Phytochemical and Nutritional profiles of *Lasianthera africana, Heinsia crinata* and *Gongronema latifolium*

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Abstract: *Lasianthera africana*, *Heinsia crinata* and *Gongronema latifolium* were screened for their phytochemical contents and composition, while vitamin contents, mineral elements and proximate values of the plants were analysed using standard procedures. A comparative analysis of the results showed that alkoloids and cardiac glycosides were not detectable in *G. latifolium* which rather contains high levels of other phytochemicals such as anthraquinones (23.3±0.03mg/100g), cyanogenetic glycosides (19.0±0.00mg/100g), saponins (18.2±0.02%), tannins (16.1 ± 0.03mg/100g) and flavonoids (11.0±0.10mg/100g). However, *L. africana* and *H. crinata* had some phytochemical contents and compositions such as saponins (15.9±0.00% and 16.1±0.01% respectively), besides some levels of tannins (10.0±0.00mg/100g and 0.3+0.00mg/100g respectively), pointing to their medicinal potentials. Nutritionally, *G. latifolium* had significantly high concentrations ($P < 0.05$) of vitamins A, C, E and niacin, besides minerals such as Se, Cu, Mg and Cr, while thiamine was significantly high ($P < 0.05$) in *H. crinata*. Carbohydrates, proteins and fibre were relatively high in the three plants, unlike fat which was equally low. It is concluded that, although the three plants are medicinally and nutritionally potent, *G. latifolium* appears to be most potent.

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Introduction

Lasianthera africana (Editan), Heinsia crinata (Atama) and *Gongronema latifolium (utazi)* are used by the people of Southern Nigeria for treatment of some ailments and as food. They are respectively called Editan, Atama and utazi by the Efik and Ibibio people of Nigeria. These communities have for several generations used these herbs for medicinal and nutritional purposes, and the leaves of these herbs are used to quench bacterial skin infections, gonorrhoea and abdominal disturbance.

Evidently of course, little studies have been carried out on the phytochemical and nutritional properties of these herbs. However, Ebana *et al.* (1995) studied the nutritional and potential medicinal values of the leaves of *L. africana* (Beauv), and found that the plant contained tannins, anthraquinones, glycosides, reducing compounds, and the crude aqueous and alcoholic extracts of the leaves were found to inhibit a number of test microorganisms except *Micrococcus* and *Brucella arbortus*. Several studies have compared the chemical composition of the leaves of *Azadiracta indica*, *Vernonia amygdadina* and *Gongronema latifolium*, and concluded that *G. latifolium* had the highest crude protein and fat contents, but lowest in fibre composition (Atangwho *et al*., 2009).

Several other studies have pointed to the fact that, the therapeutic compounds that are pharmacologically active include alkaloids, cyanogenetic glycosides, philabatanins, polyphenols, saponins, anthraquinones, etc., and these are known to be present in most medicinal plants (Sofowara, 1984; Madunagu and Ebana, 1991; Itah, 1996; Atangwho *et al*., 2009). In the same vein, studies have shown that, from nutritional point of view (Udosen *et al*., 1999; Okwu, 2001; Atangwho *et al*., 2009;), most plants taken as food by man have proximate ash, crude fat, protein and fibre, carbohydrate and caloric values; the plants also may have minerals such as Na, K, Ca, P, Mg, Fe and Zn, in addition to undesirable components such as oxalates, phytate and hydrocyanic acid (HCN) (Okwu, 2001; Atangwho *et al*., 2009).

This study aims to investigate the comparative phytochemical and nutritional profiles of *Lasianthera africana*, *Heinsia crinata* and *Gongronema latifolium*.

2. Materials and Methods

2.1 Sources of test plants

The test plants were bought from market women at Marian Market, Calabar. The plants were carried to the herbarium in the Botany Department of the University of Calabar, for identification as *L. africana* (Beauv), H. *crinata* (G. Taylor) and *G. latifolium*.

2.2 Preparation of the plants extracts

The leaves of the plants were first ground in a mortar (Mukhtar and Turkur, 2000). The crude extracts of the leaves were then prepared using standard procedures (Fatope *et al*., 1999, Mukhtar and Huda, 2005). This involved soaking 50g of the powdered extract in 95% ethanol for 48hrs at room temperature to allow for maximum extraction of the components. This was followed by evaporation of the filtrate using a rotary evaporator (STUARC SCIENTIFIC, ENGLAND). The residue was retained as a crude extract for each of the test plants and stored in reagent bottles and maintained in the freezer until it was used.

2.3 Chemical analyses

For the proximate values, the plants were analysed for moisture, fibre, proteins, fat, ash and carbohydrate. As described by AOAC (1990), methods Nos. 930.09, 930.10 and 930.05 were respectively used in analysing for fat, crude fibre and ash. Using the Leco-N nitrogen determinator (Model FP-428, Leco Corporate, M1, USA), crude protein was determined. By difference, the nitrogen free extractive (NFE) was obtained. By drying the sample to a constant weight in an air circulating oven at 70-90^{o}C, the moisture content was determined. Total carbohydrate was determined as the remainer after accounting for ash, crude fibre, protein and fats.

The mineral levels of, e.g., Cu, Cr, Mn, Mg, Fe and Se, were determined using a Pye Unicam SP9 atomic absorption spectrophotometer (Pye Unicam Ltd., York Street, Britain). Regression equations were used to calculate the levels of metals in each sample, using their absorbance and dilutions (Whiteside and Milner, 1984).

The methods of Trease and Evans (1996), Harbone (1998) and Sofowora (2006) were used to determine the quantitative phytochemical compositions of the plants. The qualitative determinations (phytochemical screening) of the plants were done using the methods of Cuilei (1982), Sofowora (1984) and Gundiza (1985).

2.4 Statistical Analysis

One-way ANOVA, using SPSS Microsoft Excel package was used in analysing the data. All data were expressed as Mean + SE (mean of 3 determinations), and difference between groups considered significant at $P<0.5$.

Table 1: Phytochemical screening of plants used

Substance	*L. africana*	*Heinsia crinata*	*Gongronema latifolium*
Alkaloids	+	+	ND
Anthranoids	-	-	+
Anthraquinones	ND	-	+++
Cardiac glycosides	+	+	ND
Cyanogenetic glycoside	-	-	++
Glycides	+	-	++
Flavonoids	-	-	++
Hydroxymethyl anthraquinones	-	-	++
Mucillages	+	-	-
Phblobatannins	+	+	+
Polyphenols	-	+	++++
Reducing compounds	+	-	-
Saponins	+	+	+
Tannins	+	-	+

3. Results

Results of the phytochemical screening, phytochemical composition, proximate analysis, mineral elements and vitamin composition of the plants are respectively displayed in Tables 1 – 5. Alkaloids and cardiac glycosides were either absent or not detectable in *G. latifolium*. Anthraquinoids, anthraquinones, cyanogenetic glycosides, flavonoids and hydroxymethyl anthraquinones were totally absent in *L. africana* and *H. crinata*. Alkaloids, phlobatannins, cardiac glycosides and saponnins were present in *L. africana* and *H. crinata*. High presence of anthraquinones, cyanogenetic glycoside; hydroxymethyl anthraquinones and reducing compounds were recorded in *G. latifolium*.

G. latifolium recorded the highest level of anthraquinone (23.3 ± 0.03), cyanogenetic glycoside (19.0 ± 0.00%) and saponins (18.2 ± 0.02%) followed by *H. crinata* (16.1 ± 0.01%) (Table 2).

G. latifolium recorded the highest carbohydrate (43.7 ± 0.06%), crude protein (33.2±0.6%), but lowest in ash content (1.3 ± 0.02%). On the other hand, *L. africana* had the highest ash content (7.7 ± 0.00%). The analysis showed that at P<0.05, *G. latifolium* had the highest vitamins A, C and E (360.0.38, 290.3 ± 0.60, 45.0 ± 0.00Iu/100g respectively). Riboflavin (0.97 ± 0.00%) and niacin (0.82 ± 0.00%) were also highest in *G. latifolium*. Mineral contents were apparently similar, although *L. africana* had the highest Cr level (0.63 ± 0.01mg/100g).

Table 2: Phytochemical composition of *L. africana, H. crinata* and *G. latifolium*

Medicinal plant (mg/100g)	Alkaloids (mg/100g)	Anthra-noids (mg/100g)	Anthra-quinines (mg/100g)	Saponines (%)	Tannins (mg/100g)	Flavonoids (mg/100g)	Poly-phenols (mg/100g)	Cyano-genetic glycoside (mg/100g)
L. africana	12.1±0.10	01.1±0.03	0.00±0.00	15.90±0.00	10±0.00	0.1±0.00	0.1±0.00	12.1±0.00
H. crinata	11.2±0.02	1.0±0.03	0.1±0.00	16.1±0.01	0.3±0.00	2±0.00	3.1±0.00	11.2±0.00
G.latifolium	0.10±0.10	0.1±0.00	23.3±0.03	18.2±0.02	16.1±0.03	11.0±10	12.0±0.00	19.0±0.00

Table 3: Proximate values of *L. africana, H. crinata, H. crinata* and *G. latifolium*

Medicinal plants	Moisture (%)	Fibre (%)	Crude protein N x 6.25%	Crude fat (%)	Ash (%)	Carbohy-drate (%)
L. africana	10.9±0.00	7.7±0.00	16.1±0.10	5.1±0.06	5.2±0.01	25.2±0.10
H. crinata	10.2±0.00	7.2±0.06	15.9±0.02	9.1±0.07	3.1±0.00	27.3±0.09
G. latifolium	15.2±0.01	6.3±0.05	33.21±0.06	16±0.01	1.3±0.02	43.7±0.06

Table 4: Mineral Elements

Plants	Cu (mg/100g)	Cr (mg/100g)	Mn (mg/100g)	Mg (%)	Se (mg/100g)
L. africana	0.04+0.00	0.63+0.01	0.03+0.00	0.59+0.01	0.01+0.02
H. crinata	0.33+0.01	0.04+0.00	0.05+0.00	0.65+0.01	0.02+0.00
G. latifolium	0.09+0.00	0.04+0.00	0.05+0.00	0.05+0.01	ND

Table 5: Vitamins composition

Plants	Vitamin A (IU/100g)	Vit. E (IU/100g)	Vit. C (IU/100g)	Riboflavin (%)	Thiamine (%)	Niacin (%)
L. africana	295.1±0.6	29.81±0.30	180.0±2.25	0.86±0.05	0.71±0.10	0.36±0.00
H. crinata	331.41±0.03	36.1±3.10	165.20±6+01	0.90±0.00	0.76±0.30	0.31±0.00
G. latifolium	360.0±0.38	45.0±0.00	290.3±0.60	0.97±0.00	0.15±0.00	0.82±0.00

4. Discussions

In Africa, and indeed among the people of West Africa, several plants are known and used for the treatment of some ailments and as food. For instance, *L. africana*, *H. crinata* are used for the treatment of bacterial skin infections and gonorrheal infections respectively. These same plants are used for soup preparation (Otung, 1998). Also, many traditional plants are known for the management of diabetes mellitus (Aktar and Ali, 1984). About 400 of such traditional plants have been reported (Bailey and Day, 1989; Atangwho *et al.*, 2009). It is known that the medicinal properties of the plants have been attributed to the active ingredients of the plant materials. Moreover, the nutritional factors associated with these plants are due to the presence of some minerals and vitamins. In this study, we investigated and compared the phytochemistry, micronutrients and proximate levels of *L. africana*, *H. crinata* and *G. latifolium* as fundamental to the understanding of modes and mechanisms of action of medicinal plants in general (Atangwho, 2006). Udosen *et al.* (1999) has investigated the nutrient composition of young and old leaves of *L. africana* and *H. crinata*, but apparently, no studies have compared the phytochemical and nutritional compositions of *L. africana*, *H. crinata* and *G. latifolium* which this study examines. The study revealed the phytochemical values of *G. latifolium* (cyanogenetic glycosides, anthraquinones, saponins, tannin and flavonoids) to be highest among the three plants. Flavonoids in particular are bitter, and they have been reported to affect the heart and circulatory system, and are used as spasmodytics and diaretics (Schauenberg and Paris, 1977; Otung, 1998). The flavonoids and polyphenols are well-known oxidants (Tiwari and Rao, 2002). However, the three plants contain other phytochemical composition, but in smaller varying amounts than *G. latifolium*. This has been demonstrated by Udosen *et al.* (1999) and Atangwho *et al*. (2009).

Relatively high amounts of carbohydrate (Okwu, 2001), protein and fibre compared to low fat content and ash were demonstrated in the three plant samples. This agrees with the reports of Udosen

(1995); Udosen *et al.* (1999) and Atangwho *et al.*, (2009) who respectively worked on *Vernonia amygdalina, L. africana, H. crinata* and *G. latifolium*. These studies referred to have shown that vegetables are not good sources of fat (Ejoh *et al.*, 2007).

Micronutrient vitamins and minerals were demonstrated in this study. Vitamins A, E, C, riboflavin and niacin besides minerals, such as Se, Cu, Mg and Cr, showed that *G. latifolium* had the high concentration of vitamin A, E, C and Niacin. The results show that vitamins A, E, C, riboflavin and niacin were significantly highest ($P<0.05$) in *G. latifolium*, unlike thiamine which was significantly high ($P<0.05$) in *H. crinata*. However, Atangwho *et al.* (2009) reported vitamins A, E and niacin to be significantly higher in *G. latifolium* than *Azadirachta indica* and *Vernonia amygdalina*.

5. Conclusion

It is concluded that *G. latifolium* is most valuable among the three plant samples in terms of phytochemicals such as cyanogenetic glycoside, anthraquinones, saponin, tannin and flavonoids. This is the same with proximate values such as carbohydrate and fibre which are highest in *G. latifolium.*

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