



Ethnomedicinal and natural phytochemicals of *Guiera senegalensis* J.F. Gmel in Aliero, Kebbi State Nigeria

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Abstract

The importance of plants in meeting basic human needs is not a new field of research worldwide today due to their diversity in nature, medicinal properties, aromatic substances and metabolites since prehistoric times. In this study, through an administered semi-structured questionnaire the traditional uses of *Guiera senegalensis* were obtained and analyzed the phytochemical composition using standard methods in Aliero. *G. senegalensis* was shown to be a native and traditional plant used for the treatment of various diseases such as: diarrhea, dysentery, fever, malaria, impotence, conjunctivitis, abdominal pain, migraine, pain, cough, noxious seizures, epilepsy and cataract in the study area. Based on the part *G. senegalensis*, leaves were the most frequently mentioned (45.50%), roots (27.30%), berries, galls and mistletoes were each had the less frequency used in treated diseases by residents (9.10%). Plant compounds detected in this study were tannins, saponin glycosides, cardiac glycosides, anthraquinones, steroids, essential oils, saponin glycosides and alkaloids but flavonoid was not detected. The presence of these essential phytochemical compounds justified the use of *G. senegalensis* as a plant medicine. Therefore, identification of phytochemical compounds using high chromatographic techniques (HPLC/LC/UFLC or GC) analysis to elucidate bioactive compounds presence in leaves of *G. senegalensis*.

Keywords: *Guiera senegalensis*, Traditional uses, Phytochemical, Aliero

INTRODUCTION

Population growth, climatic constraints and diseases on a global scale have put increased pressure on plant diversity. The use of plants to cure a number of diseases is on rise and is of increasing interest in Nigeria due to the high rich cost of mainstream medicines, less side effect, high population and poor primary health care. Ethnobotany is the use of native plants for wellbeing and health promotion in communities which is not a new practice anywhere in the world (Unani *et al.*, 2009). Kebbi State becomes opulent with a diversity of plants used as green medicine in both rural and urban areas. A use of medicinal plants is increasing globally in view of the tremendous development of traditional medicine and a growing interest in herbal treatments (WHO, 2013). The use and production of

traditional/local herbal around the world depends on the flora diversity, accessibility, cheapest cost, location and indigenous ethnic groups (Aminu *et al.*, 2021). On the other hand, the current reduction in the diversity of traditional green medicinal plants is related to human agitation, overgrazing, erosion as well as the management of sufficient herbs, lack of facilities e.t.c. Modern nature, ethnic minorities and botanist adequately and ethnic differences (Bhatt *et al.*, 2020). The uses of phytomedicine have been inherited from generation to generation and today have received the most attention in the field of pharmacology.

Guiera senegalensis is known as Sabara in Hausa, in the family Combretaceae. It is a shrub reaching 3 or 5 m in height when the environmental conditions are suitable. The leaves are 3 - 5 cm

long and 1.5 to 3.0 cm wide, and arranged opposite or side-mounted (Yusuf *et al.*, 2019). It is widely distributed in the Savanna region of West and Central Africa, Nigeria, Senegal, Gambia, Mali, Niger, Burkina Faso and Ghana (Denou *et al.*, 2016). In recent decades, *G. senegalensis* found distributed in farms, bush land and along the roadside has witness a local interest as a traditional medicinal plant and source of income. It synthesizes and spontaneously accumulates essential secondary substances such as alkaloids, cardiac glycosides, steroid cores, deoxysugar, saponins glycosides, tannins, anthraquinones and flavonoids that confer its medicinal benefit (Yusuf *et al.*, 2019). This composition can contribute to the biological and physical functions of human systems as well as the defense mechanism of plant species against invading microbes (Mboh, 2001).

Medicinal plant has been used to treat a variety of diseases due to their important components such as simple and secondary metabolites. Approximately, plants produce above 500,000 vital artificial phytochemicals each with a specific function called secondary metabolites (Fatope *et al.*, 2001). These plant compounds have enabled the human body to carry out its daily activities and depend on it to fight invading factors, especially pathogens that cause diseases in or within the body when taken properly (WHO, 2020; Aminu *et al.*, 2021).

Traditional medical knowledge of plants, ethnobotany and their use by indigenous peoples is not only useful for the preservation of traditional medicine, but also for health and development needs (Kantati *et al.*, 2016; Keta, 2016). Traditional methods of curing specific diseases using plant or their derivatives in some communities are a gift passed on from parents to the next generation. Various botanists have documented the traditional uses of *G. senegalensis* in treating fever, cleansing breast milk in nursing mothers, stomach upset, dysentery, headache, and postpartum rash children (Singh, 2016; Keta, 2018). However, none of these researchers elucidated the phytochemical composition of this medicinal plant. This species is a common shrub in Kebbi with versatile and economic potentials especially for women to take care their problems, but there are few studies on the ethnobotanical uses and

important chemical constituents of this plant species in the state. Therefore, the study investigates the ethnobotanical application and phytochemical components of *Guiera senegalensis*.

MATERIALS AND METHODS

Study area

Aliero local government shares common borders with Gwandu local government area on the Northeast, Jega local government area by the southwest and Tambuwal local government of Sokoto State while the northern-west Birnin Kebbi local government. The study area covers a total of 412 square kilometers of land mass with a population of over 125, 785 inhabitants (NPC, 2006). The topography is flat and slightly undulating with compact, stony brown soil. Aliero has savannah vegetation and located at latitude of 11° 35' S, 4° 02' E (Keta *et al.*, 2020).

Data Collection

The primary data were obtained through the distribution of 200 semi-structured questionnaires in November, 2021 within Aliero local government area. Ethical consideration was obtained from the competent authority. The respondents including traditional healers, herdsmen, herbalists, farmers, elderly and others groups of both sexes were selected using random sampling method and stressed about the importance of this study before asked about the ethno-medicinal uses of *Guiera senegalensis* as adopted by Mubarak *et al.* (2022a). The questionnaire was constructed in English but interpreted in Hausa language to some of the respondents to get vital information as follows;

- 1) Local name of *Guiera senegalensis*
- 2) Disease *Guiera senegalensis* cure
- 3) Mode of preparation
- 4) Part of the *Guiera senegalensis* use in each treatment of the disease mentioned

Sample Collection and Identification

All the samples were taken from fallow farmland around Kebbi State University of Science and Technology, Aliero inserted into a vacuum box and taken to the Department of Plant Science and Biotechnology, KSUST, Aliero for identification within 30mins of collection. The samples were identified and authenticated by a Taxonomist (Prof. Dharmendra Singh) and a voucher (KSUSTA/DPSB/013) deposited at the

herbarium room, Department of Plant Science and Biotechnology, Aliero for future reference.

Sample Processing

Guiera senegalensis leaves were air-dried at ambient temperature for 7 days (1 week), then ground using a mortar, pestle and sieved to obtain a fine powder. One hundred (100 g) dry powder sample were immersed in 200 ml distilled water for 12 hours and filtered using Whatman filter paper No. 42 (125 mm) to obtain an aqueous crude extract of dried leaves *G. senegalensis* leaves (Mubarak *et al.*, 2022b).

Phytochemical Analysis of *G. senegalensis* Leaves

To determine the presence of secondary metabolites in *G. senegalensis* leaves namely tannins, saponins, glycosides, cardiac glycosides, flavonoids, anthraquinones, steroids, volatile oil and alkaloids according to Yadav and Agarwala (2011) and Wadood *et al.* (2013).

Determination for Alkaloid

Half of the crude extract (0.5 g) was stirred with 5ml of 1% hydrochloride acid on a steam bath for 20 min, allowed to cool, filtered and 1 drop of Mayer's reagent was added followed by 3 drops of Wagner reagent. The presence of cream/haze or reddish-brown precipitates indicated the presence of alkaloids.

Determination for Tannins

A One (1ml) prepared in 10% KOH was added to 20ml of distilled water containing 1ml of extract. Two drops of 5% FeCl₃ were mixed with 2ml of filtrate. The formation of a black-blue or blackish-green color indicated the presence of tannins.

Determination for Saponins

Two grams (2 g) of the leaves extract were dissolved in 20ml of distilled water, heated for 3mins and filtered. One (1ml) of the filtrate extract was placed into a test tube, filled with froth and shaken vigorously. Froth that persists for several minutes indicates the presence of saponins.

Determination for Flavonoids

Two (2grams) of leaves extract were dissolved into 20ml of distilled water, boiled for 7-10mins and filtered. The filtrate extract was acidified with

a few drops of HCl and 5ml of aliquots were made alkaline (pH 10) with sodium hydroxide. The yellow color formed indicates the presence of flavonoids.

Determination for Glycosides

Ten (10ml) of 50% H₂SO₄ were mixed with 1cm³ of the extract in a test tube and boiled in a water bath for 15mins. The 10cm³ of Fehling's solution was added and boiled again. The presence of a brick-red indicated the presence of glycosides.

Determination for Cardiac Glycosides

One (1ml) of leave extract was mixed with 2ml of 3.5% ferric chloride (FeCl₃) and then 1ml of H₂SO₄ was carefully poured onto the wall of the tube. The interfacial reddish-brown and the top layer turning patina indicated the presence of cardiac glycosides containing 2-deoxyl sugar cardiac glycosides

Determination for Saponin Glycoside

To 2.5ml of the leaves, the extract was added 2.5ml of the Fehling solution A and B. Formation of a bluish green precipitate indicates the presence of saponin glycosides

Determination for Flavonoids Glycoside

Two (2grams) of leaves extract were dissolved into 20ml distilled water, boiled for 7-10mins and filtered. The filtrate extract were acidified with few a drops of HCl and then 10ml of aliquot of the filtrate was shaken in a small funnel with 5ml of the amyl alcohol and boiled with 10ml of HCl for 2mins. An aliquot was shaken with amyl alcohol and the yellow color indicates the presence of flavonoids glycosides.

Determination for Volatile Oils

A small quantity of the leaves extract was shaken with dilute hydrochloric acid. A White precipitate indicates the presence of volatile oils

Determination for Steroids

One (1ml) of the extract was mixed with 2ml of chloroform and 2ml of H₂SO₄ was added to form a lower layer. The presence of a reddish-brown color indicates a steroid ring

Determination for Anthraquinone

Five (5ml) of leaves crude extract were shaken with 10ml of benzene, filtered and 5ml of 10% ammonia solution were added. A pink, red or

purple formation indicates the presence of anthraquinone.

Data Analysis

The data obtained during the survey and interviewed were processed and subjected to descriptive statistics using percentage in a table formed so as to provide summary description of the data obtained.

RESULTS

The result obtained is that all parts of *G. senegalensis* has been used in a variety of ways by the Aliero community to treat various ailments

such as cough, fever, malaria, tooth abscess and insecticidal attacks and soon (Table 1 to 4). According to the respondents, leaves of *G. senegalensis* had the highest number of disease cured with a percentage of 15(45.50%), while fruits, galls and mistletoes of *G. senegalensis* had the lowest with 3(9.10%) each (Table 5) respectively. However, tannins, saponins glycosides, cardiac glycosides, anthraquinones, steroids, volatile oils, saponin glycosides and alkaloids were detected in the analyzed aqueous leaves crude extract, whereas flavonoids was not detected as shown in (Table 6).

Table 1: Ethnomedicinal use and mode of preparation of the *G. senegalenses* Leaf for treatments of different ailments in Aliero LGA

Disease	Mode of Preparation
Pernicious attack	Decoction of branches in combination with leaves of <i>Momordica charantia</i>
Caries and dental abscess	<i>G. senegalenses</i> leaves were combined with leaves of <i>Prosopis africana</i> boiled and used for mouthwash and also exposure to hot vapors
Conjunctivitis	Juice crushed from the leaf is used to treated eye infection
Diarrhea and dysentery	Decoction of leafy breaches or chewed
Aches and pains	Decoction or maceration of leafy branches
Painful area	Leaves powdered were combined with karate butter used as an ointment
Epilepsy	Maceration of ground leaves combined with <i>Pterocarpuserinaceus</i> and cotyledon of cola nut. Drunk or bathing
Fever and malaria	Maceration of ground leaves combined with fruit <i>Tamarindus indica</i> treated malaria, a decoction of fresh leaves relieves fever and vomiting in children
Sexual impotence	Decoctions of leafy were made and bathed as well as exposed the pains to hot vapor
Headaches with fever	Decoction of leafy used to bathe and expose the patient head to hot vapors
Abdominal pain	Three bundles of leafy branches combined with bundles of leafy <i>Combretum micronthum</i> and unripe fruits of <i>Tamarindus indica</i> were decoction
Migraine	Decoction of leafy branches boiled and the head of the patient is exposed to hot vapors
Wounds	Fresh leaves were chewed and applied to the wound to stop the bleeding, leaves decoction is used for wound dressing
Cough	Decoction of fruits is administered orally

Table 2: Ethnomedicinal use of *G. senegalensis* galls in Aliero LGA

Illness/Diseases	Treatment
Fever, malaria, vomiting, diarrhea and cough	Decoction were drunk
Wounds	Galls were ground into a fine powder and applied to wound
Cough	Gall is combined with fresh fruits of <i>Tamarindus indica</i> into powdered and ingested

Table 3: Uses of *G. senegalensis* mistletoe in Aliero LGA

Illness/Diseases	Treatment
<i>P. falciparum</i> pernicious attack	Decoction were drunk or used as an enema in children
Cataract	Leafy mistletoe combined with the leafy of <i>Ficus capensis</i> were made into powdered and washed the patients face
Fever	Decoction used as an enema and for bathing infants

Table 4: Traditional uses of *G. senegalensis* root and root bark in Aliero

Illness/Diseases	Treatment
Dental caries	The root is used as a toothpick. Root powdered were macerated and used as a mouthwash
Diarrhea and dysentery	Roots were macerated for three days and the solution mixed with honey
Aches and pains	Root decoction is used for bathing
Fever	Decoction of roots were used
Impotence	Root bark and fruits of <i>Aframomum melegueta</i> mixed with salt
Wounds	Powdered the root bark

Table 5: Parts of *G. senegalensis* used and number of disease cured in percentage (%)

Organs	No. of Illness/Disease cured	Percentage (%)
Leaves	15	45.50
Fruits	3	9.10
Galls	3	9.10
Mistletoes	3	9.10
Root bark	9	27.30
Total	33	100

Table 6: Phytochemical Compositions of *G. senegalensis* aqueous leaves crude extract

Compound	Reagents Used	Interferences	Results
Tannins	KOH & FeCl ₃	Brown green color was formed	+++
Saponin	Froth	The persistent foam was observed	++
Glycosides	H ₂ SO ₄ & Fehling solution	Brown ring formed	++
Cardiac glycosides	FeCl ₃ & H ₂ SO ₄	A brown ring at the interface and green color in the acetic layer was obtained	+
Flavonoid	HCL & NaOH	The green color was observed	-
Anthraquinone	C ₆ H ₆ & NH ₄ OH	Rose-pinkviolet yellow	++
Steroids	CHCL ₃ & H ₂ SO ₄	Red color formed	+
Volatile oil	HCL	White color formed	+
Flavonoid glycosides	HCL & C ₅ H ₁₂ O	-	-
Saponin glycosides	Fehling solution	Foam formation	++
Alkaloids			
a. Wagners reagent	HCL	White or creamy white color.	+
b. Mayers reagent		Brown color formed	++

Key: - +++ = present in high amount, ++ = moderate amount, + = trace amount, - = not detected

DISCUSSION

The global intensification of modern medicines with less adverse effects and poor primary health care systems, especially in African countries, has increased the search for alternative sources of traditional medicines through the use of native plants by local population. Plants have received more attraction and attention from pharmaceutical companies due to their importance as source of raw material (active compounds) used for discovering new drugs that can serve as modern discoveries for the betterment of mankind. The current survey revealed that, the whole of the plants *G. senegalensis* has been found to be used as a

remedy in the Aliero community to treat diarrhea, dysentery, pains, fever, malaria, wounds, sexual impotence, migraines, coughing and many other related factors. Similar results were previously reported in Western Kordufan (Alshafei *et al.*, 2016). Zakawa *et al.* (2018), reported the traditional use of *G. senegalensis* by the people of Mubi local government of Adamawa State. According to Somboro *et al.* (2011), the whole part of *G. senegalensis* were used in cured numerous ailments such as; malaria, fever, cough, wounds, *Plasmodium falciparum* pernicious attack, caries and dental abscess, conjunctivitis, diarrhea, dysentery, epilepsy, aches, pains and Sexual impotence.

The diversity and growth of this plant suggest that it forms abundant solitary colonies in fallow loamy or sandy soils in the study area and other Sahelian regions of northern Nigeria and may play an important role in traditional uses. In addition, previous studies carried out on *G. senegalensis* have demonstrated the plants ability to treat complication of many diseases such as nausea, vomiting and diarrhea, as well as bring about well-being for mankind (Kankara *et al.*, 2015), allergic reactions, women's power at bedtime (Singh, 2016), Malaria (Ifijen *et al.*, 2019). The accumulated knowledge obtained in preparation of this plant to cure various diseases varied with decoction as the most predominant methods used. According to Mowobi *et al.* (2016), the most preferred methods of preparing used traditional medicinal plants in Keffi, Nassarawa State are infusions and decoctions. Community has relied on the ethnic practices of their owners to prepare native medicinal plants since prehistoric times.

The phytochemical composition of the analyzed *G. senegalensis* leaves revealed the presence of tannins, saponins, glycosides, cardiac glycosides, anthraquinones, steroids, essential oils, saponin glycosides and alkaloids. These secondary metabolites in leaves of *G. senegalensis* were previously reported by Somboro *et al.* (2011) in Mali, Yusuf *et al.* (2019) in Sokoto and Anka *et al.* (2020) in Zamfara. However, Salisu and Usman (2015) in Alasan Tambuwal, Nigeria, detected flavonoid. These illustrate how environmental stresses, along with agricultural activity and geography, influence the presences or concentration of phytochemicals (Aminu *et al.*, 2021). Therefore, the specific

bioactivities/compounds based on different maturation stages of this plant are still not well elucidated. Secondary metabolic chemicals detected in sufficient or moderate amounts in the leaves of the studied plants may justify their traditional use and phytopharmaceuticals. All these detected substances play important roles in the course of biochemical pathways without altering normal plant such as photosynthesis and translocation.

Many people living in the villages use cultivated or wild plants; either as single plants or in combination with other plants, to meet their health needs has become a global trend. Additionally, thousands of aromatic compounds are sourced from plants and the pharmaceutical industry uses them in the development of modern medicines because of their health effects and economic status and market value continues to rise (Pal and Shukla, 2002).

Conclusion

The *G. senegalensis* it is a culturally, economically and medicinal plant species that is diversified in the study area and was used by the inhabitants to treat a variety of ailments such as; Diarrhea, dysentery, fever, malaria, impotence, conjunctivitis, abdominal pain, migraine, pain, cough, malignant seizures, epilepsy and cataracts. These may be caused by various secondary metabolites presence in the leaf of *G. senegalense*. Understanding the mode of activity, identification, isolation and characterization of these secondary metabolites is worthy while conservation and management of these natural resource in the community critical.

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