Growth performance and carcass yield of finisher Broilers fed *Gmelina arborea* lead meal in partial replacement for Palm Kernel Cake

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ABSTRACT

A study was conducted to investigate the effect of *Gmelina arborea* leaf meal on the growth performance, dressed carcass yield and internal organs of broiler chickens at the finisher phase. 180 day old Hubbard chicks were used. The birds were grouped into 4 treatments (T1 – T4). Each treatment was replicated thrice having 15 birds per replicate. The experiment was arranged in a completely randomized design (CRD). Diet containing no leaf meal was fed at the starter phase. Feeding of experimental diets started at the end of four weeks which marked the end of the starter phase. Diet fed to control group (T1) did not contain the leaf meal, while T2 –T4 diets contained 1.00, 2.00 and 3.00 % of the leaf meal respectively in replacement of palm kernel cake. Feed and water were given *ad libitum* for the 4 weeks the experiment lasted. At the end of the feeding period, the birds were dressed and cut into carcass parts and the internal organs separated. Proximate analysis indicated that *Gmelina arborea* leaf meal contained 18 % crude protein and 3591Kcal gross energy. The leaf meal did not significantly (P>0.05) influenced all growth indices except feed: gain ratio that was negatively affected by 3.0 % level compared to control. There was no negative impact of the leaf meal on dressed carcass and internal organs. Therefore, 3.0 % *Gmelina arborea* leaf meal could be incorporated in diets for finishing broilers.

Key words: broiler chickens, dressed carcass, *Gmelina arborea*, leaf meal, internal organs, palm kernel cake

INTRODUCTION

Palm kernel cake and wheat offal have been the major high fibre low protein feedstuffs used to produce poultry feeds in Nigeria (Ndelekwute, 2012). Their inclusion specifically is to reduce cost of feed. Feed accounts for 60 – 70 % of the total production cost in modern poultry production (Oluyemi and Roberts, 2000, pp. 147-168). Furthermore, Smith (1990, pp. 69-121) had shown that nutrition has a great effect on poultry growth, egg production and meat quality. In achieving good level of nutrition standard, farmers have encountered high level of cost of production due to expensive feedstuffs such as maize and soya bean meal which constitute over 80 % in broiler diets. This has resulted to low profit maximization. This situation has created the need to look for cheap, available and less competitive and non expensive feed ingredients. In achieving this, potentials of high fibre protein feedstuffs which have little or no monetary value could be explored for finishing broilers.

The use of forages has been suggested to be a viable alternative source of proteins, fibre, vitamins and minerals for poultry feeding (Church 1991, pp. 150-165). Plant leaves are commonly processed into leaf meals, for use in poultry feed. Available information showed that forage resources from *Leucaena leucocephala, Gliricidia sepium, Sesbania sesban, Manihot spp* have been widely used in feeding non-ruminants and especially poultry for improvement of their productivity (Lopez, 1986; D'Mello *et al.,* 1987). However, the use of leaf meals is limited by their high fibre contents and in some cases, presence of varying quantities of antinutritional factors or metabolism inhibitors in their biomass. These affect the optimal utilization of forage by

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monogastric animals. Consequently, levels higher than 5 – 10 % depending on type of forage have been reported to be detrimental on survival and production of animals **(**Cariaso, 1988; Alefor and Omodara, 1994; Onwuka, 1994; Onwuka, 1996; Osagie, 1998**)**. One of such forages that could be used in feeding animals is *Gmelina arborea* leaf.

Gmelina arborea (knonw as *Gmelina* or white teak tree) is a medium-sized, fast-growing deciduous non-leguminous tree of up to 40 m tall and 140 cm in diameter (Jensen, 1995). It is usually planted in gardens and avenues. It is all season tree, drought tolerant, resistant to most diseases and pests. lt has a high biomass yield per hectare, can grow well in marginal areas and has a protein value which can support livestock production. Jensen (1995) reported that *Gmelina arborea* leaves contained 12.5 % crude protein and 1.72 % tannic acid. However, Ahamefule *et al.* (2006) reported higher protein level of 16.80 % and hence could be regarded as good source of cheap protein to farm animals especially monogastrics. The problem of feeding forage to poultry has been among others the absence of teeth. Birds do not masticate their food, hence processing forages that have potential into meal could be a good strategy. *Gmelina arborea* leaf could be said to have such potentials and it abounds in the tropics. On dry matter basis, it contains high level of protein. Therefore, the objective of this work was to determine the effect of *Gmelina arborea* leaf processed into meal on growth and carcass mass and internal organs of finisher broiler chickens.

MATERIALS AND METHODS

Site of the experiment

The experiment was carried out at the Poultry unit of Teaching and Research Farm of University of Uyo, Akwa Ibom State, Nigeria. The mean rainfall during the experiment was 2500 mm, with relative humidity of 70 %.

Experimental Procedure Adopted

Preparation of Gmelina arborea leaf meal

The *Gmelina arborea*_leaves were harvested from a *Gmelina* plants cultivated and maintained by Forestry Department of University of Uyo, Nigeria where the research was carried out. Leaves were cut from trees over twelve months old. The leaf petiole (stalks) was removed including the midrib to reduce the fibre content. The leaves were chopped into pieces sun dried and milled to powder form. The meal was stored in an air tight bag throughout the duration of the research. The palm kernel cake used was obtained from a vegetable oil factory. Proximate composition of both the leaf meal and palm kernel cake (Table 2) was determined according to Association of Analytical Chemists (A.O.A.C., 1999).

Formulation of Diets for the Experiment

Starter and finisher diets were formulated to conform to the requirements for broiler chickens in the tropics as recommended by National Research Council (NRC. 1994). Trial and error method according to Olomu (1995, pp. 218-224) was adopted. The starter diet contained crude protein 22 %, ether extract 4.65 %, crude fibre 4.05 %, calcium 1.21 %, phosphorus 1.0 %, lysine 1.12 %, methionine 0.50 % and energy 2865 KcalME/kg. It did not contain *Gmelina arborea* leaf meal, while the finisher diets contain different levels of *Gmelina arborea* leaf meal in replacement for palm kernel cake (Table 2).

Design of the Experiment

A total of 180 day old chicks of Hubbard strain were used. They were grouped into four treatment (T1 – T4) groups of 45 birds each. The treatments were replicated thrice, each having 15 birds. Treatment one (T1) served as the control diet which contained no *Gmelina arborea* leaf meal. Treatments 2 – 4 diets contained respectively 1.00, 2.00 and 3.00% of the leaf meal. The experiment was arranged on completely randomized design (CRD). The experiment lasted for 4 weeks starting from the fourth week which was the end of the starter phase. At the starter phase, diet containing no *Gmelina arborea* leaf meal was fed to all the birds. At the end of the brooding which lasted for 3 weeks the birds were transferred together to the rearing house. At the fourth week, they were randomly separated into treatment groups, making sure that the treatment groups have similar average live weight.

Management of Experimental Chicks

The chicks were managed in a deep liter open sided house. Birds were brooded for three weeks during which gumboro and Newcastle disease vaccines were administered twice on 10^{th}, 17^{th} and 1^{st} , 19^{th} day respectively. On the first day D-glucose solution was given to the chicks. From the second day antibiotic and vitamins were added to the drinking water for one week. Both feed and water were offered *ad libitum* to the birds till the end of the experiment.

Prophylactic measures against *coccidiosis* and chronic respiratory disease were observed. Adequate hygiene and routine management of liter were observed also.

Data Collection and Analysis

Data collected were on live weight, feed intake, dressed carcass and internal organs The values of feed intake and live weight were used to calculate feed: gain ration. Birds were killed, dressed and dressed carcass parts and internal organ parameters were collected according to Scott *et al*. (1969) as reported by Oluyemi and Roberts (2000, pp. 196-198) and Ndelekwute *et al*. (2012). The dressed carcass weight was expressed as percentage live weight; cut-parts weight as percentage dressed weight and weight of internal organs as percentage live weight. All percentage values were transformed using arc sine according to Preston (1996). All data were subjected to the Analysis of Variance (ANOVA) and significant means separated using Duncan Multiple Range Test according to Steel and Torrie (1980).

RESULTS

The proximate composition of the *Gmelina arborea* leaf meal is presented in Table 2. It contained high level of crude protein and nitrogen free extract. The crude fibre and energy content were low. The performance parameters of finisher broiler chickens fed *Gmelina arborea* leaf meal (Table 3) indicates that there were no significant ($P>0.05$) differences in final live weight and weight gain. However, significant difference ($P<0.05$) was observed in feed intake and feed: gain ratio. Birds that fed diet containing 3% leaf meal consumed more feed compared to the control. Nevertheless, this did not translate to improved live weight. It was further observed that the feed: gain ratio of broilers fed 3 % leaf meal was higher compared to the control. Results of carcass and internal organ analyses (Tables 4 and 5) revealed that there were no significant differences in all the parameters measured.

DISCUSSION

The crude protein of the leaf meal obtained was higher than the 12.50 % reported by Jersen (1995) but closer to 16.80 % published by Ahamefule *et al.* (2006). Similarly, the value fell within the range of 15.30 to 33.30 % reported by Mecha and Adegbola (1980) and Okoli *et al.* (2001). This variability might be due to soil types and age of the plant. This is in line with report by Ahamefule *et al.* (2006) who stated that forages of Nigerian rangeland differed in chemical composition owing to variability in soil types and constitution. It was also observed that the crude fibre content was low compared to 18 % contained by some cereal grains and oil seeds byproducts such as wheat offal, brewer's dried grains and palm kernel cake conventionally used to formulate diets for chickens (Olomu 1995, p. 60). The low fibre content is an indication that it could not hinder nutrient utilization. High level of fibre is detrimental to broiler performance. In addition, the low fibre level could have resulted from proper processing of the *Gmelina arborea* leaves (for instance, the leaf stalks were removed from the leaves which would have increased the fibre content).

The non significant difference in live weight was in contrast to the findings of Gadzirayi *et al.* (2012) who observed significant improvement in live weight. Significant increase in both daily and total feed intake by broilers fed leaf meals has been reported. Kakengi *et al.* (2007) reported significant increase in feed intake of birds fed *Moringa oleifera* leaf meal diets. It was however in contrast with Gadzirayi *et al.* (2012) who observed no significant difference in feed intake of broilers fed leaf meal. Higher feed: gain ratio at 3 % level is indicating poor utilization of the feed. This could be as a result of probable presence of antinutritional factors especially tannin which was reported to be the major antinutritional factor in *Gmelina arborea* leaf (Jensen, 1995). Though, the leaves were dried, it could be that the drying method and duration of drying were not enough to remove the tannin or reduce it to a level that could not affect productivity negatively. Antinutritional factors are known to induce negatively on chicken and other farm animals performance (Olomu, 1995, p. 286; McDonald *et al*., 1995, pp. 434-444; Onwuka, 1996)). This was not the case for the feed intake which could imply that any toxic factor in the leaf meal could not have occurred at level that could have negatively affected feed intake but rather the metabolic processes, thereby being only detrimental to the utilization of the feed. In addition higher feed intake recorded by 3.0% level compared to the control could be as a result of the difference in energy content of the two diets. Control diet contained 50 kcal/kg more. Chickens have been reported to consume more diets at lower energy level (Oluyemi and Roberts 2000, pp. 147-168). Therefore, the higher feed intake could be related to the lower energy

content of diet of treatment 4. This result was in line with Olugbemi *et al.* (2010).

All internal organs examined were not negatively affected signifying that there were no detrimental effects of the leaf meal on them. The same applies to carcass yield indicating that the *Gmelina arborea* leaf meal could not have interfered negatively with the muscle development.

CONCLUSION

Where as inclusion of *Gmelina arborea* leaf meal did not negatively affect the live weight, carcass yield and internal organs of the broilers, it could be considered for in broiler chicken diets. Hence, level of 2.0 % at the finisher phase is recommended.

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Table 1: Ingredient and nutrient composition of diets

Ingredients	T_1	T_2	T_3	T_4
Maize	53.00	53.00	53.00	53.00
Soyabean meal	25.00	25.00	25.00	25.00
Gmelina leaf meal	-	1.00	2.00	3.00
Fishmeal	3.00	3.00	3.00	3.00
Palm kernel cake	12.00	11.00	10.00	9.00
Wheat offal	3.00	3.00	3.00	3.00
Bone meal	3.00	3.00	3.00	3.00
Salt	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Premix*	0.25	0.25	0.25	0.25
Total	100	100	100	100
Nutrient Composition (Calculated)				
Crude protein	20.50	20.50	20.50	20.50
Ether extract	4.56	4.56	4.55	4.53
Crude fibre	6.55	6.55	6.50	6.45
Lysine	1.15	1.15	1.15	1.15
Methionine	0.55	0.55	0.55	0.55
Calcium	1.05	1.05	1.05	1.05
Phosphorus	0.85	0.85	0.85	0.85
Energy (Kcal/ME/kg)	2850	2810	2820	2800

*Per kg finisher diet): vitamin 10, 0001.u., vitamin D_3 12,0001.u. Vitamin E 201.U., Vitamin K 2.5mg, thiamine 2.0mg, Riboflavin 3.0mg, pyridoxine 4.0mg, Niacin 20mg, cobalamin 0.05mg, pantthemic acid 5.0mg, Folic acid 0.5mg, Biotin 0.08mg, choline chloride 0.2mg, Manganese 0.006g, Zinc 0.03g, Copper 0.006g, Iodine 0.0014g, Selenium 0.24g, cobalt 0.25g and antioxidant 0.125g.

Table 2: Proximate composition of dry *gmelina arborea* leaf meal (GALM) and palm kernel cake (PKC)

Nutrients	(GALM)	(PKC)
Crude protein (%)	18.20	18.50
Ether Extract (%)	2.73	7.85
Crude Fibre (%)	5.65	18.22
Ash (%)	8.00	5.65
Nitrogen Free Extract (%)	65.42	49.78
Energy (Kcal/GE/kg)	3591	5321

Table 3: Effect of diets growth performance of broiler chickens

Parametrs	T1 (0.00 %)	T2 (1.0 %)	T3 (2.0 %)	T4 (3.0 %)	Sem
Initial live weight (g/bird)	736	741	746	745	8.9
Final live weight (g/bird)	2109	2105	2098	2040	54.30
Weight gain (g day)	49.04	48.71	48.29	46.25	10.8
Total Feed intake (g/bird)	4256^{b}	4340^{ab}	4480^{ab}	4620^{a}	202.01
Daily feed intake (g/bird)	152^{b}	155^{ab}	160^{ab}	165^{a}	20.43
Feed: gain ratio	3.10^{b}	3.18^{ab}	3.31^{ab}	3.57^{a}	0.40

abc means along the same row with different superscripts are significantly different ($P<0.05$
SEM = Standard Error Mean

Table 4: Effects of diets on carcass yield of broiler chickens

Parametrs	T1 (0.00 %)	T2 (1.0 %)	T3 (2.0 %)	T4 (3.0 %)	Sem
Live weight (g)	2017	2083	1980	1975	75.32
Dressed weight (%)	65.29	64.81	64.49	64.56	36.7
Breast weight (%)	32.67	31.87	32.08	32.55	8.43
Thigh weight (%)	20.65	20.88	21.23	19.95	6.67
Drumstick (%)	16.21	15.98	16.04	16.01	5.03
Backcut (%)	25.45	24,95	26.06	25.87	7.23
Wing (%)	13.66	14.01	13.22	13.24	4.25
Fat (%)	0.85	0.87	0.79	0.75	0.18

Table 5: Effect of diets on internal organs of broiler chickens

Parametrs	T1 (0.00 %)	T2 (1.0 %)	T3 (2.0 %)	T4 (3.0 %)	Sem
Gizzard	1.94	1.97	1.96	2.03	.0.51
Heart	0.71	0.79	0.81	0.82	0.20
Liver	2.55	2.61	2.45	2.56	0.62
Kidney	0.72	0.81	0.78	0.80	0.26
Pancreas	0.45	0.39	0.40	0.41	0.08
Spleen	0.08	0.09	0.08	0.09	0.07
Intestine	6.77	5.98	6.45	6.67	1.44

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