

Phytochemical Screening and Nutritional Composition of *Datura Innoxia* Mill Extract as Traditional Medicine for Certain Illnesses in Eastern Part of Sierra Leone

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Abstract

The aim of the present study was to determine the phytochemical and nutrient compositions of two morphological parts of *D. innoxia*; leaf and seed in order to provide Phytochemical and nutrient information about it. Phytochemical and nutrient composition was carried out on *Datura innoxia* leaf and seed. Phytochemical screening result revealed the presence of atropine, alkaloids, scopolamine, essential oils, saponins, flavonoids, polyphenols, as well as cardiac glycosides; while tannins, Coumarins, Carboxylic acid and Valerianates were absent in all the plant parts examined. The phytochemical screening based on the standard methods of tube reactions has been performed with ethanol extracts. The quantitative estimation of total polyphenols was made by the Folin-Ciocalteu method and that of flavonoids by the use of aluminum trichloride. The phytochemical screening revealed that leaves and seeds of this plant contain alkaloids, polyphenols, flavonoids, coumarins, tannins, triterpenes and saponin. Phenolic contents of ethanol extracts are 30.97 ± 0.33 mg equivalent gallic acid / g in leaves and 14.02 ± 0.15 mg equivalent gallic acid / g in seeds; those of flavonoids are 15.13 ± 0.2 mg equivalent of quercetin / g in the leaves and 4.93 ± 0.41 mg equivalent of quercetin / g in the seeds. The three tests showed that the leaves have a higher level of antiradical activity in vitro than seeds. The nutrient composition analysis indicated significant ($P < 0.05$) variation in crude protein content which ranged from 2.09% in the root to 17.21% in the leaf, moisture content (10.00% in seed to 7.5% in seed), crude lipid content 15.52% in the seed and 7.5% in the leaf. Total ash was highest in the leaf (21.59%) and least in the seed (8.26%) while nitrogen free extract was (46.67%) and 42.25% in the seed and leaf respectively. The phytochemical screening of the *D. innoxia* revealed the presence of important pharmacological bioactive substances as well as medicinal and nutritional potentials in the leaf, seed, stem, pod and root.

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It is thus suggested that more studies on concentrations of active ingredients, anti-nutritional factors and toxicity level be carried out. The aim of the present study was to determine the phytochemical and nutrient compositions of two morphological parts of *D. innoxia*; leaf and seed in order to provide Phytochemical and nutrient information about it. Further more there were some constrains/ limitation during the research with regards getting the seeds since it a seasonal plant and the study was only limited to the Eastern part of sierra Leone, Kenema to be specific.

Keywords: Phytochemical; nutritional analysis; *Datura innoxia*.

1. Introduction

Datura, often touted as “Thorn Apple”, though considered as one of the deadliest plant species, for its super toxic components, when consumed raw is also surprisingly a powerhouse of medical components if purified properly[1,2].

Be it the leaves, fruits, flowers, stem, roots or seed, *Datura* has been traditionally used in both folklore medications and alternative therapies. However, due to the strong hallucinogenic properties of the plant, *Datura* is often used to relieve asthmatic symptoms and reduce the pain during the surgery and bone setting procedures [1,2,4]. Though a strong narcotic plant, *datura* offers umpteen health benefits and is extensively used for alleviating pain, treating fever, enhancing heart functions, improving fertility, inducing sleep, easing childbirth and promoting hair and skin health [3,4,5].

Datura is a bushy, erect annual herb that usually grows to a height of 2-5 ft. The plant has a foul stench and is widely found growing naturally in clayey-loamy soils found in fallow fields, croplands, old feedlots, waste areas, nearby construction sites, deserted vacant places, and even in waste areas. The plant has purplish-green hollow stems and smooth erect oval-shaped leaves that are arranged alternately on it. Flowers have a pleasant smell and are found in 3 distinct colors which are yellow, red, violet or greenish-white in colour [13, 14, 15,16].

They are usually large and are bisexual and hypogenous. Fruits have a bitter acid-like taste and are knobby, ovate and are coffered with short spikes. The seeds are enclosed within the fruits and are spiny, whereas roots are brown, cylindrical and branched.

It is normally found in the tropical parts of India and the temperate regions of the Himalayas and is also found growing wildy in fertile calcareous soils of North America, Mexico, North Africa, Tanzania, Uganda, Kenya, Bangladesh and in Sierra Leone.

In Sierra Leone, it is called ‘Kumbayjara’ and there are dramatic stories Incriminating the gene *Datura*. Imbibed with powerful hallucinogenic and deliriant properties, *Datura* has a mother lode of antioxidants, flavonoids, alkaloids, organic compounds, and minerals. The bioactive components in *Datura* include Daturine, Daturadiol, Hyoscine, Atropine, Noratropine, Fastudine, Allantoin, Hypocyanine,

Norhyosamine, Tropane, Meteolodine, Scopolamine, Mucilage, Albumen, Vitamin C, Niacin, and Malic

Acids [5, 6, 7, 8].

Datura plant as a whole has several characteristic properties including anti-spasmodic, analgesic, sleep-inducing, expectorant, sedative, hypnotic, intoxicant, uterine stimulant and bronchodilator properties [8,9].

Owing to its several therapeutic properties, the entire plant, be it the fresh or dry leaves, seeds, roots, or fruits, Datura has carved its way in many traditional and alternative medications.

Datura seeds when used in raw form are extremely dangerous and poisonous, hence before using them in any formulation, the seeds require a series of sodhana or purification process, to detoxify the harmful effects, so as to reduce the toxicity levels in the human body and to promote the therapeutic value of the part.

Although a medicinal plant with innumerable uses like treating fever, heart problems, respiratory disorders, psychotic conditions, insomnia, depression, improving digestion and skin disorders, it must be made clear that the plant should only be used under doctor's approval. The use of an impure plant part or consumption of an incorrect dosage can be extremely lethal and can cost your health [10,11,12].

However, a research was undertaken which was conducted in Kenema in the Eastern part of Sierra Leone which revealed that Datura innoxia alone or in combination with other plant species can be used for the treatment of heart related complications, though other research have revealed that Datura species are used for the treatment of asthma, inflammation, seizures, pain, rheumatism, gout, snake bites and poisonous insects, dermatoses, bewitching and Neuropathies.

The specie Datura innoxia Mill would be used as suppositories during difficult deliveries and for the treatment of hemorrhoids. The anticancer, antibacterial and hypoglycemic potential of the Datura genus have been suggested by Arulvasu and his colleagues and Tandon and his colleagues Several recent studies have shown the

involvement of reactive oxygen species in the etiopathogenesis of diseases such as Parkinson's, diabetes, Alzheimer's and cancer. Thus, for the treatment of these diseases, synthetic molecules

with antioxidant activity are used as sensors of these free radicals. On the other hand, the high cost of health services and drugs, as well as socio-economic factors, are causing a large part of the population to use medicinal plants for treatment [6, 7].

Most remote communities in the Eastern part of Sierra Leone, especially within the Kenema environs rely on these Datura plant species and other related plants species for curative measures due to high cost of drugs and health services as well as socio – economic factors. Most of these communities are deprived of health care facilities as most patients walk miles to access these facilities.

With the persistent used of the traditional plant species as curative measures for populations in remote communities within the Kenema environs, there has been no data to show the effects on the use of these plants

species as drug. For all these reasons, we decided to conduct a research on Phytochemical screening on the leaves and seeds on various plant compounds present in *Datura Innoxia* and their long and short term effects on the lives of inhabitants [10, 11, 12].

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2.. Materials and Methods

2.1. Plant Materials

Plant material consisting of leaves and seeds of *Datura innoxia* Mill was collected at Dauda Town in the Kenema municipality, Eastern Region of Sierra Leone in 2021. The plant was identified by various Lecturers in the Chemistry Department, Eastern Technical University of Sierra Leone.

The leaves and seeds were collected at different sites and thoroughly washed, dried at room temperature before being reduced to powder (0.2 mm) and stored away from light and moisture.

2.2. Methods

2.2.1. Preparation of ethanol extracts

The extracts were obtained by maceration of 50g of powder in 500 mL of ethanol. The mixture was stirred for 48 hours at 30°C and then filtered under vacuum. The filtrates obtained were evaporated to dryness under reduced pressure using a rotary evaporator at 45°C (heidolph).

Togola and his colleagues ARRB, 33(2): 1-8, 2019; Article no.ARRB.515733

2.2.2. Phytochemical screening

The detection of the main chemical groups of the different *Datura* extracts was carried out using

Conventional methods based on tubes reactions by specific chemical reagents [18, 19, 20]. Thus, the alkaloids were highlighted by the Dragendorff reagent. The characterization of the tannins was carried out by ferric chloride. For the determination of triterpenes, we used acetic anhydride and concentrated sulfuric acid. Diluted hydrochloric alcohol, magnesium chips and Isoamyl alcohol was used to search for flavonoids. The search for coumarins was made by the UV fluorescence method at 365 nm. The foam test revealed the saponins. We used the reagents of Baljet, Kedde and Raymond-Marthoud which respectively give an orange, purplish red, violet coloring in the presence of cardiotonic heterosides.

2.2.3. Determination of total phenolic compounds

The content of phenolic compounds of the various extracts of *Datura innoxia* Mill was estimated by the

method of Folin-Ciocalteu described by Balkan and his colleagues [21]. Thus, 500 μL of the Folin-Ciocalteu reagent (diluted to 10% in distilled water) was added to 100 μL of extract and 400 μL

of disodium carbonate (Na_2CO_3) at 75 mg / mL added to the reaction mixture. After incubation for 2 hours at room temperature and protected from light, the absorbance was read at 765 nm. A calibration curve was carried out under the same operating conditions using a dilution series of gallic acid.

The results are expressed in milligram equivalent of gallic acid by gram of extract (mg EAG / g).

2.2.4. Determination of total flavonoids

The estimation of total flavonoids was carried out according to the method described by Fofié and his colleagues [22]. 500 μL of each extract to be analyzed was added to 1500 μL of 95% methanol, 100 μL of

10% (w / v) AlCl_3 , 100 μL of 1 M sodium acetate and 2.8 mL of distilled water. The mixture

was stirred and then incubated in the dark at room temperature for 30 minutes. The blank was made by replacing the extract with 95% methanol and the absorbance was measured at 415 nm

using a UV spectrophotometer. The results are expressed in mg equivalent quercetin / g by dry matter.

2.2.5. Nutrient Composition

2.2.5.1. Moisture analysis

Moisture content was determined by using thermostat oven. 2 grams of each sample were transferred into labelled crucibles of known weights at 120°C and samples were dried to constant weight. Moisture content was expressed as percentage by weight of sample. (AOAC, 2005)

2.2.5.2. Determination of ash

The ash contents were estimated by heating the samples overnight in a furnace at 525°C (AOAC, 2005).

2.2.5.3. Extraction of crude lipids

Crude lipids were extracted from the *D. innoxia* powder samples in a soxhlet extractor with chloroform: methanol (2:1, v/v). The contents of crude lipids were determined gravimetrically after oven-drying (80°C) the extract overnight (AOAC, 2005).

2.2.5.4. Total dietary fibre analysis

The content of total dietary fibre (TDF) in *D. innoxia* was determined according to the AOAC enzymatic-gravimetric method (AOAC, 2005). In brief, aliquots of samples (1 g of dry matter) were first treated with 2 amylases, for 30 min in a boiling water bath and amyloglucosidase for 30 min at 60°C to remove starch and then a protease to solubilise protein. The enzyme-treated mixture containing the buffer solution and non-digestible materials was precipitated with 4 volumes of absolute ethanol. Thereafter, the ethanol-insoluble residue was filtered with a fibre-tec system. The residue recovered was washed, oven-dried and weighed to give the gravimetric yield of the *D. innoxia* fibre material or TDF.

2.2.5.5. Crude protein analysis

The crude protein content was calculated by multiplying the nitrogen content, which was determined by standard procedures of AOAC (2005). Crude protein was calculated by multiplying the total nitrogen by a conversion factor of 6.25.

3. Results and Discussion

3.1. Phytochemical Screening

Phytochemical screening results of ethanol extracts of leaves and seeds from *Datura innoxia*

Mill. are summarized in Table 1 and Table 2, and the determination of the nutrient content was summarized in table 3.

Table 1: Phytochemical screening of both parts of the plant (Leaf and Seed}

Chemical Group	Leaf	Seed
Atropine	+	+
Alkaloids	+	+
Scopolamine	+	+
Polyphenols	+	+
Essential oils	+	+
Cardiac glycoside	+	+
Triterpens	+	+
Flavonoids	+	+
Coumarines	-	-
Tannins	-	-
Velepatriates	-	-
Saponins	+	+
Carboxylic acid	-	-

Cardiotonic heterosides	-	-
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*** (+) = Present; (-) = Absent**

The phytochemical screening of *D. innoxia* (Table 1) showed the presence of atropine, scopolamine, essential oils, saponins, flavonoids, phenols, as well as cardiac glycosides; while tannins, coumarins, carboxylic acid and valepotriates were absent and may be due to differences in the plant species and environmental conditions. The findings of the phytochemical analysis of this research indicated the presence of some active drug Compounds (atropine and scopolamine), which have sedative, unaesthetic as well as medicinal potency as evidenced in the various uses of *D. innoxia* [15, 16].

Thus, it is clear from this characterization that the leaves and seeds of *Datura innoxia* Mill

Contain alkaloids, polyphenols, triterpenes, flavonoids, coumarins, atropines, scopolamine, essential oils cardiac glycosides and tannins [15]. However, cardiotonic heterosides were absent in both parts of the plant but cardiac glycosides were present in both organs. Saponins are present in the leaves; on the other hand they are absent in the seeds. The Presence of these metabolites has also been reported in previous work [2, 25, 26]. Saponins were not revealed in the seeds as well as cardiotonic heterosides in both

organs. However, a study conducted by other authors on the same species revealed the presence of both metabolites in leaves and seeds [27]. These same authors reported the absence of coumarins tannins, carboxylic acid and valepotriates in their samples [26, 27].

3.2. Determination of Total Phenolic Compounds and Flavonoids

Table 2: Total phenolic compounds and flavonoid contents of leaf and seeds.

	Total phenolic compounds(mgEAG/g)	Total flavonoid (mgEAG/g)
Leaves	3-.97±0.33	15.13±0.52
Seeds	14.02±0.15	4.93±0.41

These results revealed that the ethanol extracts of the leaves of *Datura innoxia* Mill are richer in total

Phenolic compounds (p-value = 3. 0E-7) and flavonoids (p-value = 2.1E-5) than the ethanol extracts of seeds. Thus, the contents of total phenolic compounds and flavonoids are respectively 30.97 ± 0.33 mg EAG / g and 15.13 ± 0.52 mg EQ / g in the leaf and 14.02 ± 0.15 mg EAG / g and 4.93 ± 0.41 mg EQ / g in the seed.

These results corroborate with those obtained by Bagewadi and his colleagues [21] with 38 ± 0.27 mg gallic acid/ g of total phenolic compounds and 19 ± 0.17 mg rutin equivalent / g of flavonoids for leaf extracts and Fatima and his colleagues [28] with 29.91 ± 0.12 mg / g of polyphenols and 15.68 ± 0.18 mg / g of

flavonoids for leaf extracts. On the other hand, the values observed are lower than those of Bhardwaj and his colleagues [29] who recorded 70.26 ± 1.12 mg gallic equivalent / g of polyphenols and 34.24 ± 1.28 mg quercetin equivalent / g of flavonoid for leaf extracts versus 51.01 ± 0.58 mg equivalent of gallic / g polyphenols and 6.99 ± 1.11 mg quercetin equivalent / g of flavonoids with *Datura innoxia* Mill seed extract.

However, a slight difference is noted between our results and the authors cited above. According to Bajalan and his colleagues [30], variation in levels of total phenolic compounds could possibly be explained by both genetic variation and geographical origins of plants. (Togola and his colleagues ARRB,) 33(2): 1-8, 2019; Article no.ARRB.515735. Studies have shown that the presence of a high content of phenols and flavonoids in the extracts of leaf and seeds of *Datura innoxia* would contribute directly to their antioxidant activity [24, 29].

According to Badiaga [31], flavonoid-rich plants would play a positive role in the treatment of cardiovascular and neurodegenerative diseases and also have antitumor activity. Saponins are glycoside components often referred to as “natural detergent” because of their foamy nature (Seigler, 2008). Saponins have been known to possess both beneficial and deleterious properties depending on its concentration in the sample (Seigler, 2008; Oakenful and Sidhu, 2009). Seigler (2008) reported that saponins have anticarcinogenic properties, immune modulation activities and regulation of cell proliferation as well as health benefits such as inhibition of the growth of cancer cells and cholesterol lowering activity [12].

Flavonoids have been reported to exert multiple biological effects including antibacterial, antiviral, antitoxic and anti-inflammatory activities (Cook and Samman, 2006). Many of these alleged effects of flavonoids have been linked to their known functions as strong antioxidants, free radical scavenger and metal chelators (Nakayama and his colleagues 2003). The positive effects of glycosides and cardiac glycosides are not common but their toxic effects include decreased heart rate, decreased sympathetic activity and decreased systemic vascular resistance (Seigler, 2008). The presence of some of these antinutrients could however be reduced by various processing techniques (Elegbede, 2008). The concentrations of atropine, scopolamine, essential oils, saponins, flavonoids, phenols, and cardiac glycosides in *D. innoxia* need therefore be ascertained.

3.3. Nutrient analysis

Table 3: Mean nutrient composition of *D. innoxia* in leaf and seed.

Nutrient Composition		
Component	Seed (%)	Leaf (%)
Moisture	10.00 (1.05)	7.50 (0.79)
Total ash	8.26 (0.85)	16.59 (1.54)
Crude lipid	15.52 (1.51)	7.50 (0.95)
Crude fibre	6.55 (0.98)	8.95 (0.75)
Crude protein	13.90	17.21

	(1.54)	(1.58)
Nitrogen free extract (NFE)	47.67 (3.67)	42.25 3.57)

(Standard error in parenthesis for three replicate, n=3)

The nutrient composition of *D. innoxia* in leaf and seed is presented in Table 3. The nutrient analyses indicated that as usual in plant parts, there was a variation in crude protein content which ranged from 13.90% in the seed to 17.21% in the leaf. There was significant difference ($P < 0.05$) in the protein contents of the two morphological plant parts. According to the NRC (2003), crude protein of less than 20% indicates low protein content of that feed stuff. These crude protein results are however comparable with the result of some tropical plant seeds analysed by Ezeagu and his colleagues (2000), who reported that *Diospyros mespiliformis* and *Entandrophragma angolense* had crude protein contents of 3.46 and 12.34%, respectively. The seed and leaf had 10.0% and 7.5% moisture contents respectively. Significant difference ($P < 0.05$) was observed in the moisture contents of the plant parts. According to NRC (2003), moisture content of 5 - 20% (DM) is regarded as high. This indicates that the moisture content of the leaf and seed were high. The results of this investigation is comparable with those obtained by Ezeagu (2000) for *Gliricidia sepium* 6.77%, *Albizia zygia* 7.8%, *Doneillia ogea* 9.86% and *D. mespiliformis* 8.99% but a variance with those obtained for *Lophira lanceolata* seed (2.78%) as reported by Lohlum and his colleagues (2010). The crude lipid content followed the same pattern with the seed having the highest lipid content of 15.52% while the leaf had 7.50%, respectively. The result of the lipid content of this research is in line with the findings of Muhammad and his colleagues (2010) who worked on five medicinal plants with *Valeriana officinalis* having fat content of 14%. Crude fibre, which measures the fibrous component (cellulose, hemicellulose and lignin), was highest in the leaf with 8.95% and seed had 6.55% respectively. Crude fibre content was low in the seed and leaf and high crude fibre (NCR, 2003).

Total ash was lowest in the seed (8.26%) and highest in the leaf which had 21.59%, respectively. Statistical analysis showed a significant difference ($P < 0.05$) in the ash contents of the plant parts. Onwugbuta (2004) recorded 12.71%, 8.10% and 6.71% as total ash contents of cowpea seedlings grown under flood and draught conditions. The Nitrogen free extract (NFE) was highest in the seed 46.67% than the leaf with 42.25 respectively; Statistical difference ($P < 0.05$) was observed in NFE contents of the plant parts. The result of NFE obtained from this research differ from those reported by Onwugbuta (2004), Jimoh and Oladiji (2005), Muhammad and his colleagues (2010) and Lohlum and his colleagues (2010), this difference 2954 J. Med. Plant. Res.

4. Conclusion

The phytochemical screening of the *D. innoxia* revealed the presence of important pharmacological bioactive substances as well as medicinal and nutritional potentials in the leaf and seed. The present study has highlighted the richness of the leaves and seeds of *Datura innoxia* Mill in several metabolites such as alkaloids, atropine, saponins, essential oils, polyphenols, triterpenes, flavonoids, coumarins and tannins.

Based on the results of the analysis, *D. innoxia* Mill can be used by local community members as a curative

measure for alleviating pain, treating fever, heart burn complication, enhancing heart functions, improving fertility, inducing sleep, easing childbirth and promoting hair and skin health.[3,4,5].

It is thus suggested that more studies on concentrations of active ingredients, anti-nutritional factors and toxicity level be carried out.

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