

Nutritional evaluation of varying proportions of *Gliricidia sepium* and *Ficus thonningii* leaves in the diet of young West African dwarf goats.

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Abstract

Sixteen (16) male of West African dwarf goats, aged 6 to 8 months and weighing 4.85 to 6.80kg were used in protein utilization study to monitor performance. The animals were randomly divided into four groups. Each group was fed foliages of *Gliricidia sepium* and *Ficus thonningii* mixed in varying proportions such that 0% (diet 1), 25% (diet 2), 50% (diet 3) and 75% (diet 4) of *Gliricidia* were replaced with *Ficus*. The feeding lasted 70 days during which dry matter intake, DMI, and changes in body weight were monitored. At the beginning of the last 10 days of the trial animals were transferred to individual metabolic cages for daily collection of faeces and urine for 7 days after the 3 days set aside for adjustment to the cages. Results showed that the mean DMI was 185.15g day⁻¹, which amounted to about 2.9% of body weight while digestibility coefficient was 65%. The daily weight gains observed for animals on diets containing 0%, 25%, 50% and 75% of *Gliricidia* replaced with *Ficus* leaves were 34.30, 34.29, 37.10 and 36.79g day⁻¹ respectively. The metabolic faecal nitrogen, MFN, and endogenous urinary nitrogen, EUN, values were 9.42g kg⁻¹ DM and 0.85g day⁻¹ kg⁻¹ BW^{0.75} respectively. Regression model that described the relationship between nitrogen, N, balance and corresponding absorbed N values indicated that the combination of *Gliricidia* and *Ficus* leaves could furnish nutrient (3.68g day⁻¹ kg⁻¹ BW^{0.75} digestible crude protein, DCP) which might support young WAD goat requirement for maintenance. Data obtained suggested that all the three combinations of diets could be fed to goats but the inclusion of *Gliricidia* and *Ficus* at equal level of 50% produced highest weight gain (37.10g day⁻¹) and supported better animal performance.

Keywords: Nutritional evaluation, *Gliricidia sepium* and *Ficus thonningii* leaves in the diet of young West African dwarf goats.

Introduction

Feed availability has been a major factor limiting the expansion of ruminant production in Nigeria. As a result of spiraling costs and dwindling supplies of conventional feed resource, it has become imperative for ruminant nutritionist therefore to research into ways of utilizing feedstuffs that are of no nutritional needs to man for feeding various classes of ruminants.

Several feedstuffs have been researched into in recent times with the view to identifying the most suitable for nutrition, cheap in cost and availability throughout the year. Although, straws and husks are abundant in Nigeria, the problems with these types of feed materials are their low energy level and digestibility (Jackson, 1977). Tropical grasses were generally low in crude protein content (Ademosun, 1994), and they are seasonally available. As they grow, the lignin

content and other cellwall materials build up rapidly adversely affecting digestibility. Studies have also shown that established pasture of *Panicum maximum* or *Cynodon nlemfuensis* alone is not adequate to support optimum production of grazing sheep and goats (Ademosun, *et al.*, 1985). Therefore, forages which are good sources of protein and other nutrients are needed to supplement the poor quality feed ingredients available in the tropics particularly during the dry season.

The use of browses and other feed source alone or as supplements had proved more satisfactory (Ademosun, 1994). Browses such as *Gliricidia sepium* and *Leucaena leucocephala* have been fed with success to small ruminants in alley farming production systems (Sumberg, 1985). The nutritional values of *Gliricidia sepium* have been variously highlighted by many researchers. Carew (1983) fed *Gliricidia* leaves as a sole ration to sheep and goats and reported an improved animal performance. Though, *Ficus* on the other hand is yet to receive much attention in ruminant production systems, its nutritional potentials have been reported. While Mohammed *et al.* (1979) gave the value of 14.38% crude protein, 30.5% crude fibre and 5.12% ash for *Ficus* leaves, Chadhokar and Lecawasam (1982) reported the corresponding values of 18.9%, 16.10% and 12% respectively for *Gliricidia* leaves. The two browse plants are perennial and are available all the year around, thus forming a good substitute or supplement to grasses during the period of drought. This ensures uninterrupted feed supply all the year round coupled with concomitant improved animal performance. Besides, it reduces the problem of unhealthy competition between man and livestock for scarcely available grains which cost accounts for a substantial portion of the total cost of production. The need to reduce dependence on conventional feedstuff for livestock production, should be viewed critically with intensification of research into evaluating lesser known or unexploited sources of food supply.

Therefore, this study was undertaken as part of a general study on goat nutrition with a view to evaluating nutritional effects of varying proportions of *Gliricidia sepium* and *Ficus thonningii* leaves on performance of the West African dwarf goats.

Materials and methods

Sixteen young West African dwarf (WAD) goats, aged 6 to 8 months, and weighing 4.9 to 4.8kg obtained from the goat unit of the Teaching and Research (T&R) farm of the University of Ibadan were used. The animals were certified free from internal and external parasites. The leaves of *Gliricidia sepium* and *Ficus thonningii* were harvested daily on the T&R farm and allowed to wilt for few hours before given to the animals.

The animals were divided into four treatment groups and each group allocated to four diets in an experiment that lasted 70 days. Before commencement of the feeding trial, the animals were fed *Gliricidia sepium* and *Ficus thonningii* leaves free choice to assess the voluntary dry matter intake of the individual animals for 14 days. While one of the four experimental diets had 0% *Gliricidia* replaced by *Ficus* (control diet, diet 1), the remaining diets had *Gliricidia* and *Ficus* leaves mixed in varying proportions in which 25%, 50% and 75% *Gliricidia* leaves were replaced with *Ficus* for diets 2, 3 and 4 respectively. The choice of diet 1 (0% *Gliricidia* replaced by *Ficus*) as the control diet was due to the abundant available research information on the consumption of *Gliricidia* leaves by ruminants, thus taken as a standard to compare goats performances observed during the trial. On the other hand, information on the *Ficus* leaves consumption by animals is scanty in literature, therefore, its use was gradually introduced to the ruminants in mixture with *Gliricidia* leaves in varying proportions to monitor performance. The feeds, water and salt lick were provided to the animals *ad libitum*. Animals were weighed once a week before feeding in the morning. In the last week of the experiment animals were moved to

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individual metabolic cages for separate collection of faeces and urine for digestibility study.

The total amounts of faeces and urine were weighed and 10% aliquots were taken as samples for laboratory analysis. The urine was preserved with addition of 3ml of diluted H₂SO₄. Faeces and feed samples were oven-dried to a constant weight in oven at 65°C for 48 hours.

Determination of chemical composition of faeces, feed samples and urine was done using standard methods (A.O.A.C., 1980). The ballistic bomb calorimeter (Gallen Kamp) was used to determine the gross energy values of the faeces, feed and urine.

Treatment means were analysed using analysis of variance (ANOVA); and where there was statistical significant difference the means were compared (Little and Hills, 1978). The linear relationship between nitrogen, N- balance (Y) and adsorbed N (X) g day⁻¹ kg⁻¹ BW^{0.75} of the experimental goats was determined using the equation below:

$$Y = \alpha + \beta X$$

Where,

α = is the intercept on the line of Y.

β = is the linear regression coefficient.

Results and discussion

The average crude protein, CP, content of 15.75% obtained for the leaves of *Gliricidia sepium* was higher than the value of 12.25% recorded for *Ficus thonningii* (Table 1). The CP content of *Gliricidia* was slightly lower than the range of 18.5 to 26.1% reported by Carew (1983) for about 12 months old tree. This might be due to the stage of maturity of the trees when the leaves were harvested. Though, the ages of the tree were not known at the time of harvesting, the tree could have been well above 1½ years old, which might responsible for its lower protein content. The CP content of *Ficus thonningii* obtained in this study was however higher than the values reported for some other species of ficus, for example, 10.75% for *Ficus elasticoides* and 5.5% for *Ficus platyphyla* (Mohammed *et al.*, 1979).

The summary of the performance characteristics of goats is presented in Table 2. The average DM intake was 2.89% of body weight. This compared favourably with the minimum of 3% recommended by ARC (1980). Treatment effect on DM intake (g day⁻¹ kg⁻¹ BW^{0.75}) was significant (p<0.05).

Table 1: Proximate Composition (g/100g DM) of *G. sepium* and *F. thonningii* leaves fed to WAD goats

Nutrient	Foliage of <i>Gliricidia</i>	<i>Ficus</i>
Dry matter (DM)%	93.20	92.00
Crude Protein (CP)	15.72	12.25
Crude fibre (CF)	25.00	18.00
Ether extract (EE)	4.50	4.00
Ash	9.00	11.00
Gross energy (GE) kcal/g DM	5.52	4.96

Animals on diets in which 0% (diet 1) and 75% (diet 4) of *Gliricidia* leaves were replaced with *Ficus* had the lowest DM intake (g day⁻¹ kg⁻¹ BW^{0.75}) of 44.09 ± 4.92 and 42.74 ± 6.25 respectively as compared to animals on diets containing 50% (diet 3) and 25% (diet 2)

Gliricidia leaves replaced with *Ficus*, on which animals recorded 52.20 ± 2.23 and 46.14 ± 4.60 intake respectively. This suggests that these diets were more acceptable to the goats. The highest DM intake recorded on diet 3 which contained 50% *Gliricidia* and *Ficus*,

respectively, gave an indication of the best combination of these materials as feed for goats. All the animals gained weight (Table 2) during the experimental period with animals on diet 3

gaining the highest weight. This is quite interesting as equal values of combination of the two leaves could produce higher effect on growth performance.

Table 2: Summary of Performance characteristics of WAD Goats fed *Gliricidia* and *Ficus* leaves

Parameter	Level of replacement of <i>Gliricidia</i> for <i>Ficus</i> leaves (%)				SE
	0	25	50	75	
Initial liveweight (kg)	6.80	6.00	4.85	6.25	0.22
Final liveweight (kg)	7.76	6.96	5.89	7.28	0.20
Live weight gain (g/day)	34.29 ^a	34.29 ^a	37.10 ^a	36.79 ^a	3.73
Drymatter intake (g/day)	186.40	185.80	183.80	184.60	0.36
Drymatter intake (g/day/kg BW ^{0.75})	42.74 ^{bd}	46.14 ^{abc}	52.20 ^a	44.09 ^{cd}	1.04
DM digestibility coeff. (%)	54.30 ^b	62.80 ^a	63.20 ^a	79.40 ^c	1.36

DM: Dry matter

a,b,c,d: Means along the same row with identical superscripts are not significant ($p > 0.05$)

SE: Standard error.

The observed daily mean liveweight gain (g day⁻¹) ranged from 34.29 ± 13.80 for goats on diet 1 which contains 0% *Gliricidia* replacement for *Ficus*, that is 100% *Glyricidia*, to 37.10 ± 18.09 for goats on diet 3, which contains equal combination of *Gliricidia* and *Ficus* leaves, at 50% replacement value. The higher weight recorded by goats on diet 3 was probably due to higher DM intake, and more efficient utilization of nutrients by the animals. The values obtained in this study compared favourably with the range of values, 35.7 to 36.5g day⁻¹ reported by Adegbola *et al.* (1985) for sheep fed urea and ground meal diets and are higher than 10.5 to 16.66g day⁻¹ reported by Isah *et al.* (1999) for WAD goats fed mango and *Gliricidia* leaves.

There was no definite trend in N intake of goats as the level of replacement of *Gliricidia* increased (Table 3). The mean N intake values of the animals ranged from 0.93 for goats on diet containing 75% *Gliricidia* leaves replaced with *Ficus* to 1.18 (g day⁻¹ kg⁻¹ BW^{0.75}) for those on corresponding 50% replacement value (diet 3).

Though treatment effect on N intake (per unit metabolic size) was not significant, it was observed that higher substitution of *Gliricidia* leaves with *Ficus* reduced the animals level of N intake. However, the higher N intake, 1.18g day⁻¹ kg⁻¹ BW^{0.75} of animals on diet 3 could be due to higher DM intake. There was a positive linear relationship existed between the N-balance (X) g day⁻¹ kg⁻¹ BW^{0.75} and corresponding absorbed N (Y) values with a correlation coefficient (r = 0.83). The relationship is represented by the equation

$$Y = 0.59 + 0.38X$$

The absorbed nitrogen at hypothetical zero N-balance (0.59) when multiplied by 6.25 gave a value of 3.68g day⁻¹ kg⁻¹ BW^{0.75} as digestible crude protein which can satisfy the nutritional needs of young WAD goats for maintenance. The value was comparable to 3.19g day⁻¹ kg⁻¹ BW^{0.75} (Winter and Goersch, 1974) and 3.40g day⁻¹ kg⁻¹ BW^{0.75} (Sengar, 1980) reported for goats but higher than 2.82 mean value recommended by NRC (1981).

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Table 3: Nitrogen (N) utilization by WAD Goats fed varying proportions of *Gliricidia* and *Ficus* leaves

Parameter	Level of replacement of <i>Gliricidia</i> for <i>Ficus</i> leaves (%)				
	0	25	50	75	SE
Nitrogen intake (g day ⁻¹)	4.70 ^a	4.40 ^{ab}	4.13 ^{bc}	3.90 ^c	0.01
Faecal N-output (g day ⁻¹)	0.56	1.42	1.59	0.75	0.10
Urinary N-output (g day ⁻¹)	0.47	1.34	1.56	0.44	0.10
N-Balance (g day ⁻¹)	3.69 ^b	1.68 ^a	0.98 ^a	2.70 ^b	0.15
N-intake (g day ⁻¹ kg ⁻¹ BW ^{0.75})	1.08	1.09	1.18	0.93	0.10
N-Balance (g day ⁻¹ kg ⁻¹ BW ^{0.75})	0.85 ^a	0.44 ^{bc}	0.28 ^c	0.64 ^{ab}	0.04
N-absorbed (g day ⁻¹ kg ⁻¹ BW ^{0.75})	0.96 ^a	0.76 ^a	0.73 ^a	0.74 ^a	0.04

^{a, b, c}Means along the same row with identical superscripts are not significant (p>0.05)

SE: Standard error.

Conclusion

All the four diets were not only acceptable to the animals but also supported reasonable weight gain when fed to young WAD goats. Beside, the nutrients furnished by the leaves can also satisfy the nutritional needs of the animals. Though, the plants are available all the year round, feeding one without a reasonable supplementation with the other may affect animal performance as evident by the least weight gain (34.29g day⁻¹) recorded for goats on diet 1 that was completely devoid of *Ficus* (0% of *Gliricidia* are replaced with *Ficus*). Optimal DMI values and weight gain by goats on diet with 50:50 combination ratio was quite encouraging as 50% of *Gliricidia* leaves could be replaced with equal value of *Ficus* to give a satisfactory level of performance. This ratio, therefore, recommended for local goat production especially during the dry season when feeding on browses becomes an imperative panacea to scanty grass availability.

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