Chemical Evaluation of Some Browse Plants Eaten by Local Breeds of Goats in Edo State, Nigeria.

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ABSTRACT

Three common browse plant *Ficus mucoso, Ficus capensis,* and *Spondia mombin* were collected from the environs of Edo State, Nigeria. The leaves, leaves plus soft twigs (15cm of apical portions), and bark (scrapings of soft outer covering of fresh green branches) were collected. Proximate, fiber, and mineral compositions were determined. The results show that dry matter (DM), crude protein (CP), fat (F), ash (A), and crude fiber (CF) were more concentrated in the leaves compared to other plants parts investigated. The macro and micro minerals contents followed the same trend. *S.mombin* leaves had the highest CP content (15.64%), while leaves of *F. capensis* and *F. mucoso* had CP content of 11.80%, and 4.96%, respectively. The leaves plus soft twigs of *F. mucoso, F. capensis, and S. mombin* contained 4.17%, 7.33%, and 3.23% CP, respectively. The DM content of *F. capensis* leaves (66.45%) was highest compared to the leaves of *S. mombin* (40.07%), and *F. mucoso* (25.40%). Moreover, *F. capensis* leaves was observed to be richer in calcium (0.698%) and magnesium (0.058) than others, while *F. mucoso* leaves ranks highest in phosphorus, sodium, and potassium (0.034%, 0.494%, and 0.428%, respectively). The results indicate that these browse plants have good levels of nutrients and mineral contents, thus their potential as good sources of feed in the improvement of small ruminant productions could be further investigated.

(Keywords: browse plants, chemical composition. Leaves, soft twigs, bark, animal nutrition)

INTRODUCTION

The livestock industry in Nigeria represents a very important national resource. It contributes substantially to the national wealth and also supplies the populace with the important animal protein, which are required for healthy living. The most crucial constraint in livestock production is year-round nutrient or feed supply in the tropics. The problem of feed supply to small ruminant seems to be enormous and so the need for investigation and search for alternative, less expensive and locally available sources of protein for ruminants become more important. The potentials of trees and shrubs as alternative fodder resources in ruminant nutrition have attracted the attention of researchers worldwide.

The merits of browse feeding to ruminants are better noticed during the critical season when availability of pastures and grassland forage is low. Browses are known to contain higher level of protein, vitamins, and minerals (Mecha and Adegbola, 1980), than what is obtainable in some grasses. The recognition of these merits necessitates an extension of research works into some browse plants that are not presently well utilized in livestock feeding most especially ruminant animals such as goats. Browse plants such as *Ficus mucoso, Ficus capensis, and Spondia mombin* are common domestic trees, as they are being raised in traditional home to provide shade in many parts of Nigeria. The objective of this study therefore is to determine the proximate, fiber, and mineral compositions of leaves, soft twig, leaves plus soft twig, and bark of *Ficus mucoso, Ficus capensis,* and *Spondia mombin* as potential fodders for ruminant production.

MATERIALS AND METHODS

Three browse plants *Ficus mucoso, Ficus capensis,* and *Spondia mombin*, observed to be commonly browsed by goats in Ekpoma, Esan West Local Government Area of Edo State, Nigeria, were collected from three different locations in the study area. Ekpoma is located between Latitude 3^{o} 8` and $7^{o}$ 8`N, and Longitude 3^{o} 2` and $9^{o}$ 8`E and at an altitude of 335m above sea level. The climate is humid tropical, characterized by a dry period (November to March) and a wet period (April to October). Annual rainfall in this location ranges between 1200mm and 1500mm. Mean temperature and humidity during the study ranged from 20 to 31^{o}C and 71 to 83%, respectively.

The area is vegetated transitionally between the dense rainforest to the south and the sparse derived savannah to the north. Each of the three plants were harvested and sorted into three portions consisting of the leaves alone, leaves and the soft twigs (15cm of apical portions) and bark (scrapings of soft outer covering of fresh green branches). The different parts of the three selected plants were sun-dried for about three to four days and placed in appropriate containers and stored for laboratory analysis. Sub-samples were taken immediately after harvesting to determine the fresh dry matter (DM) as fed.

Samples were oven-dried to a constant weight and milled to pass through a 2mm screen for subsequent analyses. The ground samples were analyzed for proximate compositions following standard procedures as outlined by AOAC (1990). Crude protein was determined by the micro-Kjeldahl procedure (N x 6.25), ash by incineration at 500^{o}C for 2h in a closed furnace and fiber was determined according to the methods described by Van Soest and Robert (1985).

Analysis of the mineral concentrations in the sampled foliages was by wet digestion using nitric-perchloric acid mixture. The mineral elements Calcium (Ca), Magnesium (Mg), Iron (Fe), Cupper (Cu), Zinc (Zn), and Manganese (Mn) were determined by the atomic absorption spectrophotometer using the Bulk Scientific model 200a (East Norwalk, USA) while the flame photometer (FP 410 Corning) was used to estimate the Sodium (Na) and Potassium (K) contents. Phosphorus (P) concentration was determined calorimetrically (Parkinson and Allen, 1975).

RESULTS AND DISCUSSION

The Proximate Composition of Different Parts of *Ficus mucoso, Ficus capensis,* and *Spondia mombin.*

Table 1 showed that the highest ($p<0.05$) dry matter value was observed for *Ficus capensis* leaves (66.45%), while *Ficus mucoso* leaves had the least value (25.40%), intermediate value was observed for *Spondia mombin* leaves (40.07%). Dry matter content of leaves plus soft twig was lower than those of the bark and leaves alone for *Ficus mocoso* and *Spondia mombin*. Different trend was observed for *Ficus capensis* where the bark had the least dry matter value compared to leaves only and leaves plus soft twig. The result is comparable to the work of Bamikole et al (2004) who recorded DM value of 20.3% for *Ficus mucoso* and 17.01%, 22.24%, 22.48% and 25.82% for *Ficus thonnningia, Ficus benamin, Ficus religiosa,* and *Ficus polita,* respectively. However, Lamidi et al. (1977) recorded a higher value of 39.79% DM (as fed) for *Ficus thonningia.* Lower values were observed for other browse plants species by oji and Isilebo (2000) such as *Palisota hirsute* (19.61%), *Terminalia superba* (18.79%), *Milletia griffonian* (17.34%), *Tereculia africana* (17.36%), and *Anthonata macrophylla*.

The leaves from all the plants studied recorded crude protein values ranging from 4.96% in *Ficus mucoso* to 15.64% in *Spondia mombin*, while intermediate crude protein value was observed in the leaves of *Ficus capensis* (11.80%). For the leaves plus soft twig, the highest crude protein was recorded for *Ficus capensis* (7.33%) while intermediate value was observed for *Ficus mucoso* (4.17%) and *Spondia mombin* had the least value (3.32%). The crude protein content of bark of the various plants showed comparable values. Generally, the Crude protein content of the bark was observed to have the least values compared to that of the leaves alone and leaves plus soft twig. This is comparable to the work of Bamikole et al (2004) who recorded crude protein value of 14.75% for *Ficus benjamina* and 13.09% for *Ficus religiosa*. But a higher value was recorded by Onwuka et al., 1989 for *Spondia mombin,* which is (17.84%) compared to the result observed for *Spondia mombin* (15.64%) in this study.

Table 1: Proximate Composition (%) of *Ficus mucoso, Ficus capensis,* and *Spondia mombin.*

Composition	*F. mucoso* Leaf	*F. capensis* Leaf	*S. mombin* Leaf	*F. mucoso* Leaf+ Soft Twig	*F. capensis* Leaf + Soft Twig	*S. mombin* Leaf+ Soft Twig	*F. mucoso* Bark	*F. capensis* Bark	*S. mombin* Bark	SEM
Dry Matter (As Fed)	25.40^{d}	60.45^{a}	40.07^{c}	18.76^{f}	42.23^{b}	17.62^{g}	19.52^{e}	14.10^{h}	19.52^{e}	3.17
Moisture	74.60^{e}	33.55^{h}	59.93^{f}	81.24^{c}	57.77^{g}	82.38^{b}	80.48^{d}	85.90^{a}	80.48^{d}	3.17
Crude Protein	4.96^{cd}	11.83^{b}	15.64^{a}	4.17^{d}	7.33^{c}	3.32^{d}	1.57^{d}	1.31^{d}	1.69^{d}	0.97
Ether Extract	0.31^{d}	1.08^{a}	0.93^{b}	0.31^{d}	0.79^{c}	0.27^{ef}	0.30^{de}	0.22^{f}	0.26^{ef}	0.06
Ash	3.75^{d}	11.40^{a}	7.47^{b}	3.15^{e}	6.23^{c}	1.64^{f}	1.14^{i}	1.34^{h}	1.55^{g}	0.65
Crude Fiber	7.51^{d}	15.95^{a}	15.46^{b}	4.57^{g}	10.51^{c}	4.40^{g}	7.05^{e}	6.00^{f}	7.71^{d}	0.80
NFE	8.87^{d}	26.22^{a}	0.57^{i}	6.56^{g}	17.3^{b}	7.99^{f}	9.46^{c}	5.23^{h}	8.31^{e}	1.39
Nitrogen	0.79^{d}	1.89^{b}	2.50^{a}	0.46^{f}	1.17^{c}	0.53^{e}	0.25^{g}	0.21^{h}	0.27^{g}	0.15

This could be as a result difference in geographical location or different stages of maturity of the plants. The result of the % CP content of the leaves of *Spondia mombin* (15.64%) compared to the leaves plus soft twig (3.32%) shows that the protein was more concentrated in leaves than in soft twig, while bark contain little or no protein. The *Spondia mombin* leaves could be a rich source of protein for ruminants. The percentage ether extract result showed that *Ficus capensis* leaf had the highest value of 1.08%, while *Spondia mombin* leaves had a value of 0.93% and *Ficus capensis* leaves with the least value (0.31%).

For the leaves plus soft twig, it was observed that *Ficus capensis* had the highest ether extract value of 0.79% compared to *Ficus mucoso* and *Spondia mombin* with values of 0.31% and 0.27% respectively. The ether extract values for bark ranged from 0.22% in *Ficus capensis* to 0.30% in *Ficus mucoso* while *Spondia mombin* recorded intermediate value of 0.26%. The ether extract content of the bark had the least values compared to that of the leaves only and that of the leaves plus soft twig. The Ash content observation showed that *Ficus capensis* leaves had the highest value (11.40%) while *Ficus mucoso* recorded the least value (3.75%). The leaves plus soft twig of *Ficus capensis* showed the highest Ash content of 6.22% compared to *Ficus mucoso* leaves and *Spondia mombin* leaves with the values of 3.15% and 1.64%, respectively. The ash content for the bark depicted *Spondia mombin* as having the highest value of 1.55%. *Ficus capensis* with the value of 1.34% and the least value (1.14%) observed for *Ficus mucoso*. The ash content of the bark is lower than that of the leaves alone and leaves plus soft twig. The result observed for the crude fiber content, showed *Ficus capensis* leaves as having the highest value of (15.95%) which is higher than that of *Spondia mombin* leaves with the value of (15.56%) and the least value of (7.51%) for *Ficus mucoso* leaves. The leaves plus soft twig of *Ficus capensis* had the highest crude fiber value of 10.51%, *Ficus mucoso* and *Spondia mombin* had similar values which are 4.57% and 4.40% respectively. This result is comparable to the work of Fadiyimu (2000) who recorded 14.00% and 13.00% for *Gliricidia sepium and P. santaliniodes* respectively for crude fiber content. Oji and Isilebo (2000) recorded crude fiber content of 7.50% and 8.10% for *Anthonata macrophylla* and *Polisota hirsute,* respectively, which is also comparable to the result observed. This result showed that, the various nutrients (crude protein, ether extract, ash, and crude fiber) are more concentrated in leaves of various plants analyzed compare to the bark and leaves plus soft twig.

Fiber Fractions of Different Parts of *Ficus mucoso, Ficus capensis*, and *Spondia mombin*

Table 2 represents the result of the analyzed fiber fractions of different parts of *Ficus mucoso, Ficus capensis,* and *Spondia mombin* leaves. Results observed shows that *Spondia mombin* leaves had the highest neutral detergent fiber (NDF) value of (23.23%), *Ficus capensis* leaves with the value (20.05) and the least NDF value (12.30%) was recorded for *Ficus mucoso* leaves.

Table 2: Fiber Fractions (%) of *Ficus mucoso, Ficus capensis,* and *Spondia mombin.*

Composition	*F. mucoso* Leaf	*F. capensis* Leaf	*S. mombin* Leaf	*F. mucoso* Leaf+ Soft Twig	*F. capensis* Leaf+ Soft Twig	*S. mombin* Leaf+ Soft Twig	*F. mucos* Bark	*F. capensis* Bark	*S. mombin* Bark	SEM
Crude fiber	7.51^{e}	15.95^{a}	15.46^{b}	4.57^{h}	10.51^{c}	4.40^{i}	7.05^{f}	6.00^{g}	7.71^{d}	0.80
Neutral detergent fiber	12.30^{e}	20.05^{c}	23.23^{a}	8.43^{h}	21.06^{b}	9.92^{g}	11.10^{f}	7.49^{i}	12.54^{d}	1.08
Acid detergent fiber	11.52^{e}	19.12^{a}	18.70^{b}	7.95^{h}	18.06^{c}	9.15^{g}	10.44^{f}	7.33^{i}	`12.19^{d}	0.87
Hemicellulose	0.78^{d}	0.93^{c}	4.53^{a}	0.48^{f}	3.00^{b}	0.77^{d}	0.66^{e}	0.16^{h}	0.36^{g}	0.27

The leaves plus soft twig showed that *Ficus capensis* have the highest value of (21.06%) for NDF, *Spondia mombin* with (9.92%) and *Ficus mucoso* with the least value of (8.43%). The bark shows *Spondia mombin* with the highest NDF value of (12.54%), the value NDF was 7.49% for *Ficus capensis* bark and intermediate value of 11.10% for *Ficus mucoso* bark.

Acid detergent fiber (ADF) level ranged from 11.52% in *Ficus mucoso* leaves to 19.12% in *Ficus capensis* leaves. The leaves plus soft wig analysis showed that *Ficus capensis* with the ADF value of (18.06%) had highest value compared to *Spondia mombin* and *Ficus mucoso* with values (9.15%) and (7.95%), respectively. The ADF content of the bark revealed that *Spondia mombin* have highest value of (12.19%) followed by *Ficus mucoso* having (10.44%) and *Ficus capensis* was having the least value of (7.33%).

Hemicellulose content observed in the leaf alone was different ($p<0.05$) in *Ficus capensis* (0.93%) and *Ficus mocoso* (0.78%) respectively. The values varied from 0.78% in *Ficus mucoso* to 4.53% in *Spondia mombin*. The highest recorded Hemicellulose value for leaves plus soft twigs was 3.00% in *Ficus capensis, Ficus mucoso* was least (0.48%) while *Spondia mombin* recorded intermediate value (0.77%). The Hemicellulose fraction value of the bark ranged from 0.16% to 0.66% in *Ficus capensis* and *Ficus mucoso* respectively. Interestingly, the generally low cell wall components values obtained were considered adequate for efficient rumen functions.

Rumen function is associated with rumination to maintain adequate salivation and optimal pH for cellulolytic microorganisms that typically yield higher acetate to propionate ratios in the rumen liquor. Dietary fiber through microbial degradation and synthesis supplies energy to support maintenance, growth, lactation, and reproduction (Lu et al., 2005).

Mineral Concentrations of Different Parts of *Ficus mucoso, Ficus capensis,* and *Spondia mombin*

Table 3 shows the percentage of macro and micro mineral concentrations of the different part of the various plants investigated. The highest value of calcium (Ca %) was observed in *Ficus capensis* leaves (0.689%), while *Ficus mucoso* leaves had the least value (0.386%). Intermediate value was observed for *Spondia mombin* (0.456%). *Ficus mucoso* had the highest value of Ca (0.377%) for leaves plus soft twig, *Spondia mombin* (0.369%) and *Ficus capensis* with the least value of (0.265%). For the bark, *Ficus capensis* had the least value of Ca (0.321%), *Ficus mucoso* with the value of (0.449%) and *Spondia mombin* with the value of 0.473% had comparable result.

For the magnesium content, the leaves of *Ficus capensis* (0.058%) and *Ficus mucoso* (0.051%) had similar values and the least value (0.010%) was recorded for *Spondia mombin.* The leaves plus soft twig of *Ficus mucoso* (0.049%), *Spondia mombin* (0.029%) and *Ficus capensis* (0.029%) had the same value of magnesium content respectively. For the magnesium content of the bark, the highest value was observed for *F. mucoso* with (0.141%) and *F. capensis* (0.136%). *Spondia mombin* was observed to have the least value of 0.058%. The bark of the various plants had the highest values of Mg compared to leaves alone and leaves plus soft twig.

Table 3: Mineral Composition of *Ficus mucoso, Ficus capensis,* and *Spondia mombin.*

Composition	*F. mucoso* Leaf	*F. capensis* Leaf	*S. mombin* Leaf	*F. mucoso* Leaf+ Soft Twig	*F. capensis* Leaf+ Soft Twig	*S. mombin* Leaf+ Soft Twig	*F. mucoso* Bark	*F. capensis* Bark	*S. mombin* Bark	SEM
% Dry matter (as fed)	25.40^{d}	66.45^{a}	40.07^{c}	18.76^{f}	42.23^{b}	17.62^{g}	19.52^{e}	14.10^{h}	19.52e	3.17
% Moisture	74.60^{e}	33.55^{h}	59.93f	81.24^{c}	57.77^{g}	82.38^{b}	80.48^{d}	85.90^{a}	80.48^{d}	3.17
MAJOR ELEMENTS (%)										
Calcium	0.386^{c}	0.698^{a}	0.465b	0.377^{c}	0.265^{e}	0.369^{cd}	0.449^{b}	0.324^{d}	0.0473^{f}	0.32
Magnesium	0.051^{bc}	0.058^{b}	0.010d	0.049^{bc}	0.029^{cd}	0.029^{cd}	0.141^{a}	0.136^{a}	0.058^{b}	0.01
Phosphorus	0.034^{a}	0.014^{cd}	0.021bc	0.036^{a}	0.011^{d}	0.026^{b}	0.019^{bc}	0.016^{cd}	0.035^{a}	0.01
Sodium	0.494^{a}	0,321^{c}	0.262d	0.485^{a}	0.162^{e}	0.354^{c}	0.428^{b}	0.175^{e}	0.420^{b}	0.02
Potassium	0.428^{ab}	0.309^{de}	0.254e	0.477^{a}	0.147^{f}	0.344^{cd}	0.344^{cd}	0.167^{f}	0.408^{bc}	0.02
MINOR ELEMENTS (PPM)										
Zinc	50.73^{d}	50.73^{d}	52.04d	37.66^{f}	82.12^{a}	45.50^{e}	63.29^{b}	64.60^{b}	58.58^{c}	2.40
Manganese	1.820^{h}	1.787^{h}	11.691b	8.768^{c}	5.196^{f}	5.891^{e}	7.794^{d}	12.665^{a}	2.223^{g}	0.76
Iron	0.481^{d}	0.401^{de}	0.320e	0.881^{c}	0.401^{de}	0.160^{f}	1.282^{a}	1.121^{b}	0.801^{c}	0.72
Copper	6.557^{d}	0.592^{g}	1.434f	1.434^{f}	6.596^{d}	14.914^{a}	7.242^{b}	6.883^{c}	2.510^{e}	0.83

For the percentage phosphorus content, the result was observed to be the highest (0.034%) for *Ficus mucoso* leaves. Similar values of 0.021% for *Spondia mombin* and 0.014% for *Ficus capensis* was recorded. This shows that *Ficus capensis* leaves, through a rich source of Ca and Mg is the poorest in Phosphorus compared to others, *F. mucoso* however is a good source of P. For the leaves plus soft twig, it was observed from the result that *Ficus mucoso* have the highest value of P (0.036%), while the least value (0.011%) for *Ficus capensis*. Intermediate value (0.026%) for *Spondia mombin*. For the bark, *Spondia mombin* was observed to have the highest value of P (0.035%) compared to *Ficus mucoso* and *Ficus capensis* with values of (0.019%) and (0.016%), respectively. The leaves plus soft twig were observed to have the highest values compared to the leaves alone and bark with the exception of *Ficus capensis.*

The percentage sodium (%Na) content showed that *Ficus mucoso* had the highest value of Na (0.494%) for leaves alone, while *Spondia mombin* had the least value (0.0262%), intermediate value was observed *Ficus capensis* (0.321%). It was observed that *Ficus mucoso* have the highest value of Na (0.485%) for leaves plus soft twig, next to *Spondia mombin* with the value of 0.354% and the least value of 0.162% for *Ficus capensis. Ficus mucoso* also had the highest value of Na (0.428%) for the bark compared to *Spondia mombin* and *Ficus capensis* with the work of Oji and Isilebo, (2000) who reported 0.25% for *Palisota hirsute.* This indicates that *Ficus mucoso* is also rich in Na.

The percentage Potassium (%K) content shows that *Ficus mucoso* had the highest value of 0.428% for leaves, while *Spondia mombin* leaves had the least value of 0.245%, intermediate value was observed for *Ficus capensis* leaves (0.309%). From the result, it was also observed that *Ficus mucoso* have the highest value of K (0.477%) for leaves plus soft twig, next is *Spondia mombin* with the value of 0.344% and the least value of 0.147% for *Ficus capensis. Ficus mucoso* also the highest value of K (0.411%) in the bark compared to the values of (0.408%) and (0.167%) for *Spondia mombin* and *Ficus capensis,* respectively. *Ficus mucoso* is a rich source of K.

Also, the result of the minor mineral elements of the various browse plants showed that *Ficus mucoso* (50.75ppm), *Ficus capensis* (50.73ppm), and *Spondia mombin* (52.04ppm) leaves contained comparable Zn content. From the result, it was observed that *Ficus capensis* had the highest value of (82.12 ppm) for leaves plus soft twig next is *Spondia mombin* (45.50ppm) and the least value of (37.66 ppm) for *Ficus mucoso. Ficus capensis* also have the highest value of (64.69 ppm) for the bark, similar to *Ficus mucoso* (63.29%) and least value for *Spondia mombin* (58.58%).

The Manganese content on the table shows that *Spondia mombin* leaves had the highest value of (11.691 ppm) and *Ficus mucoso* had a Mn value of (1.820 ppm), while similar value was observed for *Ficus capensis* leaves (1.787 ppm). The leaves plus soft twig analysis showed that *Ficus mucoso* had the highest Mn value of (8.768 ppm), while least value was observed for *Ficus capensis* (5.196 ppm), intermediate Mn value of (5.891 ppm) was recorded for *Spondia mombin.* The bark of *Ficus capensis* plant was observed to contain the highest Mn value of (12.665 ppm) compared to *Ficus mucoso* and *Spondia mombin* with the values of (7.794 ppm) and (2.223 ppm) respectively.

The Iron (Fe) content of leaves shows that *Ficus mucoso* had the highest value (0.481 ppm), and *Ficus capensis* had the value of (0.40 ppm) and the least value of (0.320 ppm) was recorded for *Spondia mombin* leaves*,* this indicates that *Ficus mucoso* is a rich source of Fe compared to other plants analysed. The leaves plus soft twig result revealed that *Ficus mucoso* had the highest value of Fe (0.881 ppm) and *Spondia mombin* had the least value of (0.160 ppm). The bark of *Ficus mucoso plant* had the highest value of Fe (1.282 ppm) and *Spondian mombin* with the values of (0.801 ppm) and *F. capensis* (1.121 ppm). From result, it was observed that the bark have the highest values of Fe compared to the leaves alone and leaves plus soft twig.

The copper (Cu) content result showed that *Ficus mucoso* had the highest value (6.557 ppm) and *Spondia mombin* have the value of (1.434 ppm) and the least value of (0.594 ppm) was recorded for *Ficus capensis. Ficus mucoso* is a good source of Cu for ruminants. The leaves plus soft twig result showed that *Spondia mombin* had the highest value of Cu (14.914 ppm). The analysis of the bark of the plant shows that *Ficus mucoso* contained (7.424 ppm) of Cu, *Ficus capensis* (6.883 ppm) and the least value of (2.510 ppm) was recorded for *Spondia mombin.* From the result, it was observed that leaves plus soft twig have the highest values of Cu compared to leaves alone and the bark.

The result obtained for Calcium (Ca) value was adequate and compare favourably with other Nigerian results (Onwuka, 1983; Agishi, 1985; Ifut, 1987; Fadiyimu, 2000). Mg and P contents were low (0.010%-0.058% and 0.011%-0.036% respectively) in different parts of browse species evaluated, which suggest that browsing ruminant animals may require Mg and P minerals. The requirements of goats indicate that 0.21-0.52% Ca and 0.16-0.37% P are adequate (NRC, 1981). McDowell (1985) stated that adequate Ca and P nutrition depends not only on sufficient total dietary supplies, but also on the chemical forms in which they occur in the diet and on the vitamin D status of the diet fed to the animal. The range values of Na and K were 0.16%-0.49% and 0.14%-0.47%, respectively). Except for *Ficus mucoso*, the level of Na and K observed were deficient in all the different parts of browse plants evaluated based on the dietary values of 0.5% recommended for goats (NRC, 1981).

The range was 50.73-64.60 ppm for Zn. Most legumes contained less than the 350 ppm recommended for goats (NRC, 1981). The level of 45 ppm of Zn recommended for goats (Mba, 1981) was found in all of the samples. The range of 1.29 to 11.69 observed in all the different parts of browse plants studied are below the 90 ppm the recommended (NRC, 1981). Based on the 10 ppm recommended for goats (Mba, 1981), the Cu levels in all different parts of browse species in this work were below the recommended value.

CONCLUSION

This study showed that *F. capensis* and *S. mombin* leaves are good sources of protein, ash and fiber while *F. mucoso* is rich in mineral elements such as sodium and potassium and needed to be supplemented for other macro and micro elements for effective use as alternative feed resources to meet the nutrient requirements of small ruminant animals.

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SUGGESTED CITATION

Isah, O.A., L.E. Omorogiuwa, and A. Okunade. 2013. "Chemical Evaluation of Some Browse Plants Eaten by Local Breeds of Goats in Edo State, Nigieria". *Pacific Journal of Science and Technology*. 14(1):406-412.

Pacific Journal of Science and Technology