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Performance and apparent digestibility of Broiler Starter Fed Diets containing Gliricidia Sepium Leaf Meal

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Abstract

One hundred and forty four (144) day old broiler chicks were used to determine the effect of *Gliricidia sepium* leaf meal (GLM) on performance and apparent digestibility of broiler starter. A basal diet (0 g/kg GLM) was formulated for the starter phase to meet the requirements of the broiler chicks. Thereafter, two diets were formulated to contain GLM at 50 and 100 g/kg respectively. The birds were arranged in a completely randomized design having three treatments with each replicate having sixteen chicks. The birds were fed *ad libitum* with their respective diets for 28 days. The final live weight of birds on the control (796g/bird vs 746 670 g/bird) and total weight gain (758 g/bird vs 708 662 g/bird) decreased with increased GLM inclusion in the diets while the total feed intake, protein intake and feed conversion ratio were similarly affected by the dietary treatments. The apparent crude protein digestibility of birds fed the control diet and diet containing 50 g/kg GLM were similar but higher than those fed diet containing 100g/kg GLM. The apparent ash digestibility of birds fed on 50 g/kg GLM containing diet (70.78%) was higher than those fed the control, and diet containing 100 g/kg GLM. It could be concluded that GLM at 50 g/kg inclusion level in diet of broiler starter may be the optimum inclusion level.

Key words : Broiler starter, *Gliricidia sepium* leaf meal, digestibility.

INTRODUCTION

Poultry plays major role in filling the gap for animal protein needs of people in many developing countries. In particular, eggs from poultry have been reported to contribute over 20% of the total animal protein supply [1]. However, poultry production is being seriously affected by feed availability in the developing countries [2] as feed cost accounts for 60-70% of the total intensive production cost [3]. This problem of feed unavailability in the developing countries has been attributed to high cost of the common conventional feed ingredients used in formulations. This thus has necessitated the search for alternative non-conventional feed stuffs that are locally available and that their processing methods could be easily adopted.

Leaves of the tropical legumes and browse plants are possible plant protein sources that can be exploited [4] due to their nutritive values, availability, relatively low cost and the non existence of competition in their consumption between livestock and man [5]. The leaf meals are also known as a good source of minerals, vitamins and oxycarotenoids.

Gliricidia sepium is a leguminous plant used for browse plants, live fencing, green manure and shade for plantation crops among others [6]. Leaves of *Gliricidia sepium* contain high quality protein [7] and minerals in adequate concentrations [8]. *Gliricidia sepium* is a member of the sub-family Papilionoideae and lies within the tribe Robinieae [9]. It is a medium-sized, thorn-less leguminous tree which usually attain a height of 10-12m and originated from Mesoamerica [10]. Spanish colonist named gliricidia the mother of cocoa 'madre de cacao' because of its use as cocoa shade tree. Presently, *Gliricidia sepium* has extensively spread to the Caribbean, the Philippines, India, Sri Lanka and West Africa [11]. After *Leucaena leucocephala, Gliricidia sepium* has been reported to be the most widely cultivated multipurpose tree; although, gliricidia yields as much as or more biomass than *Leucaena leucocephala* [12]. Gliricidia annual leaf dry matter production generally ranges from 2t/ha/year to 20t/ha/year [13, 14]. The tree is largely deciduous during the dry season, however, where sufficient moisture prevails; it does not become leafless [15].

It has been established that response of birds to feed depends on the physiological life stage of the birds. This explains why different nutrient requirements have been established for birds of different physiological age. Presently, there is a limited of information on the utilization of *Gliricidia sepium* leaf meal in broiler starter diets, which suggests the need to investigate its effect on performance characteristics of broiler chicks. Therefore, the objective of this study was to determine the effect of including different levels of *Gliricidia sepium* leaf meal on the performance and digestibility of broiler starter.

MATERIALS AND METHODS

EXPERIMENTAL SITE

The right to conduct the research had been granted by the Research Committee of the Department of Agricultural Technology, The Federal Polytechnic, Ado Ekiti, Nigeria. Thereafter, the experiment was carried out at the Teaching and Research Farm of the Agricultural Technology Department, The Federal Polytechnic, Ado Ekiti, Nigeria. The study area is located between latitudes 7°37´N and 7°12´N and longitudes 5°11´E and 5°31´E. The relative humidity is between 70 and 85% while mean annual rainfall is 1247 mm. The site is situated at about 437 mm above sea level and has the mean annual temperature of 26.2°C.

COLLECTION, PRODUCTION AND CHEMICAL ANALYSIS OF GLIRICIDIA SEPIUM LEAF MEAL

The *Gliricidia sepium* leaves were harvested fresh from the Teaching and Research Farm of the Agricultural Technology Department, The Federal Polytechnic, Ado Ekiti. Nigeria, air-dried under a shed for 14 days, thereafter hammer milled and analyzed for proximate composition as described by AOAC [16], cyanide as described by Oboh [17] and tannin as described by Makkar and Goodchild [18].

DIET FORMULATION

A basal diet was formulated for the starter phase to meet the NRC [19] requirement. Thereafter, two diets were formulated to contain *Gliricidia sepium* leaf meal (GLM) at 50 and 100g/kg respectively. The gross and analyzed compositions of the formulated diets are as presented in Table 2.

EXPERIMENTAL DESIGN AND PROCEDURE

A total number of 144 day-old broiler chicks of arbor acre were assigned to three (3) dietary treatments of three (3) replicates of sixteen (16) chicks per replicate in a completely randomized design. The mean initial body weight (g) of birds was 37.7±0.02 (mean±SEM). Thereafter, their respective starter experimental diets were fed *ad libitum* for 28days during which the weekly feed consumption and weight changes were measured. The protein intake expressed as [crude protein/100]*feed intake and feed conversion the ratio expressed as ratio of feed consumed to weight gained were calculated.

Table 1 : Proximate (g/kg), energy and anti-nutrients of *Gliricidia sepium* leaf meal

Parameters	Quantity
Dry Matter	925
Crude Protein	244
Ash	86.2
Crude fibre	125
Ether extract	16.2
Nitrogen free extract	454
Gross energy (kcal/100g DM)	386
Cyanide (mg/kg)	0.68
Tannin (%)	1.30

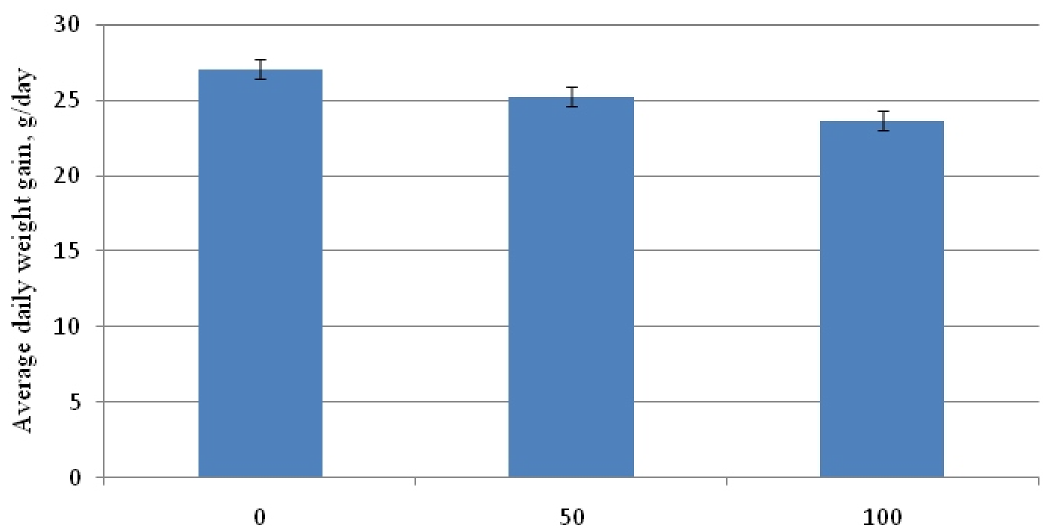

Figure 1: Average daily weight gain of broiler starter on different levels of Gliricidia leaf meal

DIGESTIBILITY TRIAL

Seven days to the end of the trial, five (5) birds were randomly selected from each replicate, housed individually in metabolism cage for faecal collection for the determination of apparent digestibility. The birds were allowed to adapt to the cage for the first three days while the last four days were the experimental period, during which the record of feed intake and faeces voided were taken as described by Oladunjoye *et al*. [20].

The droppings for each day were collected and weighed. Thereafter, aliquot sample was taken after thorough mixing of the droppings, weighed and dried in a forced air circulation oven at 60°C. At the end of the 4th day the samples for each replicate were pooled together, ground and analyzed to determine the proximate composition. Data on digestibility were expressed as 100*(Intake-Excreta)/Intake.

CHEMICAL AND STATISTICAL ANALYSIS

The proximate composition of Gliricidia *sepium* leaf meal (Table 1), experimental diets, and pooled faeces were determined according to AOAC [16] while tannin and cyanide contents of GLM were determined as described by Makkar and Goodchild [18] and Oboh *et al.,* [17] respectively.

Data obtained on performance characteristics and apparent digestibility were subjected to one-way analysis of variance using

Table 2 : The gross composition of the starter experimental diets (g/kg)

Ingredients	Diet 1 (0 g/kg GLM)	Diet 2 (50 g/kg GLM)	Diet 3 (100 g/kg GLM)
Maize	590	562	534
Gliricidia Leaf meal	0	50	100
Soyabean meal (42%CP)	170	148	140
Groundnut cake	153	153	137
Fish meal	50.0	50.0	50.0
Bone meal	20.0	20.0	20.0
Oyster shell	5.00	5.00	5.00
Premix*	2.50	2.50	2.50
Methionine	3.00	3.00	3.00
Lysine	1.50	1.50	1.50
Salt	3.00	3.00	3.00
Vegetable oil	2.00	2.00	4.00
Calculated analysis			
Crude Protein (g/kg)	236	238	240
ME (kcal/kgDM)	3049	3027	3017
Calcium (g/kg)	13.8	13.8	13.8
Phosphorus (g/kg)	5.90	5.91	6.01
Analysed composition (g/kg)			
Moisture Content	85.8	87.1	79.3
Ash	59.6	45.3	40.3
Crude Fibre	37.2	37.6	42.1
Crude Protein	234	235	237
Ether Extract	24.4	24.2	24.1
Nitrogen free extract	584	595	601

**Contained vitamins A (8,500,000 IU); D3 (1,500,000 IU); E (10,000mg); K3 (1,500mg); B1 (1,600mg); B2 (4,000mg); B6 (1,500mg); B12 (10mg); Niacin (20,000mg); Pantothenic acid (5,000mg); Folic acid (500mg); Biotin H2 (750mg); Choline chloride (175,000mg); Cobalt (200mg); Copper (3,000mg); Iodine (1,000mg); Iron (20,000mg); Manganese (40,000mg); Selenium (200mg); Zinc (30,000mg); and Antioxidant (1,250mg) per 2.5kg.*

SPSS version 20 and where differences were found; the means were compared using Duncan Multiple Range Test of the same software.

RESULTS

Generally, the intensity of yellowish pigmentation of the shanks, beaks and skins of the birds increased progressively with increase in GLM inclusion level. The gross composition and proximate composition of starter diets are shown in Table 2, while the proximate composition, gross energy and analyzed anti-nutrients of GLM are shown in Table 1. Table 3 shows the effect of GLM on performance of broiler starter. The final live weight (FLW) and total weight gain (TWG) of birds fed the control and 50g/kg GLM-based diets were similar. While the FLW and TWG of birds on 50 and 100g/kg GLM-based diets were similar, those on 100g/kg GLM-based diet were lower than those fed the control diet. The same trend was observed for the average daily weight gain (ADWG) (Figure 1).

The total feed intake, average daily feed intake, protein intake and feed conversion ratio of the birds were similar across the dietary treatments. The feed conversion ratios of the birds increased numerically from 1.75 to 1.90 with increase in the GLM inclusion level (Figure 2). The effect of varying levels of GLM on digestibility by the broiler starter is presented in Table 4. The apparent crude protein digestibility of birds fed the control diet (66.9%) and those on 50g/kg GLM-based diet (67.8%) were similar but higher than those fed 100g/kg GLM based diet (65.0%).

Table 3 : Effect of Gliricidia sepium leaf meal on performance of broiler starter

Parameters	Inclusion levels of GLM (g/kg)			SEM	*P-value*
	0	50	100		
Initial weight (g/bird)	37.7	37.7	37.6	0.02	0.18
Final live weight (g/bird)	796[a]	746[ab]	670[b]	17.8	0.05
Total weight gain (g/bird)	758[a]	708[ab]	662[b]	17.8	0.05
Average daily weight gain (g/bird/day)	27.1[a]	25.3[ab]	23.7[b]	0.63	0.05
Total Feed Intake (g/bird)	1317	1286	1257	15.9	0.35
Average daily feed intake (g/bird/day)	47	45.9	44.9	0.57	0.36
Protein intake (g/bird)	316	309	302	3.82	0.35
Feed conversion ratio	1.75	1.82	1.9	0.04	0.36

[a-b] Mean within rows having different superscripts are different at $P<0.05$

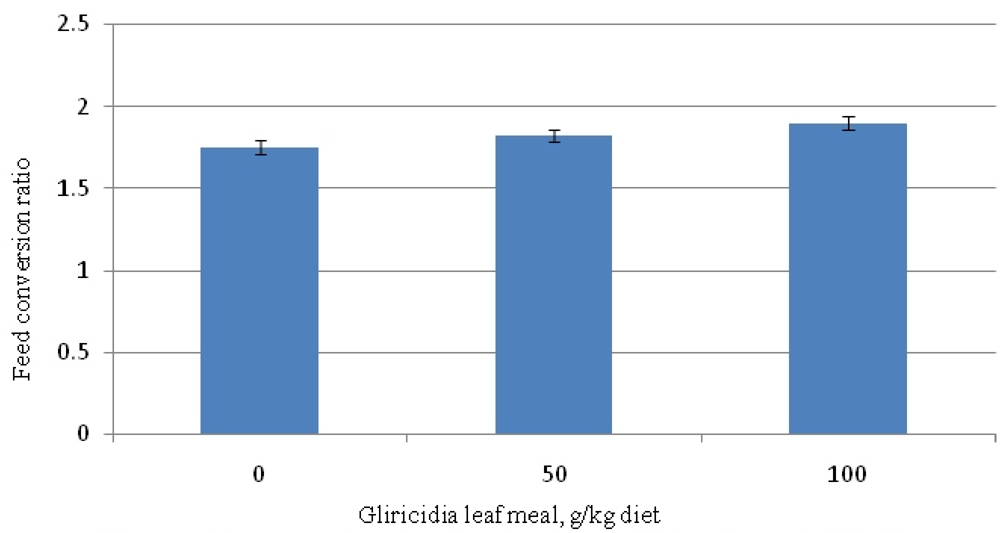

Figure 2: Feed conversion ratio of broiler starter on different levels of Gliricidia leaf meal

The apparent ash digestibility of birds fed diet containing 50g/kg GLM was the highest. While this was similar to those fed the control, and it was higher than those fed on diet containing 100g/kg GLM.

DISCUSSION

The protein content (244 g/kg) as well as ash content (86.2 g/kg) of gliricidia leaf meal suggests that *Gliricidia sepium* leaf meal could be an important contributor of plant protein and minerals in monogastric feed where protein and mineral feed ingredients are in short supply. The crude protein content and crude fibre is similar to 243.8 g/kg and 124.5 g/kg, respectively obtained by Ogungbesan *et al.*, [21] for gliricidia leaf meal. The presence of cyanide (0.68 mg/kg) and tannin (1.3%) in gliricidia leaf meal agreed with earlier reports of [22] and [23]. Excess cyanide content at 100mg/kg diet has been reported by Panigrahi [24] to adversely affect broiler performance while tannin binds dietary protein and digestive enzymes into complexes which are not readily digested [25], causes poor palatability due to their ability to bind protein of saliva and mucosa membranes [26].

In this study, increase of yellowish pigmentation of shanks, peaks and skins of broiler starter with increased GLM inclusion level indicates an efficient absorption and utilization of the pigmenting xanthophylis present in the leaf meal by the birds. This agreed with the reports of D'mello *et al.*, [27] and Esonu *et al.*, [28]. The observed depression in final live weight and total weight gain of the broiler starter chicks fed diet containing 100 g/kg GLM in this study agreed with earlier report of Ash and Akoh [29] that growth of poultry were reduced at high leaf meal inclusion level in the diet. Zanu *et al* [30] reported that inclusion of *Leucaena leucocephala* leaf meal in diets as low as 5% had adverse effect on growth performance of broiler chicken while Esonu *et al.*, [5] observed depressed body weight gain of broilers fed 15% *Microdemis puberula* leaf meal. Cheeke *et al* [31] also reported growth depression in chicks fed 20% *Robiniapseudo acacia* leaf meal. The depressed performance of the broiler starter fed 100 g/kg gliricidia leaf meal in this study could be due to the cumulative effect of some anti-nutritional factors such as tannin and cyanide in gliricidia leaf and high fibre (Table 1). Tannin binds dietary protein into complexes which are not easily

Table 2 : Effect of varying levels of *Gliricidia sepium* leaf meal on apparent digestibility (%) of broiler starter.

Parameters	Inclusion levels of GLM (g/kg)			SEM	*P-value*
	0	50	100		
Crude Protein	66.9^a	67.8^a	65.00^b	0.48	0.01
Crude Fibre	48.7	48.2	49.2	0.50	0.78
Ether Extract	71.9	71.2	70.9	0.28	0.43
Ash	68.5^{ab}	70.8^a	66.5^b	0.76	0.04

$^{a-b}$ Mean within rows having different superscripts are different at P<0.05

digestible [4, 32] and reduces palatability of diets [33]. Also, dietary tannin causes reduction of feed efficiency and weight gain in chicks [34]. In addition, excess feeding of high fibrous ingredients may lead to enlargement of the intestinal villi [35] with a resultant reduction in growth performance as observed in the current study. Generally, this finding is consistent with the recommendation of 5% leucaena leaf meal by Natanman and Chandrasekaran [36] for broiler but disagreed with the result of Ncube *et al* [37] who reported improvement in the weight of broiler chicks fed 10% *Acacia angustissima* leaf meal at the starter phase. The observed non statistical difference in the feed intake and protein intake of birds with increased GLM inclusion level in this study might suggest that the control diet and the test diets were palatable to the birds and this could explain why the birds utilized their respective diets identically. This finding is in consonance with the report of Unigwe *et al* [38] who observed similar FCR in broiler chickens fed varying levels of sundried pawpaw leaf meal. Similar result was also reported by Esonu *et al* [5] who observed no difference in the FCR between broilers fed 0% and 10% *Microdesmis puberula* leaf meal. However, the result in this study disagreed with the report of Kagya-Agyemang *et al* [6] who observed reduction of feed conversion ratio in broilers as the level of GLM increased.

The relatively poor apparent crude protein and ash digestibilities of broiler starter fed diet 3 (100 g/kg GLM) could be implicative of the relative high dietary fibre and possible cumulative effect of high tannin and cyanide content of the diet as a result of increased GLM level. Tannin has been reported to cause low digestibility in poultry birds [39]. However, the similarity of the apparent crude protein and ash digestibilities of broiler starter fed control (0 g/kg GLM) and diet 2 (50 g/kg GLM) imply that the tannin and fibre content in these diets could be within the tolerable level which might not have negative effect on the apparent digestibility at this age of broiler.

CONCLUSION

From the results of this study, *Gliricidia* leaf meal can be included up to 50 g/kg in the diet for broiler starter without adverse effect on the performance characteristics and apparent nutrient digestibility. Thus, in region where *gliricidia* leaf meal abounds, the inclusion of GLM at 50 g/kg of the diet is recommended for inclusion in the diets of broiler starter chicks.

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