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Phytochemical and mineral constituents of *Cochlospermum planchonii* (Hook. Ef. x Planch) Root

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Abstract

Aqueous extract of *Cochlospermum planchonii* root was analyzed for its phytochemical and mineral compositions. The phytochemical screening and subsequent quantification revealed the presence of saponins (7.5%), phenolics (3.16%), alkaloids (2.92%), steroids (0.89%), and tannins (0.15%), flvonoids (0.07%), phlobatannins (0.03%), triterpenes (0.09%) and anthraquinones (0.19%). Cardiac glycosides, cardenolides and dienolides were however not detected. Analysis of the mineral constituents showed that the plant contains among othersK (8.25×10^4 mg/kg), Na (3.08×10^4 mg/kg), Ca (26.80 mg/kg), Mg (32.80 mg/kg), Mn (11.35 mg/kg), Fe (91.40 mg/kg), Se (10.35 mg/kg), Cu (5.85 mg/kg) and trace amount of Pb (1.00 mg/kg) and Cd (0.20mg/kg). The constituent phytochemicals and minerals may account for varied ethnobtanical uses of the plant in folk medicine of Nigeria. It is also considered that *Cochlospermum planchonii* could be a very rich source of drug formulation, if properly harnessed and processed to reduce or eliminate the potential toxic components.

Key words: *Cochlospermum planchonii*, Cochlospermacea, Phytochemical constituents, Mineral constituents, Drug formulation, Toxic components.

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INTRODUCTION

Medicinal plants are now getting more attention than ever before because they have the potential of myriad benefits to society, especially in the line of medicine and pharmacological. The medicinal value of these plant lies in bioactive phytochemical constituents that produce definite physiological action (Akinmoladun *et al.*, 2007). The detection of active principles in medicinal plants plays a strategic role in the phytochemical investigation of crude plant extracts and is very important with regards to their potential pharmacological effects (Pascual *et al.*, 2002). Medicinal plants contain both organic and inorganic constituents, and many medicinal plants are found to be rich in one or more individual elements, thereby providing a possible link to the therapeutic action of the medicines (Singh and Garg, 1997; Ray *et al.*, 2004). Trace elements play a vital role in the formation of bioactive chemical constituents in medicinal plants and are therefore responsible for both their medicinal and toxic properties (Rajurkar and Damame, 1998). Thus, a quantitative estimation of minor and trace element can be important in determining the effectiveness and toxicity of the medicinal plants in treating various diseases and to understanding pharmacological actions.

Cochlospermum planchonii, a West African species can be up to 0.5 – 1.5m in height and growing from Guinea region to Cameroon (Kone *et al.,* 2002; Atawodi, 2005). It has various medicinal applications in different parts of Africa. In Ivory Coast, the root is used to treat schiotomiasis, jaundice, fever and back pains while in Senegal, it is used to treat jaundice, intestinal worms, bilhariasis and hepatitis (Blench, 2007). The fresh root of the plant is also used as a concoction together with fresh stem bark of *E. senegalensis* for the treatment of stomach disorder, typhoid and urinary tract infection (Togotla *et al.*, 2008). Information on the phytochemical and mineral constituent of this plant is however very scanty in literature. The present study was therefore carried out to evaluate the phytochemical and mineral compositions of the root of the plant.

MATERIALS AND METHODS

Plant material and authentication

The plant samples obtained from the traditional herb seller at 'Oja-oba' Market, Ilorin, Nigeria were authenticated at the Forestry Research Institute of Nigeria (FRIN), Ibadan, Nigeria. A voucher specimen (F.H.I 99093) was deposited at the herbarium of the institute. The plant materials were washed and air dried to a constant weight for two weeks. Thereafter, the samples were milled into powder with mechanical blender (Thomas Willey Machine, UK) and stored in an air-tight bottle till used for analysis.

Phytochemical Screening

Qualitative evaluation were carried out using chemical test on the samples following standard procedure for identification of the constituents as described by Harbone (1973); Trease and Evans (1989) and Sofowora (1993). The quantification of the detected phytochemicals was carried out as described for saponins (Brunner, 1984), flavonoids, tannins, steroids, triterpenes, phenolics and phlobatannins (El-Olemy *et al.*, 1984), alkaloids (Henry, 1973), anthraquinones (MacKay *et al.*, 1979).

Mineral Analysis

The multiple-nutrient wet acid digestion method described by AOAC (1980) was used for the mineral evaluation of the sample. Calcium, sodium and potassium levels were determined by Flame photometric method on Jenway Digital Flame Photometer (PFP7 Model) using filters corresponding to each mineral element. Determination of Pb, Cd, Cu, Mg, Se, Fe, and Mn was carried out with Atomic Absorption Spectrophotometer (AAS) Buck 211 Model.

RESULTS

The result of the phytochemical screening (**Table 1**) revealed the presence of several phytochemicals, prominent among which are saponins (7.58 %), alkaloids (2.92 %), Phenolics (3.16 %) and steroids (0.89 %). The mineral analysis of *C. planchonii* (**Table 2**) showed its rich content of elements like Na (3.08×10^4mg/kg), K (8.25×10^4 mg/kg), Fe (91.4 mg/kg), Ca (26.80mg/ kg), and Mg (32.80mg/kg) among others. The plant also contains minute amount of Pb (1.00 mg/kg) and Cd (0.20mg/ kg).

DISCUSSION

Tannins, saponins, phenolics, alkaloids and flavonoids have been suggested to be involved in anti bacterial and anti-viral activities, while tannins and flavonoids are thought to be responsible for anti -diarrheal activity (Enzo, 2007). Investigations of mode of action indicate that tannins and flavonoids

Table 1: Phytochemical components of *Cochlospermum planchonii* root.

Phytochemicals	Quatitative %
Alkaloids	2.920
Tannins	0.147
Phenolics	3.156
Cardiac glycosides	nd
Saponins	7.575
Flavonoids	0.067
Steroids	0.885
Phlobatannins	0.028
Triterpenes	0.094
Anthraquinones	0.186
Cardenolides / Dienolides	nd

nd: not detected

increase colonic water and electrolyte reabsorption while other phytochemicals act by inhibiting intestinal mobility (Enzo, 2007). This explains the anti-diarrheal use of *C. planchonii* root in traditional medicine. In addition, tannin has astringent properties, hastens the healing of wounds and inflamed mucous membrane. Plants with tannins are used for healing of wounds, varicose ulcers, hemorrhoids, frost- bite and burns (Igboko, 1983; Maiduyi, 1983). The biological functions of flavonoids include protection against allergies, inflammation, platelets aggregation, microbes, ulcer and tumour (Okwu and Okwu, 2004). They are free radical scavengers, super antioxidants and potent water soluble thus preventing oxidative damage and have strong anti-cancer activity (Salah *et al*., 1995). Thus, the acclaimed anti-inflammatory and wound healing uses of *C. planchonii* root extract may be attributed to flavonoids and tannins.

Saponins has been shown to affect sex hormones like oxytocin which is implicated in the onset of labour in women and subsequent release of milk (Okwu and Okwu, 2004). Studies have shown that saponins have antitumor and anti-mutagenic activities and can lower the risk of human cancers, by preventing cancer cells from growing. They seem to react with the cholesterol rich membranes of cancer cells, thereby limiting their growth and viability. Rao and Sung (1995) found that saponins may help to prevent colon cancer. Anti-hyperglycemic potential of saponins has also been reported (Malinow *et al*., 1977 and Olaleye, 2007). The presence of saponin in *C. plachonii* root may explain its use as an anti-diabetic agent. The saponin may be responsible for the anti-hyperglycemic activity of aqueous extract of *C. planchonii* root and its effectiveness in reverting some of the disorders of metabolism associated with diabetes metabolism reported by Yakubu *et al* (2011). The high saponin content may however be conferring possession of heamolytic property. This can influence the use of the plant in folk medicine a cholesterol binding agent.

Table 2: Some mineral constituents of *Cochlospermum planchonii* root.

Minerals	Quantity (mg/kg)
Na	3.08×10^4
K	8.25×10^4
Ca	26.80
Mn	11.35
Mg	32.80
Pb	1.00
Cd	0.20
Fe	91.4
Cu	5.85
Se	10.35

Phenolic compounds have antimicrobial properties. Phenol and phenolic compounds have been extensively used in disinfections and remain the standards which other bacteriacides are compared (Okwu, 2001). Alkaloids are the most efficient therapeutically significant plant substance (Njoku and Akumefula, 2007). Pure isolated alkaloids and the synthetic derivatives are used as the basic medicinal agent because of their analgesic, anti-plamodic and bacterial properties where they showed marked physiological effects when administered to animals (Njoku and Akumefula, 2007). This may justify the use of *C. planchonii* root extract in the treatment of pain, malaria, and enteric fever in folk medicine.

The presence of phlobatannins may suggests diuretic property on the plant (Awoyinka *et al*., 2007). Steroid in modern clinical studies have supported the role of *C. planchonii* as anti-inflammatory and analgesic agent (Singh, 2006). Anthraquinones have wide application as immunosuppressive, immunostimulant, anti-ulcer, antioxidant (Sun *et al.,* 2000) and anti-microbial activity (Wang and Chung, 1997).

The elements K, Na, Ca, Mg, and Cl are some of the macronutrients which are essential to human health and nutrition (Yamashita *et al*., 2005). Sodium acts with other electrolytes especially potassium in the intracellular space to

regulate the osmotic pressure and maintain proper water balance within the body. It is required for glucose absorption and transportation of other nutrients across cell membranes (Bakhru, 1999). In addition, normal functioning of the nervous system depends on sodium. Potassium also plays an important role in the regulation of acid base balance in the cell, water retention and is essential for protein biosynthesis by ribosomes (Sanjay *et al*., 2010). Calcium is the main constituent of the skeleton and is important for regulating many vital cellular activities such as neuromuscular transmission muscle contraction, hormonal actions, blood clotting and other cellular mortility (Martin *et al.,* 1985; Sanjay *et al*., 2010).

Magnesium is involved in over 300 enzymatic reactions in the body (Wester, 1987; Berdanier, 1994), including glycolysis, the Kreb cycle, creatine phosphate formation, nucleic acid synthesis, amino acid activation, cardiac and smooth muscle contractibility, cyclic AMP formation, and protein synthesis. Magnesium is also important in the proper utilization of vitamins B and E and functions with other minerals such as calcium, sodium and potassium in maintaining fluid and electrolyte balance (Bakhru, 1999).

Copper is an essential trace element for humans and animals. The ability of copper to easily accept and donate electrons explains its important role in oxidation-reduction reactions and scavenging free radicals (Linder and Hazegh-Azam, 1996). The main function of iron is in the transport of oxygen to the tissue (haemoglobin) and is also involved in the processes of cellular respiration (Sanjay *et al.*, 2010). Manganese plays an important role in a number of physiologic processes, as a constituent of multiple enzymes and an activator of other enzymes (Nielsen, 1999). A number of manganese-activated enzymes play important roles in the metabolism of carbohydrates, amino acids, and cholesterol. It is also thought to aid in the maintenance of epithelia tissue (Martin *et al.,* 1985). Although selenium is a toxic heavy metal, it is very important for human health. Together with Vitamin E, selenium helps the immune system produce antibodies. Selenium binds with toxic metals like mercury and is involved in promotion of normal body growth and fertility (Egunyomi *et al.,* 2005).

In conclusion the results obtained from this analysis supports that the aqueous extract of *Cochlospermum planchonii* root is a very rich source of phytochemicals and mineral elements which justify the various therapeutic uses attributed to it in folklore medicine. However the presence of trace amount of lead and cadmium however calls for caution because of their toxicity.

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