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Nutritional Value of One Major Non-Timber Forest Product: *Irvingia gabonensis* Seeds from the South West Region of Cameroon

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ABSTRACT

The forest besides timber contains many useful goods and services of both subsistence and commercial values, known as non-timber forest products (NTFPs). These NTFPs sustain rural people and rural economies. NFFPs include all forest goods and services, excluding commercial timber. In this context, the part of *Irvingia gabonensis* on the NTFP market, are the seeds from the fruits of a tall and large deciduous forest tree from the family *Irvingiaceae*. The seeds are used in the preparation of diverse dishes. Despite this product's enormous support to the traditional Cameroon dishes, the nutritional value of these products has not been well investigated in the study area. In a struggle to step up investigations on these products, a study on the nutritive value of *I. gabonensis* from three different locations in the South West Region of Cameroon was carried out. The study made use of laboratory analyses. The following values were obtained for the three seeds; dry matter (DM; 92.58 ± 0.29 - 95.35 ± 0.17%), ash (5.43 ± 0.90 - 9.29 ± 0.95 g/100 g DM), lipids (55.02 ± 0.76 - 67.49 ± 0.03 g/100 g DM), crude proteins (7.98 ± 0.24 - 8.69 ± 0.26 g/100 g DM), carbohydrates (3.18 ± 0.20 - 10.60 ± 0.96 g/100 g DM), fibre (5.94 ± 0.07 - 11.64 ± 0.09 g/100 g DM), iron (0.26 ± 0.01 - 0.94 ± 0.04 mg/100 g DM) and vitamin A (499.73 ± 0.17 - 502.21 ± 0.29 µg/100 g DM). The nutritional value of the seeds depends on their location of origin. The high lipids content of the seeds implies the seeds can be considered as a good source of lipids.

Keywords: different localities, forest food, forest tree, *Irvingiaceae*, nutritive value
Abbreviations: DM, dry matter; **NTFP**, non-timber forest product

INTRODUCTION

The Millennium Development Goals commit most countries to reduce global poverty by half by 2015 (United Nations, 2000 Available online: http://www.monthlyreview.org/.../the-millennium-de). The tasks of meeting these goals are perhaps highest in forest-dependent communities in tropical countries, where poverty tends to be more pervasive and deeper than in urban and more favoured rural areas. According to the World Bank, approximately 90% of the poorest people of the world rely on forests, semi-woodlands, and grass fields for subsistence and income (Kaimowitz 2006). The forest, besides timber, contains many useful goods and services of subsistence and commercial value to its stakeholders, called non-timber forest products (NTFPs). Ndoye *et al.* (1998) and Falconer (1990, 1992, 1995) consider NTFPs as all forest goods and services, excluding commercial timber. In this context, NTFPs include such diverse products like animal parts, leaves, sticks, local building materials, edible fungi, medicinal plants, forest foods, sponges, chewing sticks, fibres, gums, oil and rattan canes, among others. Majority of the rural and urban households in developing countries rely on the forest for their nutritional and health needs (FAO 2008; Giliba *et al*. 2010).

Good nutrition is a basic right. In order to have a healthy population that can promote development, the relation between food, nutrition and health should be reinforced (Achu *et al*. 2005). In developing countries, one of the ways of achieving this good nutrition is through the exploitation of available local resources in order to satisfy the needs of the increasing population (Achu *et al*. 2005). Knowledge of the nutritive value of local dishes soup ingredients and local food stuffs is necessary in order to encourage the increased cultivation and consumption of those that are highly nutritive. This consumption of highly nutritive local food stuffs will supplement staple carbohydrates food to the poor who cannot obtain enough protein food of animal origin (Achu *et al*. 2005).

Irvingia gabonensis as a NTFP are the seeds from the fruits of a tall and large deciduous forest tree from the family *Irvingiaceae* that are collected or gathered from the secondary forests, fallows and farm lands; and processed into seeds for the market. This NTFP is widely distributed within the South West Region of Cameroon (Sunderland *et al*. 2002). These kernels are particularly used as a soup thickener as well as in the preparation of diverse dishes by households in the South West Region of Cameroon and these dishes complement other agricultural products (Nkwatoh 2000; Sunderland *et al*. 2002; Ewane 2010; Enongene 2011).

Despite this huge contribution of this forest food to the traditional Cameroonian dish, very few nutritional data are available on this forest food that occurs within the South west Region of Cameroon, however, their economic value is well documented (Sunderland *et al*. 2002; Nkwatoh *et al*. 2010). The purpose of this study is aimed at evaluating the nutritional value of *I. gabonensis* seeds from different localities within the South West Region of Cameroon. This will aid in the promotion of the use of the seeds of this forest food in the management of nutrition related problems in Cameroon in particular and in Africa in general. It consists of analyzing the moisture, total lipids, ash, carbohydrates, crude fiber, Iron, vitamin A and crude proteins of the seeds.

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Short Communication

MATERIALS AND METHODS

Collection and treatment of samples

Seeds of *I. gabonensis* were collected from 3 different locations within the South west Region: Kumba, Mamfe and Mundemba. The seeds were bought at markets in the respective locations and transported in separate sterilized plastic bottles to the laboratory. Samples from each location were ground using an electric blender. The grounded samples were placed in air tight bottles and stored in a desiccator for further analysis.

Assay

The moisture content was determined by the AOAC (1990) method where the stored samples were dried in an oven at 105°C to constant weight. The total lipids content were extracted in Soxhlet using hexane and were determined according to the Russian method described by Bourely (1982). The ash content was analyzed by incinerating the samples in a furnace at 550°C (AFNOR 1982). Total sugars were extracted respectively with water and by hot hydrolysis with hydrochloric acid, then the content in these sugars were evaluated according to the Fisher and Stein (1961) method. Crude proteins were mineralized by the Kjeldhal method (AFNOR 1981), and the nitrogen obtained was analyzed by the method of Devani *et al*. (1989). The crude proteins content was obtained by multiplying the nitrogen content by the conventional factor of 6.25. Fibers were determined by the method of Wolf (1968). Iron was determined by colorimetry according to the method described by AFNOR (1986) while the carotenoid content was determined by the spectrophotometric method of Wolff (1968) and that of De Leenheer *et al*. (1988). The carotenoid content was converted to Vitamin A using the Coultate (1988) conversion of 6 µg of carotenoid = 1 µg of Vitamin A.

Data analysis

To investigate the significant differences that existed among the samples with respect to their location of origin, a one-way analysis of variance (ANOVA) using Statsgraphics version 5.0 was employed with Sigma Plot.

RESULTS AND DISCUSSION

Fig. 1 shows the nutritional value of *I. gabonensis* seeds. Each circle represents the location of sample collection.

Water and total ashes content

The seeds of *I. gabonensis* are slightly hydrated with a dry matter content that range from 92.58 to 95.35% and total ash content that range from 5.43 to 9.29 g/100 g DM as summarized in **Fig. 1**. The total ash content of our seeds is higher than 2.48 g/100 g DM obtained for the seeds of the forest fruit *Cola parchycarpa* (Nwiisuator *et al*. 2012) but lower than 7.73 g/100 g DM obtained for melon husks (Ogbe and George 2012). The dry matter of our seeds is lower than that (99.98%) obtained by Matos *et al*. (2009) for the same product. The dry matter values obtained by the present study are indicative of the fact that the seeds are slightly hydrated and this low water content is advantageous for the preservation of this food product (Ahmed *et al*. 2010).

Lipids contents

The lipid value of the seeds studied range from 55.02 to 67.49 g/100 g DM, this compares well with the values obtained by Matos *et al*. (2009) (34.28 to 62.67 g/100 g DM) and Kengni *et al*. (2003) (44.3 to 68.4 g/100 g DM) for the same product. The seeds are richer in lipids than the seed of the forest fruit *Cola parchycarpa* (4.76 g/100 g DM) (Nwiisuator *et al*. 2012) and some oil seeds like cotton (13 g/100 g DM), soybean (14 g/100 g DM) (Nzikou *et al*. 2007), egusi (44.85 to 53.76 g/100 g DM) (Achu *et al*. 2005) and groundnut (47 g/100 g DM) (Atasie *et al*. 2009) and as well richer in lipids than the NTFP *Ricinodendron heudelotti* (37.7 to 55.5 g/100 g DM) (Kengni *et al*. 2003). Ogbe and George (2012) reported that melon husks contain 1.71 g/100 g DM of lipid. From this finding, our seed contains several times more of lipid than melon husks. The high lipid content of *I. gabonensis* seeds is important in diets as it promotes fat soluble vitamin absorption (Atasie *et al*. 2009). A one-way ANOVA at 5% level of significance revealed that a significant difference exists in the lipid content of the seeds from the different locations.

Crude protein contents

Protein values of the seeds ranged from 7.98 to 8.69 g/100 g DM, this value is similar to the value (8.71 g/100 g DM) obtained by Matos *et al*. (2009) obtained for the same product. Thus our seeds are richer in protein compared to the seeds of the fruits of *Cola parchycarpa* (3.67 g/100 g DM) (Nwiisuator *et al*. 2012) but are less rich in protein than certain oil seeds like; groundnut (38.61 g/100 g DM) (Atasie *et al*. 2009), egusi (61.87 to 73.59 g/100 g DM) (Achu *et al*. 2005), *Dacryodes edulis* pulp (34 g/100 g DM), sunflower (34 g/100 g DM) and soybean (40 g/100 g DM) (Nzikou *et al*. 2007). A one-way ANOVA revealed that no significant difference existed in the protein content of the seeds with respect to their location of origin.

Carbohydrates

The carbohydrate contents of our seeds ranged from 3.18 to 10.60 g/100 g DM and this compares well with the range of 7.4 to 13.5 g/100 g DM obtained by Kengni *et al*. (2003) but was lower than the value (15.77 ± 0.21 to 38.54 ± 0.78 g/100 g DM) obtained by Matos *et al*. (2009) for the same product. *I. gabonensis* seeds are thus less rich in carbohydrates compared to the seeds of *Cola parchycarpa* (76.24 g/100 g DM) (Nwiisuator 2012), melon husks (61.01 g/100 g DM) (Ogbe and George 2012), sweet pepper (56.3 g/100 g DM) (Hasan and Sayed 2011), cashew nuts (26.2 g/100 g DM), coconut (32.7 g/100 g DM), cottonseed (46.7 g/100 g DM), sesame (20.2 g/100 g DM) and sunflower seeds (26 g/100 g DM) (FAO 1982) but it is higher than that obtained for groundnut (1.81 g/100 g DM) (Atasie *et al*. 2009). A one way analysis of variance (ANOVA) revealed that a significant difference exists in the carbohydrate content of the seeds with respect to their location of origin.

Fibers content

The food fibers are defined as the sum of non starchy polysaccharides (cellulose, hemicelluloses, pectic substances) and lignins, which are mainly components of plant cell walls. The fibre value of our seeds ranged from 5.94 to 11.64 g/100 g DM as summarized in **Fig. 1**. This value was lower than that obtained by Kengni *et al*. (2003) (14.1 to 24.1 g/100 g DM) for the same product but is higher than that of some staple food like groundnut (3.7 g/100 g DM) (Atasie *et al*. 2009) and egusi (3.44 to 4.15 g/100 g DM) (Achu *et al*. 2005) and as well similar to the fibre content of melon husks (8.12 g/100 g DM) (Ogbe and George 2012) and the seeds of *Cola parchycarpa* (6.77 g/100 g DM) (Nwiisuator *et al*. 2012). The high crude fiber content of *I. gabonensis* indicates its ability to maintain internal distention for a normal peristaltic movement of the intestinal tract; a physiological role which crude fiber plays. Diets low in crude fiber is undesirable as it could cause constipation and such diets have been associated with diseases of colon like piles, appendicitis and cancer (Oniang'o *et al*. 2003; Atasie *et al*. 2009). A one-way ANOVA shows a significant difference exists in the fibre content of the *I. gabonensis* seeds from the different locations.

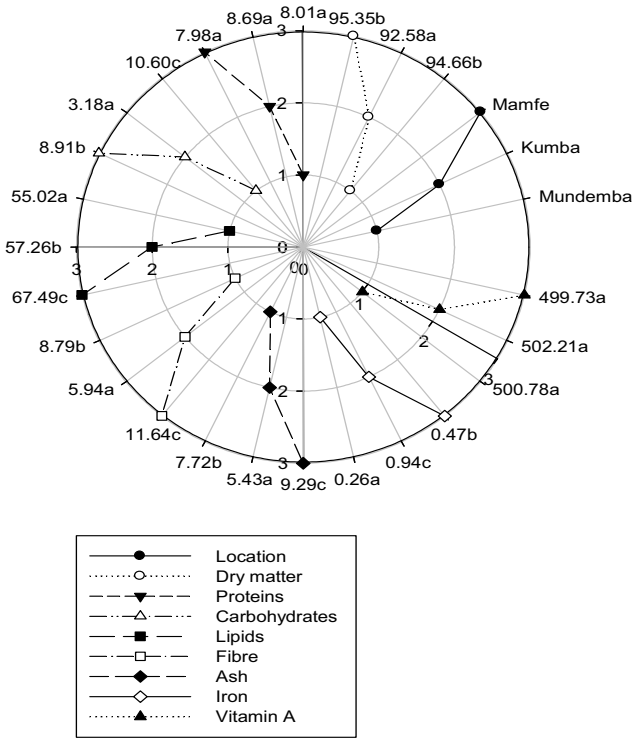

Fig. 1 Nutritional value of *Irvingia gabonensis* seeds. Analyses were carried out in triplicate (N = 3), mean values are shown; SD was always less than 20%. Different letters indicate significant differences according to Student's *t*-test ($P < 0.05$).

Iron and Vitamin A content

The Iron content of the seeds studied ranged from 0.26 to 0.94 mg/100 g DM, this value is within the range (0.19 to 47 mg/100 g DM) for that obtained by Kengni *et al*. (2003) for the same product while the vitamin A content of the samples ranged from 500.78 to 502.21 µg/100 g DM, this value is within the vitamin A range of 490 to 780 µg/100 g DM obtained for the same product by Kengni *et al*. (2003). Our seeds are richer in Iron compared to the seeds of *Cola parchycarpa* which has no iron content (Nwiisuator *et al*. 2012). The high iron content of the seeds aids in the formation of haemoglobin in the blood of humans.

The variation that exists in the nutrients of the seeds from different locations could be as a result of the difference in climate and soil types of the different localities where the seeds originated (Chapman *et al*. 2003).

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