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EFFECTS OF PROCESSING ON THE MINERAL CONTENT, PROXIMATE COMPOSITION AND PHYTOCHEMICAL FACTORS OF THE SEEDS OF *BAUHINIA MONANDRA* (KURZ)

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ABSTRACT
The mineral content, nutritive value and anti-nutritional factors in boiled seeds of Bauhinia monandra collected from the main campus of Ahmadu Bello University, Zaria, Nigeria were evaluated. Mineral content analysis revealed concentrations of Potassium 103.33mg/g, Iron 75.92mg/g, Calcium 56.55mg/g, Sodium 53.33mg/g, Phosphorus 47.60mg/g, Magnesium 43.33mg/g, and Zinc 01.11mg/g. Proximate composition of the seeds showed high crude protein in the boiled (25.75-31.69mg/g) and low crude fiber (7.11-10.75mg/g) in the raw samples. Phytochemical screening of the seeds showed that the concentration of Hydrogen cyanide, fluorine and sulphur levels reduced significantly (P<0.05) as the boiling times increased compared to the raw samples. The implications of the findings are discussed.

Key words: Bauhinia monandra, mineral content, proximate analysis, phyto-chemical screening, anti-nutritional factors

INTRODUCTION

The plant *Bauhinia monandra* (Kurz), (family: *Caesalpinaceae*) is an ornamental tree commonly found in West Africa and India (Daziel, 1955). In Nigeria, *B. monandra* is fairly widely distributed throughout the natural grassland of Northern Nigeria, stretching throughout the Savanna. It is a spreading tree with large leaves, pink and white flowers with one large anther which is elongated and sharply pointed, very persistent pods which split open by explosive mechanism (Keay *et al.*, 1989). Pods are flattened, leathery and green when fresh but brownish or black when dry. Seeds are ovate, compressed and dull brown.

The utilization of seeds rich in plant proteins as ingredients in diets meant for man and his animals will continue to be of interest. Generally, many plant proteins are low in one of the essential amino acids but a combination of plant proteins such as grains with pulse or seeds may give a high quality protein which is just as good as protein from animal foods (Anhwange *et al.*,2004). Several wild and domesticated seeds have varying quantities of mineral elements which are important as structural components for proper growth and functioning of animals. For instance, mineral elements such as calcium, magnesium, phosphorus, sodium and sulphur constitute the major structural components of the body organs, tissues and fluids, and serve as electrolytes concerned with the maintenance of osmotic pressure, acid base balance, membrane permeability, muscle irritability and oxygen transport. Mineral elements are also found in enzyme and hormone system, flowing through the integral and specific components of metalloenzymes or less specific activator of these enzymes (Reddy and Love, 1999).

The major constraints to the use of legumes as animal feed especially in its raw form, is the presence of toxic and anti-nutritional constituents. These constituents when present in high quantities have different effects on the animal's performance which include loss of appetite, reduction in dry matter intake and effect on protein digestibility (Anwa *et al.*, 2007). The proximate composition of seeds of some wild plants of Nigerian origin shows that they could be adequately used in the formulation of animal feed provided their level of toxic substances are reduced or eliminated (Eromosele and Eromosele, 1993). In view of these, the seeds of *B. monandra* which are abundant in Zaria area were analysed. This study reports the composition of essential mineral elements, the effect of boiling on proximate composition and the anti-nutritional substances present in the seeds of *Bauhinia monandra*.

MATERIALS AND METHODS

Seed Collection

Dry seeds of *Bauhinia monandra* were picked from the ground in Ahmadu Bello University, Zaria- Nigeria. They were collected, winnowed and bagged.

Seed Boiling

The seeds of *B. monandra* were divided into six portions and boiled at different times (0(T1); 10(T2); 20 (T3); 30(T4); 40(T5); and 60(T6)) minutes respectively. Boiling of seeds was carried out using an enamel pot which contained 125g of raw seeds in 1.50 liters of clean water for each portion of the seeds. The boiled seeds were air dried in the laboratory for seven days and thereafter milled to obtain a homogenous product, then stored in polythene bags before analysis.

Chemical Analysis

The mineral compositions of the seeds were determined using the method described by AOAC. (1980). Sodium and magnesium were determined by Atomic Absorption Spectrometry while sulphur and phosphorus were determined by standard colorimetric method (AOAC, 1980).

The proximate composition (moisture, crude protein, crude fibre, crude lipid and nitrogen free extract) of the seeds were determined using the standard methods of the Association of Analytic Chemist, (1980). Phytic acid was determined as described by Reddy *et al.* (1982), tannin and saponin (AOAC,. 1980), hydrogen cyanide (AOAC, 1995). All chemical analyses were carried out in duplicate.

Statistical analysis was carried using analysis of variance (ANOVA) and least significance difference (LSD) of the SPSS package to separate the means

RESULTS AND DISCUSSION

The concentrations of essential elements Potassium (K), Calcium (Ca), Sodium (Na), Magnesium (Mg), Zinc (Zn), Phosphorus (P), and Iron (Fe) are presented in Table 1. The concentration of potassium (103.33mg/g) was the highest then calcium (56.55mg/g) while that of zinc (01.11mg/g) was the least. This is an indication of high elemental composition in the seeds of *B. monandra.* These elements form part of the rigid body structure, soft tissue and body fluids of most vertebrates. Smith. (1986) states that essential elements such as calcium and phosphorus are needed for the building of healthy bones and teeth, while Fe assists in blood formation and their deficiencies cause muscle weakness and bone pain. Na and K maintain water balance in cells, they are important for nerve impulse transmitions and stimulation of normal movement of the intestinal tract. Glew *et al.* (1997) reported that magnesium is essential because it maintains, repairs cells and provides energy, and its deficiency may result in vertigo, convulsions, nervousness and heat palpitation. It also assists the muscles to keep reservoir of oxygen and increases the body's resistance to infection. Its deficiency results in anaemia, tiredness, insomnia and palpitations (Glew *et al.,* 1997). Generally, minerals work in combination with each other and other nutrients, therefore deficiency of any mineral may cause health problems (Anhwange *et al.*, 2004).

The proximate composition of the raw and boiled seeds of *Bauhinia monandra* is presented in Table 2. Treatments T1(raw) and T2 (boiled) had the highest crude protein levels of 31.69 and 27.25 respectively while T2 and T4 had the lowest fibre levels of 7.11 and 6.37 respectively. There was significant difference between the boiling times ($P< 0.05$). In this case, the effect of heat in reducing protein value of raw seeds was obvious. T1 (raw) had the highest crude protein level and its reduction via boiling for 10 minutes may be responsible for the slight decrease in the concentration of T2. The fibre content also decreased from T1 to T4 and then an appreciable increase from T5 to T6, thus showing that boiling process has an effect on the proximate composition. The ash content and nitrogen free extract reduced as the boiling times increased. Heat processing especially boiling (moist heat), have been reported to improve the digestibility of proteins by opening up their protein structure through denaturing (Abbey and Berezi, 1988). This might explain the noticeable difference between the raw and boiled samples which was significantly different ($P < 0.05$).

Heat (boiling) was found to reduce to a great extent, all the anti-nutritional factors. For instance phytate, tannin, hydrogen cyanide and saponin reduced significantly ($P<0.05$) as the boiling periods increased (Table 3). Shi *et al*. (2004) reported that portions of saponins dissolved in water were lost during soaking or boiling, thus suggesting that saponins are heat sensitive and concentrations in raw samples were higher than the boiled samples. Similarly, the levels of phytate and phytic acid of *Albezia lebbeck* reduced greatly by boiling (Anwa *et al*., 2007). Boiling Lima beans (*Phaseolus lunatus*) reduced the level of phytic acid in it (Abu *et al*., 2005). Anti-nutritional factors in most legumes prevent the digestion of proteins (Abu *et al*., 2005). Adequate moisture during processing facilitates destruction of the anti-nutritional factors while under heating produces incomplete inactivation of the anti-nutritional factors. Therefore, digestibility is enhanced by cooking and thus the metabolizeable energy value is increased (Faris and Singh, 1990).

Table 1: Composition of essential elements in the seeds of *Bauhinia monandra*

Elements	Concentration (mg/g)
Potassium (K)	103.33
Calcium (Ca)	56.55
Magnesium (Mg)	43.33
Sodium (Na)	53.33
Zinc (Zn)	01.11
Phosphorus (P)	47.60
Iron (Fe)	75.92

Table 2: Proximate Composition of raw and boiled seeds of *Bauhinia monandra*

	Treatments					
Composition	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**
Moisture(mg/g)	98.55^a	95.52^a	95.32^a	98.81^a	96.22^a	95.34^a
Crude protein(mg/g)	31.69^a	27.25^a	26.82^b	25.75^b	26.04^b	27.19^b
Crude fibre (mg/g)	9.81^a	7.11^b	7.97^a	6.37^b	9.47^a	10.75^a
Crude lipid(mg/g)	6.67^a	5.08^a	5.13^a	4.66^a	6.05^a	5.40^a
Ash	4.42^a	4.01^a	4.69^a	4.34^a	4.40^a	3.00^a
Nitrogen free extract (NFE)	56.21^a	56.46^a	55.55^b	58.92^a	54.05^b	53.75^b

Means with the same alphabets are not significantly different ($P>0.05$) at 5%

Key: T1 raw, T2 boiled 10min, T3 boiled 20 min, T4 boiled 30min, T5 boiled 40min, T6 boiled 60min.

Table 3: Levels of anti-nutritional factors of the raw and boiled seeds of *Bauhinia monandra*

		Treatments					
Anti-nutritional factors		**T1**	**T2**	**T3**	**T4**	**T5**	**T6**
Phytate (mg/g)		3.84[a]	1.82[b]	1.28[c]	0.84[c]	0.64[c]	0.60[c]
Hydrogen cyanide (mg/g)	3.48[a]	2.37[a]	0.82[c]	0.41[b]	0.40[c]	0.26[c]	
Tannin (mg/g)		6.03[a]	2.02[d]	1.84[d]	1.06[f]	0.82[f]	0.68[f]
Saponin (%)		4.02[a]	4.02[a]	4.00[a]	2.08[b]	1.68[b]	1.22[c]

Means with the same letter (s) along the rows are not significantly different (P>0.05) at 5%
Key: T1 raw, T2 boiled 10min, T3 boiled 20 min, T4 boiled 30min, T5 boiled 40min, T6 boiled 60min.

Virtually, all available ingredients of plant origin possess growth inhibiting factors which in most cases, form a shield effect on the protein molecule, thereby preventing the digestive enzymes from getting to them. This results in the passing out of all the proteinous molecules with the feaces undigested and hence making it unavailable for growth purposes (Eyo, 2003).These factors must then be eliminated or reduced to an in-significant level by special processing techniques to make them of maximum nutritional value.

CONCLUSION

The results of this study shows that *Bauhinia monandra* contains appreciable quantity of various minerals and high protein value, and boiling significantly reduced ($P < 0.05$) the levels of tannins, saponin, hydrogen cyanide and phytates in the seed, indicating that it could be utilized as a feed ingredient in the diets of culture animals.

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