NUTRIENT CHARACTERIZATION OF SOME FOOD PROCESSING WASTE MATERIALS

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ABSTRACT
Thereby achieving the dual aim of feed provision and reduction of materials from refuse heaps. This study was conducted with the objective of investigating the nutrient composition of some food processing waste materials. The materials studied were walnut shells, Thaumatococcus daniellii leaves and Banana leaves. The nutrient composition of the materials showed a profile for dry matter, crude protein, ether extract, crude fibre, ash nitrogen free extracts and metabolizable energy to be 89.62%, 7.00%, 0.36%, 67.10%, 2.27%, 23.27%, 1,273.65 Kcal/kg; 89.22%, 15.51%, 5.45%, 19.57%, 20.46%, 28.43%, 2,334.04 Kcal/kg and 97.21%, 10.62%, 12.65%, 15.82%, 14.21%, 46.70% and 3,490.1 Kcal/kg for walnut shells , Thaumatococcus daniellii leaves and Banana leaves respectively. It was recommended that these materials could be converted to ruminant feedstuff
Key words: Walnut, *Thaumatococcus daniellii*, Banana, Nutrient composition

INTRODUCTION
The quest for conversion of hitherto unusable materials for livestock feeding has formed the basis for unconventional feed development. Processing of food for human consumption generates so much by products, most of which are not useful and end up on refuse heaps contributing to environmental concerns. Walnut shells become a waste material after the nuts are removed and are discarded due to absence of alternative use. Consumption of walnuts has increased due to the purported inherent advantages viz: Provision of plant-based omega-3 fats along with high amounts of copper, manganese, molybdenum, and biotin which may help reduce not only the risk of prostate cancer, but breast cancer as well and contain the amino acid l-arginine, which offers multiple vascular benefits to people with heart disease, or those who have increased risk for heart disease due to multiple cardiac risk factors, contains several unique and powerful antioxidants that are available in only a few commonly eaten foods that may improve sperm quality, weight control, and offer support for brain health and Type 2 diabetes

Leaves of *Thaumatococcus daniellii* (TDL) used in preparing moi moi or Okpa, a breakfast meal are equally discarded after the meal is eaten. Observation have shown that scavenging pigs, goats, sheep and cattle usually struggle over these leaves on refuse heaps, emphasising the need for its nutrient characterization. Banana leaves, used in wrapping food also end up on refuse heaps. The leaves have been investigated for their nutrient composition (Wuanor et al., 2018) and also used in feeding rabbits (Waikyo, 2019). The objective of the study was to conduct a nutrient characterization of these materials as a prelude to possible ruminant feeding.

METHODOLOGY
Cooked walnuts were bought from retailers in Makurdi town over a period of three months, amounting to nine times, and the nuts separated from the shells. The shells were then sun dried and sent for proximate analysis. TDL and Banana leaves (collected from same source, over same period and number of times as the walnut shells) were sourced by buying the food wrapped in them and after removal of the food, the leaves were also sun dried and sent for proximate analysis. Proximate components of the shells and leaves were analyzed using AOAC (2005) procedure while the metabolizable energy was estimated using the formula of Carpenter and Clegg (1956).

RESULTS AND DISCUSSION

Proximate and metabolizable energy compositions of the waste materials are shown in Table 1. In general, all the materials had a high dry matter profile. This is particularly advantageous because nutrients are contained in the dry matter of a material as opposed to moisture. The crude protein ranged from 7.00 to 15.51 and qualifies the materials as ruminant feedstuff since the rumen microbes need a minimum crude protein of 7.0% to carry on their role of breaking down the scabrous feed materials that form the basal diets of ruminants. Particularly, the high crude protein of the TDL is reasoned to be caused also by the proteinous nature of the beans used in preparing pudding cooked in the leaves. The ether extract profile of the materials 0.36 to 12.65 shows that useful fatty acids will be made available for metabolism after the rumen micro organisms would have hydrogenated the fats. The higher ether extract of these banana leaves than that reported by Wuanor et al. (2018) is reasoned to be caused by the palm oil used in preparing the moi moi or Okpa that was cooked in these leaves. In general, the ash, nitrogen extract and metabolizable energy profiles of these materials showed their potential to furnish animals fed with them with minerals and energy.

CONCLUSION AND RECOMMENDATION

It was thus concluded that these materials possess attractive nutrient potentials. It was therefore recommended that the materials should be utilized in feeding ruminant animals.

Table1. Proximate and metabolizable energy compositions of some food processing waste materials

Material	DM	CP	EE	CF	ASH	NFE	Metabolizable Energy Kcal/kg
Walnut shells	89.62	7.00	0.36	67.10	2.27	23.27	1,273.65
Thaumatococcus daniellii leaves	89.22	15.51	5.45	19.57	20.46	28.43	2,334.04
Banana leaves	97.21	10.62	12.65	15.82	14.21	46.7	3,490.1

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BOTANICAL COMPOSITION AND SEASONAL VARIATION IN NUTRITIONALVAUESOF SOME SAVANNA FORAGES IN NORTH EASTERN NIGERIA

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ABSTRACT

An experiment was carried out at the Federal College of Education (Technical) Gombegrazing area with the objectives to identify the major forage resources in the area and their chemical composition as affected by seasons in the year 2018. Samples for both dry and wet season were collected using constructed quadrant frame which was randomly thrown on the ground for grasses and legumes species, plants inthe hoop were clipped. Botanical composition, chemical composition were analysed using the procedure described by AOAC (1990). Major grasses identified included Cenchrusciliaris, and Pennisetumpolystachyon.While leguminous and shrubs includeAlysicarpusviginalis, and Cassia singuena. Mean apparent nutrients composition for Neutral Detergent Fibre in dry season were found to increase significantly (P < 0.05) from 39.30% in the wet season to as high as 57.24% in the dry season in cenchrusciliaris. Acid detergent fiber from 24.39 in the wet season to 46.63% in the dry season in Digitariadebilis while lignin from 23.15 to 36.43 in Cenchrusciliarisrespectively. Crude protein and ether extracts were higher during the wet season 14.86% and 7.54% in Arachishypogeaecompared to the dry season. Anti nutitional factors were found to be higher during the wet season. It was concluded that forages such as Digitariadebilis, andCenchruscitiariswhich had over 70% dry matter content in both wet and dry season and lower content of anti-nutritional factorsin both seasons should be conserved during the time of abundance due to its abundance and high nutritional values

Key Words: Botanical Composition, Seasonal Variation, Nutritional Values, Savannah Forages, North Eastern Nigeria

INTRODUCTION

The term forage refers to herbaceous material including grasses, legumes, browse plants trees and fibrous crop by products. In seasonally dry environments, the main limitations to animal production are lack of green feed for at least half of the year coupled with the low nutritive quality of forages during most of the period of active pasture growth (Jones and Wilson, 2018). The low nutritive quality of the forage during the growth period is mainly due to environmental stresses such as high temperature (Goering and Van Soest, 2008).

Nigeria has two broad belts of vegetation types, namely, the forest and savannah types. As obtained in southern coastal areas where humid tropical conditions favour tree growth and some species of grasses which include *Pennisetumspp*, Southern Gamba (*Andropogontectorum)* and Buffel grass (*Cenchrusciliaris*). The savannah zone is commonly used to describe areas within the tropics under grass or grass with scattered trees. The vegetation in this zone includes Northern gamba (*Andropogongayanus)*, Elephant grass (*Pennisetumpurpureum)*, Guinea grass *(Panicummaximum*), Stylo (*Stylosathesgracilis)* and Bermuda grass (*cynodondaclylon*) among others, (Fayemi, A.A, Odu, C.T. and Fagbemi, A. (2012).

The area is excellent for rearing and breeding of ruminants (sheep, goats, cattle, camels, horses and donkeys (Onifade and Agishi, 2017). However over the years feeding constitute the major problem of livestock industry in the country, low nutritive value of pasture and forages affect the quality of milk and meat of farm animals (Provenza, 2013). Therefore, the study determined the major forages in the area and their chemical compositionduring dry and wet season periods. It is hoped that identifying these components of the feeds would improve livestock production and the living standard of pastoralist and the general public.

METHODOLOGY

Samples in wet seasons were collected using a constructed quadrant frame which was randomly thrown on the ground and all the plants inside the hoop were clipped. Similarly, dry season samples were taken from the same position, identified and labelledin separate containersin the laboratory. Proximate analysis according to Association of Official Analytical Chemists (AOAC, 1990) was used to determine the dry matter (DM) contents, the crude protein (CP) crude fibre (CF) ether extract (EE) total ash (TA) and nitrogen free extract (NFE). acid detergent fibre (ADF) neutral detergent fibre (NDF) and lignin were analysed using the procedure of Goering and Van Soest (2008). The data generated were subjected to analyses of variance, using the General Linear Model (GLM) of SPSS (2001). Means were separated using Duncan Multiple Range Test (DMRT) method described by (Humburg 1990).

RESULTS AND DISCUSSION

Major pasture plants in the grazing area during dry season

The effect of seasonal variation on ruminant livestock production is important. During the mid-wet season; forage biomass is higher in quality and quantity, with crude protein values of up to 12.00% in most of the native grasses. Natural grasses and legumes are rich and highly digestible at this period as supported by Provenza, (2013). The severity and duration of low- quality feed during the dry and wet seasonvaries with species within the ecology. However, there are factors that reduce the availability of thesefeed resources such as widespread annual burning of native grasslands, which drastically reduces the amount of forage on offer ((Nyako, 2010; Nuru, 2015). Table 1 shows the major forages or plants identified in the study area.

Table 1: Scientific and common names of some forage species available in F. C. E(Tech) Gombe grazing during the dry season

S/N	Botanical Names	Common names
Grasses		
1	*Andropogongayanus*	Gamba
2	*Cenchrusciliaris*	Karangiya
3	*Digitariadebilis*	Harkiya
4	*Pennisetumpolystachyon*	Kansuwa
Legummes		
5	*Alysicarpusviginalis*	Gadagi
6	*Arachishypogeae*	Harawargyada
7	*Vignaunguiculata*	Harawar Wake
Shurubs		
8	*Cassia singuena*	Rumfu
9	*Guierasengalensis*	Sabara
10	*Poliostigmareticulatum*	Kargo
11	*Ziziphusspinachristi*	Magarya

Chemical composition of forage species during dry seasons

Table 2 indicated the chemical composition of the available forages within the study area. *Digitariadebilis*shows a higher level of DM content of 88.79%, while *Vignaunguiculata*and *Arachishypogeae*indicated a lower level of DM content of 83.54 and 83.62% respectively. Generally,

the forages dry matter content, crude fibre, acid detergent fibre, andneutral detergent fibreweresignificantly different *(P<0.05).*and were higher than the wet season values. This may be connected to the fact that the nutrient content of the forages leached out or are lignified with little or no value as indicated by (Nyako 2010). However, thecrude protein and ether extract were higher during the wet season.

Table 2: Chemical composition of some forage species in F.C.E. (T) Gombe, grazing area during dry season

S/N	Sample Description	%DM	%ASH	%CP	%EE	%CF	%ADF	%NDF
1	*Andropogongayanus*	88.65^{e}	2.37^{a}	8.52^{b}	1.23^{b}	34.67^{d}	44.64^{e}	55.25^{d}
2	*Cenchrusciliaris*	88.28	1.89^{a}	7.98^{a}	0.61^{a}	36.43^{d}	46.51^{e}	57.24^{d}
3	*Digitariadebilis*	88.79^{e}	1.95^{a}	8.28^{a}	0.97^{a}	35.83^{d}	46.63^{e}	57.12^{d}
4	*Pennisetumpolystachyon*	88.56^{e}	1.91^{a}	8.19^{a}	0.72^{a}	35.26^{d}	45.44^{e}	56.51^{d}
5	*Alysicarphusviginanil*	88.84^{e}	4.09^{e}	8.86^{e}	3.25^{d}	20.89^{b}	36.72^{c}	46.83^{b}
6	*Vignaunguiculata*	83.54^{a}	6.87^{b}	7.28^{c}	4.27^{c}	22.72^{c}	38.61^{d}	49.74^{c}
7	*Arachishypogeae*	83.62^{a}	6.97^{b}	8.38^{c}	4.39^{c}	22.63^{c}	38.52^{d}	49.93^{c}
8	*Cassia singuena*	86.17^{c}	1.62^{d}	3.27^{c}	4.73^{c}	18.31^{b}	25.89^{b}	45.61^{b}
9	*Guierasengalensis*	85.52^{b}	2.51^{d}	4.73^{d}	4.21^{c}	19.66^{b}	34.25^{c}	45.44^{b}
10	*Poliostigmareticulatum*	85.22^{b}	1.25^{c}	2.63^{c}	4.13^{c}	19.19^{b}	26.23^{b}	47.41^{b}
11	*Ziziphusspinachristi*	87.26^{d}	2.25^{c}	1.43^{b}	7.22^{d}	10.59^{a}	19.14^{a}	42.98^{a}
	SEM	0.59	1.53	1.01	0.76	2.95	3.12	1.76

$^{a, b, c, d,e}$ *Means with same letters within a column, are not significantly different (P<0.05).*
SEM=standard error of the mean

Table 3: Chemical composition of some forage species in F.C.E. (T) Gombe, grazing area during wet season

S/N	Botanical Name	%DM	%ASH	%CP	%EE	%CF	%ADF	%NDF
1	*Andropogongayanus*	78.25d	12.53d	13.78c	6.05c	7.09d	24.63c	41.7d
2	*Cenchrusciliaris*	80.14b	13.61e	13.78c	4.24a	5.49b	23.13b	39.3c
3	*Digitariadebilis*	79.23b	11.81d	12.43c	5.83b	5.71b	24.39c	43.68d
4	*Pennisetumpolystachyon*	75.86b	10.15c	12.47c	7.33d	5.27b	23.03b	43.21d
5	*Alysicarpusviginalis*	77.21d	8.14b	11.16b	7.17d	6.31c	23.11b	22.13a
6	*Arachishypogeae*	76.13c	10.95c	14.86e	7.54d	4.24a	21.74a	21.24a
7	*Vignaunguiculata*	76.72c	11.16c	12.47c	7.34d	4.83a	19.26a	21.23a
8	*Cassia singuena*	78.13d	14.03e	11.43b	6.03c	4.39a	28.99d	41.15d
9	*Guierasengalensis*	79.01e	9.26b	8.53a	6.64ac	6.43c	25.43c	52.23e
10	*Poliostigmareticulatum*	77.19d	11.68d	13.27c	6.06c	7.15d	23.66b	41.59d
11	*Ziziphusspinachristi*	76.28d	11.89d	17.98e	5.67b	6.94c	46.51e	43.32d
	SEM	0.36	0.66	0.79	0.35	0.35	1.68	1.94
	Significance Level	*	*	*	*	*	*	*

DM=dry matter, ADF=acid detergent fiber, neutral detergent fiber, CP=crude fiber, EE=ether extract, [a, b, c, d,e] Means with same letters within a column, are not significantly different (P<0.05). SEM=standard error of the mean

Table 3 indicated the chemical composition of the available forages within FCE (T) Gombe grazing area during wet season. As shown *Cenchrus ciliaris* indicated higher value of DM content 80.14% while *Pennisetumpolystachyon*and *Arachis hypogeale*indicated a lower level of DM content of 75.86 and 76.13% respectively. Generally the forages dry matter content, crude fibre, acid detergent fibre, neutral detergent fibre were lower than the dry season values and are significantly different *(P<0.05).* More so, crude protein and ether extract show higher percentages during the wet season.

Table 4: Anti-Nutritive factors in the sampled forages (g/100g) in the Gombe grazing area in samples during dry season

		Wet Season			Dry Season		
S/N	Sample Description	Tannins	Saponins	Alkaloid	Tannins	Saponins	Alkaloid
1	*Andropogongayanus*	0.231	0.828	0.002	0.018	0.777	0.0008
2	*Cenchrusciliaris*	0.112	1.061	0.006	0.061	1.01	0.0048
3	*Digitariadebilis*	0.209	1.408	0.002	0.158	1.357	0.0008
4	*Pennisetumpolystachyon*	0.178	0.948	0.001	0.127	0.897	0.0002
5	*Alysicarpusviginalis*	2.72	1.278	0.409	2.669	1.227	0.4078
6	*Arachishypogeae*	0.193	1.3	0.002	0.142	1.249	0.0008
7	*Vignaunguiculata*	0.131	1.248	0.023	0.018	1.197	0.0218
8	*Cassia singuena*	0.195	1.208	0.005	0.144	1.157	0.0038
9	*Guierasengalensis*	0.112	1.408	0.001	0.061	1.357	0.0002
10	*Poliostigmareticulatum*	0.209	1.818	0.002	0.158	1.767	0.0008
11	*Ziziphusspinachristi*	0.175	0.198	0.023	0.124	0.147	0.0218
	Mean	0.406	1.155	0.014	0.355	1.104	0.0042
	Standard Error	0.228	0.141	0.036	0.072	0.021	0.0021

CONCLUSION AND RECOMMENDATION

It is concluded and recommended that forages such as *Digitariadebilis, Cenchruscitiaris*and*Arachis hypogea* which had over 70% dry matter content in both wet and dry season and lower content of anti-nutritional factors in both seasons should be conserved during the time of abundance (wet season) as animal feeds in order to ameliorate feed shortage during dry season periods.

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