PROXIMATE AND PHYTOCHEMICAL COMPOSITIONS OF THE DIFFERENT PARTS OF AFRICAN MESQUITE (*Prosopis africana*) POD

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ABSTRACT
This study investigated the proximate and phytochemical compositions of different parts of African mesquite (Prosopis africana) pod. Results of chemical composition analyses revealed that the percentage crude (CP) composition of the seeds was 25% while the CP compositions of the epicarp and mesocarp were 6.40% and 6.14% respectively. The mesocarp contained the highest composition of crude fibre (21.71%) and ether extract (2.37%). Least values of crude fibre (6.60%) and ether extract (1.27%) compositions were observed in the seeds and epicarp respectively. The ash content of the epicarp was 4.45%, while the mesocarp and seeds contained 3.77 and 3.51% ash respectively. The nitrogen-free extracts in the different parts of the African mesquite pod was between 63.15 (seeds) and 68.30% (epicarp). The epicarp had highest concentration of alkaloid (6.018%), tannins (2.467mg/kg) and phytate (0.135%), while the seeds contained highest concentration of flavonoids (0.371mg/kg) and oxalates (0.578%). The mesocarp had the least concentration of tannins (1.733mg/kg), alkaloids (4.053mg/kg), flavonoids (0.169mg/kg) and oxalates (0.255%). It was inferred that the different parts of P. africana contained sufficient quantities of which could be considered as feed resource for livestock. However, further processing of the epicarp and mesocarp would be necessary when considering incorporating them in diets of monogastrics.
Keywords: *Prosopis Africana*, Proximate, Composition, Phytochemicals, Monogastrics

INTRODUCTION

There is a severe shortage of grains for human consumption, particularly in the under-developed and developing countries, which is further aggravated by their increasing population (Dhakad *et al*., 2002), competition with livestock and in Nigeria, Farmers-Herders crisis. Ajala *et al*. (2008) suggested that solution to the present grain shortage rests on the promotion and sustenance of efficient production of all classes of meat animals using unconventional feed resources. There are around us, several materials which may be developed and used as alternative feed resources to animals. To achieve this, information on the chemical/nutritional compositions of these materials is necessary. One of such materials is the African mesquite (*P. africana pod*). *Prosopis africana* commonly known as African mesquite, Iron tree, or locally as *Kiriya* (Hausa), *Ayan* (Yoruba), *Ubwa* (Igbo) (Ogunshe *et al.,* 2007) and *Gbaaye* (Tiv), is a member of the family *Fabaceae* (Akande and Alabi, 2021). The genus *Prosopis* has 44 species of which 40 are native to the North and South Americas, to Asia and one originates from Africa (*Prosopis africana*). The pulp of African mesquite has a pleasant aroma with a somewhat bitter-sweet taste. The dried pulp is obtained when the whole dried pod is crushed to separate the seeds. On weight basis, the pulp makes up 45-55 % of the whole pod (Pasiecznik, 2018). Studies have shown that the pulp could contain between 13 – 15.23 % crude protein, 11 – 23.2 crude fibre, 1 – 3.50 % ether extracts and 3 – 6.59 % ash (Annongu and Ter meulen, 2000; Akande and Alabi, 2021).In this study, the fibre fractions, proximate and phytochemicals compositions of the different parts of *P. africana* pod were investigated.

MATERIALS AND METHODS

Study Location

The study was conducted at Joseph Sarwuan Tarka University, Makurdi. Makurdi, located between latitude 7°68'N and longitudes 8°62'E in the Guinea savannah Zone of West Africa. The area is warm with a minimum temperature range of 21.71±3.43°C and a maximum temperature range of 32.98±2.43°C and relative humidity ranges between 39.5±2.20 and 64.0±4.80% (TAC, 2011).

Source and Processing of African Mesquite (*P. africana*) Pod Parts

Whole mature dried pods of *P. Africana* were picked at the vicinity of the trees between December and February in bushes within Makurdi, Benue State, Nigeria. Collected pods were cleaned, sundried and each pod separated into its various parts of epicarp, mesocarp and seeds. The parts were milled and packaged separately in polythene bags.

Chemical Analyses

Proximate analysis of different parts of African mesquite pod (*Prosopis africana*), will be performed using procedures of AOAC (1990). The various phytochemicals were determined by the methods indicated below: Tannin by the method of Makkar and Goodchild (1996), Saponin by Obadoni and Ochuku (2001) method Oxalate by Balogun and Fetuga (1988) method, Phytates by Peng *et al*. (2009) method, Trypsin inhibitor by Shang *et al*. (2016) procedure, and Cyanogenic glucosides by the procedure of Bradbury *et al.* (1991).

RESULTS AND DISCUSSION

Proximate Composition of the Different Parts of the African Mesquite (*P. Africana*) Pod

The Proximate composition (%dry matter) of the different parts of the African mesquite (*P. Africana*) pod is presented in Table 1. The crude protein, crude fibre and gross energy composition of the various parts of African mesquite pod varied significantly ($p < 0.05$), while no significant differences ($p > 0.05$) were observed in ether extract, ash and nitrogen-free extracts compositions of the various pod parts. The result revealed their potential as sources of non-conventional feed resource for goats. The crude protein (CP) of the epicarp and mesocarp varied only slightly (6.40 ad 6.14 % respectively). These values were lower than values from relevant researche 10.0 % (Adamu *et al*., 2010), 13.3 % (FAO, 1991) and 9.5 % (Baioa, 1987), for CP in *P. Africana* pulp. The values however compares favourably to the CP of 6.1 % reported by Faramawy (2014) for *P. Chilensis* pod meal.

The CP (25.00 %) composition of the seeds of *P. Africana* obtained from this study was comparable to previous reports on the CP of *P. Africana* pod; 27.67 % (Adamu *et al*., 2010), 23.60 % (Aremu *et al*., 2007) and 22.62 % (Yusuf *et al*., 2013). The obtained CP value for the seeds of *P. Africana* was higher than 20.50 % reported by Annongu and Termulen (2000) but low when compared to the 32.27 % reported by Anhwange *et al* (2020). More so, the CP composition of *P. Africana* seeds obtained was higher than the CP of some proteinaceous concentrates such as pigeon pea (21 %), Bambara (22 %), palm kernel cake (18 %) (Ogunsipe *et al*., 2022); but comparable to the CP of 25 %, and 30 % in Cotton seeds cake and African locust bean (Ogunsipe *et al*., 2022) and 26 % in velvet bean (Tuleun and Patrick, 2007). The crude fibre (CF) content of the epicarp (19.49 %) and mesocarp (21.72 %) was high. These values compared favourably with the reports of Adamu *et al*. (2010) and Jiwuba *et al* (2020) who reported 22 % and 18.0 % respectively CF in the pulp of *P. Africana* pod. The CF content of the epicarp and mesocarp of *P. Africana* pod was higher than the CF content of conventional livestock dietary fibre sources such as maize offal (12 %) (NIAS, 2014), wheat offal (11 %) and brewer's dried grain (18.08 %) (Ogunsipe *et al*., 2022). This indicates the potential of the epicarp and mesocarp of *P. Africana* as alternative fibre sources in the diets of livestock .The CF content of the seeds (6.60 %) of *P. Africana* was similar to 6.75 % (Anhwange *et al*., 2020), 6.90 % (Yusuf *et al*., 2013) and 6.51 % (Baminas *et al*., 1998), but lower when compared with 10 % and 11.50 % reported by Adamu *etal*. (2010), Annongu and Termulen (2020) respectively.

The composition of fats in the different parts of *P. Africana* pod was highest in the seeds (2.37 %) while the epicarp and mesocarp contained 1.27 and 1.74 % fats respectively. These values were lower than 3.30 % and 5.0 % reported for *P. Africana* pulp and seeds respectively (Adamu *et al*., 2010), 4.56 % and 6.64 % in seeds (Annongu and Termulen, 2020; Yusuf *et al*., 2013). The observed values of fats in the different parts of the pod were higher than 0.6 % for *P. Africana* hulls (Gohl, 1975) and 1.35 % in the pulp (Jiwuba *et al*., 2020). When compared to previous findings, the fats composition of the seeds of *P. Africana* pod obtained from this study was low: 3.75 % (Chopra and Hooda, 2001), 2.36 (Anhwange *et al*., 2020), 6.0 % (Adamu *et al*., 2010) and 4.02 % (Shina *et al*., 2019).

Phytochemical Concentration of the Different Parts of the African Mesquite (*P. Africana*) Pod.

Table 2 presents the results of the phytochemical screening of the different parts of *P. Africana* pod. There were no significant differences ($p > 0.05$) in the phytochemicals concentration of the various parts of the African mesquite parts. Saponin levels in the different pod parts (4.809 – 6.008 %) was much higher than the reported value of 2.75 in the pulp (Jiwuba *et al*., 2020), 1.050 % in seeds (Anhwange OR Anhwange ?*et al*., 2020). High percentages of saponins in food induces a bitter taste. This may be responsible for the bitter taste of *P. Africana* pulp. Quantities of alkaloids in the mesocarp (pulp) (4.153%) was higher than 2.87 % in the pulp as reported by Jiwuba *et al*. (2020), but lower than 7.50 % reported by Anhwange *et al*. (2020).The values obtained from this study corroborates the findings of Olorunmaye *et al*. (2019) who reported that *P. African* pod contains high quantities of alkaloids. These high alkaloids concentration called for the need for further processing to reduce concentration to barest minimum before incorporation in diets of poultry and swine.

Tannins content in the various pod parts was found to be between 1.733 (Mesocarp) and 2.467 mg/kg (epicarp). These values were higher than 1.2 and 1.5 mg/kg tannin in seeds and pod respectively, reported by Sawal *et al*. (2004), 0.16 mg/kg in seeds (Anhwange *et al*., 2020), 0.97 mg/kg in seeds (Srivinas and Chaturvedi, 2019). The tannin values obtained were however lower than the concentration of 5 %, above which it can exhibit anti-nutritive

tendencies to ruminants (Mcleod, 1974). This thus reinforces the potentials of *P. African* pod as an animal feed resource.

In general, the presence of these phytochemicals in the various parts of the pod makes them to be of therapeutic and health importance but also indicates that further processing is necessary if they are to be used as feed resources for other class of livestock especially poultry and swine.

Table 1: Proximate and Gross Energy Composition of the Different Parts of the African Mesquite (*P. Africana*) Pod

Composition (% DM)	African Mesquite pod parts			SEM	P value
	Epicarp	Mesocarp	Seeds		
Crude protein	6.40[b]	6.14[b]	25.00[a]	0.16	0.003
Crude fiber	19.49[a]	21.72[a]	6.60[b]	0.62	0.000
Ether extract	1.27	2.37	1.74	0.00	0.673
Ash	4.54	3.77	3.51	0.01	0.582
Nitrogen-free extract	68.30	66.60	63.15	3.54	1.648
Gross energy (Kcal/Kg)	2764.32[b]	2732.42[b]	3306.83[a]	96.38	0.042

[ab] means with different superscript on the same row are significantly different
SEM = Standard error of mean

Table 2: Phytochemical Concentration of the Different Parts of the African Mesquite (*P. Africana*) Pod

Phytochemical	African Mesquite pod parts			SEM	P value
	Epicarp	Mesocarp	Seeds		
Saponins (%)	6.008	5.737	4.809	0.09	0.281
Alkaloids (%)	6.018	4.053	4.858	0.19	0.626
Cyanide (mg/kg)	4.127	4.645	4.325	0.07	1.841
Tannins (mg/g)	2.467	1.733	2.014	0.00	1.635
Oxalates (%)	0.289	0.255	0.578	0.00	0.852
Flavonoids (mg/g)	0.257	0.169	0.371	0.00	0.913
Phytates (%)	0.135	0.166	0.120	0.00	0.721

CONCLUSION

Based on the results obtained from this study, the following conclusions were drawn:

1. The different parts of African mesquite (*Prosopis Africana*) contains nutrients in quantities that can warrant their usage either singly or combined, as an ingredient in the diet of livestock especially ruminants.
2. The phytochemicals concentrations in the various parts of African mesquite (*P. Africana*) are at levels considered safe for ruminants but unsafe for monogastric.

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