Nig. J. Anim. Prod. 2017, 44(5): 250 - 256
Nigerian Journal of Animal Production

West African dwarf goats utilized bitter leaf (*Vernonia amygdalina)* meal as feed supplement

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Abstract

This study was carried out to determine the utilization and the optimum level of offer of bitter leaf (Vernonia amygdalina) meal (BLM) by West African Dwarf (WAD) goats. In a 20-week trial, twenty four WAD goats of both sexes, 5-7 months old, were randomly allotted to four treatments of graded levels of BLM (0% BLM (Control diet), 15% BLM, 30% BLM and 45% BLM diets) in a completely randomized design to determine the utilization of bitter leaf meal as feed for goats. The diets were used as supplements to a basal ration of Panicum maximum. Two digestibility trials were carried out. The digestible ether extract intake and digestible organic matter of goats on 0% BLM were significantly (P<0.05) higher than the values obtained for goats on bitter leaf meal diets. The average daily weight gain (g/day) for goats on 0% BML was significantly (P<0.05) higher than that of others. There were significant (P<0.05) differences in the percentage mortality of the goats fed experimental diets. The percentage mortality of goats on 30% and 45% BLM were significantly (p<0.05) higher than that of others. It is concluded that bitter leaf meal can be included in the diets of (WAD) goats up to 15% without any deleterious effect.

Keywords: Bitter leaf meal, Utilization, *Panicum maximum*, West African Dwarf Goats

Introduction

One of the major problems confronting the small ruminant production is the non availability of feed all year round to meet the maintenance and productive requirements of the animals. Although grasses abound in the tropics, seasonal changes which affect their palatability and nutritive value had been a major problem in ruminant animal production (Alokan, 1998). Poor productivity and high mortality of stock, which characterize this industry is largely explained by the inadequacy of feeding the right quantity and quality of feeds to the various livestock species (Odeyinka, 2014). Rearing of small ruminant animals in urban areas further compounded the problems and makes the use of concentrate diets more reasonable where lots of agro industrial by products and agricultural residues are generated. In Nigeria, utilization of crop residues, agro-industrial by-products and non-conventional feed resources are still at infancy process because of great competition between human and livestock for the resources, and these have greatly reduced the animal protein intake (Odeyinka *et al*., 2003).

The unprecedented increase in the cost of conventional ingredients (e.g. maize) used in compounding livestock feeds has necessitated intensive investigations into the use of agricultural and agro-industrial by-products, leguminous fodder trees and shrubs which are regarded as non-conventional feed sources (Mousa, 2011). Bitter leaf (*Vernonia amygdalina*) is a drought tolerant shrub with petiole leaf of about 6mm diameter. The leaves are used for human consumption, suggesting that the excess may be utilized as feed (Daodu and

Babayemi, 2009). Bitter leaf is a manageable size shrub that is available during dry season, its nutritional, economic value and potential as a dry season feed source for ruminant animals is underutilized. Hence, this study was designed to determine the utilization of bitter leaf meal as a feedstuff for West African Dwarf goats.

Materials and Methods

The experiment was carried out at the Sheep and Goat Unit of the Teaching and Research Farm, Obafemi Awolowo University, Ile-Ife, Osun State. The farm is approximately between latitudes 7°31'N and 7° 33'N; and longitudes 4 ° 33'E and 4 ° 34'E. It is within the tropical rainforest. Twenty four West African Dwarf (WAD) weaner goats of both sexes were used in this experiment. The ages of the animals were between 5 and 7 months. The goats were quarantined, treated with oxycare antibiotic injection for 3 days, dewormed with levamizole and given ivomec injection to guard against endoparasites and ectoparasites. Also, they were treated for pneumonia and vaccinated against peste des petits ruminante (PPR) as a routine practice prior to the commencement of the experiment. The animals were randomly allotted to four treatments in a completely randomized design with six goats per treatment and provided fresh feed and water daily. The experiment lasted for a period of 20 weeks.

The *Vernonia amygdalina* leaves for this study were harvested from the cut branches of the planted shrub within the environment of the Teaching and Research farm, Obafemi Awolowo University, Ile-Ife. Samples were air dried for two days and sun dried on concrete slabs for a day. The samples were ground prior to its incorporation in goat diets. Four concentrate diets comprising 0, 15, 30 and 45% of Bitter Leaf (*Vernonia amygdalina*) Meals (BLM) were compounded and fed to the goats as supplements to a basal ration of guinea grass (*Panicum maximum*) (Table 1). The goats were fed based on 3% of their body weights. The feed was offered once daily at 09.00 hour. Feed refusals were collected and weighed the following morning before offering fresh feed. This was used to estimate feed intakes. The animals were subjected to 14 day adaptation period. The animals were weighed at the beginning of the experiment and weekly thereafter. This was to assess live weight changes. Two digestibility trials were carried out at (10^{th} week) and (16^{th} week) of the experimental period. The metabolism trial was conducted with 3 goats per treatment in metabolism cages with facilities for separate collection of faeces and urine. The proximate composition of the feed and feacal sample was determined by standard methods (AOAC, 1990). Data obtained were statistically analyzed with the General Linear Model of SAS (2008) and the Duncan New Multiple Range Test option of SAS (2008) was used to detect significant differences among means.

Table 1: Composition of experimental diets with different levels of BLM

Ingredients	0% BLM	15% BLM	30% BLM	45% BLM
Corn bran	45.00	30.00	15.00	-
Bitter leaf meal	-	15.00	30.00	45.00
Brewers dried grain	30.00	30.00	30.00	30.00
Palm kernel cake	22.50	22.50	22.50	22.50
Bone Meal	1.50	1.50	1.50	1.50
Salt	0.50	0.50	0.50	0.50
Vitamin Premix	0.50	0.50	0.50	0.50
Total	100.00	100.00	100.00	100.00
Calculated % Crude protein	14.70	17.14	19.58	22.01

0% BLM = Control diet (0% bitter leaf meal), 15% BLM = 15% bitter leaf meal inclusion, 30% BLM = 30% bitter leaf meal inclusion, 45% BLM = 45% bitter leaf meal inclusion, CP = Crude protein

Results and Discussion

The chemical composition of bitter leaf meal (BLM) and *Panicum maximum* used in the experimental diets is shown in Table 2. The dry matter and ash content of bitter leaf meal were higher than that of *P. maximum* while *P. maximum* had higher organic matter, crude fibre, ether extract and nitrogen free extract content. The result of the chemical composition of BLM and *P. maximum* used in the experimental diets shows that the crude protein content of bitter leaf meal was quite high compared to that of *P. maximum* and comparable crude protein range of 18-21.50% for bitter leaf was reported by Bonsi *et al*. (1995), Okoli *et al.* (2003), Fajemisin *et al*. (2009) and Owen (2011). However, a high value of 32.60% from *V. amygdalina* extract was reported by Aletor *et al.* (2002). The difference in values may be as a result of stage of growth, processing method and season of harvesting.

Table 2: Chemical composition of bitter leaf meal and *Panicum maximum*

Parameter	Bitter leaf meal	*Panicum maximum*
Dry Matter (%)	86.84	20.61
Analysis % of DM		
Organic Matter	85.35	90.16
Crude Protein	25.25	7.36
Crude fibre	11.37	28.78
Ether Extract	19.49	24.44
Ash	15.65	8.45
Nitrogen free extracts	29.25	30.24

DM: Dry matter

The results of the chemical composition of experimental diets are presented in Table 3. The crude protein and crude fibre content of the diets increased with increase in the inclusion level of BLM while decrease in ether extract and nitrogen free extract values were observed. The crude protein levels of all the diets were above the 9.89% minimum requirement for ruminants reported by Ogunbosoye and Babayemi (2010). The result showed that bitter leaf meal (BLM) can serve as suitable source of

nutrients in livestock feed. The results of apparent digestibility coefficient of the dry matter and nutrients intake of experimental diets are shown in Table 4. There was significant difference in the dry matter digestibility ($P<0.05$) among the experimental animals. The dry matter digestibility, (71.53%) from the CD diet was significantly ($P<0.05$) higher than mean values of 56.89 and 58.97%, obtained by feeding 15% BLM and 30% BLM respectively. The apparent digestibility coefficient of the crude protein, crude fibre, ether extract, nitrogen free extract and ash were significantly ($P<0.05$) affected by the inclusion levels of bitter leaf meal. The crude protein digestibility results obtained in this study was similar to the report of Ngi *et al. (2006)* who obtained a range of 54.01 – 64.49% CP digestibility for Maradi × West African Dwarf cross bred goats. The performance assessment of the goats on the test diets showed that goats on control diet (CD) had higher dry matter, crude protein, ether extract and organic matter digestibilities. This could be attributed to the high fiber content of the diets with bitter leaf inclusion.

Table 5 shows the mean dry matter and nutrient intake (g/day) of goats fed the experimental diets for a 20-week period. The mean daily dry matter intakes (DMI) (g/day) were not significantly ($P>0.05$) different. The average daily intake (g/day) of the animals were 297.10, 282.93, 276.94 and 256.03g for animals fed 30% BLM, 45% BLM, CD and 15% BLM respectively. The values (256.03-297.10 DMI g/day) obtained in this study were lower than 305.20 - 311.50 g/day reported by Odedire and Oloidi, (2014). The mean live weight gains (g/day/animal), from animals fed CD was significantly ($P<0.05$) higher than animals fed 30% BLM, 15% BLM and 45% BLM, respectively. The average daily weight gains were 13.57, 9.88, 5.66 and 3.75 g/day/animal for goats fed CD, 30% BLM, 15% BLM and 45% BLM diets, respectively (Table 5). This strengthens the belief that weight reduction was indeed a consequence of the ingested *Vernonia amygdalina* leaves. Atangwho *et al.* (2012) reported respective decrease of 12.78% and 38.51% in body weight gain, of *V. amygdalina* fed rats at 5% and 15% against 17.45% decrease in body weight gain of orlistat at end of study ($P < 0.05$); but with no effect on feed intake at 4-week. The weight gains from this study were higher than 1.47-2.67 g/day reported by Osakwe

Table 3: Chemical composition of diets fed to experimental goats

Parameter	0% BLM	15% BLM	30% BLM	45% BLM
Dry matter (DM)	85.70	90.18	87.71	91.04
Analysis % of DM				
Organic matter	88.19	90.60	90.11	86.67
Crude protein	20.92	23.53	25.44	29.33
Crude fibre	8.38	9.67	10.10	10.68
Ether extract	10.16	8.96	7.20	5.61
Ash	11.81	9.40	9.89	13.33
Nitrogen free extract	43.62	43.68	42.27	41.07

0% BLM = Control diet (0% bitter leaf meal), 15% BLM = 15% bitter leaf meal inclusion, 30% BLM = 30% bitter leaf meal inclusion, 45% BLM = 45% bitter leaf meal inclusion

Table 4: Apparent digestibility coefficient of the dry matter and nutrient intake (g/day) of goats fed experimental diets

Parameter %	0% BLM	15% BLM	30% BLM	45% BLM	SEM	PROB
DDMI	71.53[a]	56.89[b]	58.97[b]	64.71[ab]	1.71	0.004
DCPI	73.57[a]	60.68[b]	59.80[b]	68.44[a]	1.69	0.003
DCFI	77.53[b]	57.18[c]	63.87[c]	85.67[a]	2.57	<0.0001
DEEI	82.91[a]	68.89[c]	63.19[d]	74.55[b]	1.75	<0.0001
DNFE	93.82[b]	94.22[b]	96.78[a]	79.94[c]	1.40	<0.0001
DAsh	57.23[a]	40.49[b]	41.66[b]	61.81[a]	2.39	<0.0001
DOM	85.06[a]	76.02[b]	77.18[b]	77.90[b]	1.00	0.001

[a, b, c]: Means within each row with different superscript are significantly different ($p < 0.05$)

SEM: Standard error of mean: PROB: Probability; DDMI: Digestible dry matter intake; CPI: Digestible crude protein intake; DCFI: Digestible crude fibre intake; DEEI: Digestible ether extract int ake; DNFE: Digestible nitrogen free extract intake; DAsh: Digestible ash; DOM: Digestible organic matter

Table 5: Performance characteristics of the experimental goats

Parameter	CD	15% BLM	30% BLM	45% BLM	SEM	PROB
Average daily feed consumption (g/day)						
Concentrate	139.12	124.75	145.89	138.38	5.15	0.56
Panicum	137.74	131.63	151.21	144.54	5.52	0.65
Total	276.86	256.38	297.10	282.93	10.24	0.59
Average initial live weight kg)	8.28	8.38	8.10	8.05	0.27	0.97
Average final weight (kg)	10.47	9.18	9.90	8.71	0.40	0.44
Mean live weight (kg)	9.52	8.78	9.21	8.48	0.27	0.55
Total weight gain (kg)	1.90[a]	0.79[c]	1.38[b]	0.53[d]	0.13	<0.0001
Average daily gain (g)	13.57[a]	5.66[c]	9.88[b]	3.75[d]	0.94	<0.0001
Percentage mortality (%)	0.00[c]	0.00[c]	50.00[a]	33.33[b]	4.41	<0.0001
Feed conversion ratio (FCR)	20.40[d]	45.34[b]	30.07[c]	75.45[a]	4.48	<0.0001

[a, b, c, d]: Means within each row with different superscript are significantly different ($p<0.05$)

SEM: Standard error of mean; PROB = Probability

and Udeogu (2007). There were significant ($P<0.05$) differences in the FCR of the goats across the diets. The results revealed the ability of goats on control diet to convert the feed consumed to weight gain. Isah *et al.* (2013) reported similar FCR range of 31.89-62.56 for West African Dwarf goats fed different tropical browse plants with *Pennisetum purpureum* as basal diet. There were significant ($P<0.05$) differences in the percentage mortality of the goats fed experimental diets. The percentage mortality of goats on 30% and 45% BLM were significantly ($p<0.05$) higher than that of others.

Conclusion

It could be concluded that 15% bitter leaf meal inclusion is the optimum level that should be offered in the diet of West African Dwarf goats for maximal performance without any detrimental effect on the animals.

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Received: 2nd August, 2017
Accepted: 30th November, 2017