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Evaluation of Nutrient and Anti-nutrient Contents of *Parkia biglobosa* (L.) Flower

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ABSTRACT: Nutritional and antinutritional contents of *Parkia biglobosa* flower were analysed using standard analytical methods. On dry weight basis, the flower had the following proximate compositions; ash (6.50 ± 1.00%), crude lipid (4.66 ± 0.29%), crude protein (6.77 ± 0.15%), available carbohydrate (78.9 ± 1.18%) and crude fibre (3.17 ± 0.29%). The calorific value was 384.7 kcal/100g. Mineral analysis indicates that the flower contain some essential minerals such as K, Na, Ca, Mg, and Zn, but was low in Cu, Mn, and Fe. The flower has low concentration of anti-nutritive factors: phytate (1.41±0.24mg %); oxalate (0.03±0.01mg %); hydrocyanic acid (0.17±0.01mg %) and nitrate (1.32±0.10mg %). The values are below the reference toxic standard levels. Therefore, *P. biglobosa* flower could supplement the microelements requirement, energy and to some extent protein.

Key words: Wild plants, *Parkia biglobosa*, flowers, nutrients, antinutrients.

INTRODUCTION

Continuous search for new sources of food nutrients especially from plants becomes imperative because 30% of the population in developing countries are currently suffering from one or more multiple forms of nutritional deficiencies, especially micro-nutrients (WHO, 2000). The major nutritional problems in these countries are insufficient food intake, consequent upon high prices of food and unbalanced food intake (Latham, 1997). Igbedioh (1990) observed that improper food intake could be the possible cause of malnutrition among population groups. In order to arrest the situation, much attention has been given on the exploitation and utilization of unusual food plants especially edible flowers which can be a potential source of nutrient (Madhumita and Naik, 2010). Just like other plant parts, it has been shown by Zhigang *et al.* (2011) and Jiayi *et al.* (2009) that some edible flowers contain appreciable amounts of phenolic compounds which are responsible for their antioxidant activities. These activities prevent oxidative damage of biological molecule in human body which causes aging, stroke, diabetes and cancer.

P. biglobosa flower (Plate 1) commonly known as ñ*Bututun Dorowa*ò (Hausa language), is distinctively large bright red globe capitulum that compose of up to 2500 individual flowers arranged around a spherical bud. The capitulum measures 45-70mm long, 35-60mm in diameter and divided into two parts: apical ball and basal portion (Hopkins, 1983).

Plate 1: *P. biglobosa* flower

P. biglobosa flowers are used as food in North ï Western Nigeria especially by rural dwellers when mixed with groundnut cake and other ingredients to make a delicious salad. The flower is also eaten as it is by children. However, there is paucity of information on the nutrient composition of the flower and the nutrients contribution to the diet of

North-Western people of Nigeria. Such information are vital and need to be investigated and documented. In many countries especially Mexico, China, Japan etc, edible flowers are being used in drinks, jellies, salads, soups, syrups (Jiayi *et al*., 2009). It is for this reason that this paper addresses the nutrient and antinutrient contents of *P. biglobosa* flower to ascertain its contribution to the nutritional need of local populace.

MATERIALS AND METHODS

Sample Collection and Treatment

P. biglobosa flowers were obtained from branches of locust bean tree at Gidan Gada Village, Wamakko Local Government Area of Sokoto State, Nigeria. Identification of the sample was carried out at Botany Unit, Usmanu Danfodiyo University, Sokoto. The sample was oven dried at 70^{o}C, cooled in a dessicator and finely ground or used fresh for moisture analysis. The dried sample was used for the analysis except for moisture content determination in which fresh sample was used.

Proximate Analysis

Moisture content: Moisture content was determined by drying the sample to a constant weight at 105 ^{o}C according to AOAC (1990).

Ash content: Ash content was measured by calcination at 550 ^{o}C to a constant weight, according to AOAC (1990).

Crude Protein content: Nitrogen content was determined according to the Kjeldahl method and nitrogen value was multiplied by 6.25 as a conversion factor (AOAC, 1990).

Crude lipid content: Crude lipid content was determined gravimetrically after hexane extraction, according to AOAC (1990).

Crude fibre content: Crude fibre was determined by Acid-alkaline-gravimetric method following the AOAC method (AOAC, 1990).

Available carbohydrates: Available carbohydrate was estimated by difference using the relation:

100 - (% crude proteins + %crude lipid + % Crude fibre + %ash) (AOAC, 1990).

Energy content: Energy content was estimated in kcal/100g by the Atwater general factors system. The percentage available carbohydrate, crude protein and crude lipid were multiplied by 4, 4, and 9 respectively (Hassan *et al*., 2008).

Mineral Analysis

The minerals were determined after sample wet digestion with a mixture of $HNO_3/HCl_4O/H_2SO_4$ in the ratio 9:2:1 v/v, respectively. Ca, Mg, Fe, Cu, Zn, Cr, Mn, Co, and Pb were determined using atomic absorption spectrophotometer. The Na and K contents of the sample were determined using atomic emission spectrometer and phosphorus by colorimetric method (AOAC, 1990).

Antinutritional Analysis

The method of Ola and Oboh (2000) was adapted for the determination of phytate. Hydrocyanic acid was determined by the AOAC (1990) method. Oxalate and nitrate were determined by the methods of Krishna and Ranjhan (1980).

Data Analysis

The data generated were expressed as mean ± standard deviation of triplicate determinations.

RESULTS AND DISCUSSION

The results of the nutritional and antinutritional composition of *P. biglobosa* flower are summarized in Tables 1-4. The result of proximate analysis showed that the *P. biglobosa* flower has high moisture content of 75.5 ± 0.87% which is within the range (73.6 - 93.2 ± 2.6%) reported for some edible flowers (Richard *et al.,* 1996; Sotelo *et al.,* 2007; Madhumita and Naik, 2010).

Table 1: Proximate Composition (%) of *P. biglobosa* flower

Parameter	Concentration (% DW)
Moisture content	75.5 ± 0.87
Ash content	6.50 ± 1.00
Crude protein	6.77 ± 0.15
Crude lipid	4.66 ± 0.29
Available Carbohydrate	78.9 ± 1.18
Crude fibre	3.17 ± 0.29
Calorific value (kcal/100g)	384.7

All values are the mean of triplicate determinations expressed in dry weight basis ± standard deviation.

High moisture content of vegetable materials is responsible for their perishable nature due to association with the rise of microbial activities (Hassan *et al.,* 2009; Ruzainah *et al.*, 2009). The ash content of the flower (6.50 ± 1.00%) was low in comparison to 9.4% in *Colocasia esculenta* (Richard *et al.,* 1996), but within the range of 5.8 to 8.6% reported for some edible flowers (Sotelo *et al.,* 2007). The ash content gives an idea of the inorganic content of the sample from where the mineral content could be obtained.

The crude protein compares favourably with that of *Madhuca indica* flowers (6.67%) (Madhumita and Naik, 2010), and falls within the range of commonly consumed edible flowers (Sotelo *et al.,* 2007). However, the value obtained was relatively low when compared to 14.9% reported for *C. esculenta* flower (Richard *et al.,* 1996). Protein is an essential component of diet which supplies adequate amounts of amino acids (Pugalenthi *et al.,* 2004). As expected, the crude lipid was low (4.66 ± 0.29%). The value obtained is similar to that of *Aloe vera* (4.2 ± 0.9%) , *Euphorbia radians* (4.9 ± 1.7%) and *Arbutus xalapensis* (3.9 ± 0.5%) as reported by Sotelo *et al.* (2007) and 5.3% for *C. esculenta* (Richard *et al.*, 1996). The low lipid content of the plants is in agreement with general observation that vegetables are low lipid containing foods (Lintas, 1992). Also the flower had a low level of crude fibre (3.17 ± 0.29%) when compared with the flowers of *Erythrina americana* (17.3%), *Aloe vera* (13.8%), *Agave salmiana* (12.7%) (Sotelo *et al.,* 2007) and *C. esculenta* (20.4%) (Richard *et al.,* 1996). Fibre plays a role in the prevention of number of diseases by reducing the level of cholesterol. The *P. biglobosa* flower has high carbohydrate content (78.9%), which is comparable to 70.4% reported for *C. esculenta* flowers (Richard *et al.,* 1996). A higher carbohydrate content of feed is desirable while deficiency causes depletion of body tissue (Barker, 1996). The major function of carbohydrate is to provide the body with energy. The caloric value (384.7kcal/100g) is similar to 388.9kcal/100g reported for *C. esculenta* flower (Richard *et al.,* 1996), but higher than 34 kcal/100g in broccoli flower (Bushway *et al.,* 2006) and 111kcal/100g in *M. indica* flowers (Madhumita and Naik, 2010).

Mineral Composition

The concentrations of different mineral elements in *P. biglobosa* flower as presented in Table 2 indicate that the sample has high concentration of potassium, calcium, magnesium and sodium; while concentrations of other minerals were low.

Table 2: Mineral Composition (mg/100gDW) of *P. biglobosa* flower

Mineral	Concentration (mg/100g DW)
K	1766 ± 76.4
Na	139.2 ± 3.82
Ca	615.1 ± 0.31
Mg	196.2 ± 0.2
P	2.53 ± 0.01
Fe	9.1 ± 0.01
Cu	3.37 ± 0.01
Zn	17.8 ± 0.13
Cr	0.7 ± 0.01
Mn	5.3 ± 0.01
Co	0.7 ± 0.01
Pb	0.4 ± 0.01

All values are the mean of triplicate determinations expressed in dry weight basis ± standard deviation.

The potassium content (1766mg/100g) is high when compared to 325mg/100g in broccoli flower (Bushway *et al.,* 2006). The levels of calcium, magnesium and sodium were 615.1, 196.2 and 139.2mg/100g, respectively and were higher than respective values of 8.9, 3.6 and 104mg/100g reported for *C. esculenta* flower (Richard *et al.,* 1996). However, phosphorus, manganese, iron, zinc and copper levels were 2.53, 5.3, 9.1, 17.8 and 3.37mg/100g respectively which were lower than respective values reported in *C. esculenta* flower (4.9, 169, 303, 82 and 19mg/100g) (Richard *et al.,* 1996). *P. biglobosa* flower also contains a reasonable amount of chromium (0.7mg/100g), and cobalt (0.7mg/100g). Earlier studies on humans and livestock has shown that optimal intakes of elements such as Na, K, Mg, Ca, Mn, Cu, and Zn can reduce individualĝs risk factors for health problems such as cardiovascular diseases (Mertz, 1982; Sanchez-Castillo *et al.,* 1998). The concentration of lead in the flower was < 0.4mg/100gDW (0.098 mg/100g fresh weight), which is below the baseline concentration (0.18 mg/kg fresh weight) reported in some plants in remote and rural environments (Ogbuagu, 2008).

The lead provisional tolerable weekly intake (PTWI) was 0.025 mg/kg (equivalent to 0.214mg/day for 60 kg person) (Llobet *et al*., 2003). This is an indication that intake of the plant should be with caution so as not to exceed the PTWI limit. Lead like other toxic elements has tendency to bioaccumulate in the tissues and organs, where it causes havoc to the body. For instance, lead inhibit active transport mechanisms involving adenosine triphosphate (ATP), depress the activity of the enzyme cholinesterase, suppress cellular redox reactions and inhibit protein synthesis (Adeyeye and Ayejuyo, 1994).

Antinutritional Composition

Table 3 shows the levels of the antinutritional factors in the flower.The levels of antinutrients were below the permissible toxic levels (Birgitta and Gullick, 2000). Furthermore, this indicates probable lack of interference with the availability of mineral elements.

To predict the bioavailability of elements such as calcium, iron and zinc; mineral to antinutrients ratios were calculated and presented in Table 4. [Oxalate]/[Ca], [Oxalate]/[Ca + Mg] and [Ca][phytate]/[Zn] ratios are below the critical level that will impair calcium bioavailability (Hassan *et al.,* 2008). Even though it was reported that Zn is the most affected by phytate in animals and humans (Hassan *et al.,* 2008), [phytate]/[Zn] ratio was below the critical level to interfere with zinc bioavailability (Hassan *et al.,* 2008). [Phytate]/[Ca] is also low compared to the critical value known to cause calcium deficiency (Hassan *et al* 2008). For adequate iron bioavailability, Mitchikpe *et al.* (2008) argue that [phytate]/[Fe] ratio should not exceed 0.4. The ratio for the flower is below the critical value which indicates that the iron in the flower may be bioavailable.

CONCLUSION

From the result of the analysis, *P. biglobosa* flower contain enough essential nutrients like carbohydrate, calorific value, lipid, protein and mineral such as (Ca, Mg, Na, K, and Fe) that can serve as potential sources of food. The level of antinutrients (phytate, oxalate, HCN, nitrate) which interfere with digestion and absorption are all below the toxic level or daily intake. It can therefore, be concluded that the flower can contribute to the human nutrient requirement and could be used as a source of nutrients supplement.

Table 3: Antinutritional Composition of *P. biglobosa* flower

Parameter	Concentration (mg/100g DW)
Oxalate	0.03±0.01
Phytate	1.41±0.24
HCN	0.17±0.01
Nitrate	1.32±0.10

Data are mean ± standard deviation of triplicate result

Table 4: Anti-nutrient to nutrient molar ratio of flowers of *P. biglobosa*

Anti-nutrient to nutrient ratio	Ratio
[Oxalate]/[Ca]	2.17×10^{-5}
[Oxalate]/[Ca + Mg]	1.42×10^{-5}
[Ca][Phytate]/[Zn]	0.1
[Phytate]/[Ca]	1.39×10^{-4}
[Phytate]/[Fe]	0.01
[[Phytate]/[Zn]	7.9×10^{-3}

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