PROXIMATE ANALYSIS OF SOME BROWSE PLANTS GROWING AT BINYAMINU USMAN POLYTECHNIC HADEJIA, NIGERIA

[1*]Muhammad, A.S., [1]Dahiru, M., [1]Salisu, N., [1]Abdullahi, H.I., [1]Shehu, B., [2]Madigawa, I.L., [1]Gumel, A.M., [1]Musa, H., [1]Abdulaziz, A., [1]Abdulkadir, U. and Sulaiman, U.U.

[1]Department of Animal Health and Production, Binyaminu Usman Polytechnic, PMB 013, Hadejia Jigawa State, Nigeria.
[2]Department of Animal Production Technology, Audu Bako College of Agriculture Dambatta, PMB 3159, Dambatta Kano State, Nigeria.
[*]Corresponding author: asmuhammad369@bupoly.edu.ng; +2347064788419

ABSTRACT
An experiment was conducted to examine the proximate composition, fibre fraction and energy contents of three (3) common browse plants growing in Binyaminu Usman Polytechnic Hadejia, Nigeria, in a completely randomized design. The browse plants were; Acacia spp., Piliostigma thonningii and Hygrophila auriculata. The proximate composition of the browse plants was significantly different (P < 0.05). The average quantity of dry matter content was 94.60% with a minimum and maximum values of 93.10% in Acacia spp. and 96.70% in Piliostigma thonningii, respectively. The crude protein (CP) ranged from a minimum of 10.02% in Piliostigma thonningii to maximum of 12.21% in Acacia spp. The average crude fibre (CF), ether extract (EE), ash and Nitrogen Free Extract (NFE) of the browse plants were 20.86%, 3.01%, 11.57% and 48.20%, respectively. The fibre fractions and energy contents of the browse plants also significantly differed (P < 0.05). The average Neutral Detergent Fibre (NDF) content was 42.87% with a minimum and maximum values of 38.00% in Acacia spp. and 51.00% in Piliostigma thonningii, while the Acid Detergent Fibre (ADF) ranged from minimum of 20.80% in Hygrophila auriculata to a maximum of 43.10% in Piliostigma thonningii. The average ADF content was 30.23%. The energy content ranged from 998.43kcal/kg in Hygrophila auriculata to 1231.22 in Acacia spp. with an average energy content of 1077.33kcal/kg. The proximate composition of the browse plants revealed that both the dry matter, crude protein and energy contents of the legumes are good enough to facilitate dry season ruminant feeding.
Keywords: Browse plants, Proximate composition, Fibre, Energy, Ruminants

INTRODUCTION

Part of any range and pasture improvement program involves evaluating the contribution of forage species to animal nutrition (Muhammad *et al.,* 2023). Grazing ruminants are exposed to quantitative and qualitative changes in the nutritive value of forages during different periods (Buxton and Fales, 1994). The quantity and quality of the forage is continually changing, either improving or deteriorating in nutritional value. Often there is a deficiency of a macro-nutrient such as energy or protein or a micro-nutrient such as a mineral or vitamin. During the dry season, ruminant diets are limited by shortages in amount and quality of available forage (Shelton, 2004), crop residues or byproducts which result in reduced livestock productivity in the tropical countries (Muhammad *et al.,* 2023).

The nutritional values of forage species are low in the dry seasons compared to the wet season (Buxton, 1996). This is as a result of the dependence of forage nutrient contents on the amount of moisture found in the soil in which the forage plants grow (Babayemi *et al.,* 2004). In addition, concentrations of nutrients in forage plants are dependent upon the interaction of a number of factors. These factors are plant species, soil type, plant age, pasture management and climate. Ruminant animals rely more essentially on pasture for their nutrient requirement than on any other feed resources (Muhammad *et al.,* 2023).

Knowing if the available nutrients in the forage meet the animal's requirements and which supplement will correct deficiencies is very important because it decides if the available forage is of an adequate feed value for animal production and it is helpful to know how to measure both pasture quality and quantity.

MATERIALS AND METHODS

Experimental Site

The study was conducted at the livestock grazing areas of Binyaminu Usman Polytechnic, Hadejia, Jigawa State Nigeria. The area is located on latitude 12º 28' N and longitude 10º 01' E. The annual rainfall ranges between 200 - 600mm per annum with relative humidity of 75 % during the rainy season and a mean annual temperature of 28º C. The area is conducive for livestock production. The common livestock species in the institution's farm include; cattle, sheep, goats, rabbits and poultry (BirdLife International, 2021; Muhammad *et al.,* 2023).

Experimental Procedure

A total of three (3) - hectare land area was identified in Binyaminu Usman Polytechnic, Hadejia. The area was part of the grazing land available for livestock. The area was traversed and twenty five (25) plant species present were identified and categorized into grasses, forbs, legumes, and browses. Thereafter, the three-hectare land was divided into three (3) transects; each measuring one (1) hectare to provide three (3) replication plots. On a monthly basis, from August to December, forage species composition were randomly sampled using 1m × 1m quadrant from each replication plot. Within each quadrant, samples of the species were identified and scored in percentage (%) relative to their proportion within the quadrant. The species found were then harvested using knife at 2cm above the ground level. The harvested species were sorted out and weighed. The browse plant samples were sundried and taken to the laboratory for analysis.

Forage Samples Collection

The samples of forage species used in this study were collected from grazing land available for livestock in Binyaminu Usman Polytechnic, Hadejia. The common browse plant species are presented in Table 1.

Table 1. Local (Hausa), English (common) and scientific names of the common browses

S/N	Local Name	English Name	Scientific Name
1.	Farar kaya	Acacia	Acacia spp
2.	Kargo	Monkey biscuit tree	*Piliostigma thonningii*
3.	Kayar rakumi	Marsh barbell	*Hygrophila auriculata*

Sample Preparation

The harvested sample was then oven-dried at 105ºC for 24 h to constant weight and ground to pass through a 1.0mm sieve using Tecator Cyclotec 1093 sample mill. The samples were then sub-sampled to obtain three samples for each species and used for the laboratory analysis.

Proximate analysis

Proximate analysis was done to determine nitrogen (N) for crude protein determination (N×6.25), crude fibre, ether extract, nitrogen free extract and ash according to AOAC (2013). Acid detergent fibre and nitrogen detergent fibre were determined in accordance with Van Soest *et al.* (1991). Energy contents were estimated using adiabatic bomb-calorimetry in which gross energy was determined by measuring heat of combustion (Pauzenga, 1985).

Statistical Analysis

The data generated were subjected to analysis of variance (ANOVA) using GENSTAT (2014), where significant differences between the means were detected and separated using Duncan's Multiple Range Test (DMRT) at 5% probability level.

RESULTS AND DISCUSSION

Proximate compositions of the common browse plants

The proximate composition of the common browse plants are presented in Table 2. All proximate components were significantly different ($P < 0.05$). The average quantity of DM content was 94.60% with a minimum and maximum values of 93.10% in Acacia spp. and 96.70% in *Piliostigma thonningii* respectively. The dry matter yield is line with the range of 95.20% to 97.00% (Aduku, 2004). Moreover, it is important to note that forage dry matter yield varies with rainfall and soil condition (Njidda, 2010). The CP contents of the browse plants ranged from a minimum of 10.02% in *Piliostigma thonningii* to maximum of 12.21% in Acacia spp. The average CP content was 10.96% which was higher than the 8% CP which is the lower threshold that will warrant giving supplements to livestock (Aduku, 2004). The CF content ranged from 19.43% in Acacia spp. to 23.11% in *Piliostigma thonningii* with an average CF content of 20.86%. The CF content was low when compared to the report of Mckell (1980) that CF usually ranges between 30% and 40% in mature plants. The EE values ranged from 2.93% in *Piliostigma thonningii* to 3.10% in Acacia spp. with an average of 3.01%. This is in line with the research of Okoli *et al.,* (2001) who reported a range of 0.95 – 5.3%. The ash contents ranged from 10.90% in Acacia spp. to 12.30% in *Piliostigma thonningii* with an average of 11.57% which agreed with the result of Khan *et al.* (2020) who reported a range of 6.28% to 18.12%. The NFE also ranged from 47.46% in Acacia spp. to 48.81% in *Piliostigma thonningii* with an average of 48.20%. This result is in agreement with the range of 40.90% to 51.10% reported by Aregheore (2000).

Table 2. Proximate composition of the common browse plants grazed by ruminant livestock

Scientific Name	MC (%)	DM (%)	CP (%)	CF (%)	EE (%)	ASH (%)	NFE (%)

Acacia spp	6.90[a]	93.10[c]	12.21[a]	19.43[c]	3.10[a]	10.90[c]	47.46[c]
Piliostigma thonningii	3.30[c]	96.70[a]	10.02[c]	23.11[a]	2.93[c]	12.30[a]	48.34[b]
Hygrophila auriculata	6.00[b]	94.00[b]	10.66[b]	20.03[b]	3.00[b]	11.50[b]	48.81[a]
Mean	5.40	94.60	10.96	20.86	3.01	11.57	48.20
LSD	0.20	0.20	0.02	0.02	0.02	0.02	0.28

[a, b, c, d] Means with different superscripts along columns differ significantly at ($P < 0.05$).

Fibre fractions and energy contents of the common browse plants

The fibre fractions and energy contents are presented in Table 3. Both the NDF, ADF and energy contents of the browse plants were significantly different ($P < 0.05$). The average NDF content was 42.87% with a minimum and maximum values of 38.00% in Acacia spp. and 51.00% in *Piliostigma thonningii* respectively. The research was in line with the observation of Njidda (2010) who reported a range of 37.30% to 51.20%. The ADF contents ranged from minimum of 20.80% in *Hygrophila auriculata* to a maximum of 43.10% in *Piliostigma thonningii*. The average ADF content was 30.23% which could be compared to the range of 16.20% to 41.20% (Njidda, 2010).

The energy content ranged from 998.43kcal/kg in *Hygrophila auriculata* to 1231.22 in Acacia spp. with an average energy content of 1077.33kcal/kg. The energy contents were higher than the range of 9.4kcal/kg to 9.5kcal/kg (Aregheore, 2000), 381.20kcal/kg to 560.35kcal/kg reported by Magdalene (2019) and 252.52kcal/kg reported by Suleiman *et al.* (2020). The result could be compared to the figures of 871.94 to 1392.35kcal/kg reported by Agida, *et al.* (2017).

Table 3. Fibre fractions and energy contents of the common browse plants grazed by ruminant livestock

Scientific Name	NDF (%)	ADF (%)	ENERGY (Kcal/Kg)
Acacia spp	38.00[c]	26.80[b]	1231.22[a]
Piliostigma thonningii	51.00[a]	43.10[a]	1002.34[b]
Hygrophila auriculata	39.60[b]	20.80[c]	998.43[c]
Means	42.87	30.23	1077.33
LSD	0.02	0.16	0.02

[a, b, c, d] Means with different superscripts along columns differ significantly at ($P < 0.05$).

CONCLUSION

The proximate composition of the browse plants revealed that both the dry matter, crude protein and energy contents of the legumes are high enough to facilitate ruminant feeding.

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