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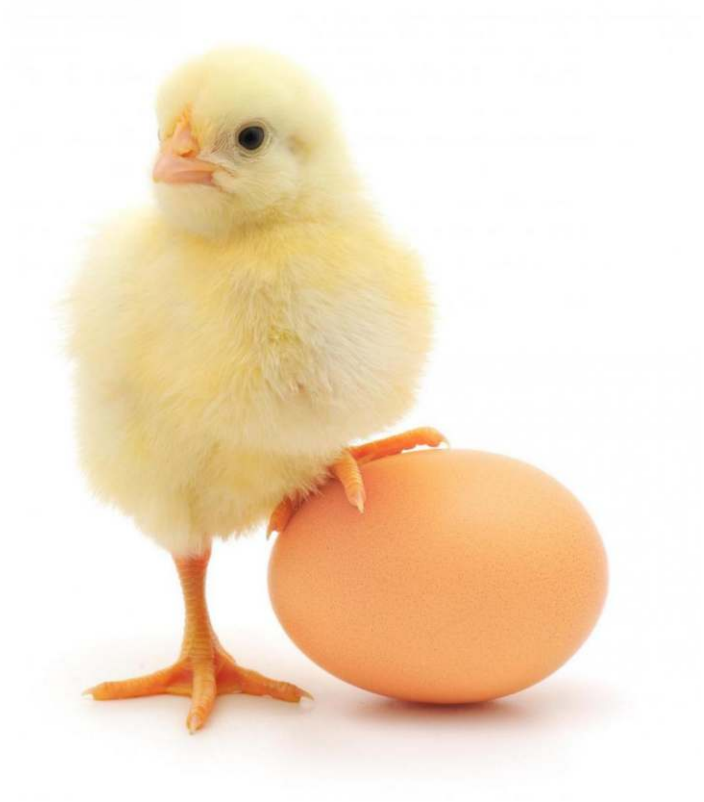

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Effect of Feeding Gliricidia Sepium Leaf Meal on the Performance and Egg Quality of Layers

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Abstract: A feeding trial was conducted to study the nutritive value of sun-dried gliricidia leaf meal (GLM) using 72 laying hens. The birds were allotted to four dietary treatments containing 0, 5, 10, and 15%GLM respectively in a completely randomized design; each treatment was replicated three times. Feed and water were provided *ad libitum*. The inclusion of GLM in layer diets significantly ($p<0.05$) reduced feed consumption in a linear fashion. Layers fed 0 and 5%GLM had similar ($p>0.05$) hen day egg production, body weight changes and feed conversion efficiency which worsened significantly at 10 and 15%GLM levels. Egg quality values showed no significant differences ($p>0.05$) in terms of egg weight, Haugh unit and shell thickness while yolk index increased ($p<0.05$) with GLM and was found to be best at 10 and 15% GLM. Yolk colour was positively enhanced at all levels of GLM. Proportionally, egg membrane values were lower ($p<0.05$) on GLM diets compared to the control while the egg yolk, albumen and shell were not affected. Boiling of egg resulted in lighter yolk and albumen but heavier shell and membrane with a 43% reduction ($p<0.05$) in egg yolk colouration. At dietary levels >5%, GLM depressed feed intake and egg production.

Key words: Gliricidia leaf meal, layers, performance, egg quality, yolk colour

Introduction

Gliricidia sepium (Jacq) is a multipurpose tree legume that is second only to Leucecanea leucocephala in worldwide popularity. Gliricidia possess the ability to provide large quantities of high quality forage matter all-year-round as well as the ability to maintain a sustainable environment through nitrogen fixation thus replenishing the soil (Chadokar, 1982). The leaves of Gliricidia sepium have a high feeding value, with crude protein comprising 20-30% of the dry matter, a crude fibre content of about 15%, and *in vitro* dry matter digestibility of 60-65% (Adejumo and Ademosun, 1985; Gohl, 1981). At the same time, the leaves also contain anti-nutritional factors like condensed tannins, cyanide coumarins, and cyanogenic glycosides (Ahn *et al.*, 1989; Smith and van Houteh, 1987; Cox and Braden, 1974). Besides these anti-nutritional factors that can impair both nutrient metabolism and other physiological processes, another important factor in gliricidia feeding is the repulsive smell that put animals off at first introduction (Lowry, 1990)

Despite its promise as a forage tree legume, gliricidia feeding is not widespread among monogastric livestock. Even, among ruminants, there are reports that it may be accepted in one region by a species and rejected in another region by the same species (Simons and Stewart, 1994). There is therefore, no consensus on the nutritive value of this plant for farm animals. This suggests differences in the constitution of the plant between regions. As a result, research on the evaluation of the nutritive value of gliricidia should be carried out wherever the plant occurs in abundance and potentials abound for it to contribute to the nutrition of farm animals (Herbert, 1998).

Consequently, this study was carried out to further elucidate on the implications of gliricidia feeding on performance and egg quality parameters of laying chickens. The egg yolk pigmenting potency was also assessed.

Materials and Methods

The leaves of Gliricidia sepium (Jacq) were harvested from plants on the University Teaching and Research farm plots. Only the green fresh leaves were harvested, leaving behind the very tender and old ones. The long stalks were removed to reduce fibrous ness before spreading in the sun. Drying was completed in two days of good sunshine. The dried Gliricidia leaves (GLM) were ground, using a 2mm screen and stored in jute bags until needed. Four experimental laying diets based on white maize were formulated such that they contained 0, 5,10 and 15 % GLM respectively (Table 1). Seventy-two Harco hens at their third month of laying life were divided into four groups of 18 birds each and randomly assigned to the four experimental diets. Each group of 18 birds was further subdivided into three replicates of six birds each and kept in three contiguous cages with a cage space between each replicate. They were fed on a white maize-based pre-trial diet for one week and thereafter placed on the experimental diets for 8 weeks. Feed and water were offered *ad libitum*. Feed intake, egg production, egg weight, feed conversion efficiency and body weight changes were recorded on a weekly basis.

Table 1: Composition of experimental layer diets containing graded levels of Gliricidia leaf meal

	GLM in diets (%)			
Ingredients	0	5	10	15
Maize	45	42.1	39.2	36.3
Soybean meal	20	17.9	15.8	13.7
Gliricidia[1]	0	5	10	15
Fixed[2]	35	35	35	35
Total	100	100	100	100
Analysis (%DM)				
Dry Matter	91.1	91.8	91.6	91.3
Crude protein	17.2	17.9	18.2	18.1
Ether extract	3.25	3.34	3.01	2.60
Crude fibre	3.43	3.88	4.29	6.36
Ash	3.35	3.52	3.74	3.68
[3]ME (KJ/Kg)	2.57	2.43	2.26	2.1

[1] Composition of GLM (%): 92.58 dry matter; 24.38 crude protein, 1.75 ether extract, 12.45 crude fibre, 8.64 ash, 45.36 nitrogen free extract

[2] Fixed ingredients contains (%): wheat offal, 19.25; fish meal, 3; oyster shell, 9; bone meal, 3; methionine, 0.25; salt, 0.25 and vitamin-mineral premix, 0.25 supplied per kg: retinol, 120 mg; cholecalciferol, 25 mg; dl-&-tocopherol, 6g; menapthone, 800 mg;thiamine, 400 mg; riboflavin, 2.0 mg; panthothenic acid, 4.0 g;cyanocobalamin, 4.8 mg; folic acid, 400 mg;biotin, 20 mg; vitC, 60.0 g, choline chloride, 120.0 g; Mn, 4.0 g; Fe, 2.0 g; Zn, 18.0 g; Cu, 800m g; I, 620 mg; Co,90 mg; Se, 40 mg.

[3] Calculated metabolizable energy content short of whatever ME contributed by Gliricidia leaf meal

Egg quality parameters were measured every two weeks. The eggs were broken with a blunt knife and contents poured on a piece of flat glass positioned on a flat surface. The albumen and

Table 2: Effect of Gliricidia leaf meal on performance and egg quality parameters of layers.

	GLM in diets (%)				
Parameters	0	5	10	15	SE
Performance					
Feed intake (g/d)	123.9a	120.7b	117.9c	116.6d	2.73
Body weight change, g	0.42a	0.36a	-1.43b	-1.91b	1.05
Hen day egg production, %	86.9a	85.3a	76.0b	65.8c	2.73
Egg weight, g	58.8	57.8	59.9	57.1	0.61
Feed / kg egg (kg)	2.45c	2.48c	2.61b	3.15a	0.10
Egg quality					
Haugh unit, %	83.1	83.9	84.8	84.4	0.83
Shell thickness, cm	0.33	0.33	0.33	0.33	0.002
Yolk index	0.39b	0.40b	0.42a	0.42a	0.005
Yolk colour	1.0d	2.25c	3.63b	5.88a	0.47

SEM: Means with different superscripts on the same row are significantly different ($p < 0.05$)

Table 3: Effect of Gliricidia leaf meal based diets on raw, boiled and average value of egg components

	GLM in diets (%)					
Components (%)	0	5	10	15	SEM	Average value
Yolk						
Raw	24.5	24.2	23.9	24.4	0.16	24.2
Boiled	21.2	22.9	22.3	23.6	0.55	22.5
Albumen						
Raw	62.9	63.1	63.2	61.3	0.3	62.6
Boiled	63.3	60.3	61.1	58.2	1.14	60.7
Shell						
Raw	9.48	9.58	9.62	9.90	0.08	9.65
Boiled	9.93	10.2	9.73	9.88	0.22	9.94
Membrane						
Raw	1.73a	1.55c	1.55c	1.60b	0.04	1.61
Boiled	2.28	1.85	2.20	2.25	0.12	2.15
Yolk colour						
Raw	1.0	2.25	3.63	5.88	0.47	3.19
Boiled	1.0	1.0	2.0	3.25	0.02	1.81

SEM: Means with different superscripts on the same row are significantly different ($p < 0.05$)

yolk heights were measured using a tripod micrometer. Yolk diameter was taken as the maximum cross-sectional diameter of the yolk using a pair of callipers and read on a ruler in millimetre. The yolk index was calculated as the proportion of yolk height to diameter. Haugh unit scores were calculated from egg weight and albumen height using the formula $HU = 100\log (H + 7.57 - 1.7W^{0.37})$. The Roche colour fan of Vuilleumier (1969) was used to determine the pigmenting potency of diets on egg yolk. Shell thickness was determined with a micrometer screw gauge after the removal of membranes as the average of 3 readings taken at the waist, broad and narrow regions. The component of raw eggs were determined by separating yolk from albumen using a yolk separator while shells free of membranes were oven-dried at 100 °C overnight and cooled to room temperature. The yolk and dried shells were weighed separately and albumen weight obtained by difference. The effect of hot water on the proportion of egg component was determined by immersing six eggs from each replicate in boiling water for 8 minutes. The eggs were thereafter, carefully broken out, membranes removed, albumen and yolk carefully separated and weighed as for the raw eggs.

Dried samples of GLM and diets were analysed for proximate contents (AOAC, 1990). Data collected were subjected to analysis of variance and treatment means compared using the Duncan's multiple range tests (Daniel, 1991)

Results

The results of the performance and egg quality response of layers are presented in Table 2. There was a consistent decrease ($p < 0.05$) in feed consumption with increase in gliricidia content of the diets. Birds fed 0% and 5% GLM had similar ($p > 0.05$) egg production rate, body weight changes and feed conversion efficiency (kg feed / kg egg) which worsened at 10 and 15%GLM inclusion in the diets.

Egg weight, Haugh unit and shell thickness were not significantly ($p > 0.05$) influenced by the inclusion of GLM. Layers on 0 and 5% GLM diets have similar yolk index values while those on 10 and 15% levels were also similar ($p > 0.05$) but differ significantly ($p < 0.05$) from the 0 and 5% GLM diets. The use of GLM in layer diets positively enhanced ($p < 0.05$) the egg yolk colour at all levels. The effect of diet and boiling on egg components of layers are shown in Table 3. The inclusion of GLM did not adversely affect the proportion of raw egg yolk, albumen and shell. Only the values for egg membranes indicated significant variations, being lower on GLM diets than the control diet. Boiling resulted in lighter yolk and albumen but heavier shell and membrane compared to the raw eggs. However, only the raw albumen indicated a significant difference ($p < 0.05$) among the dietary treatments while other components at both raw and boiled status showed only numerical differences ($p > 0.05$). In addition, boiling significantly reduced the yolk colouration from 3.2 to 1.8 in raw and boiled eggs respectively.

Discussion

The chemical content of GLM falls within the range reported by (Adejumo and Ademosun, 1985; Chadokar, 1982; Gohl, 1981). The protein content is higher but crude fibre and ash contents were lower than that registered by Herbert (1998). Variations in composition may be ascribed to differences in soil nutrient status, genetic variation, processing methods and proportion of stalk in the meal.

Feed consumption was significantly reduced in birds fed GLM diets compared to the control diet. The observation is in agreement with reports by (Herbert, 1998; Onwudike, 1995; Raharjo *et al.*, 1987; Mishra *et al.*, 1977) on various animal species. The lowered intake also resulted in the reduced hen-day egg production rate recorded by birds fed GLM. Basically, diets containing 10 and 15% GLM should be consumed more because of their higher fibre content so that birds could meet their energy requirements (Yu *et al.*, 1998). This assertion can only come true if the inherent palatability problems in gliricidia (Simons and Stewart, 1994; Lowry, 1990) are considered and averted. Ahn *et al.* (1989) claimed that drying reduced the tannin content of gliricidia, thus making it more palatable. However, it was not confirmed whether the tannins or some other factors removed during drying were the problem. Atta-krah and Sumberg (1988) also reported that palatability could be improved by wilting and drying of the forage before being offered to animals. In this trial, processing of gliricidia leaves by sun drying before grinding and incorporation into poultry diets appeared not to have made any significant positive impact. Observations on feeding pattern indicated that though the birds eventually got used to GLM even at 15%, the intake remained lower implying the utilization problems associated with gliricidia. This is also evident in body weight losses recorded by birds fed 10 and 15% GLM, a situation similar to reports of toxicity and growth inhibition in poultry (Raharjo *et al.*, 1987) and rabbits (Herbert, 1998; Raharjo *et al.*, 1988). Feed conversion values became poorer with increase in GLM that might be due to increased dietary fibre content (Yu *et al.*, 1998) and palatability problems. Lowry (1990) observed depressed feed consumption and feed conversion efficiency in animals offered gliricidia based diets.

In terms of egg quality, Haugh unit increased with GLM but the differences were not sufficient enough to cause significant variations. The similar ($p > 0.05$) values obtained for shell thickness across dietary treatments were close to values reported for layers in the tropics (Oluyemi and Roberts, 1981). The diets were thus presumed to support internal egg quality, calcium metabolism and shell deposition. The increase in yolk colouration indicated the presence of carotene in available form in the leaves of gliricidia, thus supporting the findings that all green plants contain xanthophylls and its source, availability and value will dictate the degree of pigmentation. Possibly, the use of gliricidia leaf meal could be harnessed towards poultry product pigmentation in the tropics where consumers favour deep coloured poultry egg and skin.

Diet and boiling has little impact on the proportion of egg components. A slight decrease in the proportion of yolk, albumen and membrane with an increase in shell content was caused by GLM. Boiling resulted in a decrease of 7.2% for yolk and 3.1% for albumen but an increase of 2.9 and 25.1% for shell and membrane respectively. Yolk colour was decreased by about 43% through boiling. Subjecting the eggs to boiling lead to physiological changes in the internal egg components. Conventionally, the whole egg solidified, resulting in the coagulation of egg proteins. The egg white became a soft, tough mass and the yolk that is enclosed by the albumen also coagulated at boiling. However, due to the larger proportion of fat in yolk than albumen, breaks up into a powder instead of being soft and tough as in albumen.

In conclusion, the utilization of gliricidia in its present form at a dietary level above 5% is of little beneficial effect to the laying hens, apparently due to the low intake at higher dietary levels. The beauty of its use as a source of yolk pigment cannot be fully appreciated due to associated factors like high crude fibre, low metabolizable energy and low palatability that limit its use in layer diets. In order to improve the relative value of GLM in layer diets, oil or molasses can be added to mask the odour and enhance its palatability.

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