Original Article

Nutritional and Phytochemical Potential of *Spilanthes uliginosa* (Sw) Leaves

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ABSTRACT

Background: The use of plants to cure diseases is as old as the mankind and this therapeutic potential of plants lies in some chemical components that are present in plants that produce definite physiological and biochemical actions on the human body.
Objectives: To investigate some nutritional and the phytochemical constituents of the leaves of *Spilanthes uliginosa* (Sw).
Methods: The phytochemical and proximate analyses of *Spilanthes uliginosa* (Sw) leaves were carried out using methods of AOAC. The leaves were assayed for contents of vitamins; A, C, E, B1, B2 and B3 using spectrophotometric methods while the mineral elements status were determined using AAS.
Results: Results indicate carbohydrate, protein, fat, crude fibre, moisture and ash contents; 16.85%, 41.05%, 1.51%, 7.39%, 23.02 and 10.21% respectively. Vitamin and mineral analysis revealed the order folic acid > ascorbic acid > riboflavin > thiamin > β-carotene > α-tocopherol and Mn>Cu>K>Fe>Zn>Co>Ca>Na. The results of the phytochemical analyses revealed that the leaves contained various quantity of phytochemicals; alkaloids, glycosides, phenolics, phytates, saponins, flavonoids and tannins recorded 2.15±0.50, 0.23±0.01, 51.50±0.85, 2.28±0.32, 4.31±0.01, 2.30±0.01, and 2.61±0.29 respectively.
Conclusion: The leaves of *Spilanthes uliginosa* (Sw) contained numerous nutritional and phytochemical constituents. This study therefore concludes that *Spilanthes uliginosa* (Sw) is very nutritive despite the presence of some anti-nutritive components such as glycosides, phytates and tannins.

The importance of medicinal plants to most developing countries cannot be over emphasized. Plants have been used for the healing and curing of many human diseases or injuries for thousands of years. However, in the present century this practice is being gradually dislodged by the introduction of synthetically derived drugs as well as Western medical practices. Traditional therapies continue to be practiced in all corners of the globe but largely under the harmony of a western biochemical model. Medicinal plants are of great

importance because of the following reasons: Many of the plants can provide an alternative to imported drugs, ie plants can provide new substances that are useful against diseases for which suitable cure are not yet available.

Keywords: *Spilanthes uliginosa* (Sw), Phytochemicals, Proximate compositions.

INTRODUCTION

The use of plants for healing and treatment of diseases or injuries has gained considerable momentum in the world for thousands of years. However, in the present century this practice is being gradually dislodged by the introduction of synthetically derived drugs as well as Western medical practices. The adverse effects resulting from overuse of synthetic drugs has motivated mankind to go back to nature for safer remedies. Traditional therapies are continued to be practiced in all corners of the globe but largely under the harmony of a Western biochemical model. Medicinal plants are of great importance because of the following reasons: many of the plants can provide an alternative to imported drugs, ie plants can provide new substances that are useful against diseases for which suitable cure are not yet available.

Spilanthes uliginosa (*Sw*), commonly known as *Acmella uliginosa* (Sw) is an annual herb or short-lived perennial approximately half meter tall with erect stems, sometimes decumbent[1]. It is not known from the wild[2] and it is thought to have been derived through cultivation of *Acmella alba* (L'Hér.).

Spilanthes uliginosa (Sw) belongs to a family Asteraceae and it is a short perennial herb in the tropics and sub-tropics. About sixty species of *Spilanthes* have been reported from various parts of the world including India, and they have a characteristic flower head which distinguishes individual species. It originated in Africa and South American tropics, but is distributed in tropics and sub-tropics of the world[3]. The genus occurs widely in damp pastures, at swamp margins, on rocks near the sea and as a weed of road sites[4]. The seed germinates vigorously in about 12 days under greenhouse condition (21-32^{o}C). Damp and cool conditions are held responsible for rotting of seeds. The plant is grown indoor, or in the greenhouse, so that the seedlings become well established at the time of transplanting to the garden[1].

Spilanthes uliginosa (Sw) is a heavy feeder, preferring rich soils and an occasional side dressing of organic compost. As an ornamental, it is propagated by seed or by stem-cuttings (Shanthi and Amudha, 2010). It is sold in markets in Madagascar throughout the year with peak supplies from November-March. The leaf and buds may be harvested continually as often as the plants can afford[2].

The plant is traditionally used in Asia, Central and South America and in Africa as therapeutic diets[5]. The leaves and parts thereof are used by indigenous herbalists in the treatment of various ailments such as toothache, headache, convulsion/epilepsy, malaria, thyphoid fever, tuberculosis, snake bites and in wound healing among others[6]. The plant also stimulates the salivary glands to produce more saliva and may serve as a tonic for healthy gums and oral flora[3]. It seems to boost production of leukcocyte and antiviral interferon suggesting that the plant may be

useful in enhancing immune system function[1,7]. In some countries, the plant is used as a salad material because of the conical and paleceous form of the receptacle[8].

Lack of information on the nutritional and phytochemical contents of many number of native plants with which Nigeria is endowed with is partly responsible for their under-exploitation especially in areas beyond the traditional localities where they are found and consumed. Among the plants in which their nutritional and phytochemical analyses have not been extensively studied are leaves of *Spilanthes uliginosa* (Sw).

This paper therefore dealt with evaluating the phytochemical, proximate, vitamin and mineral contents of the leaves of *Spilanthes uliginosa* (Sw) grown in Nigeria.

MATERIALS AND METHODS

Collection and preparation of *Spilanthes uliginosa* (Sw) leaf extract

The plant of *Spilanthes uliginosa* (Sw) was collected from Ogboji-Agoutu Ezzagu in Inyaba Development Centre of Ebonyi State, Nigeria. The plant was identified by Dr (Mrs) Nnamani, K. of the Department of Applied Biology of Ebonyi State University, Abakaliki. The leaf of the plant was removed from plant stalk, rinsed with clean water and shade dried to a constant weight. The dried plant sample was ground to fine powder with grinding machine, packaged in glass jars and stored at 4^{o}C until analysis.

Proximate analysis

The samples were analyzed for proximate compositions which include moisture content, fat/oil, ash, protein, fiber and carbohydrate contents. Proximate contents of the leaves were determined according to the procedures of Association of Official Analytical Chemist (A.O.A.C,)[9].

Determination of vitamin and mineral contents

The leaf of *Spilanthes uliginosa* (Sw) was assayed to determine the amount of vitamin A, C, E, B_1, B_2 and B_9 using Spectrophotometric method as described by Okwu[10] while minerals by atomic absorption Spectrophotometer (AAS) as described by Onwuka[11].

Phytochemical analysis

The phytochemical constituent of the leaf was carried out according to the method described by Amin *et al*[12] and Trease and Evans[13].

All the analyses were done in triplicate and all reagents and chemicals were of analytical standard.

Statistical analysis

Three analytical determinations were carried out on each independent replication for every parameter. Three independent replicates (n = 3) were obtained from each treatment and the results presented in tables and are reported as means ± standard deviation (SD). Data were analyzed by t-test ($P < 0.05$).

RESULTS

Table 1 showed the results of proximate composition of *Spilanthes uliginosa* (Sw) leaves and it indicates that the leaves contained considerate amount of carbohydrate, ash and crude fibre with high protein and moisture content and low level of fat. This confirms that *Spilanthes uliginosa* (Sw) is a good source of these nutrients. The results of the Vitamin Contents were presented in table 2. This showed that the leaves of *Spilanthes uliginosa* (Sw) has appreciable high amounts of vitamin contents in the order of

folic acid > ascorbic acid > riboflavin > thiamin > β-carotene > α – tocopherol. Table 3 and 4 showed the results of mineral and antinutrient constituents in the plant leaves respectively. The leaves contained high levels of magnesium, copper and potassium with relatively low level of sodium content while the antinutrients status indicate that the plant contained low levels of phytate, glycosides and tannins. Table 5 showed the results of phytochemical analysis of *S. uliginosa* (Sw) leaves indicating the high amount of phenols and saponins with low amounts of alkaloids, and flavonoids.

DISCUSSION

Table 1 showed the result of proximate analysis of *Spilanthes uliginosa* (Sw) and it revealed that the leaf contained an average protein content value of 41.05% which is the highest parameter. This result indicates that the leaf is a good source of protein. Protein serves as enzymatic catalyst, mediate cell responses, control growth and cell differentiation[14]. An average moisture content value of 23.02% was second to the highest parameter observed. High moisture content in any food has been proved to cause caking and it can also determine the storage/shelve life and the viability of microbial growth[15]. Average carbohydrate content value of 16.85% was third of the highest parameter and this implies that they can provide readily accessible fuel for physical performance and regulate nerve tissue[16]. Next to carbohydrate is ash content (10.21%) and is a reflection of amount of minerals preserved in the leaves. Minerals are essential for proper functioning of body system; some function as cofactor while some as secondary messenger in some biochemical reactions[17]. Average crude fibre (7.39%) was the second to the last parameter noted. This showed that the plant can serve as a source of dietary fibre and can be employed in the treatment of diabetes, obesity and gastrointestinal tract diseases. It is also an indication that it contains a proportion of cellulose, hemicellulose and lignin. The lowest parameter was average fat content value of 1.51% and this is universal stored form of energy in living organisms. Fats are major structural elements of biological membranes as phospholipids and sterol[18].

Table 2 showed the result of vitamin compositions of *S. uliginosa* (Sw) leaves as a good source of folic acid, ascorbic acids, thiamine, riboflavin, beta - carotene and apha-tocopherol in the order of abundance. The high level of folic acid in the plant implies that it could help in formation of red blood cells. It could also regulate nerve cells at embroyonic and foetal stages of development, helping to prevent abnormalities of the brain, spinal cord and neural tube defects[19]. Ascorbic acid was the second highest vitamin and is vital for the body performance[10]. Deficiency of ascorbic acid impaired normal formation of intercellular substances in the body, including collagen, bone matrix and tooth dentine. The pathological change resulting from this defect is weakening of endothelial wall of capillaries due to a reduction in amount of intercellular substances[20]. Ascorbic acid helps many enzymes perform their work; for example, the enzyme involved in formation and maintenance of the tissue protein collagen depend on ascorbic acid for their activity[14]. This function of ascorbic acid also accounts for the requirement for normal wound healing. The availability of ascorbic acid in all the plants could give them the potential of being use them in the treatment of common cold and other diseases such as prostrate cancer [23]. Thiamin and riboflavin are crucial for growth, digestion and appetite stimulation. Deficiency of thiamin results to nutritional disease known as beri-beri. It is characterized by muscular weakness palpitation of the

heart and degeneration of the nerves owing to the accumulation of pyruvate and ketoglutarate in blood. Next to vitamin B is β-carotene which helps in normal vision, morphogenesis, growth and cell differentiation. β-carotene plays a crucial role in iron utilization, humoral immunity; T-cell mediated immunity and natural killer cell activity. α-Tocopherol is the lowest vitamin present with a value of 0.19 g/100mg. The most essential benefit of ascorbic acid, β-carotene and α-Tocopherol is their roles as a natural antioxidant by scavenging free radical and molecular oxygen[22]. This vitamin has been suggested to increase sexual performance, to treat intermittent claudication by reducing arterial blockage and slow down the aging processes[23].

The result of mineral composition of thev leaves was shown in Table 3 and this result revealed that *S. uliginosa* (Sw) leaves contained high levels of Manganese, copper and potassium but relatively low level of sodium. These minerals are necessary for the normal biochemical processes in human system. Manganese acts cofactor for many enzymes and its deficiency of normal growth, bone formation and reproduction. It also participates in the production of sex hormones and maintaining reproductive health. Copper is involved in development of immune cells and its deficiency lead to low levels of white blood cells and diminished immune cell function[24,25]. Copper is also essential in brain and nervous system formation as well as production and maintenance of myelin which insulates the nerves ensuring the proper transmission of nerve impulses among others[14]. High potassium content suggests that it may enhance vital cell functions including neuro-transmission, muscle contraction, and maintenance of acid-base balance[26]. Calcium is in moderate level and this calcium concentration is necessary for blood coagulation and for integrity of intracellular cement substances[12]. Thus, the potential of *S. uliginosa* (Sw) *to* stop bleeding and its use in treating wounds could be as a result of its high calcium content. Sodium is an important mineral in the body fluid and in maintenance of electric potential in the body[27]. However, high intake of sodium increases the risk of hypertension, cardiovascular diseases, cerebral haemorr-hage and hypertension-related stroke[28]. Thus, the low level of sodium present in this plant might be an added advantage.

Table 4 shows antinutrients composition of *S. uliginosa* (Sw). Literature has shown that phytic acid bind zinc, iron and other micronutrients in the intestinal lumen to reduce their bioavailability. Though, no upper limit has been set yet for phytic acid consumption. This may be due to some beneficial effects now attributed to dietary phytic acid[29] reported that phytic acid reduce plasma glucose effects that are beneficial in diabetic and hyperlipidemia management. Tannins which were found in the plant are known to be effective in the treatment of sore throat, diarrhoea and haemorrhage. Tannins reduce absorption of iron and other metals because the ability to precipitate with them while glycosides in large quantity are very toxic in animals.

Table 5 showed the result of phytochemical compositions of *S. uliginosa* (Sw) leaves and it indicates the various amounts of saponins, alkaloids, phenols and flavonoids. These compounds are known to be biologically active and therefore aid the antimicrobial activities of *S. uliginosa* (Sw)[30].

Alkaloids (2.471 g/100 g), a secondary metabolite compound observed in the extract of *S. uliginosa* (Sw) has the biological property of toxicity against cells of foreign organisms. Alkaloids have been reported to play an essential roles in elimination and reduction of human cancer

cell lines[15]. Alkaloids are used in treatment and management of numerious diseases such as headache associated with hypertension, cold, fever chronic catarrh[31].

Saponin (5.651 g/100 g) found to be present in *S. uliginosa* (Sw) extracts and has supported the usefulness of this plant in managing inflammation. Studies have shown that saponins exhibit inhibitory and cytotoxic effects on inflamed cells[32,31].

Flavonoids (3.246 g/100 g) are other constituents of *S. uliginosa* (Sw) leaves and they are large compounds occurring ubiquitously in food plants. A time they at times occur as glycosides with several phenolic hydroxyl groups on their ring structure. Flavonoids have been reported to exhibit a wide range of biological activities like antimicrobial, anti-inflammatory, anti-angionic, analgesic, antiallergic, cytostatic and antioxidant properties[33].

Phenols (0.232 g/100 g) are also found to be present in this plant. Phenols, saponins and flavonoids are known for their antioxidant activities and hence they help to protect the body against cancer and other degeneratives diseases by scavenging free radicals[34].

CONCLUSION

The chemical analysis carried out on *Spilanthes uliginosa* (Sw) leaves revealed its Nutritional and Phytochemical composition. The Proximate analysis showed a high level of Carbohydrate and crude fibre with a little bit of Protein. The mineral analysis indicated that *Spilanthes uliginosa* (Sw) contained macro/major elements which are needed in high quantity in meals, Potassium been the highest. Sodium and Magnesium were also found to be abundant in this sample. Micro elements were also found to be present. These are all good indication of high nutritive value. Despite the presence of some Anti-nutrient that could serve as mineral inhibitors, *Spilanthes uliginosa* (Sw) can still be used as sources of these minerals. The Phytochemical content also is an indication that this sample has potential protective vices against degenerative diseases.

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Statement or information on competing interest

The author (s) declared that there is no competing interest in this manuscript.

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Table 1. Proximate composition (%) of *Spilanthes uliginosa* (Sw) leaves

Phytochemicals	*S. uliginosa* (Sw)
Carbohydrate	16.85±0.01
Protein	41.05±0.01
Fat	1.51±0.01
Crude fibre	7.39±0.01
Moisture	23.02±0.00
Ash	10.21±0.02

Data are expressed as the mean value ± standard deviation.

Table 2. Vitamin content (mg/100g) of *Spilanthes uliginosa* (Sw) leaves

Vitamins	*S. uliginosa* (Sw)
β- carotene	0.22±0.02
Ascorbic acid	0.89±0.02
α- tocopherol	0.19±0.01
Thiamin	0.36±0.03
Riboflavin	0.58±0.03
Folic acid	19.11±1.02

Data are expressed as the mean value ± standard deviation.

Table 3. Mineral composition (mg/100g) of *Spilanthes uliginosa* (Sw) leaves

Mineral Micro - elements	*S. uliginosa* (Sw)
Iron	0.23±0.02
Zinc Macro - elements	0.16±0.06
Manganese	0.70±0.20
Copper	0.52±0.10
Sodium	0.05±0.10
Potassium	0.42±0.00
Calcium	0.12±0.20
Cobalt	0.15±0.16

Data are expressed as the mean value ± standard deviation.

Table 4. Anti-nutrient composition (mg/100g) of *Spilanthes uliginosa* (Sw) leaves

Phytochemicals	*S. uliginosa* (Sw)
Phytate	2.28±0.32
Glycosides	0.23±0.01
Tannins	2.61±0.29

Data are expressed as the mean value ± standard deviation.

Table 5. Phytochemical composition (mg/100g) of *Spilanthes uliginosa* (Sw) leaves

Phytochemicals	*S. uliginosa* (Sw)
Alkaloids	2.15±0.50
Plenolics	51.50±0.09
Saponins	4.31±0.01
Flavonoids	2.30±0.01

Data are expressed as the mean value ± standard deviation.