Available online at http://www.ajol.info/index.php/njbas/index
Nigerian Journal of Basic and Applied Science (June, 2012), 20(3): 195-198
ISSN 0794-5698

Full Length Research Article

Comparative Evaluation of Nutritional Composition of African Locust Bean (*Parkia biglobosa*) Fruits from Two Locations

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ABSTRACT: The most logical approach towards the improvement and efficient use of indigenous fruits to supply nutritional requirement for human diet is through the investigation of their nutritional values. This study was carried out to investigate the nutritional value of African locust bean (*Parkia biglobosa*) fruit collected from two different agro-ecological zones. The fruit was separated into outer yellow pulp and inner seed and were analyzed for proximate, vitamins and mineral contents. The result obtained from the study shows that locust bean pulp from rain forest vegetation had the highest value for crude protein (15.34%), crude fibre (19.45%) total ash (4.50%) and dry matter (91.1%). Locust bean pulp from derived savannah vegetation had the highest values in all the vitamin variables except vitamin E (18.07 µg/100g) and β–carotene (11.34 µg/100g). The result of mineral composition shows that locust bean pulp in the rain forest had the highest value in all the variables except Iron (29.85 mg/kg). Locust bean fruit collected from rain forest had the highest proximate and mineral value, while fruit collected from derived savannah had the highest proportion of vitamins. The study has shown that location significantly affects the nutritional composition of locust beans fruit.
Keywords: Comparative evaluation**,** *Parkia biglobosa,* nutritional value, rain forest, savannah

INTRODUCTION

The quality and quantity of nutrients present in the food consumed by people in developing countries is very low compared to the actual requirement from a balance diet for normal growth (FAO 2004). Rural dwellers in developing countries cannot afford animal products which are rich sources of protein because they are either too expensive or simply unavailable. This situation has made many people to depend mainly on carbohydrate diets; comprising cereal grains or starchy roots and tuber crops with low protein, thus leading to high level of malnutrition. In the quest of rural dwellers to increase the protein level of their food, many wild fruits have been found to be good alternative. In many communities in south west Nigeria, edible fruits from wild plants are often taken as food or added to food as condiment to supplement important minerals and vitamins in human diets (Olujobi, 2012).

The contribution of these wild edible fruits to the dietary need and nutritional requirement of people in the rural area cannot be overemphasized. Some wild fruits have higher nutritional values in term of protein compared, with the levels found in some cultivated fruits (Eromosele *et al.*, 1991 and Alabi *et al*., 2005). Fruits of most tropical trees are good source of minerals, fibre and vitamins and they also provide essential nutrient such as protein for human health (Ali and Deokule, 2009). Locust bean fruit is a good example of widely consumed wild fruit in Nigeria. Locust bean tree grows over a wide range of agro-ecosystem, from rain forest in the south to savannah in the north. In the search for plant protein and vitamin substitutes, Africa locust bean *(Parkia biglobosa)* seed has been found to be very useful especially in the fermented form and it is widely eaten among all the tribes across the country. However, the yellow dry powdery fruit pulp has not attracted much attention. Literature has revealed that the fruit pulp is used in rural communities in Africa during emergencies, when the grain stores are empty (Edem and Miranda, 2011). The pulp is also used as an ingredient in the preparation of various stews, and soups (Odebunmi *et al.*, 2010).

Recently the urgency of the world food problem has thrown a challenge not only to the agriculturist and nutritionist but also to the foresters, to investigate the possibility of utilizing product from wild plants as additional source of protein, fat, vitamins, minerals and energy. In order to guide the choice of the portion of wild fruits to be consumed and the provenance that will be very rich in term of their nutritional value, there is the need to chemically analyse the nutritional composition of these wild fruits. Hence this study was designed to determine the proximate values, vitamin and mineral composition of locust bean fruit from different agro-ecological zones.

MATERIALS AND METHODS

Sample collection and preparation

Matured locust bean pods were collected from two different agro-ecological locations in Ekiti State

Nigeria (Ikere – Ekiti in rain forest vegetation and Omuo - Ekiti in derived savannah vegetation). The fruit were collected at the onset of rainy season (April). The pods were sun-dried and the fruits were removed from the pod manually. The fruit yellow pulp was separated from the seed by scraping it off with the aid of a knife. Dehulling of the seed was done with aid of mortar and pestle to separate the cotyledon and the seed coat .The dehulled seeds were ground into powder using a blender. The yellow pulp was also dried and made into powder. Fine powders of both samples were obtained by sieving with 1 mm aperture and the samples were stored for laboratory analysis. Soil samples were collected from the two agro-ecological locations and were sun dried and stored for analysis.

Nutritional Analysis

Standard methods of the Association of Official Analytical Chemists (AOAC 2000) were used for determination of moisture, crude protein, crude fat, total ash and crude fibre contents of each sample. Moisture content was determined by heating 2.0 g of each fresh sample to a constant weight in a crucible placed in an oven maintained at 105 ^{0}C. The dry matter was used in the determination of the other parameters. Crude protein (% total nitrogen x 6.25) was determined by digesting 2.0 g of the sample using Kjeldhal method. Crude fat was determined by exhaustively extracting 5.0 g of each sample in a Soxhlet apparatus using petroleum ether (boiling point range 40 – 60 ^{0}C) as the extractant. Ash was determined by the incineration of 10.0 g samples placed in a muffle furnace maintained at 550 ^{0}C for 5 hours. Crude fibre was obtained by digesting 2.0 g of sample with 4.0 ml of 8% conc. H_2SO_4 and 40% NaOH and incinerating the residue in a muffle furnace maintained at 550 ^{0}C until constant weight was obtained. The minerals and vitamins were determined as described by AOAC (2000). Each analysis was carried out in triplicate. Student's t-test was used to test for the significant differences in the mean proportion of the various composition analysed in the fruit between the two location.

RESULTS

Chemical properties of the soil of the collection sites

The soils of the two collection sites are slightly acidic, with pH value of 5.90 in the rain forest and 6.50 in the savannah respectively. Organic matter and total nitrogen are relatively low in the rain forest soil but relatively high in the derived savannah soil. Available phosphorus and potassium are very low in the rain forest soil while in the derived savannah soil they are relatively high (Table 1).

Proximate, Vitamin and Mineral value of locust beans fruits as influenced by location

Crude fat is significantly higher (8.71%) in locust bean pulp from derived savannah than locust bean pulp from rainforest zone ($P < 0.01$). Also crude protein, crude fibre, total Ash and dry matter of locust bean pulp are higher in fruit collected from rainforest vegetation; however the values in the two vegetation zones are not significantly different ($P > 0.05$) (Table 2). Proximate value is significantly higher ($P < 0.01$) in locust bean seed collected from rainforest vegetation for all the parameters, except for moisture content which is higher in locust bean collected in derived savannah vegetation zone (7.06%). However, the result shows that dry matter content did not significantly different ($P > 0.05$) in both locations (Table 3).

The vitamin content of locust bean pulp did not differ significantly ($P > 0.05$) for all the variables in both rainforest and derived savannah vegetation zone (Table 4). However the values for vitamin B1, B2, C and D were higher in locust bean from the savannah vegetation while vitamin and E and β-carotene are higher in locust bean pulp from rainforest vegetation with 18.13 µg/100g and 11.37 µg/100g respectively. Vitamins C, D and E are significantly higher ($P < 0.01$) in locust bean seed collected from derived savannah vegetation (13.82 µg/100g, 66.10 µg/100 and 119.05 µg/100g) than locust bean seed collected in rainforest vegetation zone. The result however, shows that Vitamins B1, B2 and β-carotene (A) are not significantly different ($P > 0.05$) in both vegetation zones (Table 5).

The contents of calcium, magnesium and manganese are significantly higher ($P > 0.01$) in locust bean pulp from rainforest vegetation with a significantly higher content of iron (31.84 mg/kg) in locust been from derived savannah vegetation (Table 6). Calcium is significantly higher (1470.33 mg/kg), ($P < 0.01$) in locust bean seed from rainforest vegetation than locust bean seed from derived savannah vegetation. However, the values for magnesium, iron, and manganese, in the seed from both vegetation zones are not significantly different ($P > 0.05$) (Table 7).

Table 1: Chemical properties of the soil of the collection sites

Variables	pH(H_2O)	OC (%)	TN (%)	Avai.. P (ppm)	K (me/100g)	Ca (me/100g)	Mg (me/100g)
Rain forest	5.90	0.32	0.07	3.15	5.65	8.35	8.02
Derived savannah	6.50	1.20	0.42	7.15	21.08	1.94	0.67

OC = Organic Carbon; TN = Total Nitrogen Av. P = Available Phosphorus

Table 2: Proximate Value of Locust Bean Pulp (%)

Variables	Crude protein	Crude Fat	Crude Fibre	Total Ash	Moisture content	Dry Matter
Rain Forest	15.34 ± 0.34	8.1 ± 0.13	19.45 ± 0.38	4.50 ± 0.37	8.40 ± 0.39	91.1 ± 0.16
Derived Savannah	14.62 ± 0.35	8.71 ± 0.08	18.96 ± 0.16	3.94 ± 0.25	9.30 ± 0.34	90.48 ± 0.38
t-value	2.54ns	7.02**	2.04ns	2.16ns	3.04*	2.57ns

*Significant at 5%: **Significant at 1%: ns not significant

Table 3: Proximate Value of Locust Bean Seed (%)

Variables	Crude protein	Crude Fat	Crude Fibre	Total Ash	Moisture content	Dry Matter
Rain Forest	31.07 ± 0.27	23.22 ± 0.39	13.22 ± 0.24	7.20 ± 0.04	6.20 ± 0.13	93.25 ± 0.42
Derived Savannah	30.04 ± 0.18	21.71 ± 0.35	11.23 ± 0.44	6.39 ± 0.40	7.06 ± 0.17	92.74 ±0.05
t-value	5.54**	4.88**	6.87**	3.42**	6.89**	2.10ns

*Significant at 5%: **Significant at 1%: ns not significant

Table 4: Vitamin Content of Locust Bean Pulp (µg/100g)

Variables	**Vitamin**					
	B1	B2	C	D	E	**β-Carotene**
Rain Forest	0.10 ± 0.03	0.02 ± 0.01	5.00 ± 0.05	11.16 ± 0.38	18.13 ± 0.15	11.37 ± 0.26
Derived Savannah	0.12 ± 0.03	0.03 ± 0.01	6.19 ± 1.00	11.75 ± 0.03	18.07 ± 0.19	11.34 ± 0.21
t-value	0.67ns	1.00ns	2.06ns	2.65ns	040ns	0.14ns

ns = not significant

Table 5: Vitamin Content of Locust Bean Seed (µg/100g)

Variables	**Vitamin**					
	B1	B2	C	D	E	**β-Carotene**
Rain Forest	0.16 ± 0.08	0.04 ± 0.03	13.20 ± 0.04	62.90 ± 0.10	118.20 ± 0.20	158.07 ± 34.71
Derived Savannah	0.17 ± 0.02	0.06 ± 0.03	13.82 ± 0.05	66.10 ± 0.06	119.05 ± 0.12	185.99 ± 0.39
t-value	0.29ns	0.74ns	17.03**	48.50**	6.32**	1.33ns

**Significant at 1%: ns not significant

Table 6: Mineral composition of locust bean pulp (mg/kg)

Variables	Calcium	Magnesium	Iron	Manganese
Rain Forest	2398.33 ±1.53	45.90 ± 0.10	29.85 ± 0.17	35.30 ± 0.20
Derived Savannah	2287.59 ± 0.08	44.67 ± 0.15	31.84 ± 0.09	33.40 ± 0.02
t-value	125.4**	11.69**	17.43**	16.37**

**Significant at 1%

Table 7: Mineral composition of locust bean seed (mg/kg)

Variables	Calcium	Magnesium	Iron	Manganese
Rain Forest	1470.33 ± 4.50	30.60 ± 2.52	50.67 ± 2.52	34.15 ± 0.30
Derived Savannah	1428.12 ± 0.02	28.67 ± 0.06	53.19 ± 0.02	34.15 ± 0.03
t-value	16.21**	1.33ns	1.74ns	0.02ns

**Significant at 1%; ns not significant

DISCUSSION

The high proximate value obtained in locust bean fruit collected from rain forest could be due to the freshness of the fruit at harvest. The fruit of locust bean in the rain forest mature late and does not dry early because of the high humidity and low temperature, whereas the fruit collected from derived savannah were not fresh because of harsh climatic condition of the area during collection. This assertion is in agreement with the report of Nadro and Umaru (2004) that locust bean fruit collected during the rainy season contained higher proximate value than the one collected during the dry season. Lower values of vitamins B1, B2, C and D in fruit pulp collected from rain forest vegetation could probably be due to leaching by heavy rain (Miller and Hayes, 1982), since vitamins B1, B2 and C are water soluble (Nelson and Cox, 2000). The observed decrease in vitamin D agrees with the findings of Grandy and Yhakker (1980) who stated that vitamin D is susceptible to decomposition by high relative humidity and water.

Reduction in values of β carotene and vitamin E in the fruit pulp from savannah zone might be due to high temperature. This assertion corroborates the report of Nadro and Umaru (2004) that high temperature and oxygen can destroy vitamin A and E to yield epoxides and biologically inactive quinines respectively. The higher values obtained for the entire vitamin variables (Table 6) in locust bean collected from savannah might largely be due to better nourishment as the savannah soil is more fertile than the soil of the rainforest (Table 1). Because of the hard seed coat, environmental factors such as temperature and humidity may not have serious effect on the seed so as to affect the vitamin content.

The significant higher value of Ca in locust bean fruit pulp collected from rainforest might be due to the relative abundance of the minerals in rainforest soil. The significant higher Ca, value in locust bean seed could also be due to soil effect as observed for the pulp in rain forest vegetation zone. Similar result was obtained by Nadro and Umaru (2004).The significant low Fe value might result from abundant moisture which causes the iron to oxidize to form immobile $Fe_2O_3.\ xH_2O$ and then leached away by rain thereby making it unavailable to the plant.

CONCLUSION

It has been observed in this study that locust bean fruit contained in its different parts (pulp and seed), considerable amount of proximate constituents i.e. (crude protein, crude fat, crude fibre, ash and moisture content), vitamins (B1, B2, C, D, E and *B* carotene) and minerals (Ca, Mg, Fe and Mn) in varying proportions. The study reveals that the proportion of some of these components is significantly different in the fruits collected from rainforest vegetation and savannah vegetation. However, the result has also shown that locust bean fruit collected from rainforest vegetation contained higher proximate constituents and mineral than fruit collected from savannah vegetation zone, while vitamin content is higher in fruit collected from savannah vegetation. It is therefore concluded from the study that location significantly affects the nutritional composition of locust bean seeds.

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