Research Paper

INDIGENOUS BROWSE PLANTS USED FOR GOATS IN AKWA IBOM STATE, NIGERIA; THEIR PHYTOCHEMICAL, MINERAL, NUTRIENT AND ANTINUTRIENT CONTENTS.

ABSTRACT

Goatmeat is considered a delicacy among the people of Akwa Ibom State and is consumed on at least a weekly basis by each household. The production of local goats has not been able to meet the local demand and thissa has resulted in the massive importation of goats into the state. A possible cause for the low production is the availability of browse plants for goat farmers. A total of 20 plant species in 19 genera and 13 families were identified as common fodders used for goats in Akwa Ibom State. Four of these plants investigated were , *Palisota hirsuta* (Thunb.) K. Schum , *Rauvolfia vomitoria* Afzel., *Spondias mombin* L. and *Manniophyton fulvum* (Muell) Arg. The phytochemical screening of dried, ethanolic extracts of the samples showed the presence of bioactive constituents like tannins, flavonoids, cardiac glycosides, saponins, anthraquinones, alkaloids and cyanogenic glycosides. Terpenes though present in trace amounts in *M. fulvum*, was completely absent in *S. mombin* while anthraquinones were absent in *M. fulvum.* The proximate analyses showed that ash content was highest in *P. hirsuta* (10.6%), crude protein was highest in *R. vomitoria* (25.88%), crude fibre, crude fat and moisture content were highest in *P.hirsuta* (28.57%, 12.22%, and 84% respectively). The mineral elements, calcium (200mg/100g), magnesium (74.4mg/100g) and iron (97.58mg/100g) were very high in *P. hirsuta* than in the other three browse plants. The toxic components such as oxalates were highest in *S. mombin* (598.4mg/100g). These results show that these browse plants may form good feed resources for modern intensive native goat production. As a result, their conservation by cultivation could lead to sustainable usage of the resource since they are still collected in the wild and due to overexploitation and other human activities are being lost.

Keywords: Browse, phytochemical, nutrient, mineral, anti-nutrient, conservation.

INTRODUCTION

Goats are small ruminant animals which play a significant role in the economy and nutrition of landless, small and marginal farmers [1]. Among the people of Akwa Ibom State, goats are commonly used in ceremonies and have very important in traditional uses and in the preparation of local delicacies. It would be safe to state that in many homes '*afia efere'* and recently pepper soup rice are meals eaten at least once every week. The crowds in goat markets all over Uyo metropolis especially at weekends is enough evidence to prove the high demand for goat meat. In order to meet the demand goats are imported in lorry and trailer-loads into the state. However, for traditional ceremonies the demand for the native species (*okop usem ebot)* also known as the West African dwarf goat, has not been compromised.

Rearing of the native goats is largely practiced by the rural dwellers where there are still enough shrubs and trees to provide goat feed. The tender shoots of trees, twigs and leaves of shrubs and woody plants as well as fruits make up a large part of the natural diet of many ruminant animals including goats. Tree fodder have been

said to be rich in nutrients and therefore, provide high quality feed for grazing ruminants [2]. However, such fodder has become difficult to collect with a lot of clearing of bushes for various human activities. With the availability of limited goat feeds, the number of goats a farmer can rear is usually few thus resulting in low production of goats to meet market demands. Most tree leaves and twigs contain secondary metabolites such as tannins and anti-nutritional factors and are therefore fed to the goats with caution since they may be toxic when consumed in large quantities [3]. Some browse plants are also used for herbal cures in goats as well as in man. The presence of some anti-nutrients may cause low palatability and thereby make the feed unacceptable to the farm animals [4].

The nutritive value of feeds depends on feed intake and the efficiency of absorption and assimilation of nutrients from the feed during digestion. Feeds of high nutritive value promote high level of production which is seen in live weight gain [5]. Goatmeat is lean meat and is therefore low in cholesterol and healthier for consumption. It is also preferred because of its chewability [6].

Work has been done on trees and shrubs of Known fodder value in tropical humid Africa by [7] and [8].The latter reported that efforts to screen 22 native browse plant species in Nigeria were abandoned after two years of observations because they could not match the productivity of two exotic plants; *Gliricidia* sp. and *Leucaena* sp.

The introduction of the used of exotic, more productive plants as goat feed may eventually lead to loss of indigenous knowledge of browse plants among other deleterious effects of exotics on the environment. This work aims at conserving indigenous knowledge and drawing attention back to indigenous browse plants and why they should still be used in rearing the native goats by;

- Identifying commonly used browse plants among the people of Akwa Ibom State
- Investigating the phytochemical, nutrient, anti-nutrient and mineral constituents for such browse plants and,
- Making recommendations based on the findings.

MATERIALS AND METHOD

A structured questionnaire was administered to 45 respondents who of necessity were goat farmers or had knowledge of how to keep goats. The ages ranged from 20 to above 46. The plants were collected, authenticated and processed for storage in the University of Uyo herbarium of the Department of Botany and Ecological Studies. The use of the browse plants in herbal cure for the goats was documented.

Fresh leaves of *Palisota hirsuta* collected from Ikono, *Rauvolfia vomitoria* from Itu, *Spondias mombin* and *Manniophyton fulvum* from Uyo were air dried for 4 days after which they were reduced to powdered form. This was stored in air tight containers. The methods of chemical analyses used were those of [9] and [10].

For the phytochemical screening, 200g of each powdered sample was extracted using 70% ethanol. Each mixture was allowed to stand for 72 hours at room temperature. The extract was then filtered and the filtrate concentrated to dryness *in vacuo* at 40^{o} C. The dried extract was then used.

The proximate analyses were done using the micro kjedhal method of [9] for crude protein. For crude fat, the samples were weighed into porous thimbles, 200ml of petroleum ether poured into a round bottom flask, a soxhlet extractor fitted into it and placed on the heating mantle for 6 hours. The extracted oil or fat was concentrated in vacuo and weighed. For ash content, 1.0g of the dried sample was weighed into three crucibles of known weights. The crucibles with their content were covered and placed in a muffle furnace and ignited for 24hours at 500^{o}C after which they were cooled in dessicator and the crucible weighed with contents. These procedures were repeated until a constant weight for each crucible was obtained. Crude fibre determination was done by weighing 2g of the sample into a conical flask and adding 150ml of 1.25% H_2SO_4. The mixture was

boiled gently for 30 minutes while maintaining a constant volume. The content in the beaker was filtered and the residue rinsed with hot distilled water until it was acid free. The material was scraped into a flask for base digestion by adding 200ml of dilute boiling 1.25% NaOH and allowed to boil gently for 30minutes while maintaining a constant volume. The mixture was was then filtered, and the filtrate was washed thoroughly with hot distilled water until it was base free. The residue was rinsed once with 10% HCL and twice with industrial methylated spirit or ethanol. It was then dried in an oven at 105^0 C and weighed before it was ignited in a furnace at 550^0C for 90 minutes then weighed again. The loss in weight of crucible and content after ignition was calculated as the crude fibre content. The carbohydrate content was determined as the difference obtained after subtracting total organic nitrogen, crude fat, crude fibre, crude protein and ash content from the total dry matter. The moisture content was determined by weighing 2.0g of the powdered sample into 3 empty crucibles of known weight. After weighing the crucibles with their content, they were placed in an oven, dried at 105-110^0C for 24 hours, cooled in a dessicator containing silica gel as a drying agent and weighed. The procedure was repeated until a constant weight was obtained for each sample.

Mineral content was determined by the wet digestion method in which 0.05g of sample was weighed into a digestion flask then 10ml of perchloric acid and 20ml of concentrated nitric acid was added. The content was digested on a hot plate until the colour turned white. The digest was allowed to cool and 20ml of distilled water was added before filtering and making it up to 50ml. The solution was then used for the determination of Sodium (Na) and Potassium (K) by flame analyzer/ photometer, Calcium (Ca) and Magnessium (Mg) by EDTA titration method and Phosphorus (P) by yellow (vanadomolybdate) colorimetric method and Iron (Fe) by orthophenanthroline colorimetric method.

Statistical deviations were calculated for triplicate determinations and the means tested with the student's t-test.

RESULTS AND DISCUSSION

From the survey of browse plants used for goats by the people of Akwa Ibom State, it was found that both men and women rear goats as a result, 60% of the respondents were males and 40% were females. None of the respondents focused only on goat farming as the only source of income. Rather, 80% of them were business people e.g. traders etc. While 20% were farmers. A total of 20 plants species belonging to 13 families were identified. These are listed in Table 1. Out of these 40% (8 species) were found to be used as herbal cures for various ailments as listed in Table 2. The survey also showed that 91% of the respondents agreed that goat meat is very popular in Akwa Ibom State and 86% preferred the native African dwarf goats to those imported into the State from the Northern part of Nigeria because of its flavour and taste. The difference in flavour and taste of the native goats was attributed to the indigenous fodder fed to them by 75% of the respondents. The fodder fed to native goats differs according to age as stated by 48% of the respondents. Some of these are listed in Table 2. Many (93%) of the respondents collect their fodder in the morning

Table 1: Common browse plants used for goats in Akwa Ibom State

S/N	PLANT FAMILY	PLANT NAME	LOCAL NAME
1	Anacardiaceae	*Mangifera indica* L.	Nsukakara
2		*Spondias mombin* L.	manko
3	Annonaceae	*Annona muricata* L.	Sawasawa
4	Apocynaceae	*Landolphia membranacea*	mba

5		*Rauvolfia vomitoria* Afzel	Mmongeba ebot
6	Commelinaceae	*Palisota hirsuta* (Thumb)K. Schum.	Edong ebot
7	Dennstaedtiaceae	*Pteridium aquilinum*	Nyama asabo
8	Euphorbiaceae	*Alchornea cordifolia* (Schum. &Thinn.)Mull. Arg.	Mbom
9		*Manniophyton fulvum*	Nkunikun
10		*Microdesmis puberula* (Hook. f) Ex Planch.	Ntabid
11		*Ficus exasperata* Vahl.	Ukwok
12	Fabaceae	*Albizia lebbeck* (L.) Benth.	Ubam india
13		*Baphia maxima* Bak.	Emum
14		*B. nitida* Lodd.	Afuo
15	Lauraceae	*Persea americana* Miller	Eben mbakara
16	Malvaceae	*Urena lobata* L.	Ndidi
17	Passifloraceae	*Barteria nigritiana* Hook. f	Ekpaekpang
18	Poaceae	*Andropogon gayanus*	Mbokok ekpo
19	Polygalaceae	*Carpolobia lutea* G. Don	Ikpafum
20	Samydaceae	*Homalium letestui* Pellegr.	Otong idim

hours while 86% were not aware of formulated feeds for goats even though according to 97% of them they have difficulties collecting fodder for their goats. The respondents (31%) noted that there is special fodder for pregnant goats as also listed in Table 2. According to 82% of the respondents, the massive importation of goats into the state is a threat to the survival of the native goats.

The result of the phytochemical screening, nutrient composition, anti-nutrient composition and mineral composition of *Palisota hirsuta* (Thumb.)K. Schum., *Rauvolfia vomitoria* Afzel, *Spondias mombin* L. And *Manniophyton fulvum* are as summarised in Tables 3, 4, 5 and 6.

Table 2: Some fodder used in the management of ailing goats

S/N	FAMILY	PLANT NAME	LOCAL NAME	AILMENT CURED
1	Anacardiaceae	*Spondias mombin* L.	Nsukakara	For dislodging retained placenta
2	Costaceae	*Costus afer* Ker Gawl.	Mbritem	Constipation/ pregnant goats
3	Euphorbiaceae	*Manniophyton fulvum*	Nkunikun	Fever / for goats in labour
4		*Microdesmis puberula*	Ntabid	Insecticide against tick/mite infestation
5	Icacinaceae	*Lasianthera africana*	Editan	Internal heat/ pregnant goats
6	Malvaceae	*Urena lobata*	Ndidi	To stop purging in Goats
7	Verbanaceae	*Vitex doniana*	Nkoro	Against vitamin defficiency
8		*Rauvolfia vomitoria*	Mongeba ebot	For breastfeeding goats

141 **Table 3**: Result of phytochemical screening

TEST	PLANT SAMPLE	OBSERVATION	INFERENCE
Alkaloids (Dragendorffs	*Spondias mombin*	No precipitate observed	-
Test)	*Manniophyton fulvum*	Precipitation observed	+
	Palisota hirsuta	No precipitate observed	-
	Rauvolfia vomitoria	Precipitate observed	+++
Saponins (Frothing Test)	*S. mombin*	Persistent frothing for more than 30 minutes was observed	++
	M. fulvum	Same	++
	P. hirsuta	No frothing observed	-
	R. vomitoria	Persistent frothing for more than 30 minutes	+++
Tannins Test (ferric	*S. mombin*	Blue-black precipitate was	
chloride Test)		Observed	++
	M. fulvum	Same	++
	P. hirsuta	Same	+++
-	*R.vomitoria*	Same	+++
	S. mombin	Effervescence observed with reddish colour	++
Flavonoids (Shinodas	*M. fulvum*	Same	++
Test)	*P. hirsuta*	Effervescence with orange colour was observed	+
	R. vomitoria	Effervescence with reddish colour was observed	++

142

TEST	PLANT SAMPLE	OBSERVATION	INFERENCE
Anthraquinones (Borntrager's Test)	*Spondias mombin*	Violet colour was observed in the ammonia phase	+
	Manniophyton fulvum	No violet colour was Observed	-
	Palisota hirsuta	No colour change	-
	Rauvolfia vomitoria	A red colouration was observed in the ammonia phase	+
Cardiac glycosides			
• Lieberman's Test	*S. mombin*	No colour change	-
	M. fulvum	No colour change	-
	P. hirsuta	A violet colour was Observed	+++
	R. vomitoria	Same	+++
• Salkowski's Test	*S. mombin*	No reddish – brown colour at the interphase	-
	M. fulvum	A reddish brown colour –a steridial ring was Observed	+
	P. hirsuta	Same	+++
	R. vomitoria	Same	+++

TEST	PLANT SAMPLE	OBSERVATION	INFERENCE
• Keller-Kiliani Test	*Spondias mombin*	No browning at Interphase	-
	Manniophyton fulvum	A reddish –brown ring was observed at the interphase	+
	Palisota hirsuta	A brown ring was observed at the interphase	+++
	Rauvolfia vomitoria	Same	+++

- **= Absent**

+ **= Trace**

++ **= moderate**

+++**= strongly present**

From Table 3, alkaloids were absent in *S. mombin* and *P. hirsuta* and strongly present in *R. vomitoria.* Saponins were completely absent in *P. hirsuta* and strongly present in *R. vomitoria.* All four samples contained tannins. These were moderately present in *S. mombin* and *M. fulvum* and strongly present in *P. hirsuta* and *R. vomitoria.* Flavonoids occurred in moderate amounts in three of the samples except in *P. hirsuta* where it occurred in trace amounts. Anthraquinones were absent except in *S. mombin* and *R. vomitoria* where they were found in trace amounts. In all the tests for cardiac glycosides, both *P. hirsuta* and *R. vomitoria* showed strong presence of the glycosides.

The analyses of nutrient composition as seen in Table 4 showed that *P. hirsuta* had the highest value for moisture content (84.00 %), crude protein (25.88%), crude fibre (28.57%), and crude fat (12.22%).

Table 4: Nutrient composition of the four browse plants

Nutrient	*S. mombin*	*M. fulvum*	*P. hirsuta*	*R. vomitoria*
MOISTURE CONTENT	50.80%	34.80%	84.00%	76.50%
CRUDE PROTEIN	17.06%	18.81%	14.65%	25.88%
CRUDE FIBRE	20.00%	13.00%	28.57%	21.00%
CRUDE FAT	11.81%	10.34%	12.22%	10.54%
ASH CONTENT	8.00%	5.00%	10.66%	8.00%
CARBOHYDRATE	43.13%	52.85%	33.88%	34.56%

Table 5: Anti-nutrient composition of the four browse plants

Anti-Nutrient	*S. mombin*	*M. fulvum*	*P. hirsuta*	*R. vomitoria*
PHYTIC ACID	42.64mg/100g	41.52mg/100g	27.59mg/100g	45.27mg/100g
OXALIC ACID	598.40mg/100g	589.60mg/100g	290.40mg/100g	202.40mg/100g
TANNIC ACID	10.31 mg/100g	8.31mg/100g	6.16mg/100g	3.11mg/100g

The anti-nutrient analysis in Table 5 showed that oxalic acid was much higher in all the four browse plants than other anti-nutrients while tannic acid was the lowest in all four.

The mineral analysis as seen in Table 6, showed high content of potassium and phosphorus in both *Palisota hirsuta* and *Rauvolfia vomitoria (*192.00mg/100g and 256.00mg/100g) and (26mg/100g and 41mg/100g) respectively. *Spondias mombin* and *Manniophyton fulvum* had the least values for magnesium which were, 0.29mg/100g and 0.24mg/100g respectively, while the least values in *P. hirsuta* and *R. vomitoria* were for sodium at 1.5mg/100g and 1.9mg/100g respectively.

Table 6: Mineral Composition of the four browse plants

Minerals	*S. mombin*	*M. fulvum*	*P. hirsuta*	*R.vomitoria*
CALCIUM	1.20mg/100g	0.06mg/100g	20.00mg/100g	14.00mg/100g
MAGNESIUM	0.29/100mg	0.24mg/100g	7.44mg/100g	2.88mg/100g
POTASSIUM	16.00mg/100g	12.8mg/100g	192.00mg/100mg	256.00mg/100g
SODIUM	9.60mg/100g	6.40mg/100g	1.50mg/100g	1.90mg/100g
PHOSPHORUS	4.05mg/100g	2.90mg/100g	26.00mg/100g	41.00mg/100g
IRON	0.68mg/100g	0.57mg/100g	9.76mg/100g	7.13mg/100g

Indigenous goat farming is largely dependent on experience and indigenous knowledge of the farmers. Such Knowledge is usually passed down from generation to generation with little or no documentation. It is increasingly becoming obvious that indigenous knowledge of biodiversity is very important [11]. More (60%) men than women (40%) were found to be goat farmers. This could be due to the work involved in collection of fodder for the goats which would mean more stress for the women who already have a lot to do in order to keep the family.[12] also observed that there were 60% males to 40% females among the respondents who collect and use mistletoes in herbal cures. With urbanisation, the common browse plants have become scarce around the towns and necessitate travelling farther distances before they can be collected. A total of 97% of respondents stated that they had difficulties in collection of browse plants. Indigenous browse species were screened by [8] out of which seven of the species were also documented in this work. The other thirteen species were not included in their work.

Goat farming was observed to be largely a secondary source of income since 80% of the respondents were business people involved in different kinds of trade in addition to goat farming. In spite of the high demand of goat meat in the state, it is easier to buy imported goats and sell them than to be involved in goat farming. In their work, [13], observed that 54% of the TBAs they interviewed had other sources of income.

A total of 40% of the browse plants as listed in Table 2, were found to be used as herbal cures for various ailments and conditions in the goats. According to the respondents such browse plants alone are provided for the goats in order to ensure that the goat will consume them. In many cases plants used in herbal cures are also eaten as food. Athough formulated feeds exist for goats, 86% of the respondents said they were unaware of them..

The phytochemical screening (Table 3) revealed that the browse plants had secondary metabolites in different quantities and some were completely lacking. Saponin was present in three of the browse plants and absent in *P. hirsuta.* In goats, large doses of plant leaves containing saponins can cause distension of the rumen according to [14]. All four browse plants were found to contain tannins. According to [15], plant tannins are complex phenolic polymers varying in chemical structure and biological activity. They inhibit the utilisation of nutrients through astringency, enzymes inhibition and reduced forage digestibility. It is also associated with high lignin content, low crude protein, reduced bloating and increased protein absorption in grazing ruminants [16]. According to [15], dry matter intake, nitrogen intake and nitrogen balance were significantly influenced by the saponins and tannins in the leaves of *Gliricidia sepium, Manihot esculenta* and *Spondias mombin.*

Proximate analyses are used extensively for quick estimation of nutrient potentials of feed stuffs including tropical browse plants used by indigenous farmers for ruminant feeding[17]. The crude protein value (as shown in Table 4), for *Spondias mombin* (17.06%) and *Manniophyton fulvum* (18.81%) was found to be comparable to values obtained for *Aspillia africana* (17-17%) by [18] and for *Amaranthus spinosus* (18.55%) by [19]. The highest crude protein value (25.88%) in all four browse plants was obtained in *Rauvolfia vomitoria.* This value is comparable with the value obtained for *Microdesmis puberula* (25.9%) and *Dialium guineense* (24.96%) as reported by [20] and [21] and exceeds the minimum protein requirements of 10-12% for ruminants as estimated by [22]. The introduced species of *Gliricidia* and *Leucaena* were reported to have protein values of 22.2% and 22.5% respectively by [21]. These are often preferred above indigenous browse plants as documented by [8]. However, *R. vomitoria* has a higher protein value than they do and should be further exploited.[20], also reported a crude protein value for *R. vomitoria* to be 27.14% in their work while [19], reported a crude protein value of 15.34% for *Palisota hirsuta* which was comparable to the value obtained in this work which was 14.65%. [25] concluded that crude protein values of certain indigenous browse species including *S. mombin* were considered as protein supplements suitable for feeding to livestock.

The carbohydrate value for *S. mombin* (43.13%), *M. fulvum* (52.85%), *P. hirsuta* (33.88%) and *R. vomitoria* (34.56%) were comparable to values obtained by [25] for *Justicia insularis* (45.14%) and [20] for *Ricinodendron heudelotti* (46.27%) and *Vernonia amygdalina* (40.08%). Carbohydrate is the main source of

energy for man and animals as a result these browse plants are necessary for the goats.[20], however reported higher carbohydrate values for *Palisota hirsuta* (54.46%) and [21] reported a higher value (53.86%) for carbohydrate in *Rauvolfia vomitoria.*

The ash content in *S. mombin* (8.00%) and *M. fulvum* (5.00%) compared favourably with that of *Alchornea cordifolia* (5.20%), *Urena lobata* (7.00%) and *Calopogonium mucunoides* (6.00%) as reported by [19]. In *P.hirsuta*, the ash content of 10.66% obtained in this work was similar to the value (10.80%) obtained by [20] while the ash value for *R. vomitoria* (8.00%) was found to differ from the value (5.20%) reported by [21].

Minerals are vital for normal growth, reproduction and proper functioning of the body [26]. They protect and maintain the structural components of the body, organs and tissues. They catalyse several enzymatic processes and hormone systems and maintain acid-base balance, water balance and osmotic pressure in the blood and cerebral spinal fluids [27]. Potassium content was very high in *R. vomitoria* (256mg/100g) and according to [28], the concentration of potassium required by livestock during lactation is 7.0mg/100g. Potassium deficiency causes a decrease in feed intake and reduces weight gain. Values for calcium, phosphorous and magnesium were high in the browse plants and such high dietary mineral content are good for foetal development and lactation according to [29]. However, calcium contents of *P. hirsuta* and *R. vomitoria* were lower than the calcium requirements (4.0g/kg DM) needed for all forms of production in ruminants [22]. The values of iron in *P. hirsuta and R. vomitoria* were quite high compared to those of *S. mombin* and *M. fulvum.* Iron functions in the immune system of animals and is a constituent of several enzymes associated with the mechanism of electron transport [29]. The differences in values obtained could be due to the level of the minerals in the soil, climate, and stage of growth or the portion of material used for the analyses [30].

Anti-nutrient composition of the browse plants for phytic acid were higher [*S. mombin* (42.46mg/100g), *M. fulvum* (41.52mg/100g), *P.hirsuta* (27.59mg/100g) and *R. vomitoria* (45.27mg/100g)] than the range of values (13.80mg/100g to 25.20mg/100g) reported by [20] for browse plants including *P. hirsuta*. [31], reported a phytic acid value of 89.2mg/100g for *Cajanus cajan*. According to him, concentration of phytic acid in forages may chelate several mineral elements especially calcium, magnesium and iron and also interferes with their absorption and utilization. Oxalic acid values ranged from 202.40mg/100g in *R. vomitoria* to 598.40mg/100g in *M. fulvum.* [15] stated that ruminants can consume considerable amounts of high oxalate plants without adverse effects due to microbial decomposition in the rumen. Tannic acid content ranged from 3.11mg/100g in *R. vomitoria* to 10.31mg/100g in *S. mombin*. These values were much lower than those obtained for other anti-nutrients in the browse plants.

CONCLUSION

The efficiency of goat production considering high local demand depends on adequate fodder production. The production, management and sustainable use of fodder will enhance the economic benefits for indigenous goat farmers. A total of 20 plant species in 19 genera and 13 families have been identified in this work as common plants used by indigenous goat farmers as fodder and as herbal cures for various ailments in goats. Results of phytochemical, nutrient, anti-nutrient and proximate analyses have shown that four of the species (*S. mombin, M. fulvum, P. hirsuta and R. vomitoria*)contain bioactive compounds such as saponins, tannins, anthraquinones, flavonoids, alkaloids, cardiac glycosides which suggests that the plants are of high medicinal value. This may be a validation of their use in herbal care by the indigenous goat farmers. Nutritionally, the browse plants were also found to compare favourably with other introduced fodder such as *Leucaena* sp. and *Gliricida* sp. These plants were also found to be rich in minerals which improve the productivity of the goats. Based on the high anti-nutrient contents there is need for developing methods of processing these browse plants in order for the goats to benefit maximally from them. It is recommended that indigenous goat farmers be encouraged to cultivate browse plants along with goat rearing. This could also serve as a means of income as they go into fodder production and sales. There should be concerted efforts to conserve forests around cities, towns and villages. Sustainable utilization of forest resources should also be emphasised. These measures would encourage more

people to get involved in indigenous goat farming so that they do not become endangered and eventually extinct.

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