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Nutritional Potential of the Leaves and Seeds of Black Nightshade- *Solanum nigrum* L. Var *virginicum* from Afikpo-Nigeria

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Abstract: The nutritional potential of the leaves and seeds of *Solanum nigrum* L. Var *virginicum* was assessed by determining proximate and phytochemical composition. Results indicate protein content of the leaves and seed as 24.90% and 17.63% respectively. Other findings are ash 10.18% and 8.05%, crude fibre, 6.81% and 6.29 and carbohydrate, 53.51 and 55.85% for the leaves and seed respectively. Mineral analysis revealed the order Mg>K>Ca>Fe>Na>Mn>Zn in the leaves and Mg>K>Fe>Ca>Na>Mn>Zn in the seeds. Phosphorus and sulphur levels were 75.22 and 8.55 mg/100g in the leaves and 62.50 and 14.48, g/100g in the seeds. Vitamin content indicate the order vit C>vit B_1>Folic acid>Vit E>Vit A in both the leaves and seeds. Phytochemical analysis revealed high oxalate, phenol but low sterol content in the studied plant materials. Cyanide levels were higher in the leaves compared to the seeds. These results suggest that *S. nigrum* L. Var *virginicum* to be nutritive despite the presence of some anti-nutritive components like oxalate.

Key words: *Solanum nigrum*, proximate and photochemical composition

Introduction

Traditional societies have always exploited edible wild plants to provide adequate nutrition, food security and income generation (Omoti and Okyi, 1987; Antia *et al*., 2006; Dhellot *et al*., 2006a). These wild plants serve as an indispensable constituent of human diet supplying the body with minerals, vitamins and certain hormone precursors, in addition to protein and energy (Onyenuga and Fetuga, 1995; Fleuret, 1979; Edmonds and Chweya, 1997). However, many of these inexpensive nutritive wild plants are yet to be adequately studied and utilized. Among these leafy vegetables are the leaves and seed (fruits) of Black nightshade.

Black nightshade (*Solanum nigrum* L. Var *virginicum*) is an annual herbaceous plant (and may sometimes be perennial) which can reach up to 100cm in height. The stem may be smooth or bear small hairs (trichomes). The flowers usually white in colour, have five regular parts and are up to 0.8cm wide. The leaves are alternate and some what ovate with irregularly toothed wavy margin and can reach 10cm in length and 5cm in width. The fruit is a round fleshy berry up to 2cm in diameter and yellowish when ripe. The seeds are brown and numerous. It is a common species in arable lands, near rivers and old walls, grows everywhere in Africa and America (Edmonds and Chewya, 1997).

Occasionally, the leaves and seeds (berries) are used as vegetable in soup, Yam and coco yam porridges and as spinach in some parts of Nigeria particularly among the Igbos and Efik-Ibibio people of South-Eastern Nigeria. Besides being used for human consumption, the leaves serve as fodder and browse for domestic herbivorous animals.

According to (Pereez *et al*., 1998) and (Son *et al*., 2003), the extract of its fruits have anti-tumour and neuro-pharmacological properties and can be used as an anti-oxidant and cancer chemo preventive matter. Though information on the pharmacological properties seems to abound in literature, there is little information on the chemical compositions of *Solanum nigrum* L. Var *virginicum* leaves and seeds. The present study therefore aimed at assisting in closing this gap in knowledge on Black nightshade leaves and seeds especially from the Eastern part of Nigeria. This information will highlight the usefulness or otherwise of this under-utilized plant.

Materials and Methods

The leaves and seeds (berries) of *Solanum nigrum* L. Var *virginicum* were obtained from Eke main market, Afikpo North Local Government Area, Ebonyi State, Nigeria and identified by a taxonomist in the Department of Plant Science and Biotechnology, of Abia State University, Uturu. The leaves were cleaned destalked, weighed and oven dried at 60°C for 24hrs.

After drying, the leaves and seeds were ground separately into a fine powder using a mortar and pestle, sieved and stored in an air-tight contained, kept in a desiccators until analyzed.

Proximate composition, mineral elements and the vitamins (A, B, C, folic acid and E) were determined by the method of (AOAC, 1984).

Moisture content determination involved drying a known weight of sample to a constant weight at 60°C in an oven (Gallen kamp hot box).

Determination of ash content involved incineration in a muffle furnace (Gallen kamp hot box) at 550°C for 8hrs.

Crude fat determination involved Soxhlet extraction of a known weight of sample with petroleum ether (b, p 40-

Table 1: Proximate of Composition *Solanum nigrum* L. Var. *virginicum* leaves and seeds in

Parameters	%Dry Matter of Leaves	%Dry Matter of Seeds
Caloric value (Kcal)	355.04±0.19	43.54±0.19
Ash content	10.18±0.02	8.05±0.04
Crude fat	4.60±0.01	12.18±0.02
Crude Protein	24.90±0.02	17.63±0.01
Crude fibre	6.81±0.01	6.29±0.01
Carbohydrate	53.51 0.01	55.85±0.03
Moisture content	84.70±0.01	76.86±0.04

Values are mean±S.D of triplicate determinations

Table 2: Elemental Composition of *Solanum nigrum* L. Var. *virginicum* leaves and seeds

Mineral Elements	Composition (Mg-/100g) of Leaves	Composition (Mg-/100g) of Seed
Calcium, Ca	17.33±0.03	11.82±0.02
Magnesium, Mg	247.59±0.01	201.36±0.01
Iron, Fe	13.01±0.01	12.91±0.01
Zinc, Zn	0.07±0.01	0.05±0.01
Potassium, K	42.89±0.02	37.19±0.02
Sodium, Na	2.71±0.02	2.11±0.02
Manganese, Mn	1.52±0.02	0.86±0.01
Phosphorus, P	75.22±0.02	62.50±0.00
Sulphur, S	8.55±0.01	14.48±0.01

Values are mean±S.D of triplicate determinations

60°C) and methanol mixed properly in the ration 1:1. Determination of crude protein was done using the micro Kjeldahl nitrogen method which involves the digestion of a given weight of the sample with concentrated H_2SO_4 and catalyst to convert any organic nitrogen to ammonium sulphate, $(NH_4)_2\ SO_4$ in solution followed by the decomposition of ammonium sulphate with NaOH. The ammonia liberated was distilled into 5%boric acid. The nitrogen from ammonia was deduced from titration of the trapped ammonia with 0.05NHCl using methylene red and methylene blue (double indicator solution) indicators. The value of nitrogen obtained was multiplied by the general factor (6.25) to give the % crude protein.

Crude fibre was obtained from the loss in weight on ignition of dried residue remaining after digestion of fat-free samples with 1.25% each of sulphuric acid and sodium hydroxide solutions under specified condition i.e.

$$\% \text{ crude fibre} = \frac{\text{Loss of weight of ignition x 100}}{\text{Weight of sample used}}$$

Carbohydrate content was determined by subtracting the total ash content, crude fat lipid), crude protein and crude fibre from the total dry matter.

The caloric value estimation was done by summing the multiplied values for crude protein, crude fat (lipid) and carbohydrate (excluding crude fibre) by their respective AT WATER factors (4,9,4).

The mineral elemental constituents (Ca, Mg, Fe, Zn, K, Na, Mn, P and S) in *Solanum nigrum* L. Var *virginicum* leaves and seeds were analyzed separately, using atomic absorption spectrophotometer (Hitachi 26100 model) after acid digestion of the samples.

For the phytochemicals, Alkaloids, Saponins, Flavonoids Anthocyanin, and sterols were determined by the methods of (Harborne, 1973). Tanins, Phytic acid and Hydrogen cyanide were determined by alkaline titration methods (A.O.A.C, 1984) and total Polyphenol was determined by the method of (Swain, 1979). This method involves extraction of polyphenol with methanol at 80°C for one hour and then quantifying the bluish extract spectrophotometrically at 760nm. Total oxalate was determined by the permanganate titration method of (Dye, 1956).

Results and Discussion

Proximate composition of leaves and seeds of *solanum nigrum* L. Var *virginicum* is as presented in Table 1. Ash, fibre, crude protein and moisture contents were higher in the leaves compared to the seeds.

The ash content of the leaves (10.18%) is similar to the values reported for some commonly consumed leafy vegetable in Nigeria, including *Ocinum graticinum*, *Hibiscus esculenta* and *Ipomea batata*. It is however; lower than the reported value of 20.05% for *Talinum triangulare* (Akindahunsi and salawu, 2005; Antia *et al.*, 2006). Ash content of the seeds obtained in the present study is 8.05%. This value compares favourably with a reported value of 7.18% for *S. nigrum* from Congo Brazzavile (Dhellot *et al.*, 2006b).

The lipid content observed for *S. nigrum* leaves is similar to those reported for *calchorus africa*, *Amaranthus hybidus* l. *triangulare* but about half the value for *Bacsilla alba* leaves (Ifon and Basir, 1979; Akindahunsi and salawu, 2005) lipid content of the seed of *S. nigrum* observed in this study is similar to that of a number of tropical plant seeds chrysophyllum albidum and *Dacroydes edulis* (Akubugwo and Ugbogu, 2007), but much lower than the values for *canarium schweinfurthii*, *Balanites aegyptiaca*.

Pulp and Cotton (kapseu *et al.*, 1997; Kapseu and Permantier, 1997; Kapseu *et al.*, 1999; Dzondo *et al.*, 2005). Therefore, *S. nigrum* seed contains moderate lipid content.

The fibre, carbohydrate and crude protein content of both the leaves and seeds of *S. nigrum* observed in this study are similar to reported values for a number of tropical plants (Afolabi *et al.*, 1986; Dhellot, 2006 a, b).

Compared to the energy content value of 304.99Kcal for Xanthosoma sagittofolium and 355.19 kcal for colocosia esculenta leaves, (Davidson *et al.*, 1975), *S. nigrum* is a good source of energy.

Mineral element analysis as shown in Table 2 indicates that *S. nigrum* contains high levels of magnesium and phosphorus but relatively low level of zinc. This study also indicates the vit C content to be high while vit A is

Table 3: Vitamin Composition of *Solanum nigrum* L. Var *Virginicum* leaves and seeds

Vitamins	Composition (Mg-/100g) of Leaves	Composition (Mg-/100g) of Seeds
Vitamin A	4.66±0.02	1.71±0,03
Vitamin B1	17.14±0.01	10.91±0.01
Vitamin C	35.18±0.02	23.38±0.01
Folic acid	11.61±0.01	8.13±0.02
Vitamin E	9.72±0.02	5.71±0.01

Values are mean ± S.D of triplicate determinations.

Table 4; Phytochemical Compositions of *Solanum nigrum* L. Var. *virginicum* leaves and seeds

Phytochemicals	Composition (Mg-/100g) of Leaves	Composition (Mg-/100g) of Seeds
Alkaloids	1.62±0.02	1.07±0.05
Saponins	0.25±0.01	0.16±0.01
Falvonoids	0.81±0.01	1.01±0.01
Anthocyanim	0.13±0.01	0.08±0.01
Sterols	0.05±0.00	0.00±0.00
Tannins	0.19±0.01	0.00±0.00
Total Oxalate	78.65±0.04	58.81±0.01
Phytic acid	0.82±0.01	04.48±0.02
Total Polyphenol	13.17±0.02	14.69±0.01
Cyanide	10.63±0.02	1.53±0.02

Values are mean±S.D of triplicate determinations.

low. In deed, as shown in Table 3, the order of magnitude of the studied vitamins is vit C>vit B> Folicacid>vit E>vit A. Though the vitamins content of the samples are low, consumption of this plant material will contribute in meeting the daily vitamin requirement as stipulated for healthy adults (National Academy of Science, 2004).

Results of phytochemical evaluation are as presented in Table 4. The result indicates that oxalate levels were high in both leaves and seed of *S. nigrum*, and that sterols and tannins were below detectable levels in the seed. Apart from total phenols and flavonoids, the level of other studied phytochemical was higher in the leaves relative to the seed. The oxalate level is similar to that reported for *Telferia occidentalis* and *Vanonia amygdalin* (Mc-Graw, 1987). Oxalate is an anti-nutrient. Consumption of *S. nigrum* may though elicit adverse physiological responses. However, initial processing such as cooking is known to significantly reduce total oxalate content of vegetables (Akwaowo *et al*., 2000). This may therefore mitigate the potent adverse effect of consuming the plant that Phytochemicals have potential beneficial effects such as polyphenols which reduce blood pressure while saponins may prevent cancer. (Richelle *et al*., 2001; Sharp, 1997) .

Conclusion: This study showed that *S. nigrum* L. Var *virginicum* leaf and seed from Ebonyi state, Nigeria contain appreciable levels of protein, fibre and carbohydrate. The study further revealed that it is a good source of magnesium phosphorus and the water soluble vitamins such as vit C, B and folic acid.

Though the leaves in particular contain relatively high levels of oxalate and cyanide, the processing methods prior to consumption which may include cooking reduce their final consumed amount. In summary therefore, the plant has high nutritional value and is recommended as a cheap source of plant protein, energy and mineral elements such as magnesium and phosphorus.

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