

Evaluation of the Phytochemical and Nutritional Profiles of *Cnidoscolus aconitifolius* Leaf Collected in Abakaliki South East Nigeria

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Abstract: This study investigated the phytochemical contents and nutritional profile of *Cnidoscolus aconitifolius* leaf collected from Abakaliki Southeast Nigeria. The phytochemical, proximate and mineral content analyses were done using standard methods, whereas vitamin concentrations were evaluated using HPLC method. The preliminary qualitative phytochemical screening revealed the presence of phenols, flavonoids, alkaloids, terpenoids, saponins and absence of phlobatanins, tannins, steroids, anthraquinones and cardiac glycosides. Further quantitative phytochemical analysis in (mg/100g) revealed that phenols, saponins, alkaloids and flavonoids contain 33.02 ± 0.32 ; 6.305 ± 0.13 ; 1.96 ± 0.26 and 2.955 ± 0.09 , respectively. Proximate composition (%) showed that carbohydrate, proteins, crude fat, moisture, ash content and crude fibre contains 41.895, 7.68, 1.145, 13.53, 4.585 and 31.165, respectively. The results of vitamin analysis in (mg/100g) of vitamin A, vitamin B₂, vitamin B₁, vitamin B₉, vitamin C, vitamin D, vitamin E and vitamin K corresponds to 59.6445, 5.84, 1.36, 9.425, 892.025, 88.992 and 69.785, respectively and concentrations of minerals in (mg/100g) of Phosphorus, Copper, Zinc, Iron, Calcium, Potassium and Sodium were 24.68, 7.1, 15.64, 14.83, 29.16, 33.88 and 41.47 respectively. This investigation shows that *Cnidoscolus aconitifolius* leaf from Southeast Nigeria contains high medicinal and nutritional compositions which could be exploited beneficially in treatment of diseases as well as nutritional supplements.

Key words: *Cnidoscolus aconitifolius* leaf • Phytochemical • Proximate • Vitamin • Mineral • HPLC

INTRODUCTION

Generally, plants could either be ornamental, medicinal, as well as nutritional, hence there has been a high level of reliance on plants as a whole by both man and animals for survival [1]. Medicinal plants seemed to be the most researched due to its use over the years in rural communities to treat infections and diseases, with a lot of positive results, thus making them the richest bio-resource of drugs in traditional system of medicine. They also function as medicaments. These medicinal values of plants reside majorly in some chemically active compounds that produce a definite physiological action on the human and animal body [2]. Thorough scientific investigations of these phytochemicals go a long way in their proper use for treatment of diseases in medicine and new drug development in the pharmaceutical field [3].

On the other hand, nutritional interest in most plants stems basically from their rich contents of essential amino acids, carbohydrate, lipids, vitamins and minerals. Carbohydrates and lipids are primary suppliers of energy, amino-acids are for growth and repair of worn out tissues whereas vitamins play a very significant role in maintenance of health and making great contributions to a healthy immune system as well as provisions of all the nutrients necessary for good health [4, 5]. Minerals also helps in maintenance of all physiological processes, acting sometimes as catalysts and are major constituents of teeth, bones, tissues, blood, muscle and nerve cells.

Cnidoscolus aconitifolius (family-Euphorbiaceae), commonly called chaya is a leafy perennial shrub native of Yucatan peninsula of Mexico in Central America [6, 7]. The plant which is also called spinach tree is consumed as vegetable in soups, salads and therapeutically used for a

number of ailments such as diabetes, atherosclerosis, gallstone and high cholesterol [8]. Chaya is a good source of protein, vitamins, calcium and iron; and is also a rich source of antioxidants such as Vitamin C and E as well as Flavonoids [9] and have a possible antidiabetic effect [10]. This study evaluates the phytochemical content and nutritional profile (proximate, vitamins and minerals composition) of *Cnidoscolus aconitifolius* collected from Abakaliki, Southeast Nigeria.



Fig. 1: Leaf of *Cnidoscolus aconitifolius*

MATERIALS AND METHODS

Chemicals and Reagents: HPLC-grade solvents were used for analysis. Analytical reagent-grade acetonitrile and methanol were obtained from Lab-Scan (Tedia Company, USA). The water used for HPLC and sampling was prepared with a Millipore Simplicity instrument (Millipore, Molsheim, France). All vitamin standards were of chromatography grade and were purchased from Sigma Chemical Co. (Poole, Dorset). All other chemicals and reagents were of standard analytical grades.

Sample Collection: *Cnidoscolus aconitifolius* plants were collected from a location in Abakaliki, South-East Nigeria. The leaves were removed, cleaned and air dried at room temperature range of 25°C-28°C for about 30days before they were grinded to powder using a blending machine and then stored for use in the analysis. Further ethanolic extract of the leaves of the plant were prepared according to standard methods [11].

Preparation of the Plant Extract: The plant samples collected were air dried and grinded using the blending machine. The powdered extracts were concentrated to dryness and the residue was obtained as a greenish after which, the residues were transferred into a pre-weighed sample containers and were stored and later used for phytochemical screening.

Phytochemical Screening: The leaves extract of *Cnidoscolus aconitifolius* were analyzed for the presence of Alkaloid, Saponin, Anthraquinone, Steroids, Tannin, Flavonoid, Phlobatanin, Terpenoids, Phenol and Cardiac glycosides according to standard methods [11].

Determination of Phytochemical Composition: Quantitative phytochemical analysis to determine the level of Alkaloids, Tannins, Saponins, Phlobatanin, Phenol, Anthraquinone, Steroids, Terpenoids, Flavonoid and Cardiac glycosides using standard methods as described by Sofowora, 2008 [11] and Trease and Evans, 1985 [12] were carried out.

Proximate Analysis: The determination and evaluation of carbohydrate content, moisture content, ash content, crude fiber, proteins and crude fat was done using the methods described by AOAC [15].

Determination of Vitamins: High Performance Liquid Chromatographic system (Shi-madzu-UFLC Prominence), equipped with an auto sampler (Model-SIL 20AC HT) and UV-Visible detector (Model-SPD 20A) was used for the analysis. The data were recorded using LC-solutions software. The HPLC method was employed in the determination of vitamins A, B₁, B₂, B₆, C, D, E and K contents.

Mineral Analysis: Mineral contents of *Cnidoscolus aconitifolius* leaf were determined using UNICAM solar 969 Atomic Absorption Spectrophotometer for elements such as P, Fe, K, Na, Zn, Ca and Cu.

RESULTS

Phytochemicals: The results of the qualitative and quantitative analysis of *Cnidoscolus aconitifolius* is represented in the Tables 1 and 2

Phytochemicals: Table 1 showing the qualitative composition of phytochemicals in *Cnidoscolus aconitifolius* leaf.

Table 2 Shows that phenol, flavonoids, saponin and alkaloid compositions of the plant were 33.02 ± 0.32 , 2.955 ± 0.09 , 6.305 ± 0.13 and 1.96 ± 0.26 (mg/100g) respectively

Table 3 shows that the proximate contents of the plants were 41.895, 7.68, 1.145, 13.53, 4.585 and 31.165 (100%) respectively for carbohydrates, protein, crude fat, moisture, ash and crude fibre.

Table 1: Shows the presence of phenol, flavonoids, alkaloids, terpenoids and saponins.

Phenol	+
Flavonoid	+
Phlobatanin	-
Tannin	-
Alkaloid	+
Terpenoid	+
Steroid	-
Saponin	+
Anthraquinone	-
Cardiac glycoside	-
Presence (+)	
Absence (-)	

Table 2: Quantitative compositions of phytochemicals present in *Cnidoscolus aconitifolius* leaf

Phytochemicals	Sample composition (mg/100g)
Phenol	33.02±0.32
Flavonoid	2.955±0.09
Saponin	6.305± 0.13
Alkaloid	1.96± 0.26

Table 3: Proximate content of *Cnidoscolus aconitifolius* leaf

Proximate	Concentration (100%)
Carbohydrate	41.895
Protein	7.68
Crude fat	1.145
Moisture	13.53
Ash	4.585
Crude fibre	31.165

Table 4: Vitamins composition of *Cnidoscolus aconitifolius* leaf

Vitamins	Composition (mg/100g)
Vitamin C	892.025
Vitamin B ₂	5.84
Vitamin B ₁	1.36
Vitamin B ₉	9.425
Vitamin A	59.6445
Vitamin D	88.992
Vitamin E	69.785
Vitamin K	-

Table 5: Minerals composition of *Cnidoscolus aconitifolius* leaf

Minerals	Composition (mg/100g)
Phosphorus	24.68
Copper	7.1
Zinc	15.64
Iron	14.83
Calcium	29.16
Potassium	33.88
Sodium	41.47

Table 4 shows the vitamin compositions of the plant in mg/100g as follows; vitamin C 892.025, vitamin B1 1.36, vitamin B2 5.84, vitamin B9 9.425, vitamin A 59.6445, vitamin D 88.992 and vitamin E 69.785

Table 5 shows the mineral compositions of the plant in mg/ 100g as follows; phosphorus 24.68, copper 7.1, zinc 15.64, iron 14.83, calcium 29.16, potassium 33.88 and sodium 41.47.

DISCUSSION AND CONCLUSION

Phytochemical constituents are responsible for medicinal activity of plant species. The qualitative phytochemical screening and Nutritional evaluation of the leaf of *Cnidoscolus aconitifolius* showed the presence of Phenols, Flavonoids, Alkaloids, Terpenoids and Saponins which are in agreement with those obtained by Peixoto *et al.*, [13] and Price *et al.* [14]. Generally, the evaluation of chemical components of plants furnishes vital information about the phytochemicals for discovery of new drugs and clue compounds for other applications [5].

Cnidoscolus aconitifolius leaves have high content of phenols (33.02 mg/100g). This was quite expected as many species of this genus are known for their high phenolic content. The presence of phenol is a clear indication that the plant; *Cnidoscolus aconitifolius* can be exploited in pharmaceuticals for the treatment of many disease conditions. The presence of phenols makes the plant a potential cancer therapy because phenols are well known for the enormous ability to combat cancer.

The alkaloids content of *Cnidoscolus aconitifolius* leaves was relatively small (1.96 mg/100g), likewise the flavonoids content which is (2.955mg/100mg). The presence of flavonoids is in agreement with those reported by Peixoto *et al.*, [13], of substantial amount of flavonoids especially in aerial parts of *Cnidoscolus* species and Yuan *et al.* [1], who reported isolation of fifteen flavonoids from *Cnidoscolus aconitifolius*; however, it is in contrast with those reported by Awoyinka *et al.* [2].

The leaves of *Cnidoscolus aconitifolius* had appreciable quantity of Saponins (6.305mg/100mg). This is in agreement with those reported by Awoyinka *et al.* [2]. Saponins protect against hyperglycaemia, hypercholesterolaemia, hypertension [12], have antibiotic properties and anti-inflammatory property and aid healing [14]. Saponins natural tendency to ward off microbes makes them an effective therapy for fungal and yeast infections. Saponin serves as natural antibiotics, which help the body to fight infections and microbial actions. Its presence makes *Cnidoscolus aconitifolius* a potential antibiotics drug. The presence of terpenoids also justifies and supports the use of *Cnidoscolus aconitifolius* in the

treatment of bacterial infections because Terpenes are active against bacteria; it also serves as anti-diarrheal agent [12].

Similarly, phlobatanins were not detected; this is in agreement with those reported by Awoyinka *et al.* [2]. Tannin was absent which is in contrast to a previous study reported by Araújo *et al.* [7], who reported its presence and attributed the healing and anti-inflammatory activities of *Cnidoscolus* species with its tannin content, this may probably due to solvent effect. Hence, this plant could be suitable for these purposes. Cardiac glycosides was not detected, this is in contrast with those reported by Trease and Evans [12] and Olayinka *et al.* [5] on the presence of cardiac glycosides and its use for over two centuries as stimulants in cases of cardiac failure which perhaps justifies the already locally established function of the plant in the treatment and management of hypertension [12, 14], this perhaps might be as a result of methods and effect of solvents on the extract.

The potential of a particular food or plant is determined primarily by its nutrient composition. The nutritional evaluation of *Cnidoscolus aconitifolius* revealed the presence of proximate such as carbohydrate, protein, crude fat, moisture, ash and crude fiber.

The results of the nutrient composition revealed that the carbohydrate content (41.895%) was the highest, while crude fat was the least (1.145%). Protein content was found to be at (7.68), the ash content (4.585%), moisture content (13.53%) and crude fibre (31.165%).

The high presence of carbohydrate, crude fibre and moisture content are clear indication that it's nutritional essence.

Ash content of a plant based food is the function of the mineral elements present. Its presence shows that *Cnidoscolus aconitifolius* possesses mineral elements. Other important proximate available includes crude fat and crude protein which are in appreciable quantity. Their presence goes further to expose the nutritional benefit of the leaf.

The vitamin evaluation revealed the presence of Vitamins A, B₁, B₂, B₉, C, D and E. The result showed that Vitamin C content (892.025mg/100g) was the highest while vitamin B₁ was the least (1.36mg/100g). Vitamin A is at (59.6445mg/100g), Vitamin B₂(5.84mg/100g), Vitamin B₉ (9.425mg/100g), Vitamin D (88.992mg/100g) and Vitamin E (69.785mg/100g). The high content of Vitamin C is a clear indication that *Cnidoscolus aconitifolius* can serve as an antioxidant. Vitamin C is a potent antioxidant that facilitates the transport and uptake of non-heme iron at

the mucosa, the reduction of folic acid intermediates and the synthesis of cortisol. Its deficiency includes fragility to blood capillaries gum decay, scurvy [10]. The Vitamin A content of *Cnidoscolus aconitifolius* is important for normal vision, gene expression, growth and immune function by its maintenance of epithelial cell functions [11].

Vitamin E just like Vitamin A is a powerful antioxidant which helps to protect cells from damage by free radicals and it is vital for the formation and normal function of red blood cells and muscles [10]. Adequate supply of dietary antioxidants may prevent or delay diabetes complications including renal and neural dysfunction by providing protection against oxidative stress [5]. B complex vitamins found in *Cnidoscolus aconitifolius* are essential for growth, development and a variety of other bodily functions. They play a major role in the activities of enzymes [4].

The mineral evaluation revealed the presence of Phosphorus (P), Copper (Cu), Zinc (Zn), Iron (Fe), Calcium (Ca), Potassium (K) and Sodium (Na). The result of the analysis showed that the sodium content (41.47mg/100g) was the highest and copper content (7.1mg/100g) was the least. The presence of sodium and potassium to such extent shows that the plant can be used in the management and treatment of diseases associated with the central nervous systems and also in the prevention of CNS associated disease condition. This is because Potassium and sodium ions are known activators of energy potentials across nerve membrane. Calcium (Ca) is an important factor in fibrinect formation which forms fibrinogen and subsequently fibrin and collagen. Fibrin which is a clotting factor responsible for homeostasis together with calcium ions may serve as replenishment in diarrheic conditions, maintenance of normal nervous function and gut peristalsis.

Phosphorus and copper also aids in brain function. Iron plays a vital part in blood function and this may explains the traditional use of this plant as blood booster. Zinc is an essential component of more than 10 important enzymatic functions of the body and without zinc, the body will quickly lose overall function and results in a number of health concerns, including an inability to heal wounds, store insulin, fight off disease, develop proper growth patterns, as well as defend against a variety of skin infections. Previous investigation of the mineral content of *Cnisdoscolu saconitifolius* has shown that it contains Magnesium which is also important in many intermediary metabolism and enzymatic actions.

Conclusion and Recommendation: The results of this study showed that the leaves of *Cnidoscolus aconitifolius* contain useful chemical compounds that are both medicinal and nutritional which can be utilized for chemotherapeutic purposes and nutritional supplements. However it is recommended that anti-nutrients investigations using variety of solvents should further be carried out to ensure its complete safety for human consumption.

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