Proximate composition and micronutrient potentials of *Dialium guineense* wild growing in Benin

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Abstract

*Dialium guineense* wild is a tree growing exclusively in tropical Africa. Fruits from this tree are consumed by populations since many centuries. So it takes part to satisfy their nutritional needs and display an historical role as nutrients provider. Nutrient composition of the fresh fruit pulps was determined using standard methods of AOAC and those of European norms. Like the other fruits, it emerges that the fruit pulp is rich in minerals with interesting values for iodine (04.34 ± 0.12 mg/100 g), iron (14.75 ± 0.25 mg/100 g), calcium (70.14 ± 10 mg/100 g) and potassium (366 ± 0.26 mg/100 g). Bio-molecules analyzes have shown a high content in total carbohydrates (80 ± 1.8 g/100 g) and crud lipid (09.21 ± 0.50 g/100 g).Crud proteins content is (6.12 ± 0.33 g/100 g). Ascorbic acid was found in the pulp (4.5 ± 0.01 mg/100 g) with 9.36 ± 1.36 g/100 g moisture content. This investigation sought to provide data on the fruit pulp composition for judicious dietetic and socio-economic uses.

Introduction

According to FAO’s evaluations, close to 870 millions people were underfed in 2010-2012 (FAO, 2012). The malnutrition by deficiency in micronutrients (“hidden hunger”) that touches about 2 billions of people (either more than 30% of the world population), has heavy consequences concerning public health. Minerals particularly have a prime importance in human body metabolism so their deficiency or excess are both harmful (Hashmi *et al.*, 2007). Fruits are known as excellent source of mineral and vitamins (Nahar *et al.*, 1990) and may permit to increase rural population food quality (Kunhlein, 1989). *Dialium guineense* with English name velvet tamarind or black velvet is one of the most consumed wild fruit in tropical Africa. The tree grows to about 20 at 30 m in height, low-branching, rarely straight, bearing a compact densely leafy crown but is often shrubby (Okegbile and Taiwo, 1990; Akoègninou 2006). In Benin, the plant is called “assonswen”among the Fon and “awin” by Yorubas. The fruit pulp is red with astringent flavour and is eaten raw when dry by man and animals (Matsuda, 2006). Some works have been reported on the fruit in Nigeria (Achoba *et al.*, 1992; Arogba *et al.*, 1994; Ubbaoou *et al.*, 2005; Adepoju, 2009) and Ghana (Ofosu *et al.*, 2013). There is limited or no information in the literature about the proximate composition of *Dialium guineense* wild growing in Benin where this plant is endangered (Meregini, 2005). It is therefore the aim of this study to corroborate its historic nutrient provider role by chemical analyzes in view to widen rural populace mineral source and preserve the plant.

Material and Methods

Sample collection and identification

The fruits of *Dialium guineense* have been harvested at the stage of maturity in Tankpé, Akassato and Glo from January to March 2013 while ripe fruits were available. Several samplings have been made to some weeks of interval. Samples from these three localities were submitted to the same analyzes in view to compare their results. Voucher specimen was deposited at the Benin National Herbarium for reference under the number AA 6462 / HNB. They have been kept at the laboratory in a dry aerated environment. Analyzes have been made on the pulp obtained before every manipulation by ridding the fruit of its coat and seed.

Chemical analyses

The fruit pulp from each locality has been analyzed in triplicate for moisture (AOAC 2003, Method: 950.46B), crude protein (AOAC 2003, Method: 990.03), crude lipid (AOAC 2003, Method: 920.39) and ash (AOAC 2003, Method: 942.05). Total carbohydrate was obtained using colorimetric...
method of Dubois et al. (1956) by adding phenol and sulfuric acid and readings taken on jenway RS 252 spectrophotometer. After calcination in a Nabetherm C 290 furnace (600°C) in crucibles made of china, the ashes have been diluted in hydrochloric acid (3 mol/l). Sodium and potassium have been measured out by spectrometry of flame with a Varian SpectrAA-110 apparatus. The measures have been preceded of cesium chloride’s (5%) addition. They took place respectively under steam-powered lamp of sodium or potassium and were compared with absorption of standards of these minerals. A molecular absorption spectrophotometer portable HACH DR /2400 permitted readings at 240 nm and 265 nm of the contents in total iodine and total iron respectively. DPD Total iodine reagent cat 14064-99 lot A 0257 from HACH PRMACHEM USA was added 3 minutes before iodine’s measure. Ferrover reagent lot A 1159 from HACH PERMACHEM has been used for iron measure. Complexometry with EDTA (Ethylene Diamine Tetra acetic Acid) served for dosage of calcium (NF T 90-016, August 1984) and magnesium (NF T 90-003, August 1984). Indicators of calcium ions (calver cat 917-99 lot A O313 HACH PERMACHEM USA) and magnesium (black eriochrome T) permitted to follow the reaction. Vitamin C in the pulp was determined by reverse titration with sodium thiosulphate and iodine using thiodene as indicator.

Statistical analysis

Data from three independent replicate trials were subjected to statistical analysis using Statistica version 6.0. Differences between means were tested using Z-test.

Results and Discussion

The mean elemental composition of the fruit pulp showed presence of calcium, sodium, magnesium, iron, iodine and potassium in varying quantities (Table 1 and 2). Because of the proximity of these localities, a great difference doesn’t appear in the fruits composition. However, the fruits reaped at Tankpè contained the most elevated values for iron and sodium while those of Akassato had the best contents in iodine and potassium. Calcium, magnesium and vitamin C levels were higher in samples from Glo. Iron, iodine and potassium in varying quantities showed presence of calcium, sodium, magnesium, phosphorus, zinc, manganese and copper contents were reported to be low (Adepoju, 2009). The same work showed that Dialium guineense had low moisture because it becomes dry during maturation.

Some considerable variations occur in food composition because of their biologic origin. These variations are the fact of endogenous factors (degree of maturity, genetic influence) or exogenous ones like temperature, sunshine and nature of soils (Paul and Southgate, 1988). However, despite a divergence of water and minerals contents, our results were globally in agreement with those published by Adepoju (2009) and Ofosu (2013) on Nigeria’s Dialium guineense and those of Ghana. Obviously, with 09.36% of moisture, median value between those reported (04% - 17.1%) (Arogba et al., 1994; Ubbbaonu et al., 2005; Adepoju, 2009), the pulp of the studied fruit here couldn’t be considered as refreshing in comparison with those consumed frequently (mangoes, oranges, pineapple, bananas).

In spite of the relatively weak value of crude proteins contained in the pulp (06.12%), the fruits of Dialium guineense are richer in proteins than the wild berries from British Colombia (Kuhnlein,1989), orange, strawberry and melon (Anon, 1960). This fruit therefore wear a particular aspect because fruits are generally not considered like sources of proteins (Edem et al., 1984; Ishola et al., 1990). This value was within the range (8.3% and 6.3%) stated in literature (Arogba et al., 1994; Adepoju, 2009).

The high level of total sugars (80%) was in the range of the values published early and explains the fruit sweetened taste. The sugars measured out here regrouped digestible carbohydrates as well as the food fibers little or nearly not energizing. A weak rate of these fibers (0.6%) being returned by Adepoju, the quasi-totality of sugars would then be digestible. The fruit is therefore indicated for children and people with hypoglycemia. The diabetics, on the other hand, should avoid some or limit the consumption (Table 3 and 4).

Vitamin C content of the pulp was close to those (1.8 - 6.2 mg/100 g) returned in the literature (Wu Leung, 1968; Eremosele, 1991). It places the fruit of D. guineense to the rank of good sources of vitamin C and its consumption can contribute to satisfy the journal requirement that is 90 to110 mg (Marieb, 1999). The importance of this vitamin resides otherwise in its antioxidant power (Vojdani et al., 2000; Laight et al., 2000; Masaki et al., 2010) inhibiting the ominous effect of free radicals on the DNA. It is indispensable for iron absorption; claves repair and blood vessels.

<table>
<thead>
<tr>
<th>Table 1. Minerals and vitamin C composition of Dialium guineense (D. g.) growing in Akassato,Glo and Tankpè</th>
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<tbody>
<tr>
<td>D. g. of Akassato</td>
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<tr>
<td>Vitamin C [mg]</td>
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<tr>
<td>Calcium [mg]</td>
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<tr>
<td>Magnesium [mg]</td>
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<tr>
<td>Iron [mg]</td>
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<tr>
<td>Iodine [mg]</td>
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<tr>
<td>Sodium [mg]</td>
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<tr>
<td>Potassium [mg]</td>
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n = average of three independent samples, analyzed in triplicate. Means in the same line followed by different letters are significantly different (p < 0.05)
Table 2. Average of vitamin C and minerals of D. g. growing in Benin

<table>
<thead>
<tr>
<th>Dialium guineense wild growing in Benin</th>
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<tbody>
<tr>
<td>Vitamin C (mg)</td>
<td>04.58±0.01</td>
<td></td>
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<tr>
<td>Iodine</td>
<td>04.34±0.12</td>
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<tr>
<td>Iron</td>
<td>14.75±0.25</td>
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<tr>
<td>Magnesium</td>
<td>30.84±5.6</td>
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<tr>
<td>Calcium (mg)</td>
<td>70.14±10</td>
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<tr>
<td>Potassium</td>
<td>366±0.26</td>
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Table 3. Proximate composition of D. guineense growing in Akassato, Glo and Tankpè (g /100 g edible portion of fruit pulp)

<table>
<thead>
<tr>
<th></th>
<th>D. g. of Akassato</th>
<th>D. g. of Glo</th>
<th>D. g. of Tankpè</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture</td>
<td>7.17±1.4b</td>
<td>13.13±1.38a</td>
<td>99.8±1.6a</td>
</tr>
<tr>
<td>Ashes</td>
<td>1.5 ±0.04 a</td>
<td>1.72 ±0.05 b</td>
<td>1.89±0.06c</td>
</tr>
<tr>
<td>Total carbohydrate</td>
<td>78.4±3.3 a</td>
<td>81±1.2 a</td>
<td>79.7±1.4 a</td>
</tr>
<tr>
<td>Crude lipids (g)</td>
<td>8.66±0.4 a</td>
<td>9.66±0.2 a</td>
<td>9.33±0.30a</td>
</tr>
<tr>
<td>Crude proteins (g)</td>
<td>6.17±0.46 a</td>
<td>5.77±0.3 a</td>
<td>6.43±0.23 a</td>
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</tbody>
</table>

Table 4. Average of ashes, moisture and bio-molecules of D. g. growing in Benin

<table>
<thead>
<tr>
<th>Dialium guineense wild growing in Benin</th>
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<tbody>
<tr>
<td>Moisture</td>
<td>09.36±1.36</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ashes</td>
<td>01.70±0.05</td>
<td></td>
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</tr>
<tr>
<td>Total carbohydrate</td>
<td>80±1.8</td>
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</tr>
<tr>
<td>Crude lipid</td>
<td>09.21±0.50</td>
<td></td>
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<tr>
<td>Crude protein</td>
<td>06.12±0.33</td>
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The abundant presence of sugars in the pulp of Dialium guineense fruits makes of it a good supplier of this nutriment quickly usable by cells. Its high contents in major minerals (calcium, sodium, magnesium, potassium) as well as that in minor minerals (iodine, iron) open the way for use in order to palliate mineral deficiency problems. Diabetics and obese should avoid this fruit while children and pregnant women need some.

Acknowledgements

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