) peel meal (CPM) diet supplemented with cashew nut (*Anacardium occidentale* Linn) reject meal (CNM) were studied for 13 weeks using four hundred and thirty-two 9 weeks old Yaafa Brown pullet chicks. The birds were maintained on a grower diet consisting of 3 levels of CPM (0, 10 and 20%) each supplemented with 4 levels of CNM (0, 10, 20 and 30%) in a 3 x 4 factorial experimental layout. The highest weight gain of 7.96 g/bird/day was obtained in diet 3 (0% CPM and 20%CNM) while the highest feed intake of 107.29 g/bird/day and cost of 1 kg feed of $0.31 were obtained in diet 12 (20% CPM and 30% CNM). CPM inclusion in the diets significantly (p<0.05) influenced the haemoglobin concentration and the serum total protein. The growing pullets performed poorly with increasing CPM in the diets but had an improved performance, as CNM was included. It was then concluded that the combination of 10% CPM and 30% CNM was appropriate for enhanced performance of growing pullets.

RESUMEN

El rendimiento y contituyentes sanguíneos de pollos en crecimiento alimentados con harina de peladuras de mandioca (*Manihot esculenta* Crantz) (CPM) suplementados con harina de residuos de semilla de anacardo (*Anacardium occidentale* Linn) (CNM), fue estudiado durante 13 semanas empleando 432 pollitos Yaafa Brown de nueve semanas. Las aves fueron mantenidas con una dieta de crecimiento consistente en tres niveles de CPM (0, 10 y 20%), cada uno de ellos suplementado con cuatro niveles de CNM (0, 10, 20 y 30%), en un diseño factorial 3 x 4. La mayor ganancia de peso fue de 7,96 g/ave/día obtenida con la dieta 3 (0% CPM y 20% CNM) mientras que la mayor ingestión de alimento de 107,29 g/ave/día y coste de 1 kg de alimento de $0,31, se registró con la dieta 12 (20% CPM y 30% CNM). La inclusión de CPM en las dietas influyó significativamente (p<0,05) sobre la concentración de hemoglobina y proteína sérica total. El rendimiento de los pollos en crecimiento se empobreció al aumentar la proporción de CPM en las dietas, aunque el rendimiento mejoró al incluir CNM. Se concluyó que la combinación de 10% de CPM y 30% de CNM, fue apropiada para mejorar el rendimiento de pollos en crecimiento.

INTRODUCTION

In view of high poultry feed cost resulting from the cost of maize and vegetable protein sources such as soyabean meal, it is almost never profitable to feed protein at a level which will maximize animal performance. Hence, there is a need to find

Recibido: 16-2-07. Aceptado: 1-10-07.

an appropriate alternative feed resource which can replace a certain proportion of maize and vegetable protein sources in the diets of growing pullets at a lower cost of production. Many research efforts were invested in the search for alternative energy sources for poultry (Aina, 1990; Eruvbetine *et al.,* 2003). One of such alternatives is cassava. Though it is a staple food for humans, there is increasing interest in its use as a substitute for maize in feeding livestock. The renewed interests in cassava are because of availability throughout the year, efficient production of cheap energy (Hahn and Keyser, 1985), drought tolerance and ability to thrive on marginal soils.

It is noteworthy that the protein content of cassava is of poorer quality (Agunbiade *et al.,* 2001) compared to that of cereal grain. When utilized in replacing cereals in diet for monogastric animals, it becomes imperative to balance for protein deficiencies, which are sometimes expensive. Hence, cashew nut reject meal finds an excellent supplement as both protein and energy source in the diets of poultry (Sogunle *et al.,* 2005). The processing of the raw nut carried out in many of the producing countries revealed that 60-65% are of commercial value while 35-40% of the processed nuts are often discarded either as broken or scorched kernels (Fetuga *et al.,* 1974). The discarded nut is said to contain a significant quantity of high protein material, which is particularly useful for feeding monogastric animals. The inclusion of full-fat cashew nut rejects and cassava peel meal in the diets of the growing pullets was studied to determine the effects of the combination on the bird's performance.

MATERIALS AND METHODS

EXPERIMENTAL SITE

The experiment was carried out in 2006 at the poultry unit (deep litter pen) of the Teaching and Research Farm, University of Agriculture, Abeokuta, Nigeria (7° 15' N, 3° 25' E). The period of the experiment was early dry season (i.e. September-November).

EXPERIMENTAL BIRDS AND MANAGEMENT

Four hundred and thirty two (432), 9 weeks-old Yaafa Brown pullet chicks were used for the study that lasted for 13 weeks. The birds were divided into 12 treatment groups with 3 replications of 12 birds each and were managed intensively in a deep litter pen containing wood shavings (6 cm deep) as litter material. The diets consisted of three levels (0, 10 and 20%) of cassava peel meal with each level supplemented with four levels (0, 10, 20 and 30%) of cashew nut reject meal **(table I)**.

CHEMICAL ANALYSIS

The proximate compositions of the test ingredients and diets were determined by the method of AOAC (1995). The moisture content was determined by oven- drying the diets and faeces to constant weight at 65°C for 26 hours.

BIOCHEMICAL AND HAEMATOLOGICAL ANALYSES

At the 13th week blood samples (2 ml each) were collected via the wing veins of 3 birds per replicate group into ethylene diamine tetra acetate (EDTA) bottles for serum biochemical analysis (total protein, albumin, globulin, uric acid, creatinine ,and glucose) and haematological (packed cell volume, haemoglobin, red blood cell, white blood cell and platelet) analyses. Packed cell volume (PCV), haemoglobin concentration (Hb) and red blood cell (RBC) were determined using Wintrobes 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) (Varley *et al.*, 1980).

Data Collection

Data were collected daily on the birds' body temperature (°C) which was measured via the wing web using a digital clinical thermometer. The prevailing market prices ($) of the ingredients at the time of the study were used to calculate the cost of 1kg feed consumed and the cost of 1kg feed consumed/weight gain (Naira 127.00= $1.00).

Experimental design and statistical analysis

The experimental layout was a 3x4 factorial arrangement. The data obtained were subjected to analysis of variance using SAS (1999). Significant means among variables were separated using Duncan Multiple Range Test (Duncan, 1955) at 5% level of significance.

RESULTS AND DISCUSSION

Table II showed that cassava peel meal (% air-dry basis) contained: 80.95, dry matter; 5.50, crude protein; 21.36, crude fibre; 0.67, ether extract; 66.49, nitrogen-free extract; 21.95, hydrocyanic acid content (mg/kg); while, cashew nut reject meal contained: 95.40, dry matter; 21.20, crude protein; 2.15, crude fibre; 46.21, ether extract; 3.68, ash;

***Table I.** Composition of growers' mash.* (Composición del pienso de crecimiento).

Diets	1	2	3	4	5	6	7	8	9	10	11	12
Ingredients (%)												
Cassava peel meal	0	0	0	0	10	10	10	10	20	20	20	20
Cashew nut meal	0	10	20	30	0	10	20	30	0	10	20	30
Maize	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0
Soyabean meal	10.5	8.5	6.5	4.5	12.5	10.5	8.5	6.5	15.5	13.5	11.5	8.5
Wheat offal	48.0	40.0	32.0	24.0	36.0	28.0	20.0	12.0	23.0	15.0	7.0	0.0
Fish meal	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Bone meal	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Oyster shell	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
*Vit./Min. premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Determined analysis (%)												
Dry matter	88.00	85.00	87.00	85.00	87.00	87.00	87.50	84.00	88.50	83.50	83.00	85.00
Crude protein	15.01	15.24	15.68	15.76	15.37	15.55	15.40	15.39	15.45	15.53	15.61	15.22
Crude fibre	3.17	3.19	2.91	2.86	4.01	3.91	3.65	3.42	4.21	4.07	4.18	4.23
Ether extract	4.50	3.50	4.00	5.00	4.50	3.00	5.00	4.50	5.00	3.00	4.00	3.00
Ash	23.77	23.12	23.32	23.71	23.94	22.79	23.29	23.90	23.86	23.98	23.45	23.33
NFE	53.55	54.95	54.09	52.67	52.18	54.75	52.66	52.79	50.98	53.42	52.76	54.22
**Calcium	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36
**Phosphorus	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68
ME(MJ/kg)	12.60	12.61	12.62	12.63	12.10	12.11	12.13	12.14	11.58	11.59	11.60	11.64

*Vit./Min. Premix contained: Premix (Embavit No 90) contained Vit. A, 10 000000 iu; D_3, 2 000000 iu ; E, 12500 iu; K, 1.30 g; B_1, 1.30; B_2, 4.00 g; D Calcium-Pantothenate, 1.30 g; B_6, 1.30 g; B_{12}, 0.01 g; nicotinic acid, 15.00 g; folic acid, 0.05 g; biotin, 0.02 g; Co, 0.20 g; Cu, 5.00 g; Fe, 25.00 g; I, 0.06 g; Mn, 48.00 g; Se, 0.10 g; Zn, 45.00 g; choline chloride, 200.00 g; BHT, 50.00 g. **Calculated.
NFE: Nitrogen-free extract.

Table II. *Proximate composition (%) of CPM and CNM (air-dry basis).* (Composición nutritiva de CPM y CNM, % sobre material seco al aire).

	CPM	CNM
Dry matter	80.95	95.40
Crude protein	5.50	21.20
Crude fibre	21.36	2.15
Ether extract	0.67	46.21
Ash	5.98	3.68
Nitrogen-free extract	66.49	26.76
Hydrocyanic acid (mg/kg)	21.95	ND

CPM= Cassava peel meal; CNM= Cashew nut reject meal; ND= Not determined.

and 26.76% nitrogen-free extract. The CPM cyanide content (21.95 mg/kg) was lower than the optimum tolerable level of 100 mg/kg reported by Tewe (1975; 1983). Hence, the variety used in the study was a low cyanide variety (IITA, 1994). In addition the proximate composition of CNM agreed with the values reported by Sogunle *et al.* (2005).

The single effect of CPM inclusion levels on the performance of growing pullets shown in **table III** revealed significant ($p<0.05$) differences in all the parameters considered except in the mortality and the cost of 1kg feed. The average body temperature of the birds was highest (41.5°C) in 10% CPM inclusion comparable to the values obtained at 0% CNM inclusion. The values, though increased with increasing CPM in the diets were within the reported values of 41-42°C recorded for birds (Marsden and Morris, 1987). The final weight (g/bird) and the weight gain (g/bird/day), feed efficiency and protein efficiency ratio decreased with increasing CPM inclusion in the diets. However, the cost of feed consumed per weight gain and the mortality increased with increasing CPM inclusion in the diets.

Moreover, the single effect of CNM on performance showed depressed significance ($p>0.05$) in all the parameters considered except in the cost of feed consumed and the cost of feed consumed per weight gain. The average body temperature of the birds (°C) decreased with increasing CNM inclusion in the diets. The cost of 1kg feed, cost of feed consumed ($) and the cost of feed consumed per weight gain ($/g) increased with increasing CNM inclusion levels. The highest values of $0.03 and $0.01/g were obtained in the cost of feed consumed and the cost of feed consumed per weight gain, respectively, at the 30% CNM inclusion levels. Mortality decreased with increasing CNM inclusion in the diets thereby confirming the reports of Onifade *et al.* (1999) that CNM is an excellent feed resource.

CPM inclusion in the diets significantly ($p<0.05$) influenced the haemoglobin concentration (g/dl) and the serum total protein (g/dl). The highest value of 11.55 g/dl was obtained at the 10% CPM inclusion level for haemoglobin while 51.87g/dl was obtained at 20% CPM inclusion level comparable only to 51.63 g/dl at 10% CPM inclusion level were obtained for the serum total protein. The red blood cell (RBC) and serum albumin increased with increasing CPM inclusion levels in the diets, but the white blood cell (WBC) decreased with increasing CPM inclusion levels in the diets. On the other hand, increase in CNM inclusion levels significantly ($p<0.05$) reduced the packed cell volume whereas it showed varying effects on the serum glucose, though, the highest value of 68.21 g/dl was obtained at 30% CNM inclusion.

The interactive effect of CPM and CNM inclusion in the diets on the performance characteristics and cost benefits of growing pullets **(table IV)** showed no significant ($p>0.05$) differences in all the parameters across treatments. The average body temperature (°C) of the birds ranged from 41.1 in diets 1 (0% CPM and 0% CNM) and 11 (20% CPM and 20% CNM) to 41.7 in diet 5 (10% CPM and 0% CNM). Hence, the highest body temperature was obtained in diet 5 (10% CPM and 0% CNM). The highest weight gain of 7.96 g/bird/day was obtained in diet 3 (0% CPM and 20% CNM) while the highest feed intake of 107.29 g/bird/day and cost of 1kg feed of $0.31 were obtained in diet 12 (20% CPM and 30% CNM). The nature of the feed could probably confer some astringency on them and thereby reduce their palatability and consumption. This could result to a reduced availability of nutrients for growth purposes, hence, the relatively reduced performance of the growing pullets (Ologhobo and Balogun, 1987).

The results of the interactive effects of CPM and CNM diets on the haematological parameters, nitrogen utilization and nutrient digestibility of growing pullets **(table V)** revealed statistical similarities ($p>0.05$) in all the parameters considered on hematology across treatments. However, the range of values obtained was within normal

Table III. *Single effect of CPM and CNM diets on the performance, cost benefits and haematological parameters (9 birds/treatment) of growing pullets.* (Efecto aislado de las dietas con CPM y CNM sobre el rendimiento, coste-beneficio y parámetros hematológicos (9 aves por tratamiento) de pollos en crecimiento).

	CPM inclusion levels				CNM inclusion levels				
	0%	10%	20%	SEM	0%	10%	20%	30%	SEM
Performance									
Ave. bird body temp. °C	41.4^b	41.5^a	41.4^a	0.18	41.5	41.4	41.4	41.4	0.18
Initial wt. (g/bird)	671.69^a	606.60^b	608.55^b	20.49	632.15	636.57	624.54	622.52	17.75
Final wt. (g/bird)	1364.65^a	248.11^b	1228.99^b	44.98	1276.21	1292.91	1281.16	1272.05	38.96
Wt. gain (g/bird/day)	7.59^a	7.05^b	6.82^b	0.33	7.08	7.18	7.21	7.14	0.29
Feed intake (g/bird/day)	99.97^b	98.31^b	103.58^a	2.17	101.86	100.51	99.17	100.95	1.88
Feed efficiency	0.08^b	0.07^a	0.07^a	0.004	0.07	0.07	0.07	0.07	0.003
Protein intake (g/bird)	15.41^b	15.17^b	16.00^a	0.33	15.56	15.52	15.45	15.59	0.29
Mortality (%)	2.08	2.78	5.56	3.11	5.55	2.78	2.78	2.78	2.69
Cost of feed ($)									
1 kg ($)	0.27	0.28	0.29	0.002	0.25	0.27	0.29	0.31	0.20
consumed ($)	0.03	0.03	0.03	0.00	0.03	0.03	0.03	0.03	0.00
consumed/wt.gain ($/g)	0.004	0.004	0.004	0.00	0.003	0.004	0.004	0.004	0.00
Haematology									
Packed cell volume (%)	32.65	34.33	34.11	2.45	35.35^a	34.27^b	33.33^b	33.21^b	1.01
Haemoglobin (g/dl)	10.02^c	11.55^a	11.33^b	0.15	11.34	11.23	11.40	11.27	0.26
Red blood cell (g/dl)	4.25	4.36	4.40	0.17	3.92	3.97	3.85	3.70	0.17
White blood cell (x 10^3/l)	5.95	5.76	5.45	0.23	5.72	5.62	5.39	5.48	1.11
Platelet (g/dl)	152.30	158.00	154.33	13.11	152.13	155.38	158.66	153.32	5.13
Serum total protein (g/dl)	50.38^b	51.63^a	51.87^a	0.84	52.65	51.53	52.65	51.91	1.33
Serum albumin (g/dl)	29.10	29.45	29.52	0.48	30.10	29.70	30.36	30.00	0.68
Serum globulin (g/dl)	21.28	22.18	22.35	1.32	22.55	21.83	22.29	21.91	1.12
Serum uric acid (mg/dl)	3.40	3.39	3.42	0.04	3.51	3.58	3.57	3.50	1.02
Serum creatinine (mg/dl)	1.54	1.55	1.52	0.03	1.40	1.37	1.35	1.34	0.08
Serum glucose (g/dl)	61.23	61.41	61.37	1.31	65.30^b	63.00^c	63.00^c	68.21^a	1.27

[abc]Means in the same row with different superscripts differ significantly ($p<0.05$); CPM= cassava peel meal; SEM= standard error of mean; CNM= cashewnut reject meal: Naira 127.00= $1.00.

Table IV. *Interactive effects of CPM and CNM diets on the performance characteristics and cost benefits of growing pullets.* (Efectos interactivos de las dietas con CPM y CNM sobre características del rendimiento y coste-beneficio de pollos en crecimiento).

	Diets												
	1	2	3	4	5	6	7	8	9	10	11	12	SEM
Cassava peel meal	0	0	0	0	10	10	10	10	20	20	20	20	
Cashew nut meal	0	10	20	30	0	10	20	30	0	10	20	30	
Av. Body temp. °C	41.1	41.4	41.5	41.5	41.7	41.4	41.5	41.5	41.6	41.4	41.1	41.3	0.13
Initial wt. (g/bird)	657.6	670.8	709.7	648.6	625.0	618.1	573.6	609.7	613.9	620.8	590.3	609.2	14.48
Final wt. (g/bird)	1333.0	1386.3	1433.7	1305.5	1256.9	1244.2	1221.4	1269.9	1238.7	1248.2	1188.4	1240.7	31.81
Wt. gain (g/bird)	675.4	715.5	724.0	656.9	631.9	626.2	647.8	660.2	624.8	627.4	598.1	631.5	14.32
Wt. gain (g/bird/day)	7.4	7.8	8.0	7.2	7.0	6.9	7.1	7.3	6.9	6.9	6.6	6.9	0.23
Feed intake (g/bird/day)	103.0	99.6	99.3	98.0	99.4	98.0	98.3	97.6	103.2	104.0	99.9	107.3	1.53
Feed efficiency	0.07	0.08	0.08	0.07	0.07	0.07	0.08	0.07	0.07	0.07	0.06	0.06	0.003
Protein intake (g/bird)	15.47	15.18	15.57	15.44	15.27	15.23	15.14	15.02	15.94	16.14	15.60	16.33	0.23
Mortality (%)	2.78	0.00	2.78	2.78	5.55	2.78	0.00	2.78	8.33	5.56	5.55	2.78	2.19
Cost of													
1 kg feed ($)	0.24	0.27	0.29	0.31	0.25	0.27	0.29	0.31	0.26	0.28	0.30	0.31	0.001
feed consumed ($)	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.00
feed consumed/wt.gain ($/g)	0.003	0.003	0.003	0.004	0.003	0.004	0.004	0.004	0.004	0.004	0.004	0.005	0.02

CPM= cassava peel meal; CNM= cashew nut reject meal; SEM= standard error of mean; Naira 127.00= $1.00.

Table V. *Interactive effects of CPM and CNM diets on the haematological parameters, nitrogen utilization and nutrient digestibility (9 birds/ treatment) of growing pullets.* (Efectos interactivos de las dietas con CPM y CNM sobre los parámetros hematológicos y la utilización del nitrógeno y digestibilidad de los nutrientes para pollos en crecimiento (9 aves por tratamiento).

	Diets												
	1	2	3	4	5	6	7	8	9	10	11	12	SEM
Cassava peel meal (CPM)	0	0	0	0	10	10	10	10	20	20	20	20	
Cashew nut meal (CNM)	0	10	20	30	0	10	20	30	0	10	20	30	
Haematology													
Packed cell volume (%)	31.51	31.12	32.12	31.24	33.05	31.76	30.05	31.00	32.17	32.03	32.06	32.25	2.33
Haemoglobin (g/dl)	9.77	9.76	10.15	10.35	11.01	10.38	10.21	9.93	10.43	10.32	10.38	10.21	0.26
Red blood cell (g/dl)	3.40	3.37	3.56	3.50	3.61	3.62	3.57	3.25	3.67	3.68	3.25	3.25	0.24
White blood cell (x 10^3/l)	5.50	4.89	5.57	4.83	4.92	4.95	4.77	5.46	5.63	5.40	4.92	5.43	0.94
Platelet (g/dl)	152.00	147.63	151.33	150.92	150.03	152.76	153.14	149.13	150.67	150.23	153.10	150.33	12.11
Serum Total protein (g/dl)	51.23	50.33	52.17	52.33	52.61	51.37	50.33	49.67	51.67	51.33	51.17	51.33	2.18
Serum albumin (g/dl)	31.67	31.33	31.76	31.12	32.17	31.67	30.33	29.97	30.33	29.79	30.35	31.33	2.51
Serum globulin (g/dl)	19.56	19.00	20.41	21.21	20.44	19.70	20.00	19.70	21.34	21.54	20.82	20.00	1.79
Serum uric acid (mg/dl)	3.10	3.33	3.37	3.32	3.40	3.35	3.31	3.11	3.12	3.40	3.41	3.33	0.47
Serum creatinine (mg/dl)	1.47	1.43	1.53	1.49	1.55	1.53	1.49	1.47	1.56	1.55	1.55	1.49	0.18
Serum glucose (g/dl)	61.00	61.33	65.00	66.37	66.35	66.23	61.76	61.52	62.33	62.91	63.00	65.33	2.81
Nitrogen intake (g/day)	6.76	6.70	6.90	6.92	6.50	6.90	6.82	6.69	7.03	6.92	6.90	7.00	0.08
Nitrogen output (g/day)	2.46^{a}	2.36^{b}	2.00^{cd}	1.93^{d}	1.76^{f}	2.47^{a}	1.86^{e}	1.82^{e}	1.95^{d}	2.05^{c}	2.01^{cd}	1.98^{d}	0.03
Nitrogen retained (g/day)	4.29^{e}	4.33^{e}	4.90^{b}	4.99^{ab}	4.75^{c}	4.43^{d}	4.96^{ab}	4.94^{b}	5.07^{a}	4.88^{b}	4.90^{b}	5.02^{a}	0.06
Nitrogen retention (%)	63.58^{e}	64.71^{d}	71.04^{bc}	72.12^{ab}	72.97^{a}	64.23^{d}	72.71^{a}	72.73^{a}	72.22^{ab}	70.43^{c}	70.91^{b}	71.78^{b}	0.36
Digestible													
dry matter(%)	47.02	46.76	46.85	46.61	50.98	47.09	48.11	49.33	51.25	51.16	49.80	48.85	0.63
crude protein (%)	63.57^{e}	64.68^{d}	71.05^{b}	72.10^{ab}	72.94^{a}	64.24^{d}	72.75^{a}	72.74^{a}	72.25^{ab}	70.04^{c}	70.95^{b}	71.77^{b}	0.36
crude fibre (%)	65.51^{a}	62.70^{b}	56.69^{f}	59.31^{d}	51.42^{c}	55.80^{g}	55.67^{g}	56.17^{f}	57.41^{e}	61.21^{c}	54.52^{h}	52.28^{i}	0.61
ether extract (%)	82.01^{c}	61.02^{i}	72.02^{f}	72.84^{f}	82.63^{c}	63.02^{h}	73.15^{e}	88.56^{a}	85.86^{b}	74.85^{d}	86.38^{b}	64.62^{g}	0.33
nitrogen-free extract (%)	51.60	55.29	50.06	51.49	53.91	56.89	52.70	52.76	53.67	58.40	54.55	56.06	0.54
Total digestible nutrient (%)	57.61^{c}	57.00^{d}	56.35^{e}	58.37^{bc}	59.77^{a}	57.57^{cd}	59.21^{b}	59.93^{a}	61.74^{a}	59.68^{b}	59.92^{a}	57.90^{c}	0.40

^{abc}Means in the same row with different superscripts are different ($p<0.05$); SEM= standard error of mean.

limits for avian species (Fraser and Mays, 1986). In addition, the results showed significant ($p<0.05$) increase in the nitrogen retention values with increasing inclusion of CPM and CNM in the diets.

From the performance of the growing pullets, it could be adduced that the proportion of dietary energy obtained from fats versus carbohydrates exerted an effect on appetite through a physiological *appetite control center* responsible to the blood levels of certain nutrients such as glucose and amino acids as reported by Mcleod (1982). Jensen *et al.* (1970) corroborated these findings that such an effect might involve an increased ability of the chicks to convert dietary energy from fat into stored energy, thereby ensuring a greater increase in dietary intake. Whitehead and Fisher (1975) observed that dietary fat improved efficiency of feed utilization of poultry diets and the improvement was attributed to the high energy concentration of fats, while Homer and Schiable (1980) attributed it to both increased density and improved palatability. The latter observation was evident from the use of CNM as a dietary fat supplement in the present study which resulted from a higher energy density of the CNM supplemented diets. Thereby, it confirmed the suggestions of Stockstad *et al.* (1983) that fats might also increase energy utilization of other dietary constituents. It was then concluded that the combination of 10% CPM and 30% CNM was appropriate for enhanced performance of growing pullets.

REFERENCES

Agunbiade, J.A., O.A. Adeyemi, O.E. Fasina and S.A. Bagbe. 2001. Fortification of cassava peel meal in balanced diets for rabbits. *Nig. J. Anim. Prod.,* 28: 167-173.

Aina, A.B.J. 1990. Replacing maize with cassava peels in finisher rations for cockerels: The effects on cut-up pieces of eviscerated carcass. *Nig. J. Anim. Prod.,* 17*:* 17-22.

A.O.A.C. 1995. Official methods of analysis. 16th edition, Washington, D.C.

Duncan, D.B. 1955. Multiple range and F tests. *Biometrics,* 11: 1-42.

Eruvbetine, D., I.D. Tajudeen, A.T. Adeosun and A.A. Oloyede. 2003. Cassava (*Manihot esculenta*) leaf and tuber concentrate in diets for broiler chickens. *Bioresource Tech.,* 86: 277-281.

Fetuga, B.L., G.M. Babatunde and V.A. Oyenuga. 1974. Composition and nutritive value of cashew nut to rats. *J. Agric. Fd. Chem.,* 22: 678-682.

Fraser, C.M. and A. Mays. 1986. The Merck veterinary manual: A handbook of diagnosis. Therapy and disease prevention and control for the veterinarian. 6th edition. Merck and Co., Inc. Rahway, New Jersey, U.S.A. p. 1613-1614.

Hahn, S.K. and J. Keyser. 1985. Cassava as a basic food of Africa. *Outlook on Agriculture*, 4: 95-100.

Homer, A. and J. Schiable. 1980. Poultry feeds and nutrition. 2nd Edition, Avi Pub Company. New York. p. 73.

IITA. 1994. International Workshop on Cassava Safety. Acta Horticulture, ISHC. No 373. 1-4 March. IITA. Ibadan. Nigeria.

Jain, N.C. 1986. Schalm's veterinary haematology. 4th Edition. Lea and Febiger. Philadelphia.

Jensen, L.S., G.W. Shumair and J.D. Latshaw. 1970. "Extra caloric" effect of dietary fat for developing turkeys as influenced by calorie to protein ratio. *Poult. Sci.,* 49: 1697-1704.

Marsden, A. and T.R. Morris. 1987. Quantitative review of the effects of environmental temperatures on food intake, egg output and energy balance in laying pullets. *Br. Poult. Sci.,* 28: 693-704.

Mcleod, J.A. 1982. Nutritional factors influencing carcass fat in broilers -A review. *World's Poult. Sci. J.,* 38: 194-200.

Ologhobo, A.D. and A.M. Balogun. 1987. The value of dried fish silage for pullets and the layer hen. *Nig. J. Anim. Prod*., 14: 67-76.

Onifade, A.A., O.O. Tewe, O. Okunola and A.O. Fanimo. 1999. Performance of laying pullets fed on cereal free dietary based on maize offal, cassava peels and reject cashewnut meal. *Brit. Poult. Sci.,* 40: 84-87.

SAS Institute. 1999. SAS User's Guide: Statistics.

Inc. Cary, N.C. p. 923.
Sogunle, O.M., A.O. Fanimo, W.O. Biobaku and A.M. Bamgbose. 2005. The feeding value of full-fat cashew nut (*Anacardium occidentale* Linn) rejects and low cereal diets for broiler chickens. *Nig. J. Anim. Prod.,* 32: 46-53.
Stockstad, E.L.R., T.M. Jukes and W.L. Williams. 1983. Growth promoting effects of aureomycin on various types of diets. *Poult. Sci.*, 32: 1054-1058.
Tewe, O.O. 1983. Thyroid cassava toxicity in animals. In: Cassava toxicity and thyroid: Research and public health issues (F. Delange and R. Ahluwalia, eds.). Proc. of International Workshop on Cassava Toxicity. Ottawa, Canada. IDRC-207e. Ottawa. p. 114-118.
Tewe, O.O. 1975. Implications of cyanogenic glucoside of cassava in the growth and reproductive performance of rats and pigs. PhD thesis, University of Ibadan, Nigeria. 517 p.
Varley, H., A.H. Gowelock and M. Bell. 1980. Determination of serum urea using the acetyl monoxide method. Practical biochemistry. 5th Edition. William Heinemann Medical Books Ltd. London.
Whitehead, C.C. and C. Fisher. 1975. The utilization of various fats by turkeys of different ages. *Br. Poult. Sci*., 16: 481-485.