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PHYTO-NUTRITIONAL PROFILES OF BROOM WEED (*SIDA ACUTA)* LEAF EXTRACT

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ABSTRACT

Medicinal plants are abundant in phytochemicals that has significant therapeutic effects. They are relatively cheap, effective and safe in prolong use. This experiment was carried out to investigate the phyto-nutritional profile of broom weed (Sida acuta) leaf extract. Proximate analysis Sida acuta leaf indicated the presence of dry matter (91.88 %), crude protein (18.01 %), ash (9.73 %), crude fibre (6.24 %), ether extract (1.77 %) and energy (2760 Kcal/kg). Phytochemical screening of the extract revealed the presence of condensed tannins, hydrolysable tannins, flavonoids, saponins, phenols, oxalate, phytate, alkaloids, terpenoids and glycosides at 0.82 %, 2.02 %, 4.25 %, 0.20 %, 0.17 %, 0.05 %, 0.23 %, 0.22 %, 0.95 % and 0.02 % respectively and the vitamin constituents are thiamine (0.33 mg/100g), ascorbic acid (30.17 mg/100g), riboflavin (0.05 mg/100g), β-carotene (0.79 mg/100g) and niacin (0.41 mg/100g). Mineral analysis showed that it contained calcium (127.6 mg/100g), phosphorus (78.6 mg/100g), potassium (31.6 mg/100g), magnesium (102.1 mg/100g), iron (2.14 mg/100g), manganese (0.60 mg/100g), copper (0.04 mg/100g) and zinc (1.75 mg/100g). Result on amino acid composition showed that they contained lysine (2.11 mg/100g), arginine (1.77 mg/100g), aspartic acid (2.13 mg/100g), threonine (1.85 mg/100g), histidine (4.71 mg/100g), serine (2.03 mg/100g), glycine (1.05 mg/100g), alanine (3.31 mg/100g), cystine (5.06 mg/100g), valine (0.88 mg/100g), leucine (2.04 mg/100g), phenyalanine (4.72 mg/100g), tyrosine (3.51 mg/100g), isoleucine (2.84 mg/100g), methionine (0.85 mg/100g) and proline (1.05 mg/100g). It was concluded that Sida acuta leaf extract is rich in various nutrients and phytochemicals conferring it the ability to perform multiple biological activities and as a natural alternative to antibiotics.

Key words: *Medicinal plants, nutrients, Sida acuta, phytochemicals.*

1. Introduction

The important of plants of various types cannot be over emphasized. Since the time immemorial, plant has been taking so important in various approaches. Several plant leaves are delicacy in the preparation of stew in some tribes, which when its number and types is not complete the stew look awkward and unacceptable to them. The belief is that different plant contributes different nutrient to the stew which make it delicious and nutritional. Therefor plenty plants of proven nutritional/medicinal qualityare of important to many pharmaceutical companies manufacturing a wide range of allopathic medicines, due to their phytochemical properties. This has caused increasing consideration of natural drug to an individual and most companies producing most synthetic drug.

One of the common examples is the use of plant extractive in the production of antimalarialfrom the plant called *Artemisia annua*. The drug is proven inthe cure of malaria.Mostafa *et al*., (2012) identified extract from *Artemisia annua to be the* most effective anti-malarial because it rich in artemisinin, which was extracted from the leaves of *Artemisia annua*. This and several others havemade plant to be major source of breakthrough in the pharmaceutical industries.

It is an inevitable fact that increasing research on medicinal plants could pave the way for the discovery of novel therapeutic agents against many diseases that areoutstanding diseases (Perumalsamy *et al*., 2019) whichthreatened human existence.Interestingly, WHO has recognized the significanceof traditional medicine in the health-care sector andhas assessed that approximately eighty percent ofthe population living in the developing countriesdepend on herbal medicines for their primary health care requirement (Negash *et al*., 2017). There are many plants in the tropical countries that have not been harnessed, knowing their Phyto-profile will help to enable many people to be attracted to their usefulness as a result of their Phyto-properties.

Phytochemicals also called active principles or phytochemical substances (Ekpo and Etim, 2009) are the predominant substances present in many medicinal plants which responsible for many observed physiological actions. These phytochemicals are present in many forms such as alkaloids, steroids, tannins, glycosides, volatile oils, phenols, and flavonoids (Perumalsamy *et al*., 2019) while Ekpo and Etim, (2009) and Asaolu (2003) stated the active chemicals to consist terpenses, flavonoid, bioflavonoid, benzophonones, xanthenes as well as some metabolites such as tannins, saponins, cyanates, oxalate and anthrax-quinones which are non-specifically confined to various parts of a plant such as leaves, flowers, bark, seeds, fruits or roots (Perumalsamy *et al*., 2019). All these active ingredients are used in the phototherapy and help to control or prevent many diseases. Ekpo and Etim, (2009) established that medicinal plants are known to owe their curative potentials to certain biological active substances, which exist in parts

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of the plants.

Sida acuta (broom weed) is one of the plants with medicinal potential qualities and present in abundance in the tropics. Itis drought resistance tropical weeds that are common in almost everywhere. *Sida acuta* is an erect, branched and perennial shrub with a woody tap root, hairy branded upto 1m high and is reproduced from their seeds. The stem is woody, rounded and slender, and is fibrous and hairy especially when young. The leaves are simple and alternate while the inflorescence is solitary and axillary with stalks up to 1.3 cm long jointed about half of the length. The flowers are yellow with five petals and the fruit is capsuled with 5 - 6 carpels (Ekpo and Etim, 2009).Therefore, this study was designed to examine the phytochemical properties of *Side acuta* to make it uses known and popular to the populace.

2. Materials and methods

Study Area: The experiment was carried out at Division of Animal Nutrition, Sumitra Research Farm, Gujarat, India during the month of December to February, 2018.

Collection and processing of *Sida acuta* extract: Fresh and mature leaves of *Sida acuta* were collected within the farm premises and authenticated by a botanist (Liu Yung). The leaves were washed with running tap water, shade dried in a clean tray for 12 days and pulverized to coarse powder with a Panasonic electric blender Model WS-812 KJ and stored in an air tight container for further analysis. 100g of the sample was soaked in 1000 ml water and agitated with anelectric blender for 10 minutes, thereafter the mixture was turned into a another container, kept in the refrigerator at 4^{o}**C**for 72 hours and then filtered using filter paper (Whatmann No. 1) to obtain *Sida acuta* leaf extract (SAL).

Laboratory procedures: Proximate analysis of experimental leaf was determined by standard methods as described by AOAC (1990). Mineral content of SAL was determined using an Atomic Absorption Spectrophotometer (AAS) model 236-12. Phytochemical screening of flavonoids, saponin, phytate, terpenoids, steroids and phenol of SAL and *Sida acuta* leaf was carried out using methods described by Boham and Kocipai-Abyazan (1974),Harbone (1973) and Odebiyi and Sofowora (1978) respectively. Tannins were analysed using Folin-Denis spectrophotometric method (Shabbir *et al*., 2013). Alkaloids, phytate and oxalate were determined according to the method outlined by Day and Underwood (1986). Vitamin analysis of ascorbic acid, thiamine, riboflavin, niacin and β-carotene according to the procedures outlined by Uzomah*et al*. (2002), Augustine (1985) and Okwu and Josiah (2006).Amino acids were analysed using commercial diagonistic kits (Humburg, Braunschweig, Germany, Model RS-567A.

Statistical analysis: All data were subjected to one -way analysis of variance (ANOVA) using SPSS (20.0) and significant means were separated using Duncan multiple range test of the same software. Significant was declared if $P \leq 0.05$.

3. Results and Discussions

The proximate composition of *Sida acuta* is shown in table 1. Proximate composition can be described as the term used in the field of animal science or feed analysis to means the six components of feed for the animal that are of major or commonly important which are moisture, crude protein, ether extract, crude fiber, crude ash and nitrogen free extracts and they are usually expressed in percentages. Proximate compositions are very important in the formulation of animal diet in other to estimate the value of what the farmer is given to his or her animals. Also for any non-conventional ingredients to be used in animal feeding or as supplement, the proximate needs to be established. According to Raimi *et al*. (2014) plants are basic source of knowledge in our today medicine. Most of the feed given to animal are from plant kingdom, this make it so important to know the profile of all the plant around to harnessed their importance. *Sida acuta* had 91.88% dry matter, 18.01% crude protein while ash, crude fibre, ether extract and energy level were 9.73%, 6.24%, 1.77% and 2760.00 (Kcal/Kg), respectively. The protein composition and dry matter percentage were similar compare to the 19.13% (CP) and 91.07% (dry matter) report by Raimi *et al*. (2014), but had significantly lower crude fibre (6.24%) compared to 9.50% reported by the authors. Difference observed in crude fibre may be as result of variation in the age at harvest or varieties of the *Sida acuta* leaf. The ADL generally increased with the growing maturity stage of growths for forages (Homolka *et al*., 2012).

*Sida acuta*leaves had varied phytochemical properties compared to *Sida acuta leaf extract* (Table 2). After assessment, it was discovered that *Sida acuta* contains phytochemical properties which include the saponins, tannins, alkaloids, flavonoids, phytates, phenols, oxalate, terpenoids, glycosides and steroids. Also, the analysis revealed that *Sida acuta* leaf and extract had similar condensed tannin but varied hydrolysable tannin. *Sida acuta* leaf consists of lower (1.52%) hydrolysable tannin compared to *Sida acuta* leaf extract (2.02%). More phytochemical was discovered when compare to the findings ofSenthilkumar*et al.* (2018) that reported absence of tannins, saponins.The composition of the leaf extract from this study was lower compare to the report of Chinelo and Miracle (2018) except flavonoids (3.86 mg/100g). The authors reported highest compositions of alkaloids, flavonoids and steroids being 0.55, 2.31 and1.85 mg/100g respectively.The differences might be as a result of age at harvest or the variety of the *Sida acuta. Abutilon indicum*, *Gossypium herbaceum*, *Hibiscus mutabilis*, *Hibiscussabdariffa*, *Hibiscus rosa-sinensis*, *Sida acuta*, *Sidacordifolia*, *Sida rhombifolia* and several others are the genera with great ethnomedicinal values (Rahman and Gondha, 2014). The study of Richa and Sharma (2014) indicated the high presence amounts of alkaloids, flavonoids, terpenoids and glycosides in methanolic leaf extract of *S. acuta* and presence of these phytoconstituents in *S. acuta* showed excellent anti-bacterial and anti-malarial properties (Karou*et al*., 2003, Alka and Kumar, 2012). Alkaloid presence has been implicated to process the pharmacological property (Chinelo and Miracle, 2018).

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Phytochemicals are present in many plants, this help the plant to elicit the chemotherapy common to them. The was established by Edeoga *et al.*, (2005) w*hen Cleome nutidosperma, Emilia coccinea, Euphorbia heterophylla,Physalis angulata, Richardia bransitensis, Scopaniadulcis, Sida acuta, Spigeliaanthelmia, Stachytarphetacayennensis* and *Tridaxprocumbens* were accessed. All the plants were found to contain alkaloids, tannins and flavonoids except for the absence of tannins in *S. acuta*. The absence of tannins in the *Sida acuta* was contrary to the result of this study. The differences in the report may be as a result of species assessed or methodology employed in the assessment.

Vitamins are organic nutrients that are necessary for growth and development of animals. Body needs vitamins to function properly and most vitamins cannot be produced by the animal in sufficient quantity on their own. Therefore, there is need to obtained them from the feeds fed. Plant can manufacture vitamin necessary for their metabolism, human being and animal cannot do the same except vitamin D. This may be because of lack of some necessary enzyme or pigments. Animal and human need to inject the vitamin through the feed/food and *Sida acuta* has Thiamine (B_1), Ascorbic acid (C), Riboflavin (B_2), β-carotene and Niacin (B_3) (Table 3) that can improve the animals' need of them.

The composition of thiamine (0.33mg/100g) in this plant was similar to the report of Olivier, (2017- 0.36mg/100g) and Nwankpa *et al*. (0.36mg/100g- 2015) while the quantity of niacin (0.41mg/100g), ascorbic acid (30.17mg/100g) recorded in this study was higher when compared with the report of Olivier (2017) and Nwankpa *et al*. (2015). Although the authors reported higher (0.12 and 0.12mg/100g, respectively) riboflavin compared to the report of this research (0.05mg/100g). According to John and Richard (2013), riboflavin can be synthesized de novo by plant, yeast, and prokaryotic cells, mammals need to obtain riboflavin by consuming plant-based foods or, if necessary, supplemental sources. Riboflavin is very important vitamin in animal system, it is the precursor to the coenzymes, flavin mononucleotide (FMN) and flavin adenine dinucleotide (FAD) (John and Richard, 2013). The author implicated riboflavin deficiency to have possible genetic defects in human riboflavin transporter.

Higher vitamin C compare to other research results might be an added advantage as a result of numerous role it plays in animals. According to Khalid *et al*., (2004) vitamin C is essential for the development and maintenance of connective tissues. It plays an importance role in bone formation, wound healing and the maintenance of healthy gums. It plays other importance role such as activation of vitamin B, folic acid, conversion of cholesterol to bile acids and tryptophan to the neurotransmitter, serotonin. It also performs the role of antioxidant that protects the body from free radicals' damages. Vitamin C is also used as therapeutic agent in many diseases and disorders, it helps to protects the immunes system, reduces the severity of allergic reaction and helps to fight infections. Given plant with such quality to the animal will help to maintain healthy livestock products.

Thiamine is another vitamin present in *Sida acuta*. Thiamine is very important vitamin in animal nutrition because it cannot be produced sufficiently by ruminants, given *Sida acuta* to such ruminants will therefore improve the health status of the animal. Thiamine deficiency was identified to be common in ruminants primarily because of the inability to activate the vitamin through the help of rumen microbes, it causes cerebrocortical necrosis and neurological signs (Jessica *et al*., 2013).

Table 4 shows the mineral composition of *Sida acuta*leaf (mg/100g). The macro elements determined include calcium, phosphorus, potassium, magnesium and sodium while the micro elements include iron, manganese, copper and zinc. Except sodium and magnesium, other mineral elements observed in this experiment were higher than the reported values according to Raimi *et al*. (2014). Although experience has shown that phytonutrient contents of plants cannot be the same, so the variation are much expected. This is because many factors contributed to the soil nutrients availability and plant uptake, but the present of these minerals in this amount is an added advantage to the use of *Sida acuta* leaf meal. Calcium for example, it is the most abundant mineral in the body of both animal and man (98%). It is found in the bone and teeth. Helps in blood clothing, membrane permeability, muscle contraction, nerve functioning etc (Rick, 2020). The variation in the phytonutrients could be as a result of different soil type or varieties. The different may also be as a result of water/or moisture content in the soil. It has been stated by Ogundola*et al*. (2017), that type of soil, soil texture and effect of environmental exposure can influence the nutritional composition of plant. According to Paetsch *et al*. (2017) established that plant mineral contents depends upon the interaction of number of factors which include soil, plant species, stage of maturity, yield, pasture management and climate. It was also discovered by the authors that heavy rainfall and high temperature accentuate the soil mineral deficiency.

The amino acid profile of *Sida acuta* is presented in table 5. Amino acids are building blocks of proteins and polypeptides that are the major component of animals' muscles and tissues. Amino acid also has been identified to be part of some fluid such as milk and also it plays significant role in the biochemical and metabolic processes in cell of all the animals (Kemi, 2019). Considering the contribution such as body building block, important fluid constituent, metabolicactivities, growth, production, reproductionetc, this make the determination of the constituent in some plant like *Sida acuta* very important. All the sixteen amino acids determine are very important to the animal. According to Vernon and Peter (1994), plant protein food contributes approximately 65% of the per capita supply of protein on worldwide basis, therefore *Sida acuta* is a valuable plant, considering all the available amino acid. Although literatures are scarce on the amino acid profile of *Sida acuta*, but it has been documented that nitrogen is the fourth most abundant compound in plants. This nitrogen is a component of proteins nucleic acids, chlorophyll, diverse secondary compounds and many cellular structures (Sandra, 2010). Also, the proven performance of rabbit fed *Sida acuta* meal according to Udeh, (2007), Naandam, (2012) and Jerebi, (2015) has shown the protein quality of the leaf

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in the diet of rabbits.

Table 1: Proximate composition of *Sida acuta* leaf

Parameters	% Composition
Dry matter	91.88
Crude protein	18.01
Ash	9.73
Crude fibre	6.24
Ether extract	1.77
Energy (Kcal/kg)	2760.0

Table 2: Phytochemical analysis of test material

Parameters	*Sida acuta* leaf	*Sida acuta* leaf extract	*Permissible range (%)
Condensed tannin	0.73	0.82	1.88
Hydrolysable tannin	1.52	2.02	2.56
Flavonoids	3.86	4.25	12.10
Saponin	0.19	0.20	7.02
Phenols	0.15	0.17	-
Oxalate	1.01	0.05	0.54
Phytate	0.57	0.23	2.30
Alkaloids	0.41	0.22	2.13
Terpenoids	0.58	0.95	-
Glycosides	0.10	0.02	-
Steroids	1.42	1.05	-

*Alagbe *et al*. (2019); Alagbe and Oluwafemi (2019); Olafadehan *et al*. (2020)

Table 3: Vitamin composition of *Sida acuta* leaf

Parameters	Composition (mg/100g)	*Requirement (mg)	**% RDA
Thiamine (B_1)	0.33	1.8	31.0
Ascorbic acid (C)	30.17	36.3	39.0
Riboflavin (B_2)	0.05	10.0	34.0
β-carotene	0.79	1.00	6.00
Niacin (B_3)	0.41	2.60	5.00

**USDA (2010)

Table 4: Mineral composition of *Sida acuta* leaf

Parameters	Composition (Mg/100g)
Macro elements	
Calcium	127.6
Phosphorus	78.5
Potassium	31.6
Magnesium	20.9
Sodium	102.1
Micro elements	
Iron	2.14
Manganese	0.60
Copper	0.04
Zinc	1.75

Table 5: Amino acid composition of *Sida acuta* leaf

Amino acids	Composition (mg/100g)	*Reference level
Lysine	2.11	5.50
Arginine	1.77	1.00
Aspartic acid	2.13	-
Threonine	1.85	0.65
Histidine	4.71	0.30

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Serine	2.03	-
Glycine	1.05	1.20
Alanine	3.31	-
Cystine	5.06	0.35
Valine	0.88	0.82
Leucine	2.04	1.20
Phenylalanine	4.72	0.50
Tyrosine	3.51	0.45
Isoleucine	2.84	0.60
Proline	1.05	0.20
Methionine	0.85	0.35

*Dean (1971)

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