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Full Length Research Paper

Morpho-physiological performance and economic implications of guinea fowl keets fed Dried Cassava Alabo Meal

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The study was carried to report morpho-physiological performances and economic implications of guinea fowl keets fed Dried Cassava Alabo Meal (DCAM) as a complete substitute for maize. Two guinea fowls tarter diets were made such that diet 1 (control) contained maize as the main energy source whereas in diet 2, the maize was completely replaced with DCAM and the diets were balanced for crude protein. Ninety six (96) guinea fowl keets of both sexes were divided into 2 groups of 48 birds and each group randomly assigned to one of the diets, using completely randomized design (CRD). After some mortality has been encountered, each group was further sub-divided into 3 replicates of 14 birds and fed the experimental diet for 6 weeks. No trace of HCN was detected in the DCAM whereas the raw cassava meal contained about 800 PPM HCN. The birds on DCAM diet consumed significantly ($P < 0.05$) less feed than the control and gained significantly ($P < 0.05$) more body weights. Feed conversion ratio was also significantly ($P < 0.05$) improved by DCAM. It is therefore, concluded that DCAM could completely replace maize in the diets of guinea fowl keets with economic efficiency. Though, diet based on DCAM seems more costly. The DCAM diet also promoted abdominal fat deposition which may be rejected by some fat intolerant consumers. It is therefore recommended that further research be conducted to developing a technology that could make the processing of cassava tuber into Dried Cassava Alabo Meal more easily for inclusion into poultry and other monogastric animals feeding ration with less capital involvement in terms of labour and cost of feed.

Key words: Cassava meal, birds, morpho-physiology, cost, Northern Guinea Savanna, Nigeria.

INTRODUCTION

All poultry feeds are referred to as 'complete' feeds and are designed to contain all the protein, energy, vitamins, minerals and other nutrients necessary for proper bird growth, egg production and health (Smith, 2004).Maize has remained the chief energy source for poultry and other monogastric livestock. The demand for maize by man as food and other industrial uses coupled with it low production locally have placed additional constraints on its continual use in poultry diets. Furthermore, the low production and high cost of the crop may not be unconnected with scarcity of inorganic fertilizer and inadequate rainfall distribution in northern guinea savannah of Adamawa State. There is a need for greater exploration of other alternative feed sources or local 'substitutes' that are not in competition or relatively cheap

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and or readily available. Thus, replacing it or part thereof with a non-competitive alternative will probably help in reducing the cost of poultry feed (Nagalakshmi et al., 1999 and Shittu et al., 2004). Amongst the energy sources surveyed, cassava seems to be the only supreme alternative locally available energy source that could effectively replace maize in livestock diet (Oyenuga, 1961; Omole, 1977 and Oke, 1978).Even though, with the help of distinguished characteristics of this bird to mature, reproduce and resist diseases under different ambient temperatures and nutritional regimes, guinea fowl has been given importance as an alternative poultry (Sarica et al., 2003 and Boko, 2004).

Nigeria produces more than 38.5 metric tons of cassava per year which is an excellent source of carbohydrate, but its utilization is limited by its hydro cyanide content which is very toxic to health of both humans and livestock when ingested without proper processing and detoxification (Udedibie et al., 2004). Different attempts have been made to detoxify cassava tuber of its cyanide content, so as to make it useful and vital food ingredient for monogastric animals. These attempted processing methods include, the use of additives by Obioha et al. (1984), cooking by Okeke et al. (1985), sun drying by Odukwe et al. (1994) and through fermentation by Udedibie et al. (2004). Amongst these methods of detoxification, fermentation proved to be the most effective means of completely eliminating cyanide. Other processing methods produced contradictory results. Udedibie et al. (2008) reported that sun-drying of cassava *fufu?* meal produces a non – dusty, hydro cyanide free product with long shelf - life, that effectively replaced maize completely in layers diets, but the efficacy in guinea fowl has not been determined. The objectives of this study was to assess Sun – Drying Cassava Alabo as one of the processing and treatment methods to get rid of its cyanide content and dusty form in order to improve its feeding value as an energy source in guinea fowl keets diet and also, to report morpho-physiological performance in relation to economic implications of guinea fowl keets fed Dried Cassava alabo meal (DCAM) as a complete substitute for maize.

MATERIALS AND METHODS

Experimental site

The experiment was conducted at Kwargashe village, Lala District, Gombi Local Government Area of Adamawa State, Nigeria between August and September, 2011. Haematologial and serum biochemical indices were estimated at the Ahamadu Bello University (ABU) Teaching Hospital Zaria, Kaduna State, Nigeria.

Source of cassava tubers

Fresh raw cassava tubers of bitter variety used for this experiment were purchased from local cassava farmers in Jalingo market, Taraba State, Nigeria.

Cassava treatment and processing methods

The cassava tubers were weighed and then peeled. The peeled cassava tubers were cut into pieces, washed and then soaked in a big clay pot filled with clean water, allowing it to ferment for 4 days under room temperature. The fermented tubers were sieved into sacks in the morning hours, squeezed and hard pressed using sticks and stones for two hours to drained water and produce fermented cassava paste. The paste was heat treated in boiling water for 30 min and molded into balls and then spread in bits on polyethylene sheets and sun - dried for 4 days. The dried cassava alabo flakes were milled using normal grinding machine to produce Dried Cassava Alabo Meal (DCAM). The samples of raw cassava meal and DCAM were subjected to proximate analysis according to AOAC (1980) and HCN determined using the picrate paper method developed by Bradbury et al. (1999).

Experimental diets

The experiment was conducted in two stages; the starter and grower stages. Two guinea fowl starter diets were formulated such that, diet 1 (control) contained maize (*Zea maize* L.) as the main energy source only while diet 2 had Dried Cassava Alabo Meal (DCAM) as the major energy source, replacing maize completely. Other ingredients were included which make the two diets balanced and fairly iso – nitrogenous and iso – caloric. Ingredient and nutrient composition of the starter diets are shown in Table 1. At the end of 6 weeks of starter stage, two grower diets were also formulated such that, diet 1 (control) contained maize as the sole energy source while diet 2 contained DCAM as the bulk energy source, replacing maize completely. Other ingredients included were made to meet nutrient requirements of growers as shown in Table 2.

Experimental birds and design

One hundred and twenty (120) day old pearl strain guinea fowl keets of both sexes were purchased from National Veterinary Research Institute (NVRI) Vom, Plateau State, Nigeria and were kept and fed with commercial Pfizer feed for one week during which 24 mortality were recorded. After one week of acclimatization, they were divided into 2 treatment groups of 48 birds each and each group was randomly assigned to a treatment diet. Each group was further subdivided into 3 replicates of 16 birds and each replicate was

Table 1. Ingredient and Nutrient Composition of Experimental Starter Diets.

Ingredients (%)	Control Diet	DCAM
maize	50.0	0.00
DCAM	0.00	48.0
Soybean meal	28.0	30.0
Fish meal	2.00	30.0
Blood meal	2.00	3.00
Wheat offal	9.00	7.00
Palm Kernel Cake	5.00	5.00
Bone meal	3.00	3.00
Common salt	0.25	0.25
Tm/vitamin Premix	0.25	0.25
L – Lysine	0.25	0.25
L – Methionine	0.25	0.25
Total	100	100
Calculated Composition of the Diets (% of DM).		
Crude protein	23.1	23.1
Crude fiber	4.36	6.84
Ether Extract	3.86	2.03
Ash	3.66	4.16
NFE	65.1	65.8
ME (Kcal/kg)	2.75	2.70

DCAM = Dried cassava alabo meal. Premix contains per kg diet: Vitamin A 4,000,000.00i.u.; Vitamin D3 800,000.00i.u.; Vitamin E 9,200 mg; Niacin 11,000.00 mg; Vitamin B1 720.00 mg; Vitamin B2 2,000.00 mg; Vitamin B6 1,200.00 mg; Vitamin B12 6.00 mg; Vitamin K3 800.00 mg; Pantothenic acid 24.00 mg; Folic acid 300.00 mg; Choline Chloride 120,000.00 mg; Cobalt 80.00 mg; Copper 1,200.00 mg; Iodine 400.00mg; Iron 8,000.00mg; Manganese 16,000.00 mg; Selenium 80.00 mg; Zinc 12,000.00 mg; and Anti-Oxidant 500.00 mg (Manufactured by Bio-Organics Nutrient Systems Limited).

housed in 2 × 2 m floor pen fitted with brooding facilities littered with wood shavings. Feed and water were provided two times a day. The feeding trial lasted for 6 weeks with a first pinioning of the birds.

The growers' stages commenced at the 7th week with 84 birds reshuffled after recording 12 mortalities during starter phase and were divided into 2 groups of 42 birds each and each group was randomly assigned to a treatment diet using completely randomized design (CRD). Each group was further sub-divided into 3 replicates of 14 birds in each and each replicate housed in a 2 × 2 m deep litter pen. Feed and water were also provided two times daily. The experiment also lasted for 6 weeks. Adult guinea fowl strain used is shown in Figure 1.

Data collection

The birds were weight at the beginning of the trial and weekly thereafter to obtain their body weight gains. Daily feed intake per group was determined by subtracting the weight of leftover feed from the weight of the feed offered the previous day. Data collected includes: initial body weights, weekly body weights, final body weights, daily feed intake, total feed intake, feed conversion ratio (g feed/g gain), Organ weights, haematological and serum biochemical indices, mortality and cost of production. At the end of the feeding trial, 3 birds were randomly selected from each treatment group (one bird per replicate) and 2 mls of blood was collected from the veinal wings of the birds into bijou bottles, one containing Ethylene Dianne Tetraetic Acid (EDTA) as anticoagulant (mg/ml) and the other without EDTA for serum biochemical determination. The indices evaluated were haemoglobin (Hb) count, white blood cell (WBC), red blood cell (RBC) count, packed cell volume (PVC), mean cell volume (MCV), means cell haemoglobin concentration (MCHC), enterocytes and Lymphocytes, monocytes, eosinophil and basophils. Four birds were randomly selected from each group, starved overnight, weighed and then slaughtered with knife to obtain the weights of the carcass and that of the internal organs (gizzard, liver, spleen, kidney, heart, crop) as well as the weights of the thigh, head, chest muscle, shank, wing, neck, intestine and abdominal fats and were expressed

Table 2. Ingredient composition of the experimental growers' diets.

Ingredients (%)	Control Diet	DCAM
maize	60.0	0.00
DCAM	0.00	55.0
Soybean meal	20.0	25.0
Fish meal	2.00	3.00
Blood meal	2.00	3.00
Wheat offal	7.00	5.00
Palm Kernel Cake	5.00	5.00
Bone meal	3.00	3.00
Common salt	0.25	0.25
Tm/vitamin Premix	0.25	0.25
L – Lysine	0.25	0.25
L – Methionine	0.25	0.25
Total	100	100
Calculated Chem. Composition (% of DM).		
Crude protein	19.8	19.8
Crude fiber	4.04	6.97
Ether Extract	3.87	1.88
Ash	3.29	4.10
Nitrogen Free Extract	68.9	67.5
ME (Kcal/kg)	3.07	2.97

DCAM= Dried Cassava Alabo Meal. Premix contains per kg diet: Vitamin A 4,000,000.00i.u.; Vitamin D3 800,000.00i.u.; Vitamin E 9,200 mg; Niacin 11,000.00 mg; Vitamin B1 720.00 mg; Vitamin B2 2,000.00 mg; Vitamin B6 1,200.00 mg; Vitamin B12 6.00 mg; Vitamin K3 800.00 mg; Pantothenic acid 24.00 mg; Folic acid 300.00 mg; Choline Chloride 120,000.00 mg; Cobalt 80.00 mg; Copper 1,200.00 mg; Iodine 400.00 mg; Iron 8,000.00 mg; Manganese 16,000.00 mg; Selenium 80.00 mg; Zinc 12,000.00 mg; and Anti-Oxidant 500.00 mg (Manufactured by Bio-Organics Nutrient Systems Limited).

Figure 1. Adult breeds of guinea fowls used in this research study.

Table 3. Performance of Experimental Starter guinea fowl Fed Dried Cassava Alabo Meal

Parameters	Control	DCAM	SEM
Av: initial body wt. (g)	202.08	203.58	1.74
Av: final body wt. (g)	1312.50[a]	1439.58b	32.74
Av: total body wt. gain (g)	1110.42[a]	1236.00b	33.31
Av: daily body wt. gain (g)	39.66[a]	44.14b	1.19
Av: total feed intake (g)	2658.05[a]	2316.66b	74.20
Av: daily feed intake (g)	94.93a	82.73b	2.65
Av: feed conversion ratio S feed/g gain	2.39a	1.87b	0.07
Feed Cost (N/kg)	85.81	95.23	-
Cost production (₦ per kg chick)	186.18	180.60	-
Savings (₦/kg gain)		₦ 5.58	
mortality	5	7	

ab means within a row with different superscripts are significantly different (P<0.05).

as percentage of dressed weight.

Data analysis

The data generated on feed intake, feed conversion ratio, body weight gains, haematological and serum biochemical indices as well as the internal organ weights were subjected to one way analysis of variance (ANOVA) according to Snedecor and Cochran (1978). Where analysis of variance indicated significant treatment effects, means were compared and separated using least significant difference (LSD) according to Snedecor and Cochran (1978).

RESULTS AND DISCUSSION

The results of proximate analysis revealed that no trace of hydrogen cyanide (HCN) content detected in the DCAM product. This could be because of the fermentation period and the time taken for cooking treatment subjected to cassava meal which is not in conformity with the report of Udedibie et al. (2008) who reported that about 800 PPM hydrogen cyanide (HCN) content was found in the original raw cassava tuber used. The proximate composition of DCAM product was similar to values obtained by Udedibie [2008] as 2.82% CP, 2.86% CF, 1.02% EE, 1.98%, Ash and 91.68% NFE as shown in Tables 1 and 2.

The results of performance of the starter guinea fowl keets fed dried cassava alabo meal are summarized in Table 3. The results also indicated that feed intake of the control group was significantly (P<0.05) higher than the DCAM group whereas the DCAM group recorded significantly (P<0.05) heavier final body weights gain with 12 mortality than the control group which has no mortality. This is in contrast to earlier reported findings by Udedibie et al. (2008) where no significant difference existed in body weight changes of laying birds fed Dried Cassava Fufu Meal and the control diet based on maize. It therefore, appeared that, guinea fowl keets responded more positively with cassava diet in body weight gain than chicken layers. The results of feed conversion ratio revealed that, the control group had significantly (P < 0.05) lower feed conversion ratio than the DCAM group. This is due to the fact that DCAM group consumed less feed and gained heavier body weights. Although the DCAM diet was more expensive than the control diet but because of higher efficiency of the use of DCAM diet, it cost less to produce 1 kg of guinea fowl keet than control diet as shown in Table 3. Poultry and swine production have depended mostly on maize as the bulk of their energy source (Udedibie, 2007). This has resulted to an increase in the prices of livestock and their products (Udedibie, 2007).

The results of performance of the grower stage are summarized in Table 4. As in the starter stage, the daily feed intake of the control group was significantly (P < 0.05) higher than that of the DCAM group. But there was no significant (P > 0.05) difference between themin terms of final body weights gain. This agreed with the report of (Udedibie, 2007) which stated that 12 hour wetted sum-dried cassava tuber completely replace maize. There was no mortality during the grower trial. This could be because; the birds have developed enough feathers and are strong enough to withstand any stress, may have gotten used to the diets and environmental imperfects. The results of feed conversion ratio in the grower stage showed that, the group on DCAM had better feed

Table 4. Performance of experimental grower guinea fowl fed dried cassava alabo meal.

Parameters	Control	DCAM	SEM
AV. Initial body wt. (g)	1432.40	1441.26	14.74
AV. Final body wt. (g)	2526.66	2526.66	75.99
AV. Total body wt. gain(g)	1094.26	1085.46	67.78
AV. Daily body wt. gain (g)	39.16	38.80	2.43
AV. Total feed intake (g)	4716.66	4126.66	252.14
AV. Daily feed intake (g)	168.45[a]	147.38[b]	6.24
AV. feed conversion ratio (feed/g gain)	4.35[a]	3.79[b]	0.26
Feed cost (₦/kg)	85.01	95.16	-
Cost production (₦ Per kg chick)	350.26	342.69	-
Savings (₦/kg gain)		7.57	
mortality	-	-	-

ab Means within a row with different superscripts are significantly different (P<0.05).

Table 5. Carcass and internal organ weights of the experimental birds.

Parameters	Control	DCAM	SEM
Carcass weights (% DW)			
Live weight (g)	2650.00	2725.00	51.03
Dressed weight (g)	1750.00	1850.00	64.55
Dressed wt. (% of Lw)	65.94	67.95	1,93
Chest muscle (% of Dw)	22.65	24.60	1.55
thigh	30.27[a]	35.20[b]	1.35
Head	2.85[a]	2.36[b]	1.60
Shark	4.06	5.06	0.42
wing			
Neck	4.52[a]	5.27[b]	0.14
Internal organ weight (% of Lw)			
heart	0.45	0.55	0.01
liver	1.13[a]	1.65[b]	0.09
gizzard	1.13a	0.87b	0.10
kidney	0.19	0.18	0.004
Abdommal fat	1.29[a]	2.09[b]	0.16
intestine	1.69	1.84	0.17
Intestinal length (cm)	198.75	182.25	6.41

[ab] means within a row with different superscripts are significantly different (P<0.05).

conversion ratio, the difference was not statistically significant (P > 0.05). The cost of producing DCAM was more expensive than that of the control diet, but due to efficiency of utilization of Diet by the birds, it costs less to produce 1kg of guinea fowl keet using DCAM as shown in Table 4.

Data on carcass and internal organ weights are presented in Table 5. There were significant differences (P <0.05) between the carcass weights so also the internal organ weights. The livers of birds on DCAM group were significantly (P<0.05) heavier than those of the control group. Similar observations had been made by Udedibie et al. (2004) with broilers and Enyenihi et al. (2009) with laying hens. The reason could not be immediately provided since the cassava meal used in the study was completely devoid of HCN. Enlarged livers are

Table 6. Heamatological indices of the experimental birds.

H. Indices	Control	DCAM	SEM
WBC ($x10^3$ / ul)	75.900	72.066	4272.46
RBC ($x10^3$ /ul)	2.21	1.95	0.760
Hb (g/dl)	8.24	7.03	0.760
PVC (%)	27.92	25.13	2.680
MCV (g/dl)	126.21	129.07	4.180

usually common with feeds containing certain levels of toxicity (Bamgbose and Niba, 1995) and (Atuehene et al., 1986). The gizzards of birds on DCAM group significantly decreased (P< 0.05) in weights contrary to earlier reported findings by Udedibie et al. (2008) and Aderemi et al. (2006). This may be due to treatment procedure of the cassava meal and type of birds used. The weights of the kidneys were not affected by the treatments (P>0.05), but birds on DCAM group developed significantly (P < 0.05) more abdominal fat. This also corroborates a similar observation made by Enyenihi et al. (2009) in laying birds. The results on the haematological and serum biochemical indices are presented in Table 6. There were no significant (P > 0.05) differences in haematological indices of birds in both groups but blood cholesterol of birds on DCAM group was significantly (P < 0.05) higher than that on control group.

Conclusions

The results of this study have demonstrated that DCAM could completely replace maize in diets of poultry with economic efficiency. Even though diet based on DCAM seems to be more expensive, the higher efficiency of its utilization by guinea fowl keets compensated for the high cost. The DCAM diet also facilitates abdominal fat deposition which may be rejected by some fat intolerant consumers.

RECOMMENDATIONS

It is therefore recommended that, further research be conducted to develop a technology that would make processing of cassava tuber into DCAM for all monogastric animals in a cheaper, presentable, acceptable and more conventional way. In view of the fact that DCAM induces more abdominal fat in guinea fowl keets, it may be necessary to avoid total replacement of maize with DCAM in poultry ration.

REFERENCES

Aderemi FA, lawal TE, Alabi OM, Ladokun OA, Adeyemo GO (2006). Effect of Enzyme Supplemented Cassava Root Seriate on Egg Quality, Gut Morphology and Performance of Egg Type Chickens. Int. J. Poult. Sci., 5:526 – 529.

AOAC (Association of Official Analytical Chemists). 1980. Official Methods of Analysis. 13th edition.AOAC, Washington, DC, USA.

Atuehene CC, Don koh A, Nkansh –Dako P (1986). Effect of Raw Cotton Seed Meal on the Performance, Carcass Characteristics and Certain Blood Parameters of Broiler Chickens. J. Anim. Prod., 6:107-114.

Bamgbose AM, Niba AI (1995). Carcass Traits, Relative Organ Weight and Gut Characteristics of Broiler Chickens Fed Cotton Seed Cake in Starter and Finisher Rations J. Anim. Prod., 11: 68-73.

Boko CK (2004). Contribution À L'amLioration De L' LevageVillageois De La Pintade Locale Dans Le Département Du Borgou (Nord-Est Du Bénin). CommunautéFrançaise De Belgique. GemblouxFacultéUniversitaire Des Sciences Agronomiques. Pp. 45.

Bradbury ME, Egan SV, Bradbury JH (1999) Picrate Paper Kits for Determination of Total Cyanogen in Cassava Products. J Sci. Food Agric., 79: 595-601.

Enyenihi GE, Udedibie ABI, Akpan MJ, Obasi OL, Solomon IP (2009). Effects of 5 hour- Wetting f Sundried Cassava Tuber of the Meal on the HCN Content and Dietary Value of the Meal for Laying Hens. Asian J. Anim. Vet. Adv., 4 (6):326-331.

Nagalakshmi D, Sastry VRB, Agrawal DK, Katiyar RC, Verma SVS (1999). Performance of Broiler Chicks Fed Diet Containing Urea-Ammoniated Neem (*Azadirachtaindica*) Kernel Cake. Brit. Poult. Sci., 40: 77 – 83.

Obioha FC, Azubuike GO, Ene LSO, Okereke HE, Okoli OO (1984). The Effect of Partial Replacement of Maize with Cassava Peel on Layer Performance. Nutr. Rep. Int., 30: 1429-1429.

Odukwe CA (1994). The Feeding Value of Composite Cassava Root Meal for Broiler Chicks.Ph.D. Thesis, University of Nigeria, Nsukka, Nigeria.

Oke OL (1978). Problems in the Use of Cassava in Animal Feeding. Anim. Feed Sci. Tech., 3:345-380.

Okeke GC, Obioha FC, Udogu AE (1985).Comparison of Detoxification of Cassava-Bore Cyanide.Nutr. Rep. Int., 32:139-147.

Omole TA (1977). Cassava in the Nutrition of Layers

Proc., Workshop on Cassava as Animal Feed, Held at University of Gualph, Ontanio, Canada, 18th – 20th April, 1977, By B. Nestle and M. Graham (Eds.), pp. 29 – 36.

Oyenuga VA (1961). Nutritive Value of Cereals and Cassava Diets for Growing Fattening Pigs in Nigeria. Bit J. Nutr., 115:327 – 338.

Sarica M, Camci Ö, Seluk E (2003). Quail pheasant, pigeon guinea fowl and Ostrich Farming. Ondokuz Mayis University. Faculty of Agriculture Book, 4:129-144, Samsun, Turkey.

Shittu AM, Olayode GO, Bamiro OM, Aderemi FM (2004). Effects of Using Non-Conventional Feedstuffs on the Productivity and Costs of Egg Farms in Ibadan, Nigeria .Nig. J. Anim. Prod. 31(1): 65 – 78.

Smith TW (2004). Feeding Quails.Mississippi State University Extension Service.http://www.thepoultrysite.com. Accessed on the 20th January, 2008.

Snedecor GW, Cochran WG (1978). Statistical Methods. 6thedin.,Iwa State University Press, Ames, Iowa.

Udedibie ABI (2007). Wetting Method Improves the Nutritive Value of Cassava for Broilers in Nigeria. Cassava Cyanide Diseases Network News, 7:1-3.

Udedibie ABI, Anyaegbu BC, Onyechekwa GC, Egbuokporo OC (2004). Effects of Feeding Different Levels of Fermented and Unfermented Cassava Tuber Meal on Performance of Broilers. Nig. J. Anim. Prod, 31:211 – 219.

Udedibie ABI, Enyenili GE, Akpan MJ, Obasi OL Solomon IP (2008). Physio Chemical Nature and Nutritive Value of Dried Cassava Fufu Meal for Laying Hens. Nig. Agric. J. 39(1&2): 44-49