Nutritional Composition of African Locust Bean *(Parkia Biglobosa)* Husk as a Potential Feed Resource for Ruminant Animals

Ogunbosoye D.O.[1], Ishola J.T.[1], Majengbasan A[1]., Bashiru S.[2], Lukman A.[1] and Ogunsola F.O[1].

[1]Department of Animal Production, Kwara State University, Malete. [2]School of Agricultural Technology, Federal Polytechnic, Ayede, Oyo State.

Corresponding Author E-mail: olufunflory@gmail.com, jamiuishola@gmail.com

Abstract
The search for sustainable feed resources in livestock production has intensified due to rising feed costs and increasing demand for environmentally friendly alternatives. This study evaluated the nutritional profile of the African Locust bean (*Parkia biglobosa)* husk, an agro-industrial by-product, as a feed resource for ruminant livestock. The husk of African Locust Bean was analysed for proximate analysis, minerals and anti-nutritional components. Atomic absorption spectrometry was used in the determination of the levels of Ca and Mg, while the Flame photometer was used to analyse for K and Na. Anti-nutritional Factors, including trypsin inhibitor, oxalates, phytates, tannins and saponins were also determined using appropriate techniques. The findings showed the husk contained low (<5%) CP contents, high fibre, and appreciable quantities of important minerals. Proximate analysis revealed low crude protein (4.98%), moderate ash, and high fibre fractions, indicating its value primarily as a roughage base feed resource. Anti-nutritional screening identified tannins, saponins, phytates, oxalates, and alkaloids in tolerable ranges, suggesting limited risks when included at moderate levels. The findings support the waste valorisation of the African Locust bean husk as a sustainable input in small ruminant feeding systems, combining waste management with the maintenance of feed quality and production efficiency.

Keywords; Proximate analysis, *Parkia biglobosa* husk, ruminant nutrition, waste valorisation

Description of Problem

About 201,000 tonnes of *P.biglobosa* fruit are produced annually in Northern Nigeria alone [1, 2], a substantial quantity of the husk is regarded as waste, contributing to environmental pollution, with the extract finding purpose in the construction industry as a bonding agent between locally moulded clay tiles and the soil beneath [3]. Multiple research studies have been done on the seed and pulp of this plant; however, there is scanty information on the nutritional profile of the husk of the African Locust bean tree. This study was carried out to provide a scientific baseline information that could facilitate further research into the exploration of *Parkia biglobosa* husk as a potential alternative feed material for ruminant animals.

Materials and Methods

Collection and Preparation of Plant Materials

Fresh husks of *P. biglobosa* were collected from Otte village, Asa Local Government, Kwara State. The samples were identified at the Department of Plant and Environmental Biology, Kwara State University, Malete. The husks were oven dried at about 40 °C, the fibrous strands were removed by hand, and the husk was ground in an industrial blender into a lumpy powder. This powder was stored in an airtight bag at room temperature until the analysis was carried out.

Determination of Proximate Analysis and Mineral Content

The proximate analysis of the grounded husk powder was determined by standard methods [4]. The NDF, ADF, and ADL were analysed according to the procedures of Van Soest *et al.* [5]. Hemicellulose and cellulose contents were determined by calculation. The silica content was determined following the standard AOAC guidelines [4]. All proximate determinations were done in duplicates and on a dry matter basis. Atomic Absorption Spectrophotometry (AAS) [6] was used to determine the calcium and magnesium content, while Flame photometer [4] was used to analyse for potassium and sodium. The phosphorus content was determined following the spectrophotometric molybdenum blue method [7]. Iron, zinc, copper, manganese, and selenium were analysed using the AAS method [4, 8].

Determination of Anti-nutritional Factors

Tannin content was quantified by the Folin-Denis spectrophotometric method as described by AOAC [7] and modified by Makkar [9]. Saponin level of the sample was determined by the spectrophotometric method of Obadoni and Ochuko [1], and Alkaloid level was determined by the gravimetric method following the procedures of Harborne [10]. Phytate was assayed by the method of Wheeler and Ferrel [11]. Oxalate was measured following the titration method by Day and Underwood [12]. Trypsin inhibitor was estimated according to Kakade *et al*. [13]. Phenolic content was determined using the Folin-Ciocalteu colourimetric method [6, 14].

Results and Discussion

Proximate and Fibre Composition of African Locust Bean (*Parkia biglobosa)* Husk.

With a crude protein (CP) content of 4.98%, indicating that the husk is relatively low in protein compared with conventional protein-rich feedstuffs such as groundnut cake (45–50% CP) or soybean meal (40–45% CP), NRC [15]. Although the CP falls below the minimum dietary protein requirement of approximately 7% CP needed in ruminant diets to support optimal rumen microbial [5] activity, NRC [15], the husk can still serve as a basal roughage with supplementation by nitrogen-rich sources such as urea, legume forages or oilseed cakes. The ether extract fraction was low (<5%), which is consistent with the characteristic of fibrous crop by-products and suggests limited energy contribution from fat. This is nutritionally advantageous since excessive dietary fat (>7% of DM) has been reported to reduce fibre digestibility in ruminants [16].

Table 1: Proximate composition

Parameters	Value (%)
Moisture content	10.41
Crude protein	4.98
Ash	6.77
Crude fibre	47.78
Crude fat	2.63
Carbohydrate	27.43

Table 2: Fibre fraction composition

Parameters	Value (%)
Neutral detergent soluble	2.61
Neutral detergent fibre	97.41
Acid detergent fibre	85.01
Acid detergent lignin	80.25
Silica	3.99
Hemicellulose	4.76
Cellulose	12.4

Also, the crude fibre (CF) and neutral detergent fibre (NDF) fractions were high, consistent with the fibrous nature of seed husks. This high fibre content composition underscores its role as a roughage source that can stimulate rumination, saliva production, and buffering of rumen pH [5]. However, excessive fibre may limit voluntary intake and digestibility, indicating the husk should be incorporated as part of a balanced ration rather than as a sole feed resource.

Antinutritional composition of African Locust bean (*Parkia biglobosa)* husk

The anti-nutritional composition of *P.biglobosa* is highlighted in Table 3. Measured compounds included tannins, phytates, saponins, alkaloids, oxalates, trypsin inhibitors, phenolics, and triterpenes. The concentrations of tannins, phytates, and oxalates fall within the ranges reported for browses and unconventional feed resources [14, 17]. While these compounds may impair nutrient utilization when present at high levels, they have been reported to have shown selective modulation of the rumen microbial population [17, 18] resulting in an improvement of rumen fermentation and nitrogen metabolism, and a decrease in methane production and nutritional stress such as bloat or acidosis, thus improving the productivity and health of animals [11, 18].

Table 3: Antinutritional composition of African Locust bean (Parkia biglobosa) husk

Antinutritional factor	Value (%)
Tannin	0.018
Saponin	5.7
Alkaloid	4.73
Phytate	9.0
Oxalate	0.016
Trypsin inhibitors	0.008
Phenolics	11.99

Mineral composition of African Locust bean (*Parkia biglobosa)* Husk

The macro- and micro-mineral constituents of *P.biglobosa* are summarised in Table 4. The husk showed high levels of potassium, calcium, magnesium, and phosphorus, with appreciable concentrations of iron and zinc. These minerals are essential for growth, reproductive performance, and milk production in small ruminants [19]. The relatively high calcium and phosphorus values (2100.15mg/kg and 2979.74mg/kg, respectively) suggest that *P.biglobosa* could positively contribute to bone development, foetal growth and lactation in pregnant and lactating West African Dwarf (WAD) goats, provided anti-nutritional factors are brought within tolerable limits.

Table 4: Mineral composition of African Locust bean (*Parkia biglobosa)* Husk

Mineral	Value (mg/kg)
Calcium	2100.15
Potassium	3763.01
Sodium	1886.36
Phosphorus	2979.74
Magnesium	2300.53
Zinc	67.5
Iron	119.90
Selenium	0.058
Manganese	36.25
Copper	14.97

Conclusion and Application

This study concluded that the presence of secondary metabolites such as tannins, saponins, and phytates, while potentially limiting nutrient utilisation at high concentrations, may confer beneficial bioactive roles, including antioxidative effects, methane reduction, and modulation of rumen microbial populations when present at moderate levels. These findings underline the potential and application of husk as a low-cost, sustainable and alternative feed ingredient if it can be improved by solid-state fermentation.

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