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# Evaluation of Proximate, Fibre Fractions, Mineral Compositions and Phytochemical Screening in Camel's Foot (Piliostigma Reticulatum DC) Pods in Kebbi State, Nigeria

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***Abstract*- The study was conducted to evaluate the proximate, fibre fractions, mineral compositions and phytochemical screening of *Piliostigma reticulatum* pods obtained in the senatorial districts of Kebbi State. Three areas covering three grazing reserves were randomly selected from each senatorial district. In each area 50m x 50m plot size were measured and demarcated where there are uncultivated stands of the browse plant. Matured pods were harvested during the dry season of 2015 to 2016 (December to February) from selected plant stands in all the areas in each district and pooled together as a representative sample. Representative sample for each senatorial district were dried, milled and taken to the laboratory for proximate, fiber, minerals and phytochemical analysis. Data on the various components (crude protein, ether extract, ash, crude fibre, nitrogen free extract, fibre fractions and minerals) were subjected to analysis of variance using SPSS 20.0 (2015) software package. The results indicated that all the parameters measured for proximate composition and minerals were not significantly (P>0.05) affected by their locations with the exception of sodium and phosphorus. Kebbi North was significantly (P<0.05) higher in DM, CP, CF and NDFcompared to Kebbi South, while there was no difference (P>0.05) between Kebbi North and Kebbi South in Acid Detergent Fibre (ADF) and Acid Detergent Lignin (ADL). However, there was a significant (p<0.05) difference in the sodium content among the means. But no significant (p>0.05) differences occurred among Kebbi North and Kebbi Central. The highest potassium, sodium, calcium, magnesium and phosphorus contents were recorded in Kebbi North (5500mg/kg), Kebbi Central (106mg/kg), Kebbi South (1.45mg/kg), Kebbi South (1.95mg/kg) and Kebbi North (6.90mg/kg) respectively. The phytochemical screening of the Camel's foot pods revealed the presence of saponins, phenolics, tannins, flavonoids and alkaloids at moderate and trace levels. The pods of *P. reticulatum* obtained across the senatorial districts of Kebbi State have nutritive value which livestock can effectively benefit in their diet.***

***Index Terms*- chemical compositions, camel's foot pods, senatorial districts, kebbi state**

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## I. INTRODUCTION

The difficulty of animal feed availability in terms of quantity and quality are more severe in rangelands of arid, semi-arid and tropical regions with scarce and erratic rainfall that limits the growth of herbaceous species in this region [1]. The search for nutritionally balanced feed to make available to the livestock sector has stimulated investigation into many unusual sources of protein [2]. There is an increase interest in the rational utilization of potential livestock feed resources such as browse species that are adapted to tropical environments [3]. Browse plants are less subjected to seasonal variation than grasses in terms of nutrients content. Furthermore, their leaves are green at the end of the dry season, before the rains and before other forage plants appear. This occurs at a time when animals' need is maximal for feed of a high nutrient content, as they are grazing on low-quality grasses. Browse plants alone keep healthy animals in fair condition, but may be inadequate as the sole feed stuff. A mixture of several species for browsing is superior to a single species [4]. Much of the plant materials is high in protein, ranging from about 10 to more than 25% on dry weight basis, and is high in most minerals except phosphorus, which may drop to 0.12%. The crude protein of browse plants usually exceeds that of grasses by two-to four-folds, especially in the dry season when the content of the latter may drop to 3% or lower. Crude fiber content of most browse plants may be high, but not more than dry season grass or hay. Dry matter content ranges between 30-60% compared to 60-80% for the dry grass [5] [6].

Although considerable information now exists on the nutrients composition of most well known and easily cultivated legume crops in Nigeria [7], little or no information could however be obtained concerning the nutritional properties of Camel's foot pods which is not cultivated but well known and abundant in the grazing reserves and fallow areas of Kebbi State [8]. Camel's foot are useful sources of animal feeds [9] [10] [8] beside their multipurpose usage such as prevention of desertification, medicine, handcraft, allowing soil fixation and enhancing the restoration of rangelands [3].There is the need for continuous screening of indigenous browse plants in order to identify those with good potentials as livestock fodders which can thus serves as alternative to those conventional protein feed sources that have been evaluated [11]. The purpose of this work therefore is to chemically evaluate the proximate, fibre

fractions, mineral compositions and phytochemical screening of *P. reticulatum* pods obtained in Kebbi State.

## II. MATERIALS AND METHOD

*Study area*

The study was conducted in three randomly selected areas in each senatorial district of Kebbi State (north, central and south) during the 2014/2015 dry season. The State lies at the extreme North West corner of Nigeria on latitudes $10^0$ to $13^0$ $15^1$ and longitude $3^030^1$ to $6^0$ East. Annual rainfall ranges between from 550mm-650mm occurring between April and September. The mean temperature is $23^0$c, maximum is about $38^0$c and the minimum is about $18^0$c. The relative humidity ranges from 21-47% and 51-79% during the dry and rainy seasons respectively [12].

*Collection of samples and laboratory analysis*

Three (3) areas covering three grazing reserves were selected from each of the three (3) Senatorial districts of the State using a Stratified Purposive Random Sampling. In Kebbi north, Arewa, Shiko and Tsamia were selected. In Kebbi central, Dalijan, Hilema and Andarai were selected. In Kebbi south, Ribah, Birnin Yauri and Giron Masa were selected. A reconnaissance survey was conducted in the study areas to determine the population stands of camel's foot per hectare. Three sampled plots each measuring 50mx50m were randomly mapped out and demarcated on a 5km transect. Matured pods were harvested during the dry season of 2015 to 2016 (December to February) from selected plant stands in all the grazing reserves in each district, pooled and bagged together as a representative sample. Representative samples for each senatorial district after collection were dried, milled and taken to the laboratory for proximate, fibre fractions, mineral compositions and phytochemical determinations.

*Proximate components*

Thoroughly mixed representative samples of harvested pods from each senatorial district were analyzed for proximate composition according to [13] procedures to determine the Crude Protein (CP), Ether Extract (EE), Ash, Crude Fiber (CF) and Nitrogen Free Extract (NFE)

*Fiber fractions*

Thoroughly mixed representative samples of the harvested pods from each senatorial district were analyzed for fiber fractions: Neutral Detergent Fibre (NDF), Acid Detergent Fibre (ADF), and Acid Detergent Lignin (ADL) by the procedures of [14].

*Mineral compositions*

Thoroughly mixed representative samples of the harvested pods from each senatorial district were used to determine mineral elements. Sodium, Potassium and Calcium were estimated using emission flame photometer, while Phosphorus and Magnesium was determined using Atomic Absorption Spectrophotometer.

*Phytochemical screening*

Thoroughly mixed representative samples of the harvested pods from each senatorial district was used to determine the total Phenolics by the method described by [15], Saponins by the spectrophometric method of Brunner as described by [16], Flavonoids and Alkaloids by gravimetric method of Harbone, Tannins were determined by method of Maga as described by [17].

*Data Analysis*

Data generated were subjected to analysis of variance using SPSS 20.0 (2015) software package. Means were separated using the Duncan's New Multiple Range Test (DNMRT) at P=0.05.

## III. RESULTS AND DISCUSSION

*Proximate and fibre Compositions of Camel's foot pods in the Senatorial Districts of Kebbi State*

The results of the proximate and fibre fractions determination of *P. reticulatum* pods obtained from the Senatorial districts are presented in Table 1. The results indicated that all the parameters measured were not significantly different ($P>0.05$) between their means from one location to another. However, there were significant difference ($p<0.05$) in the ADF and the ADL measured across the areas. The crude protein contents of *P. reticulatum* pods obtained across the locations was within the range of earlier work of [18] who reported a range value of 7% to 13% CP for 17 preferred browse species by ruminants. The crude fibre recorded for all the values obtained in this work was higher when compared with those of most legumes seeds. High crude fiber content of *P. thonningi* seeds was also reported by [7].The values of the ether extract obtained in this work were lower than those reported by [9] who reported 27.9% in the seeds of *P. reticulatum.* This indicated that the pods of *P. reticulatum* are not oil fruits. The dry matter content of *P. reticulatum* in this study was higher than those of most legume seeds [19] [20]. This implies that the shelf life for this pod would likely be longer than those of most legume seeds. The ash contents (4.01%-4.52%) of the pods reported in this study were comparable with those of *P. reticulatum* seeds ($4.0\pm0.1$) as earlier reported by [9] whose values were however slightly higher than most legumes seeds reported by [21]. While the nitrogen free extracts content of 37.12-38.03% was within the range of other legumes, 23% in groundnuts to 66% in Bambara nut [22]. The values obtained for the NDF and ADF in this study were higher than those reported by [23] of 36.7% and 23.4% respectively. The ADL value reported was slightly higher than the mean of 17.5% for *P. reticulatum* pods [23]. The higher variations in the NDF and ADF of the pods in this study might be due to the differences in the stage of growth as earlier reported by [24]. Seasonality, differences in plant species, nutrient composition of the soil and site differences are known to be the major factors affecting the nutritive value of native pasture plants [25] [26].

Table 1: Proximate and fibre Compositions of Camel's foot pods in the Senatorial Districts of Kebbi State

| | Senatorial Districts | | | |
|---|---|---|---|---|
| Parameters (%) | Kebbi North | Kebbi Central | Kebbi South | SEM |
| Dry Matter | 91.11 | 91.56 | 90.17 | 2.88 |
| Crude Protein | 9.88 | 9.55 | 9.94 | 0.59 |
| Crude Fiber | 38.01 | 37.61 | 37.92 | 2.60 |
| Ether Extract | 8.81 | 9.00 | 9.11 | 0.69 |
| Nitrogen Free Extract | 37.12 | 38.03 | 37.72 | 1.83 |
| Ash | 4.21 | 4.01 | 4.52 | 0.67 |
| Neutral Detergent Fiber | 59.20 | 53.90 | 54.10 | 2.66 |
| Acid Detergent Fiber | $58.00^a$ | $52.80^{ab}$ | $48.80^b$ | 2.37 |
| Acid Detergent Lignin | $29.20^a$ | $26.70^{ab}$ | $18.20^b$ | 3.09 |

ab: means in the same row followed by the same superscripts were not significantly (P<0.05) different

*Mineral Composition of Camel's foot pod in the Senatorial Districts of Kebbi State*

The results of the mineral composition of *P. reticulatum* pods (Table 2) revealed a non- significant difference (p>0.05) in the potassium, calcium, magnesium and phosphorus contents among the means. However, the pods showed higher (p<0.05) levels of sodium and potassium but with low concentration of calcium, magnesium, and phosphorus across the senatorial districts. The range of calcium levels (0.95-1.45g/kg) obtained across the areas was within the level of 1.15g/kg DM recommended for adult sheep weighing 50kg live weight [27] [24]. The phosphorus levels obtained across the areas (5.80-6.91g/kg) were higher than the level (1.60-2.70g/kg DM) recommended for adult sheep [24]. The magnesium contents (1.20-1.95g/kg) of this study fell within the range recommended (1.00-2.00g/kg) requirements for different classes of ruminants [28]. The potassium concentrations obtained in this study are above the critical level (7.00-8.00g/kg) required for adult sheep [24] [29]. Trees and shrub legume forages are rich in most essential nutrients and minerals and tend to be more digestible than grasses and crop residues [30]. However, the observed differences in mineral composition in *P. reticulatum* pods across the study areas might be due to genetic factors, rainfall and soil composition [31].

Table 2: Mineral Composition of Camel's foot pod in the Senatorial Districts of Kebbi State

| | Senatorial Districts | | | |
|---|---|---|---|---|
| Parameters (g/kg) | Kebbi North | Kebbi Central | Kebbi South | SEM |
| Na | 103[a] | 106[a] | 80[b] | 5.64 |
| K | 550 | 500 | 500 | 0.00 |
| Ca | 1.05 | 0.95 | 1.45 | 0.24 |
| Mg | 1.40 | 1.20 | 1.95 | 0.29 |
| P | 6.91 | 5.80 | 6.45 | 1.26 |

ab: means in the same row followed by the same superscripts were not significantly (p>0.05) different

*Phytochemical screening of Camel's foot pod in the Senatorial Districts of Kebbi State*

The phytochemical screening of the Camel's foot pods (Table 3) revealed the presence of saponins, phenolics, tannins, flavonoids and alkaloids. However there was moderate amount of Saponins in the samples obtained from Kebbi central and south than those in the north. Likewise was moderate amount of Alkaloids in the samples obtained from Kebbi central compared to those in the north and south. This was in line with the findings of [32] who reported that the variations in the nutrient contents of browse plants might be due to plant parts, season, location, soil type and age. Some of these chemical compounds have been reported to have inhibitory effects on some gram negative bacteria such as *Escherichia colli* and *Bacillus subtilis* amongst others [33]. They also have prominent effects on animal systems and microbial cells [34] [35]. The main limitation to effective utilization of fodder trees as feed for ruminants is the high content of tannins and other anti-nutrients such as saponins, cyanogens, mimosine, coumarins etc which limit nutrient utilization [36]. The presence of some of these anti nutrients could however be reduced by various processing techniques such as drying, cooking, heating etc [21].

Table 3: Phytochemical Composition of Camel's foot pod in the Senatorial Districts of Kebbi State

| | Senatorial Districts | | |
|---|---|---|---|
| Parameters | Kebbi North | Kebbi Central | Kebbi South |
| Saponins | + | + | ++ |
| Phenolics | + | + | + |
| Tannins | ++ | ++ | ++ |
| Flavonoids | ++ | ++ | ++ |
| Alkaloids | + | + | + |

+ (Trace amount), ++ (Moderate amount)

## IV. CONCLUSION

In view of this study, it could appear that *P. reticulatum* pods obtained across the grazing reserves in the senatorial districts of Kebbi State have nutritive value which livestocks can effectively benefit in their diet. The pods are high in crude protein and most essential minerals such as calcium, magnesium and phosphorus above the minimum required by ruminants. The moderate and trace amounts of the phytochemicals of the pods can be tolerated by livestock without any negative effect. The pods can therefore be utilized as a cheap source of protein supplement for livestock especially during the dry season.

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