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Evaluation of the Mineral Nutrients and Organic Food Contents of the Seeds of *Lablab purpureus*, *Leucaena leucocephala* and *Mucuna utilis* for Domestic Consumption and Industrial Utilization

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Abstract: Investigations were carried out on the mineral nutrients and organic food contents of seeds of three fodder *Lablab purpureus*, *Leucaena leucocephala* and *Mucuna utilis* for domestic consumption and industrial utilization. *Leucaena leucocephala* seeds contained the highest amount of lipids crude protein carbohydrates and ash contents. *Lablab purpureus* contained the lowest amount of lipid crude protein crude fibre and ash content. The seeds of *Mucuna utilis* has the highest fibre content. Seeds of *L. leucocephala* have highest mineral nutrient contents, which includes N, P, K, Ca, Mg, Mn, Fe, Cu and Zn. However the seeds of *L. purpureus* contained P, Cu and Mg in higher quantities than the seeds of *M. utilis* of the three seeds, *L. leucocephala* seeds contained the highest saponification value, least iodine and acid contents. Seeds of *L. leucocephala* were found to be good for consumption and the oil can be used industrially for soap making.

Key words: Mineral nutrient % organic food % domestic comsumption % forage % saponification

INTRODUCTION

Fodders are known as forages. These are crops grown primarily for feeding farm animals. Forages include *Lablab purpureus*, *Leucaena leucocephala* and *Mucuna utilis*. Growing animal legumes as manures for incorporation in the soil in rotation with other crops can have several beneficial effects. As a rule, the most important effect as assumed, is increase in the available nitrogen of the soil. Which is thought to form the rapid decomposition of buried plant materials [1]. This phenomenon will give rise to immediate recycling with a relatively low C:E ratio, which enables the microbes to rapidly fix nitrogen at higher rate [2]. Moreover, legumes are normally of better nutritive values than grasses because legumes have higher contents of protein, calcium, phosphorus and lower contents of fibres [3].

From present study, it is found out that research on forage legumes was negligible in the past. Hence, most works on this group of plants are recent especially in the 19th century. However, reasonable amount of research was carried out on forages in India [4]. These reseachers studied some varieties of Indian leguminous plants. Apart from being used as fodders, some of these legumes can serve as direct food for human consumption [5]. Other uses of these legumes, include their being used as pulp, lumber firewood and charcoal [6]. Some are used in the production of gum [7], while some could be used as warm expellers in contraceptives, abortion as well as in the making of necklaces and decoration of household items [8]. Literature shows that these seeds are of different origin, belonging to different sub-families of the family Fabaceae [9]. *Leucaena* originates from central America and Mexico [10] and is a member of the sub-family Mimosoidae, while *Mucuna* and *Lablab* belong to the sub-family papillionodae originating from Guinea and tropical Asia. It is likely that the fodders would contain organic food items and mineral nutrients which are not only useful to animals but to man as well. Hence, this investigation reports on the food and nutrient components of the seeds of *Lablab purpureus*, *Leucaena leucocephala* and *Mucuna utilis* for possible use in future as food for human consumption and industrial utilization.

MATERIALS AND METHODS

The seeds of *L. purpureus*, *Leucaena leucocephala* and *Mucuna utilis* were collected from Forest Research

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Institute of Nigeria (FRIN) in Ibadan. All the seeds sample wise were stored in sterile white polythene envelops and kept inside desicator to prevent attack by microorganisms.

Determination of food contents: The dry seeds of each sample were ground into powder form using pestle and mortar. The powder was sieved through a 0.002 mm wire mesh to obtain fine powdered forms. Each sample of the powdered seeds were kept in McCartney bottles and stored in the dessicator for analysis later.

Determination of the lipid content: The lipid content was determined using petroleum ether in soxhlet reflux extractor as described by Block [11].

Determination of carbohydrate contents: Four grammes of each of the powdered sample seeds were weighed into sterile filter paper and wrapped. Each sample was extracted with 100 mL of 80% ethanol for 12 h in a soxhlet reflux extractor. The extractions were then evaporated into dryness in a vacuum evaporator. The residues were then each dissolved in 5 mL of sterile distilled water for chromatography work using the method of Dubois *et al*., [12] and modified by Faparusi [13].

Determination of crude fibre content: The crude fibre content was determined using the Acid-base method of AOAC [14]. Two grammes of the powdered form of each seed sample was poured into measured sinister digesting thimbles of a tecator filler equipment. The thimbles were hooded after measuring the samples. Already boiled 30 mL Hcl solution was introduced into each of the thimbles through a funnel and allowed to digest for 30 min. Later 30 mL NaOH solution was introduced into each thimble and again allowed to digest for 30 min. The thimbles were washed with hot boiling distilled water. The thimbles were then removed from the hood and taken to the oven maintained at 100°C to dry before cooling in the desiccators. The thimbles were re-weighed and the difference between the final weight and the initial weight of the used thimbles was determined.

Determination of crude protein: Protein contents of the samples were determined using the method described by McKee [15], Osborne and Voogst [16].

Determination of saponification value: Two grammes of each oil sample was weighed into conical flasks 25 mL of alcoholic KOH solution was added. Reflux condensers were attached to each conical flask. The flasks were heated in boiling water for 1 h with frequent shaking. Ten milliliter of phenolphthalein (1%) solution was added to each solution in the conical flask. Each solution was titrated with hot 0.5 mL HCl to determine the saponification value. The experiments were replicated three times.

Determination of acid and iodine values: Two grammes each of the extracted oil were used for the determination of both the acid and iodine value using the methods described by AOAC [14] and Alabi *et al.*, [17].

Determination of mineral elements: The mineral elements were determined using the analytical method of determining mineral constituents of food products [18]. Samples obtained through ashing were used for this procedure which was the white fluffy mas. Five milliliter of concentrated hydrochloric acid was used to digest each ash content in a glass petridish. The mixture was transferred to 50 mL chemical flask using distilled water. Particles which cannot dissolve and would cause contamination were filtered off using Whatman's no. 1 filter paper in a funnel. The new filterate was made up to mark in readiness for mineral nutrient determination. The elements determined include Na, Ca, K, P, Mg, Mn, Fe, Cu and Zn. The determination was made using method described by Hack [18] standard reagents for the various elements to be determined were prepared. The series spectrophotometer was first warmed up for 30 min. Then, the standard reagent of the elements to be determined and distilled water were used to standardize the equipment. The samples contained in 10 mL cuvette was then introduced into the sample chamber where the samples were read and recorded.

RESULTS

The results show that *Leucaena leucocephala* seeds contain the highest amount of lipid, crude protein, carbohydrates and Ash contents. The values obtained were significantly higher ($p = 0.05$) than those obtained for *M. utilis* and *L. purpureus* seeds (Table 1). *L. purpureus* seeds contained low amount of lipid, crude protein, crude ash contents while seeds of *M. utilis* contained higher amount of crude fibre (Table 1). Seeds of *L. leucocephala* have the highest amount of mineral contents such as P, K, Ca, Mg, Na, Mn, Fe, Cu and Zn. The values obtained were significantly higher ($p = 0.05$) than those of *M. utilis* and *L. purpureus* (Table 2) *M. utilis* contained the highest amount of N (Table 2).

Table 1: Food analysis of *L. purpureus*, *L. leucocephala* and *M. utilis* seeds

Type of seeds used	Lipid content (%)	Crude protein content (%)	Carbohydrate content (%)	Crude fibre content	Ash content mg/100 g
Lablab purpureus	4.3±0.2c	1.14±0.22b	24.48±0.32c	10.5±0.80b	9.62±0.90c
Leucaena leucocephala	12.5±0.5a	8.40±0.15a	40.56±1.20a	4.33±0.26c	21.46±1.20a
Mucuna utilis	7.5±0.3b	1.42±0.23b	26.89±0.39b	13.96±1.00a	12.28±0.84b

Table 2: The mineral contents of seeds of *L. purpureus*, *L. leucocephala* and *M. utilis*

	Cations value mg/100 g					Non-ions value mg/100 g				
Types of seeds used	N	P	K	Ca	Mg	Na	Mn	Fe	Cu	Zn
Lablab purpureus	118.3c	167.0b	104.2c	14.8c	39.0b	8.8b	33.2c	214.4c	42.3b	42.3c
Leucaena leucocephala	338.0b	189.8a	137.3a	44.4a	44.6a	12.6a	52.6a	642.4a	55.0a	125.1a
Mucuna utilis	443.0a	105.0c	115.6b	22.0b	36.0c	8.8b	47.8b	239.1b	20.5c	61.5b

Table 3: The saponification, Iodine and Acid values of seeds of *L. purpureus*, *L. leucocephala* and *M. utilis*

	(mg/100 g)		
Seed types used	Saponification value	Iodine value	Acid value
Lablab purpureus	72.81±4.0c	13.85±1.5a	6.40±1.64a
Leucaena leucocephala	108.74±2.0a	4.90±0.6b	1.08±0.05c
Mucuna utilis	86.36±6.5b	14.96±1.62a	5.09±0.42ab

Each value is a mean of four replicates,
Figures followed by same alphabet along the columns are not significantly different at p = 0.05 using DMRT to separate the means

The seeds of *L. leucocephala* contained the highest saponification value followed by *M. utilis* and tailed by seeds of *L. purpureus*. The seeds of *L. leucocephala* contained the least amount of acid and iodine values, which are significantly less ($p = 0.05$) than those of *L. purpureus* and *M. utilis* (Table 3).

DISCUSSION

The presence of sugars in these seeds indicate that necessary materials needed to liberate energy during tissue respiration are readily available which guarantee readiness for energy supply in aid of seed germination. The presence of the various mineral nutrients such as Ca, Mg, K, N, Na, Zn, Cu, Fe and Mn are of biochemical importance to the physiology of the seeds. Nitrogen is a common constituent of protein synthesis, nucleic acid, RNA and DNA. Phosphorus is a constituent of co-enzyme NADH and NAD. Which are important energy producing units in biomembranes as in (ATP) Adenosine triphosphate. Calcium is important in cell-wall formation, and in the formation of cell membranes, lipid structures. Calcium is involved in normal mitosis thus, ensuring non-occurrence of abnormalities in seeds and plants [19]. Magnesium is an important constituent of chlorophyll molecule which ensures non-discolouration of young seedlings. Webster and Varnera [20], reported that potassium is essential as an activator for enzymes involved in the synthesis of certain peptide bonds. Iron functions in the synthesis of chloroplastic protein and may impair the machinery for chlorophyll synthesis [21, 22]. Manganese plays an important role in respiration and nitrogen metabolism, while copper acts as a component of phenolases, laccase and Ascorbic acid oxidase [19]. Zinc is involved in the biosynthesis of plant auxin-iodole-3-Acetic acid (IAA) and participates in the metabolism of plants as activator of growth [19]. Taking into consideration the various physiological contributions of these mineral nutrients to seedling development, it may be deduced that these seeds have enough materials to aid germination and growth if inhibitors are removed from the testa.

The oil contents obtained from *L. leucocephala* contain saturated fatty acid which would solidify as fats at a low temperature. The lipid content also have significantly high saponification value of 108.74 mg/100 g, which is higher than the recommended value of 100 mg/g by the British Pharmacopoeia [23] and Paranjpe [24]. The low iodine value is an indication that the fats are non-drying and would be good for cooking. The low acid value denotes its suitability for consumption. These observations are similar to that of Alabi *et al.* [25] and Ayelaagbe *et al.* [26].

From these studies it has been made clear that seeds of *Leucaena leucocephala* would be advantageous to man either for consumption and for small scale industrial set up in oil production.

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