

Phytochemical Analysis, Cytotoxicity and Antifungal Activities of *Guiera Senegalensis* Leaves Extract Review

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ABSTRACT

The aim of this review is to investigate the phytochemical analysis, toxicity, and the antifungal activity of *Guiera senegalensis* leaves extract and compare methods. Extract of the leaves of *Guiera senegalensis* was tested for its antimicrobial activity against *Stemphylium solani*, *Aspergillus flavus*, *Trichoderma viride*, *Penicillium Spp.*, *Fusarium verticillatum*, *Cladosporium cladosporioides*, and *Fusarium solani*. This review showed that *Guiera senegalensis* leaves extract has no inhibition activity against all of the tested fungal strains. On the other hand, the toxicity test, which was conducted by using brine shrimp, suggests that *Gs* leaves extract is apparently not toxic. The phytochemical screening revealed that *Guiera senegalensis* leaf extract contains alkaloids, flavonoids, terpenoids, tannin, carbohydrates, proteins, steroids, and saponins. The results of this preliminary investigation suggest that the medicinal plant extract may be safe to use as a drink for treatment of various diseases as has been practiced for years in the villages of Western Sudan. More research is needed to investigate if there is any side effect when the extract is taken orally. Further, the medicinal properties of the phytochemical compounds of *Guiera senegalensis* need to be further investigation.

Keywords

Phytochemical components, *Guiera senegalensis*, Extract, Antifungal activity.

Introduction

Guiera senegalensis commonly known as Sabara in Hausa is a shrub of the savannah region of west and central Africa. It is widely being used in traditional medicine for the remedy of ailments/diseases. Its leaves extract is being used against dysentery, diarrhoea, gastrointestinal

Pain and disorder, rheumatism and fever [1]. The astringent property of this plant was reported to be due to its tannin content [2].

In view of Williams, E.T et al., [3]. *Guiera senegalensis* is a tropical shrub of the family Combretaceae, which is used in traditional medicine in northern Nigeria. It is used by local herdsmen in the treatment of trypanosomiasis. Also the plant continues to be one of the plants used by local livestock farmers, traditional healers and Fulani herdsmen in the treatment of snakebite in northern

Nigeria. The plant is used in folkloric medicine in the treatment of dysentery, diarrhoea, stomach upset and hemorrhoids in local communities in Nigeria.

Medicinal properties of plants are hinged on the presence of bioactive principles such as alkaloids, phenols, tannins, glycosides and essential oils amongst others. This necessitates the need for continued screening of medicinal plants, not only to determine the scientific basis for their usage, but also to discover new active principles. The galls of *Guiera senegalensis* demonstrated pronounced antioxidant potential, showed high polyphenols, total tannins and total flavonoids contents [4]. The flavonoids are not only present in plants as constitutive agents but have also accumulated in plant tissues in response to microbial attack [5].

According to Nabaa et al. [6], in the Sudan, *Guiera senegalensis* is locally known as Ghubaysh of which the leaves extract and the roots powder are used for treatment of a variety of diseases and wounds, respectively. In a companion paper [7], we found that *Guiera senegalensis* leaves' extract has been used for treating jaundice which represents more than 51.5% of conditions treated; and 48.5% of the other diseases that include diabetes mellitus, hypertension, cough, arthritis, enteritis, diarrhea and malaria. In addition, the majority of people surveyed have used roots' powder of *Guiera senegalensis* for treatment of wounds, including diabetic wounds, and inflammation of skin, and injuries. *Guiera senegalensis* extract was also used in the folk medicine in other countries and found to be effective against leprosy, fever, and was helpful against increased blood pressure and high blood sugar levels [8].

In addition to its usefulness as traditional medicinal plant, *Guiera senegalensis* has been shown to increase soil fertility and crop production without use of fertilizers in the Northern Sahel region, especially in low-yields-low input farms [9]. The importance of *Guiera senegalensis* in traditional medicine became more apparent with the recent increase in fungal infections in Africa, and elsewhere. Extracts of Leaves, shoots and galls of *Guiera senegalensis* were found to be useful against bacteria and fungi infections in Burkina folk medicine [10]. These antimicrobial properties were credited to the crude methanol extracts of *Guiera senegalensis* [11]. Studies of medicinal plants usually concentrate on the part of the plant that has been shown to have value in traditional medicine.

Although *Guiera senegalensis* leaf extract has been used to treat jaundice and many diseases in Western part of Sudan, the antifungal activity of leaf extract has not been documented. The plant extract is prepared by boiling the leaves or soaking them in water [7]. Since there are thousands of species of fungi present in the environment and at least a hundred of them are pathogenic [12], antifungal activity of medicinal plants needs to be addressed. It is worth mentioning that the antifungal activity of many medicinal plant species in Africa has not been satisfactorily explored. The aim of the study was to examine the phytochemical properties, antimicrobial efficacy and toxicity of *Guiera senegalensis* leaves'

extract in order to find out their biological activity.

Sample collection

According to Ogbaba et al., [13], *Guiera senegalensis* leaves were collected from healthy plants in Gwallameji, within Bauchi metropolis and transported to the Biology/Microbiology laboratory of Science Laboratory Technology Department, Federal Polytechnic Bauchi in sterile polythene bags. This is in agreement with other study of Nabaa et al., 2016, the leaves of *Guiera senegalensis* used in this study were randomly collected from *Guiera senegalensis* bushes around Ghubaysh village area of Western Kordofan State, West of the Sudan [6].

Sample preparation

In agreement of Ogbaba et al., [13], the leaves collected were washed and dried in the laboratory away from sun light for seven days to prevent the loss of active components. Some of the leaves were ground and then sieved to obtain powder. Some fresh leaves were also preserved in the refrigerator while others were ground for immediate use. According to Nabaa et al., 2016, The plant leaves were dried in the shade. After drying, the leaves were ground well into fine powder using mechanical blender, and the powder was transferred into airtight containers with proper labeling for future use.

Aqueous Extraction

According to Ogbaba et al., [13], the procedure used for aqueous extraction was that described by Predrag et al.. This was obtained by weighing 250g of the plant powder. 500ml of distilled water was added to it and was heated for 20 minutes in a water bath. It was then filtered; the mixture and the filtrate were concentrated over the water bath and the extract was stored in a sterile bottle and labeled. This is in agreement with Nabaa et al., 2016, Five grams of the plant powder was placed in a beaker containing 100 ml. distilled water; soaked and shaken well. The solution was filtered with the help of filter paper and the filtrate was kept and used for further photochemical analysis. The extracts were then kept in sterile bottles, under refrigerated conditions, until further use.

Phytochemical screening

According to Ogbaba et al., [13]. Photochemical screening to detect the presence of secondary metabolites such as alkaloids, flavonoids, saponins, tannins, glycosides, anthraquinone, steroids and terpenes was carried out according to standard procedures as reported by Sofowora [14]. This is in agreement with the study of Nabaa et al., 2016, the presence of different phytochemicals whose biological activity can be of valuable therapeutic index. The result of the presence of the phytochemicals in *Guiera senegalensis* extract, shown in Table 1, is indicated by the colour intensity in a scale of 4 (+, ++, +++, ++++).

Plant Species	Flavonoids	Alkaloids	Terpenoids	Tannin	Proteins	Carbohydrates	Steroids	Saponin
<i>Guiera senegalensis</i>	+++	+++	++	+	++	++	++	+

Since medicinal plants, such as *Guera senegalensis*, are expected to be a valuable source for a variety of drugs, no wonder that 80% of individuals from developed countries use traditional medicines extracted from plants according to WHO. It, therefore, is important to investigate traditional medicinal plants to assess, following scientific methodologies, their properties, safety, and efficiency of treatment, and the optimum dose [15].

According to Mohammed S.Y. and Sule M.S. [16], Phytochemicals are biologically active substances found in plants in small amounts, which are not established nutrients but which nevertheless seem to contribute significantly to protection against degenerative disease [17]. Phytochemicals are many and some of them include alkaloids, flavonoids, tannins, saponins etc. Their functions and mechanism of actions may include the following among others: antioxidant activity, hormonal action, stimulation of enzymes, and interference with DNA replication and anti-bacterial properties.

Test for flavonoids

According to Nabaa et al., 2016, For the confirmation of flavonoids in the *Guera senegalensis* leave powder, 0.5 g of plant extract was placed in a test tube and 10 ml of distilled water was added, 5 ml of dilute ammonia solution were added to a portion of the aqueous filtrate of the plant extract followed by addition of 1 ml concentrated H_2SO_4 . Indication of a yellow color shows the presence of flavonoids in each extract.

Test for saponins (frothing test)

According to Ogbeba et al., 2017. 5ml extract was mixed with 5ml of distilled water in a test tube and it was shaken vigorously. The formation of stable foam was taken as an indication for the presence of saponin. In view of Nabaa et al., 2016, the crude extract was mixed with 5 ml of distilled water in a test tube and it was shaken vigorously. The formation of stable foam was taken as an indication for the presence of saponins.

Test for steroids

According to Ogbeba et al., [13]. Five drops of concentrated H_2SO_4 were added to 1ml of extract in a test tube. Red coloration was observed, which indicated the presence of steroids. Nabaa et al., 2016, *Guera senegalensis* leaves powder was mixed with 2 ml of chloroform and concentrated H_2SO_4 was added sidewise. A red color produced in the lower chloroform layer indicated the presence of steroids. Another test was performed by mixing crude extract with 2 ml of chloroform. Then 2 ml of each of concentrated H_2SO_4 and acetic acid were poured into the mixture. The development of a greenish coloration indicated the presence of steroids [18].

Test for Tannins

To 1 ml of the extract, 1ml of freshly prepared 10% Potassium hydroxide (KOH) was added. A dirty white precipitate showed the presence of tannins. Ogbeba et al., 2017. According to Nabaa et al., 2016, Crude extract of *Guera senegalensis* powder was mixed with 2 ml of 2% solution of $FeCl_3$. A blue-green or black coloration indicated the presence of tannins [18].

Test for alkaloids

To 3 ml of the extract, 1ml of 1% hydrochloric acid (HCl) was added in a test tube. The mixture was heated for 20 minutes, cooled and filtered. Two drops of Mayer's reagent were added to 1ml of the extract. A creamy precipitate was an indication of the presence of alkaloids. Ogbeba et al., 2017. In the of Nabaa et al., 2016. The procedure used for determination of alkaloids in *Guera senegalensis* sample is similar to that described by [19]. Briefly, 0.2 g of *Guera senegalensis* leave powder was added to a glass test tube that has 3 ml of hexane. The powder and hexane were thoroughly mixed, shaken well, and filtered. To the hexane and *Guera senegalensis* leaves extract mixture, 5 ml of 2% HCl were added, and the mixture heated until boiling. The mixture was then filtered, and 1-3 drops of picric acid were added to the hexane, HCl and *Guera senegalensis* leave extract filtrate. The presence of alkaloids in the *Guera senegalensis* sample was confirmed by the yellow-colored precipitate that was formed.

Conclusion and Recommendations

Medicinal plants are used for discovering and screening of the phytochemical constituents which are very helpful for the manufacturing of new drugs for treatment of various diseases. The results obtained in this review have shown that *Guera senegalensis* leaves have high concentration of alkaloids and low concentration of tannins and saponins and have no toxic effect and show no antimicrobial activities in case of fungi. These observations and the findings of this review suggest an urgent need for investigating why *Guera senegalensis* extract is credited for curing several diseases and infections in Africa. It would be important to find out which phytochemical compound in *Guera senegalensis* is responsible for what activity. Therefore, the important phytochemical compounds identified by this review in the *Guera senegalensis*, will be helpful in treating different diseases of this particular region of Africa, and may be in other regions. The results could serve for further pharmacological and phytochemical research. Also more research needed to evaluate the potential effectiveness of the crude extracts as the antimicrobial agents.

References

1. Sule MS, Mohammed SY. Toxicological studies on the leaves of *Guiera senegalensis* and *Psidium guajava* in rats. *Biol Environ Sci J Trop*. 2006; 3: 81-83.
2. Koumare M, Cross J, Pitet G. Chemical constituents of *G. senegalensis*. *Plant Medical*. 1968; 2: 204-209.
3. Williams ET, Barminas JT, Akinniyi J, et al. Antidiarrhoeal effects of the root extracts of *Guiera senegalensis* in male mice. *African Journal of Pure and Applied Chemistry*. 2009; 3: 152-157.
4. Sombié PAED, Adama Hilou, Ahmed Coulibaly, et al. Brain protective and erythrocytes hemolysis inhibition potentials from galls of *Guiera senegalensis* J.F. GMEL Combretaceae. *Journal of Pharmacology and Toxicology*. 2011; 6: 361-370.
5. Galeotti F, Barile E, Curir P, et al. Flavonoids from carnation *Dianthus caryophyllus* and their antifungal activity. *Phytochemistry Letters*. 2008; 1: 44-48.

6. Naba KA, Abdulkadir EE, Abdelfattah N. Antitoxic, Antifungal and Phytochemical Analysis of Medicinal Compounds of *Guiera senegalensis* Leaves in Sudan. 2006; 4.
7. Alshafei NK, Ahmed SM, Abdelfattah NA. Preliminary Observations on the Uses of *Guiera Senegalensis* as a Traditional Medicinal Plants in Western Kurdofan, Sudan. *Journal of Plant Biochemistry and Physiology*. 2016.
8. El-Gazali GEB, El-Tohami MS, El-Egami AAB. Medicinal Plants of the Sudan: Medicinal Plants of the White Nile Province. Medicinal and Aromatic Plant Research Institute, Khartoum Sudan. 1994.
9. Dossa EL, Diedhiou I, Kouma M, et al. Crop Productivity and Nutrient Dynamics in a Shrub *Guiera senegalensis* Based Farming System of the Sahel. *Agron J*. 2012; 104: 1255-1264.
10. Nacoulma OG. Plantes médicinales et Pratiques médicales Traditionnelles au Burkina Faso. cas du plateau central T1 and T2. Thèse Doctorat d'Etat ès Sciences Naturelles. Université de Ouagadougou. 1996.
11. Bassene E, Mahamat B, Lo M, et al. Comparaison de l'activité antibactérienne de trois Combretaceae. *Combretum micranthum* *Guiera senegalensis* *Terminalia avicennioides*. *Fitoterapia*. 1995; 66: 86-87.
12. Keeler RF, Tu AT. Toxicology of Plant and Fungal Compounds. *Handbook of Natural Toxins*. 1991; 6: 665.
13. Ogbaba J, Iruolaje FO, Dogo B A. Antimicrobial Efficacy Of *Guiera Senegalensis* And *Prosopis Africana* Leave Extract On Some Bacterial Pathogens. *European Journal of Biology and Medical Science Research*. 2017; 5: 27-36.
14. Sofowora, Abayomi. Medicinal Plants and Traditional Medicine in Africa. Spectrum Books limited. 1993; 67-69.
15. Srinivasan D, Perumalsamy LP, Nathan S, et al. Antimicrobial Activity of Certain Indian Medicinal Plants Used in Folkloric Medicine. *Journal Ethnopharmacol*. 2001; 94: 217-222.
16. Mohammed SY, Sule MS. Potency Of Partially Purified Anthocyanin From Leaf Extract Of *Guiera Senegalensis* Against Carbon Tetrachloride Induced Lipoperoxidation In Rats. *Bayero Journal of Pure and Applied Sciences*. 2009; 2: 155-158.
17. Ivor ED. Recommended dietary intake levels of phytochemicals: feasible or fanciful. *Asia Pacific Journal of Clinical Nutrition* 2002; 9: 5119-5122.
18. Yadav RNS, Agarwala M. Phytochemical analysis of some medicinal plants. *Journal of Phytology*. 2011; 3: 2075-6240.
19. Wadood A, Mehreen G, Syed BJ, et al. Phytochemical Analysis of Medicinal Plants Occurring in Local Area of Mardan. *Biochem Anal Biochem*. 2013; 2: 144.