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Research Article

Growth Performance and Economic Value of garri used as a Replacement for Maize in the Diets of Local Turkeys

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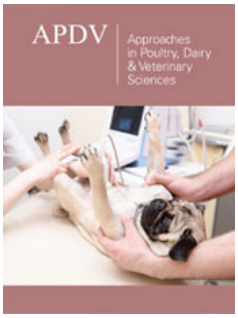

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Abstract

An experiment was conducted to investigate effect of garri on growth and economic performance of local turkeys as an alternative feed ingredient to maize. A total of one hundred and thirty-five day- old unsexed local poults were used for the study. Birds were randomly allotted to five dietary treatments with three replicates in a completely randomized design (CRD). Each treatment group had twenty-seven poults with nine poults per replicate. The experiment lasted for 16 weeks, 0-8 weeks and 9-16 weeks for the starter and grower phases respectively, during which starter and grower diets were fed. Garri replaced dietary maize at 0, 25, 50, 75 and 100% in the diets designated T1, T2, T3, T4, and T5 respectively. Feed and water were offered ad libitum throughout the experiment. Results indicated that at the starter phase 75 and 100% garri significantly ($P<0.05$) reduced live weight, feed intake and produced poor feed: gain ratio. There was no significant difference ($P>0.05$) in live weight, feed intake and feed: gain ratio between control, 25 and 50% garri. During the grower phase 75 and 100% reduced ($P<0.05$) live weight, but there was no difference in feed intake and feed: gain ratio. Replacing maize with 75 and 100% garri significantly ($P<0.05$) reduced gross margin. Therefore 50% garri could be used to replace maize in diets of local turkeys.

Keywords: Economic performance; Garri; Growth; Maize; Local turkeys

Introduction

There are factors that constitute a hindrance to the fast expansion of intensive poultry production in Nigeria. They are are majorly the high cost of feeds and feedstuffs and insufficient supply of feed at the proper quality and quantity to the birds [1]. Feed constitutes about 70%-80% of the total production cost in poultry business [1]. However, among cereal grains, maize is a common feedstuff of choice for energy in monogastric diet and its inclusion in diets ranges from 50%-70% [2,3]. This is not sufficiently available due to competition between livestock, human consumption and industrial uses. This scarcity has led to a rise in the cost of maize and would invariably, lead to increase in cost of animal feed and consequently animal protein [4]. Cassava (*Manihot esculenta*, Crantz) is one of the most vital food crops in the humid tropics, since it is naturally suited to condition of low nutrient availability and has the potency to survive in a drought situation. Cassava as a crop is cultivated in most countries in the tropical regions of Africa. The crop has served as an alternative energy source and its inclusion in diets for poultry has been extensively studied [5]. Cassava remains the most vital food in terms of carbohydrates and can be processed into various forms such as garri, fufu and tapioca [6,7].

Cassava, however, contains cyanogenic glucosides of whose hydrolysis produces hydrogen cyanide (HCN) which is toxic to poultry [8]. The cyanide can be eliminated to a tolerable level through the following processes like boiling, drying, grating, soaking, fermentation, or a combination of these processes to produce final products containing not more than 100ppm HCN [9]. Cassava meal popularly known as garri is obtained by the fermentation and frying of peeled cassava tuber pulp and is a stable human food. It is mainly used in Nigeria, Cameroon, Sierra Leone, Benin, Togo and Ghana. It is fairly expensive to feed garri to animal because of cost, since it is an acceptable human food. It is widely known in Nigeria and other West African countries as a third major source of energy to both man and animals. Turkey production is an important aspect of poultry production that has contributed greatly to this growth. According to Smith AJ [10] carcasses of turkeys contain a higher percentage of protein than the carcasses

of chicken. However, its production in Nigeria has largely remained at the smallholder level due to high cost of feed, inconsistency in feeding programmes, as well as lack of knowledge of the adequate levels of nutrient requirement [11].

This study was therefore designed to evaluate the performance of local turkey birds fed different graded levels of garri as replacement for dietary maize.

Material and Methods

Experimental site

The research was conducted at the poultry farm located in Ifa Ikot Akpan in Uyo local Government area of Akwa-Ibom State, Nigeria. The site lies between latitude of 50-27'N and longitude of 7°32'E and at an altitude of 125m above sea level. It is ecologically situated in the rainforest zone of Nigeria with annual rainfall of 800mm, average temperature of 28°C and relative humidity of 75%.

Procurement and processing of test ingredients

Cassava varieties UMUCASS 36 (TMS 01/1368) and UMUCASS 37 (TMS 01/1412) used to prepare the garri were harvested from Akwa Ibom State Agricultural Development Programme (AKADEP) farm in Ntak Ikot Udo, Ikot Ekpene, and University of Uyo research farm. The freshly harvested cassava tubers were peeled, washed and grated. The grated pulp was put in jute sacks and were pressed with a hydraulic jack between wooden platforms for 2 days to express excess liquid from the pulp, while it is fermenting. The dewatered and fermented lumps of pulp were crumbled by hand and most of the fibrous matters removed. The remaining mass was sieved. The fine pulps were then fried in an iron pan over a fire. The garri was packed into bags after cooling, stored for inclusion in the turkey diets.

Management of Experimental Animals and Experimental Diets

A total of one hundred and thirty-five-day-old local turkey poults were used for this experiment. On arrival the turkey poults were fed a commercial broiler starter diets for one week after which the poults were randomly allotted to five dietary treatments with twenty-seven poults per treatment. It was replicated three times with nine poults per replicate. The experiment which lasted for 16 weeks was divided into two phases: the starter phase (0-8weeks) and the grower phase (9-16weeks). The experiment lasted for 16 weeks. During this period, the birds were fed daily and watered ad libitum using the appropriate feeding and watering troughs. The birds were managed in deep litter pens during the brooding and rearing phases. Routine medication and litter management were carried out. Five experimental turkey starter and grower diets were formulated such that garri replaced maize at 0, 25, 50, 75 and 100% in the diets. They were respectively formulated to conform to the report of NRC [12] on turkey starter and grower rations (Tables 1 & 2).

Table 1: Composition of starter turkey diets.

Ingredient (%)	T_1 (0%)	T_2 (25%)	T_3 (50%)	T_4 (75%)	T_5 (100%)
Maize	38.00	28,50	19.00	9.50	0.00
Garri	-	9.50	19.00	28.50	38.00
Palm Kernel Cake	8.50	8.50	8.50	8.50	8.50
Soya Bean Meal	44.00	44.00	44.00	44.00	44.00
Fish Meal	5.80	5.80	5.80	5.80	5.80
Bone Meal	3.00	3.00	3.00	3.00	3.00
Salt	0.25	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10	0.10
Vitamin Premix	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100
Calculated Nutrient Composition					
Crude Protein (%)	28.61	28.04	27.47	26.90	26.33
Ether Extract (%)	1.60	1.52	1.61	1.59	1.53
Crude Fibre (%)	6.07	7.00	7.54	7.75	7.92
Ash (%)	8.86	8.88	8.87	8.69	8.79

Calcium (%)	1.29	1.29	1.29	1.29	1.29
Phosphorus (%)	1.00	0.98	0.96	0.94	0.90
ME (Kcal/kg)	2844	2878	2913	2948	2983

*1kg of premix contains: Vitamin A (5,000.000 I.U), Vitamin D3 (1,000.000 I.U), Vitamin E (16,000mg), Vitamin K3 (800mg), Vitamin B1 (1,200mg) Vitamin B2 (22,000gm), Niacin (22,000mg), Calcium pantothenate (4,600mg), Vitamin B12 (10mg), Folic acid (400mg), Biotin (32m), Choline chloride (260,000mg), Manganese (948,000mg), Iron (40,000mg), Zinc (32,000mg), Copper (3,400mg), Iodine (600mg), Cobalt (120mg), Selenium (48mg), Anti-oxidant (48,000mg).

ME: Metabolizable Energy

Table 2: Composition of grower turkey diets.

Ingredient (%)	T_1 (0%)	T_2 (25%)	T_3 (50%)	T_4 (75%)	T_5 (100%)
Maize	51.00	38.25	25.50	12.75	0.00
Garri	0.00	12.75	25.50	38.25	51.00
Palm Kernel Cake	12.30	12.30	12.30	12.30	12.30
Soya Bean Meal	28.00	28.00	28.00	28.00	28.00
Fish Meal	5.00	5.00	5.00	5.00	5.00
Bone Meal	3.00	3.00	3.00	3.00	3.00
Salt	0.25	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10	0.10
Vitamin Premix	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100
Calculated Nutrient Composition					
Crude Protein (%)	22.91	22.15	21.38	20.62	19.85
Ether Extract (%)	1.40	1.32	0.81	0.81	0.53
Crude Fibre (%)	7.88	6.10	6.78	7.98	4.93
Ash (%)	5.80	5.71	7.87	7.27	8.39
Calcium (%)	1.20	1.20	1.20	1.20	1.20
Phosphorus (%)	0.92	0.89	0.87	0.84	0.82
ME (Kcal/Kg)	2918	2965	3011	3058	3105

*1kg of premix contains: Vitamins A (5,000.000 I.U), Vitamin D3 (1,000.000 I.U), Vitamin E (16,000mg), Vitamin K3 (800mg), Vitamin B1 (1,200mg), Vitamin B2 (22,000gm), Niacin (22,000mg), Calcium pantothenate (4,600mg), Vitamin B12 (10mg), Folic acid (400mg), Biotin (32m), Choline chloride (260,000mg), Manganese (948,000mg), Iron (40,000mg), Zinc (32,000mg), Copper (3,400mg), Iodine (600mg), Cobalt (120mg), Selenium (48mg), Anti-oxidant (48,000mg).

ME: Metabolizable Energy

Parameters Measured and Statistical Analysis

The initial weights of birds were taken at the beginning of the experiment, and subsequent weighing was carried out on weekly basis. Final weight gain was obtained by subtracting initial weight from the final weight. Data on feed intake was obtained by using the difference between the quantity given and the quantity of the left over each day. The feed: gain ratio was calculated by dividing the daily feed intake per bird by the daily weight gain. All collected data were subjected to analysis of variance (ANOVA) in a completely randomized design according to Steel and Torrie [13] using Statistical Package for Social Science (SPSS). Means separation were carried out using the Multiple Range Test as described by Duncan [14].

Economics of Analysis

Cost analysis was carried out at the end of each phase to assess the economic viability of the ingredients used. The cost per kg feed ingredient used and that of the diets were noted. The mean feed intake was used to calculate the mean cost of feed consumed by the poults in each treatment. This was computed as described by Shonaiya et al. [15] and as reported by Ekwu [16].

Results

Data on growth performance and economics of production of turkey poults fed garri as a substitute for maize in diets of starter turkeys are presented in Table 3. All the parameters considered on growth performance showed significant differences (P<0.05) with the exception of the initial weight. The final live weight and daily weight gain were similar in birds that consumed diets containing 0, 25 and 50% garri, while substitution at 75 and 100% reduced the parameters significantly. Significant (P<0.05) difference was observed among the treatment means for daily feed intake. Substitution at 50% was significantly (P<0.05) higher than 100% but similar to treatments control, 25 and 75%. However, 100% was similar to treatments control, 25 and 75%. The feed: gain ratio of 0%, 25% and 50% substitution levels were the same. However, it was observed that of control was better than those of 75 and 100%. Also, the feed: gain ratio of 25, 50, 75 and 100% were the same.

Table 3: Growth performance of starter turkey fed garri as a substitute for maize.

Parameters	T_1 (0%)	T_2 (25%)	T_3 (50%)	T_4 (75%)	T_5 (100%)	SEM
Initial Weight (g/bird)	49.00	50.67	48.85	49.39	48.70	0.29
Final Live Weight	622.26^{a}	592.59^{a}	592.59^{a}	496.30^{b}	462.96^{b}	17.59
Daily Weight Gain (g/bird)	10.24^{a}	9.71^{a}	9.63^{a}	7.99^{b}	7.38^{b}	0.77
Daily Feed Intake (g/bird)	27.60^{ab}	27.87^{ab}	30.18^{a}	26.10^{ab}	24.50^{b}	0.34
Feed: Gain Ratio	2.70^{b}	2.88^{ab}	3.11^{ab}	3.27^{a}	3.32^{a}	0.44

^{ab}Means treatment in a row with different superscripts are significantly different (p<0.05).
SEM: Standard Error of Means

Table 4 shows the effect of garri on the economics of production of starter turkey. Cost per kilogram increased as level of garri was increased. Feed cost per weight gain followed similar trend as feed cost per kilogramme. There was no difference in feed cost per bird. Substituting by 75 and 100% significantly reduced revenue compared to the revenue of control, 25 and 50% which were similar. The gross margin also took similar trend as the revenue. At the grower phase, the data on growth performance are presented in Table 5. All the parameters measured for the growth performance were influenced by garri except for daily feed intake and feed: gain ratio. The final live weight and daily weight gain as observed followed the same trend as in starter phase. The final live weight and daily weight gain were similar in birds that consumed diets containing 0, 25 and 50% garri, while substitution at 75 and 100% reduced the parameters significantly (P<0.05). There were no significant differences in daily feed intake and feed: gain ratio. Substitution of maize for garri in the diet influenced the economic indices measured. Feed cost/kg feed also increased as the level of substitution was increased as in starter phase. In Table 6 Substitution of maize increased feed cost per bird and feed cost per weight gain at all levels. Revenue and gross margin were negatively (P<0.05) affected by garri at the all the levels of substitution. The two indices significantly deteriorated as the level of substitution was increased.

Table 4: Economic production of starter turkey fed garri as a substitute for maize.

Parameters	T_1 (0%)	T_2 (25%)	T_3 (50%)	T_4 (75%)	T_5 (100%)	SEM
Feed cost/kg (₦)	134.34^{e}	141.94^{d}	149.54^{c}	157.14^{b}	164.74^{a}	2.87
Feed cost/bird (₦)	207.62^{b}	239.92^{a}	233.41^{a}	240.81^{a}	245.60^{a}	10.05
Feed cost/kg Weight gain (₦)	362.91^{e}	444.34^{d}	429.86b^{c}	521.45^{b}	539.65^{a}	19.45
Revenue/Bird (₦)	519.23^{a}	487.74^{a}	489.37^{a}	402.84^{b}	372.21^{b}	17.67
Gross Margin/Bird (₦)	311.61^{a}	247.82^{a}	255.95^{a}	162.03^{b}	156.64^{b}	17.7

$^{a-c}$Means treatment in a row with different superscripts are significantly different (p<0.05), ₦=Nigeria's official currency.

SEM: Standard Error of Mean

Table 5: Growth performance of grower Turkey fed garri as a substitute for maize.

Parameters	T_1 (0%)	T_2 (25%)	T_3 (50%)	T_4 (75%)	T_4 (100%)	SEM
Initial Weight (g/bird)	622.26[a]	592.59[a]	592.59[a]	496.30[b]	462.96[b]	19.31
Final Live Weight (g/bird)	2682.42[a]	2600.78[a]	2640.74[a]	2396.74[b]	2357.41[b]	41.69
Daily Weight Gain (g/bird)	36.79	35.86	36.57	33.94	33.83	4.89
Daily Feed Intake (g/bird)	123.24	129.27	130.79	124.79	122.85	1.49
Feed: Gain Ratio	3.35	3.6	3.58	3.68	3.63	0.56

[abc] Means treatment in a row with different superscripts are significantly different ($p<0.05$), g/b=gram per bird.

SEM: Standard Error of Mean

Table 6: Economic of production of turkey grower fed Garri as a substitute for maize.

Parameters	T_1 (0%)	T_2 (25%)	T_3 (50%)	T_4 (75%)	T_5 (100%)	SEM
Feed cost/kg (₦)	141.09[e]	148.16[d]	155.12[c]	162.13[b]	169.14[a]	2.65
Feed cost/bird (₦)	973.82[b]	1071.23[a]	1136.95[a]	1133.00[a]	1163.63[a]	21.23
Feed cost/weight gain (₦)	472.69[b]	540.58[a]	555.79[a]	599.36[a]	606.29[a]	14.89
Revenue/bird (₦)	3296.28[a]	3176.29[b]	3177.03[b]	3031.10[c]	3071.10[c]	39.08
Gross margin/bird (₦)	2322.53[a]	2104.07[b]	2140.58[b]	1898.11[c]	1907.47[c]	51.3

[abc] Means along the same columns with different superscripts are significantly different($P<0.05$), ₦=Nigeria's official currency

SEM: Standard Error of the Means

Discussion

The results on growth parameters showed that garri was not a better feed ingredient than maize. This was supported by the observation made when growth parameters such as live weight and feed intake were decreased at higher level of garri. This can be attributed to lower density of digestible nutrients in garri compared to maize according to Shanaiya et al. [15]. Also, this could be attributed to inability of the birds to digest garri which created a gut fill sensation and subsequent depression of appetite; lower protein content of garri compared to maize and high energy level in garri [16]. Similar results were also reported by Shanaiya et al. [15] and [16] who observed that live weight and feed intake of starter broiler chickens declined progressively as the amount of cassava root meal increased in the diets.

The increased value of feed: gain ratio obtained in this study could be attributed to the digestion rate of garri which was reported to be relatively low when compared to maize [17]. Also, Mafouo et al. [18] opined that because the protein content of garri is low with higher fibre compared to maize, the absorption rate would also be low. This did not allow the birds to get the required essential nutrients for growth according to [17]. The similar final live weight, weight gain, feed intake and feed: gain ratio of the poults that consumed control, 25% and 50% garri denotes that garri can replace maize up to 50% without adverse effect. This agrees with the observations of Muller et al. [19], Oke [20] and Eshiett and Ademosun [21]. This also was similar to the findings of Stevenson and Jackson [22] and Shanaiya [15] which showed that replacement of maize with cassava flour above 50% was detrimental to growth performance of starter broiler chickens. At the grower phase, the reduction in the final body weight and daily weight gain of the birds fed diets containing 75 and 100% garri is an indication that the performance of the birds at the starter phase negatively affected the performance at the grower phase. This agrees with the report of Ekpeyong and Obi [23] and Saentaweesuk et al. [24]. Daily feed intake and feed: gain ratio at the grower phase were not affected negatively at any level of garri, an indication of adaptation during which the capacity of the birds to utilize garri better has been developed. Digestion and nutrient utilization are better at later age [25]. It also suggests that feeding of garri at the grower phase could be adopted [26].

This result shows that the production cost per kilogram diet increased as the inclusion of garri increased at both the starter and grower phases. This must have resulted from the fact that the cost of a unit of garri was higher than the cost of a unit of maize which it replaced. The low revenue and gross margin at the starter phase as compared to 75 and 100% can be attributed to high cost of the diets. Also, the lower gross margin arising from the feeding of diets containing garri at all levels could be attributed to the cost of the feeds and poor performance of the birds that consumed garri. This is in agreement with the findings of Shonaiya et al. [15] who reported that substituting cassava meal for maize beyond 25% and or 50% at best may not optimize good monetary returns.

Conclusion

In this study garri did not perform better than maize but had similar effect up to 50% substitution level as regards to live weight, feed intake and feed: gain ratio. Economically garri did not perform better either, but equaled maize at 25 and 50%. In conclusion, 50% of garri can substitute maize in diets for local turkeys.

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