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PHYTOCHEMICALS AND CLINICAL POTENTIALS OF GYMNEMA SYLVESTRE (GURMAR)

Medicinal Plants

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ABSTRACT

Gymnema sylvestre (Asclepiadaceae) is located in many regions of Asia, Africa and Australia and popularly known as "gurmar" for its distinct property as sugar destroyer, is a reputed herb in the Ayurvedic system of medicine. The main phytoconstituents responsible for sweet suppression activity includes triterpene saponins known as gymnemic acids, gymnemasaponins, Conduritol-A and a polypeptide, gurmarin. Gymnema sylvestre is also known to have anti-oxidant, antibiotic, anti-inflammatory, antiviral, gastro and hepatoprotective, antimicrobial, anticancer and lipid-lowering activities. This review explores of phytochemistry and pharmacological activities of Gymnema sylvestre and its chemical constituents associated with its therapeutic potentials.

KEYWORDS

Gymnema Sylvestre; Antidiabetic; Herbal Medicine

INTRODUCTION:

The conservative estimate shows that there are 250,000 to 500,000 species of plants on Earth [1] and a relatively small percentage (1 to 10%) of these are used as food but substantial number of plants are used for medicinal purposes [2]. The herbal medicine represents probably the first and certainly the oldest system of human health care. Diabetes mellitus is a major endocrine disorder affecting nearly 10% of the population worldwide [3]. The disease in its severe state affects major systems of the body, leading to multiorgan complications. Plants possessing anti diabetic activities are of significant interest. The bioactive constituents found in many plant species are isolated for direct use as drugs, lead compounds, or pharmacological agents. These traditional approaches might offer a natural key to unlock diabetic complications [4].

Among the potential medicinal plants, *Gymnema sylvestre*, belongs to the family of Apocynaceae, and is traditionally used for the treatment of various dieseases. It is a wild herb found in India, Africa, Australia, and China [5]. It is known as Meshashringi, Merasingi, Kavali, Vakundi, Dhuleti, Podapatri, Adigam and Cherukurinja . This plant is also recognized as 'Gurmur', due to having sugar lowering property . *Gymnema sylvestre* was considered as one of the major botanicals to treat diabetes in the Ayurvedic system of medicine and also is included in Indian Pharmacopoeia as an anti-diabetic plant. It is rich source of many bioactive compounds such as gymnemic acid, stigmasterol, quercitol gymnemin,, lupeol, gurmarin, gymnemagenin, etc. which are mainly effective in lowering of blood sugar. Gymnemic acid, the active ingredient of this plant, is extracted from leaves and used widely as anti-diabetic [6], anti-sweetner [7, 8] and anti- hypercholesterolemia [9].

Phytochemical Analysis Of *Gymnema Sylvestre:*

MATERIALS AND METHODS :

Chemicals – Biuret's reagent , Million's reagent, ,Barford's reagent , Ferric chloride, Mayer reagent, Molisch's reagent, Ninhydrin solution, sodium hydroxide, Wagner's reagent, Liebermann's reagent, Salkowski's reagent , chloroform, Acetic acid all chemicals were used to find out the presence of phytochemical constituents which were obtained from the research lab of Krishna College.

Plant Material - Fresh Leaves of selected medicinal herb ***Gymnema sylvestre*** (Gurmar) was harvested from the herbal garden of Krishna College Bijnor in the month of July to october 2022. The collected leaves were thoroughly washed with tap water to avoid dusts and other unwanted materials accumulated on the leaves from their natural environment. The dust free leaves were shade, dried at room temperature. After 4-5 days for obtaining 50 percent ethanol aqueous extract, the properly dried leaves were then grinding into the fine powder by using the grinding machine than the powder material of Gurmar leaves were weighed properly. The fine powder of Gurmar leaves was stored in a clean and tightly closed container for extraction.
Preparation of ethanolic aqueous extract of ***Gymnema sylvestre*** (leaves)- The extract of leaves were obtained in sufficient quantity by using distilled water and ethanol . In this process firstly 20 g powdered leaves of ***Gymnema sylvestre*** (Gurmar) were placed in 250 ml of beaker and 50 ml of distilled water and 50 ml of ethanol was poured into beaker after addition of water and ethanol kept for overnight at the room temperature approximately 24 hrs for thorough mixing and also complete elucidation of active materials to dissolve in the respective solvent then, extract was filtered by using muslin cloth followed by Whatman no 1 filter paper , after done this process filtrate was dried. Finally, the residues were collected and used for the experiment .

Phytochemical Analysis Of Ethanolic Aqueous Extract Of *Gymnema Sylvestre* –

Test For Glycosides

Liebermann's Test- Liebermann' test for the analysis of glycoside are present or not in aqueous extract of in this test 5 mg extract of ***Gymnema sylvestre*** was mixed properly with 2ml of chloroform and then 2ml of acetic acid were mixed in the. Solution than it was cooled in ice. After cooling 1 ml of concentrated Sulfuric acid was added. The colour will be change from violet to green with the presence of alkaloids in the extract.

Salkowski's test- for the analysis of glycoside 2ml of chloroform were with 1ml of extract. Then 2ml of concentrated Sulphuric acid were added and shaken gently. A reddish brown colour indicated the presence of glycoside.

Test For Triterpenoids

The dry crude plant extract (5 mg) was dissolved in chloroform (2 mL) and then acetic anhydride (1 mL) was added to it. Concentrated sulphuric acid (1 mL) was added to the solution. Formation of reddish violet colour shows the presence of triterpenoids.

Test For Saponins

Foam test was performed for identification of saponin in the aqueous extract in which 1ml extract was dissolved into the 5ml of distilled water. After addition of distilled water it was shaken for proper mixing till foam was observed. Few foam was added with 2 drops of olive oil and it was shaken vigorously. It should be produced emulsion with the saponins.

Test For Protein

Biuret's test- 5 mg extract was added with the few drops of biuret's reagent. The obtained mixture was shaken well and allowed to warm for 1-5 min. Appearance of red or violet colour indicated presence of proteins.

Ninhydrin test- aqueous extract of tulsi was mixed with 2 ml of 0.2% solution of Ninhydrin and boiled for 2 min on water bath, if violet colour appeared with the presence of amino acids and proteins in the aqueous extract.

Test For Alkaloids:

Mayer's test- 5 mg extract of *Gymnema sylvestre* was transferred in the test tube and then added 1% hydrochloric acid HCl, the obtained solution was gently heated. Red colour indicate the presence of alkaloids because Potassium mercuric iodine are present in Mayer's reagent.

Wagner's test- In this test 5 mg extract of *Gymnema sylvestre* was taken in a test tube than 0.5 of wagner reagent was added in a solution shaked well. Appearance of reddish brown colour showing the alkaloids are present. Reddish brown colour because of iodine forms a complex is insoluble and has the colour brown reddish.

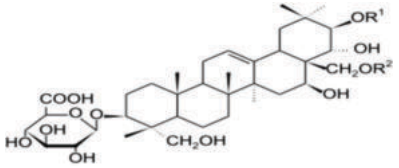
Phytochemistry of *Gymnema sylvestre*

Leaves of *Gymnema sylvestre* were investigated using chromatographic techniques and were found to have several therapeutically important chemical compounds such as Oleanane and dammarane type of saponins.[10]. The leaves of this plant also have saponins, anthraquinones, cardiac glycosides etc. Moreover, this plant was also observed to have tannin, quinones, flavonoids, and phenols [11].

The phytochemical compounds found in the analysis of *Gymnema sylvestre* with their structure and mode of action are given as :

1. Gymnemic Acid :

Gymnemic acids are triterpenoid glycosides**.** solated from the leaves of *Gymnema sylvestre* . They are anti-sweet compounds, or sweetness inhibitors [12]. More than 20 homologs of gymnemic acid are known. Gymnemic acid I has the highest anti-sweet properties. It suppresses the sweetness of most of the sweeteners including intense artificial sweeteners such as aspartame and natural sweeteners such as thaumatin, a sweet protein**.**



Name	Gymnemic acid I	Gymnemic acid II	Gymnemic acid III	Gymnemic acid IV
R1	tigloyl	2-methylbutanoyl	2-methylbutanoyl	tigloyl
R2	acetyl	acetyl	H	H

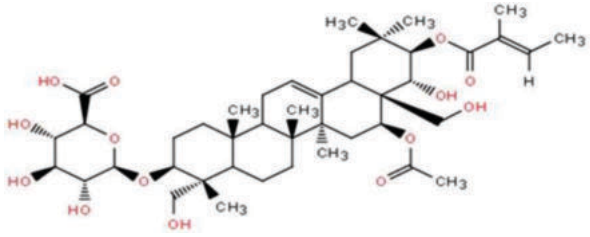
Reduction of blood sugar because Gymnemic acid molecules fill the receptor location in the outer layer of intestine so preventing sugar absorption in intestine.

2. Gurmarin -

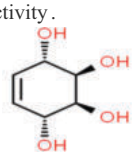
Gurmarin is a polypeptide consists of 35 amino acid residues containing 3 intramolecular disulfide bridges that form a cystine knot. Gurmarin block the ability to sweet taste or bitter flavours and thus reduces sweet carving. We previously demonstrated that recombinant gurmarin, produced by the methylotropic yeast *P. pastoris*, is capable of selectively suppressing sweetener-induced responses from cells that heterologously express the rat sweet taste receptor [13].

3. Gymnemoside A –F

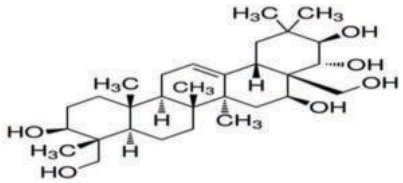
These are the Dammarene Saponins compounds isolated from the *Gymnema sylvestre*. These are different types such as Gymnomosides A, B,C,D,E,F. These compounds have Inhibitory effects on increased level of serum glucose. [14].



4. Conduritol A – Conuritol A and some of its analogues present an important hypoglycemic activity .



5 . Gymnemagenin- Gymnemagenin has anti hyperglycemic activity.



Some other phytochemicals such as anthraquinone, flavones, flavonoids like epicatechin, Apigenin, Luteolin, Kampferol, Hentriacontane, Pentri- acontane, Phytin, Resin, Lupeol, β-amyrene related glycosides, alkaloid (conduritol), α and β- chlorophyll, Stigmasterol, d-quercitol, Nonacosane, Lignin etc. also found in *Gymnema sylvestre which are the Antidiabatic compounds and also show* antioxidant activites.

Therapeutic Uses Of *Gymnema Sylvestre*

Antidiabetic Activity

The most widely known effect of ***Gymnema sylvestre*** is anti-diabetic activity. Its 50% aqueous ethanol solution reduce glucose level by 32%. Gymnemic acids (a type of triterpene saponin compounds) are the class of active constituents isolated form ***Gymnema sylvestre***. In a study, oral administration of small concentrations (0.2 g/kg) of this plant produced a reduction in the elevated levels of blood sugar induced by sucrose [15].

Anticancer Activity

Gymnema sylvestre was found to have anticancer activity in various investigations. Its constituent gymnemagenol (C30H50O4) showed positive anticancer activity against HeLa cells [16].

Antimicrobial Activity

The aqueous extract showed moderately anti-microbial activity against *S. aureus, C*. krusei, *C. perfringens* type-A and *C*. kefyr where the hexane extract showed activity against *S. aureus, B. cereus, S*. enterica, H. paragallinarum and *C. perfringens* type-A [17].

Antioxidant Activity

Ethanol extract of this plant revealed significant ($p < 0.05$) 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging activity and showed better antioxidant potential than *A. bilimbi* and *C. frutescens*. Anti-oxidant activity of *Gymnema sylvestre* against DPPH was also observed in an investigation by [18].

Anti-Inflammatory Activity

Methanoic extract of Gymnema sylvestre showed anti-inflammatory activity in Wistar rats where carrageenan-induced inflammation was introduced in the rats. Methanolic extract of this plant reduced carrageenan-induced rat paw edema significantly ($p < 0.05$) [19].

CONCLUSION :

Antidiabetic activity along with antioxidant potential of 50% aqueous and ethanolic leaves extract of Gymnema sylvestre have been reported till date due to the presence of flavonoids, phenols and various bioactive compounds like gymnemic acid, Gurmarin ,gymnemarerin, Gymnemoside A –F, Conduritol A and other secondary metabolites like saponins, tanins (phenolic compounds) and triterpenoids that are antioxidants but show antidiabetic activity also. So, we can conclude from various literature reviews that biocomponents possess both antidiabetic and antioxidant activities and antioxidants with their antidiabetic features also. As diabetes incidence increases day by day, more effective research and analysis must be required to find out other active phytochemical compounds with exact active antidiabetic mechanism of action for human welfare in near future.

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