Feeding value of Cashewnut testa for Broiler Chickens

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Abstract

This study was conducted to investigate the response of broiler chickens to diets containing cashewnut testa (CNT). Two hundred and four (204) day-old unsexed Arboracre broiler chicks were randomly allotted to four dietary treatments consisting of three replicates of seventeen chicks each. The treatments consist of a control and three other diets with CNT included at 5, 10 and 15 % as a substitute for wheat offal in the control diet. Cashewnut testa had 1.5, 20.0, 54.0, 17.0, 2.0 and 94.5% crude protein (CP), crude fibre (CF), nitrogen free extract (NFE), ether extract (EE), ash and dry matter (DM), respectively. Weight gain was highest ($P < 0.05$) in birds fed 5% CNT diet (35.24 g) while the lowest value (27.32 g) was for 15% CNT diet. The CNT inclusion increased ($P < 0.05$) feed intake and feed: gain ratio values. The CP retention and digestible EE, CF, NFE, ash, DM and total digestible nutrient were not significantly ($P > 0.05$) affected by CNT inclusion in the diets. The serum metabolites were significantly ($P < 0.05$) affected by the levels of CNT in the diets. Total serum protein increased ($P < 0.05$) with increasing level of CNT in the diets. Among the carcass parameters measured, breast, neck and back weights were highest ($P < 0.05$) for 5 % CNT diet while abdominal fat, small intestine and large intestine weights increased ($P < 0.05$) with increasing levels of CNT in the diets. No significant effect ($P > 0.05$) in juiciness, flavor intensity, tenderness and off flavor was recorded among the meat samples from the broilers fed the diets. Meat lipid and ash increased ($P < 0.05$) in the CNT diets. Cost of feed per kg decreased while cost of feed per kg live weight gain increased ($P < 0.05$) with increasing level of CNT in the diets. It was concluded that 5 % CNT could replace wheat offal in broiler diets.

Keywords: Cashewnut testa, broiler, performance

Introduction

The extremely high price of conventional feed ingredients in Nigeria has increased the feeding cost to about 80% of the total cost of livestock production, especially for poultry and pigs. One of the solutions to this problem is the evaluation of alternative feed ingredients with favourable yield characteristics and of relatively lower cost. In many developing countries there exist large

untapped potential feed stuffs for poultry. Among these is cashew-nut testa (CNT), a by-product obtained during the processing of cashew-nut (*Anacardium occidentale*) to obtain the seeds or kernels which are used for human food. Cashew-nut testa is not utilized by man and it is a potential feed for intensive broiler production. Cashew nut testa has been reported to form about 2 to 5 percent of the whole cashew

fruit components (Agnoloni and Giuliani, 1977). It is normally seen as a waste product that is not utilized as human food or animal feed. In Nigeria for example, a total of 152,000 metric tonnes of cashew nut was produced in 1999 (FAO, 1999), with increasing awareness on the importance of these product to livestock industry, the level of its production can potentially be increased. As the cultivation and production increases, greater quantities of this by-product are likely to become available at little or no cost for feeding livestock. Other by-product from cashew is cashew nut meal. This meal can be regarded as a moderate source of protein and an excellent energy source because of the high fat content. It has been reported that the protein value of cashew nut is equal to that of soybean but higher than of groundnut (Ohler, 1979, Sogunle *et al.*, 2005).

This study was therefore designed to determine the effect of cashew nut testa on the performance, serum chemistry, internal organ characteristics and meat quality of broilers as well as the economics of its inclusion in broiler diets.

Materials and Methods

Test ingredient and diets

The cashewnut testa (CNT) was obtained from the Cashew Processing Factory of the University of Agriculture, Abeokuta, Nigeria. The CNT was processed as described by Fetuga *et al.* (1974). The composition of the test ingredient is shown in table 1. The cashew nut testa was then incorporated into straight broiler diet at 0, 5, 10 and 15% levels. The compositions of the diets are also shown in table 1.

Animals, feeding and management

Two hundred and four (204) unsexed one week old Arbor acre broiler chicks obtained from a commercial hatchery were used. They were weighed and randomly allotted to the four dietary treatments. Each treatment contained 51 birds

was divided into 3 replicates of 17 birds each. The chicks were brooded for 3 weeks and all routine vaccinations and necessary medications were given. Feed and water was available at all times. The birds were reared on deep litter house with wood shavings as litter material. The litter was changed fortnightly.

Experimental design

The experiment was designed to be a Completely Randomized Design and lasted for 56 days. At 7 weeks of age, 2 birds per replicate were randomly selected and kept in metabolic cages for faecal collection. The birds were allowed 4 days of adaptation period to their different diets followed by 3 days of total collection of droppings. The droppings were collected every morning and stored at -18°C . The samples were pooled; individual samples were thawed, mixed and dried.

Data collection

Feed intake and body weight of birds were determined weekly. A record of mortality was kept as it occurred. At the 56th day of the experiment, blood samples (3 ml) were collected into sample bottles from each of the 6 birds per treatment in the metabolic cages slaughtered by cervical dislocation for carcass analysis. The blood samples were thereafter analyzed for serum globulin, albumin, total protein, creatinine, cholesterol, uric acid, serum glutamate oxaloacetate transaminase (SGOT) and serum glutamate pyruvate transaminase (SGPT) levels. The serum biochemical indices were carried out using routine standard clinical chemistry procedures (Olorede *et al.*, 1996).

The slaughtered birds were defeathered after scalding in warm water. They were then cut into retail parts and weighed. Weights of parts were expressed as percentage of the live weight. The prevailing market prices of the ingredients as at the time of the study were used to calculate cost benefit parameters.

Table 1: Composition (%) of the Experimental Diets and Cashew Nut Testa (Cnt).

Ingredients	Inclusion level of cashew nut testa.				CNT
	0%	5%	10%	15%	
Maize	42.50	42.50	42.50	42.50	
Full fat Soya	30.00	30.00	30.00	30.00	
Wheat offal	15.00	10.00	5.00	-	
Cashew nut testa	-	5.00	10.00	15.00	
Blood meal	5.00	5.00	5.00	5.00	
Fish meal	2.50	2.50	2.50	2.50	
Bone meal	3.00	3.00	3.00	3.00	
Oyster shell	1.00	1.00	1.00	1.00	
Salt	0.25	0.25	0.25	0.25	
Vit/Mineral Premix*	0.25	0.25	0.25	0.25	
Methiomine	0.50	0.50	0.50	0.50	
<i>Determined Analysis</i>					
CP (%)	22.90	22.21	21.66	21.10	1.53
Crude fibre (%)	4.18	4.87	4.98	5.13	20.00
Gross Energy (MJ/kg)	14.31	14.42	14.56	14.78	12.19
Ether extract (%)	3.51	3.62	4.14	4.23	17.00
Ash (%)	7.96	8.41	8.65	9.13	2.00
Dry matter (%)	89.80	90.02	89.97	90.08	94.50
Phytate (%)	0.09	0.08	0.12	0.12	1.86
Tannin (%)	0.05	0.10	0.11	0.12	1.24

*Premix contained the following: (Univit. 15 Roche) 1500 I.U., Vit. A, 1500 I.U. Vit. D: 3000 I.U., Vit. E, 3.0g Vit. K, Vit. B2, 0.3g, Vit. B6, 8.0 mg, Vit. B12, 8.0g, Nicotinic Acid, 3.0g, Ca-Pantothenate; 5.0 mg, Fe, 10.00g, Al, 0.2g, Cu, 3.5 mg, Zn, 0.15 mg, I, 0.02g, Co, 0.01g, Se.

Determination of meat quality

The meat sample from the drumstick and thigh region were analysed (AOAC, 1990) to determine dry matter by oven drying, protein by the kjeldahl method, fat by fosslet fat analysis, and ash by muffle furnace. Two samples per carcass were analysed. For the sensory evaluation, frozen meat from the breast were thawed with the skin and bones intact. The meat samples were cooked at

170°C in a conventional pre-heated gas oven for 20 min. Cooked meat samples were removed from the oven, allowed to cool for 10 min, de-boned and muscles cubed. They were served to a 15-member trained panel. A modified hedonic scoring scale was employed (Williams and Damron, 1998). The panelists were instructed to score each samples for juiciness, flavour intensity, tenderness and off flavour. Eight-point

scale was employed for juiciness, flavor intensity and tenderness while 6-point scale was employed for off flavor.

Chemical analysis

Feed, test ingredient and droppings samples were dried at 60°C for 24 h and milled (1mm screen) before analyses and all analyses were performed on dried samples, except for nitrogen (N) of droppings which was determined in fresh samples. Dry matter (DM), ash, CP ($N \times 6.25$), crude fat (EE) and crude fibre (CF) were determined in dry samples according to the AOAC. (1990) methods. Tannin was determined according to Follin Denis methods (AOAC, 1990) and phytate by methods of Wheeler and Farrell (1971). Gross energy was determined by Gallenkamp adiabatic bomb calorimeter (CBA305) method. All analyses were performed in duplicate and are presented on a DM basis.

Statistical analysis

All data were subjected to analysis of variance, and the means were separated using Duncan's Multiple Range Test as outlined by Daniel (1991).

Results and Discussion

The proximate composition of cashew-nut testa revealed that it has 1.53% crude protein which is very low when compared to other fibre feed stuffs as reported by Aduku (1993). However, it has a higher level of fat (ether extract) of about 17% and gross energy of 12.19 MJ/kg. It could therefore be affirmed that cashew nut testa can be a good source of energy and fibre based on its high fat content.

Table 2 showed the growth performance of the broilers. The final live weight of birds decreased ($P < 0.05$) with increasing level of CNT. The decrease weight may be attributed to the tannin and phytate contents of CNT which increased

with increasing dietary levels. The presence of these anti-nutritional factors has been shown to reduce growth rate of broiler due to reduce protein and specific amino acids utilization (Douglas *et al.*, 1992; Elkin *et al.*, 1995). In addition, phytates is capable of forming complexes with cations resulting in reduced availability of calcium, magnesium, potassium and copper (Birk and Peri, 1980). With reduced availability of these nutrients and minerals, animals consuming diets with some probable level of anti-nutritional factor may not be able to meet their nutrients requirements for tissue accretion hence the poor growth rates of the birds fed CNT diets.

Abdelsamie *et al.* (1983) also noted that increasing fibre level had significant effect on the growth and feed utilization of birds. This is in agreement with result of this study since the CNT is highly fibrous and as its level of inclusion increases, it tends to reduce the final live weight. Similar trend was observed in the daily weight gain. As the level of CNT increased, daily weight gain decreased. The growth depression must have resulted from the increase in the crude fibre content of the diets and also the presence of anti-nutritional factors – tannin and phytate. Savory and Gentle (1976) observed that the final weight gain of birds fed with low fibre diet was significantly higher than those fed with high fibre diet and concluded that bird on high fibre diets weighed less than those on low fibre diets.

Cashewnut testa inclusion significantly increased ($P < 0.05$) feed intake, feed: gain ratio and protein intake but it decreased ($P < 0.05$) the protein efficiency ratio. Feed intake was highest in birds fed 15% level of CNT. This is in conformity with the report of Savory and Gentle (1976) that high fibre increases feed intake to allow birds meet their requirement for some dietary components other than energy.

Table 2: Growth Performance and Nutrient Utilization of Broilers Fed Diets Containing Cashewnut Testa

Parameters	Inclusion level of cashew nut testa (%)				± SEM
	0	5	10	15	
<i>Growth performance</i>					
Initial weight (g/bird)	93.00	80.00	90.00	90.00	1.460
Final weight (g/bird)	2053.00 ^a	2053.00 ^a	1833.00 ^a	1620.00 ^b	0.032
Weight gain (g/bird/day)	35.00 ^a	35.24 ^a	31.113 ^{ab}	27.32 ^b	0.572
Feed intake (g/bird/day)	102.20 ^c	110.83 ^a	107.56 ^b	112.97 ^a	1.072
Feed: Gain Ratio	2.93 ^b	3.15 ^b	3.45 ^{ab}	4.20 ^a	0.105
Protein intake (g/bird/day)	1.30 ^c	1.37 ^a	1.30 ^c	1.32 ^b	0.014
Protein efficiency ratio	1.51 ^a	1.44 ^{ab}	1.38 ^{ab}	1.17 ^b	0.064
<i>Nutrients utilization (%)</i>					
Dry matter digestibility	79.72	80.82	81.52	79.54	0.899
Crude protein retention	80.66	81.37	81.73	80.06	0.697
Digestible ether extract	89.99	90.69	91.45	90.62	0.339
Digestible crude fibre	35.04	37.40	36.21	38.46	0.459
Digestible NFE	86.21	86.98	87.37	86.70	2.574
Digestible ash	52.31	55.25	54.73	53.42	0.281
Total digestible nutrient	60.13	60.47	58.99	57.27	0.915

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

Higher value of feed: gain ratio with increasing level of CNT indicates a reduced utilization of feed as the level of CNT in the diet increases. This is again in line with Ortiz *et al.* (1994) who reported adverse effect of tannin/phytate containing extract on feed: gain ratio. Abdelsamine *et al.* (1983) noted that growth and feed utilization were impaired when diets constituting fibrous ingredients are fed to birds. The decreased ($P < 0.05$) protein efficiency ratio with increasing level of CNT in the diets agreed with the report of Woodman and Evans (1987) that fibrous feeds might decrease the digestible crude protein. A study by Oyawoye and Nelson (1999) reported a poor efficiency of feed utilization at high levels of rice offal fed to young cockerels due to high fibre level of rice offal. This further confirms the result of this study as the least PER value was recorded in diet containing

15% inclusion level of CNT which had the highest crude fibre level.

The nutrient utilisation estimates (Table 2) revealed that the inclusion levels of cashew nut testa in the diets had no significant ($P > 0.05$) effect on the nutrient digestibility by the birds. It could be observed that the values obtained for dry matter digestibility were a pointer to the values obtained for total digestible nutrient (TDN). The values varied without following any particular trend from 0% to 15% inclusion levels of CNT in the diets with the least values of 57.27%, TDN and 79.54%: dry matter digestibility were obtained in the 15% inclusion level of CNT. This may be due to the fact that CNT is highly fibrous and indigestible at high level (Oluokun and Olalokun, 1999). These findings supported the studies of Onifade (1993) and Onifade and

Babatunde (1997) that high fibre content interfered with nutrient availability at the tissue level thereby reducing the nutrient available for growth and maintenance.

Hedge *et al.* (1978) and Trait and Wright (1990) reported that fibre decreased the availability of nutrients by reducing the period of exposure of the food to the digestive enzymes and absorptive surfaces and this is due to the increased rate of passage induced by fibre, thus impaired absorption of nutrients.

The total serum protein increased ($P < 0.05$) with increasing level of CNT (Table 3). Kaneko (1989) reported that thermal stress caused an increase in adrenal activity resulting in increase in turnover, which led to decrease in total serum protein. The total serum protein maintains osmotic balance between the circulatory blood and tissue spaces. The uric acid level increased ($P < 0.05$) from 0% to 10% CNT inclusion levels and later dropped at 15% inclusion level of CNT. The increase could be due to the imbalance in amino acid composition of the diets. Imbalance of amino acid in the diets could cause elevated blood urea concentration (Eggum, 1970). Blood urea level especially in monogastric is influenced by quantity, quality, and proximity of the

proceeding meal, which increases mostly after eating. Urea is a function of protein quality. High urea indicates low protein quality fed.

The serum cholesterol (mg/dl) increased ($P < 0.05$) as the level of inclusion of CNT increased but the lowest value was recorded in the diet containing 5% level of CNT. It could not be ascertained that the diets led to increased cholesterol level since Holland *et al.* (1993) had reported that the kernels of cashew nut contained no cholesterol not to talk of the testa. However, the values obtained in the present study corresponded with the normal values of 150-250 mg/dl reported by Kaneko (1989).

The serum glutamate oxaloacetate transaminase (SGOT) and serum glutamate pyruvate transaminase (SGPT) were significantly ($P < 0.05$) influenced by the level of inclusion though with fluctuating values but the highest was recorded from the diet containing 5% level of CNT inclusion. This agreed with Ekpenyong and Biobaku (1986) that the value of SGOT and SGPT are normally low in blood, but becomes high when the plane of nutrition is low or when there is an occurrence of liver damage.

Result of the carcass characteristics is shown in Table 4. The dressing percentage was not

Table 3: Serum Metabolites of Broilers Fed Diets Containing Cashewnut Testa.
Inclusion level of cashew nut testa (%)

Parameters	0	5	10	15	± SEM
Total protein (g/L)	45.07 ^b	48.57 ^a	48.93 ^a	49.37 ^a	0.267
Uric acid (mg/dl)	5.33 ^a	5.50 ^a	5.67 ^a	3.70 ^b	0.176
Albumin (g/L)	27.60 ^c	30.93 ^a	29.33 ^b	29.80 ^b	0.180
Globulin (g/L)	17.47 ^b	17.63 ^b	19.00 ^a	19.57 ^a	0.121
Creatinine (mg/dl)	1.20 ^b	1.47 ^a	1.10 ^b	1.07 ^b	0.024
Cholesterol (mg/dl)	127.00 ^b	117.93 ^c	129.57 ^b	149.10 ^a	0.592
SGOT (IU/L)	10.00 ^c	14.00 ^a	10.67 ^{ab}	11.67 ^b	0.204
SGPT (IU/L)	6.00 ^b	7.67 ^a	5.00 ^c	5.67 ^b	0.204

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

Table 4: Carcass Characteristics of Broilers Fed Diets Containing Cashewnut Testa.

Parameters	Inclusion level of cashew nut testa (%)				± SEM
	0	5	10	15	
Dressing percentage	78.80	75.26	75.33	76.43	1.03
^a Relative weights of cut up parts (%)					
Head	3.08 ^a	2.76 ^b	3.00 ^{ab}	2.71 ^c	1.11
Neck	3.67 ^b	4.58 ^a	4.17 ^b	3.39 ^c	1.41
Breast	20.53 ^a	20.59 ^a	18.46 ^c	20.00 ^b	0.01
Back	12.78 ^b	14.81 ^a	12.96 ^b	9.28 ^c	0.01
Drumstick	9.80	10.23	10.99	11.50	0.01
Thighs	10.74	10.66	12.05	10.94	0.01
Shanks	3.91	4.00	4.11	4.30	1.72
Wings	8.69	8.33	8.70	8.72	0.01
^a Relative weight of organs (%)					
Heart	0.29	0.40	0.37	0.56	0.26
Kidney	0.02	0.01	0.01	0.01	0.02
Lungs	0.42	0.63	0.46	0.50	0.02
Liver	1.22	1.73	1.66	2.07	0.51
Gizzard	1.52	1.84	1.92	2.28	0.73
Abdominal fat	0.01 ^c	0.01 ^c	0.38 ^b	0.89 ^a	0.23
Small intestine	2.20 ^c	3.27 ^b	3.27 ^b	5.74 ^a	1.43
Large intestine	0.78 ^b	0.99 ^a	0.84 ^b	1.26 ^a	0.43

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

^apercent of liveweight

significantly affected by the varying dietary inclusion level of CNT. The mean values for dressing percentages are in agreement with the range (75% to 95%) reported by Anonymous (1983). Bonkamp *et al.* (1973) observed that the substitution with a high fibre content, lower energy feed stuff for maize progressively reduced the metabolisable energy content of the feeds which affect feed intake and efficiency which consequently affect the live weight and dressing percentage of the birds.

The diet had significant ($P < 0.05$) effect on the head, neck, breast and back. This could be due to the effect of reduced feed utilization occasioned by the increased level of CNT. The drumstick, thighs, and wings were not

significantly affected by the diets and also the heart, kidneys, lungs, liver and gizzard. However the value obtained for the gizzard increased with increasing levels of CNT. This could be as a result of the increment in the levels of fibre in the diets. The values obtained for abdominal fat increased ($P < 0.05$) with increased level of cashew nut testa. In contrary, Tewe and Egbunike (1992) observed that chickens gave a consistent decline in the body fat with increase in fibre contents.

The weight of small intestine and large intestine increased ($P < 0.05$) with increased level of cashew nut testa. This agree with the findings of Wetch *et al.* (1988) who added oat hulls in a cola starch-casein whole egg to diets of chicks and reported a significant increase in the small intestine length.

This increment in the length of gastro-intestinal tract was explained to be the form of structural adjustment due to high fibre content of the diet.

Meat composition indicated no significant ($P>0.05$) difference among diets for meat protein, NFE and dry matter (Table 5). The diets showed a significant ($P<0.05$) influence on the meat lipid and ash. This could be because of appreciable quantity of ether extracts and ash in the test ingredient (CNT).

The diets had no significant influence on the juiciness, tenderness, and off flavor of the meat samples from broilers fed the diets. The off-flavor scores were above the threshold value of five, indicating that no off-flavor was detected. This agreed with the findings of Arellano *et al.* (1997) who fed broilers graded levels of shrimp meal and observed no peculiar odours or off-flavours in the breast meat.

The economic analysis (Table 6) of this study revealed that the cost price per kg of feed was ₦51.76, ₦49.59, ₦49.31 and ₦49.04 for 0, 5, 10 and 15 %, respectively. The feed cost per kg decreased with increasing level of CNT. Nworgu *et al.* (1999), Mc Nab and Shannon (1994) highlighted the need for dietary formulation which can be used as an alternative non-competitive, readily available and cheap ingredients which can partly replace the conventional energy and protein feedstuffs in poultry diets. However, it is obvious that the best ration from the biological point of view is determined by the highest yield per unit feed consumed regardless of the feed consumption level (Brown and Mc Cartney, 1979). The total cost of feed consumed per bird showed an increment from ₦296.07 in 0% to ₦310.42 in 15% while cost of feed/ kg liveweight gain increased ($P<0.05$) from ₦151.06 in 0% to ₦202.90 in 15%.

Table 5: Meat Compositional Profile and Sensory Evaluation of Broilers Fed Diets Containing Cashewnut Testa

Parameters	Inclusion level of cashewnut testa (%)				± SEM
	0	5	10	15	
<i>Compositional profile (%)</i>					
Dry matter	95.49	96.58	96.88	95.80	0.19
Crude protein	30.46	31.11	30.11	31.30	0.14
Lipid	8.13 ^a	7.99 ^c	8.06 ^b	8.17 ^a	0.01
Ash	8.84 ^b	9.38 ^a	9.70 ^a	9.19 ^{ab}	0.07
Nitrogen free extract	49.68	49.68	50.23	49.48	0.33
<i>Sensory evaluation¹</i>					
Juiciness	6.07	6.13	6.07	5.80	0.28
Flavor intensity	5.47	5.87	5.80	5.33	0.35
Tenderness	5.47	5.60	5.47	6.07	0.38
Off-flavor	5.80	5.53	5.60	5.73	0.15

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

¹Eight-point scale were employed for juiciness, flavour intensity, and tenderness where 8= extremely juicy/intense/tender, 7=very juicy/intense/tender, 6= moderately juicy/intense/tender, 5= slightly juicy/intense/tender, 4= slightly dry/bland/tough, 3= moderately dry/bland/tough, 2= very dry/bland/tough and 1= extremely dry/bland/tough. A six-point scale was employed for off-flavour where 6 = none detected, 5 = threshold, barely detected, 4= slight off-flavour, 3= moderate off-flavour, 2= strong offflavour, and 1= extreme off-flavour.

Table 6: Economic Evaluation of Broiler Fed Diets Containing Cashewnut Testa

Parameters	Inclusion level of cashew nut testa (%)				
	0	5	10	15	± SEM
Total weight gain (g/bird)	1960.00 ^a	1973.00 ^a	1743.00 ^{ab}	1530.00 ^b	0.03
Total feed consumed (kg/bird)	5.72	6.21	6.02	6.33	1.07
Cost of feed /kg (₦)	51.76	49.59	49.31	49.04	0.26
Total cost of feed consumed/kg (₦)	296.07	307.95	296.85	310.42	0.63
Cost of feed/kg Live weight gain (₦)	151.06 ^c	156.08 ^c	170.31 ^b	202.90 ^a	1.12

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

Conclusion

It can therefore be inferred that 5 % CNT inclusion level in the diet was the most efficient in terms of the economy of feed conversion bringing about gains comparable to those of the control diet at the cheapest cost.

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