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Nutrient Contents of Pride of Barbados (*Caesalpinia pulcherrima* Linn.) Seeds

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Abstract: Physical parameters and nutrient contents of the whole seeds and seed nuts of *Caesalpinia pulcherrima* L. were determined using gravimetric, Spectrophotometric and titrimetric method of analyses. Organic matter was high in both whole seeds and seed nuts 93.78-95.50 %, followed by dry matter 90.95-92.70 %. Crude protein was between 42.97-48.08%, carbohydrate was found to be 18.30-39.10%, crude fibre was between 5.98-9.06 %, crude lipid 5.65-6.0 %, and moisture content was between 7.30-9.05 % in whole seeds and seed nuts respectively. Abundance of mineral elements in whole seeds and seed nuts of *C. pulcherrima* were found to be in the order: phosphorus > magnesium > sodium > potassium > calcium> iron. Sodium to Potassium ratio (Na/K) was 1.23-130 while Calcium to Phosphorus ratio (Ca/P) was 0.25-0.66 for whole seeds and seed nuts. The calorie value was 217.47-312.15 kcal/100g. The length of pod (LOP) was 9.28±0.03 cm, the breadth of pod (BOP) was 1.52±0.14 cm, number of seeds per pod (NOSPP) was 7.0±1 while the weight of seed was 1.07±0.16 g. There was no correlation between the LOP and the NOSSP at 95% with r= 0.52. *C. pulcherrima* could be a good source for low cost plant protein, good source for iron, as well as good source for calcium. The whole seeds were found to be richer in nutrients then the seed nuts expect for the mineral element phosphorus and magnesium.

Key words: Nutrient contents, *Caesalpinia* pulcherrima, pride of barbados, seeds

Introduction

Nutritional science is concerned with the research and discovery of new feeding materials, in the context of improving the overall quality of humankind's life. Most developed countries have advanced sufficiently in both the science of nutrition and medium income to no longer have sufficient nutritional problems. In developing countries like Nigeria, where the annual population growth rate is 3% (APAC, 1994) the situation is quite different. Thus the need for vigorous nutritional research with the view to discover new and affordable food sources for both humans and livestock.

Legumes are important major sources of plant protein and fats in tropical countries. They are good sources of essential amino acids and fats. Although the nutritional values of legumes is of great importance, their intake in not as expected (Ahmed *et al*., 2006). Importance of legumes could be viewed from two points i.e. positive and negative. The positive factors include high protein and lysine content, which allows legumes to serve as excellent protein supplements to cereal grains. Their positive effect on blood cholesterol through the dietary fibre cannot be overlooked. The negative factors could be grouped into; Antinutritional factors such as enzyme inhibitors, flatulence factors, polyphenols, tannin and phytic acid. Other negative nutritional factors include protein, carbohydrate indigestibility and sulphur amino acid deficiency (Ahmed *et al*., 2006).

The industrial use of legumes depends on the knowledge of their nutritional contents, and use of effective methods to remove or reduce their antinutritional properties. Processing techniques like soaking, cooking, germination and fermentation have proved to reduce some of the antinutritional factors in legumes (Mosha and Savanberg, 1990; lorri and Svanberg, 1995; WHO, 1998, Ahmed *et al*., 2006). Many workers (Olaofe *et al*., 1993; Adeyeye *et al*., 1999; Akintayo *et al*., 1998; Onwuliri and Obu, 2002; Adebowale and Lawal, 2004 and Aremu *et al*., 2006) have reported the compositional evaluation, functional properties, amino acids and protein solubility of some legume flours.

Pride of Barbados is in the genus of tropical green shrubs, which belongs to the fabacae bean family. Its common names include dwarf poinciana, Bird of paradise (Russel *et al*., 1997) and it is also known as *Waken bature* among the *Hausa* speaking people of west Africa. Pride of Barbados is a legume belonging to the legumimosae family, which is the second largest family among the dicotyledonous plants (Prohp *et al*., 2006). The plant is believed to have originated from Asia, but it is widely distributed in the tropics. It grows between 10 ft. to 12 ft in height and 6 ft. to 12 ft in width (Bailey, 1949). Pride of Barbados which is a highly medicinal

plant (Prohp *et al.*, 2006) like other legumes contains considerable nutrients.

The aim of this study was to determine the proximate and chemical composition of the whole seeds and seed nuts of *C. pulcherrima* for public and dietary awareness of its nutritional contents.

Materials and Methods

Collection and of samples: Brown ripe pods of *C. pulcherrima* were collected near the main gate of the University of Abuja mini campus, Gwagwalada Abuja Nigeria between the months of October and November.

Physical parameters and sample preparation: The length of pod (LOP), the breath of pod (BOP), the number of seeds per pod (NOSPP), and then the weight of seeds (WTOS) were measured. The seeds were then grouped in to two; one-half was set for drying under the sun, while the other was soaked in water for three (3) days to dehull. After which the dehulled seeds were dried under the sun. Both the dried whole seeds and seed nuts were ground into fine powder using a clean pestle and mortar for each. The collected powder was sieved and stored in clean-labelled airtight screwed top plastic containers until required for analysis.

Proximate analyses: The proximate analyses for moisture, dry matter, ash, organic matter, lipid (fat) content and crude fibre were carried out in triplicates according to the methods described by (AOAC, 1984). Nitrogen was determined by the micro-kjedahl method as modified by (Concon and Diane, 1973) and the nitrogen content was converted to protein by multiplying by 6.25 (Jeanette, 1987). Carbohydrate was determined by the Manual Clegg Anthrone method as described by (Osborne and Voogt, 1978). All proximate results were expressed as percentage of sample analyzed.

Estimation of energy value: The sample calorific value was estimated (in kcal/g) by multiplying the percentages of crude protein, crude lipid and carbohydrate with the recommended factors (2.44, 8.37 and 3.57 respectively) as proposed by (Martin and Coolidge, 1978).

Mineral elements analysis: Sodium (Na) and Potassium (K) were determined using the standard flame emission photometer using NaCl and KCl to prepare the standards (AOAC, 1984). Phosphorus was determined calorimetrically using the spectronic 20 (Gallenkamp, UK) as described by (Pearson, 1976) with KH_2PO_4 as the standard. Calcium (Ca), magnesium (Mg) and iron (Fe) were determined using Atomic Absorption Spectrophotometer (AAS Model SP9). Values are expressed in mg/100g.

Results and Discussion

Results for the physical parameters for the pods and seeds of *C. pulcherrima* shows that the mean length of pod (LOP) was 9.28±0.03 cm (n=50). This value was lower than 10.8 cm reported by (Hutchison and Melville, 1948). This decrease could be attributed to the difference in geographical location. The mean breadth of pod (BOP) was 1.52±0.14 cm (n=50) which were the same as those reported by (Hutchinson and Melville, 1948). Mean number of seeds per pod (NOSPP) in *C. pulcherrima* was 7.0±1.0 (n=50), the mean weight of seed was 1.07±0.164g (n=50). LOP and NOSPP were found to be correlated at α 95% with r = 0.52.

The results for proximate analyses of *C. pulcherrima* seeds (Table 1) shows whole seeds have higher moisture content (9.05±0.05 %) against seed nuts (7.3±0.1 %). These values were lower than 31.60±0.07 % obtained for *Gnetum africanum* (Afang) seeds (Ekop, 2007). The dry matter contents in both whole seeds and seed nuts of *C. pulcherrima* were high, between 90.95±0.05 and 92.7±0.1 respectively. Percentage organic matter was also high in both whole seeds and seed nuts (95.50±0.11 and 93.78±0.1 % respectively). This shows that the seed are rich in organic matter.

The ash contents which is an indicator for mineral elements was between 4.5±0.11% in whole seeds and 6.22±0.1 % in seed nuts, values were higher than those reported in *G. africanum* seeds (Ekop, 2007) and 3.2-4.6g/100g in Nigerian underutilized legume flours (Aremu *et al.*, 2006) but within the range reported for 104 legume seeds by (Prakash *et al.*, 2001).

Crude protein was 48.08±0.48 % in whole seeds and 42.97±0.37 % in seed nuts. These values were higher than those reported for *Acacia mellifera* (41.6%), *Bauhinina triandra* (42.7%), *Lathyrus odoratus* (42.8%), and soybean (42.8%) (Prakash *et al.*, 2001), hence qualifying *C. pulcherrima* as a good potential source for low cost protein.

The crude lipid in *C. pulcherrima* whole seeds (6.6±0.1%) and seed nuts (5.65±0.15 %) were higher than 3.15±0.1 % reported in *G. africanum* seeds, but lower than 22.8 -23.5% as reported by (Salunkhe *et al.*, 1985) for soya bean. These results confirmed the findings of (Ega, 1986) that whole seeds of legumes are richer than seed nuts in lipid contents.

The crude fibre contents of the whole seeds (9.06±0.15%) were higher than those in the seed nuts (5.98±0.36 %). Values obtained were higher than the range for legumes reported by (Parkash *et al.*, 2001) but lower than 29.00±1.23 % reported in (Hassan and Umar, 2006) for Balsam Apple (*Momordica balsami* L.) leaves. *C. pulcherrima* could not be a rich source of crude fibre because it fell short of the RDA for fibre in children, adults, pregnant and lactating mothers are 19-25%, 21-38%, 28% and 29% respectively (Ishida *et al.*, 2000). Since crude fibre is an important part of diet,

Table 1: Proximate composition of whole seeds and seed nuts of *C. pulcherrima* (%Dry matter basis) and Calorie (cal/g)

Parameter	Whole seeds*	Seed nuts*
Moisture %	9.05±0.05	7.30±0.1
Dry matter %	90.95±0.05	92.7±0.1
Ash content %	4.50±0.11	6.22±0.1
Organic matter %	95.50±0.11	93.78±0.1
Carbohydrates %	39.10±0.1	18.3±0.7
Crude lipid %	6.6 0±0.1	5.65±0.15
Crude fibre %	9.06±0.15	5.98±0.36
Crude protein %	48.08±0.48	42.97±0.37
Calorie value (kcal/100g)	312.15	217.47

* Mean ± Standard Deviation of three replicates.

which decreases serum cholesterol levels, risk of coronary heart disease, hypertension, diabetes, colon and breast cancer (Ishida *et al.,* 2000).

Carbohydrate contents in *C. pulcherrima* whole seed (39.10±0.1%) and seed nuts (18.3±0.7 %) were lower than carbohydrates in *G. africanun* seeds 87.62±004 % (Ekop, 2007) but within range reported for legumes by (Parkash *et al.,* 2001). Showing that *C. pulcherrima,* seeds are poor sources for carbohydrates compared to other food sources.

Calorie yields in *C. pulcherrima* whole seeds (312.15 kcal/100g) and in seed nuts (217.47 kcal/100g) were lower than 448. 83 kcal/100g in *G. africanum* seeds (Ekop, 2007) and 546.13 kcal/100g in the fish *Citharinus citharus* reported by (Abdullahi, 1999) in Nigeria.

The mineral composition in mg/100g of *C. pulcherrima* whole seed and seed nuts are presented in Table 2. The abundant minerals were Phosphorus (56.0-124.0 mg/100g) and Magnesium (58.50-69.50 mg/100g) followed by Sodium (40.50-49.50 mg/100g), Potassium (31.0 - 39.50 mg/100g), Calcium (30.50-37.50 mg/100g) and Iron (15.0-21.0 mg/100g) as the lowest. Mineral contents in this study were abundant in the order Phosphorus > Magnesium > Sodium > Potassium > Calcium > Iron, this was contrary to the order Magnesium > Calcium > Potassium > Phosphorus reported in (Aremu *et al.,* 2006) for Nigerian underutilized legume flours.

(Fleck, 1976), reported that calcium in conjunction with magnesium, phosphorus, manganese, vitamin A, C and D, chlorine and protein are involve in bone formation. From the results obtained, *C. pulcherrima* will serve as a good source for the minerals involve in bone formation.

Iron is an essential trace element for haemoglobin formation, normal functioning of the central nervous system and in the oxidation of carbohydrates, proteins and fats (Adeyeye and Otokiti, 1999). In this studies the amount of iron ranges between 15-21 mg/100g, this was higher than the range (4.3-119.1 mg/100g) found by (Sena *et al.,* 1998) in some underutilized vegetables of Republic of Niger showing *C. pulcherrima* as a good source of iron suitable to maintain daily balance as the adequate required amount is 1.00 mg/day (Bothwell *et al.,* 1989).

Table 2: Mineral composition in mg/100g of *C. pulcherrima* whole seeds and seed nuts

Mineral (mg/100g)	Whole seeds*	Seed nuts*
Sodium (Na)	49.50±0.05	40.50±0.05
Potassium (K)	39.50±0.05	31.00±0.01
Calcium (Ca)	37.50±0.03	30.50±0.15
Magnesium (Mg)	58.50±0.35	69.50±0.05
Iron (Fe)	21.0±0.01	15.0±0.05
Phosphorous (P)	56.0±0.04	124.0±0.01
Na/K	1.23	1.30
Ca/P	0.66	0.25

* Mean ± Standard Deviation of three replicates. Na/K = Sodium to Potassium ratio. Ca/P = Calcium to Phosphorus ratio

The ratios of Sodium to Potassium (Na/K) and that of Calcium to Phosphorus (Ca/P) are shown in Table 2. The ratio of Na/K in the body is of great importance in the control of high blood pressure. Na/K ratio of less than one is recommended, hence seeds of *C. pulcherrima* might not be good source for lowering blood pressure levels since they fall slightly above 1 (1.23-.130) as against the flours of Nigerian underutilized legumes which are very good sources of lowering blood pressure (Aremu *et al.,* 2006). Shills and Young. (1988) brought the concept of Ca/P ratio into light, because modern diets which are rich in animal proteins and phosphorus tend to promote the loss of calcium in urine. If Ca/P ratio is low i.e. more than normal, high amount of calcium may be loss in urine, resulting in a decrease in the calcium levels of bones. Nieman *et al.* (1992) considered a food source good if Ca/P ratio is above one and poor if the ratio is less than 0.5. *C. pulcherrima* whole seed gave a Ca/P value (0.66) which indicates it as a good source of minerals for bone formation, as against (0.25) for the seed nuts.

Conclusion: From the result of analyses, it can be shown that the whole seeds of *C. pulcherrima* have higher nutrient composition and calorie value than the seed nuts. It was also the same in terms of mineral elements composition in the exception of Phosphorus and Magnesium, which were more in the seed nuts. Hence given it a high Na/K ration than the whole seeds. Seed of *C. pulcherrima* also showed higher nutritional values compared to some legumes most especially in terms of crude protein, this will make them a good source of plant protein. They could also serve as a good source for iron and calcium required for healthy bones. However, may not serve as a good source for carbohydrates. If antinutritional studies could be carried out on the seeds suggesting ways of removing the antinutritional factors like in other unconsumed legumes, coupled with studies on possible integration with other food or feed supplements, *C. pulcherrima* could offer a good source for human and animal feed.

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