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Nutritional performance of West African Dwarf (WAD) Goats fed Wild Sunflower (*Tithonia diversifolia*) Leaf Meal Supplemented Diet

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Abstract

A study was conducted to investigate the nutritional response of West African Dwarf Goats offered a concentrate diet containing Wild sunflower leaf meal, as supplement to a guinea grass basal diet. Twenty WAD goats with age range of 5 – 7 months weighing approximately $6.94\text{kg} \pm 0.37$ were randomly allotted to a concentrate diet containing graded levels of wild sunflower leaf meal (WSLM) at 0, 10, 20 and 30% levels of inclusion, in a completely randomized design. The experiment lasted for 16 weeks and parameters determined include feed intake, weight gain, digestibility, nitrogen utilization and feed conversion ratio.

Results obtained indicate no significant difference ($P > 0.05$) in the dry matter intake (DMI), weight gain and dry matter digestibility of the goats on the different diets. However, the crude protein digestibility and nitrogen utilization of goats on 0% and 10% WSFLM inclusion were higher ($P < 0.05$) than those on 20% and 30% WSLM diet.

It was concluded that wild sunflower leaf meal can serve as a forage supplement to the WAD goats up to 30% level of inclusion without any deleterious effect.

Keywords: digestibility, nitrogen utilization, WAD goats, wild sunflower leaf meal.

Introduction

The major constraint to ruminant livestock production in the tropics is the availability of cheap and quality feedstuffs, especially in periods of drought or dry season. The increasingly expensive nature of most feed ingredients has resulted in reduced livestock production activities by subsistence farmers who constituted the majority of the livestock holder in the typical sub-Saharan Africa, and this has impacted negatively on the available animal protein for human consumption.

Although, grasses abound in the tropics, seasonal changes in their palatability and nutritive values have been a major challenge in ruminant animal production (Alokan, 1998). There is therefore the need for alternatives to conventional feed resources. Such alternative feed resources with potential include *Mimosa invisa* (Nworgu and Fapohunda, 2002), *Tephrosia candida* (Odedire and Babayemi, 2008) and *Tithonia diversifolia* (Odunsi *et al.*, 1996). *Tithonia diversifolia* (wild sunflower) is a weed of cultivated crops, wasteland and road sides. The plant is an early colonizer at the start of rains and is capable of growing late into the dry season when most forages are no longer available due to drought (Odedire and Oloidi, 2011) and there is paucity of information the use of wild sunflower meal in ruminant livestock diet, hence this study.

Material and Methods

The experiment was conducted at the Sheep and Goat Unit of the Teaching and Research Farm, Obafemi Awolowo University, Ile-Ife. Twenty growing West African Dwarf (WAD) goats weighing approximately $6.94\text{kg} \pm 0.37$ were used for this study. Goats were randomly allotted to

four treatments in a completely randomized design, with five goats per treatment. The goats were housed in an open - sided, well-lighted and adequately ventilated building with concrete floor that had been previously disinfected with germicide. The concrete floor was covered with 5 cm layers of wood shavings to absorb urine and for easy removal of faeces. Provision of fresh feed and water were done daily. Wild sunflower leaves were harvested prior to flowering and the harvested leaves were spread on a concrete slab and air dried for seven days and then milled and stored for later use. Four concentrate diets were compounded comprising 0, 10, 20 and 30% levels of inclusion of wild sunflower leaf meal (Table 1) and fed to the WAD goats as supplement to a basal ration of guinea grass (*Panicum maximum*) for a period of 112 days. The goats were transferred to metabolism cages with facilities for separate collection of urine and faeces for digestibility trial at 14th and 16th week of the experimental period. Faeces and urine were collected daily before morning feeding. Subsamples of the faeces voided were taken daily and dried in a forced-draught oven at 70°C for 48 hours. 10% of the daily urine voided was also taken and stored for later analysis. Animals' weight was taken using hanging scale at the start of the study, and weekly, throughout the experimental period. Feeding of the goats was done at 5% of their body weight. Samples of feed and faeces were analyzed for Proximate and fibre composition using the method described by AOAC (1990). All data obtained were analyzed with the General Linear Model of SAS (2008) and the Duncan New Multiple Range Test of the same package was used to test for any significant differences among the treatment means.

Results and Discussion

The gross composition of the experimental diets is shown in Table 1 while the chemical composition of diets is shown in Table 2. The result of the chemical composition shows that wild sunflower has feed value suitable as livestock feed. All the diets had crude protein values above the 8% CP minimum requirement for ruminants (Norton, 1994).

Table 1: Gross Composition of the experimental diets

Ingredients	Control	10% WSLM	20% WSLM	30% WSLM
WSLM	-	10.00	20.00	30.00
Maize	45.00	45.00	45.00	45.00
Soya bean	30.00	20.00	10.00	-
Palm Kernel Cake	18.00	18.00	18.00	18.00
Groundnut Cake	4.50	4.50	4.50	4.50
Bone meal	1.50	1.50	1.50	1.50
Salt	0.50	0.50	0.50	0.50
Vitamin	0.50	0.50	0.50	0.50
Total	100	100	100	100

Control: Concentrate diet without wild sunflower leaf meal; WSLM: wild sunflower leaf meal inclusion

Table 2: Chemical composition of diets fed to the experimental goats (on dry matter basis)

Parameter (g/100g)	Control	10% WSLM	20% WSLM	30% WSLM
Ash	8.43	7.59	8.76	8.17
Crude Protein	17.20	15.60	15.50	15.46
Ether extract	8.19	7.97	7.37	7.19
Crude fibre	14.50	14.40	14.30	14.28
Nitrogen free extract	51.68	54.44	54.07	54.90

Control: Concentrate diet without wild sunflower leaf meal; WSLM: wild sunflower leaf meal inclusion

Table 3 shows the performance characteristics of WAD goats fed the experimental diets. Intake values obtained for the animals were similar ($P>0.05$) an indication that the goats were well adjusted to the experimental diets. Similarly, the total mean daily dry matter intake (DMI g/day) was not significantly different ($P>0.05$) across the diets, ranging from 305.2g/day in to 311.5g/day but values obtained in this study were lower to those reported by Ahametule and Elendu (2010) where intake ranged between 357g/day and 456g/day for West African Dwarf (WAD) goats fed cassava leaf-maize offal based diets. The mean total daily Crude Protein Intake (CPI g/day) of goats fed Control diet was higher ($P<0.05$) than those on concentrates with WSLM inclusion. The CP intake ranged from 31.69% to 35.75% CP for goats on 30%WSLM and control diet respectively. This could be attributed to reduced palatability with increasing WSLM as a result of its saponin content, but feedstuffs containing saponin have been reported to be capable of reducing methane production (Babayemi *et al.*, 2004) which supposes that the feed may be a good option in the current issue of green house gases. There were no significant differences ($P >0.05$) in the nutrient digestibility of all the various parameters except for the crude protein) where the highest ($P<0.05$) CP digestibility (68.53%) was recorded for the goats on control diet although the difference in the CP values of the control and 10%WSLM (68.11%) was not significant ($P >0.05$). The least ($P< 0.05$) CP digestibility was recorded for goats on 30% WSLM. The total weight gain of the animals ranged ($P>0.05$) from 2.56 kg (30% WSFLM) to 3.11 kg (10% WSFLM) and Average daily gain of the goats were not significantly different ($P>0.05$) across the treatments with a range value of 26.12 g/day (30%WSFLM) and 31.73 g/day (10% WSFLM). The daily weight gains in this experiment compared well with the results of Ajayi *et al.* (2005) who obtained 23.81 – 46.64g per day for West African Dwarf goat fed *Mangifera indica* , *Ficus thionningii* and *Gliricidia sepium* foliages as concentrate supplements to basal diet of guinea grass (*Panicum maximum*). but lower than that reported by Oni *et al.*, (2010) who obtained a daily gain of 33.8 – 52.9g/day for West African Dwarf goats fed different levels of dried cassava leaves (*Manihot esculenta*)- based concentrates with *Panicum maximum*.

Table 3: Performance characteristics of WAD goats fed experimental diets

Parameter	Control	10% WSLM	20% WSLM	30% WSLM	SEM	PROB
Dry matter intake (g/day)						
Concentrate	208	208	206	205	3.59	0.9233
Panicum	103.5	102.5	100.4	100.2	1.26	0.2340
Total	311.5	310.5	306.4	305.2	3.87	0.6949
Digestibility	71.24	70.57	70.66	70.98	2.42	0.7935
Crude protein intake (g/day)						
Concentrate	35.75 ^a	32.45 ^b	31.93 ^b	31.69 ^b	0.38	0.0001
Panicum	8.36	8.30	8.13	8.12	1.10	0.0622
Total	44.11 ^a	40.75 ^b	40.06 ^b	39.81	1.01	0.0001
Digestibility	68.53 ^a	68.11 ^a	62.62 ^b	57.97 ^b	1.75	0.0164
Weight (kg)						
Initial weight	6.94	6.94	6.94	6.94	1.06	1.0000
Final weight	9.65	10.05	9.60	9.50	1.53	0.9933
Total weight gain	2.71	3.11	2.66	2.56	0.02	0.1403
Ave. daily gain (g)	27.65	31.73	27.14	26.12	5.86	0.9145
FCR	11.27	9.78	11.28	11.68	0.57	0.2322

^{a, b}: Means within row with different superscript are significantly different ($P< 0.05$);

Control: Concentrate diet without WSLM; WSLM: wild sunflower leaf meal inclusion; FCR: Feed conversion ratio

The results for nitrogen utilization of the goats fed experimental diets are presented in Table 4. Faecal nitrogen of the animals were similar ($P > 0.05$), in 20%WSLM and 30%WSLM. Urine nitrogen was least ($P < 0.05$) in goats fed 30% WSLM and highest for goats fed the control diet, although the values recorded for those on 10%WSLM and control are similar ($P > 0.05$). On the overall, Nitrogen retention was better ($P < 0.05$) in animals on 10% WSLM and Control diet with values of 53.36 and 54.02 % respectively. The reason for the reduced Nitrogen retention in goats on 20%WSLM and 30%WSLM can be attributed to the anti-nutritive components of Wild sunflower (Odedire and Oloidi, 2011), as Nitrogen retention was observed to decrease with increasing level of inclusion of WSLM

Table 4: Mean nitrogen utilization of WAD goats fed experimental diets

Parameter (g/day)	Control	10% WSLM	20% WSLM	30% WSLM	SEM	PROB
Nitrogen intake	7.59 ^a	6.84 ^a	5.83 ^b	5.76 ^b	0.03	0.0210
Faecal Nitrogen	2.39	2.18	2.16	2.42	0.39	0.6340
Urinary Nitrogen	1.10 ^a	1.01 ^a	0.66 ^b	0.36 ^c	0.04	0.0012
Nitrogen balance	4.10 ^a	3.65 ^a	3.01 ^b	2.98 ^b	0.37	0.0032
Nitrogen utilization (%)	54.02 ^a	53.36 ^a	51.62 ^b	51.74 ^b	2.72	0.0223

^{a, b, c} : Means within row with different superscript are significantly different ($P < 0.05$)

Conclusions and Outlook

From the result of the experiment, it can be concluded that wild sunflower possesses adequate nutritive value as to support good growth of West African Dwarf goats, especially during the period of drought and the forage can effectively serve as alternative feed ingredient in the WAD goats' diet with inclusion level of up to 30 % without any deleterious effect.

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