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Mineral and Proximate Composition of Selected Forages Fed to West African Dwarf Bucks in ObioAkpa

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Abstract
The nutritive value of leaves from six forages was analysed. They included *Andropogon tectorum, Panicum maximum, Aspilia africana*,*Gmelina aborea, Alchornea cordifolia* and *Bambusa vulgaris*, andwere collected from Obio-Akpa in Akwalbom State. The forages were analysed for proximate composition, mineral/vitamin concentrations and anti-nutritive components. Results showed no significant ($p>0.05$) differences in the dry matter content which ranged from 86.52 to 98.36%.*A. africana* and *G. arborea* recorded protein contents which was higher than the crude protein (CP) of other forages analysed. A range of 1.94 to 5.24% and 1.28 to 5.84% were recorded for ether extract (EE) and crude fibre (CF) values for the six forages. The values reported for minerals showed that *B. vulgaris* had the lowest value of calcium (0.45%) while *A. tectorum* was low in magnesium (Mg) and potassium (0.57 and 0.22%). Highest content of vitamin A and B_{12} was recorded in *a. tectorum* (1.17 and 2.11µg/100g), respectively. The values reported for anti-nutritive factors ranged from 0.98 to 2.23 for tannins, 1.94 to 3.76 for Saponins, 0.01 to 1.23 for oxalates, 0.22 to 0.71 for hydrogen cyanide (HCN) and 1.05 to 1.55mg/g for phytates. The results showed that the forages studied have good nutrient contents and safe levels of anti-nutritional factors,thus they may be used as feed resources to enhance the production of ruminants.

Keywords: Forages, anti-nutritional factors, hydrogen cyanide

Introduction
Ruminant animals depend on essential mineral elements from pastures for their health and performance. Minerals are the most variable amongst all the nutritional contents supplied by pastures. Underwood and Scuttle (1999) reported that pastures often fail to supply all the mineral elements needed by grazing animals in adequate quantity. Animals depend on forages to satisfy all of their requirements nutritionally under pasture system, but unfortunately forages do not supply all these needed minerals throughout the year. Mineral inadequacies in forages have been reported (Vegas and McDowell, 1997) which cause low production rates and reproductive failures. This is likely to affect the production rates of grazing animals (Judson and McFarlane, 1998). Livestock improvement demands the efficient use of available forages and other feed resources and their potentials in meeting the animal needs and maintaining their health status.

Therefore, this study was designed to investigate the mineral status and proximate composition of selected forages used by grazing animals.

Materials and Methods
The leaves of six indigenous forages commonly consumed by ruminant animals were used in this study. The species were *A. tectorum, P. maximum, A.africana, G. aborea, A. cordofolia and B. vulgaris.* All the plants were harvested from ObioAkpa in OrukAnam Local Government Area (LGA) of Akwalbom State, Nigeria. The area is located between latitude 5° 17^{1}N and 5° 27°N between longitude 7° 27^{1}N and 7° 58^{1}E with an annual rainfall ranging from 3500mm – 5000mm and average monthly temperature of 25°C. The study location lies between latitude 4° 28^{1}N and 5° 3^{1}N and between longitude 7° 27^{1}E and 8° 20^{1}E with a relative humidity between 60 – 90%.The forage samples were analysed for dry matter (DM), crude protein (CP), ether extract (EE), crude fibre (CF) and ash according to the procedures of AOAC (2002). The mineral composition (calcium and magnesium) of the forages were analysed using atomic absorption spectrophotometry. The hydrogen cyanide (HCN) was determined by the Knowels and Watkins distillation method.), phytates was estimated as phytic acid by Maga method (1982). Tannin and Saponins were determined according to (Polshettiwar *et al*., 2007). Potassium and sodium was determined by flame photometry (Junsomboon and Jakmunce, 2011).

The means and standard error of means were calculated. Means were separated using Duncan's Multiple Range Test (Duncan, 1955).

Results and Discussion

The proximate composition of the leaves from*A. tectorum, P. maximum, A. africana, G. arborea, A. cordifolia and B. vulgaris*are presented in Table 1. Values obtained from proximate analysis showed no significant (p>0.05) differences among the treatment groups. However, these values did not show any consistent trend in the study. Among all the forages used in the experiment, *B. vulgaris* recorded the highest percentage of crude fibre (41.85%) while the least (12.80%) was recorded in *A. africana*. This may have been due to the dry season in which the experiment was conducted. Fibre is important in the diet of farm animals, it acts as diluents. Its absence in diets leads to incidence of a wide range of diseases which include colon biventricular, obesity and diabetis mellitus (Oke *et al.* 2007). Fibre is also necessary for proper bowel movement (Odoemelam and Ahamefule, 2006). Ash content of the forages followed the same trend as crude fibre. The high ash value of the forages except *A. tectorum*, may have been an indication of high mineral content of the forages used in the study. The proximate values so obtained, were contrary to those reported by Ikhimoya *et al.* (2007), Obua *et al*. (2012) and Philip and Owen (2014).

Table 1 Proximate composition of selected forage plants used for the experiment

Parameter	A. tectorum	P. maximum	A. africana	G. arborea	A. cordifolia	B. vulgaris	Mean	SEM
DM (%)	86.52	98.23	98.36	96.75	97.54	96.86	97.38	10.17
Crude protein (%)	2.75	2.42	12.51	13.24	7.95	8.29	11.19	2.80
Ether extract (%)	5.24	2.86	1.94	2.12	3.45	2.02	2.94	0.52
Crude Fibre (%)	3.93	2.17	1.28	1.46	1.75	5.84	3.24	4.86
Ash Content (%)	16.38	2.89	1.79	2.32	2.25	2.35	4.66	0.48
NFE	41.22	87.89	80.84	77.61	82.14	82.35	75.34	6.96
Energy (Kcal/kg)	1735.20	802.60	1826.20	1778.60	1116.10	1045.00	3278.48	182.47

SEM = Standard error of the means

Results of the phytochemical analysis of six (6) selected forage plants are as shown in Table 2. There were no significant (p>0.05) differences observed among the different parameters studied. Phytates are known to increase requirements for minerals, especially phosphorus which forms insoluble complexes with phytic acid because of the special affinity for this metal ion and zinc (Tulean *et al.,* 2008). The tannin content of the forages used in the study were at tolerable levels and ranged from 0.98% in *A. tectorum* to 2.27% in *A. cordifolia*. In ruminants, condensed tannins have been shown to be beneficial. The protein-tannin complex in the rumen dissociates post-ruminally as a sort of by-pass protein and the effect of its presence may therefore be negligible. The saponin content of the forages ranged from 1.94% in *A. tecterum* to 3.76% in *G. arborea*. Saponins are chacraterised by a bitter taste and foaming properties. In non-ruminants, retardation of growth rate due primarily to reduction in feed intake is probably the major cause.

Table 2: Phytochemical analysis of selected forages used

Parameter	*Andopogontectorum*	*Panicum maximum*	*Aspilia Africana*	*Gmelina arborea*	*Alchornea cordifolia*	*Bambusa vulgaris*	SEM
Tannins	0.98	1.12	1.34	1.44	1.27	2.23	0.18
Saponins	1.94	2.18	3.33	3.76	1.95	2.71	0.31
Oxalates	0.98	1.01	0.74	1.45	0.17	1.23	0.18
Hydrogen cynide	0.43	0.71	0.43	0.22	0.47	0.23	0.07
Phytates	1.05	1.32	1.25	1.55	1. 11	0.97	0.09

However, in ruminants, saponins cause bloat but because saponins undergo bacterial degradation in the rumen, growth may not be retarded in ruminant animals (Kumar, 1991).Although the values of the anti-nutritional factors were not significant, their values however fell below the toxic levels recommended for ruminant animals (Kumar, 1991; Philip *et al.,* 2014; Njidda, 2010). Mineral and vitamin composition of selected forage plants used for the study is as summarized in Table 3. The values obtained among the treatment means reveals that there were not significantly (p>0.05) different. Values for minerals though not significant, fell within the normal range recommended for ruminants except magnesium (Mg), sodium (Na), iron (Fe), copper (Cu) and zinc (Zn). Mineral deficiency could result in depression of animal performance. Sub clinical mineral deficiencies are widespread and responsible for yet unestimated, but probably great economic losses in livestock production.

However, mineral status of grazing animals in most African countries has received very little attention. The values recorded for vitamins indicate that there were also no significant (p>0.05) differences among the treatments but were in line with earlier reports (Akinsoyinu, 1986).

Table 3: Mineral and vitamin compositions of selected forages

Minerals	*A. tectorum* T_1	*P. maximum* T_2	*A. Africana* T_3	*G. arborea* T_4	*A. cordifolia* T_5	*B. vulgaris* T_6	SEM
Fe (ppm)	1.95	2.44	1.55	1.22	2.56	1.97	0.10
Zn (ppm)	0.48	2.75	2.17	0.54	0.75	1.42	0.12
Co (ppm)	1.09	1.11	0.49	0.42	0.34	0.29	0.05
Cu (ppm)	0.81	1.07	0.65	0.17	0.81	0.25	0.11
Cr (ppm)	0.35	3.14	2.34	0.12	1.29	0.91	0.08
Na (mg/kg)	0.93	0.49	0.84	1.21	1.19	0.97	0.11
Mg (mg/kg)	0.57	1.29	0.84	0.61	1.15	0.75	0.05
K (mg/kg)	0.35	0.92	0.75	0.22	0.65	0.35	0.04
Ca (mg/kg)	0.46	0.74	0.75	0.54	1.32	0.45	0.03
Vitamins							
Vitamin C (mg/100g)	1.53	2.22	1.03	1.62	0.55	0.85	0.09
Vitamin A (µg/100g)	1.17	0.62	1.23	0.65	0.79	0.87	0.17
Vitamin E (µg/100g)	0.41	0.09	0.32	0.57	0.53	0.44	0.87
Vitamin B1 (mg/100g)	0.71	0.44	1.43	0.55	1.03	0.99	0.04
Vitamin B6 (mg/100g)	1.05	0.76	0.75	0.92	1.16	0.89	0.06
Vitamin B12 (µg/100g)	1.45	0.24	0.90	2.11	1.76	0.43	0.04

Means of treatment in a row are not significantly (p<0.05) different

Conclusion

Among all the forages evaluated in this study, *Andropogon tectorum* had low mineral content but can be combined with other forages for use by grazing animals for better result.

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