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THE EFFECTS OF FEEDING VARYING LEVELS OF CASSAVA FOLIAGE ON THE PERFORMANCE OF WEST AFRICAN DWARF GOAT

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Abstract
An experiment was conducted to estimate the effect of replacing Gliricidia sepium leaves (GSL) with cassava foliage (CFL) at 0, 30 and 60% in the diets of West African Dwarf (WAD) goats. Allocation of animals was into three treatments of four animals each. This study reports the effect of these dietary treatments on the feed intake, digestibility, body weight changes and the blood parameters of the experimental goats. DM intakes of the animals ranged between 2.5 to 2.9 percent of the body weight. Goats fed 60% CFL had the highest (P<0.05) dry matter intake (DMI) of 386.86g with average daily weight gain of 46.55g/day, while goats fed 60% GSL had 311.15g and 34.74g/day, respectively. The replacement of GSL with CFL increased the weights of goats. DM and CP digestibility of the diets in the experimental goats decreased (P<0.05) as GSL was being replaced with CFL, while the fibre fractions digestibility were not influenced (P>0.05) by the dietary treatments. Also, the replacement of GSL with CFL did not affect (P>0.05) the blood parameters monitored. It was however concluded that cassava foliage can successfully replace Gliricidia sepium leaves in the diets of WAD goats.

Keywords: Cassava, Gliricidia, Goats, Performance.

Introduction

In Nigeria, goats contribute about 24% of the meat supply and there population makes them to be the second most important livestock species (Adu *et al.*, 1979; Oni, 2002). Like sheep and cattle, goats are ruminants, and are able to digest foodstuffs such as grasses and leaves. They are naturally browsing animals and will eat shrubs and trees in preference to grass. They have been found to have advantages over other animals because of their wide adaptability (Clair and George, 1999).

Forage has always been an extremely important source of nutrients in goat feeding, if they are to be fed economically. With the increased interest in forage management, there is also an increased interest in improved livestock nutrition on forage. Livestock that lack adequate nutrients in their diets have been found to have poor performance and health (Bialey, 2003). *Gliricidia sepium* is an extremely versatile plant which fulfills a number of roles in smallholder agricultural production systems. Its leaves, because of its high feeding value have been used extensively to feed small ruminants with satisfactory results (Flavey, 1982 and Odeyinka, 2001). Cassava by-products on the other hand have been evaluated and adopted as routine feed ingredients in Nigeria. Its leaves have been found to be nutritious for ruminants and contains appreciable amount of protein, fat, vitamins and carbohydrates (Nweke and Ezumah, 1992). The experiment reported here was therefore design to determine the potentials of cassava foliage (TMS 30572) as a replacement for *Gliricidia sepium* leaves in the diets of West African Dwarf (WAD) goats.

Materials and Methods

Experimental Site and Animal Management

Twelve (12) West African Dwarf goats aged 8 to 9 months with average body weight of 9.5kg were used in an experiment that lasted for 84 days at the Small Ruminant unit of the Teaching and Research Farms, University of Agriculture, Abeokuta, Nigeria. The goats were given long acting antibiotics, vaccinated against *Pestes des petit ruminantes* (PPR) and treated against gastrointestinal parasites using albendazole tablets before the commencement of the experiment. They were randomly allocated to three dietary treatments of 0, 30 and 60% *Gliricidia sepium* leaves (GSL) replaced with cassava (*Manihot utilissima*) foliage (CFL). Four animals initially balanced for weight were allotted to each treatment group. Cassava peels and *Pennisetum purpereum* were fixed at 25 and 14% respectively, while mineral/salt mixture was added at 1% of the total feed constituents as shown in Table 1. The GSL and CFL were sun dried for 24 hours before offering them to the goats. The animals were fed at 4% of their body weight and allowed free access to water.

Table 1. Composition (%) of the experimental diets fed to West African Dwarf goats

Ingredients	Diet 1	Diet 2	Diet 3
Cassava foliage	60	30	0
Gliricidia sepium leaves	0	30	60
Cassava peels	25	25	25
Pennisetum purpereum	14	14	14
Mineral/ salt mixture	1	1	1
Total	100	100	100

Data Collection and Analyses

The diets which were fed twice per day at 08.00 and 14.00hrs were weighed before being offered to the animals in feeding troughs. The feed orts were collected everyday from individual animals and weighed before fresh ones were offered. The animals were weighed at the commencement of the experiment and then once weekly at 7.30 a.m. At the last 14 days of the experiment, the animals were transferred to different metabolic crates for the digestibility trial. They were allowed 7 days adjustment period to the metabolic crates and the last 7 days were used for the collection of faeces and urine. Total daily faecal output were measured for each animal and 10% sample taken, dried and bulked to constant weight in a hot dry oven at 105^0 C. Samples for chemical analysis were taken from previously bulked feed and faeces and pre- dried at 60^0C before grinding. The nitrogen content of feeds and faeces were determined using Kjeldhal method. Ground feeds and faeces were analysed for crude protein and ether extract as described by AOAC (1995). Results obtained were used for the calculation of digestibility of nutrients for the experimental animals.

About 5mls of blood was also collected from each of the animals at the beginning and end of the experiment by jugular vein puncture and transferred into heparinised bottles to prevent blood coagulation. They were taken to the laboratory to determine the packed cell volume (PCV), glucose, cholesterol, blood urea nitrogen (BUN), and total protein (TP) as described by Hyduke (1975). Data obtained were subjected to analysis of variance by method of SAS (1999) and significant means were separated by Duncan (1955) multiple range test.

Results and Discussion

The proximate composition of the experimental diets is shown in Table 2. The chemical components of cassava foliage (CFL) and *Gliricidia sepium* (GSL) in this study compared favorably with the values reported in the literature (Onwuka, 1992, Nguyen and Inger, 2000).

However, the cassava foliage composition in this study was slightly higher in values than those reported by Alli- Balogun *et al.* (2003) who fed cassava foliage as a protein supplement to sheep. The variation might be attributed to the specie of cassava foliage used in the experiment with the stage and time of harvesting.

Table 2. Proximate composition (%) of the experimental diets fed to WAD goats

Nutrients	60% CFL 0% GSL	30%CFL 30%GSL	0% CFL 60%GSL	CFL	GSL
Dry matter	89.00	87.50	87.08	91.25	88.50
Crude protein	17.41	16.02	17.02	25.10	23.21
Ether extract	15.10	14.21	10.17	12.71	6.98
Ash	8.90	9.12	10.21	8.59	9.11
Nitrogen free extract	38.28	34.97	43.58	36.66	37.01
Neutral detergent fibre	44.54	48.20	42.54	31.41	41.51
Acid detergent fibre	33.65	37.40	32.66	29.30	28.32
Acid detergent lignin	6.34	6.01	6.12	7.53	7.25
Gross Energy (MJ/Kg)	19.22	17.98	18.32	19.75	18.63

CFL – Cassava foliage; GSL – Gliricidia sepium leaves.

The high dry matter (DM) and crude protein (CP) values of CFL as compared with GSL in this study is in line with the findings of Onwuka (1992) who reported that the DM and CP values of CFL were slightly higher than those of GSL.

Data on performance characteristics of the experimental animals are summarized in Table 3. DM intakes of the experimental animals ranged between 2.5 to 2.9 per cent of their body weight and falls within the range suggested by Devendra and Burns (1983) for goats fed *ad libitum*. DM intake (DMI) was highest with animals fed 60% CFL, probably because the combination was palatable followed by goats fed 30% CFL. Animals fed 60% GSL had the least DMI which supports the works of Onwuka (1992) and Odeyinka (2001) who reported low intake for GSL compared to cassava leaves and *Leucaena leucocephala* when fed to goats. This might be attributed to the offensive smell given off by GSL which puts animals off and invariably responsible for the relatively low feed intake. Also, diets containing GSL above 30% has been reported to result in low DMI and are less effectively used by the animals (Reeds *et al*, 1990, Davendra, 1993; Nguyen and Inger, 2000). The higher DMI recorded for goats fed 30% GSL over those on 60% GSL corroborates the study cited by Alburazak (1995) where *ad libitum* and intermittent feeding of GSL forage fed to cattle were compared, animals offered napier grass supplemented with GSL forage performed better compared to those fed sole GSL.

Table 3. Performance characteristics of WAD goats fed *Gliricidia sepium* leaves replaced with cassava foliage.

Parameters	60% CFL 0%GSL	30% CFL 30%GLS	0% CFL 60%GLS
Average DM intake (g/day)	386.86 ± 24.43^{a}	350.15 ± 14.65^{ab}	311.15 ± 11.11^{b}
Total DM intake (% of LW)	2.88 ± 0.04^{a}	2.64 ± 0.03^{ab}	2.59 ± 0.03^{b}
Crude protein intake (g/day	67.35 ± 1.55^{a}	56.09 ± 1.01^{ab}	52.96 ± 1.32^{b}
Average initial Weight (Kg)	9.48±1.02	9.83±0.47	9.09± 0.95
Average final Weight (Kg)	13.39±0.97	13.28±0.36	12.01±0.83
Average weight gain (Kg)	3.91 ± 0.06^{a}	3.45 ± 0.13^{ab}	2.92 ± 0.09^{b}
Average DWG (g/day)	46.55 ± 1.68^{a}	41.07 ± 1.55^{b}	34.74 ± 1.12^{b}
Average DWG ($g/W^{0.75}$day)	17.82 ± 1.01^{a}	16.22 ± 0.99^{ab}	14.31 ± 0.98^{c}
Feed conversion efficiency	8.31±0.98	8.52± 1.07	8.95± 1.05

Means on the same row with different superscripts are significantly ($P < 0.05$) different
CFL – Cassava foliage; GSL – Gliricidia sepium leaves; DM- Drymatter; LW- Liveweight; DWG – Daily weight gain.

The DMI of 350.15 and 311.15g/day for goats fed diets containing 30 and 60% GSL in this study were slightly higher than 233.80 to 294g/day recorded for the same breed of goats fed fresh GSL (Mba *et al*., 1982). This may be attributed to the longer period of GSL exposure to sunlight after harvesting which agrees with the reports of Hawkins *et al*. (1990) and Mtenga *et al*. (1992) that recommended wilting Gliricidia for 12 to 24 hours before feeding to goats as a means of increasing its acceptability.

The crude protein (CP) intake was observed to be highest in animals fed 60% CFL which differed ($P<0.05$) from the other dietary treatments. This may probably be due to the higher CP content of diet containing 60% CFL. This agrees with the works of Onwuka (1992) and Odeyinka (2001) who observed higher CP intake by goats fed diets with higher crude protein content.

The highest CP intakes in goats fed 60% CFL may have contributed to the increase in the daily weight gain in goats due to better balance of nutrients in the diets.

The replacement of GSL with 60% CFL ($P<0.05$) increased the weight gain of goats. Animals fed 60% CFL had the highest ($P<0.05$) average daily weight gain values of 46.55g/day with least values (34.74g/day) recorded for those on 60% GSL. This maybe due to the high nutrient intake by goats fed 60% CFL which invariably resulted in high digestibility of the nutrients. The average daily weight gain values observed in this study are comparable to those reported by Aina (2002) who fed the same breed of goat with forage and cassava peels with varying levels of dietary salt.

Feed conversion efficiency shows that the experimental goats had better feed conversion efficiency when GSL is completely replaced with CFL in the diets; thereby suggesting better feed utilization compared to the other treatments, hence a higher body weight gain. The result is in support of the works of Onwuka and

Akinsoyinu (1989) and Ifut (1992), who reported higher productivity in the same breed of goat fed cassava leaves with peels and cassava peels supplemented with forages, respectively.

The mean values for nutrient digestibility coefficients are presented in Table 4. The DM and CP digestibility were comparable with those reported by Ogunmoye (1995) and Adeneye and Sunmonu (1994) who reported 51.53 to 59.80% and 64.30 to 84.10%, respectively for WAD goats and sheep fed forage with concentrate.

Table 4. Nutrient digestibility (%) of *Gliricidia sepium* replaced with cassava foliage in the diets fed to WAD goats

Parameters	60% CFL 0% GSL	30% CFL 30% GSL	0% CFL 60%GSL
Dry matter	61.53±2.78[a]	58.57± 3.49[ab]	56.03±1.66[b]
Crude protein	71.19±1.95[a]	70.96±2.94[a]	65.17±1.28[b]
Ether extract	53.81±0.50[a]	54.15±0.80[a]	50.06±0.38[b]
Neutral detergent fibre	60.07 ±2.09	56.54±1.78	54.92±1.51
Acid detergent fibre	42.65±1.98	42.89±1.78	43.33±1.76
Acid detergent lignin	40.12±1.52	39.35±1.22	41.73± 1.63

Means on the same row with different superscripts are significantly ($P < 0.05$) different
CFL – Cassava foliage; GSL – Gliricidia sepium leaves.

Moreover, the DM and CP of diets containing 60% CFL were most digested ($P<0.05$) by goats compared to goats on the other dietary treatments. This may probably be attributed to the high nutrient intake in the diets due to a better balance of nutrients. The replacement of GSL with CFL did not have any effect ($P>0.05$) on the NDF, ADF and ADL digestibility of the three diets.

The mean values for haematological and blood parameters of goats, as measured in the study are presented in Table 5. The concentration of blood components of goats were used to monitor nutrient status between the treatments. The PCV, glucose, hemoglobin, total plasma protein, cholesterol and blood urea nitrogen increased as GSL was been replaced with CFL, although there were no significant effect ($P>0.05$) within the treatments, suggesting that the replacement of GSL with CFL did not influence the blood parameters of the experimental goats. Moreover, the obtained values for the blood parameters fell within the normal range for goats as reported by Kaneko, (1989) and Puls, (1994).

Table 5. Mean values of haematological and biochemical parameters of WAD goats fed *Gliricidia sepium* replaced by cassava foliage

Blood parameters	60% CFL 0% GSL	30% CFL 30% GSL	0%CFL 60%GSL
Packed cell volume (%)	31.75±1.18	30.00±0.82	28.90 ±2.42
Plasma glucose (mmol/L)	3.01±0.09	3.13± 0.17	3.32 ± 0.23
Hemoglobin (g/dl)	9.25±0.56	8.99±0.49	8.67±0.45
Total plasma protein (g/L)	85.70±3.69	84.30 ± 2.36	83.63±3.01
Cholesterol (mmol/L)	3.09±0.22	2.86±0.11	2.53±0.03
Blood urea nitrogen (mg/dl)	12.68 ± 0.77	12.93±0.91	12.08±0.72

Mean values in the same row are not significantly different ($P > 0.05$)
CFL – Cassava foliage; GSL – *Gliricidia sepium* leaves.

Conclusion

The replacement of *Gliricidia sepium* leaves with cassava foliage in the diets of goats resulted in enhanced intake of the total DM with an improvement in the digestibility of the diet. This invariably resulted in increased body weight gain of the animals with no adverse effect on the blood parameters. Thus, cassava foliage at 60% has the potential to successfully replace *Gliricidia sepium* leaves in the diets of West African dwarf goats, resulting in favorable performance.

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