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Phytochemical Analysis of *Senna occidentalis* Leaves

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ABSTRACT

This study was designed to evaluate the phytochemical composition of *Senna occidentalis* leaves. The quantitative phytochemical analysis was carried out with spectrophotometric method. The results of the quantitative phytochemical compositions revealed the presence of tannins, phenols, flavonoids, alkaloids, glycosides, terpenoids, steroids and saponins at the concentrations of 4241.15 ± 0.035 mg/100g, 2705.32 ± 0.01 mg/100g, 661.77 ± 0.004 mg/100g, 724.37 ± 0.004 mg/100g, 116.29 ± 0.003 mg/100g, 18.43 ± 0.01 mg/100g, 28.83 ± 0.01 mg/g and 14.36 ± 0.004 mg/g respectively in *Senna occidentalis* leaves. The results indicate that *Senna occidentalis* leaves are good source of phytochemicals and this may inform the use in ethno medicine.

KeyWords: Phytochemicals, *Senna occidentalis*, Ethno-medicine and Spectrophotometric

INTRODUCTION

Many pharmaceuticals currently available have a long history of use as herbal remedies including opium, aspirin digitalis and quinine [1]. Aja 2010 [2], reported that about 70% of the human population is dependent wholly or partially on plant-based medicines and the world health organization (2008) estimated that 80% of the world population use herbal medicine for some aspect of primary health care. Across the different regions of the world, several plants are now known to have medicinal effects. Plant

contains many biologically active components which have potentials for development as medicinal agents, most of which have been found to be safe and affordable by the common man [3]. It has been reported that there are over 8000 species of known medicinal plants in Africa considered as an essential part of traditional health care systems. More than 80 percent of African population is dependent on these cheap and effective traditional medicines used against many diseases and infections [4].

A typical example of such plants is *Senna occidentalis* L known as “*ewe oriesi*” in Yoruba, “*Akidi agbara*” in Igbo, “*Dora rai*” in Hausa and ‘Coffee Senna’ in English belongs to the family Caesalpiniaceae [5], subfamily of Caesalpinioideae [5]. It is an ayurvedic plant with huge medicinal importance [5]. They are commonly found in the tropics [6]. It is in the same genus as *Senna* and sometimes called coffee senna. The leaves of the plant are used for the treatment of yaws, scabies, itches and ringworm among the Yoruba tribe of south western Nigeria [7]. In addition to this, the leaves are also known to be effective against jaundice, headache and toothache. Infusion of *C. occidentalis* leaves is used as an effective treatment for hepatitis among the rural dwellers in northern part of Nigeria [8]. *C. occidentalis* leaves have ethno medical importance like wound healing, treatment of sores, itch, cutaneous diseases, bone fracture, fever, ringworm and throat infection [9, 10]. *C. occidentalis* is used as a diuretic and in the treatment of snake-bite [11, 12]. Different parts of this plant have been reported to possess anti-inflammatory and antiplasmodial activities [13, 14, 15, 16]. Verma *et al.* (2010) [17], reported that ethanolic extract of this plant exhibited significant anti-diabetic activity in normal and alloxan-induced diabetic rats. Bin-Hafeez and Hussaini (2001) [10] have also shown that extract obtained from *C. occidentalis* was useful as a cellular protector and preventive to cell damage. Sadiq *et al.* (2012) [18] reported the

susceptibility of *Sallmonella typhi* and *Shigella* species to the ethanolic extract of *C. occidentalis*.

Phytochemical simply means plant chemicals. They are naturally occurring components in fruits, vegetables, legumes and grains [19]. They give plants its colour, flavour, smell and are part of a plant's natural defence system [20]. Phytochemicals are bioactive, non-nutrient plant compounds in fruits, vegetables, grains and other plant foods that have been linked to reducing the risk of major degenerative diseases [21]. The medicinal values of plants lie in their component phytochemicals such as alkaloids, tannins, flavonoids, cyanogenic glycosides, saponins and other phenolic compounds, which produce a definite physiological action on the human body [22].

In Nigeria, a number of pharmacological properties such as diuretic, anti-helminthic, blood purifier, laxative, carminative and anti-inflammatory actions have been ascribed to *C. occidentalis*, besides its use to treat abdominal diseases, fevers, headache and bronchitis [23]. The indiscriminate use of herbal medicines including *C. Occidentalis* plant in our communities despite its claimed efficacy still poses a lot of medical challenges on the users and therefore, needs to be evaluated to ascertain the various phytochemical constituents linked to their medicinal uses. The high cost of conventional drugs, particularly in resource poor communities of the African continent has led to the increased use of plants as an alternative for the treatment of diseases [24, 25, 26]. Although several synthetic drugs are available, attention is currently being focused on the use of plants and plant products in prevention or correction of various metabolic disorders or in the treatment of specific diseases because of several side effects associated with the use of synthetic drugs [27, 28, 29]. The continual search for and the interest in natural plant products, for use

as medicines has acted as the catalyst for exploring methodologies involved in obtaining the required plant materials and hence probing their constituents [30, 31, 33, 34, 35, 36, 37]. Therefore, this study evaluated the phytochemical compositions of *Senna occidentalis* leaves.

MATERIALS AND METHODS

Materials: Equipment/instrument, chemicals and reagents used were of analytical grade and quality.

Collection and Preparation of *Senna occidentalis* Leaves

Fresh leaves of *Senna occidentalis* were collected from Abakaliki in Ebonyi State, Nigeria and were classified by a taxonomist in Applied Biology Department, Ebonyi State University, Abakaliki, Nigeria. A part of the plant was also deposited in the herbarium for reference purposes. The leaves of *Senna occidentalis* were washed thoroughly under running tap, dried under room temperature for a period of one (1) week and pulverized into powdered form using an electrical grinding machine. The powdered form was stored in an air tight container and kept in a refrigerator for the research.

Methods

Quantitative Phytochemical Analysis of *Senna occidentalis* Leaves:

The phytochemical constituents of the samples were carried out by the methods modified by the following

Determination of Flavonoids: This was determined by the method of Harborne (1973) [14].

Principle: Flavonoids reacts with dilute ammonia (NH_3) to produce a coloured complex which can be measured spectrophotometrically at 490nm.

Procedure: Exactly 1g of the sample was macerated in 20ml of ethylacetate and it was filtered. Then 5ml of the filtrate was collected and added into 5ml of dilute ammonia. The upper layer was pipetted into a cuvette and the absorbance was read at 490nm.

Determination of Saponin: This was determined by the method of Harborne (1973) [14].

Principle: Saponin reacts with anisaldehyde and ethyl-acetate to give a coloured complex which is read spectrophotometrically at 430nm.

Procedure: Exactly 1g of the sample was weighed and macerated in 20ml of petroleum ether which was decanted into a beaker and washed again in 10ml of petroleum ether. The filtrate was combined and evaporated to dryness. The residue was dissolved in 5ml of ethanol. Then 2ml of the dissolved residue was transferred into a clean and dried test tube and 2ml of chromogenic solution (Colour reagent) was added. This was allowed to stand for 30 minutes and the absorbance was read at 550nm.

Determination of Alkaloids: This was determined using the method of Harborne (1973) [14].

Principle: H_2SO_4 reacts with alkaloids in the presence of formaldehyde to form a coloured complex which is read spectrophotometrically at 565nm.

Procedure: Exactly 1g of the coarse sample was weighed and macerated in 20ml of ethanol: 20% sulphuric acid (1:1), and filtered. Exactly 1ml of the filtrate was pipetted into a clean and dried test tube. 5ml of 60% sulphuric acid was added into the test tube, which was allowed to stand for 5mins. 5ml of 0.5% formaldehyde in 60% sulphuric acid was also added. This was mixed properly and allowed to stand for 3hrs. Absorbance was read at 565nm.

Determination of Tannins: This was determined by the same procedure of Harborne (1973) [14].

Principle: Tannins reduce phosphotungstomolybdic acid in alkaline solution to produce highly coloured blue solution, the intensity of which is proportional to amount of tannins. The intensity is measured in spectrophotometer at 720nm.

Procedure: Exactly 1g of the powdered plant sample was weighed, macerated in 20ml of distilled water and filtered. 5ml of the filtrate was pipetted into a clean and dry test tube and 0.3ml of 0.1N ferric chloride in 0.1N HCl. 0.3ml or 0.0008M potassium ferricyanide was added to the tube. Absorbance was read at 720nm.

Determination of Glycosides: This was determined by the method of Harborne (1973) [14].

Procedure: Exactly 1g of the sample was weighed and dissolved in 20ml of distilled water. 2.5ml of 150% lead acetate was added and filtered. 2.5ml of chloroform was also added, the solution was stirred vigorously. The lower layer of the sample in the test tube was collected and was allowed to evaporate to dryness. The residue was then dissolved in 3ml of glacial acetic acid. To the mixture, 0.1ml of 5% ferric chloride and 0.25ml of concentrated sulphuric acid was added respectively and kept in the dark for 2hrs. Absorbance was read at 530nm.

Determination of Phenols: This was determined by the method of Malick and Singh (1980).

Principle: Phenols react with phosphomolybdic acid in folin-ciocalteau reagent in alkaline medium to produce a blue coloured complex (Molybdenum blue) which can be estimated spectrophotometrically at 650nm.

Procedure: Exactly 1g of plant sample was weighed, macerated in 20ml of 80% ethanol and filtered into a clean dried test tube. 5ml of the filtrate was pipetted into a test tube and 0.5ml folinciocaltaeu reagent was added. After 2mins, 2ml of 20% sodium carbonate was also added. The absorbance reading was at 650nm

Determination of Cyanogenic Glycosides: The method modified by Trease and Evans (1989) [33] was used to extract and estimate cyanogenic glycosides.

Principle: Cyanogenic glycosides react to alkaline picrate under boiling temperature to produce a colour that is read spectrophotometrically at 490 nm.

Procedure: Exactly 1g of the plant sample was weighed and macerated. 1ml of the filtrate was pipetted into a test tube and 4ml of alkaline picrate solution was added. The mixture was boiled for 5mins and was allowed to cool. Absorbance reading was taken at 490nm.

Determination of Terpenoids: This was determined by the method of Harborne (1973) [14].

Procedure: Exactly 1g of the coarse sample was macerated in 20ml of ethanol and filtered. 1ml of filtrate was pipetted and 1ml of 5% phosphomolydic acid was added. Gradually, 1ml of sulphuric acid was also added. It was allowed to stand for 30mins and then 2mls of ethanol was added. Absorbance was read at 700nm.

Determination of Steroids: This was determined by the method of Harborne (1973) [14].

Procedure: Exactly 1g of the coarse sample was macerated in 20mls of ethanol and filtered. Using measuring cylinder, 2mls of the filtrate was pipetted and 2mls of chromogenic solution (colour reagent) was also added.

The mixture was allowed to stand for 30mins. Absorbance was read at 550nm.

RESULTS

Result of Phytochemical Analysis of *Senna occidentalis* Leaves

The phytochemical compositions of *Senna occidentalis* leaves revealed the presence of tannins, phenols, flavonoids and alkaloids as the major phytochemicals while glycosides, terpenoids, steroids and saponins were detected at minute concentrations as shown in Figure 1 and 2.

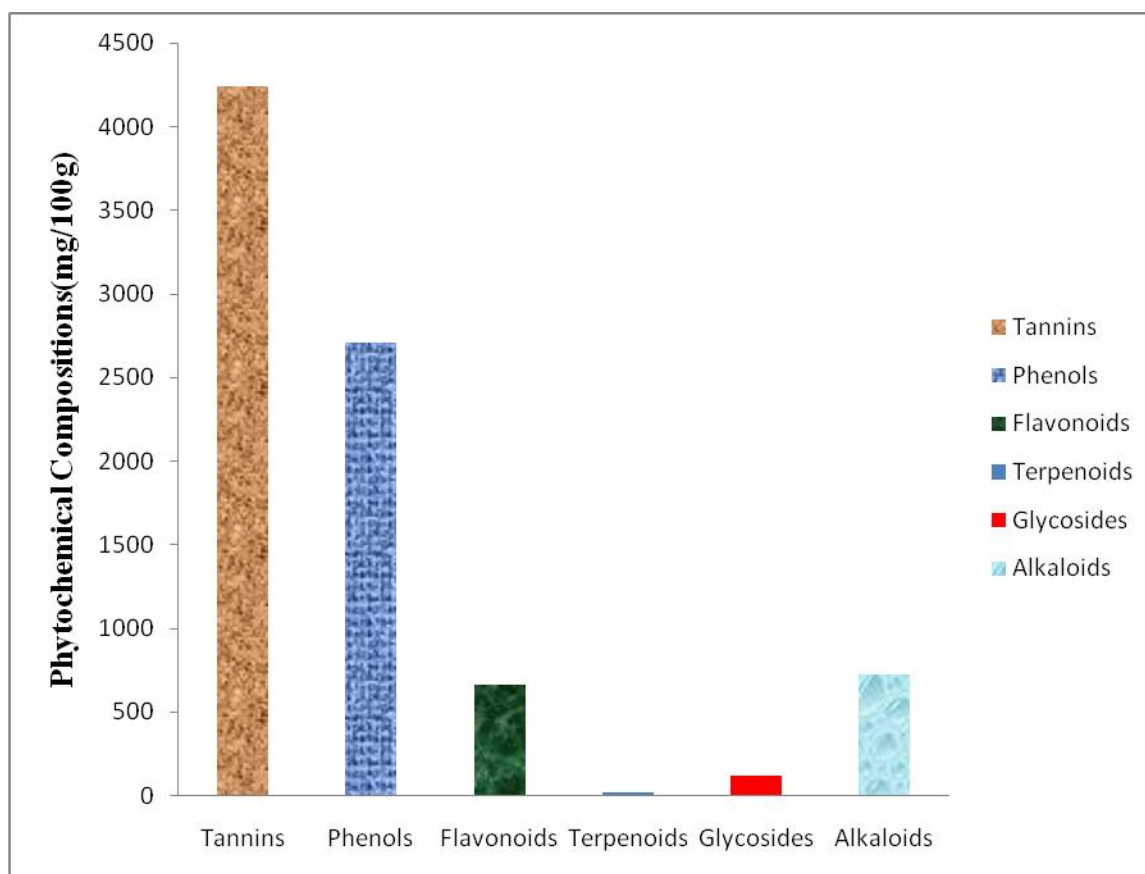


Figure 1: Phytochemical Compositions in mg/100g of *Senna occidentalis* Leaf

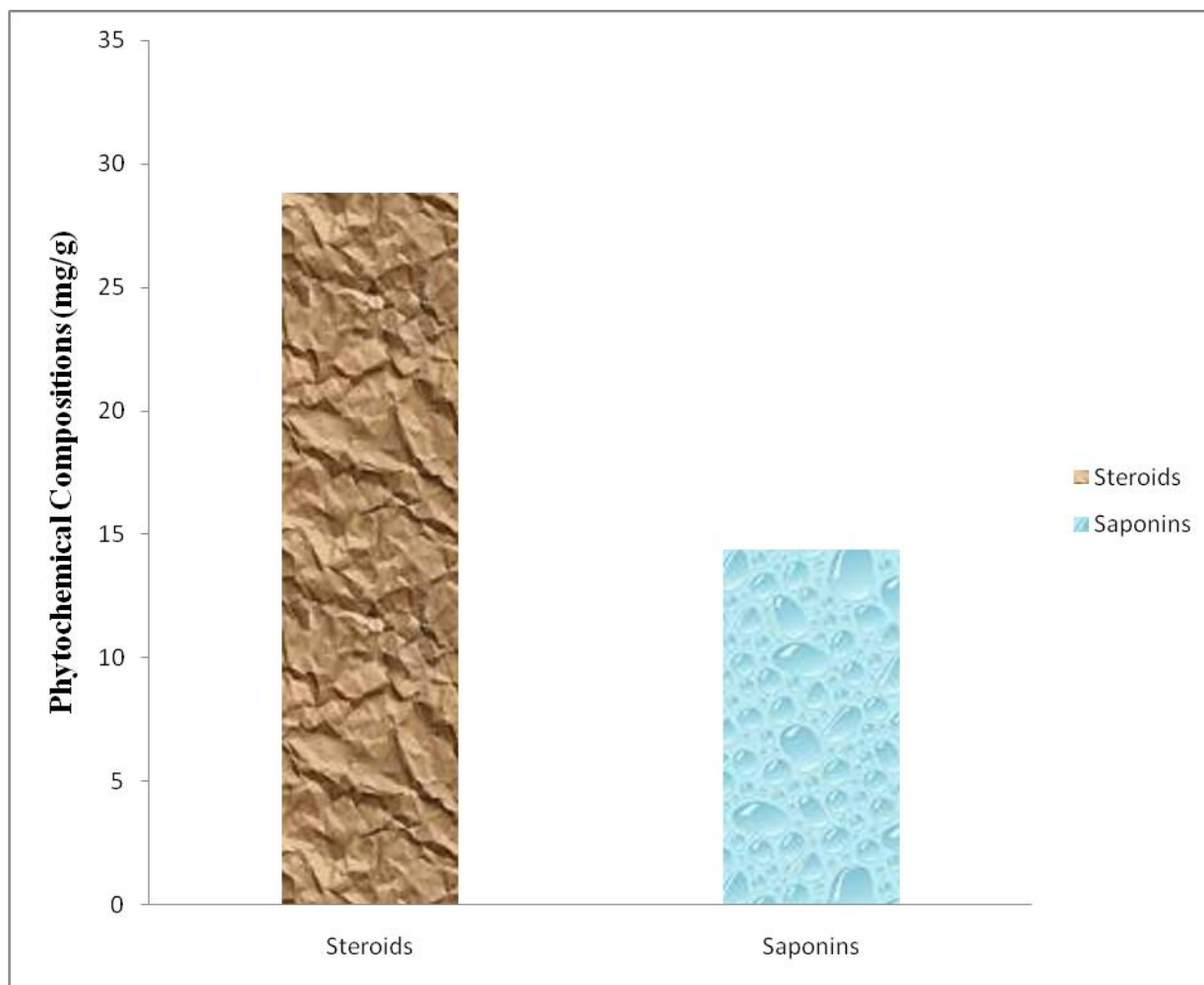


Figure 2: Phytochemical Compositions in 100mg/g of *Senna occidentalis* Leaf

Discussion: Phytochemical analysis is very useful in the evaluation of some active biological components of some plants [8]. Phytochemical screening helps to reveal the chemical nature of the constituents of the plant extract which may also be used to search for bioactive agents that could be used in the synthesis of very useful drugs [30]. The result of phytochemical analysis revealed the presence of alkaloids, phenols, flavonoids, cyanogenic glycosides, tannins, steroids, saponnins and terpenoids in *Senna occidentals* leaf as shown in Figure 1 and 2. The result of the study revealed that *Senna occidentals* leaf correlate with the report of Aja *et al.* (2010) which showed that *Talinum triangulare* leaves are rich in phytochemicals. This result also supported the reports of Aja *et al.* (2015) that revealed high levels of phenols and other phytochemicals in *Dissotis rotundifolia* and *Cajanus cajan* leaves and seeds. Aja *et al.* (2011) had revealed that *Moringa oleifera* leaf is a good source of phytochemicals which is in line with the present result on *Senna occidentalis* leaves. This result does not correlated with the report of Nwali *et al.* (2012) which showed that *Bryophyllum pinnatum* leaf contained low levels of phytochemicals.

High levels of tannin in *Senna occidentalis* leaf indicates that *Senna occidentalis* is a good source of tannins as shown in Figure 1. This indicates that *Senna occidentalis* leaf have antimicrobial activities (Carson and Riley, 2003). This is in line with the study by Carson and Riley (2003) that reported anti-bacterial and astringent properties of tannic acid which have action upon mucous tissue such as tongue and inside the mouth. The indigestion of tannic acid cause constipation and can be used in the treatment of diarrhea. Tannins are polyphenols that are obtained from various parts of different plant belonging to multiple species. Tannins can also be effective in curbing hemorrhages and as well restrict bare swellings [10].

The result obtained revealed high level of phenols in *Senna occidentals* leaf as shown in Figure 1. This could be the reason behind the traditional uses in the treatment of rheumatism and painful swelling [8]. Phenols are strong antioxidants which prevent oxidative damage to biomolecules such as deoxyribonucleic acid (DNA), lipids and proteins which play a role in chronic diseases such as cancer and cardiovascular diseases [10]. Phenols can be used in reduction of risk for infection in minor skin irritations and also kills germs. Phenols can improve effectiveness at relieving of itching and it can be added to lotion meant for the relief of insect bites and sunburn and other painful itching skin conditions [11].

Appreciable amount of flavonoids was found in *Senna occidentals* leaf as shown in Figure 1. This indicates that *Senna occidentalis* leaves could be a good source of flavonoids and as such is good for the management of cardiovascular diseases and oxidative stress, since flavonoids are biological antioxidants; flavonoids provide protection against these diseases by contributing along with antioxidants vitamins and enzymes to the total antioxidant defense system to human body [12]. Flavonoids possess substantial anti-mutagenic and anti carcinogenic activities due to its antioxidant and anti-inflammatory properties [13]. High level of alkaloids in *Senna occidentalis* leaf obtained in the result showed that *Senna occidentalis* is a good source of alkaloids as shown in Figure 1. Alkaloids have been implicated in inducing a stress response and apoptosis in human breast cancer cell [14]. Alkaloids which are nitrogen-containing naturally occurring compounds commonly found to have anti-microbial properties [15]. The alkaloids can be used as a central nervous system stimulant as well as powerful pain relievers [16].

The result of phytochemical analysis revealed that *Senna occidentalis* leaf contained appreciable amount of saponins content as shown in Figure 2.

This justifies the use of the extract from this plant to stop bleeding and in the treatment of wounds [18]. Saponin has the property of precipitating and coagulating red blood cells. Saponin has been reported to cause the reduction of blood cholesterol by preventing its re-absorption [33]. Saponins inhibit sodium ion (Na^+) efflux by the blockage of the entrance of Na^+ out of the cell (Schneider and Woliling, 2004). This leads to higher Na^+ concentration in the cells, by activating the $\text{Na}^{2+}\text{Ca}^{2+}$ an anti-porter in cardiac muscle which strengthens the contraction of heart muscle [26]. Saponins have antioxidant, anti-inflammatory, anti apoptosis and immunostimulant and anti-neurodegenerative properties and therefore could delay neural aging [23]

The result also revealed an appreciable amount of steroids in leaf of *Senna occidentalis* as shown in Figure 2. This indicates that the plant is good source of steroid. The level of terpenoids revealed in *Senna occidentalis* leaf is shown in Figure 2. A relatively small amount of cyanogenic glycosides was found in *Senna occidentalis* leaf which revealed that the *Senna occidentalis* is not a good source of glycosides as shown in Figure 1. Cyanogenic glycosides in plant-based food can improve glucose metabolism and can enhance the overall health of diabetic patients by improving the lipid metabolism, antioxidants status, also in improving capillary function and lowering of cholesterol level [32]. Glycosides contribute in the modification of tumourgenesis and also inhibit carbohydrate mediated in tumor growth [30]. The result obtained in this study has shown that the leaves of *Senna occidentalis* contain phytochemicals like tannins, phenols, flavonoids, terpenoids, glycoside, alkaloids, Saponins and steroids. This therefore signifies that *Senna occidentalis* leaves can contribute significantly to the health management of man and should be recommended in our daily nutritional need.

Conclusion: The study revealed that *Senna occidentalis* leaf is a good source of phytochemicals and this may inform the use of this plant in ethno-medicine.

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