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Comparative Studies of selected browses of South-Southern part of Nigeria with particular reference to their proximate and some anti-nutritional constituents in different locations

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Abstract

The study was carried out to determine the influence of locations on the proximate chemical composition and some anti- nutritional components of some samples of browse plant leaves. Five samples each of the leaves of commonly utilized browse plants were sourced from each study location, these were; *Gmelina arborea*, *Daniella oliveri, Sarcophalus, latifolia, Vitex doniana and Ficus thoningii.* These were harvested from Obubra in Cross River State and Idoro in Akwa Ibom State, Nigeria and used for the study. Generally, few variability was recorded in both locations with values of percentages crude protein (CP) (17.50 to 26.25), crude fibre (26.15 to 45.30), Ash (5.15 to 14.90), ether extract (1.99 to 13.60), nitrogen free extract (7.20 to 41.51) and moisture content (26.29-73.20) which appeared to be relatively higher in samples from Akwa Ibom. The concentration of anti-nutritional factors were generally also low in both location. Phytate 0.21 to 4.03, oxalate 0.35 to 13.30, saponins 0.002 to 3.60, tannin content ranged from 0.35 to 5.10 and alkaloids 0.001 to 2.38. The results showed that the browse plants studied have good levels of nutrients, low and safe levels of anti-nutritional factors. Based on these results, it is therefore recommended that, the browse plants may be actively used in the feeding of livestock in the two locations where it is even seem to be luxuriant and available during the dry season.

Keywords: Chemical Nutrients; Ever Green Forages; Leaf Meal; Toxic Constituents

1. Introduction

Some potential vegetables for human and animal use are not preferred due to bitter or sour taste, unpleasant odour or lack of knowledge about the nutritional and medicinal properties. Understanding the proximate and phytochemical composition potentials of some of these vegetables may encourage their utilization for animal feeding, nutraceutical and pharmaceutical purposes. These vegetables are available and will be cheap sources of alternative feed to improve the scope of animal production which may as well increase the amount of animal protein intake by Nigerians which is quite important because of it's contribution to human health.

This search for alternative feed resources has over the past few decades rekindled research interest in the use of tropical browse plants as sources of nutrients for ruminants as well as non-ruminants due to its availability (Mecha and Adegbola 1980; D'Mello 1992). Browses constitute an abundant biomass in farmlands, bush fallows and forests in the humid tropical environment of south southern Nigeria. They are commonly utilized in the wild by small-holder livestock farmers for feeding small ruminants (Aletor and Omodera 1994).

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The potential of leaf meals from these tropical trees and shrubs to yield relatively higher levels of crude protein and minerals and lower crude fibre levels than tropical grasses has also been recognized (Okoli et al., 2002). Many of these browse plants are in the wild, used as medicinal plants and feeding of ruminants in villages without having information on the content that sustained the animals so the need to scientifically evaluate their nutritive importance as well as the phytochemical constituents of some of them so as to add to the range of the already known browses that are used in feeding ruminants and non-ruminants.

The feeding of browse forages to animals especially in the dry season is too essential because grasses and herbaceous legume forages are scarce at that time, so it is becoming too necessary that more effort should be intensified for a search for more. The nutrient composition as well as some of the anti-nutritional constituents of *Gmalina arborea, Daniella oliveri, Sarcophalus, latifolia, Vitex doniana and Ficus thoningii* should be evaluated in different locations to see its level so that it could be conveniently used in feeding livestock. This is because some of the leaves of these plants eaten by human are abundantly available and remain green all year round. They seem to be even luxuriant at the peak of the dry season. Adegbola and Oduozo (1992) and Alawa and Amandi (1991) opined that some of the limiting factors associated with using browse plants as animal feeds include procurement, storage, high fibre content , toxic substances, poor feed intake, poor digestibility and consequent low performance of the animals. However, there is need to investigate the nutritional composition of these browse plants because of their availability as alternative feed resources to livestock. Wahua and Oji (1987), and Oji and Isilebo (2000) among others, have characterized the nutrient composition of some indigenous browse plants of the South Eastern part of Nigeria. Their studies showed that crude protein and crude fibre contents of such plants range from 15.3% to 33.3% and 2.7% to 44.40%, respectively. However, tropical browses have been shown to contain varying quantities of condensed tannin and other anti-nutritional substances in their biomass that affect their optional utilization by animals (Okoli et al., 2001).

Scanty information are available on the nutrient composition of some of these forages. Tegbe et al., (2004) reported in their study that, the proximate composition (g/100g) of dried Ficus leaf meal have dry matter ((40.61%), crude protein (18.51%), crude fibre (19.41%), ether extract (5.57%) and ash (10.87%). The values which were similar to the data reported by Bamikole et al. (2001) and they indicated that the mean crude protein content of Ficus species were consistent with the report of Oji and Isilebo (2000) on the crude protein of browse plants in tropical West Africa. The authors also were of the view that the level of CP in Ficus is higher than the critical level of 7g/100 g Dm at which feed intake of the animal is depressed. Bamikole et al. (2001) reported that Ficus species have good levels of nutrients particularly protein for livestock feeding and that the level of anti-nutritional factors is low and a good acceptability level is guaranteered in Ficus. Abejishi et al. (2018) in their preliminary study on some tropical wild forages on the feeding of rabbits reported the proximate composition of the forages to be in the range of crude protein of 8.75 to 18% which were within the range of 5.00 to 35.00% reported by Cheeke (1971) for tropical forages and also within the range reported by Shane (2012) of 7.00 to 28% for most forages. The CF range of 7.32 to 22.08 was a bit lower than the value 9.00 to 30.0% obtained by Cheeke (1971) and the values of 9.0 to 37%.that reported by Shane (2012). The EE range of 2.00 to 6.41% of the forages were also within the range of 1.5 to 12.00% reported by (Shane 2012). Gboshe and Ukorebi (2020) studied similar browse plants in Obubra of Cross River State and reported that the browse plants has a good array of nutrients, low in anti-nutritional factors though vary in nutrient contents. That these differences observed could be attributed to variations in locations and varieties of the forages.

It was therefore, the aim of this present study to evaluate the proximate composition as well as some anti-nutritional constituents of the leaves of these five browses species. *Gmalina arborea* (DA), *Daniella Oliveri* (DO) *Sarcocephalus latifolia* (SL) *Vitex doniana* (VD) and *Ficus thoningii* (FT) from two locations in the south southern zone, Cross River and Akwa Ibom State. The leaves of which are available all year round and even luxuriant at the peak of dry season, with the aim of determining if they can be conveniently added to the range of forages that can be fed to livestock.

2. Materials and Methods

2.1. Sources of the browse plants

The Fresh leaves from the apical portions of the branches of the five selected browse plants, *Gmalina arborea* (GA), *Daniella oliveri* (DO), *Sarcocephalus latifolia* ,(SL), *Vitex doniana* (VD) and *Ficus thoningii* (FT) were harvested from the surrounding bushes of Obubra community and Idoro community in Akwa Ibom state. They were identified at the Department of Forestry of the University of Cross River State and University of Uyo.

2.2. Chemical analysis

Fresh foliage of the selected browse plants were sun-dried for 3 days, cut into pieces (2 to 5 cm), oven-dried at 60 to 70^{o}C for 24 hours and milled thoroughly with a laboratory milling machine and screened for subsequent analysis. Proximate composition was determined for percentages of moisture content (MC), dry matter (DM), crude protein (CP), crude fibre (CF), ether extract (EE), ash and nitrogen free extract (NFE) according to the methods of A OAC (2010).

2.3. Nutritional/Chemical Analysis

All analyses were carried out using the methods outlined by the Association of Official Analytical Chemists AOAC (2010).

2.4. Proximate Analysis

The analyses entails the determination of moisture to get dry matter (DM), crude protein (CP), ether extracts (EE), crude fibre (CF), ash and Nitrogen free extract (NFE).

2.4.1. Dry matter and moisture determination

The weight of the empty dish was recorded. Five grammes of sample of leaf which have been grinded to a meal was placed in the dish and the weight of both dish and leaf meal determined and recorded. The dish containing the sample was placed in an oven until a constant weight was obtained at 100^{0}C. The dish and content was placed in a desiccator to cool. The percentage moisture and dry matter were determined as follows:

$$\% \text{ moisture} = \frac{W2-W3}{W2-W1} \text{x } 100$$

Where:

W_1 = Initial weight of empty dish
W_2 = Weight of dish plus sample before drying
W_3 = Final weight of dish plus sample after drying
% Percentage dry matter (DM) = 100 - % moisture content

2.4.2. Crude protein determination

The crude protein contents of the samples were determined using the Kjeldahl procedure. Two grammes each of the samples were placed in a digestion tube and two Kjeldahl tablets were added. Two mililitres of concentrated sulphuric acid (H_2SO_4) was added and digested at 420^{0}C for 3 hours. After cooling, 80ml of distilled water was added, subsequently 50ml of the solution was taken and equal quantity of 40% caustic soda (NaOH) added and placed on the heating section of the distillation chamber. Thirty millilitres of 4% boric acid plus bromo cresol green and methyl red indicators were poured into a conical flask and placed underneath the distillation chamber for the collection of ammonia. The solution in the conical flask was observed until it changed from orange to green. About 0.1ml of normal H_{Cl} was poured into a burette. The content of the conical flask was then titrated until the colour changed from green to pink. The burette reading was taken. A similar content of flask without distillate was also titrated and the reading taken. The percentage crude protein was computed using the relationship:

$$\% \text{ CP} = \frac{(\text{A} - \text{B})\text{x N x F x } 6.25}{\text{Weight of sample}}$$

Where:

A = volume of acid for the titration
B = volume of acid for titrating blank sample
N = normality of acid used for titration
F = factor 14.007

Note: Molarity and Normality concentrations are interchangeable.

Normality = valence x molarity

Molarity = normality/valence

2.4.3. Crude Fibre determination

Two grammes of the leaf meal was defatted with petroleum ether. The sample was boiled under reflex for 30minutes in 200ml of a solution containing 1.25g of H_2SO_4 per 100ml. The solution was filtered. The residue was then transferred into 200ml of a solution containing 1.25g of carbon free NaOH per 100ml in a beaker and boiled for 30 minutes. The final residue was filtered, dried in an electric oven, weighed and incinerated. The incinerated sample was cool and the weight recorded. The loss in weight after incineration multiplied by 100 is the percentage crude fibre. Thus:

$$\% \text{ CF} = \frac{\text{Difference in Weight}}{\text{Weight of sample}} \text{ x } 100$$

2.4.4. Ether extract determination

The ether extract was determined using the Soxhlet apparatus. Two grammes of each sample was weighed into a thimble and mixed with 200ml petroleum ether in a conical flask. The solution was heated at 45^0C for 2 hours. The flask was removed, reweighed and percentage fat determined using the relationship:

$$\% \text{ Fat} = \frac{\text{Weight of fat}}{\text{Weight of sample}} \text{ x } 100$$

2.4.5. Ash determination

The ash content of the leaf meal was determined by weighing 5g of finely ground dry sample. The sample was charred on a Bunsen flame inside a fume cupboard, to drive off the smoke. The sample was transferred into a pre-heated muffle furnace at 550^0C until a white or light gray ash was obtained. Percentage ash was determined using the relationship:

$$\% \text{ Ash (dry basis)} = \frac{\text{Weight of ash}}{\text{Weight of original sample}} \text{x } 100$$

2.4.6. Determination of nitrogen free extract

Nitrogen free extract (NFE) was determined indirectly by computing the differences as follows: NFE = 100 – (CP + CF + EE + ASH)

2.5. Determination of anti-nutritional factors of the browse plants:

2.5.1. Phytate determination

Phytate was determined according to the method of Maga (1982) and by titration method described by Wheeler and Ferri (1971). The phytate was extracted from the ground meal using 0.2N HCl. Subsequently, 0.5ml of the extract was measured using a pipette and placed inside a test tube fitted with ground glass stopper. One mililitre of solution was added, covered with the stopper and firmly fixed with a clip. The tube was heated in boiling water bath for 30 minutes and then placed in a container of ice to cool. The content of the tube was centrifuged for 30 minutes at 3000rpm and 1ml of the extract transferred to another test tube and also 1.5ml solution of Bi-pyridine solution of phytate was estimated.

2.5.2. Saponin determination

Saponin was determined gravimetrically by the method of Oduguwa et al. (1998).

2.5.3. Oxalate determination

Oxalate was determined using the titration technique described by Chima and Igyor (2007). Two grammes of ground seed meal sample was suspended in 190ml of distilled water in a 250ml volumetric flask. Ten millilitres of 6 M HCl was added and the suspension digested at 100^0C for one hour. Subsequently, it was filtered and 125ml of the filtrate measured into a beaker and, four drops of methyl red indicator added. This was then followed by addition of concentrated NH_4OH solution until the test solution changed from pink to faint yellow colour. Each portion was heated at 90^0C, cooled and filtered to remove precipitate containing ferrous ion. The filtrate was again heated to 90^0C and 10ml of 5% $CaCl_2$ solution added with constant stirring. The solution was cool and allowed to stay overnight at 5^0C. The solution was then centrifuged at 2500rpm for 5 minutes, supernatant decanted and the precipitate completely dissolved in 10ml of 20% H_2SO_4 solution. The total filtrate from the digestion of the two grammes flour was made up to 300ml. Aliquots of 125ml of the filtrate was heated to near boiling point (97^0C), cooled and titrated against 0.05M standard

KMnO4 solution until a faint pink colour persists for 30 seconds. The oxalate content was calculated using the relationship:

$$Oxalate\ content\ (\%) = \frac{T\ x\ (Vme)(DF)x10^5}{(ME)x\ MF}$$

where:

T = Titre of KMn04 (ml) Vme = Volume – mass equivalent (i.e 1cm^3 of 0.05m KMn04 solution is equivalent to 0.00225g anhydrous oxalic acid).
DF = dilution factor (2.4).
A = Aliquot use (125ml)
ME = Molar equivalent of KMn04 in oxalate.
MF = Mass of flour used.

2.5.4. Tannins determination

The Folin-Denis Spectrophotometric method by Bohm and Kocipai (1994) was used to determine tannin content. One gramme of sample was dispersed in to 10ml distilled water in a test tube and agitated. The solution was allowed to stand for 30 minutes at room temperature and was thereafter shaken every 5 minutes for 30 minutes. The solution was then centrifuged at 112 g-force and 2.5 ml of the extract dispersed into a 50 ml, volumetric flask containing 2.5 ml standard tannic acid solution. One mililitre of Folin-Denis reagent was then added, followed by 2.5ml of saturated Na_2CO_3 Solution. The whole mixture was diluted to the 50ml mark of the flask incubated for 90 minutes at room temperature. The absorbance was then measured at 250nm in a genway Model 6000 electronic spectrophotometer. Blank reading was also taken and tannin content calculated as follows:

% Tannin = An/As x C x 100/W x 5

Where:

An = absorbance of test sample
As = absorbance of standard solution
C = concentration of standard solution
W = weight of sample used.

2.5.5. Alkaloids determination

Alkaloid was determined using the gravimetric method of Harbone (1973).

Five grammes of the sample were dispersed into 50ml of 10% acetic acid solution in ethanol. The mixture was shaken and allowed to stand for 4 hours and filtered. The filtrate was evaporated to one-quarter of its original volume. A drop of 1% ammonium hydroxide (NH_4OH) was added to the filtrate. A filter paper of known weight was used and, the alkali applied to it to wash off the precipitate. The precipitate left in the filter paper was dried in an oven at 60^{0}C for 30 minutes and weighed. By difference, the weight of alkaloid was determined as follows:

$$\%\ Alkaloids = \frac{W2-W1}{W}\ x\ 100$$

where:

W = Initial weight of sample
W_1 = Weight of empty filter paper
W_2 = Weight of filter paper + precipitate

3. Results

3.1. The proximate composition of the browse plants

The proximate composition of the wild forages used in these study in the two locations is presented in Table 1 and 2. The proximate composition of the wild forages in the two locations studied had some comparative values with some

few variations. The proximate composition from the two locations indicates that the leaves from Idoro in Akwa Ibom contained slightly higher moisture content (Table 2). The crude fibre and ether extract content of the leaves were marginally higher than those obtained from obubra (Table 2), while the crude protein and ash were higher in obubra. The result also indicates that the two locations contained appreciable amount of carbohydrates suggesting that they can be ranked as carbohydrate.

3.2. Anti-nutritional factors of experimental browses used for the study

The anti-nutritional factors of experimental browse plant leaves from the two locations are shown in Table 3. The phytochemical analysis indicated that the leaves are rich in phytonutrients (Table 3). Saponins, oxalate and alkaloids. The anti-nutrient contents (phytate and tannin) were observed to be significantly low in both locations as shown in Table 3.

4. Discussion

Results of proximate analysis are extensively employed in research and industry for quick estimation of nutrient potentials of feedstuffs. Although such results may not give a true indication of the nutritive value of a feed due to some factors, they however, supply clues in research, to plan for potential value for further in vitro or in vivo studies Mecha and Adegbola (1980) and (Okoli et al., 2003; D'Mello 1992). Proximate analysis is specifically useful in screening the potentials of the array of tropical browse plants utilized by indigenous farmers for ruminant feeding. It also gives out values that should be used while formulating rations with them.

The proximate composition of the wild forages used in the two locations studied as shown in Table 1 and 2, had some comparative values with some few variations which may be attributed to the different soil types and may be, the different annual rain fall intensity in the locations. This findings agreed with Sar et al. (2014) who stressed that location and year of growth (environmental variance) were factors affecting the concentrations of each nutrient in the proximate composition of cereal grains. Skogerson et al. (2010) affirms that a greater percentage of the differences among cultivars of millets specifically, were due to an interaction of cultivar with the environment. The proximate composition indicated that the moisture content was relatively higher in those browse plants harvested from Akwa Ibom state. High amount of moisture in crops makes them vulnerable to microbial attack, hence, spoilage (Desai and Salunkle 1991). The moisture content of any food is an index of its water activity (Frazier and Westeff 1978) and is used as a measure of stability and susceptibility to microbial contamination (Davey 1989). These slightly high moisture contents also mean that dehydration would increase the relative concentration of other food nutrient and therefore improve the shelf-life or preservation of the leaves. There is also need to store the leaves in cool condition if they would be kept for a long period without spoilage especially in the tropics where wastage of feedstuffs is estimated to be around 50% due to high moisture content (Thompson 1996). The high moisture is also pointing out that, the leaves should be wilted before feeding to ruminant so as to avoid bloat which is cause by excessive consumption of succulent leaves that generate gas accumulation in the rumen which cause a condition known as bloat.

However, It was generally observed that, other nutrients were comparable to the nutrients values of the forages, especially CP and CF which were within the ranges of 15-30% CP and 20 -45% CF (Aduku 2012). This however, were against the CP and CF values of 12-22% and 16-26% respectively obtained by Ugwuene (2003) and 12-16% CP and 15-25% CF obtained by Shiawoya and Adams (2004) for tropical forages and is also within the range of 7.00 to 28% reported by Bohn Kocipai (1994) for most forages. The CF range of 26.15-44.40 was higher than 7.32 to 22.08 (Abejeshi et al., 2018) and within the range except the upper value of 9.00 to 3.0.0% obtained by Cheeke (1971) and that reported by Shane (2012) of 9.0 to 37%. Aduku and Olukosi (1990) observed that the range of fibre required in rabbit diets reflects a high requirement for forage in the diet for optimum growth.

The EE range of 2.00 to 6.41% present in the experimental forages was also within range of 1.5 to 12.00% reported by (Abejeshi et al., 2018) and (Shane (2012)). The few differences observed could be attributed to variations in location and varieties of forages (Ogieva 1988). The results of proximate composition of the leaves of the browse plants study in Obubra, Cross River State and Idoro, Akwa Ibom State is presented in Table 1 and 2 respectively.

Table 1 Proximate composition (g/100g) of the five browse plants from Obubra

Browse plants	MC	DM	CP	CF	ASH	EE	NFE
Gmelina arboea *Daniella Oliveri*	26.29 58.20	73.71 41.80	23.00 21.90	17.15 26.20	5.39 7.45	13.60 4.35	34.48 40.20
Sarcocephalus Latifolia	67.40	32.60	19.50	35.60	5.65	2.20	27.10
Vitex doniana	59.10	40.90	17.50	36.70	5.15	2,55	38.10
Ficus thoningii	72.10	27.90	26.30	44.40	13.9	5.20	10.30

MC= moisture content, DM= dry matter, CP= crude protein, CF= crude fibre, EE= ether extract and NFE= nitrogen free extract

Table 2 Proximate composition (g/100g) of the five browse plants from Idoro

Browse plants	MC	DM	CP	CF	ASH	EE	NFE
Gmelina arboea *Daniella Oliveri*	50.30 60.20	41.71 39.80	22.00 20.90	17.15 25.90	5.39 7.46	13.60 5.35	41.51 40.39
Sarcocephalus Latifolia	68.30	31.70	21.00	36.10	5.80	1.99	35.11
Vitex doniana	61.50	38.50	16.90	35.70	5.25	1,82	40.33
Ficus thoningii	73.20	6.80	26.50	45.30	14.90	6.10	7.20

MC= moisture content, DM= dry matter, CP= crude protein, CF= crude fibre, EE= ether extract and NFE= nitrogen free extract; Values obtained were of triplicate values

4.1. Anti-nutritional factors of experimental browses used for the study in both locations

The anti-nutritional factors of experimental browse plant leaves used for the study in the two location is shown in Table 3. The percentage components of anti-nutritional factors in this present study were low and comparable with the reports of George (2003) and Ologhobo (1989). Among the anti-nutritional factors, the tannin content of 1.24, 1.22, 2.34, 5.1 and 0.34 obtained in *Gmelina arborea*, *Ficcus thoningii, Vitex doniana, Daniela oliveri, and Sarcocephalus latifolia* from Obubra and 1.25, 2.28, 1.23, 0,35 and 2.33 of Idoro respectively were comparable to values (0.13 to 6.31%) reported previously by (Okoli 2003). A threshold concentration of 5% tannin had been reported above which there is rejection of browse plants by goats (Ologhobo1989).

Table 3 Anti-nutritional factors of experimental browse plant leaves from the two locations

Anti-nutrient (mm/100g	Obubra GA	FT	VD	DO	SI	Idoro GA	FT	VD	DO	SI
Phytate	2.22 ±0.1	4.02 ±0.02	0.18 ±0.1	--	0.42 ±0.1	2.22 ±0.1	4.03 ±0.1	0.21 ±0.1	0.18 ±0.1	0.34 ±0.1
Oxalate	12.10 ±0.1	12.3 ±0.1	0.39 ±0.2	--	--	12.2 ±0.1	13.02 ±0.1	0.35 ±0.1	0.36 ±0.1	--
Saponins	1.89 ±0.1	3.60 ±0.15	--	0.02 ±0.1	1.25 ±0.1	1.88 ±0.1	2.99 ±0.1	--	--	1.30 ±0.1
Tannin	1.25 ±0.1	1.22 ±0.13	2.33 ±0.1	5.10 ±0.1	0.34 ±0.1	1.24 ±0.1	1.22 ±0.1	2.28 ±0.1	2.20 ±0.1	0.32 ±0.1
Alkaloid	--	--	0.89 ±0.1	0.001 ±0.1	2.38 ±0.1	0.00 ±0.1	--	0.80 ±0.1	0.84 ±0.1	2.25 ±0.1

Ga= gmalina arborea, Ft= Ficcus thoningii, Vd = Vitex doniana, Do = Daniela oliveri, Sl = Sarcocephalus latifolia, (--) = not present; Values were of triplicate values

The phytin levels reported in this study ranged from 0.42 to 4.03 mm/100g, from both locations is lower than the 13.80 to 25.20 mm/100 g reported by Fadiyimu et al. (2011) for the south-eastern browses in Nigeria. These levels are unlikely to have any adverse effects on animals. The oxalate content of the browse species was not consistent with the reported values (1.49 to 5.79%) of some browse plants relished by ruminants in Nigeria (Acamovic et al., 2004). Oxalate content in this present study was low. It has been reported that 20 g/kg oxalate can be lethal to chicken (Teferedegne 2000). The saponin content of 0.002-2.55 mm/100 g was also low as in other leguminous browse species. Report from (Oduguwa et al., 1998) shows values of 3.24% and 3.47% for *Parkia biglobosa* and *Afzelia Africana* respectively. Feedstuffs containing saponin had been shown to be defaunating agents (Teferedegne 2000). Cheeke (1971) reported that saponin has effect on erythrocyte haemolysis, reduction of blood and liver cholesterol, depression of growth rate, bloat (ruminant) inhibition of smooth muscle activity, enzyme inhibition and reduction in nutrient absorption. Saponins have been reported to alter cell wall permeability and therefore, to produce some toxic effect when ingested (Belmar et al., 1999). The anti-nutritional effects of saponins have been mainly studied using alfalfa saponins. Sharma and Chandra (2001) observed that 4-7 weeks of ad libitum feeding of albizia gave rise to toxic manifestation in sheep. Symptoms included, listlessness, anorexia, weight loss and gastro-enteritis. The toxicity of saponins can be reduced by repeatedly soaking the feed in water, though the level recorded in this present study may not pose any problem to the animals.

5. Conclusion

The proximate composition of the forages had good nutrient profiles which is perceived can support the maximum performance of livestock.

The anti-nutritional factors were also observed to be low which implies that, it may not interfere with nutrient absorption and utilization by livestock.

The study portrayed that all the forages apart from supporting livestock growth, it may also not pose any health hazards of any nature since human being used some as vegetables in soup preparation and others used it as medicinal leaves in orthodox medicine.

Based on these findings, since it was observed that, these forages apart from supporting growth, it may also be medicinal. It is therefore, recommended that, the forages may be actively encouraged in the feeding of livestock.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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