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Research Article

Effects of Dried Unripe Plantain Peel Meal (*Musa paradisca*) on Performance, Carcass Quality and Internal Organs in Poultry Broiler Birds

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Abstract

A total number of one hundred (100) Anak broiler birds were used to assess the effects of different inclusion levels of unripe plantain peels meal (UPPM) for maize grain on carcass quality, performance and internal organ changes in starter broiler birds. Five replacement levels of UPPM (0%, 12.5%, 25.0%, 37.5% and 50%) were evaluated in the experiments as treatments 1,2,3,4 and 5 respectively. Measurements of body height, thigh length, leg length, live weight, heart girth, body length, shank length, wing length and head circumference were taken on the second week of the experiment and weekly thereafter till the end of the experiment. Daily feed intake, feed conversion ration, feed cost, body weight and organ weights were assessed in the various groups. Results of the experiment showed mean daily feed intake (48.00g, 60.00g, 79.54g 81.00g and 89.02g) and mean daily weight gain(34.51g, 31.08, 30.29, 30.20 and 28.50g) for diets T_1, T_2, T_3, T_4 and T_5 respectively. T_1 differed significantly ($p<0.05$) from T_4 and T_5. The diet of UPPM improved performance characteristics, carcass quality and organ weight. The study showed that UPPM could economically replace maize grain in broiler ration. The 37.50% (T4) appeared to be the optimal replacement level of UPPM for maize grain as performance significantly dropped beyond 37.5% inclusion level in broiler diets.

Keywords: Unripe Plantain Peels Meal; Maize Grain; Broiler Finisher; Poultry Feed

Introduction

The high cost of feed in most tropical countries clearly indicates that the production of cereal grains for livestock business in these countries is grossly inadequate [1,2]. Furthermore, the stiff competition existing between humans and animals over the available grains has resulted in the near collapse of the poultry industry in Nigeria [3]. There is urgent need therefore to turn attention to exploitation of other tropical sources. Reject unripe plantain peels are exemplary of this unrealized potential.

The use of plantain peels in poultry has been limited because of possible deleterious effect resulting from the presence of tannins. Tannins exist in the plantain in two forms, (a) "Free or active tannins" which impart a strong bitter taste and (b) "bound tannins" or "vegetable tannates" which are insoluble, supposedly inert and which have little or no effect on palatability [4-7].

During the sun drying process, the level of free tannin decreases because the tannins are slowly bound in an insoluble form [8]. Though the level of free or active tannin is much higher in the peel than in the pulp, both are significantly reduced by time the peels are sun dried to reduce the moisture content up to 10% [9,10]. Plantain peels are highly digested and is an excellent source of energy. Compared with other Musa species, crude protein level is high (Ahaotu, 2010). Methionine and Cystine, the sulphur containing amino acids are moderately limiting in plantain protein. Plantain peels is well balanced with regard to the ratio of protein to calories. The plantain peels protein – calorie ratios are considerably higher than those of maize and other cereals.

Sun drying the unripe plantain peels before milling will help a great deal in reducing the anti-nutritional toxic substances (tannins). Considering the problem of toxicity, there is need therefore to investigate the potential of unripe plantain peels meal as an alternative feed ingredient in broiler ration.

Materials and Methods

The experiment was carried out at the Teaching and Research Farm of Imo State Polytechnic, Umuagwo, lmo State, Nigeria. The Polytechnic farm is situated in the South Eastern Zone of Nigeria with an annual rainfall of 2000mm – 2484mm and average temperature of 26^0c (Ofomata,1975).

Experimental birds

A total of one hundred Anak strain broiler birds of twenty day old were bought from a commercial hatchery, in Owerri, Imo State were used for this experiment. The birds were fed commercial starter feed (livestock feeds) for stabilization. After the first week, one hundred birds were selected on apparent viability and good conformation and assigned to five treatment groups such that each treatment had twenty birds raised on deep litter for four weeks and were replicated five times.

Source and processing of unripe plantain peels meal

The unripe plantain peels used for this study were harvested from Oha Self Help Organization Farms in Atta West Autonomous Community in Ikeduru Local Government Council, lmo State, Nigeria. Atta lies between latitudes 5^0 36^1 00^{11} and 40^0 78^1 00^{11}N and longitudes 7^0 7^1 00^{11} and 39^0 55^1 00^{11}E at the elevation of about 90m above sea level, within the South Eastern Agricultural zone of Nigeria. The average annual rainfall, temperature and humidity of Atta are 2500mm. 27^0C and 75% respectively (Ofomata, 1975).

The unripe plantain peels were dried in the sun for 4 – 6 days depending on the intensity of sun by spreading them evenly on a cemented floor. During drying, the peels were turned regularly to prevent uneven drying and possible decay of the peels. After considerable dehydration has been achieved (indicated by bristliness and crispiness of the peels), processing was done by grinding in a hammer mill to produce unripe plantain peels meal.

Unripe plantain peels meal was subjected to proximate, mineral and vitamin analyses (Table 1) at the Imo State Polytechnic, Umuagwo, Nigeria, using standards methods [11]. The mineral analysis was carried out using the methods of Grueling [12], while gross energy was determined with a Gallenkamp Oxygen, Adiabatic bomb Calorimeter.

Chemical Component	Unripe plantain peels meal (%)
Crude Protein	10.64
Crude Fiber	5.82
Ether Extract	9.57
Ash	12.82
Metabolisable Energy Kcal/kg	3918.90

Table 1a

Formulation of the experimental diets

Five experimental broiler finisher diets containing 0, 12.5, 25, 37.5 and 50% unripe plantain peels meal for treatments 1,2,3,4 and 5 respectively, were formulated in which 0% UPPM; (T1) was the control (Table 2). The ingredients were thoroughly mixed to ensure homogeneity and milled in a hammer mill. The feed was fortified with vitamin premix and synthetic amino acids in line with National Research Council recommendation [13].

Minerals	Mg per 100gm
Calcium	10.00
Phosphorus	34.00
Sodium	35
Magnesium	25
Copper	2
Iron	6.55
Zinc	--
Manganese	8
Iodine	--
Silica Free Ash	12.09
Sulphur	10
Potassium	401
Chlorine	125
Vitamins C	I.U./g
Vitamin A	0.28
Ascorbic Acid	11.00
Thiamine	0.03
Riboflavin	0.05
Niacin	0.65

Table 1b: Minerals and Vitamins Composition of Unripe plantain peels meal.

Experimental design

The birds were divided into five groups of 20 birds each according to the five dietary treatments and reared on a deep litter house. The experiment replicated five times in a completely randomized design. Adequate number of feeders and watering cans were provided for the birds to achieve *ad libitum* access to feed and water, with regular observation and manipulation of the brood facilities.

Data collection

Initial weights of the birds were measured at the second week of the experiment (two weeks old), while live weight was subsequently measured on weekly basis to evaluate weight changes. The weight at the end of the experiment (5 weeks old) was measured as the final weight, while feed intake was measured by subtracting the feed remaining from that supplied the previous day. Data were

also collected on weight gain by subtracting the initial weight from the final weight.

Feed conversation ratio was obtained by dividing the average feed intake (kg) by weight gain (kg) and the feed cost was calculated as the sum of all the items included in a diet.

Data were collected from each treatment groups and subjected to one- way analysis of variance according to Steel and Torrie [14], while the Duncan Multiple Range Test as outlined by Gordon and Gordon [15] was used to separate differences in means.

Ingredients	T_1	T_2	T_3	T_4	T_5
Unripe plantain peel meal	0	12.5	25	37.5	50
Maize grain	50	37.5	25	12.5	0
Fish meal	5	5	5	5	5
Soybean meal	14	14	14	14	14
Wheat offal	10	10	10	10	10
Palm kernel meal	5	5	5	5	5
Spent grain	6	6	6	6	6
Bone meal	9.15	9.15	9.15	9.15	9.15
Vitamin/mineral premix	0.4	0.4	0.4	0.4	0.4
DL-methionine HCL	0.2	0.2	0.2	0.2	0.2
Common salt	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100

Table 2a: Ingredient Compositions of Experimental Broiler Starter Diets.

Nutrients (%)	T1	T2	T3	T4	T5
Crude protein	17.90	18.01	18.21	18.28	18.64
Ether extract	1.92	2.43	2.87	3.30	3.50
Crude fiber	3.83	3.96	4.08	4.24	5.02
Dry matter	80.30	68.20	62.05	56.24	41.96
Calcium	3.77	3.84	3.95	3.99	4.06
Phosphorus	1.85	1.94	2.20	2.45	2.62
Lysine	0.88	0.70	0.65	0.52	0.41
Crude fiber %	3.83	3.96	4.08	4.24	5.02
Dry matter %	80.30	68.20	62.05	56.24	41.96
Calcium %	3.77	3.84	3.95	3.99	4.06
Phosphorus %	1.85	1.94	2.20	2.45	2.62
Lysine %	0.88	0.70	0.65	0.52	0.41
Methionine + Cystine %	0.33	0.31	0.30	0.27	0.26
ME (Kcal/kg)	2425.50	2487.80	2498.20	2589.50	2688.60

Table 2b: Calculated Nutrient Composition of the Experimental Diets.

2.5kg of premix/tonne contain: Vitamin A10, 000 I.U; Vitamin D_3 20,000 I.U; Vitamin E 12,000 I.U; Vitamin K 2.5g; Thiamine 1.5 g; Riboflavin 5g; Pyriboflavin (B6) 1.5g; Vitamin B_{12} 1.0mg; Biotin 2mg; Niacin 15g; Panthotenic acid 5g; Zinc 50g; Iron 25g; Copper 5g; Iodine 1.4g; Selenium 100mg; Cobalt 300mg; B.H.T. 25g.

Results and Discussion

The performance parameters of the starter broiler, Table 3 showed that a significant difference ($p<0.05$) was existed between birds in various treatments in daily weight gain, daily feed intake, feed cost per weight gain and mortality. However, in carcass evaluation there is a significant difference ($p<0.05$) between birds in the various treatments for shank length, wing length, body length, thigh length, hearth girth, leg length, eviscerated weight, live weight at 5th week and dressed carcass weight.as showed in Table 4.

Parameters	T_1	T_2	T_3	T_4	T_5	SEM
Initial live weight (g) at 2nd week	133	134	132	135	134	0.10^{ns}
Mean live weight at 5week old (g)	865^{d}	785^{c}	842^{b}	833.7^{b}	756.75^{a}	2.96*
Mean weight gain (g)	34.51^{a}	31.08^{b}	30.29^{b}	30.20^{b}	28.50^{c}	0.21*
Mean feed Intake (g)	48.00^{a}	60.00^{b}	79.54^{c}	81.00^{d}	89.02^{e}	1.03*
Feed conversion ratio	2.61	2.87	3.17	3.19	3.2	0.05*
Feed cost/kg weight gain	156.12^{a}	150.56^{b}	145	141.88^{d}	73.88^{e}	1.51*
Mortality	1.00^{a}	1.00^{a}	1.00^{a}	1.00^{a}	4.00^{b}	0.04*

Table 3: Performance Characteristics of Broiler Starter Birds Fed Unripe Plantain Peels Diets.

^{abcde}: Means within same row, having different superscripts are significant different ($P<0.05$).

Parameters	T_1	T_2	T_3	T_4	T_5	SEM
Drum Stick (cm)*	5.8	5.7	5.6	5.7	5.8	1.22^{ns}
Wing length (cm)*	10.7^{a}	9.9^{b}	9.7^{b}	9.3^{b}	8.8^{c}	0.30*
Body length (cm)*	18.1^{a}	17.5^{b}	17.5^{b}	17.0^{c}	16.8^{c}	0.81*
Thigh length (cm)*	5.8	5.5	5.5	5.4	5.6	1.24^{ns}
Hearth Girth (cm)*	15.2^{a}	15.0^{a}	14.6^{b}	14.2^{b}	13.4^{c}	0.44*
Live weight at 5th week (gm)*	930^{a}	905^{b}	890^{c}	855^{d}	798^{e}	2.32*
Dress carcass weight (gm)*	850^{a}	832^{b}	815^{c}	798^{d}	735^{e}	2.11*

Table 4: Carcass Evaluation of Broiler Starter Birds Fed Ranging Replacement levels of Unripe Plantain Peel Meal for Maize Grain.

^{abcde}: Means within same row having different superscripts were significantly different ($P<0.05$).

*: Significant ($P<0.05$)

NS: Not significant ($P>0.05$).

Birds on the control diet (T_1) were significantly ($p<0.05$) heavier than those of T_2 and T_3, which were significantly ($p<0.05$) heavier than birds on T_5. Body conformations of broilers fed the control diet (T_1) were like those fed T_2 unripe plantain peels meal-containing diets. In addition, the 37.5% inclusion level appeared to have better dressed carcass weight than lower inclusion values. This performance is attributed to a better balance of amino acids.

Differences in eviscerated weight were attributed to differences in taste and levels of graded fibre in the diets. These results agree with Asuquo., *et al.* [16]; Mkeerebari and Hedo [17] who reported that bulkiness encourages higher eviscerated weights in birds.

Clavijo and Maner [18]; Ullman [19]; Calles., *et al.* [10] and Celleri., *et al.* [20] reported an anti- nutritional effect of UPPM arising from the presence of tannins, which reduced availability, absorption and utilization of nutrients for productive purposes.

Consequently, birds fed 50% UPPM (T_5) were consumed more than those of other treatments to satisfy their body requirements [4,21-24].

The increasing level of UPPM will be reduced nutrient availability and thus reduced weight gain, but amino acids and fortified vitamins could be used to suppress the anti-nutritional effect of tannins and results in improvement of production efficiency [25,26].

The liver weight at the starter phase slightly increased with 37.5% (T_4) inclusion levels of UPPM for maize grain in the diets but the highest weight was observed at 50% inclusion level (T5). Clavijo and Manner [18]; Bressani., *et al.* [21] reported that increasing the levels of UPPM from 37.5% improved crop weight liver and spleen weights in starter broilers.

The significantly ($p<0.05$) larger weights of the liver in birds on diets T_1, T_2 and T_4 are in agreement with Celleri., *et al.* [20] while the larger weights of gizzard and proventriculus at T_1, T_3 and T_4 are in line with the findings of Calles., *et al.* [10] who stated that higher inclusion levels of UPPM diets increased the sizes of gizzard and proventriculus in starter broiler birds.

Parameters	T_1	T_2	T_3	T_4	T_5	SEM
Weight of intestine (gm)	55^a	53^a	52^a	47^b	40^c	0.96^*
Heart weight (gm)	0.4	0.5	0.5	0.4	0.6	0.43^{ns}
Gizzard and proventriculus weights (gm)	40.1^a	35.2^b	35.1^b	40.3^a	45.4^c	0.01^*
Liver and spleen weights (gm)	11.3^a	14.9^b	15.1^b	16.3^c	16.4^c	0.39^*
Crop weight (gm)	0.5^a	1.3^b	1.3^b	1.9^c	2.1^c	1.65^*

Table 5: Organ weights of Anak Broiler Starter birds fed varying replacement levels of unripe plantain peel meal maize grain.

Conclusion

The inclusion levels of unripe plantain peel meal (UPPM) at higher level improved the performance of the tested animals. This results of the corresponds with the findings of Mkeerebari and Hedo [17]; Clavijo [27] and Bressani., et al. [21] respectively [28,29].

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