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Comparative Phytochemical Screening and Nutritional Potentials of the Flowers (petals) of *Senna alata* (l) roxb, *Senna hirsuta* (l.) Irwin and barneby, and *Senna obtusifolia* (l.) Irwin and barneby (fabaceae)

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ABSTRACT

Comparative phytochemical screening and nutritional potentials of the flowers (petals) of *S. alata, S. hirsuta and S. obtusifolia* (Fabaceae) were investigated. *S. alata, S. hirsuta* and *S. obtusifolia* are plants that have been frequently used as a medicine. The phytochemical screening reveals the presence of saponins, tannins, flavonoids, and cardiac glycosides and the absence of alkaloids in all three species. Quantitative evaluation of the petals of *S. alata, S. hirsuta* and *S. obtusifolia* reveals moisture content (%) of 12.5, 13.5, 13; Ash content (%) 6,11, 9. Acid insoluble (%) 1.5, 2.5, 2; Sulphated ash (%) 5, 9, 5.3; protein (%) 5.1, 8.2, 4.1, Fats (%) 5, 3.5, 4.4; Fibre (%) 25, 40, 30; Carbohydrate (%) 53.7; 42, 40.7 respectively. The above results indicates that despite the absence of information on the phytochemical screening, quantitative parameters and nutritional potentials of the petals of these studied species they contain nutrients and mineral elements, and bioactive compounds that may be useful in nutrition and in the synthesis of various therapeutic drugs.

INTRODUCTION

Man since immemorial time has been using herb or plants products as medicine for developing immunity or resistance against cold, joint pains, fevers, and so on. Scientific data in a good number of medicinal plants investigated has been well documented (Gupta, 1994). However, only very few drugs of plant origin could reach clinical use and the National Formulatory could not adopt even a dozen of plants for medicines.

For this reason, a special effort is needed for the development of herbal drugs having therapeutic utility (Gupta, 1994). Medicinal principles are present in different parts of plants like root, stem, bark, heartwood, leaf, flower, fruits, or plant exudates. These medicinal principles are separated by different processes; the most common being extraction. Extraction is the separation of the required constituents from plant materials (Burkill, 2002). Plant derived substances has obtained greater attention in the recent years to prevent and cure human diseases as they are considered to be more bio-friendly. It is generally estimated that over 6000 plants in India and Africa are in use in tra ditional folk, and herbal medicine, representing about 75% medicinal needs of the third world countries (Veerachari and Bopaiah, 2011). According to Okoli *et al*. (2007), traditional society in Africa and else where have always used herbs to promote healing. In the recent years, researchers on Medicinal Plants have attracted a lot of attention globally. Large body of evidence has accumulated to demonstrate the promising potential of medicinal plants used in various traditional, complementary and alternate system of treatment of human diseases (Alam, 2009).

Medicinal plants have provided the modern medicine with numerous plant-derived therapeutic agents (Evans, 2000 and Oladunmoye *et al*., 2009). Many plants contain a variety of phytopharmaceuticals, which have found very important applications in the field of Agriculture, Human, and Veterinary Medicine. Natural products play a dominant role in the development of novel drug leads for the treatment and prevention of disease (Newman *et al*., 2003; Gilani and Rahman, 2005).

World Health Organisation estimates that 70% of population from many countries is using traditional medicine to cure various ailments (WHO, 1991). *Senna alata* L., *Senna hirsuta* L., and *Senna obtusifolia* L., are the woody annual herbs or undershrub herbs which are native to Africa as medicinal species with active functions and therapeutic agents (Ayo, 2010).

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The main medicinal uses of *S. alata* are as a laxative or purgative and in the treatment of skin problems. For laxative purpose usually a decoction of the leaves is drunk and less often the flowers, roots, or the stem are used (Adedayo *et al.,* 2001). The decoction of the leaves of *S. hirsuta* is used against irritation of the skin in Thailand and in Laos the seeds are used as a substitute for coffee while S. *obtusifolia* leaves, seeds, roots and flower are used in folk medicine, primarily in Asia. It is believed to possess a laxative effect like *S. alata* compared to *S. hirsuta* as well as to be beneficial for the eyes (Oliver, 2005, Sofowora, 2008). Skin problem treated with *S. alata* include ring worm, favus and other mycoses, impetigo, syphilis, sores, psoriasis, herpes, chronic lichen planus, Scabies, rashes, and itching (Burkill, 1995). According to Sofowora (2008), *S. obtusifolia* are use as folk remedy, the seeds are often roasted, then boiled in water to produce a tea but in Java and in South-East Asia, *S. hirsuta* are used medicinally for treating herpes. In India, leaf decoction of *S. alata* are used as an expectorant in bronchitis and dyspnoea, as an astringent a mouth wash and a wash in cases of eczema (a skin condition in which areas of skin become red, rough and Sore) (Neuwinger, 2000). The seed of *S. hirsuta* contains a water-soluble gum, though not in commercial quantities, and it also contain bioanthraquinone which may prove medicinally important (Sangat-Roemantoyo, 1997). The root decoction of *S. alata* is drunk to treat painful menstruation and tattooing (Etukudo, 2003). *S. obtusifolia* are used as food for caterpillars of some Lepidoptera (butterflies and Moth insects). In Queensland, *S. obtusifolia* is a weed of pastures where it competes with pasture for light, reduce available grazing areas, nutrients and water and can rapidly exclude all other species (Annig *et al*., 1989). *S. hirsuta* is used as a forage plant and green manure (Sangat-Roemantyo, 1997). *S. obtusifolia* is useful against gastrointestinal condition, and its leaves and sap are used as ingredient in soaps, shampoos and lotioning in the Phillipines (Oliver, 2005). *Senna (Cassia)* species have been of keen interest in phytochemical and pharmacological research due to their excellent medicinal values. They are well known in folk medicine for their laxative and purgative uses (Dalziel, 1948; Abo *et al*., 1999; Hennebelle *et al*., 2009). Besides, they have been found to exhibit anti-inflammatory (Chidume *et al*., 2001), antioxidant (Yen *et al*., 1998; Yen and Chuang, 2000), hypoglycaemic (Bhakta *et al*., 1997), antiplasmodial (Iwalewa *et al*., 1990, Iwalewa *et al*., 1997), Larvicidal (Yang *et al*., 2003), antimutagenic (Silva *et al.*, 2008; Yadav *et al*., 2010) and anticancer activities (Prasanna *et al*., 2009). They are also widely used for the treatment of wounds (Bhakta *et al*., 1998), skin disease such as ringworm, scabies and eczema, gastrointestinal disorder like ulcers (Dalziel, 1948, Benjamin, 1980; Abo *et al*., 1999; Elujoba, Abere and Adelusi, 1999; Jacob *et al*., 2002), and Jaundice (Pieme *et al*., 2006). Etukudo (2003) pointed out that *S. alata* can be used to treat ailment like stomach pain during pregnancy, dysentery, haemorrhoids, blood in the urine (Schistosomiasis, gonorrhoea), convulsion, heart failure, oedema, jaundice, headache, hernia, one-sided weakness or paralysis in tropical Africa. Also, Sofowora (1993) reported that the young pods of *S. alata* are eaten as vegetable, but only in small quantities and toasted leaves are sometimes used as a coffee, *S. alata* has a strong decoction made of dried leaves used as an abortifacient. *Senna*, the leave juice is squeezed into the eye to treat eye sties, conjunctivitis (appolo) and other minor eye problems (Fabricant and Farnsworth, 2001). Generally, the leaf, flower, root and seed are used in herbal medicine all over the world (Dennis, 1988). Smith (2009) reported that the flower and young fruit are used as curries. Phytochemical investigation of plant extracts shows the presence of active principles in the plant parts like flower, bark, leaves, root, fruits, etc. phytochemicals are non-nutritive plant chemicals that have protective or disease preventive properties. Plant produce these chemicals to protect itself but research works demonstrates that many phytochemicals can protect humans against disease (Trease and Evans, 2002; Krishnaiah *et al*., 2009; Essiett *et al*., 2010). Knowledge of chemical constituents of plants is desirable because such information will be of value for the synthesis of complex chemical substances. Plants are rich in a wide variety of secondary metabolites such as alkaloids, flavonoids, Saponins, and tannins, etc, which have been found to in-vitro have anti-microbial properties (Alam, 2009). From available literature, there is no information on the phytochemical screening, quantitative parameters and nutritive values of petals of *S. alata, S. hirsuta* and *S. obtusifolia*. The aim of this research is to establish the chemical constituents of the flowers which would eventually be useful in preparing a monograph of the plant for proper and easy identification and also at establishing some diagnostic parameters such as quantitative parameters of the crude drug (flowers) and dietary awareness of its nutritional status. The significance of the studies is to prove that *S. alata, S. hirsuta* and *S. obtusifolia* have various therapeutic uses for the synthesis of drugs and medicinal plants in the developing countries.

MATERIALS AND METHODS

Fresh flower (petals) of *S. alata*, *Senna hirsuta* and *Senna obtusifolia* were collected from a bush in Ibesikpo, Nsit atai and Uyo Local Government Area of Akwa Ibom State.

Extraction of Plant Materials

The fresh petals of *S. alata*, *S. hirsuta* and *S. obtusifolia* were air dried and reduced to powder with the aid of a mortar and pestle. The powdered petals were accurately weighed and then 20g each were macerated cold in 400ml of 50% ethanol and distilled water for 72 hours (3 days) at room temperature following the method suggested by Sofowora (1993). The liquid extracts were recovered by filtration using cotton wool and glass funnel. The filtrate obtained was concentrated in a vacuo at 40^{o}C to yield a semi-solid mass. The extract obtained was accurately weighed and then used for phytochemical screening.

Phytochemical Screening

Cold extraction was carried out on the materials, which was later concentrated to dryness in *vacuo* at 40^{o}C. The dry extract was subjected to phytochemical screening according to the

standard methods of Sofowora (1993) and Trease & Evans (2002) and Harborne (1998) to detect the presence or absence of certain bioactive compounds.

Quantative Microscopy/Proximate Analysis

The moisture content of the powdered leaves was determined by loss on drying method (African Pharmacopoeia, 1986). The ash value, acid insoluble ash, water-soluble ash and sulphated ash were determined as described (British Pharmacopoeia, 1980; African Pharmacopoeia, 1986). The water and alcohol extractive values were obtained using the method outlined (Brain and Turner, 1975; British Pharmacopoeia, 1980). The fat (lipids), crude fibre, crude protein and carbohydrate were obtained using the method outlined (Pearson, 1976; Okon, 2005; AOAC, 2000).

RESULT

Phytochemical Screening

The result of the preliminary phytochemical screeing of the petals of *S. alata, S. hirsuta* and *S. obtusifolia* are summarized in Table 1. The petals of *S. alata, S. hirsuta and S. obtusifolia* reveals the presence of Cardiac glycosides (Liebberman's test and Salkowski test) in all three species and absence of Alkaloids in all three species. However, Saponin was found to be present in *S. alata* and *S. obtusifolia* but absent in *S. hirsuta*. Tannins was present in *S. alata* but absent in S. hirsuta and *S. obtusifolia*. Also, Cardiac glycoside (keller killianis test) was present in *S. alata* but absent in *S. hirsuta* and *S. obtusifolia*.

Quantitative Evaluation

The quantitative evaluation of the powdered petals of *S. alata, S. hirsuta and S. obtusifolia* are: Moisture content (%) 12.5, 13.5, 13; Ash content (%) 6, 11, 9; Acid insoluble (%) 1.5, 2.5, 2 Sulphated Ash (%) 5, 9, 5.5 respectively (Table 2).

Nutritional Analysis

The nutritional analysis of the powdered petals of *S. alata, S.hirsuta and S. obtusifolia* are: Proteins (%) 5.1, 8.2, and 4.1; Fats (%) 5, 3.5, 4.4; Crude Fibre (%) 25, 40, 30; carbohydrate (%) 53.7, 42, and 40.7 respectively (Table 3).

Table. 1: Result of Phytochemical screening metabolites in petals of *S. alata, S. hirsuta and S. Obtusifolia*.

Metabolites	Inferences		
	S. alata	*S. hirsuta*	*S. obtusifolia*
Saponins	++	-	+
Tannins	+	-	-
Flavonoids	++	+	-
Alkaloids	-	-	-
Cardiac glycosides			
(a) Salkowski Test	+++	+++	+++
(b) Keller killiani Test	+	-	-
(c) Lieberman's Test	+	+	+

Notes
- Absent
+ Traces
++ Moderately present
+++ Abundantly present

Table. 2: Results of Quantitative Evaluation of the petals of *S. alata, S. hirsuta and S. Obtusifolia.*

Evaluation Parameters	Values (% W/W)		
	S. alata,	*S. hirsuta*	*S. obtusifolia*
Moisture content	12.5	13.5	13
Ash Content	6	11	9
cid insoluble	1.5	2.5	2
Sulphated Ash	5	9	5.5

Table. 3: Result of Proximate Analysis of Nutritional Evaluation of *S. alata, S. hirsuta and S. obtusifolia.*

Evaluation Parameters	Values (% W/W)		
	S. alata,(%)	*S. hirsuta* (%)	*S. obtusifolia (%)*
Protein	5.1	8.2	4.1
fats	5	3.5	4.4
fibre	25	40	30
carbohydrate	53.7	42	40

DISCUSSION

Phytochemical screening of the petals of *S. alata, S.hirsuta and S. obtusifolia* reveals the presence of various bioactive compounds such as saponins, tannins, flavonoids, and cardiac glycosides (Salkowski, Keller Killiani and Lieberman's test) which are the basis of therapeutic potentials of medicinal plants. The presence of tannins as reported by Maynard (1997), is capable of lowering available protein by antagonistic competition and can therefore elicit protein deficiency syndrome, "Kwashiokor".

Saponin is responsible for its anti yeast, anti fungal, antidote, antimicrobial and antiinflamatory activities. It is also believed that the role of Saponin in plant is to protect against attack by potential pathogens (Sparg *et al*., 2004). Flavonoids which are also known as vitamin p or plan modifier, elicit a wide of therapeutic activities as antihypertensive, antirheumatism as well as antimicrobial as identified with flavonoids (Veerachari, and Bopaiah, 2011). Essiett *et al*. (2010), reported that many plant containing flavonoids are diuretic and the antioxidants, the leaves and stems of these plants can be equally applied in each case. Cardiac glycosides were detected in the extract and this compound has been useful in the treatment of asthma (Trease and Evans, 2002). Quantitative evaluation is an important parameter in setting standard for crude drugs (Trease and Evans, 2002).

However, the values of solvent extractives can be a means of providing preliminary information on the quality of the drug. The results of the moisture content in *S. alata, S. hirsuta and S. obtusifolia* that was not high indicates less chances of microbial degradation of the drug during storage because excess moisture can result in the breakdown of important constituents by enzymatic activity and as a result may encourage the growth of yeast and fungi during storage (African Pharmacopoeia, 1986), as such the moisture content (%) of 12.5, 13.5, 13 in *S. alata, S. hirsuta and S. obtusifolia* respectively.

The general requirement for moisture content in Crude drugs was that, it should not be more than 14%, since it was normal, and implies that the plants can be stored for a longer period with lower chances of microbial attack and growth. The total ash value (%) was 6, 11, and 9 in *S. alata, S. hirsuta and S.*

obtusifolia respectively, this implies that plants have normal complexes of inorganic and organic compound (British Pharmacopoeia, 1980) but the value of Acid insoluble ash (%) are 1.5, 2.5, and 2 in *S. alata, S. hirsuta and S. obtusifolia*, this implies that the normal acid insoluble ash has a portion of ash content which was acid insoluble and hence, may be physiologically important as salt in the body when consumed. It also indicated high digestibility of plant when eaten (Ibrahim *et al*., 2010). The sulphated ash value (%) is 5, 9, 5.5 in *S. alata, S. hirsuta and S. obtusifolia*, respectively.

This implies that *S. hirsuta* has a higher sulphated ash value than that of *S. alata* and *S. obtusifolia* and are good criteria to judge the identity and purity of crude drug. Proximate analysis of a food is the nutritional composition of that food.

It is the estimate of the nutritive value of human food in its chemical form. The proximate analysis as shown in Table 3 shows that the protein content is relatively low in *S. obtusifolia* (4.1%) than in *S. hirsuta* (8.2%) and *S. alata* (5.1%) but it can contribute to the formation of hormones which controls a variety of body functions such as growth, repairs and maintenance of body protein (Mau *et al*. (1999). The fat content of *S. alata* (5%) was higher than that of *S. hirsuta* (3.5%) and *S. obtusifolia* (4.4%) and the beneficial effect of high fat content can be used for storage and transport forms of metabolic fuel. Also, high fat content can be exploited for nutritional advantage in health (Omode *et al*., 1995). The crude fibre content of *S. hirsuta* (40%) was higher than that of *S. obtusifolia* (30%) and *S. alata* (25%) The carbohydrate content was higher in *S. alata* (53.7%) than in *S. hirsuta* (42%) and *S. obtusifolia* (40.7%). The relatively high carbohydrate content can be used as energy sources and also it is necessary in the digestion and assimilation of other food. However, this study reveals that *S. alata*, *S. hirsuta* and *S. obtusifolia* contains essential nutrients for good human and animal health.

CONCLUSION

S. alata, S.hirsuta and S. obtusifolia have been distinguished on the basis of phytochemical screening, quantitative evaluation and nutritional analysis. The presence of secondary metabolites such as saponin, tannins, flavonoids, cardiac glycosides, protein, fats, fibre and carbohydrate are of great importance as a source of new useful drugs. The soil type affects chemical constituents leading to chemical races of the plants. From these studies, it can be concluded that all three species of *Senna* have many beneficial effects with respect to the presence of the above secondary metabolite which are likely to combat with many disease and also boost the immune system. However, the phytochemical characterization of the extracts, the identification of responsible bioactive compound and quality of standards are necessary for future study. Pharmacological activities to elicit medicinal properties of each plant should be carried out by other researchers.

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