Anti-nutrient and phytochemical compositions of
Psychotriasp, Cnidoscolusaconitifolius and Telfariaoccidentalis
from South Eastern Nigeria.

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Abstract: The study examines anti-nutrient and phytochemical compositions of some leafy vegetables in the south east zone of Nigeria. Chemical and phytochemical analyses were carried out using standard AOAC methods. Phytochemical screening of these vegetables showed that they contain bioactive chemical substances such as alkaloids, anthocyanin, carotenoid, flavonoid, oxalate, saponin and tannins. Glycoside was present only in the Psychotriasp samples. Pro-vitamin A and vitamin E concentrations were highest in Psychotria (5.31 and 3.69mg/100g, respectively) while Cnidoscolus contained the highest vitamin C, 437.7 mg/100g. Similarly Psychotriasp had oxalate value of 5.43g/100g, C. aconitifolius had 0.35g/100g and T. occidentalis had 0.06g/100g. Saponin concentration in the raw samples of T. occidentalis was 0.89g/100g, C. aconitifolius samples 0.04g/100g. Tannins concentration in C. aconitifolius was 0.18g/100g while T. occidentalis had 0.14g/100g and Psychotriasp had 0.13g/100g. The phytochemical values for solar-dried samples indicated that C. aconitifolius had alkaloid content of 1.32g/100g and T. occidentalis had 0.95g/100g. Anthocyanin concentration in Psychotriasp was 0.20g/100g, C. aconitifolius 0.17g/100g and T. occidentalis 0.13g/100g. C. aconitifolius had carotenoid level of 0.15g/100g while Psychotriasp had 0.03g/100g. Flavonoid content in C. aconitifolius was 0.35g/100g and T. occidentalis 0.15g/100g. Similarly Psychotriasp had oxalate value of 27.7g/100g, C. aconitifolius had 0.96g/100g and T. occidentalis had 0.17g/100g. Saponin concentration in the solar-dried samples was 1.21g/100g in T. occidentalis and 0.79g/100g in Psychotriasp samples. Tannins concentration was 0.35, 0.26 and 0.23g/100g in Psychotriasp, Cnidoscolus and T. occidentalis respectively.

I. Introduction
The increased awareness of the health protecting properties of non-nutrient bio-active compounds found in fruits and vegetables has directed immense attention to vegetables as vital components of daily diets. For populations in sub-Saharan Africa, this attention (on vegetables as vital dietary components) reinforces the significant roles that leafy vegetables have long held as important components of African diets. They are indispensable ingredients of soups or sauces that accompany carbohydrate staples (Ene-Obong, 2001; Smith and Eyzaguirre, 2007; Chweya and Eyzaguirre, 1999). African indigenous and traditional leafy vegetables thus have a pivotal role in the success of the World Health Organization’s (WHO) global initiative on fruits and vegetables consumption in the sub-continent (Smith and Eyzaguirre, 2007).

Vegetables are those herbaceous plants whose part or parts are eaten as supporting food or main dishes and they may be aromatic, bitter or tasteless (Mensah, et al., 2008; Edema, 1987). The utilization of leafy vegetable is part of Africa’s cultural heritage and it plays important roles in the customs, traditions and food culture of the African household. Nigeria is endowed with a variety of traditional vegetables and different types are consumed by the various ethnic groups for different purposes. The poor state of the economy in developing countries has made consumption of nutritious foods out of the reach of more than 65-70% of the people (Nworgu, 2004). One of the ways of solving this problem is through the use of unconventional sources of protein and micronutrients to supplement the diets of man and farm animals.

According to Mensah et al. (2008), vegetables are the cheapest and most available sources of important proteins, vitamins, minerals and essential amino acids. Vegetables are included in meals mainly for their nutritional value. However, some are reserved for the sick and convalescence because of their medicinal properties. The lack of nutritional information and inadequate development of nutritionally improved products from local raw materials have direct bearing on nutrition. Leafy vegetables are ideal for weight management as they are typically low in calories. They are useful in reducing the risk of cancer and heart disease since they are low in fat, high in dietary fiber, and rich in folic acid, vitamin C, potassium and magnesium, as well as containing a host of phytochemicals, such as lutein, beta-cryptoxanthin, zeaxanthin, and beta-carotene.

The role of green leafy vegetables in nutrition and human health is inevitable. Several studies have proven its efficacious abilities in promoting good health (Alada, 2000; Oyeyemi, et al., 2008; Modi, et al.,
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2006). Green leaf vegetable play crucial roles in alleviating hunger and food security by contributing bulk of the nutrient content needed daily in our diets (Usikua, et al., 2010). Hence the need to explore more sources of these natural reservoir of vitality and health.

Phytochemicals and anti-nutrients are chemical substances found in leafy vegetables and plant generally. Some of these chemical substances could be deleterious to human health and that of livestock when consumed. These substances are alkaloids, glycoside compounds, oxalates, tannins, phytate, and methyl-cysteine–sulfoxide (Nworgu et al., 2007).

From reviewed literatures on Psychotriasp, not much work have been done on them in Africa especially Nigeria. Most species of Psychotria are common in the understory of tropical and subtropical forest. Majority of them are found in west tropical Africa, but few are indigenous to Nigeria. Some are found in the Northern, middle and North east of Nigeria while some are located in the south, south east and middle belt of Nigeria (Lachenaud& Harris, 2010). However, there are about five different species of Psychotria in Nigeria. These are Psychotrianevosa found in southern Nigeria, Psychotriaarticulata in southern Nigeria, Psychotriasucculenta in northeast Nigeria Psychotriafernandopoeosis in south-East and lastly Psychotria-leptophylla in the middle belt of Nigeria had shown that, despite the large number of Psychotriasp very few studies have been carried out on them.

The major problem of GLV’s utilization in nutrition is the presence of toxic substances such as lectins, alkaloids, saponins, protease inhibitors, phytate, among others (D'Mello, 1995). In order to reduce the toxicity of these substances, adequate processing techniques is essential. Mendoza and del Rosario (1988) recommended soaking the leaves at 70°C for 10 minutes, while Abeke, et al.,(2003) recommended 20 minutes for cooking beans of Lablab purpureus before consumption. Oduguwa et al., (1999) reported that autoclaving whole pods of Samaneasaman(JacqMerill) at a temperature of 100°C for 15 minutes resulted to better feed intake and weight gain compared to the rabbits fed 100g/kg raw Samaneasamandiet. Cooking improves nutritive values of legume seeds and brings the values close to that of meat and milk products by destroying some of the anti-nutritional factors (Amaefule, &Obioha, 2001). Processing improves the utilization of protein and energy from legumes and vegetables (Kaankuta et al., 2000). Knowing the phytonutrient compositions is important because it will help to elucidate the possible mechanisms by which these medicinal plants performed their nutritional and or therapeutic functions.

II. Material And Methods

Materials

Sample collection and processing

Samples of Psychotriasp “Aya-azu” was collected from Ubulu-Uku, Delta State Nigeria, while Cnidoscolusaconitifolius “iyanapaja” and Telfariaoccidentalis “ugu” were harvested from the vegetable gardens at Sir Louis Mbanefo Street, University of Nigeria, Nsukka (UNN). Two (2) kg each of Psychotriasp, CnidoscolusaconitifoliusandTelfariaoccidentalis leaves were plucked and rinsed with deionized water. The samples were dried using solar drier facility at Energy Research Center, UNN. The dried samples were pulverized and packaged in air-tight-polyethene bags for chemical analysis.

Phytochemical analysis

Qualitative and quantitative screenings were carried out to ascertain the presence of different phytochemical (saponin, tannins, phyhtate, alkaloids, glycoside, anthocyaninsetc) in the GLV samples before quantitative analysis was carried out. The methods as described by Trease and Evans (1989) were used.

Statistical analysis

The data are expressed as mean± SEM. Statistical analysis was carried out by one-way analysis of variance (ANOVA). Difference were considered to be statistically significant when p<0.05.

III. Results

The anti-nutrient composition for the three vegetables is presented in Table 1. Phytate and tannins content in Psychotriasp ranged from 0.29-0.72mg/100g and 0.13-0.35 mg/100g respectively. C. aconitifolius phytate and tannins content ranged from 0.66-2.72mg/100g and 0.18-0.25 mg/100g while that of T. occidentalis ranged from 0.27-1.50 mg/100g and 0.14-0.23 mg/100g respectively. The oxalate content for raw Psychotriasp was 5.42 mg/100g, C. aconitifolius (0.34 mg/100g) and T. occidentalis (0.06 mg/100g).

The phytochemical screening of Psychotriasp, Cnidoscolusaconitifolius and Telfariaoccidentalis is presented in Table 2. Alkaloids, anthocyanin, carotenoid, flavonoid, oxalate, saponin and tannins were present in these three vegetables. Glycoside was identified only in the Psychotriaspand was absent in Cnidoscolusaconitifolius and Telfariaoccidentalis samples. The solar-dried samples of Psychotriasp had higher levels of alkaloids and tannins than the fresh samples, while the fresh sample had higher flavonoid content than

DOI: 10.9790/2402-10228690 www.iosrjournals.org 87 | Page
all the samples studied. The solar dried T. occidentalis had the highest saponin content. C. aconitifolius (solar dried) had appreciable quantities of alkaloids.

Quantitative phytochemical values for Psychotria, C. aconitifolius and T. occidentalis are presented in Table 3. Alkaloid content for the raw samples showed that C. aconitifolius had 1.14g/100g, T. occidentalis 0.85g/100g and Psychotria had 0.82g/100g. The concentration of anthocyanin in C. aconitifolius was 0.05g/100g, and 0.02g/100g in T. occidentalis. Carotenoid value was 0.06g/100g in Cnidoscolusaconitifolius but Psychotria had 0.02g/100g. Flavonoid content in C. aconitifolius was 0.19g/100g while T. occidentalis had 0.04g/100g. Glycoside was present in raw Psychotriasp 0.01g/100g. Similarly Psychotria had oxalate value of 5.43g/100g. C. aconitifolius had 0.35g/100g and T. occidentalis had 0.06g/100g. Saponin concentration in the raw samples of T. occidentalis was 0.89g/100g, C. aconitifolius samples 0.04g/100g. Tannins concentration in C. aconitifolius was 0.14g/100g while T. occidentalis had 0.13g/100g and Psychotria had 0.13g/100g. The phytochemical values for solar-dried samples indicated that C. aconitifolius had alkaloid content of 1.02g/100g and T. occidentalis had 0.95g/100g. Anthocyanin concentration in Psychotria was 0.20g/100g, C. aconitifolius 0.17g/100g and T. occidentalis 0.13g/100g. C. aconitifolius had carotenoid level of 0.15g/100g while Psychotria had 0.35g/100g. Flavonoid content in C. aconitifolius was 0.35g/100g and T. occidentalis 0.15g/100g. Similarly Psychotria had oxalate value of 27.7g/100g, C. aconitifolius had 0.96g/100g and T. occidentalis had 0.17g/100g. Saponin concentration in the solar-dried samples was 1.21g/100g in T. occidentalis and 0.79g/100g in Psychotrias sample. Tannins concentration was 0.35, 0.26 and 0.23g/100g in Psychotria, Cnidoscolus and T. occidentalis respectively.

Table 1: Anti-nutrient compositions of Psychotria, Cnidoscolusaconitifolius and Telfariaoccidentalis samples (mg/100g).

<table>
<thead>
<tr>
<th>Plant Materials</th>
<th>Phytates</th>
<th>Tannins</th>
<th>Oxalates</th>
<th>Saponins</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychotria (raw)</td>
<td>0.29±0.01</td>
<td>0.13±0.00</td>
<td>5.42±1.22</td>
<td></td>
</tr>
<tr>
<td>Psychotria (dried)</td>
<td>0.72±0.21</td>
<td>0.35±0.01</td>
<td>27.7±3.21</td>
<td></td>
</tr>
<tr>
<td>Cnidoscolusaconitifolius (raw)</td>
<td>0.66±0.03</td>
<td>0.18±0.01</td>
<td>0.34±0.01</td>
<td></td>
</tr>
<tr>
<td>Cnidoscolusaconitifolius (dried)</td>
<td>0.27±0.01</td>
<td>0.14±0.02</td>
<td>0.06±0.02</td>
<td></td>
</tr>
<tr>
<td>Telfariaoccidentalis (raw)</td>
<td>1.50±0.23</td>
<td>0.23±0.01</td>
<td>0.17±0.00</td>
<td></td>
</tr>
<tr>
<td>Mean ± SD (n=3)</td>
<td></td>
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</tbody>
</table>

Table 2: Phytochemical screening of psychotria, Cnidoscolusaconitifolius and Telfariaoccidentalis

<table>
<thead>
<tr>
<th>Phytochemicals</th>
<th>Green leafy vegetables</th>
<th>Alkaloid</th>
<th>Anthocyanin</th>
<th>Carotenoid</th>
<th>Flavonoid</th>
<th>Glycoside</th>
<th>Oxalate</th>
<th>Saponin</th>
<th>Tannin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychotria sp. (raw)</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>++</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Psychotria. (Dried)</td>
<td>++</td>
<td>+</td>
<td>+</td>
<td>++</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>C. aconitifolius (raw)</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>++</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>C. aconitifolius (dried)</td>
<td>++</td>
<td>+</td>
<td>+</td>
<td>++</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>T. occidentalis (raw)</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>++</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>T. occidentalis (dried)</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>++</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

+ indicates the presence of constituents.
++ indicates that the constituents are highly present.
-Indicates the absence of constituents

Table 3: Phytochemical contents of Psychotria, Cnidoscolusaconitifolius and Telfariaoccidentalis.

<table>
<thead>
<tr>
<th>Phytochemicals in g/100g</th>
<th>Green leafy Vegetables (raw)</th>
<th>Alkaloid</th>
<th>Anthocyanin</th>
<th>Carotenoid</th>
<th>Flavonoid</th>
<th>Glycoside</th>
<th>Oxalate</th>
<th>Saponin</th>
<th>Tannin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychotria (raw)</td>
<td>1.14±0.05</td>
<td>0.04±0.01</td>
<td>0.02±0.00</td>
<td>0.35±0.01</td>
<td>0.05±0.01</td>
<td>27.7±3.21</td>
<td>0.79±0.02</td>
<td>0.35±0.01</td>
<td></td>
</tr>
<tr>
<td>Psychotria (dried)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>C. aconitifolius (raw)</td>
<td>1.32±0.05</td>
<td>0.17±0.03</td>
<td>0.15±0.01</td>
<td>0.30±0.00</td>
<td>0.96±0.02</td>
<td>0.26±0.02</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>C. aconitifolius (dried)</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T. occidentalis (raw)</td>
<td>0.85±0.03</td>
<td>0.02±0.00</td>
<td>0.03±0.00</td>
<td>0.04±0.01</td>
<td>0.06±0.01</td>
<td>0.89±0.02</td>
<td>0.14±0.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T. occidentalis (dried)</td>
<td>0.95±0.03</td>
<td>0.13±0.00</td>
<td>0.07±0.01</td>
<td>0.15±0.00</td>
<td>0.17±0.02</td>
<td>1.21±0.01</td>
<td>0.23±0.01</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Mean ± SD (n=3)

IV. Discussion

Phytochemicals and antinutrients are chemical substances found in leafy vegetables. Some of these chemical substances could be deleterious to human health and that of live stocks. These substances are alkaloids, glycoside compounds, oxalates, tannins, phyte, and methyl-cysteine–sulfoxide (SMCO)
Psychothria spp, C. aconitifolius and Cnidoscolus aconitifolius vegetables showed the presence of phytochemicals such as alkaloids, anthocyanin, carotenoids, flavonoids, and glycosides. The medicinal properties of these components have been documented by a number of researchers (Mensah et al., 2012; Oyagbemi et al., 2008; Okigboet al., 2009). The importance of alkaloids, saponins, tannins and carotenoids in various antibiotics used in treating common pathogenic strains has been reported by Kubmarawa et al., (2007). It is noteworthy that, alkaloids were recorded in all the three leafy vegetables studied and that they all have nutritive and medicinal values. Further efforts at searching for more literature indicates that Psychothria spp has a lot of varieties but very few are found in Africa. Latest of these findings was by Martin and Diane (2002) who identified two new spp of Psychothria (Psychothria bimbensis and Psychothria moliurensis) in the Western Cameroon. The specie of Psychothria found in Ubuluku Nigeria may be a new specie as efforts at identifying the specific specie is still ongoing because of wide variations observed in this specie from the existing known species.

The presence of tannins at a moderate concentration may confer on the vegetables more therapeutic and nutritional benefits than reported by other vegetables with high levels of these anti-nutrients. Tannins are of wide occurrence in plants and are usually found in greatest quantity in dead and dying cells. They exert an inhibitory effect on many enzymes due to their ability to denature protein (Treas and Evans, 2009). These authors also stated that tannin containing drugs will precipitate protein and have been used traditionally as styptics and internally for the protection of inflamed surfaces of mouth and throat. Studies on the antitumor activity of tannins have also been reported by Ken-ichiet al., (1993).

Flavonoids are naturally occurring plant compounds with established in vitro antioxidant properties and potential cardioprotective effects (Shandet al., 2002). This work showed that Psychothria spand C. Aconitifolius had the highest flavonoid contents and may function as possible cardioprotective agents. Flavonoids and other poly-phenolics from a number of plants have also been reported to possess nutritional and medicinal properties (Pourmoradet al., 2006; James et al., 2008; Arbonnier, 2004) which support the claims of the rural consumers on the use of these lesser known vegetables. Despite the multiple medicinal uses of Cnidoscolus one possible disadvantage is that the fresh leaves of this plant contain high levels of cyanogenic glycosides. This result is in agreement with earlier work by Adeniran et al., (2013); Ross-Ibarra and Molina-Cruz (2002) who reported that Cnidoscolus contain glycosides which, upon hydrolysis, liberate hydrogen cyanide and cyanide molecules, potent toxic anti-nutritional compounds. Therefore the cyanogenic content of Cnidoscolus leaves makes it potentially deleterious to health (Kuti and Konoru, 2006). This may be the reason why we observed some itching effect on the skin during sample collection. Thus it is imperative that the use of medicinal plants be supported by scientific studies that evaluate their safety and efficacy. In this respect, Torrico et al. (2010) indicated that Cnidoscolus can be used for therapeutic purposes due to the low value of the median toxic dose (TD50) and considering that the toxic effects possibly attributed to cyanogens contained in Cnidoscolus are lights and reversible. In addition, cooking, as well as other heat treatments hydrolyze the cyanogenic glycosides, minimizing the risk of toxicity (Martin and Ruberté, 1978; Kuti and Konoru, 2006). Cnidoscolusleaves are now being commercialized as tea product in dried form, because the dried leaves conserve high polyphenol contents (Loarca-Fiña et al., 2010).

In conclusion, the phytochemical properties of these lesser known plants seem to make them a good source of nutritional and therapeutic agents.

**References**


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