The feeding value of full-fat cashew nut (*Anacardium Occidentale* Linn) rejects and low cereal diets for broiler chickens

O.M. Sogunle¹, A.O. Fanim¹, W.O. Biobaku¹ and A.M. Bamgbose²

¹Department of Animal Production and Health, University of Agriculture, Abeokuta, Nigeria.

²Department of Animal Nutrition, University of Agriculture, Abeokuta, Nigeria.

Abstract

A study was conducted to examine the economic benefits of using full-fat cashew nut (FFCN) rejects and low cereal diets on 195 Anak 2000 strains of broilers. The five diets used contained: 0%, 25%, 50%, 75% and 100% FFCN for diets 1 to 5, respectively, as a replacement for full-fat soyabean (FFSB). Cost of feed per weight gain reduced from N38.41 in diet 1 to N24.43 in diet 5 and the total cost of feed consumed per bird reduced from N116.17 in diets 1 to N86.24 in diet 5. Weight gain also decreased while feed/gain increased with inclusion level of FFCN in the diets. Revenue/feed cost increased ($P < 0.05$) with inclusion level of FFCN. The treatment also had significant ($P < 0.05$) effect on the nutrients digestibility. The carcass characteristics showed a non-significant ($P > 0.05$) difference between treatments in all the parts except the shanks. The result showed a significant saving in the total cost of feed consumed/bird without any negative effect on the performance of the birds.

Keywords: Full-fat cashew nut reject, economic benefits, broilers, carcass characteristics, cereal diets.

Introduction

Dietary factors principally protein-to-energy ratio can be used to manipulate body fatness in broilers. Increasing this ratio, particularly in broiler finisher diets, can lower the total body fat content and also improve feed efficiency (Jones and Wiseman, 1985). However, these benefits are usually negated by the greater cost of the higher protein diets needed. Hence, the search for and the conversion of full-fat cashew nut (FFCN) rejects into high quality feedstuffs that will replace plant protein source and then supplement favourably the main energy source which currently plays the dual role of feeding

man and his livestock.

Full-fat cashew nut (*Anacardium occidentale*) is a processed cashew nut whose oil is retained. The pericarp of the nut consists of two shells between which lies a resinous layer containing an acrid fluid that has a corrosive effect on the skin, producing blisters on the finger if the shells are broken manually. The discarded nuts which are either broken or scorched kernel contain a significant quantity of high-protein material which is particularly useful for feeding of monogastric animals (Fetuga *et al.*, 1973b). Göhl (1981) and Holland *et al.* (1993) reported that the kernel is rich in Na (2.90mg), K (730mg), Ca (35mg), P

(510mg), Mg (250mg), Cu (2.04mg), Zn (5.7mg), Cl (490mg), Mn (1.8mg), Se (34µg), I (11µg) and Fe (6.2mg). Holland *et al.* (1993) also reported that the kernel contains 6µg carotene (a pro-vitamin A source), 9.1g poly unsaturated fatty acid which contains chiefly linoleic acid, 29.4g mono unsaturated fatty acid and 10.1g saturated fatty acid. The undefatted kernel contains 215g/kg crude protein, 1.4g methionine/16g nitrogen and 454g/Kg ether extract (Fetuga *et al.*, 1973b). The authors reported that the kernel does not have the problem of aflatoxin poisoning as in the case of groundnut.

Full-fat cashew nut (FFCN) is particularly useful in feeding monogastric animals, being a moderate source of protein and an excellent energy resource because of its high fat content (Onifade *et al.*, 1999). It is also of significance in feeding of broilers because of the lower heat increment associated with dietary fat metabolism which is of great advantage for birds in the tropics (Fuller, 1981). Mateos and Sell (1981a), however suggested that specific effects of fat in improving energy utilization were due to retardation of the rate of intestinal feed passage. This then resulted in a marked effect of the source of dietary energy supplement on lipogenesis. The authors then concluded that fat supplementation stimulated it. Hence, the inclusion of full-fat cashew nut (FFCN) rejects in the diets of broilers as an energy supplement. The present study was conducted to evaluate the economic benefits and also examine the carcass characteristics of broilers fed full-fat cashew nut rejects and low cereal diets.

Materials and Methods

Experimental site

The study was carried out in the poultry unit of the Teaching and Research Far, University of Agriculture, Abeokuta, Nigeria (7° 15' N, 3° 25').

Cashew nut

The cashew nut rejects (broken, slightly burnt and scorched kernels) used in the experiment were obtained from the cashew nut processing limited (CAPIL), Ibadan. During processing roasting of the nuts was done to cut down the amount of cashew nut shell liquid and thereby make the shell more brittle for cracking.

Animals and management

A total of 195-day old Anak 2000 strains of broiler chicks were obtained from S and D farms limited, Abeokuta. The 195 chicks were divided into 39 birds per treatment and then brooded for 2 weeks with the use of a coal pot as source of heat, in a deep litter system. Each treatment consisted of 3 replicates of 13 birds each. The diets were fed to the birds from day-old *ad-libitum*. On the day of collection of the birds, they were given vitalityte soluble powder against stress condition. On the second day, they were vaccinated using New Castle Disease vaccine (I/O). On the 7th and 14th days, they were orally immunized against New Castle Disease (Lasota) and Infectious Bursal Disease (Gumboro), respectively, by dissolving 200 doses of each vaccine in 2 litres of chlorine-free water. The birds were also prophylactically treated against bacterial infection at the second week using Terramycin (Chick formula) soluble powder (50g in 60 litres) and against coccidiosis using embazin forte at 30g per 50 litres of

Table 1. Proximate composition of full-fat cashew nut (FFCN) rejects (%).

Fraction	(%)
Dry matter	95.61
Crude Protein	20.36
Crude fibre	2.10
Ether extract	45.49
Ash	3.65
Nitrogen-free extract	28.40

Table 2.

Composition of the experimental diets (%)

Ingredient	Replacement level with FFCN rejects(%)				
	0	25	50	75	100
Maize	52.50	43.33	34.35	25.47	16.51
FFSB	22.00	16.50	11.00	5.50	-
FFCN	-	9.72	19.44	29.16	38.88
Wheat offal	13.00	18.16	22.91	27.67	32.51
Fish meal	2.50	2.50	2.50	2.50	2.50
Blood meal	5.00	5.00	5.00	5.00	5.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Oyster shell	1.00	1.00	1.00	1.00	1.00
Vit./Min. premix*	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Methionine	0.50	0.40	0.30	0.20	0.10
Calculated Chemical Composition					
Crude Protein (%)	21.45	21.39	21.31	21.24	21.17
Phosphorus (%)	0.76	0.76	0.76	0.76	0.76
Calcium (%)	1.37	1.37	1.37	1.37	1.37
Methionine (%)	0.83	0.83	0.83	0.83	0.83
Lysine (%)	1.22	1.48	1.74	1.99	2.25
ME** (Kcal/Kg)	2988.04	2961.72	2940.19	2921.05	2921.05
Energy Protein ratio	139.30	138.46	137.97	137.53	137.98
Determined Analysis					
Crude Protein (%)	21.17	21.08	21.01	20.83	20.79
Crude Fibre (%)	3.89	3.92	4.13	4.27	4.36
Ether Extract (%)	7.12	9.99	13.14	16.38	19.81
Ash (%)	3.24	3.45	3.86	4.04	4.33
Dry matter	90.79	90.50	90.92	91.32	91.09

*Premix (Univit 15 Roche) contained: 1500IU, Vit A; 1500IU, vit. D; 3000IU' vit E; 3.0g, vit.K; 2.5g, vit.B₁; 0.3g, vit. B₆; 8.0mg, vit B12; 8.0g, Nicotinic acid; 3.0g, Ca- Panthothenate; 5.0mg, Fe; 10.0g, Al; 0.2g, Cu; 3.5mg; Zn; 0.15mg, I; 0.02g, Co; 0.01g, Se.

**ME-metabolizable energy FFCN: Full fat cashew nut

water at the 21st day. On the 56th day, 3 birds/treatment were slaughtered by cervical vetting for carcass analysis.

Diets

The diets were formulated as shown in Table 1. Diet 1, the control treatment, contained only full-

fat soyabean (FFSB) as the major plant protein source. FFSB was thereafter replaced in diets 2, 3, 4 and 5 with 25%, 50%, 75% and 100% by FFCN, respectively. Wheat offal was prominently used as energy diluent to moderate the metabolizable energy of the diets to remain within the recommended range for broilers in the tropics. The ex-

perimental diets were fed to the birds from day-old to the 8th week.

Chemical Analysis

The proximate composition of the test ingredient (FFCN) rejects and experimental diets were determined by the method of A.O.A.C. (1990). The results obtained are as shown in Tables 1 and 2, respectively. Moisture contents of the test ingredient and diets were determined at 105°C for 26 hours.

Determination of Nutrient Digestibility

On the 7th week of the experiment, 3 birds from each treatment were transferred to a metabolic crate. The birds were given specific quantity of feeds for a week with 3 days of adjustment and the faeces voided were collected whole and dried to constant weight. The procedure of Vogtmann *et al.*, (1975) was used in calculating the digestibility of fat, crude fibre and nitrogen free extract. The percentage Total Digestible Nutrient (TDN%) was then calculated using the formula:

$$\text{TDN (\%)} = \% \text{ digestible protein} + \% \text{ digestible Nitrogen} - \text{free extract} + \% \text{ digestible fibre} + (2.25 \times \% \text{ digestible ether extract})$$

Economics of Production

The market costs of the ingredients at the time of the study were used to calculate the total cost of the feed per 100kg of the diet, cost of feed per kg diet (N), total cost of feed consumed per bird (N), economy of feed conversion (N) and revenue per feed cost.

Statistical Analysis

The data obtained were subjected to analysis of variance using Mstat-c as described by Scott *et al.*, (1989). The design was Randomized Complete Block (RCB) design. The variables that were significantly ($P < 0.05$) different were compared using Duncan Multiple Range Test (Duncan, 1955).

Results and Discussion

The values obtained on the proximate composition of FFCN rejects confirmed that the crude protein content (20.36%) of the rejects is less than that of FFSB which is 39% whereas its ether extract of 45.49% is remarkably greater than 18% recorded for FFSB (Fetuga *et al.*, 1973b). This thereby supports the inclusion of FFCN rejects in the diets as an energy supplement as well as a favourably replacement for FFSB. Table 2 shows that the replacement of FFSB by FFCN rejects was done by ensuring that the same protein content (%) was supplied in all diets. As the level of replacement with FFCN rejects increased from 0% in diet 1 to 100% in diet 5, the maize content decreased. This was done to realize the benefits of using FFCN rejects as an energy supplement. The metabolizable energy (kcal/kg) and crude protein contents decreased with increasing FFCN rejects inclusion. These did not effect any significant change on the energy/protein ratio of the diets as recommended by NRC, (1994).

The total cost of feed/kg reduced steadily from N29.50 in diet 1 to N20.81 in diet 5 (Table 3). Also the cost of feed/kg weight gain and the total cost of feed consumed/bird showed a reduction from N38.41 in diet 1 to N24.43 in diet 5 and N116.17 in diet 1 to N86.22 in diet 4, respectively. It could therefore be affirmed that it is cheaper to reduce the cereal content of broiler diets by substituting FFCN for FFSB in the diets. The FFCN is thus a potential livestock feed component (Onifade *et al.*, 1999). The results obtained showed significant ($P < 0.05$) increase in revenue/feed cost with inclusion level of FFCN.

The performance characteristics (Table 4) show that there is no significant ($P > 0.05$) difference between treatments in daily weight gain, feed in-

Table 3. Economics of production

Parameter	Replacement level with FFCN rejects (%)					SEM
	0	25	50	75	100	
Initial weight (g/bird)	43.77 ^b	43.77 ^b	43.67 ^b	44.95 ^a	44.95 ^a	0.16
Final weight (g/bird)	1345.67 ^a	1317.33 ^b	1237.00 ^c	1202.10 ^c	1219.00 ^d	15.10
Total weight gain (g/bird)	1302.00 ^a	1273.56 ^a	1193.33 ^b	1157.05 ^d	1174.05 ^b	16.88
Total feed consumed (Kg/bird)	3.94 ^b	3.85 ^c	3.81 ^c	3.75 ^d	4.14 ^a	0.04
Cost of feed/kg(N)	29.50 ^a	27.29 ^b	25.14 ^c	22.98 ^d	20.18 ^a	0.82
Economy of feed conversion (N)	38.41 ^a	34.76 ^b	30.00 ^b	26.59 ^b	24.43 ^c	1.46
Total cost of feed consumed/bird (N)	116.17 ^a	104.93 ^b	95.73 ^c	86.22 ^d	86.24 ^d	3.09
Revenue/feed cost	-	220.66 ^d	436.20 ^c	651.85 ^b	868.51 ^a	81.95

^{a,b,c,d,e} Means within the same row with different superscripts differ significantly (P<0.05).

SEM: Standard Error of Means. FFCN : Full fat cashew nut.

Table 4. Performance characteristics of broiler fed FFCN rejects

Parameter	Replacement level with FFCN rejects (%)					SEM
	0	25	50	75	100	
Daily weight gain (g/day/bird)	23.25	22.74	21.31	20.66	20.96	0.70
Feed intake (g/day/bird)	70.33	68.67	68.00	67.00	74.00	1.61
Feed/gain ratio	3.04 ^a	3.02 ^a	3.20 ^{ab}	3.25 ^{ab}	3.53 ^b	0.11
Protein Intake	14.89	14.48	14.29	13.96	15.39	0.13
Protein efficiency ratio (PER)	1.56	1.57	1.49	1.48	1.36	0.05
Mortality (%)	7.69	5.13	0.00	2.56	15.38	1.18

^{ab} : Means within a row with different superscripts differ significantly (P<0.05).

SEM: Standard Error of Means. FFCN : Full fat cashew nut

Cashew nut rejects in broilers diets.

Table 5. Nutrients digestibility of FFCN rejects

Parameter	Replacement level with FFCN rejects (%)					SEM
	0	25	50	75	100	
Crude protein	80.25 ^b	83.64 ^a	75.61 ^c	79.69 ^b	70.73 ^d	2.22
Ether extract	90.85 ^c	94.59 ^{ab}	92.80 ^b	95.03 ^a	93.41 ^{ab}	0.76
Crude fibre	16.50 ^c	30.39 ^a	22.79 ^c	26.51 ^b	17.32 ^d	0.94
Nitrogen- free extract	85.12 ^b	87.67 ^a	80.58 ^d	83.22 ^c	72.26 ^e	2.78
Total Digestible Nutrient (TDN)	57.81 ^b	61.79 ^a	56.35 ^b	58.44 ^b	52.21 ^c	1.63

a,b,c,d,e: Means within a row with different superscripts differ significantly (P<0.05)

SEM: Standard Error of Means. FFCN : Full fat cashew nut.

Table 6. Carcass characteristics (%)

Parameter	Replacement level with FFCN rejects (%)					SEM
	0	25	50	75	100	
Carcass yield¹						
Dressing percentage	79.20	77.57	83.73	83.87	80.33	2.09
Relative weight of cut-up part²						
Head	3.23	3.38	3.23	3.78	3.40	0.15
Neck	3.33	3.18	3.68	3.66	3.01	0.18
Breast	14.93	15.88	17.25	13.85	14.48	1.31
Back	13.48	14.40	12.50	13.39	12.31	0.68
Drumsticks	9.64	9.24	10.83	10.13	10.25	0.38
Thighs	9.75	9.09	10.33	9.09	10.32	0.52
Shanks	4.34 ^c	5.11 ^{abc}	5.51 ^{ab}	5.95 ^a	4.80 ^{bc}	0.25
Wings	8.06	8.06	8.61	8.92	8.82	0.24
Organ weight³						
Heart	0.49	0.44	0.51	0.55	0.52	0.04
Kidneys	0.08	0.08	0.08	0.10	0.08	0.10
Lungs	0.87	0.72	0.71	0.71	0.69	0.06
Liver	1.91	1.67	1.62	1.90	1.86	0.16
Gizzard	2.20	2.09	2.67	3.05	3.51	0.20
Abdominal fat	0.54	0.65	0.41	0.39	0.38	0.09

^{1,2,3} Values expressed as percentages of live weight

a,b,c: Means within the same row with different superscripts differ significantly (P<0.05).

SEM: Standard Error of Means. FFCN : Full fat cashew nut

take, protein intake, protein efficiency ratio and percentage mortality. On the feed/gain ratio, there was a significant ($P < 0.05$) decrease in the values obtained from 3.04 in diet 1 to 3.53 in diet 5. The results obtained therefore supported the observations of Waldroup *et al.* (1976) and Pesti (1982) that as the level of metabolizable energy in diets increases or decreases, feed intake changes inversely, although the rate of adjustment is not always sufficient to keep energy intake constant. The daily weight gain by the birds reduced steadily from diets 1 to 4 and then increased in diet 5 with a mean value of 20.96g. The decrease confirmed the observations of Fisher and Wilson (1974) that an increase in energy density of feeds, increases the weight gain of broilers and vice versa. However, the results showed a non-significant ($P > 0.05$) difference, indicating a somewhat equal gain.

The nutrients digestibility (Table 5) showed that the digestibility values were lowest in diet 5 and highest in diet 2. The replacement of FFBSB with FFCN in the diets increased ($P < 0.05$) the EE and CF digestibilities. Significant ($P < 0.05$) differences can be seen between treatments on all the digestible nutrients. The TDN (%) showed the least value (52.21) in diet 5 due to the high fibre content of the diet thereby confirming the findings by Onifade (1993), and Onifade and Babatunde, (1997) that the high fibre content of the full-fat cashewnut-based diets interfered negatively with nutrient availability at the tissue level.

In all the parts considered for the carcass characteristics of the birds, there were no significant ($P > 0.05$) differences between treatments except in the shanks. This could have resulted from the differences in the live weight of the birds. There were marginal increases ($P > 0.05$) in abdominal fats in diets 1 and 2, 0.54% and 0.65%, respectively.

The lowest value of 0.38% was recorded in diet 5. The low abdominal fat deposition recorded in all the treatments resulted from the effect of a narrow E/P ratio (Jackson *et al.*, 1982). This then confirms the studies that if supplemental dietary fat is added at the expense of carbohydrates and if the E/P ratio remains constant, fat supplementation of the diet has no significant ($P > 0.05$) effect on carcass fat (Laurin *et al.*, 1985). The benefits of this study are seen in the significant savings in the total cost of feed consumed/bird and the effectiveness of replacing FFBSB and a reduced cereal content with FFCN rejects.

References

- A.O.A.C (Association of Official Analytical Chemist) 1990: Official methods of analysis. 15th edition, Washington, D.C.
- Duncan, D.B. 1955: Multiple range and F tests. *Biometrics*, 11:1-42
- Fetuga, B.L., Babatunde, G.M and Oyenuga, V.A 1973b. Protein quality of some Nigerian feedstuffs II. Biological evaluation of protein quality. *J. Sci. Fd. Agric.* 24: 1515-1523.
- Fisher, C. and Wilson, B.J. 1994. Response to dietary energy concentration by growing chickens. In: T.R. Morris and B.M. Freeman (Editors), *Energy Requirements of Poultry. British Poultry Science, Edinburgh*, pp. 151-184.
- Fuller, H.L. 1981. Formulating broiler feed for hot weather use. In: *Poult digest. June* Pp 321- 323. Butterworth Nottingham.
- Gohl, B.O. 1981. Tropical feeds, feed information summaries as nutritive values. Food

- and Agriculture Organisation (FAO) of the United Nations . Rome. 1981 (12):401.
- Holland, B., Welch.A.A, Unwin, I.D., Buss, D.H., Paul, A.A and Southgate, D.A.T. 1993. Nuts. *The composition of foods. 5th edition. Richard Clay Ltd. United Kingdom* Pp 313.
- Jackson, S., Summers, J.D. and Leeson, S. 1982. Effect of dietary protein and energy on broiler carcass composition and efficiency of nutrient utilization. *Poult. Sci.* 61:2224 – 2231
- Jones, R.L and Wiseman, J. 1985. Effect of nutrition on broiler carcass composition: influence of dietary energy content in the starter and finisher phases. *Brit Poult. Sci.* 26:381-388.
- Laurin, D.E., Touch Burn, S.P., Chavez, E.R and Chan, C.W. 1985. Effect of dietary fat supplementation on the carcass composition of three genetic lines of broilers. *Poult Sci.* 64: 2131-2135.
- Mateos, G.G . and Sell, J.L 1981a. Influence of fat and carbohydrate source on rate of food passage of semi purified diets for laying hens. *Poult. Sci.* 60:2114-2119.
- N.R.C (National Research Council). 1994. Nutrient Requirement of Poultry. National Academy of Science. Washington DC.
- Onifade, A.A. 1993. Comparative utilization of three dietary fibre sources by broiler chickens. Ph. D. Thesis, University of Ibadan, Ibadan, Nigeria.
- Onifade, A.A. and Babatunde, G.M . 1997. Comparative utilization of three tropical by-product feed resources supplemented with or without molasses by broiler chicks. *Arch de Zootec,* 46:137-144.
- Onifade,A.A., Tewe, O.O., Okunola, O. and Fanimu, A. O. 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.
- Pesti, G.M. 1982. Characteristics of the response of male broiler chickens to diets with various protein and energy contents during the growing phase. *Brit. Poult. Sci.* 24:91.
- Scott, P.E, Daniel, G.R and Geordon, A.P. 1989. Mstat-C. Data analysis software VI. 42. Michigan State University, Michigan, U.S.A.
- Vogtmann, H., Pfrirter, P. and Prabuck, A.L. 1975. A new method of determining metabolizability of energy and digestibility of fatty acids in broiler diets. *Brit. Poult. Sci.* 16:531.
- Waldroup, P.W., Mitchell, R.J., Payne, J.R and Johnson, Z.B. 1976. Characterization of the response of broiler chickens to diets varying in nutrient density contents. *Poult. Sci.* 55:130.

(Received 09 March 2004 , Accepted 20 August 2004)