Comparative Evaluation Of The Nutrient Compositions Of *Andrographis Paniculata* And *Gongronema Latifolium*

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Abstract: A lot of research has been carried out on *Andrographis paniculata*, including comparison of its nutritional profiles with those of other plants, but little information on *Gongronema latifolium* is available. The aim of this study was to compare the nutritional compositions of *A. paniculata* with those of *G. latifolium*. The raw extract of each of the plants was analysed for phytochemical composition, while proximate values, mineral and vitamin contents of the plants were analysed using standard proceures. The results show that flavonoids (2.96±0.14%), and Saponins 2.8±0.25%) were higher in *A. paniculata* indicating greater potential to strengthen capillarity walls for blood circulation and anti-inflammation than *G. latifolium*. On the other hand, *G. latifolium* contained higher levels of tannin and hydrocyanides (2.01±0.01 and 12.9±0.04% respectively), indicating a greater resistance to infection and relaxant effect on the heart and muscles. *Glatifolium* contained higher levels of protein (31.1±0.07%), Carbohydrate (41.8±0.05%) and fat (17.01±0.01%) indicating greater energy supply and cellular build-up of the body than *A. paniculata*. *A. paniculata* contained higher calcium (106.3±2.00mg/1000ml), Magnesium (124.3± 1.40mg/1000ml), Potassium (125.6±2.100mg/1000ml) than *G. latifolium*, while *G. latifolium* contained higher levels of vitamins A, C and E (381.6±0.28, 290.3+0.45 and 44.01±0.12mg/1000ml respectively). There was no significant difference ($p>0.05$) between the two plants. In conclusion, the two plants are good sources of nutrients in a relatively similar status.

[Nsor Odo Alobi, Matthew Egbobor Eja, Arikpo Ikpi Okoi, Uno Agbo Uno, Bassey, Godwin Asuqo. **Comparative Evaluation Of The Nutrient Compositions Of *Andrographis Paniculata* And *Gongronema Latifolium*.** *N Y Sci J* 2015;8(12):16-20]. (ISSN: 1554-0200). http://www.sciencepub.net/newyork. 3. doi:10.7537/marsnys081215.03.

Keywords: Nutritional profiles, phylochemical profiles, good nutrient sources, *Andrographis paniculata, Gongronema latifolium*

Introduction:

Andrographis paniculata and *Gongronema latifolium* are similarly bitter herbaceous plants used for medicinal and nutritional purposes in different parts of the world (Puranik *et al*., 2012; Alobi *et al*., 2012). *A. paniculata* is native to India and Sri Lanka and also found in other parts of Asia, America and Africa where it is applied for the treatment of upper respiratory infection, cancer, diabetes, leprosy, influenza, dysentery etc. *A. panaculata* belongs to the family Acanthaceae and commonly called "King of bitters" (Puranik *et al*., 2012; Huidrom and Deka, 2012). It grows annually with branched, erect-running ½ to 1 meter in height (Huidrom and Deka, 2012).

G. latifolium, popularly called utazi in Ibo and Ibibio tribes of Nigeria, belongs to the family Asclepiadaceae. It is a climber, woody below, with hollow glabrous stems. Its flowers are greenish-yellow, while the leaves are used as spices. *G. latifolium* grows in the Southern part of Nigeria, particularly in the Cross River Rainforest of Nigeria. It is eaten raw or slightly cooked for the treatment of diarrhoea or dysentery, besides heart-related diseases.

The medicinal and nutritional significance of *A. paniculata* has been widely investigated (Saxena *et al*., 1998; Dua *et al*., 2004; Mishra *et al*., 2007; Chandrasekaran *et al*., 2010; Xu *et al*., 2012). Several bioactive compounds against certain diseases, e.g., 1,2-dihydroxy-6,8-dimoxy-xanthone against malaria, has been isolated from the roots of *A. paniculata (Dua et al.,* 2004). A broad range of effects of *A. paniculata* against liver disorders, bowel complaints of children, etc., has been investigated (Puri *et al*., 1993). From nutritional point of view, the leaves of *A. paniculata* can be cooked and eaten as vegetable; even domestic livestock also grazes the plant especially during famine (Puranik *et al*., 2012). Any part of the plant is believed to contain bioactive compounds and thus serves as an important source of minerals (Puranik *et al*., 2012).

On the other hand, not much research has been carried out on *G. latifolium*. However, a few authors have researched on the chemical composition of leaves of *G. latifolium* and other plants, and their nutritional profiles (Atangwho *et al*., 2009; Alobi *et al*., 2012).

The aim of this study is to compare the nutritional values of *Andrographis paniculata* and *Gongronema latifolium* including the nutritional implication on human health.

2. Materials and methods

2.1 Sample collection

The leaves of the two plants, *Andrographis paniculata* and *Gongronema latifolium* were collected from the herbarium of the Cross River University of Technology, Calabar. The leaves were washed with water and immediately carried to the laboratory to be analysed for phytochemical composition, proximate values, mineral elements and vitamins composition.

2.2 Preparation of the plants extracts

Fresh leaves of *A. paniculata* and *G. latifolium* were separately pounded in a clean mortar and the raw extract of each of the plant extracts was squeezed out (Eja *et al*., 2011). The crude extracts of the leaves were prepared using the methods of Fatope *et al*. (1999) and Mukhtar and Huda (2005). In these methods, the extracts were first dried to constant weight at 60^{o}C and 50g of the powdered extracts was soaked in 95% ethanol for 48hrs at room temperature to allow for maximum extraction of the components (Alobi *et al*., 2012). This was followed by evaporation 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 (Alobi *et al*., 2012).

2.3 Chemical analyses

To observe the proximate contents, the plants were analysed for moistures, fibre, crude protein, crude fat, ash and carbohydrates. The methods of AOAC (1990), Nos. 930.09, 930.10 and 930.05 were respectively used in analyzing for fat, crude fibre and ash, while protein was determined using the Leco-N nitrogen determinator (Model FP-428, Leco, Corporate, MI, USA). By difference, the nitrogen free extractive (NFE) was obtained. The moisture content was obtained by drying the sample to a constant weight in an air circulating oven at 70-90^{o}C. Total carbohydrate was determined as the remainder after accounting for ash, crude fibre, protein and fats.

The mineral contents of Ca, Mg, Zn, K, P, Pb and Fe were determined using a Pye Unicam Sp9 atomic absorption spectrophotometer (Pye Unicam Ltd., York Street, Britain). The levels of metals in each sample using their absorbance and dilution were calculated using regression equations (Miller and Miller, 1986).

The quantitative phytochemical compositions of the plants were assessed using the methods of Trease and Evans (1989), Sofowora (1993) and Harbone (1998). These phytochemical compositions were alkaloids, flavonoids, saponins, tannins, oxalates and hydrocyanides.

Vitamin contents were analysed using the methods of AOAC (1990). The respective plant leaf extract (2.0mls) was placed in a test tube, followed by one drop of isopropanol and a drop of concentrated H_2SO_4 and allowed to digest. The level of vitamin A was then measured with UV vis spectrophotometer at the wavelength of 325nm. The same treatment goes to the standard for vitamin B_1, 5% diazophenyl sulphuric acid is added to 0.5ml of each of the extracts and allowed for some time for colour development before being measured with U.V vis spectrophotometer at the wave length of 550nm. Also vitamin C was determined using the method of Puranik *et al*. (2012). This involves digesting 5g of the respective dried samples in concentrated $HN0_3$. The digest was quantitatively transferred to a 50ml volumetric flask and made up to volume with distilled water PUranik *et al*., 2012). A blank digest was treated the same way. Both digests were measured with U.V. vis spectrophotometer at 550nm. For vitamin E determination, 2 drop of concentrated HN03 and 5ml of distilled water were added to 0.5ml of each of the extracts, shaken and allowed for colour development before measuring with U.V. vis spectrophotometer at a wave length of 600nm. The same treatment was given to the standard (AOAC, 1990).

2.4 Statistical analysis

The data obtained for phytochemical composition, proximate values, mineral elements and vitamin composition were analysed using one-way analysis of variance (ANOVA) (Miller and Miller, 1986) to ascertain the significant difference between *Andrographis paniculata* and *Gongronema latifolium*.

3. Results

Results of the phytochemical composition, proximate values, mineral elements and vitamin composition of the plants are respectively shown in Tables 1-4. Apart from flavonoids (2.96$\pm$0.14%) and saponins (2.8$\pm$0.25%) which were relatively higher in *A. paniculata* than in *G. latifolium*, tannins and hydrocyanides were equally higher (2.01$\pm$0.01% and 12.9$\pm$0.04% respectively) in G. *latifolium*. The table shows no significant difference ($p>0.05$) between *A. paniculata* and *G. latifolium*.

The quantitative estimation of the % proximate values of *A. paniculata* and *G. latifolium* is contained moisture (28.1$\pm$0.9 and 15.3$\pm$0.00) respectively, fibre (15.7$\pm$0.3 and 5.9$\pm$0.04), crude protein (1.5$\pm$0.19 and 31.1$\pm$0.07), fat (2.0$\pm$0.05 and 17.01$\pm$0.01), ash (16.13$\pm$0.83 and 1.40$\pm$0.01) and carbohydrate (36.3$\pm$0.5 and 41.8$\pm$0.05). These indicate that *A. paniculata* contained higher moisture, fibre and ash than *G. latifolium*, while *G. latifolium* contained higher crude protein, crude fat and carbohydrate than *A. paniculata*. However, there was no significant difference ($p>0.05$) between *A. paniculata* and *G. latifolium*.

The composition of the mineral elements is presented in Table 3. From the table, there is an indication that *A. paniculata* contains higher calcium, magnesium and potassium (106.3±2.00, 124.3±1.40 and 125.6±2.10mg/1000ml respectively). On the other hand, *G. latifolium* contains slightly higher levels of zinc and iron (0.5±0.02 and 0.28±0.03mg respectively). Also, there is no significant difference between *A. paniculata* and *G. latifolium* ($p>0.05$).

The presence of four essential vitamins, A, C, B, and E in the plants, are represented in Table 4. *G latifolium* apparently contains higher vit. A, vit. C and vit. E (381.6±0.28, 290.3±0.45 and 44.01±0.12mg/1000mls respectively) than *A. paniculata*.

Table 1: Phytochemical composition

Medical plant	Alkaloids (%)	Flavonoids (%)	Saponins (%)	Tannins (%)	Oxalates (%)	Hydrocyanides (%)
A. paniculata	1.90±0.18	2.96±0.14	2.8±0.25	0.49±0.30	0.85±0.06	1.88±0.2
G. latifolium	1.96±0.03	0.49±0.03	0.65±0.04	2.01±0.01	0.32±0.01	12.9±0.04

Values are mean ± standard deviation of triplicate measurements

Table 2: Proximate values

Medical plant	Moisture (%)	Fibre (%)	Crude protein (%)	Crude fat (%)	Ash (%)	Carbohydrate (%)
A. paniculata	28.1±0.9	15.7±0.3	1.5±0.19	2.0±0.05	16.13±0.83	36.3±0.5
G. latifolium	15.3±0.00	5.9±0.04	31.1±0.07	17.01±0.01	1.40±0.01	41.8±0.05

Values are mean ± standard deviation of triplicate measurements

Table 3: Mineral Elements

Medical plant	Calcium	Magnesium (Mg)	Zinc (Zn)	Potassium (K)	Phosphorus (P)	Lead (Pb) (%)	Iron (Fe)
A. paniculata	106.3±2.00	124.3±1.400	0.226±0.140	125.6±2.100	2.09±0.250	0.030±0.00	0.466±0.31
G. latifolium	11.3±0.01	10.03±0.01	0.5±0.02	102.0±0.02	0.5±0.05	0.01±0.00	0.288±0.03

Results are presented in mg/1000mls, and values are mean ± standard deviation of triplicate measurements

Table 4: Vitamins composition

Medicinal plant	Vit. A	Vit. C	Vit. B_1	Vit. E
A. paniculata	172±1.0	1.24±0.20	0.27±0.05	0.37±0.04
G. latifolium	381.60±0.28	290.3±0.45	0.17±0.01	44.01±0.12

Results are present in mg/1000mls, and values are mean ± standard deviation of triplicate measurements

4. Discussion

In this study, it was necessary to examine the nutritional values of the two plants, *Andrographis paniculata* and *Gongronema latifolium*, in view of the fact that much has been published about *A. paniculata* in the literature while little has been published about *G. latifolium* even when they seem to possess medicinal and nutritional similarities.

This study revealed that *A. paniculata* contained fairly high levels of flavonoids (2.96±0.14%) and saponins (2.8±0.25%). On the other hand, *G. latifolium* contained 0.49±0.03% flavonoids and 0.65±0.04% saponins, indicating that *A. paniculata* has higher antioxidant element than *G. latifolium*. Elsewhere, it has been observed that methanolic extract of *A. paniculata* contains high level of antioxidant (Huidrom and Deka, 2012). Thus, *A. paniculata* has a greater potential than *G. latifolium* to strengthen capillary walls for more effective blood circulation besides the possession of phytoestrogens which are associated with the relief of menopausal symptoms, and reduction of osteoporosis, improvement of blood cholesterol level, and lowering of the risk of certain hormone cancer and coronary heart attack (Tiwari and Rao, 2002; Odugbemi, 2006; Alobi *et al*., 2012). Equally *A. paniculata* is richer in saponins which are used as anti-inflammator and wound healing than *G. latifolium* (Tiwari and Rao, 2002). Also, tannins are higher in *G. latifolium* and they are known to draw the tissues closer together and improve their resistance to infection (Houghton, 2007). Elsewhere, high level of saponin has similarly been observed in *A. paniculata* (Puranik *et al*., 2012). Puranik *et al*. (2012) indicates that saponin is an anti-

nutritional factor which reduces the uptake of certain nutrients including glucose and cholesterol, and thus has hypercholesterolemia effects, and aids in lessening the metabolic burden that would have been placed on the liver (Price *et al*., 1987; Puranik *et al*., 2012). On the other hand, the level of tannin demonstrated in *G. latifolium* was higher than in *A. paniculata*. Elsewhere, it was equally demonstrated to be relatively high (Udosen *et al*., 1999; Atangwho *et al*., 2009), indicating a greater resistance of *G. latifolium* against infection than *A. paniculata*. Hydrocyanide level in *G. latifolium* (12.9±0.04%) appeared to be higher than in *A. paniculata*. Elsewhere, it was equally high (Alobi *et al*., 2012), indicating that *G. latifolium* has relaxant effect on the heart and muscles (Sofowora, 1993; Puranik *et al*., 2012). On the whole there was no significant different ($p>0.05$) in phytochemical properties between *A. paniculata* and *G. latifolium*.

Analysis of the proximate values of the two plants revealed that *A. paniculata* contained higher moisture (28.1±0.9), fibre (15.7±0.3) and ash (16.13±0.83) than *G. latifolium*, whereas *G. latifolium* contained more protein (31.1±0.07) and carbohydrate (41.8±0.05). There was no significant difference between the two plants ($p>0.05$). All these point to the fact that there is a balance between two plants with respect to proximate values.

The results of this study show that *A. paniculata* contains higher calcium, magnesium, potassium and phosphorus (106.3±2.00, 124.3±1.40 and 2.09±0.25mg respectively), while *G. latifolium* contains zinc and iron (0.5±0.02 and 0.28±0.03mg respectively) in the absence of significant difference ($p>0.05$) between the two plants. Similar high content of calcium and magnesium in *A. paniculata* has been reported by Puranik *et al*. (2012), while similar results for *G. latifolium* has been reported by Atangwho *et al*. (2009). Some of the metals are essential to man and other organisms. For instance, iron is a component of haemoglobin, while zinc is used in enzymes; calcium is essential for the bones (Huheey, 1978).

Out of the four essential vitamins (A, C, B_1 and E) analysed from the two plants, vitamins A, C and E (381.6±0.28, 290.3±0.45 and 44.01±0.12mg/1000mls respectively) were higher in *G. latifolium* than *A. paniculata*, indicating that *G. latifolium* is richer in such essential vitamins than *A. paniculata*.

5. Conclusion

The potential nutritional properties of the two plants are relative. For instance, *A. paniculata* is richer in flavonoids and saponins than *G. latifolium*, while *G. latifolium* contains higher levels of tannin and hydrocyanide. Also, *G. latifolium* has higher levels of protein and carbohydrate than *A. paniculata* which rather has higher levels of moisture content, fibre and ash. Equally, calcium, magnesium, potassium and phosphorus are higher in *A. paniculata*, while zinc and iron are slightly higher in *G. latifolium*. Vitamin A, C and E are of higher levels in *G. latifolium* indicating that *G. latifolium* is richer in these vitamins than *A. paniculata*.

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12/08/2015