



## ACCEPTABILITY AND UTILIZATION OF GRADED LEVELS OF GMELINA ARBOREA AND CASSAVA PEELS CONCENTRATES IN WEST AFRICAN DWARF SHEEP .

Aye P.A. and Tawose O.M.

Department of Animal Production and Health Sciences  
Ekiti-State University , Ado-Ekiti, Ekiti-State.

*Email: amokapius@yahoo.com*

### ABSTRACT

The nutritive value ,voluntary dry matter intake, and the nutrient digestibility of graded levels of *Gmelina arborea* and cassava peels concentrates in WAD sheep was investigated. Twelve WAD sheep aged 1-2 years old and weighting  $14.00 \pm 0.45$  kg were used in a complete randomized design. Diets were formulated such that cassava peels was replaced with *Gmelina arborea* leaf meal at 0, 33.33, 66.67, 100% levels, designated as diets A, B, C, and D respectively. Diet without *Gmelina arborea* leaf meal was tagged the control diet. The concentrate feed was compounded to contain 16% CP. Diets with 33.33% inclusion level of *Gmelina arborea* had significantly ( $P < 0.05$ ) higher dry matter intake (DMI)  $598.80 \text{g day}^{-1}$ , while the lowest DMI  $425.00 \text{g day}^{-1}$  was obtained in animals fed 100% inclusion level of *Gmelina arborea*.. Crude protein intake (CPI) of animals fed diets with 33.33% inclusion levels of *Gmelina arborea* were significantly ( $P < 0.05$ ) highest, followed by 66.67% inclusion level and the least was observed in 0% inclusion level of *Gmelina arborea*. Dry matter digestibility (DMD) was significantly ( $P < 0.05$ ) different across the dietary treatments, animals placed on diets with 33.33% inclusion level had the highest DMD, followed by animals on diets with 66.67, 100 and 0% inclusion levels. CP digestibility ( $P < 0.05$ ) increased from 33.33% to 100% inclusion levels of *Gmelina arborea* leaf meal, the lowest CP digestibility was observed at 0% inclusion level. CF digestibility ( $P < 0.05$ ) increased from 33.33% to 100% inclusion levels of *Gmelina arborea* leaf meal, while the lowest CF digestibility was observed at 0% inclusion level. N intake increased significantly ( $P < 0.05$ ) with increase in the level of *Gmelina arborea* inclusion from 33.33% to 100%. N retention was significantly ( $P < 0.05$ ) different, diets with 33.33% *Gmelina arborea* inclusion had the highest value ( $64.36 \text{g day}^{-1}$ ) followed by 66.67%, 100% and the least ( $52.64 \text{g day}^{-1}$ ) was at 0% inclusion level of *Gmelina arborea*. N balance values also followed the same trend. From the results of this study, it can be concluded that the inclusion of *Gmelina arborea* leaf meal in WAD rams diet was well tolerated without adverse effect on acceptability, intake and nutrient digestibility, and inclusion level of 33.33% is hereby recommended in ruminant's diet for optimum performance and productivity. .

**KEYWORDS:** Cassava peels; *Gmelina arborea*; Intake; Nutrient digestibility; Nitrogen utilization.

## Council for Innovative Research

Peer Review Research Publishing System

Journal: JOURNAL OF ADVANCES IN AGRICULTURE

Vol .4 , No . 2

[www.cirjaa.com](http://www.cirjaa.com), [jaaeditor@gmail.com](mailto:jaaeditor@gmail.com)



## INTRODUCTION

The livestock industry plays a critical role in the economy of nations especially a developing country like Nigeria. Its role in the supply of animal protein to the Nigerian populace cannot be underscored (Ademosun, 1994). Dry season feeding of livestock especially ruminants in the tropics has always been a problem to the farmers. At this time, the performances of the animals are seriously impaired. One possible way to alleviate this problem of poor feeding regime during the extended dry season and maintain production in the tropics is to feed the ruminants with crop residues and browses which may serve as alternative feeds in the dry period. Incorporation of browse leaves into ruminant diets reduces total cost of production without a decrease in productivity or in efficiency of feed utilization. Browse plants have great potential as source of high quality nutrients for ruminants, being high in proteins, minerals and vitamins (Babayemi *et al.*, 2003; Amata and Lebari, 2012). They are available all year round because of their drought resistance, persistence, vigorous growth, re-growth and palatability (Crowder and Chheda, 1982). Further, browse plants are found all year round in contrast to grasses which rapidly deteriorate with increasing fibre and decreasing protein. They also have higher nutritive value than grasses (Agishi, 1984). The browse species: *Gmelina arborea*, *Leuceana leucocephala*, and *Gliricidia sepium*, have been reported to remain green to larger part of dry season and have been fed to ruminants with appreciable results (Lamidi *et al.*, 2009). Consequently, the objective of this study is to validate the nutritional potential of replacing cassava peels with *Gmelina arborea* leaf meal at different inclusion levels in WAD sheep.

## MATERIALS AND METHODS

### Site Location

The experiment was conducted at the small ruminant unit of the Teaching and Research Farm, Ekiti State University, Ado-Ekiti. Ado-Ekiti is in the Humid Zone of West Africa (HZWA), with a tropical climate and a bimodal rainfall distribution between April and October accompanied by a break in August and the peak during June and September (Adegun, 2014). Dry season occurs between November and March. The site is between Latitude  $07^{\circ} 37' 15''$  N and Longitude  $05^{\circ} 13' 17''$  E, with a temperature range of  $21^{\circ}\text{C}$  to  $28^{\circ}\text{C}$  and high humidity.

### Feed Preparation

Fresh *Gmelina arborea* leaves were harvested from the *Gmelina arborea* plantation of Ekiti State University, Ado-Ekiti. The fresh leaves were air dried for 5 days and milled into a leaf meal using the hammer mill. Cassava peels were collected from the "garri" processing unit of the Teaching and Research Farm, Ekiti State University, Ado-Ekiti, and sun dried for 6 days to crisp hard, after which it was ground into a powdery form by the hammer mill. Four diets were formulated such that cassava peels was replaced with *Gmelina arborea* leaves meal at 0, 33.33, 66.67, 100% and levels, diet without *Gmelina arborea* leaf meal was used as the control diet. The concentrate feed was compounded to contain 16% CP.

### Purchase and Management of Experimental Animals

Twelve West African Dwarf rams with an average weight range of  $14 \pm 4.5\text{kg}$  and age ranged of 1-2 years were procured from open market in Otun-Ekiti for the purpose of the digestibility trial. The rams were quarantined for four weeks according to NAPRI (1984) procedures. They were fed *Panicum maximum*, dried cassava peels and water *ad-libitum* during the quarantine period. The metabolic cages were cleaned and disinfected before the animals were introduced. The animals were treated against ectoparasites by the use of Cypermethrin 'Ectocyp Pour on' (1.3ml) and against endoparasites using Ivermectin (Tectin) (0.3ml), and an antibiotics (Oxytetracyclin 200LA, 1ml) was given to boost their immunity against infections.

### Balance Studies:

Rams were transferred to metabolic cages and were allowed two weeks period of acclimatization. Feed and drinkable water were provided twice daily at 0700h and 1600h. Metabolic cages of 3m x 3m dimension which were made of wood, ideal for the collection of urine and faecal samples, as described by Osuji *et al.* (1993) and modified by Aye (2007) were cleaned and disinfected before the animals were introduced. Weight of the basal and experimental diets were taken before and after feeding for seven days. Voluntary feed intake was determined by deducting the refusal from the quantity of feed supplied. The experiment lasted for 21 days.

### Data collection and analytical procedure

The weekly weight gained obtained from the trial was determined from the difference in previous week's weight and the new weight. The weights of the animals were determined before and after 7-day collection period. The last seven days were used for faecal and urine collection. The average daily feed intake, weekly weight gain and average daily gain were evaluated. The total faeces voided were collected and weighed and 10% aliquot samples were taken and oven-dried for 48 hours. The faecal samples were dried at  $65^{\circ}\text{C}$  to constant weight, the dried faecal samples were milled using the laboratory hammer mill, so as to pass through 2mm sieve prior to chemical analysis and was stored in airtight bags till required for analysis. Urine collected in a container laced with 2-3 drops of  $\text{H}_2\text{SO}_4$  (in order to prevent nitrogen escape) was analyzed for nitrogen and minerals. The dry matter, crude protein, ether extract, crude fibre, and ash of the faeces were determined by standard methods. Analysis of variance were done on the data generated and were statistically analyzed using general linear model option Minitab software version 13.2. Treatment means were separated using



Duncan's Multiple Range Test (Duncan, 1955). Results obtained were used to determine the nitrogen balance, nitrogen retention, and the digestibility co-efficient.

## RESULTS

The nutrient compositions of the experimental diets were presented in Table 1 and the values reported were influenced by the varying incorporation of the feed components. Dry matter values ranged from 87.80 to 88.60g 100g<sup>-1</sup> but no significant difference was observed among the treatment means ( $p>0.05$ ). Crude protein values observed decreased as *Gmelina arborea* content exceeded 33.33% in the treatment diets but not significantly different ( $p>0.05$ ). Crude fiber increased with increasing level of *Gmelina arborea* in the diets and the highest value was observed in the control diet. Diet A had the highest value of CF 5.8g 100g<sup>-1</sup> while diet B had the least value 4.15g 100g<sup>-1</sup>. The EE content among the treatment means was not significantly different ( $p>0.05$ ) while the nitrogen free extract (NFE) values ranged from 57.12g 100g<sup>-1</sup> (diets A) to 60.24g 100g<sup>-1</sup>, (diet C) and significant difference ( $p<0.05$ ) was observed among the treatment means. The gross energy values of the diets varied from 14.82 MJ kg<sup>-1</sup> to 15.35 MJ kg<sup>-1</sup>. The highest gross energy value was recorded in diet C while the least was observed in diet B.

**Table 1: Proximate composition of experimental diets (g 100g<sup>-1</sup>)**

TREATMENT	DM	CP	CF	EE	ASH	NFE	GE(MJ Kg <sup>-1</sup> )	SEM
<i>Panicum maximum</i>	84.27	8.17	32.20	3.50	13.32	42.81	22.00	0.40
TRT A (0 % GLM)	87.80	12.55	5.89	3.79	8.45	57.12	14.95	0.33
TRT B (33.33 % GLM)	88.16	14.56	4.15	5.15	6.70	57.60	14.82	0.60
TRT C (66.67% GLM)	88.60	13.92	4.75	4.24	5.45	60.24	15.35	0.14
TRT D (100 % GLM)	87.63	13.05	5.12	4.50	5.15	59.81	15.22	0.18

Diets A: 0:100%,

Diet B: 33.33:66.67%,

Diet C: 66.67:33.33%,

Diet D:100:0%

## Mineral Composition of the Experimental Diets

The mineral values obtained in the experimental diets were shown in Table 2. The result obtained showed that calcium content ranged from 0.57g 100g<sup>-1</sup> to 0.90g 100g<sup>-1</sup>. The calcium values in the diets supplemented with *Gmelina arborea* leaf meal were higher than value obtained in the control diet. Diet D had the highest phosphorus value of 0.88g 100g<sup>-1</sup> and diet A had the least value of 0.54g 100g<sup>-1</sup>. The Magnesium content was least in diet A and highest in diet D. Of all the nutritionally important minerals analyzed diet D had the highest values while diet A had the least values.

**Table 2: Mineral Constituents of Experimental Diets (g 100g<sup>-1</sup>)**

MINERALS	A	B	C	D	SEM
Calcium	0.57	0.62	0.78	0.90	0.06
Phosphorus	0.54	0.60	0.72	0.88	0.10
Magnesium	0.30	0.40	0.49	0.52	0.20
Sodium	0.33	0.40	0.55	0.61	0.08
Potassium	0.31	0.49	0.56	0.61	0.10
Iron	0.42	0.48	0.50	0.68	0.13
Zinc	0.43	0.51	0.59	0.73	0.07

The antinutrients obtained in the experimental diets were presented in Table 3. The saponin concentrations in the diets ranged from 0.11% in diet D to 0.30% in diet A. The alkaloid values varied from 0.18% in diet A to 0.29% in diet D. The tannin and phytate contents were also influenced by the dietary treatments. The cyanide concentration decreased with increasing inclusion of *Gmelina arborea* leaf meal in the diets while the values for phytate increased with increasing inclusion of *Gmelina arborea* leaf meal in the rations. The antinutrients observed among the treatment means of all the experimental diets were not significantly different ( $p>0.05$ ) and the values were negligible.

**Table 3 : Antinutrients of Experimental Diets (%)**

Antinutrient	A	B	C	D	SEM
Saponin	0.30	0.17	0.14	0.11	0.12
Alkaloid	0.18	0.21	0.25	0.29	0.90
Cyanide	0.30	0.17	0.16	0.15	0.10
Tannin	0.11	0.13	0.17	0.20	0.15
Phytate	0.10	0.14	0.20	0.26	0.15

**Daily nutrient in WAD sheep fed the experimental diets (g day<sup>-1</sup>)**

The nutrient intake in WAD sheep fed the experimental diet was presented in Table 4. Significant differences ( $p < 0.05$ ) were observed in the dry matter intake (DMI) of the WAD sheep, diets with 33.33% inclusion level of *Gmelina arborea* had significantly ( $p < 0.05$ ) higher dry matter intake of 598.80g day<sup>-1</sup>, while the lowest DMI of 425.00g day<sup>-1</sup> was observed in animals fed 0% inclusion level of *Gmelina arborea* (control). Generally, lower values were obtained in animals kept under the semi intensive management system

**Table 4 : Daily nutrient intake in WAD rams fed the experimental diets (g day<sup>-1</sup>)**

TRT	DM	CP	CF	EE	NFE	ASH	SEM
A	425.00 <sup>d</sup>	46.18 <sup>d</sup>	133.70 <sup>d</sup>	17.78 <sup>c</sup>	228.50 <sup>d</sup>	61.72 <sup>d</sup>	0.33
(SI)	268.08 <sup>d</sup>	27.98 <sup>d</sup>	113.54 <sup>d</sup>	11.83 <sup>d</sup>	136.17 <sup>d</sup>	44.36 <sup>d</sup>	0.33
B	598.80 <sup>a</sup>	68.53 <sup>a</sup>	169.60 <sup>a</sup>	25.94 <sup>a</sup>	336.10 <sup>a</sup>	78.24 <sup>a</sup>	0.15
(SI)	344.90 <sup>a</sup>	54.97 <sup>a</sup>	154.35 <sup>a</sup>	22.54 <sup>a</sup>	284.52 <sup>a</sup>	62.05 <sup>a</sup>	0.41
C	559.30 <sup>b</sup>	57.71 <sup>b</sup>	163.80 <sup>b</sup>	25.63 <sup>a</sup>	309.91 <sup>b</sup>	75.46 <sup>b</sup>	0.04
(SI)	336.20 <sup>b</sup>	42.94 <sup>b</sup>	148.23 <sup>b</sup>	20.45 <sup>b</sup>	251.35 <sup>b</sup>	54.53 <sup>b</sup>	0.57
D	485.50 <sup>c</sup>	53.33 <sup>c</sup>	145.40 <sup>c</sup>	21.34 <sup>b</sup>	264.21 <sup>c</sup>	64.70 <sup>c</sup>	0.26
(SI)	301.36 <sup>c</sup>	36.73 <sup>c</sup>	130.44 <sup>c</sup>	14.44 <sup>c</sup>	194.60 <sup>c</sup>	47.02 <sup>c</sup>	0.40

a,b,c,d Means with the same superscripts in the same column are not significantly different ( $P < 0.05$ ).

The results of digestibility coefficient of nutrients by experimental animals were presented in Table 5. The observed digestibility values of the nutrients were significantly ( $p < 0.05$ ) influenced by the dietary treatments. The digestibility coefficient increased with the increased inclusion of *Gmelina arborea* leaf meal in the diets but a decline was observed at 100% inclusion level in the diets. The digestibility of the dry matter ranged from 70.61% (diet A) to 84.84% (diet B) and this was significantly different ( $p > 0.05$ ) in all treatments. The animals fed diet B had the highest value of digestibility coefficient and least value was in animals fed diet A (control). The digestibility coefficient of crude protein varied from 60.51% to 80.21% and these were significantly different ( $p > 0.05$ ) from one another. The crude fibre digestibility coefficient ranged from 84.92% (diet A) to 91.01% (diet B) and the values were significantly different ( $p > 0.05$ ). The digestibility coefficient of EE and NFE were 66.54%-86.89% and 59.59% -84.65%. There were significant different in C of D of EE and NFE ( $p < 0.05$ ).

**Table 5: Co-efficient of digestibility in WAD rams fed the experimental diets (%)**

TRTS	DM	CP	CF	EE	NFE	SEM
A	70.61 <sup>d</sup>	60.59 <sup>d</sup>	84.92 <sup>c</sup>	66.54 <sup>d</sup>	59.59 <sup>d</sup>	0.24
B	84.84 <sup>a</sup>	80.21 <sup>a</sup>	91.01 <sup>a</sup>	86.89 <sup>a</sup>	84.65 <sup>a</sup>	0.7
C	81.06 <sup>b</sup>	74.41 <sup>b</sup>	90.5 <sup>a</sup>	79.8 <sup>b</sup>	81.1 <sup>b</sup>	0.09
D	76.7 <sup>c</sup>	68.87 <sup>c</sup>	89.93 <sup>b</sup>	69.5 <sup>c</sup>	73.65 <sup>c</sup>	0.18

a,b,c,d Means with the same superscripts in the same column are not significantly different (P<0.05).

### Nitrogen utilization in WAD goats fed the experimental diets

The results of the nitrogen utilization in WAD sheep fed the experimental diets were presented in Table 6. The mean nitrogen intake of the experimental animals increased from 7.3g/d to 10.97g/d due to increased dietary protein intake. The values observed in the nitrogen balance ranged from 3.89g/d to 8.24g/d while the nitrogen retention values ranged from 52.63g/d to 75.11g/d; and significant (p<0.05) differences were observed in experimental animals fed diets A,B and C and D.

**Table 6: Nitrogen utilization in the experimental animals**

PARAMETERS	A (control)	B	C	D	SEM
Mean live weight (kg)	15.40	14.97	15.10	15.25	0.05
Mean live weight (W <sup>0.75</sup> kg)	7.77	7.61	7.66	7.72	0.04
Nitrogen intake (g/day)	7.39 <sup>c</sup>	10.97 <sup>a</sup>	9.23 <sup>ab</sup>	8.53 <sup>b</sup>	0.35
Faecal-N (g/day)	2.91	2.17	2.36	2.66	0.22
Digested N (g/day)	4.48 <sup>d</sup>	8.80 <sup>a</sup>	6.87 <sup>b</sup>	5.87 <sup>c</sup>	0.07
Urinary – N (g/day)	0.59	0.56	0.45	0.38	0.32
N- Balance (g/day)	3.89 <sup>c</sup>	8.24 <sup>a</sup>	6.42 <sup>b</sup>	5.49	0.03
N –Retention (g/day)	52.64 <sup>d</sup>	75.11 <sup>a</sup>	69.56 <sup>b</sup>	64.36 <sup>c</sup>	0.25

a,b,c,d: means with the same superscripts in the same column are not significantly different (p<0.05)

### Physiology Parameters of the Experimental Animals

The physiology parameters of the experimental animals were presented in Table 7. The mean respiratory rates of the sheep fed graded levels of *Gmelina arborea* leaf meal under the intensive management system varied from 25.20/minute to 27.11/minute. These values were significantly (P<0.05) lower than those fed on the control diet 29/minute. The rectal temperature of sheep fed supplemental *Gmelina arborea* leaf meal were not significantly (P>0.05) different from those fed control diets. This shows that the rectal temperatures of animals were fairly constant and were within the critical level. The pulse rates of sheep fed *Gmelina arborea* leaf meal varied from 73 pulse/minute to 74 pulse/minute. Values recorded in animals placed under the semi-intensive system of management were higher than values observed on animals in the intensive system of management.

**Table 7: Physiological Parameters of the Experimental Animals**

Parameters	A	B	C	D
Mean Pulse rate (I)	73	73	76	76
Mean Respiratory rate (I)	26	27	28	29
Mean Rectal Temp.(°C) (I)	39	39	39	39
Mean Pulse rate (SI)	76	75	76	77
Mean Respiratory rate (SI)	28	28	29	28



---

Mean Rectal Temp.(°C)(SI)	39	39	39	39
---------------------------	----	----	----	----

---

I: Intensive management system, S.I: Semi-intensive management system

## DISCUSSION

*Gmelina arborea* is an evergreen tree with good biomass yield; it is a good source of plant protein with a balance of other nutrients containing low anti-nutritional and fibre fractions. It has high quality nutritive values as observed from the proximate composition Table 1. The values obtained in diets supplemented with *Gmelina arborea* leaf meal showed higher protein content and lower crude fibre content when compared to the diet that has no *Gmelina arborea* supplementation. This is in line with the reports of Osakwe and Udeogu (2007); Ahamefule *et al.* (2006); Adu *et al.* (1996) which stated that the *Gmelina arborea* leaf meal contained as much as 10.01-38.4 g 100g<sup>-1</sup> crude protein and 3.10-30.46 g 100g<sup>-1</sup> crude fibre. The crude protein (CP) of *Gmelina* leaf meal (GLM) reported in this study was higher than the CP (14.11%) reported by Isah *et al.* (2008) and lower than the GLM value (26.69g 100g<sup>-1</sup>) reported by Lamidi (2005). This result agrees with Babayemi *et al.* (2003); Amata and Lebari (2012) which opined that *Gmelina arborea* leaves has high quality nutrient for ruminants, being high in protein, minerals and vitamins. They also have higher nutritive value than grasses (Agishi, 1984). *Gmelina arborea* leaves have been reported to remain green to larger part of dry season and have been fed to ruminants with appreciable results (Lamidi *et al.*, 2009).

The crude proteins obtained in this study were within the range of 11.33-19.62g 100g<sup>-1</sup> obtained by Onwuka (1980) from browse plants which he opined were sufficient for ruminants feeding in the tropic and these were higher than the 10% recommendation for growth/maintenance of ruminants (Ranjhan, 1993). Browse plant such as *Gmelina arborea*, unlike grasses during dry season are usually protein-rich (Osakwe and Udeogu, 2007). This features makes the under-utilized and non-conventional plant resources valuable and this justifies evaluating them as animal feed resources. The mineral content of *Gmelina arborea* obtained in this study was similar to what was reported by Ahamefule *et al.* (2006), but higher than 0.45 % Ca and 0.32 % P reported by Lowry (1995) for *Gmelina* leaves. Thus the mineral contents of the feeds offered were within the optimum requirements for maintenance and production (Okafor *et al.*, 2012), and therefore may not require supplementation. The tannins, phytates and saponins contents in *G. arborea* leaves obtained in this study agreed with the submission of Okafor (2012) and Yusuf (2011) who reported similar values in their work with *Gmelina* leaves. *Gmelina. arborea* leaves have been implicated to contribute useful amounts of protein with particular reference to amino acids, for livestock diets in the form of leaf meals. The anti-nutritional content of the leaves is low, implying that the overall nutritional value of the leaves will not be affected (Amata and Lebari; 2012). The anti-nutritional factors content were within the tolerable ranges and did not have any detrimental effects on the experimental rams.

Appetite generally refers to internal factors (Physiological or psychological) that stimulates or inhibit hunger in the animals (Salveson, 2004). The feed intake and digestibility were within acceptable range in all the treatments. This agrees with the findings of Lu *et al.* (1996) who reported that particle size reduction enhances forage digestion in ruminants by increasing surface area available for the digestive action of the rumen microbes and enzymes. He further asserted that the physical form of diet could influence intake and the rate of passage of the forage through gastro intestinal tract of ruminants. It is hereby submitted that the reduction of particle size prior to feeding by chopping and grinding resulted in an increased feed intake.

The result obtained from feeding concentrates to the rams showed that the concentrate diets were well accepted and tolerated by the experimental animals and this agrees with the findings of Shaver *et al.* (1999) who reported that the digestibility of feed's dry matter and its proximate component is dependent on some feed related factors such as the rate of passage of digesta through the gastro-intestinal tract. They observed that in order to obtain maximum digestibility, fine-grinding often followed by pelleting should be done on feedstuffs for ruminants. This has a marked effect on the manner in which roughages are digested and hence on their overall utilization. Ground roughages pass through the rumen faster than long or chopped materials and their fibrous component may be less completely fermented. The grinding of roughages therefore reduced the digestibility of their crude fibre by as much as 20% units, and of the dry matter as a whole by 5-15% units.

Dry matter intake and digestibility were lowest in the diet that had the lowest crude protein content and this agrees with the findings of Mc Donald *et al.* (1995) who asserted that the voluntary feed intake is reduced with a reduction in the crude protein content of any diet. Low protein content of diets depresses voluntary intake in ruminant animals. Matured sheep and cattle eat less when the crude protein content is below 0.08-0.1% of the dry matter. This findings is also in agreement with Alokun (1998), who reported a decrease in feed intake when crude protein level of diet was decreased from 15.05% to 11.95% in ruminants. Arigbede *et al.* (2003) reported a drop in dry matter intake from 344.5g/d to 258.50g/d, when crude protein content of diets fed to West African Dwarf buck dropped from 12.50% to 8.90% on dry matter basis.

## CONCLUSION

The present study extends frontiers of knowledge on the potentials of *Gmelina arborea* as a feed resource. The study revealed that the general performance of WAD sheep was enhanced when fed graded levels of *Gmelina arborea* leaf meal as a replacement for cassava peels in the diets of the experimental animals. *Gmelina arborea* are potential sources of energy and nitrogen which would help fill the gap in feed availability to ruminants during the dry season. The use of *Gmelina arborea* as a feed resource will ensure that the animals are not just being maintained but can be sustained for



productive performance during extended dry seasons. The good biomass yield, all year round availability and high nutritive value of *Gmelina arborea* presents it as a potential feed resource for ruminants. The results of the experiment clearly indicate that *Gmelina arborea* leaf meal is a good source of vegetable protein for small ruminants.

The observed feed acceptability, feed intake and nutrient utilization of the WAD sheep in this study showed that *Gmelina arborea* leaf meal was not detrimental to animal health and well being and therefore could be used to supplement *Panicum*- cassava peels in sheep diets.

## REFERENCES

1. Adegun, M.K. (2014): Fodder yield and utilization of *Moringa oleifera* as protein supplement for small ruminants in South Western Nigeria. Ph.D Thesis. Department of Animal Production and Health Sciences, Ekiti- State University, Ado-Ekiti Pp 197.
2. Ademosun, A.A. (1994): Constraints and prospects of small ruminants research and development in Africa.. In S.A.B. Lebbie, B. Rey and E.K Irungun (eds). Small Ruminant Research and Development in Africa CTA publication series .Book of Proceedings 2<sup>nd</sup> Biennial Conference of the African Small Ruminant Resource Network. Tanzania Pp 266.
3. Adu I.F, A.B.I Udedibie and K.A Okeleye, (1996): On-farm establishment and productivity of *Gmelina* and *Gliricidia* as browse for goats. *Nig. Anim. Prod.* 23 (1 and 2): 47-52
4. Agishi E.C, (1984): Nigerian Indigenous Legumes and their Forage Values. *Paper presented at the 9th Annual Conference of Nigerian Society for Animal Production held March, 1984 at the University of Nigeria, Nsukka.*
5. Ahamefule FO, B.E Obua, JA Ibeawuchi and NR Udosen, (2006): The nutritive value of some plants browsed by cattle in Umudike, Southeastern Nigeria. *Pakistan Journal of Nutrition* 5 (5): 404-409.
6. Alokun, J.A. (1998): Performance of Yankasa Sheep Fed Banana Foliage and Elephant Grass. Proceedings of the Silver Anniversary of the Conference of the Nigeria Society of Animal Production. Gateway Hotel, Abeokuta, Nigeria, 21-26 March, 1998. Edited by Oduguwa, O.O., Fanimu, A.O and Osinowo, O.a (Eds) Pp.51-52.
7. Amata I.A and T.A. Lebari (2012 ): Comparative evaluation of the amino acid profile and antinutritional Content of the leaves of four selected browse Plants in the tropics. *International Journal of Plant, Animal and Environmental Sciences; Vol 2, Issue 1, ISSN:2231-4490.*
8. Arigbede, O.M, Bamikole, M.A and Babayemi, O.J. (2003): Evaluation of three forms of two Indigenous multipurpose tree species fed to West African Dwarf goats ASSET Series A (2003) 3 (1) 33-41
9. Aye, P.A. (1998): The effects of two management systems on some physiological parameters and growth rate of the West African Dwarf goats. M.Tech. Thesis. Federal University of Technology, Akure. Pg 45.
10. Aye, P. A., (2007): Production of multinutrient block for ruminants and alcohol from the waste product of *Leucaena* and *Gliricidia* leaves using local technologies. Ph.D. Thesis. Federal University of Technology, Akure. Pp 163.
11. Babayemi O.J, MA Bamikole, I.O Daniel, A Ogungbesan and A Babatunde, (2003): Growth, nutritive value and dry matter degradability of three *Tephrosia* species. *Nig. J. Anim. Prod.* 30 (1 and 2): 62-70
12. Crowder LV and HR Chheda, (1982): Tropical Grassland Husbandry, Longman Inc. New York Pp. 294 and 295.
13. Duncan D. B., (1955) : Multiple Range and Multiple F Tests. *Biometrics* 11, 1-42.
14. Isah, O.A. Omoniyi L.A. and Olatunji A.O. (2008). Identification and chemical composition of feed resources used in ruminant production in Ado-Odo ota and Abeokuta South local government area of Ogun state, Nigeria. In: .Adeyemi , O.A., Ogungbesan, A.M., Dada, A.O, Eniolorunda, O.O., Awojobi, H.A., Oke, D.B and Agunbide, J.A. (Eds) *Proceedings of Nigerian society for Anim. Prod.* 23<sup>rd</sup> Annual conference held in Ayetoro, Ogun state. Pp 619-621.
15. Lamidi A.A, A.B.J. Aina, S.O. Sowande and A.O Johosho, (2009): Assessment of *Panicum maximum* (Jacq), *Gliricidia sepium* (Jacq) and *Gmelina arborea* (Roxb) - based diets as all year round for West Africa Dwarf goat. *Proceedings of 14th Annual conference of Animal Science Association of Nigeria (ASAN)*, Sept. 14th -17th LAUTECH Ogbomoso, Nigeria.
16. Lowry, J. B. (1995): Delicious trees; A dry-season feed resources in Australian tropical woodland? *Tropical Grasslands*, 92: 13 - 17.
17. Lu, C.D., Jorgensen, N.A., and Barrington, G.P (1996): Intake, digestibility and rate of passage of silages and hays from wet fractionation of Alfalfa, *Journal of Dairy Science*. 63: 2051-2059.



18. McDonald, P., Edward, R.A., Grenhalgh, J.F.D. and Morgan, C.A. (1995). *Animal Nutrition*. 5<sup>th</sup> Edition. Pearson Education Limited, Edinburg gate, Garlow Essex CM20 2JE, United Kingdom. NAPRI (1984): Highlights of Research Achievements on Animal Production, Science and Technology Briefing Lagos December 1984 Pp. 3-17.
19. Okafor EC, CAM Lakpini and A Fayomi, (2012): Dried *Gmelina (Gmelina arborea roxb)* leaves as replacement forage to groundnut haulms in the diet of fattening Red Sokoto bucks. *Inter J Agri Biosci*, 1(1): 5-10
20. Onwuika, C.F.I. 1980: "The Chemical Composition and *in vitro* Organic Matter Digestibility of Some Browse Plants in Nigeria". M.Sc. Thesis, University of Ibadan, Department of Animal Science: Ibadan, Nigeria.
21. Osakwe, I.I. and R.N. Udeogu. 2007: "Feed Intake and Nutrient Digestibility of West African Dwarf (WAD) Goat Fed *Pennisetum purpureum* Supplemented with *Gmelina arborea*". *Animal Research International*. 4(3):724 – 727.
22. Osuji P.O., Nsahlai I.V. and Khalili H. (1993): Feed Evaluation. *ILCA Manual 5*. (International Livestock Center for Africa), Addis Ababa, Ethiopia. Pp40. Polysaccharides in relation to animal nutrition, *J.Dairy Sci.*, 74, 3583-3542.
23. Ranjhan, S.K. (1993): *Animal nutrition and feeding practices*. 4<sup>th</sup> Ed. Vikas publishing house PVT Ltd. New Delhi, India – Pp. 104-105.
24. Salveson, R. E . (2004): Utilization of aquatic plants in steer diets: Voluntary intake and digestibility MSA Thesis University of Florida, Gainesville.
25. Shaver, R.D. Nytes, A.J. Shatter, L.O., Jorgensen, N.A. (1999): Influence of the amount of feed intake and forage physical form on digestion and passage of pre-blown alfalfa hay in dairy cows. *Journal of Dairy Science*, 69 : 1545-1559.
26. Williamson, G. and Payne, W.J.A. (1978). *An introduction to animal husbandry in the tropics*. The English Language Book Society and Longmans, London.
27. Yusuf H.A, 2011: Growth performance of Yankasa sheep fed varying proportions of *Gmelina arborea* leaves and maize stover, M.Sc. Thesis Animal Science department, Ahmadu Bello University, Zaria,