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Some Anti-Nutritional and Mineral Contents of Extra – Cotyledonous Deposit of Pride of Barbados (*Caesalpina pulcherrima*)

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Abstract: The edible extra-cotyledonous deposit of Pride of Barbados (*Caesalpina pulcherrima*) was investigated for some minerals and anti-nutritional factors. Results obtained, showed that while phytohaemagglutinin was absent, vanadium was very poor in the extra-cotyledon of this legume. However, oxalate, trypsin inhibitor, phytate and polyphenol were found to be present at 18.09 ± 2.29, 0.28 ± 0.00, 96.40 ± 0.20 and 65.00 ± 0.02 mg/100g respectively. The sample was also found to contain the following essential minerals: iron (3.32 ± 0.09), zinc (3.59 ± 0.01), copper (1.36 ± 0.01), sodium (1.51 ± 0.04), potassium (6.22 ± 0.48), calcium (83.37 ± 0.24), Phosphorus (28.75 ± 0.37), magnesium (14.65 ± 0.24) and manganese (11.52 ± 0.13) mg/kg DM. Extra-cotyledonous deposit of Pride of Barbados is a good source of calcium and may serve as a cheap single source of a considerable number of essential minerals.

Key words: Anti-nutrients, minerals, extra-cotyledon, pride of barbados

Introduction

Pride of Barbados (Caesalpina pulcherrima) as a legume belongs to the family leguminosae (Elegbede, 1998; Prohp *et al*., 2004) which are known to contain biologically active principles. These anti-nutrient factors have adverse nutritional and physiological effects. According to Ihekoronye and Ngoddy (1985) some of these active principles interfere with digestive processes thereby preventing efficient utilization of the legume protein. Sometimes they are capable of precipitating deleterious effects in man and animals, with manifestable toxicity ranging from severe reduction in food intake and nutrient utilization to profound neurological effects culminating in death (Osagie, 1998). It has also been reported that tropical legumes contain a more complex array of these substances than any other crop species (Osagie, 1998). Minerals form an integral part of functionally important organic compounds such as iron (Fe) in haemoglobin or zinc (Zn) in insulin (Delvin, 1997). They are essential for the normal functioning of muscles, heart, nerves and in the maintenance of body fluid composition among others (White *et al*., 1973). Mineral deficiencies have manifested in forms of different disease conditions as goitre, rickets and one form of metabolic dysfunction or the other.

Extra-cotyledonous deposit of Pride of Barbados is the translucent coat over the cotyledon embedded under the green testa of the seed (Prohp and Maduemezia, 2004). Children and adults eat this part of the plant from time to time. However, it is not a staple food in Nigeria (Prohp *et al*., 2004). Earlier studies on some functional properties, nutrient potentialities, ash and moisture contents have shown that this edible part of Pride of Barbados (extra – cotyledon) may be a potential food supplement (Prohp and Maduemezia, 2004; Prohp and Alaiya, 2003). Recent report has shown that of all the legumes analyzed in Nigeria, so far, Pride of Barbados presumably has the lowest cyanide content in the extra – cotyledon as well as in other parts of the plant (Prohp *et al*., 2004).

In this work therefore, the aim is to determine mineral and some anti-nutritional contents of extra-cotyledonous deposit of Pride of Barbados with the view of further understanding its usefulness.

Materials and Methods

Pride of Barbados (Caesalpina pulcherrima) plants grown around Faculty of Natural Sciences, Ambrose Alii University, Ekpoma, Edo State, Nigeria were the sources of experimental specimen. The mature pods were dissected to reveal the seeds in lateral arrangements. About 500g were air dried, milled and sieved through 1mm diameter sieve of a Hammer Miller (Glen Creston 14-5805) before analysis.

Analytical procedure: The mineral constituents of air-dried material were determined after wet digestion with a mixture of nitric, sulphuric and perchloric acid using Atomic absorption spectrophotometer. Sodium and potassium contents were determined with flame photometer. (AOAC, 1975).

Determination of antinutrients: Trypsin inhibitor was extracted with 1M NaOH and determined spectrophotometrically at 280nm.

Oxalate was determined by the method of Ukpabi and Ejidoh, 1989). Phytate was determined by the method of Maga (1982) while polyphenol content was determined

Table 1: Some anti-nutritional contents of extra-cotyledonous deposit of Pride of Barbados (*Caesalpina pulcherrima*)

Anti-nutritional factor	Mg/100
Oxalate	18.09 ± 2.29
Phytohaemagglutinin	ABS
Trypsin Inhibitor	0.28 ± 0.00
Phytate	96.40 ± 0.20
Polyphenol	65.00 ± 0.02

ABS = absent. Values are mean + S. E. M. of three separate determinations

Table 2: Mineral contents of extra-cotyledonous deposit of Pride of Barbados (*Caesalpina pulcherrima*)

Minerals	Mg/kg DM
*Iron (Fe)	3.32 ± 0.09
*Zinc (Zn)	3.59 ± 0.01
*Copper (Cu)	1.36 ± 0.01
Cadmium	2.68 ± 0.00
Lead (Pb)	2.71 ± 0.14
*Sodium (Na)	1.51 ± 0.04
*Potassium (K)	6.22 ± 0.48
*Calcium (Ca)	83.37 ± 0.24
Vanadium	0.15 ± 0.01
Cobalt (Co)	11.26 ± 0.02
Nickel (Ni)	11.19 ± 0.18
*Phosphorus (P)	28.75 ± 0.37
*Magnesium (Mg)	14.65 ± 0.24
*Manganese (Mn)	11.52 ± 0.13

*Some essential minerals determined.
Values are mean ± S.E.M. of three separate determinations.

spectrophotometrically at 500nm using vanillin reagent on catechin substrate.

Phytohaemagglutinin determination: The agglutinability of a 3% rabbit red blood cell was used as a quantitative assessment of phytohaemagglutinin content. Haemagglutinin was extracted from a 40% w/v mixture of finely ground sample (425ug in phosphate buffered saline (PBS), pH 7.4). The mixture was shaken with a mechanical shaker for 5 minutes before filtering through cheesecloth. For determination, one drop of red blood cell suspension and one drop of PBS, was shaken in a circular depression and agglutinability recorded as weak (+) moderate (++), strong (+++), positive or negative (-) (Ihimire, 1997;Crichton and Walker, 1985).

Results

Table 1 and 2 are the results of some anti-nutritional and mineral contents of extra-cotyledonous deposit of Pride of Barbados (Caesalpina pulcherrima) determined. Phytohaemagglutinin was absent (Table 1) in extra – cotyledon of this legume which also has very poor amount of vanadium, and high calcium content (Table 2).

Discussion

The nutritional importance of a given food depends on the nutrient and anti-nutritional constituents (Aletor *et al.*, 1994). The values of phytate and polyphenol contents determined (Table 1) in extra-cotyledonous deposit of Pride of Barbados, were lower than 234.00± 3.60mg/100g DM (for phytate) and 15.10 ± 0.80mg/g DM (for polyphenol) as reported for raw lima beans and lima beans boiled for 160 minutes respectively (Egbe, and Akinyele, 1990). The level of oxalate recorded was below reported values for fresh (raw) samples of some tropical leafy vegetables like Manihot essulenta, Talinum triangulare, Crassocephalum biafiae and Celosia argentea (Aletor and Adeogun, 1995). Phytate, polyphenol and oxalate affect bioavailability of composite nutrients. They complex with bivalent ions like Ca^{2+}, Mg^{2+}, Fe^{2+} and Zn^{2+} making them unavailable especially in monogastric animals (Aletor and Omodara, 1994).

Extra-cotyledonous extract did not record any agglutination with 3% red blood cells or rabbit erythrocyte. Haemagglutinin, a toxic protein, found in soyabeans was absent in extra-cotyledonous deposit of Pride of Barbados. It is capable of imparting bitter or unacceptable taste when present in legumes alongside other anti-nutritional factors e.g. tannins, anthocyanins and phytates (Elegbede, 1998). The level of trypsin inhibitor obtained was low compared to that reported for Ife Bimpe, IT84E-124 and TVX716. The values reported were 2.11, 5.26, 3.16 and 2.11 mg/g respectively (Aletor and Aladetimi, 1989). However, the level of trypsin inhibitor detected in the sample was comparable to that reported for some vicia genotypes (Aletor and Adeogun, 1995). Trypsin inhibitor in high un-tolerable limit lowers the digestibility of legume proteins.

A total of fourteen minerals were determined in extra-cotyledonous deposit of Pride of Barbados. Calcium was predominantly present at 83.37 ± 0.24 mg/g (Table 2). However, the levels of the minerals recorded were lower than was reported in some leguminous browse plants like Cassasia alata, Cajanus cajan, and Cassia nodosa. (Aletor and Omodara, 1994).

In conclusion, extra-cotyledon of Pride of Barbados is a good source of calcium and also contains an appreciable number of some essential minerals. It may, therefore, be explored for inclusion as an addition to the existing nutritional supplements.

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