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Performance, carcass and organ weight characteristics of broiler chickens fed diets containing graded levels of *Gongronema latifolia*

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Target audience: *Animal Scientists, Feed millers, Farmers*

Abstract

A forty-nine day (7 weeks) feeding trial was conducted on 150 day-old Anak 2000 broiler chicks to evaluate the effect of graded levels of Gongronema latifolia leaf meal on the performance, carcass/organ weight characteristics in a completely randomized design. The birds were assigned to five dietary treatments of 30 birds each, subdivided into 3 replicates, each containing 10 birds. There were no significant (P>0.05) treatment effects in average initial weights, average final body weight, average body weight gain and feed conversion ratio. There was significant depression in average daily feed intake (P<0.05) at 10% dietary level. Dietary levels of 2.5%, 5.0% and 7.5% GLLM (P<0.05) increased dressing percentage of the experimental birds. Percentage weights of necks, wings, thighs, drum sticks, breasts, hearts, liver, spleen, lungs and pancreas (expressed as percentage of live weights) were similar (P>0.05). However, dietary levels of 2.5% - 10.0% GLLM yielded significantly higher (P<0.05) percentage weights of proventriculus than the control diet. The result obtained from the experiment suggests that 7.5% dietary inclusion of the leaf meal can support normal broiler production.

Key words: *leaf meal, broiler, performance, organ weight, Gongronema latifolia*

Description of Problem

Livestock industry is of socio-economic and nutritional importance for nations worldwide. Apart from providing a means of livelihood for a significant population of the farming families, it contributes significantly to the Gross Domestic Product (GDP) of the nation (1).

Worthy of note is the fact that the success of the industry hinges basically on adequate nutritional and health management of the animals. Over the years, poultry industry has been among the most lucrative sectors of agriculture in Nigeria. Indeed from inception, through the early 1980s, the industry has experienced a significant development and expansion. As a result, there has been an appreciable national flock size and worthwhile income for farmers. This favourable trend was, however, short-lived. During the last two decades, the industry has witnessed a serious set back due largely to inadequate feed supply which stems from unavailability of protein concentrate and short supply of energy sources. Moreso, the problem has been aggravated by competitive demand for some of the existing feed ingredients like maize, millet and soybean for livestock feeding, and human consumption. This dismal trend has been responsible for the prohibitive cost of finished feeds.

Agreeably, feed cost accounts for 60 - 80% of the total production cost of commercial poultry and intensive livestock production in general. The high feed cost relative to monogastric livestock products from the early

1980s to date has drastically slashed farmer's profit margin. The obvious implication here is that revenue accruing from the sales of poultry meat, eggs, and other commercial livestock products cannot adequately compensate for the cost of production of the same. The consequence of this has been far-reaching. Resource-poor farmers have been forced out of production while "bigger farmers" have reduced stock population to as low as 30 to 50%, while new entrants have been demoralized. In view of this limiting circumstance, it becomes imperative to search for cheaper, readily available, non-conventional feed sources that will be well suited for sustainable monogastric production industry. Such feed should of course be low in competitive demand for human food. It is this line of thought that has generated this research interest in *Gongronema latifolia,* known in Efik and Ibibio as *utasi* and *in* Igbo language as *utazi* to determine its value as a feed ingredient for poultry diet.

Gongronema latifolia (utazi) is a wild tropical creeping plant with lush deep green vegetation. Where it grows in a swampy area or inland valley, the vegetation is perennial, otherwise, it is deciduous. The plant plays a significant role in ethnomedicine among the local populations where its leaf meal extract is used in treating malaria, stomach-ache and diarrhoea. (2) reported that methanolic extract of *G.latifolia* exhibited marked activity against *Pseudomonas aeruginosa and E.coli* with both having a minimum inhibitory concentration (MIC) of 15.625 mg/ml in an *in vitro* study. Their investigations have new evidence to corroborate an earlier work by (3), which reported the use of *G. latifolia* in the treatment of diarrhoea.

There is paucity of information on the nutritional properties of *G. latifolia*. It would therefore seem necessary to undertake a preliminary investigation of its leaf to determine its nutritional significance as feed ingredient in poultry diets.

Materials and Methods

The research was carried out in the poultry unit of the Teaching and Research Farm of the School of Agriculture and Agricultural Technology (SAAT), of the Federal University of Technology (FUT), Owerri.

Preparation of *Gongronema latifolia* Leaf meal (GLLM) Fresh leaves of *G. latifolia* were harvested from the forest area of Ovonum in Obubra Local Government Area of Cross River State, Nigeria. Harvested leaves were dried under shade to prevent inactivation of its chemical constituents by direct insolation. The drying process which was done in the months of December and January was carried out for 5 - 7 days until the leaves became crispy to touch. The dried leaves were milled to particle sizes that would pass through a 2mm sieve, using a hammer mill. The *G. latifolia* leaf meal (GLLM) so prepared was stored in air-tight plastic containers under cool dry conditions prior to use.

Proximate Analyses and Metabolisable Energy Determination of GLLM

Samples of the leaf meal were subjected to proximate analysis using the methods described by (4) to determine the following proximate fractions: Moisture content, Percentage dry matter (DM), Crude protein (CP) , Crude fibre (CF), Ether extract (EE), Ash, and Nitrogen free extractives (NFE).

The metabolisable energy (ME) of the leaf meal was calculated, using the methods of (5).

Mineral Analysis

The following macro minerals were determined using the standard procedures (4):

Calcium (Ca), Magnesium (mg), Potassium (k) and Phosphorus (P)

Experimental Diets

The experiment was in two phases, the starter and finisher phases respectively. Five broiler starter experimental diets were formulated such that inclusion of GLLM was at 0.0, 2.5, 5.0, 7.5 and 10% levels, respectively. White maize was used as the major energy source for the rations. At the second phase of the trial (finisher phase), the experimental diets were adjusted to broiler finisher diets by increasing the energy level and reducing protein content. The ingredients composition of the experimental diets is shown in tables 1 and 2.

Table 1: Ingredient Composition of the Experimental Broiler Starter Diets

	Dietary Levels of GLLM **(%)**				
INGREDIENTS	0.0	2.5	5.0	7.5	10.0
Maize (white)	50.00	48.00	46.00	44.00	42.00
Soybean meal	28.00	28.00	28.00	28.00	28.00
GLLM	0.00	2.50	5.00	7.50	10.00
Wheat offals	8.00	7.75	7.25	6.75	6.25
Palm kernel cake	5.00	5.00	5.00	5.00	5.00
Fish meal	2.00	2.00	2.00	2.00	2.00
Blood meal	3.00	3.00	3.00	3.00	3.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Common salt	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25
Vitamin/trace mineral premix**	0.25	0.25	0.25	0.25	0.25
Total	**100**	**100**	**100**	**100**	**100**

** To provide the following per kilogram of feed: Vit. A, 10,000 iu, Vit. D3, 2000 iu, Vit. E, 5iu; Vit.K, 2mg; Riboflavin, 4.20mg; Vit. B12, 0.01mg; Panthotenic acid, 5mg; Nicotnic acid, 20mg; Folic acid, 0.5mg; choline, 3mg; Mg, 56mg; Fe, 20mg; Cu, 10mg; Zn, 50mg; Co.125mg.

Table 2: Ingredient Composition of the Experimental Broiler Finisher Diets

	Dietary Levels of GLLM (%)				
Ingredients	0.0	2.5	5.0	7.5	10.0
Maize (white)	60.00	58.00	56.00	54.00	52.00
Soybean meal	16.00	16.00	16.00	16.00	16.00
GLLM	-	2.50	5.00	7.50	10.00
Wheat offals	8.00	7.50	7.00	6.50	6.00
Palm kernel cake	7.00	7.00	7.00	7.00	7.00
Fish meal	2.00	2.00	2.00	2.00	2.00
Blood meal	3.00	3.00	3.00	3.00	3.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Common salt	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25
Vitamin/tracemineral premix**	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100

** To provide the following per kilogram of feed: Vit. A, 10,000iu; Vit. D3, 2000iu; Vit. E, 5iu; Vit.K, 2mg; Riboflavin, 4.20mg; Vit. B12, 0.01mg; Panthotenic acid, 5mg; Nictotnic acid, 20mg; Folic acid, 0.5mg; choline, 3mg; Mg, 56mg; Fe, 20mg; Cu, 10mg; Zn, 50mg; Co,125mg.

Experimental Birds and Design

A total of one hundred and fifty (150) day-old Anak broiler chicks used in the trial was acquired from a reputable distributor in Owerri, Imo State. The birds were raised on commercial broiler starter diet for one week, after which random distribution of the birds was made into five groups of thirty birds each, and randomly assigned to the five experimental diets in completely randomized design (CRD). Each group was further sub-divided into three replicates of ten birds each and housed in separate pens. Normal brooding was carried out for three weeks. Throughout the experimental period, feed and water were provided *ad libitum* for all treatment groups. This was accompanied by necessary prophylactic medication of antibiotics, coccidiostat, and anti-stress; and vaccination with New Castle and Gumboro disease vaccines. The starter phase of the experiment lasted four weeks (28 days). This was followed by the finisher phase with a similar feeding/watering regime for another four weeks. On the whole the feeding experiment lasted for a total of eight weeks (56 days).

Data Collection

The birds were weighed at the beginning of the trial and weekly thereafter throughout the eight week duration of the study. Daily feed intake per group was recorded. Other data collected included: initial body weights, weekly body weights and final body weights, total feed intake, weekly body weight gain, total body weight gain, feed conversion ratio (g feed / g gain) and mortality. Visual observation of the skin, shank and beak colours was also made.

Carcass and Organ Weights Evaluation

Four birds each per treatment were randomly selected, starved overnight of feed only, weighed and sacrificed by cervical bone dislocation. Thereafter, the jugular veins were severed and the carcasses thoroughly bled. Before defeathering, the carcasses were scalded in hot water of about 80^{o}C for about a minute and the feathers plucked manually after. The carcasses were then eviscerated by cutting through the vent and the viscera removed. Thereafter the dressed carcass weights were obtained. The neck, wings, thigh, drum stick and breast were sectioned out and weighed using a sensitive electronic scale, and their weights expressed as percentages of the respective live-weights of birds used. In addition, weights of the internal organs (heart, liver/gall bladder, spleen and gizzard), and abdominal fat were recorded. These and the dressed carcass weights were also expressed as percentages of the respective live weights.

Statistical Analyses

Data generated from the study on feed intake, body weight gain, feed conversion ratio, and carcass/organ weight evaluation were subjected to one-way analysis of variance (ANOVA) as outlined by (6). Where significant treatment effects were detected by ANOVA, the means were separated using the Duncan's New Multiple Range Test (DNMRT) as outlined by (7).

Results

Chemical Composition of GLLM

The proximate/mineral composition of GLLM is shown in Table 3.

The moisture content was 8.04%. The percentage composition of other proximate fractions on dry matter basis were: crude protein, 14.25; ether extract 2.84 and ash, 6.26. Others were crude fibre, 2.84 and nitrogen free extractives, 60.39. The five macro minerals analyzed for showed the following results (mg/100g): calcium 10.8; magnesium, 45; potassium, 486; sodium, 3.86 and phosphorus, 395mg/100g.

Table 3: Chemical Composition of GLLM

Nutrients	Concentration (%)	SE (±)
Moisture	8.04	0.19
Dry matter	91.96	0.01
CP (%Dm)	14.25	0.01
EE (%Dm)	2.84	0.02
Ash (%Dm)	6.26	0.01
Crude fibre(%Dm)	2.84	0.02
NFE (%Dm)	60.39	0.01
ME (Kcal/kg)	2903.41	0.99
Calcium (mg/100g)	10.8	0.12
Mg (mg/100g)	45.0	1.20
K (mg/100g)	486.0	0.58
Na (mg/100g)	3.86	0.01
P (mg/100g)	395.3	0.15

Values are means of triplicate determinations

Table 4: Effects of Different Dietary Levels of GLLM on the Performance of Broiler birds

Parameters	Dietary levels of GLLM					
	T1 (0%)	T2(2.5%)	T3(5.0%)	T4(7.5%)	T5(10%)	SEM
Av. initial body weight (g)	105.0	103.3	105.0	104.3	104.0	0.36
Av. final body (Kg)	1.90	1.71	1.62	1.61	1.60	0.08
Av. body weight gain (Kg)	1.80	1.61	1.51	1.50	1.50	0.08
Av. daily feed intake (g/day)	90.8^{a}	85.5^{ab}	79.8^{b}	73.9^{b}	73.1^{b}	0.13
Av. daily body weight gain (g)	36.6	32.8	30.8	30.7	30.6	1.70
Feed conversion ratio (g feed/g gain)	2.5	2.6	2.6	2.4	2.6	0.10

^{ab}Means in the same row with different superscripts are significantly different ($P<0.05$)

Performance Evaluation

The effects of different dietary levels of GLLM on performance of broiler birds are summarized in table 4.

Apart from the average daily feed intake, other parameters measured were not significantly ($P>0.05$) affected by the treatments. Average daily feed intake reduced significantly ($P<0.05$) with increasing dietary levels of GLLM.

Table 5: Effects of Different Dietary Levels of GLLM on Carcass and Organ Weights of broiler birds expressed as percentages of live weights

Parameters	Dietary Levels of GLLM					
	T_1**(0.0%)**	T_2**(2.5%)**	T_3**(5.0%)**	T_4**(7.5%)**	T_5**(10.0%)**	**SEM**
Live weight (Lw)(Kg)	1.70	1.65	1.70	1.72	1.52	0.73
Dressing % (% of Lw)	81.30[b]	88.01[a]	91.22[a]	88.21[a]	84.62[b]	1.79
Weight of neck	6.0	6.4	6.31	6.26	5.76	0.23
Weight of wings	8.48	8.71	8.58	8.60	8.19	0.36
Weight of thigh	21.61	22.53	22.41	21.94	21.10	0.89
Weight of drum stick	3.56	4.16	3.49	3.56	3.62	0.30
Weight of breast	20.87	19.64	19.45	19.84	19.99	1.04
Weight of heart	0.51	0.42	0.46	0.48	0.57	0.03
Weight of liver/gallbladder	1.67	1.72	1.82	1.70	1.77	1.0
Weight of Spleen	0.16	0.14	0.14	0.16	0.14	0.01
Weight of Gizzard	2.08	2.09	2.31	2.10	2.37	0.15
Weight of lungs	0.79	0.92	0.94	0.95	1.0	0.06
Weight of pancreas	0.21	0.26	0.21	0.22	0.24	0.02

[abc]means in the same row with different superscripts are significantly different ($P<0.05$).

Carcass and Organ Weights Evaluation

The effects of different dietary levels of GLLM on the carcass and organ weights (% of live weights) of the experimental birds are summarized in table 5.

All parameters evaluated apart from dressing percentage and the weights of the proventriculus were not significantly ($P>0.05$) affected by the treatments applied. The highest dressing percentage was recorded in T2, T3 and T4 which were statistically similar. The weight of the proventiculus differs significantly ($P<0.05$) among the treatments. The weights increased with increasing dietary levels of GLLM.

Discussion

Proximate Composition of GLLM

The proximate composition of GLLM (table 3) showed that crude protein and nitrogen free extract (NFE) values were 14.25 and 60.39 percent, respectively. The protein content is higher than those of cereal grains while the NFE value is higher than those of most leaf meals studied, and compares favourably with the values of some alternative local feedstuffs like jackbean, pigeon pea, bread fruit (pulp), etc. (8). The crude fibre content of 2.84% is amazingly low for a leaf meal, far less than those of other leaf meals already investigated and compares favourably with those of cereal grains like maize, guinea corn, wheat, rice and barley (8). The low fibre content of GLLM makes it well suited for monogastric feeding programs. Its metabolisable energy (ME) value of 2903.41 Kcal/kg compares favourably with those of conventional energy concentrates such as maize, guinea corn, millet, wheat, etc., while its ash and mineral contents are comparable to those of most leaf meals studied. The final body weights, average body weight gain and feed conversion ratio of birds were similar ($P>0.05$) among the treatment groups. (9) observed a rather depressed value of these parameters when broiler chicks were fed graded levels of *Mimosa invisa* leaf meal. The researchers also reported a significantly ($P<0.05$) depressed performance of broiler chickens fed *Centrosema pubescens* leaf meal at 5% dietary level and above (10, 11). The results obtained in this study might be attributable to lower fibre level of GLLM, its higher digestibility, lower concentration of

anti-nutritional factors and hence better utilization.

Average daily feed intake of birds however decreased significantly ($P<0.05$) with increasing dietary levels of GLLM. The result agrees with the findings of (12) which showed that feed intake of broiler chicks fed *Microdesmis puberula* leaf meal was significantly ($P<.05$) poor at high dietary levels. It is also similar to the reports of (13), which established a significant reduction in laying birds' feeding rate when a test diet containing *Gliricidia sepium* was compared with control diet. The result also agrees with the findings of other leaf meal studies (14, 15) among others.

Lower feed intake observed in this study is attributable to lower fibre and higher energy contents of GLLM as birds eat to satisfy their energy needs. The low acceptability of GLLM may have also contributed to the low intake of the test diets.

The FCR values obtained in this study are similar to those reported by (11) with Centrosema leaf meal as protein supplement for broilers. The values are superior to others earlier reported (16, 17, 18, 19) when broiler chicks were evaluated on some non-conventional feed stuffs. This shows that the test ingredient (GLLM) compares favourably with other non-conventional ingredients for broiler diets such as *Centrosema pubescens* leaf meal, rice offal, cocoa bean shell, *Microdesmis puberula* leaf meal, cashew nut testa and *Napoleona imperialis* seed meal.

Body Pigmentation

Broiler chickens placed on the test diets (GLLM containing diets) developed strong yellowish. Colouration of their skin, beaks and shanks which clearly distinguished them from birds on the control diet. This occurrence is traceable to the characterization of carotenoids usually present in green plants and agrees with the observations of (20) on *Alchornia cordifolia* and (21) on *Leucaena leucocaphala*. This could be a factor for consumer preference.

Minerals

Of the five minerals assayed (mg/100g), Sodium (3.86) and Calcium (10.8) were the least abundant, while Phosphorus (395.3) and Potassium (486.0) were the highest in concentration. The value of Potassium in *G. latifolia*, tends to agree with the reports of (22) which noted that Potassium is the most abundant mineral in Nigerian agricultural (plant) products. Phosphorus and Calcium are always found together in the body (within the blood, teeth and bones), as well as in animal products like milk and in poultry products like egg, as well as egg shell. The ratio of Calcium to Phosphorus in the body is of significant importance for certain physiological processes. In this study, the Ca/P ratio of 0.027 in GLLM is quite low and may not be sufficient for normal Calcium/Phosphorus metabolism in the body unless its use in feeding programmes is carried out with Calcium supplementation. (23) reported that low Ca/P ratio in the diet facilitates calcinations in the small intestine. Indeed, apart from its role in the skeletal and associated structures, Calcium is also important in blood clotting, muscle contraction and in certain enzymatic processes.

The ratio of Sodium to Potassium (Na/K ratio) in GLLM was found to be 0.008. Na/K ratio in the body is of human health care concern because it is a factor in high blood pressure. Accordingly in this respect, a ratio of less than one (1.00) has been recommended (23). It would therefore seem that the consumption of *G. latifolia* could be beneficial to humans in preventing the health challenge in question.

Carcass Characteristics

In general, birds from the test groups had numerically higher dressing percentages than

those from the control. Weights of proventriculus showed significant ($P<0.05$) treatment effects among the treatment groups. It increased progressively with increasing level of GLLM in the diets. This is suggestive of slow gastric digestion of GLLM diets and consequent accumulation of the feed in the organ for a longer period of time than the control. The reason for this is not clear.

The non-significant value of other carcass/organ weight parameters indicate that the test diets did not exert deleterious effects on them

Conclusions and Applications

The results of this study have shown the following:

1. That performance parameters of broiler birds such as the average final body weight, average body weight gain and feed conversion ratio were not significantly ($P>0.05$) affected by dietary inclusion of GLLM up to 10%;
2. that 10% dietary level of GLLM significantly ($P<0.05$) depressed the average daily feed intake of the birds;
3. 10% inclusion level of the leaf meal can support normal broiler production.

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