https://doi.org/10.33472/AFJBS.6.9.2024.2662-2672

African Journal of Biological Sciences

Journal homepage: http://www.afjbs.com

Research Paper Open Access

Swertia chirayita: A Traditional Ayurvedic Herb with Modern Scientific Promise

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Article History

Volume 6,Issue 9, 2024

Received:11 Apr 2024

Accepted : 03 May 2024

doi: 10.33472/AFJBS.6.9.2024.2662-2672

Abstract:

Swertia chirayita is a medicinal plant with a long history of use in traditional Ayurvedic medicine. This review explores the scientific basis for its application by examining its bioactive components. The article discusses the various bioactive compounds found in Swertia chirayita, including xanthones, flavonoids, and terpenoids. These compounds are believed to be responsible for the plant's reported antioxidant, anti-diabetic, antibacterial, and anticancer properties. The review also explores the historical use of Swertia chirayita in Ayurveda and its potential for future applications. Finally, the limitations of current research and the need for further studies are addressed. This review suggests that Swertia chirayita is a promising medicinal plant with a range of potential health benefits, warranting further investigation for its integration into modern medicine.

Keywords: Chirayata, flavonoids, Medicinal value, Anticancer properties.

I. Introduction:

Swertia Chirayata thrives and prospers in marshy places, woodland gardens with partial shade, and sunny edges. Due to the presence of several chemical components such as triterpenoids, mangiferin, swerchirin, flavonoids, terpenoids, saponins, lignans, pentacyclic triterpenoids, etc., the chirayata plant is well known for its therapeutic applications. Known as Afsanteen in the Unani School of Medicine, its scientific name is Artemisia Absinthium. Dried leaves, herbs and flowering tops are utilised in the Unani healthcare system. Artemis absinthium is a perennial plant with a wooden bottom and stringy root. The Afsanteen plant has spirally arranged leaves that are white over and green greyish beneath. They are bipinnate and tripinnate with long petioles, and they are covered in silky silvery-white trichomes. This plant produces

tubular, beautiful, pale-yellow flowers that are grouped in spherical capitula. Summer until autumn are when it blooms. This herb has a strong reputation for treating digestive organ weakness and is aromatically tonic. This plant is also known as an antihelminthic or an anthelmintic. In Europe, afsanteen grows along roadsides and other dry waste areas. Numerous substances, including hujyl alcohol esters, -cadinene, guaiazuleneepoxyocimene, sabinyl acetate, and (Z) - chrysantenyl acetate, are present in Artemisia absinthium and are responsible for the plant's bioactivity. Bitter sesquiterpenoid lactones and absinthin are two more key components of afsanteen. This herb contains the bitter substances artamaridinin and artamarinartamarin, artamaridin. Flavonoids are also abundant in this herb. The current study's objective was to investigate the antibacterial effects of entire Swertia chirayata and Artemisia absinthium plant crude extracts in various organic solvents. Polyphenolic compounds, which are known as its α-glucosidase inhibitory activity, may well be beneficial for the initial stage of type 2 diabetes therapy when paired with their antioxidant effect. Dietary habits associated to decrease type 2 diabetes include higher intakes of vegetables, fruits, and whole grain.

II. Methodology:

This overview was compiled based on an extensive literature search conducted using major scholarly sources including Scholarly Journals, Web of Science, SciFinder, and PubMed, Google Scholar for applicable research published since 1987 to 2023, as well as library searches of articles published in peer-reviewed journals.

III. Result and Discussion:

The practise of traditional medicine has been ingrained in the cultures of many emerging nations. Many therapeutic medicines have historically been derived from plants, either in the straightforward form of plain raw plant components or in the refined form of crude extracts. Due to the herbal medicines' low cost, ease of accessibility, and few (or nonexistent) adverse effects, therapeutic plants are now receiving more attention. Natural substances derived from plants can be found in all plant parts, including the bark, fruits, roots, seeds, etc. Recently, the search for novel chemicals in medicinal plant leaves, flowers, and other plant parts has become an attractive topic of research.

The environment has produced a vast array of natural therapies that has been utilised as to treatment of numerous illnesses. as such method of therapy has become extremely popular, particularly in the subcontinent, it is important to look at the pharmacognostic and phytochemical properties of medicinal plants. Due to the presence of amarogentin, it has antipyretic, anthelmintic, hypoglycemic, and bitter qualities. It has xanthones, which have antiplatelet, anti-cancer, anti-inflammatory, CNS stimulant, anti-fungal, and antimalarial properties. It is a treatment for neurological problems, urogenital tract disorders, skin illnesses, ulcers, gastrointestinal diseases, cough, hiccups, and liver and kidney ailments. Additionally, it is employed as a laxative, a carminative, and a purifier of breast milk.

Because of their therapeutic benefits as well as their effective antidiabetic, antibacterial, and antioxidant capabilities, plants with ethanol medicinal relevance have been the subject of research. All living things need oxygen for metabolism and food nutrients for energy in order

to survive. Consequently, oxygen is a component that all living things require. About 5%–7% or more of the oxygen that is inhaled is changed into reactive oxygen compound, such as an oxygen, -OH and hydrogen peroxide (H_2O_2).

Antioxidants stop the oxidation-inhibiting effects of these free radical intermediates. By stifling the start of oxidative chain reactions, antioxidants can inhibit the oxidation of proteins, lipids, and nucleotides, preventing ROS from harming the body's cells. These free radicals have the potential to destroy the body's healthy cells, which could result in illnesses, diseases, or cell damage. Free radicals appear to play a significant factor in ageing, diseases like cancer, heart disease, dementia, immune system decline, and Parkinson's disease, as well as cell damage that results in cell death.

Swertia chirayata has been shown to have antimicrobial action against both Gram positive and Gram negative bacterium. Astringent tonics for the eyes, cough, heart, liver, scanty urine, melancholia, dropsy, etc. are also utilised to treat this condition. In gastrointestinal diseases like dyspepsia and anorexia, the plant abstracts are also used as a bitter tonic. They are also used as a febrifuge, digestive aid, and laxative. Xanthones, which are secondary metabolites found in Swertia species, are successfully utilised to treat malaria and tuberculosis. Additionally, the Swertia species contains amarogentin, which is thought to be the most bitter ingredient discovered to date. This glycoside secondary metabolite protects the liver against CCl_4 poisoning.

Only Swertia chirayata, the principal species, has been thoroughly examined for an active ingredient that possesses antibacterial, anti-diabetic, and antioxidant properties. The majority of Swertia species have active phytochemical principles with varied degrees of activity. Swertia cordata and Swertia Chirayata, two Gentianaceae plants, are the subjects of the inquiry. In this family, many plants are utilised as medicines. Due to their respective folklore reputations, Swertia Chirayata and Swertia cordata were chosen for phytochemical and biological investigations.

The environment has produced a vast array of natural therapies that has been utilised as to treatment of numerous illnesses. as such method of therapy has become extremely popular, particularly in the subcontinent, it is important to look at the pharmacognostic and phytochemical properties of medicinal plants. Due to the presence of amarogentin, it has antipyretic, anthelmintic, hypoglycemic, and bitter qualities. It has xanthones, which have antiplatelet, anti-cancer, anti-inflammatory, CNS stimulant, anti-fungal, and antimalarial properties. It is a treatment for neurological problems, urogenital tract disorders, skin illnesses, ulcers, gastrointestinal diseases, cough, hiccups, and liver and kidney ailments. Additionally, it is employed as a laxative, a carminative, and a purifier of breast milk.

1. **Chemical Composition of Swertia Chirayata:**

(i) **Amaroswerins:** It constitutes a Secoiridoid glycoside that's that was isolated from Swertia chirayata & was discovered to have gastro-shielding properties.

(ii) **Swerchirin:** This is the greatest acidic chemical it is a secoiridoid glycoside.Numerous species in the Gentianaceae family members, such as the Swertia shrub, contain the therapeutically significant xanthone swertchirins.

(iii) **Hyperglycemia And Antimalarial Effects Chirayata :** Medicinal properties included hepatoprotective, pro-hematopoietic, along with mild chemopreventive actions. Although being diluted by a factor of It costs 1:58,000,000 and is available through Swertia Chirayata. This obtains Implications of topoisomerase suppression on leishmaniasis treatment as well as prevention.

(iv) **Swertiamarin:** Swertiamarin, a pain reliever secoiridoid glycoside that is originated from Swertia Chirayata.

(v) **Xanthones:** Xanthones have been a significant biologically active component of the medication that demonstrates Cerebral reduced levels in Mice and mouse.

(vi) **Mangiferin:** These derived Chirayata genus chemical exhibits potent anti-inflammatory characteristics in arthritis mice, in addition was responsible for increasing IL-10 and upregulating TNF-alpha, IL-1beta, IL-6, and IFN-gamma and up regulation of IL-10 in mouse joints homogenates. It is also discovered to be a powerful chemoprotective substance.

(vii) **Triterpenoids:** Triterpenoids, including swertanone, swertenol, episwertinol, gammacer-16-en-3ß-ol, and 21-oleanolic acid, ursolic acid, swerta-7, 9(11)-dien-3ß-ol, and pichierenoid are among the compounds that make up a-H-hop-22(29)-en-3ß-ol pichierenols. Swertanone is a member of these compounds and possesses anti-inflammatory properties. Oleanolic acid and taraxerol have been found to be anesthetic & emollient, correspondingly. The anti-inflammatory, chemoprotective, and microbial-resistant properties of ursolic acids.

(viii) **Lignans:** Syringaresinol, a minor portion from the herb, serves as a lignan with protective properties properties, and ß-sitosterol, a common lipid, is a further discovery.

(ix) **Riterpenoids with a pentacycle:** This perennial plant also includes a variety containing pentacyclic triterpenoids that might include ß-amyrin, friedlin, chiratenol, kairatenol, oleanolic acids, and ursolic acid. One of these, kairatenol, has been discovered to have insulating properties.

Ayush-64, Diabecon, Mensturyl syrup, as well as Melicon V cream are few examples of herbal medicines that include Chirayata aroma & contain this substance in varying amounts because of their antipyretics, a lack of glucose antifungal, and antimicrobial properties.

Phytochemical:

The existence of secondary metabolites that are not nutrients, particularly phytochemicals with antioxidant properties such phenolics and carotenoids. Flavonoids, xanthones, and iridoids, which are strong antioxidants, are known to be present in high concentrations in many medicinal plants, including Swertia chirayata. Antioxidants' impact and how it relates to type 2 diabetes have both been extensively studied.

Anthocyanins, polyphenols, and flavonoids are examples of bioactive compounds that are crucial for preserving human health. It has been established that the majority of them possess antioxidant, anti-hyperglycemic, anti-amylase, and anti-glucosidase qualities that boost insulin production and/or activity, or behave insulin-like, and so prevent the formation of diabetes. Inflammatory and oxidative stress might be a common pathway linking several mechanisms

for diabetes-related problems such as nephropathy, vascular dysfunctions, retinopathy, and neuropathy. Free radicals have been involved in the patho-physiology of many diseases including diabetes. Diabetes mellitus may cause the body to produce fewer endogenous antioxidants and more oxidative stressors. According to reports, antioxidants have been demonstrated to improve glucose disposal, lower the likelihood of developing diabetes, and lessen some of its effects.

The more antioxidant-capable medicinal herbs may be employed to control diabetes. A significant portion of Bangladesh's natural resources are medicinal plants, of which there are over a thousand different species with a variety of therapeutic uses. Rural residents' access to basic healthcare is greatly aided by these therapeutic plants. More than 60 medicinal plants are reportedly used traditionally in Bangladesh to treat diabetes, according to ethnobotanical studies.

Our market research indicates a limited availability of anti-diabetic medicinal plants (15-16), often misused due to a lack of knowledge about their optimal health benefits. Notably, there's a gap in scientific literature regarding a comparative analysis of these plants' antioxidant activity and key content like polyphenols, flavonoids, and anthocyanins. Despite this absence of research, traditional practices commonly utilize these 15-16 plants for diabetes management.

Ayurvedic Importance:

In the Ayurvedic system, powdered leaves are a component of "sudarshana churn" a tonic and febrifuge. The community members used to utilise small amounts of these plants as herbal healers, but in recent years, commercialization of some of these species has raised demand for them, leading to greater exploitation. One of the first herbal treatments for liver diseases and bronchial asthma utilised in Western India is the plant Swertia Chirayata.

The secondary metabolites amaroswerin, mangiferin, and amarogentin are responsible for Swertia chirayata's anti-inflammatory, hepatoprotective, anti-cholinergic, and immunomodulatory activities. It is a native of the temperate and subtemperate Himalayas. It is a species that grows slowly and has a lengthy gestation time and low germination rate. For the synthesis of its bioactive components and as an ex-situ conservation measure, in vitro propagation is an effective substitute. The production of bioactive secondary metabolites is often minimal, at less than 1% of the dry weight, due to their spatial, developmental, and ecological requirements. Additionally, because of the complexity of their chemical makeup, ex-vivo biosynthesis is not feasible for them. To maximise the in vitro production of secondary metabolites, a balance between elicitation and stress is needed. The reactive oxygen species are produced under stressful circumstances, which harms plant cells.[7, 8, 9]

Swertia chirayata is one of the known species of Swertia in India (Folk name: Chirayata) In ISM and Traditional Chinese Medicine, Buch-Ham is regarded as the most significant medicinal plant. It is still used as a harsh tonic, purgative, febrifuge and anthelmintic, cathartic, asthma, anti-periodic, leucorrhoea, analeptic, emetic, relaxing to pregnant uterus, and for never-ending fevers.

It is fairly common for consumers to use both conventional medications and herbal supplements without visiting a doctor, which is known as a combination of multidrug therapy. According to the World Health Organization, between 70 and 80 percentage of the world's population still consumes natural medicine, and more than 7200 chemical compounds utilised in phytotherapy were created from medicinal plants. Cytochrome P450 enzymes are crucial to the toxicology of xenobiotics and the pharmacology of pharmaceuticals. Plasma levels may rise as a result of the inhibition of enzymes involved in traditional medications. It may have less therapeutic effects and more drug-induced toxicity, as well as fewer pharmacological effects. Skin cancer progression relies on the Wnt/β-catenin signaling pathway, which activates β-catenin and promotes oncogenes like cyclin D1 and c-Myc. These oncogenes are vital for cancer stem cells, crucial for metastasis. Therefore, targeting CSCs through Wnt/β-catenin inhibition is a promising strategy for developing effective cancer treatments. Researchers are interested in phytometabolites because they are less harmful; some of them demonstrated activity against cancer stem cells, which was demonstrated to be significantly more effective than drug-resistant metastatic cancers.

An herb called chirayata (Swertia chirayata) is frequently used in Indian traditional medicine. It includes terpenoids, flavonoids, xanthones, and other phytochemicals that are quite interesting to researchers. Therefore, scientists have discovered the biological actions of pure chemicals and/or extracts from this plant. For instance, the methanol extract of this plant showed anti-hepatotoxic effect against carbon tetrachloride (CCl4) and paracetamol cytotoxicity in basic single layer culture of rat hepatocytes. Both the anthelmintic activity of the crude aqueous and methanol extract in addition to the effect of a 95% ethanol-based chirayata extract on albino rats' blood sugar levels have been noted.

Today's pathogenic bacteria are more and more resistant to chemotherapy and antibiotics, which poses a serious threat to human health. As a result, several medicinal plants are being tested for their potential to act as antimicrobials. Furthermore, antimicrobials derived from plants have a vast therapeutic potential to treat a variety of infectious disorders with little adverse effects. Antimicrobial substances can be found in abundance in medicinal herbs. Higher plants are a potential source of novel anti-infective medicines, according to recent research screening plant compounds and extracts for antimicrobial activity. Swertia Chirayata is a member of the Gentianaceae family. Living things produce reactive oxygen species (ROS) from many metabolic processes, including hydroxyl radicals, superoxide anion, and hydrogen peroxide. Many diseases, including ageing, arthritis, heart disease, cancer, inflammation, and others, may develop in the human body as a result of the oxidative damage induced by reactive oxygen species (ROS). Many ailments can be effectively treated with plant-based medications, and Chinese (or other country-specific) medicinal plants have recently received increased attention.

Extracts of it are utilised like antihepatotoxic agent and it also has antiinflammatory, anti-fungal, anti-carcinogenic, and anti-malarial activities. Swertia chirayata extracts' (SCE) antioxidant activity has been linked to the herb's hepatoprotective effects. However, not enough research has been done to determine how Swertia chirayata affects antioxidant activity and free radical control. The current study's goal was to look into the ethanol extract of Swertia

chirayata's possible antioxidant properties both in vitro and in vivo. Green Chemical methods and nanoparticle characterization have emerged as major technological issues in recent years. The vast majority of metals found are valuable metals (like gold, platinum and palladium). Due to its numerous applications, Gold Nano Particles (AuNP) have gained more prominence among these metals.

Because of their high biocompatibility, powerful dispersing and high absorption, programmable plasmon resonance of the surface, and simple surface functionalization, ability to determine the presence of heavy metal ions, environmentally friendly synthesis methods, less toxic nature, catalytic activity, and use as sensors and DNA labels, among other properties, gold nanoparticles (AuNP) are used in medicinal biology.

RSM has not yet been used to optimise the production of Gold Nano Particles (AuNP) from therapeutic plants. The numerous factors involved in the herb-based manufacturing technique of Gold Nano Particles from Genus Swertian chirayata were optimised using RSM. The biosynthesis of Gold Nano Particles (AuNP) was influenced by a number of physiochemical factors. These factors were taken into consideration for improvement, and the synthesised nanoparticle was characterised to evaluate their structural characteristics and crystallinity. Within this work. Additionally, A proposal for a putative bio-reduction method has been proposed. The Gentianaceae family includes the critically endangered medicinal plant species Swertia chirayata.

Due to the ease, non-toxicity, environmental friendliness, and lack of need for downstream processing, the manufacturing of nanoparticles on a plant-based basis has created new opportunities. The chemical and physical characteristics of the nanoparticle is very different from those of their parent metal sources. Numerous researchers have been inspired to look into potential means of controlling the sizes of the nanoparticles by the strong correlation between the morphology and the properties of nanoparticles. Studies have shown that altering synthesis-related variables including pH, metal ion concentration, temperature, incubation duration, plant extract content, etc. can change the size and structure of produced nanoparticles.[17]

Recently, gold nanoparticles (AuNPs) and silver nanoparticles (AgNPs), have drawn a lot of attention because of their countless uses in photovoltaics, catalysis, therapeutics, biomolecular imaging, cancer therapy, and electronic conductors. To advance molecular diagnostics, Gold Nano Particles (AuNP) are becoming more and more in demand. Gold nanoparticles' (AuNP) bio-detection sensitivity is frequently influenced by the size of the particles. The substantial Raman amplification provided by the asymmetric Gold Nano Particles (AuNP) can increase detection sensitivity. To create Gold Nano Particles, a variety of plant species, especially therapeutic herbs, were investigated (AuNP). In order to optimise a variety of factors used in the biosynthesis of Gold Nano Particles from Swertia chirayata, an essential medicinal plant, this study applied neurological models and examine at their capabilities. Neural models can be extremely useful in nanotechnology.

Many different chemical compounds used as medications in medicine come from medicinal plants. These are the main therapeutic resources for the entire human population. In affluent nations, herbal medications are becoming more and more common for medical use. Swertia

chirayata, in particular, is utilised to cure or manage persistent fever in herbal medicine, malaria, anaemia, hepatitis, epilepsy, bronchial asthma, liver problems, ulcers, hypertension, some forms of mental illnesses, blood purification, and diabetes.

Conclusion:

A phytochemical analysis of Swertia chirayata demonstrated the existence of flavonoid and alkaloid, saponin, tannin, and terpene. The medical usage of Swertia chirayata in treating a variety of gastrointestinal and respiratory problems, including constipation, colic, diarrhoea, and asthma, now has a pharmacological basis thanks to this study. Uroslic acid possesses anti-diabetic property. There have been claims that Swertia chirayata acquire hepatoprotective, antioxidant, low blood sugar, antileishmanial, anti-inflammatory, anticancer, antibacterial and antimalarial activity.

While enzymatic defence induction is preferred for normal plant growth under physiological and biochemical stress, it would hinder the formation of secondary metabolites. The secondary metabolites amaroswerin, mangiferin, and amarogentin are responsible for Swertia chirayata's anti-inflammatory, hepatoprotective, anti-cholinergic, and immunomodulatory activities. According to studies, the natural antioxidative enzyme catalase, superoxide dismutase, and xanthine oxidase are less active in diabetic patients. One of the first herbal treatments for liver diseases and bronchial asthma utilised in Western India is the plant Swertia Chirayata. If bioactive chemicals are purified and the right dosage is established, antibacterial activity might be boosted. Similar to this, Swertia chirayata's antiviral activity was strengthened and further complemented by non-amplification of Swertia medication treated HSV-1 infected cells by PCR.

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