INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print), 2222-5234 (Online)
http://www.innspub.net
Vol. 15, No. 1, p. 169-175, 2019

RESEARCH PAPER OPEN ACCESS

Composition analysis and nutritional impact of spontaneous food plants consumed in Daloa, region of Haut-Sassandra, Côte d'Ivoire: case of *Beilschimieda mannii* (Lauraceae) (Meisn.)

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Key words: Malnutrition, Chronically diseases, Côte d'Ivoire, Spontaneous food plants.

http://dx.doi.org/10.12692/ijb/15.1.169-175 Article published on July 06, 2019

Abstract

Malnutrition and micronutriment deficiences associated to emerging chronically diseases are serious public health in Côte d'Ivoire. The main roots are civilisation impact, and poor knowledge on traditional food consumed formulate by spontaneous food plants that for a long time flee the food base of our rural peoples. Examination of the fuctional properties of seed of *Beilschimieda mannii* were determined by proximate analysis AOAC. This study show that this plant is very rich in protein 32,58±0,11% and can provide energy-proteino diseases. Fiber is 13,54±1,70%. Carbohydrate contents are high with 87,54±1,70%. Compares to many foods rich in carbohydrates such as starchy foods from our typical diets. However, the lipid content is low with 13.5% which is interesting in order to avoid diseases related to the negative impact of oils on the proper functioning of the body such as hypertension due to the deposit of cholesterol in the blood vessels. With a Ph of 6.2 this food product is basic and helps to prevent aggression of the lining of the digestive system. In addition, this product is packed with many of the essential minerals cofactors of macromolecules such as proteins, carbohydrates and lipids. Calcium with 15, 76%, necessary for calcification of the skeleton bones, zinc with 5, 73%, iron 9, 20% and magnesium 8, 55%. A,ll of these minerals are important for the proper functioning of the human body. All these results suggest a recommendation of this product in order to effectively contribute to the nutritional disorder observed in our Ivorian communities.

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Introduction

Seeds of *Beilschmiedia mannii* (Lauraceae) are part of traditional non-timber forest products (NTFPs). These seeds are sold in local markets as ingredients for making typical sauces. They are consumed by certain populations in the forest regions of Côte d'Ivoire. They are rich in essential nutrients (carbohydrates, proteins, lipids) and minerals (Ca, K, Mg, Fe), which are important nutritional supplements in the often starchy diet of our mostly rural African people (*Foutou* to the plantain, *Foutou* yam, *Placali*, etc.) (Oulaï *et al.*, 2014).

In Côte d'Ivoire some plants, such as Ricinodendron heudolotii, are eaten for their aroma and organoleptic character (Saki *et al.*, 2005). Unfortunately, little research is done on spontaneous food plants in general.

However, better use of plant biodiversity based on a scientific evaluation of the properties of spontaneous food plants, methods of production would offer potentially valuable solutions allowing biodiversity to face the problems confronting contemporary society (N'dong *et al.*, 2007). Unfortunately, one of the major dangers facing our forest cover is agriculture for agricultural production and the achievement of food security. Many hectares of forest are thus transformed into plantations. Forest remains a reservoir of natural wealth (fauna, flora, biosphere ….) Scattered throughout the territory (Kouamé *et al.*, 2008).

The African and Ivorian forests in particular, contain extraordinary food potential, their nutritional knowledge could be useful in the face of the factor of impoverishment (Kouamé *et al.*, 2015). As a result, the food policies of our African countries to achieve the abundance of food products have replaced our traditional plants gradually with many exotic plants. In addition, faced with the mixing of civilizations and transhumance, the consumption of spontaneous food plants nowadays, is less and less common in many homes especially urban. The modification of food habits seriously impacting the well-being of many African peoples (Apema *et al.*, 2010). But knowing that it is possible to feed anywhere in nature reminded us of the importance; generous wild flora. Despite the simplification of feeding a large number of people to a limited selection of high-energy foods as a result of urbanization and socio-economic changes, there are unprecedented consequences for relative human health. Emerging diseases such as diabetes, hypertension, cancer, cardiovascular diseases (N'dong *et al.*, 2007).

Faced with this scourge, the search for an alternative strategy is essential to strengthen the nutritional status of urban and rural populations, an essential link in development (Dally *et al.*, 2014) .Thus, attempts to domestication of these non-wood forest products of plant origin would be considered only two decades ago.Germination tests of certain plants have been carried out in the areas of Tai west central of Côte d'Ivoire (Bonnetin, 2000) on the *attia: Coula edulis* (olacaceae) and the makoré, *Tigghemella hackellii* (Sopotaceae) with they had noticed the importance for the lives of indigenous peoples (Ouattara, 2006). ·Proceeded to the domestication of the guinea pepper or *Xylopia aethiopica* (Amoraceae) in the region of Divo, (Djahe et Gnahoua, 2014) in the West Central of Côte d'Ivoire. Diets in Côte d'Ivoire are generally based on the combination of sauces made with plant-based ingredients and the staple (carbohydrate) (Dally *et al.*, 2010).

The chemical and mineral determination has been studied to determine the nutritional potential of *Beilschmiedia mannii* in order to encourage them further in the diet of our modern societies and to cope with the many noncommunicable diseases.

Materials and methods

Beilschmiedia mannii, an undergrowth tree in the lowland rainforest, sometimes in swampy areas, often at the edge of rivers. Found mainly in primary and secondary evergreen forests.Dried raw or cooked fruits can be roasted, powdered and added as a condiment and enrichment to soups (sauces). They can also be cooked with carbohydrate foods or used as

a vegetable. The recommended methods of analytical association chemists (AOAC, 1990; AOAC, 1998) were used to determine moisture levels, ash, crude protein and raw fat.Moisture content was determined by heating 2 grams of constant weight samples in a furnace crucible (MMM Medcenter Gmbh (D-82152, Munich, Germany) maintained at 105 ° C for 4 hours. The ash was determined by incineration of 1 g samples placed in a muffle furnace (P Selecta, Spain) maintained at 550 ° C for 6 hours. The crude protein content (% total nitrogen × 6.25) was determined by the Khedjahl method (Tchachambe *et al.*, 2017) ·using 1 g samples. The crude fat was obtained by exhaustively extracting 5 g of each sample in a Soxhlet apparatus for 8 hours using hexane as the extractant (Enzonga-yoka *et al.*, 2011). Total carbohydrate (%) was estimated by difference as showing in the equation:

Total Carbohydrates (%) = 100 - [Proteins (%) + Fat (%) + Asch (%) + Fiber (%)].

Analysis of minerals

The minerals were extracted from the ashes by adding 20 ml of 2.5% HCl, heated in a steam bath to reduce the volume to about 7 ml, and this was quantitatively transferred to 50 ml of volumetric flask. It was diluted to volume (50 ml) with deionized water, stored in clean polyethylene bottles, and the mineral contents were determined using a spectrophotometric absorption atom (Perkin-Elmer, Model 2380, and USA).One grams of powdered sample were ashed 550°C for 12h in a muffle fumace. If ashing was incomplete, concentrated nitic acid (several drops) was added and the samples re-ashed for a further 6h at 550°C. The ashed sample were disolved in 6N HCL (5ml) with de-ionized water. The concentrations of iron, zinc, magnesium contents were ditermined in aliquots by Flame Atomic Absorption Spectrometry (ACTIUNICAM 929 serie GE 4999190) b (Bogmis *et al.*, 2018). For the determination of calcium, lat hanum (1%V/V) was added to both standarts and samples to suppress interference from phosphorus. Replicates of fod composites were analyzed to check on the homogeneity of portion sample from food and reproductibility of method. The accuracy of the method was ditermined based on the recommandations of the National Bureau of Standar (NBS, Nigeria Ochard Leaves Standard, Reference Material N° 1571).

Statistical analysis

All the analyses were performed in triplicate and data were analysed using EXCELL and STATISTICA 7.1 (StatSoft). Values were expressed as mean ± standard deviation (SD).

Results and discussion

Proximate nutritional composition

Beilschmiedia mannii dried fruit are free of water with a content of (3.7%). the nutrient concentration is high especially for proteins with an average content of 32.58%, a carbohydrate content of 36.78% and a fiber content of 13.54%, a lipid content of 13, 5% with an average pH for the product which is 6, 7.

(Table **1**).The analysis of the nutrient content of this product by adding dry matter shows that macronutrients are well represented especially for proteins as well as for fibers. In addition, the lipid and carbohydrate contents are not negligible.

Table 1. Proximate nutritional composition of the dried fruit of *Beilschmiediamannii.*

Nutrients	Ash	Dry weight	Proteins	crude fat	carbohydrate	crude fiber	Ph
Component %	4,2±0,10^{e}	96,30±0,25^{a}	32,58±0,11^{c}	13,50±0,15^{d}	36,78±1,78^{b}	13,54±1,70^{d}	6,2

Values are means ± SEf or five déterminations.Means with differents letters in a column within each independent variable are significantly different (p<0, 05).

The proximate composition of *Beilschmiedia mannii* studiesshow that the *Beilschmiedia mannii* containedcrude fat (13,5±0,15), protein (32,58±0,11),. It also contained (3,7%) in moisture, ash (4,2±0,10), crude fiber (13,54±1,70), carbohydrate by difference («36,78±1,78). Some these values were in agreement

with those reported by (Arogba, 1999; Achal, 2002).

Moisture content of *Beilschmiedia mannii* was (3, 7%.). This value fell within the range of mean values of moisture of legume (between 7, 0% and 11,0%) reported by (Arkoyed et Doug, 2006).

Seeds with low moisture content could store for a longer time without spoilage. Therefore, the moisture estimated in *Beilschmiedia mannii* was comparable to vales reported by (De melo *et al*., 2001) whereas the estimated obtained for *Cucurbits lanatus* and *Cucurbit mannii* were lower than reponted by (Badifu, 2001).

The differences observed could be attributed to intraspecies variability or procedures od drying seed (Enoch *et al*., 2004; Bankol *et al*., 2005).

Table 2. Mineral composition (mg/100g) of *Beilschmiedia mannii* dry fruit powder.

Nutriments	Ca	Mg	Fer	Zn
Composition %	15,76±0,55^{a}	8,55±0,41^{c}	9,20±0,21^{b}	5,73±0,04^{d}

Values are means ±SE for five déterminations. Means with differents letters in a column within each independent variable are significantly different (p<0, 05).

Ash content of *Beilschmiedia mannii* in study was (4,2±0,10). Previous studies show Ash content of kolanut, jackbeen and cowpea to be 3,1%, 3,6% and 3,2% respectivly (Arogba, 1999), and of cashew nut flour 4,4 ±0,1% (Aremu *et al*., 2006)·. Ash content of 1,5-2,5% for nut has been recommended for suitability as animal feeds (Pomeranz et Clifton, 1981). But with the value of Ash reportedin this study, *Beilschmiedia mannii* may be unsuitable for animal feeds. This is agreement with (Aremu *et al*., 2006)**.**

Crude fat content (13,5±0,15) was lower than those reported soybean seed (23, 5%) (Paul et Southgate, 1980). (Aremu, *et al*., 2006) reported 36,7% for crude fat in Cashew nut flour, this may be due to differences in the species of the Cashew nut and the environment in which they grow. Fat promotes the absorption of fat soluble vitamins hence it is very important in diet.

The value obtained for *Beilschmiedia mannii* is higher than these from studies reported by (National Research Council, 1974; De Melo *et al*., 2001), elsewhere cucurbits species consumed in Côte d'Ivoire. Certain plant oils, such as peanut oil, contain a high content of polyunsaturated acid which is beneficial for controlling cholesterolemia and protecting against cardiovascular diseases (Asibuo *et al*., 2008). Protein content (32,58±0,11%) is higher comparable to previous reports show that it is nutritiously rich (Achal, 2002). The proteins content of *Beilschmiedia mannii* analyzed suggests that it can be contribute to the daily protein need of 23,6g for adultsas recommended by the (National Research Council, 1974). Protein also plays a part in the organoleptic properties of food in addition to being a source of amino-acid (Okon, 1983). However, it is not enough for a meal to contain the required level of protein, it must also contain essential amino acids in balanced proportions (Taiwo *et al*., 2008).

Indeed, the organoleptic characteristics (taste, odor color and consistency) of spontaneous food products would not have disturbed their consumption by our rural indigenous population.

(Oumarou *et al*., 2012) confirmed in Niger, the improvement of the nutritional status of malnourished children from the tests of acceptability and effectiveness of complementary foods made with local products.

In addition, the cooking of plants contributes strongly to the strong reduction in the content of anti-nutritional molecules such as ptytates and oxalate (Wong *et al*., 2006)**.**The crude fiber of *Beilschmiedia mannii* (13,54±1,70%) compared favorably with the USDA nutrient database for the fiber range from 3,0-

3,8%. (Aremu, 2006) recorded a lower value (1,2±0,3%) for cashew nut flour.

Crude fiber facilitent l'hydratation des cellules (Afass, 2002). In addition, they helps the maintenance of normal peristaltic mouvement of the intestinal hence diet containing low fiber could cause constipation and eventualy lead to colon diseases (piles, cancer and appendicitis (Okon, 1983).

Value of carbohydrate (by difference) 1,4% is very low compared to expected range of mean values forlegumes (20-26%) of dry weigt (Arkoyed et Dougty, 2006). This could be due to the high levels of cruds fat and protein in the study sample. The results obtained were comparable to those from several studies which are realized on plants seeds consumed in Côte d'Ivoire which are generaly low in fiber and Ash content (Badifu, 2001; Onyeike et Achre, 2002).

Mineral composition

The contents of minerals are important and well represented for this product in particular in calcium (15.76%), in magnesium (8.55%), in iron (9.20%), and zinc (5.73%) which are essential in the physiological well-being of the body (Table 2).

Mineral component is showed that. Calcium content (15.76) is reported by (Umar *et al.*, 2007) in Ethiopian disches . magnesium with 8.55 ± 0.41%, zinc with , 73 ± 0.04%, iron with 9.20 ± 0.21%. This apparently low mineral content of this plant product remains appreciable compared to many other exotic food products grown.

Indeed, animal products would be good sources of minerals (Ulten *et al.*, 2005; Gibson et Fergusson, 1999). The making of these typical sauces could raise the low mineral content found in this food product *Beilschmiedia mannii*.

Conclusion

The chemical analysis of *Beilschmiedia mannii* reveals peculiarities of great nutritional interest.This food plant is an important resource for people, especially rural people.

The fruits of this spontaneous food plant are particularly rich in nutrient proteins necessary for the construction of the body. They also have appreciable and significant levels of minerals that play an important role in the movement of macromolecules (cofactors).

In addition, carbohydrate deficiency, which is a nutrient supplying metabolic energy, can be filled by the other ingredients used in the preparation of many dishes. An extension of *Beilschmiedia mannii* will necessarily pass through a good awareness of the rural population that city dwellers on the interest of this plant and the exploitation of potential nutritions of typical dishes.

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