

Determination of proximate and phytochemical composition of African locust bean (*Parkia biglobosa*) forage



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Abstract

Browse plants is one of the cheapest sources of feed for ruminants and other farm animals. The leaf of African locust bean (*Parkia biglobosa*), a tree belonging to the family leguminosae was studied. The Locust bean foliage (LBF) was evaluated for the proximate and antinutritional factors. The proximate analysis showed that LBF had high crude protein (16.23%), dry matter DM (90.05%), crude fibre CF (21.36%), low fats (0.68%), ash (6.11) and soluble carbohydrate (55.62%). Anti-nutrients contents included oxalates (4.02 mg/100g), phytate (0.06 mg/100g), trypsin (0.44g/100g), saponin (2.80 mg/100g), cyanide (1.60 mg/100g), tannin (24.15 mg/100g) and alkaloid (6.70 mg/100g). The values obtained for the proximate composition may be an indication that LBF is a promising browse plants which could be fed to the grazing animals during the dry season, when fresh forages are scarce.

Keywords: Locust bean foliage, proximate composition, antinutritional factors,

Introduction

Browse plants is one of the cheapest sources of feed for ruminants and pseudo-ruminants. Shrubs and tree leaves are important component of diets of grazing animals and also played a significant role in nutrition of livestock in the tropical region. The leaves of the evergreen tree and shrubs are used as emergency source of feed by the ruminants in the semi arid region of Northern Nigeria (Njidda and Ikhimiya, 2010). They are potential source of fodders throughout the year, especially during the dry season when grassland and fresh pastures are not available. Foliage offer a considerable potential as major source of energy, proteins minerals and vitamins for herbivorous animals (Babayemi and Bamikole, 2006). Browse species, because of their resistance to heat, drought, salinity, alkalinity, drifting sand, grazing and repeated cutting, are the major feed resources during the dry season (Fagg and Stewart, 1994). Some parts of browse species can be found during the dry season including pods, fruits and leaves. Most trees

or shrubs produce their leaves during wet season, thus browse is more available during the dry season (Palgrave, 1983). Several indigenous and exotic browse species have been investigated and evaluated for inclusion in ruminant feeding systems in Nigeria. African locust bean (*Parkia biglobosa*) tree belong to the family Leguminosae, sub family Mimosoidae and genus *Parkia*. The Leaves alternate, dark green, bipinnate to 30 cm long, pinnae up to 17 pairs with 13-60 pairs of leaflets, 8-30 mm x 1.5-8 mm, of distinctive shape and venation. Leaflets held on a long rachis. The young seedlings are nutritious and heavily browsed by livestock. An important attribute of *Parkia biglobosa* trees is that most of their leaves remain green throughout the dry season and branches are lopped and used as fodder (Orwa *et al.*, 2009). *Pakia biglobosa* are known to contain high amount of essential nutrient, vitamins, minerals, fatty acid and fibre (Gafar and Itodo, 2011). The seeds are brown- blackish in colour, tasty seasoning which is rich in protein and are commonly

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used as condiment in local soups and as a dietary protein source (Wokoma and Aziagba, 2001; Achi, 2005; Chukwu *et al.*, 2010). Seeds and bark contain tannin, and the bark is used in tanning. The pulp is high in energy value and it contains between 60% - 66% carbohydrates. Afolayan *et al.* (2014) reported that the pulp is rich in essential vitamins and minerals and could be a potential source of energy in livestock ration. The pulp could also serve as natural yolk colorant in laying hens diets (Afolayan *et al.*, 2015). In order to explore the economic importance of the famous locust bean tree, this study is therefore aimed at evaluating the proximate composition and anti nutritional factors present in the locust bean foliage.

Materials and methods

Locust bean foliage used for this study was collected from the locust bean trees around the Livestock Section of the Samaru College of Agriculture, Ahmadu Bello University, Zaria. The college is located in the Northern Guinea Savannah zone of Nigeria (11° 11'N Latitude, 7° 38'E Longitude, 686 meters above sea level).

Sample preparation

Leaves were harvested from the locust bean trees. The leaves were air dried at room temperature for 72 hours. Sub sample of the dried leaves were then taken to the Biochemical Laboratory of the Department of Animal Science, Ahmadu Bello University, Zaria and were analyzed for proximate composition and anti nutritional factors.

Proximate analysis

The proximate analyses were done using the micro kjeldahl method of A.O.A.C. (1990) for crude protein. For crude fat, the samples were weighed into porous thimbles, 200ml of petroleum ether poured into a round bottom flask, a soxhlet

extractor fitted into it and placed on the heating mantle for 6 hours. The extracted oil or fat was concentrated in a vacuum oven and weighed to the nearest 0.1mg. For ash content, 1.0g of the dried sample was weighed into three crucibles of known weights. The crucibles with their content were covered and placed in a muffle furnace and ignited for 24 hours at 500°C after which they were cooled in a desiccator and the crucible weighed with contents. These procedures were repeated until a constant weight for each crucible was obtained. Crude fibre determination was done by weighing 2g of the sample into a conical flask and adding 150mL of 1.25% H₂SO₄. The mixture was boiled gently for 30 minutes while maintaining a constant volume. The content in the beaker was filtered and the residue rinsed with hot distilled water until it was acid free. The material was scraped into a flask for base digestion by adding 200mL of dilute boiling 1.25% NaOH and allowed to boil gently for 30 minutes while maintaining a constant volume. The mixture was then filtered, and the filtrate was washed thoroughly with hot distilled water until it was base free. The residue was rinsed once with 10% HCL and twice with industrial methylated spirit or ethanol. It was then dried in an oven at 105°C and weighed before it was ignited in a furnace at 550°C for 90 minutes then weighed again. The loss in weight of crucible and content after ignition was calculated as the crude fibre content. The carbohydrate content was determined as the difference obtained after subtracting total organic nitrogen, crude fat, crude fibre, crude protein and ash content from the total dry matter. The moisture content was determined by weighing 2.0g of the powdered sample into 3 empty crucibles of known weight. After weighing the crucibles with their content, they were placed in an

oven, dried at 105-110°C for 24 hours, cooled in a desiccator containing silica gel as a drying agent and weighed. The procedure was repeated until a constant weight was obtained for each sample.

Determination of antinutritional factors

The presence of antinutritional factors (oxalates, tannin, phytates, saponin, trypsin inhibitor, cyanide and alkaloids) was detected quantitatively by the standard methods as described by AOAC (1990).

Results and discussion

Table 1 shows the proximate composition values of the LBF. It is evidenced from the result that the LBF might be a promising browse plant and had adequate nutrients to meet the requirements of the grazing animals. However, the crude protein (16.23%,) value in the present study was slightly lower than 17.06% reported by Alalade *et al.* (2016) but in consonance with the value (16.45%) reported by Ladipo and Akinfemi (2004), which is relatively higher than 8% crude protein requirement of ruminant animals (Norton, 2003). Hence, LBF could be a potential source of

protein for the grazing animals. The LBF was high in crude fibre (21.34%) and slightly higher than the levels (15- 20%) recommended by Buxton (1996) for ruminant production. The variation may be due to differences in climate, locations and the analytical procedures used. The value (6.11%) recorded for ash in this study may indicate that LBF is a potential source of minerals for grazing animals. This is also in agreement with the findings of Okoli *et al.* (2001) who reported that the ash content in most browse plants falls within a range of 3.0 – 9.6%. The carbohydrate (55.62%) content in LBF is above average and is an indication that it could supply energy to support the growth and performance of grazing animals.

Generally, the presence of anti-nutritional factors in livestock diets causes physiological depression and decrease the bio availability of protein and energy thereby resulting in poor growth and performance. However, most of the values recorded for antinutrients contained in LBF in this study (Table 2) seems moderate and may fall within tolerance dose for livestock

Table 1: Proximate composition of locust bean forage

Nutrients	Composition (%)
Dry Matter	90.05
Crude Protein	16.23
Crude Fibre	21.36
Fat	0.68
Ash	6.11
Carbohydrate	55.62

Table 2: Antinutritional factors present in locust bean forage

Antinutrients	Concentration (mg/100g)
Oxalate	4.02
Phytate	0.06
Trypsin Inhibitor	0.44
Saponin	2.80
Cyanide	1.6
Tannin	24.15
Alkaloid	6.70

except for the tannin (24.15mg/100g) which is relatively higher but may not have toxic effect. Although, doses above tolerance level has the potential of causing fur loss in rabbits (Bailey *et al.*, 1999) and also react with proteins in taste buds of the mouth due to its astringents nature. The finding of Knight and Walter (2001) is in line with the results obtained for oxalates in this study. The author reported that renal damage due to deposition of calcium oxalates crystals in the renal tubules is usually not severe enough to cause death, and also <2% of oxalate has been reported as the safe level in ruminants. The value recorded for cyanide in this study is lower than the lethal dose (2.4mg/body weight) reported for ruminants. Saponin: the saponin content of the LBF is relatively lower than the values obtainable in other common feedstuffs such as lima beans (24.50 mg/100 g) and millet (19.47mg/100g) as reported by Osagie (1998). Ruminants can tolerate high dose of saponin in their diets, because of its beneficial effects such as defaunation, which has the potentials of increasing nitrogen utilization of the ruminant and may lead to an increase in growth, milk, or wool production (Elizerbeth *et al.*, 2005). Alkaloids: the alkaloids content in LBF (6.70mg/100g) is safe for ruminants and even pseudo ruminants (rabbits and swine) and lower than the value reported by Mainka *et al.* (2007). The authors reported no-observed-effect level (NOEL) between 0.60 and 4.66 mg/kg in pigs diets.

Conclusion

Results obtained from the study showed that LBF has high nutritive values and could be fed to rabbits and ruminant animals. It is high in crude protein (16.23%), dry matter (90.05%), crude fibre (21.36%) but has low fats (0.68%), ash content of (6.11) and soluble carbohydrate

(55.62%).

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