PROXIMATE COMPOSITION AND FIBRE FRACTION OF AFRICAN BLACK PLUM PLANT PARTS AS A SUPPLEMENT IN RUMINANT NUTRITION

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ABSTRACT

This study was conducted to evaluate the proximate composition and fibre fraction of different parts of African black plum plant. Fresh leaves and ripe fruits of the plant were collected from trees within and around Federal University Dutse, Jigawa state, Nigeria. The different plant parts were analyzed and the result revealed that dry matter and carbohydrate contents were significantly ($p<0.05$) high in the leaf, crude protein was higher ($p<0.05$) in the nut whereas nitrogen free extract and energy contents were significantly ($p<0.05$) higher in the fruit. Crude fibre, ether extract and ash were similar ($p>0.05$) among the plant parts. The fruit contained significantly ($p<0.05$) higher contents of acid detergent fibre (19.25%), acid detergent lignin (9.40%) and hemicellulose (16.30%) but lower contents of neutral detergent fibre (38.30%) and cellulose (5.40%). It was concluded that the different plant parts of African black plum contain appreciable quantities of nutrients and low contents of cell wall adequate for supplementation in the diets of ruminant animals.

Keywords: African black plum, Leaf, Nut, Fruit, Ruminant

INTRODUCTION

Nutrition is the most important consideration in ruminant production systems (Fasae *et al*., 2010), as the major constraint in the development of livestock sector is poor availability of nutrients (Cheema *et al*., 2011). Inadequacy in the amount and quality of feed available, is grossly responsible for the low livestock productivity in the tropics. Ruminants depend solely on plants for their nutrient requirements and energy in particular (Fasae *et al*., 2010). Indigenous fodder trees and shrubs remain green at critical times of the year and produce large quantities fodder all year round. The year-round availability of these fodders when incorporated to ruminant diets helps to tackle the effects of poor nutrition (Achonwa *et al*., 2021). African black plum (*Vitex doniana*) is a tree plant that grows wildly in the middle belt and savanna regions of Nigeria. The fruit is a drupe and has a sweet mesocarp which accounts for about 20–25% of the weight of the whole fruit (Abu, 2007). It's a multiple-use plant widely used for food, as medicine and as a source of firewood and the leaves are often used as vegetables (Dadjo *et al*., 2012). Some researchers on forest resources have described *Vitex doniana* as an untapped forest resource that deserves to be better known (Abu, 2007). The focus on *Vitex doniana* has been on ethnobotanical studies, there is scanty information on the use of the tree plant in the nutrition of ruminant animals. This study therefore evaluates the nutritional composition of African black plum plant parts for incorporation into the diets of ruminant animals.

MATERIALS AND METHODS

Fresh leaves of African black plum were collected from trees within and around Federal University Dutse and air-dried on concrete floor until they became crispy. The ripe fruits were harvested from trees within and around Federal University Dutse, dried and cracked using hammer mill. The cracked fruits were sieved to separate the dried fruit pulp from the nuts. The fruit pulp and nut obtained along with the dried leaf were milled separately using commercial maize milling machine and stored in polythene bags until required for analysis. The ground sample of each plant part was analyzed in triplicate for dry matter (DM), crude protein (CP), ether extract (EE), crude fibre (CF) and ash according to AOAC (2005). Crude protein was calculated as N × 6.25. NFE (%) = DM (%) – (EE (%) + CP (%) + TA (%) + per cent CF), Samples of the different plant parts were analyzed for neutral detergent fibre (NDF), acid detergent fibre (ADF), acid detergent lignin (ADL) and cellulose according to Van Soest *et al*. (1991). Data collected were subjected to analysis of variance and significant differences among means were compared using Duncan Multiple Range Test.

RESULTS AND DISCUSSION

The chemical composition of the different parts of African black plum (*Vitex doniana*) plant is presented in Table 1. The result showed the leaf contained significantly ($p<0.05$) higher dry matter (95.33%) and

carbohydrate (18.89%) contents than the nut and the fruit. Crude protein was significantly ($p<0.05$) different among the plant parts with the nut having the highest (8.75%). Crude fibre, ether extract and ash contents were similar ($p>0.05$) among the plant parts whereas nitrogen free extract (83.88%) and energy (386.96%) contents were higher ($p<0.05$) in the fruits. The crude protein content above 6% observed among the plant parts will provide the minimum ammonia levels required by ruminants to ensure optimum microbial growth in the rumen and will also supply the critical nutrients needed to enhance fermentation of feeds in the rumen (Fasae *et al*., 2018). Crude protein concentration obtained for African black plum leaf was similar to 8.10% and 8.53% reported by Adejumo *et al.* (2013) and Okukpe *et al.* (2019). Crude fibre (20.70%) content of the leaf was higher than 7.15% and 2.75% reported by Okukpe *et al.* (2019) and Adejumo *et al.* (2013) respectively for *Vitex doniana* leaf and was also higher than 7.50 - 19.90% reported by Okoli *et al.* (2003) for browse plants. Dietary fibre reduces blood cholesterol and the risk of hyperglycemia by slowing down the rate of glucose absorption into the bloodstream (Okeke and Adaku, 2009). Ether extract is important in hormone production, insulation and protection of body organs (Soetan and Atanda, 2018). Feedstuff having 1-2% crude fat have been reported to reduce the risk of diseases due to its excessive consumption, thereby sufficient to maintain good health (Sodamade *et al*., 2013). The ether extract recorded suggest they contain adequate crude fat to satisfy the energy requirement of ruminant animals (Fasae *et al.,* 2018). Soluble carbohydrates and starch are the main constituents of nitrogen free extract. Nitrogen free extract (76.44 – 83.88%) obtained in the present study indicates the plant parts have appreciable level of carbohydrates, and thus, can serve as energy source (Amaza, 2021). Soetan and Akanda (2018) reported high energy content of food samples are attributed to their high level of carbohydrates. Dietary ash gives an indication of the mineral content of foods which helps to maintain the acid-base balance of the body system (Soetan and Atanda, 2018). Ash content of the different plant parts agrees with reported range (3.00 - 34.57%) for browse plants (Okukpe and Adeloye, 2011). The carbohydrate content obtained for the leaf was higher than the report of Adejumo *et al.* (2013) whereas that obtained for the fruit was lower than reported value (28.40%) by Vunchi *et al.* (2011).

Table 1: Chemical composition (%) of the different parts of African Black plum plant

Parameters (%)	**African Black plum plant parts**		
	Leaf	**Nut**	**Fruit**
Dry matter	95.33^{a}	90.38^{c}	92.00^{b}
Crude protein	8.20^{ab}	8.75^{a}	6.56^{b}
Crude fibre	20.70	23.80	8.77
Ether extract	1.76	2.09	2.76
Nitrogen free extract	76.44^{c}	80.43^{b}	83.88^{a}
Ash	2.78	2.79	5.48
Carbohydrate	18.89^{a}	10.31^{b}	8.12^{c}
Energy	350.71^{c}	379.22^{b}	386.96^{a}

$^{a, b, c,}$ means in the same row are significantly ($p<0.05$) different

Table 2 presents the fibre fraction of African black plum plant parts. The result showed significant ($p<0.05$) differences in all the parameters evaluated with acid detergent fibre, acid detergent lignin and hemicellulose having significantly ($p<0.05$) higher contents in the fruit (19.25%, 9.40% and 16.30%, respectively). Fibre is important in the diet of farm animals and acts as diluents, some level of fibre enhances proper bowel movement (Udo *et al.,* 2018). Acid detergent fibre and neutral detergent fibre obtained were lower than the report of Fasae *et al.* (2018) and Okoli *et al.* (2003). Neutral detergent fibre is related to the intake potential of fodder and energy value and is therefore the best indicator to predict fodder quality (Fasae *et al.,* 2018). Meissner *et al.* (1991) reported a threshold of 60% for NDF above which affect the feed intake of ruminants. The neutral detergent fibre level of the different plant parts was below the threshold level reported thereby implying the feed intake of ruminants will not be affected when any of the plant parts is included in their diets. Lignin is a component of the cell wall, and deposited as part of the cell wall-thickening process (Njidda *et al*., 2012). The lignin content of the different African black plum plant parts was within the range reported by Fasae *et al.* (2018) for neem plant.

Table 2: Fibre fraction (%) of the different parts of African Black plum plant

Parameters (%)	**African Black plum plant parts**		
	Leaf	**Nut**	**Fruit**
Acid detergent fibre	16.20^{b}	15.80^{b}	19.25^{a}

Neutral detergent fibre	40.65[b]	43.25[a]	38.30[c]
Acid detergent lignin	8.35[b]	8.50[b]	9.40[a]
Cellulose	7.30[a]	6.70[b]	5.40[c]
Hemicellulose	13.15[b]	10.51[c]	16.30[a]

[a, b, c,] means in the same row are significantly ($p<0.05$) different

CONCLUSION

The result of the study revealed that the different plant parts of African black plum contain appreciable quantities of nutrients and low contents of cell wall adequate for supplementation in the diets of ruminant animals.

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