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REVIEW ARTICLE **OPEN ACCESS**

Anti- Hyperglycemic Activity of *Caralluma fimbriata* (wall) : A Review

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ABSTRACT

Public health is significantly impacted by using natural materials, completed herbal products containing bioactive components, or mixtures thereof as treatments, particularly in developing nations. In the 250,000 plant species that make up the plant kingdom, 10% have been investigated or identified as medicinal plants that can be utilized to treat a range of illnesses. A 20–30 cm tall, upright, branching herb known as Caralluma has fleshy, green, leafless stems that taper to a tip. It is used by Indian tribes to boost endurance and curb hunger. The Asclepiadaceae family includes 50 different kinds of succulent plants under the genus name Caralluma. Caralluma is a common dwarf stem succulent that is becoming more well-known for its ability to control blood sugar, curb hunger, and aid in weight loss. This study revealed that Caralluma fimbriata extract is an anti-diabetic medication for diabetes mellitus that also reverses hepatic toxicity, hyperglycemia, and kidney toxicity while lowering insulin resistance and oxidative stress.

Keywords: *Herbs, Caralluma fimbriata Extract Antidiabetic, insulin*

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INTRODUCTION

There are roughly 250,000 kinds of plants in the plant kingdom, and of them, 10% have been studied or found to be medicinal plants that can be used to cure a variety of diseases [55]. There is an urgent need to look into other hidden elements of the flora. Contrary to traditional medicine, many plant based treatments have a longer history of usage in the treatment of many diseases [16]. The World Health Organization refers to the use of herbs, herbal materials, finished herbal products containing active components of plants, or combinations thereof as medications as employing herbal, Phyto, or botanical medicines [66]. These medicinal herbs are abundantly accessible from plant sources and have numerous therapeutic uses [52]. Due to their greater accessibility and lower toxicity, medicinal plants have a significant impact on public health, especially in developing nations [6]. Contrary to the widespread use of allopathic drugs, which has been linked to side effects, the use of medicinal herbs does not result in intoxication [52]. *Caralluma* is a medicinal, edible plant. *Caralluma fimbriata* was first grown in Britain in 1830. Indian tribes use this plant to reduce hunger and increase endurance [5, 18].

Caralluma fimbriata (wall)

Caralluma is a 20–30 cm tall, upright, branching herb. The stems are fleshy, green, leafless, and tapered to a tip. Only immature branches have tiny leaves, which quickly fall off and leave a tooth-like projection on the angles. Flowers are produced singly or in groups of three or more on short stalks at the ends of branches. Flowers are 2 cm across, like wheels. The borders of the slender, purple petals with yellow markings are ruffled and hairy. Fruits are cylindric and 10 to 12 cm long, with one pair frequently repressed. It is frequently found as a wayside shrub or boundary sign.

Caralluma is a genus of 50 diverse species of succulent plants in the Asclepiadaceae family. It is a common dwarf stem succulent that grows across the Indian subcontinent, southwest Asia, and western Africa [66]. Peninsular India is where it is more prevalent [52,59]. It is a recent addition to the family of succulent plants that are gaining popularity for their capacity to lower blood sugar levels [7,8]. It acts as an appetite suppressant [63] and promotes weight loss. Moreover, research has demonstrated that *Caralluma fimbriata* has nootropic [47] nociceptive [3], and antioxidant [7,8] properties.

ETHANOBOTANICAL RELEVANCE

The aerial portions of *Caralluma* species are typically used as a culinary herb when preparing meat during the winter [4]. Although the *Caralluma quadrangula* plant is edible in its entirety, some cultures mix the juice extracted from its stem to fresh milk and drink it as a general tonic [39]. User reports, *C. attenuata* can be consumed raw to treat diabetes, and its juice combined with black pepper is suggested for migraine relief [49,61]. *C. adscendens* is grown in revered groves in Tamil Nadu's Madurai area and known for its ulcer-curing and cooling properties [23]. Since the time of the Vedic civilization*, C. fimbriata,* sometimes known as "Indian Hoodia," has been utilized in India as an appetite suppressor [60]. Under the brand name Gena Slim, a *C. fimbriata* extract has been made available for controlling body weight [36]. Traditional medicine also employs *C. fimbriata* to treat several ailments, including diabetes, pain, fever, and inflammation [60]. The plant species is typically consumed to cure obesity, while ethnic populations in middle India utilize *C. adscendens* var. *fimbriata a*s an appetite suppressor [36].

TRADITIONAL USES

India has consumed it for thousands of years fresh, seasoned, or preserved in chutneys and pickles. During hunting, it has been used as a portable food and beverage. It is also used for its reported ability to boost endurance and lessen hunger and appetite [55]. Since tribe members typically only bring enough food for one day of hunting, *Caralluma i*s frequently referred to as a "famine food" in India [16].

MATERIAL AND METHODS

The literature review was performed using the following databases: Medline/PubMed (www.ncbi. nlm.nih.gov/pubmed/), Google Scholar (scholar.google.co.in), Research gate(www.researchgate.net), Science Direct (www.sciencedirect.com), Hindawi (www.hindawi.com), Science and Scopus (www.scopus.com); using the keywords (in English) *Caralluma fimbriata,* Antidiabetic activity.

Table: 1-Phytochemical Screening (43)

Phytochemicals	Conclusion
steroid	High
Carbohydrates	High
Protein	High
Diterpenes	Moderate
Caumarin	High
Phytosterol	High
Flavonoids	High
Saponins	Moderate
Alkaloids	High

Table : 2: Phytochemical Constituents [in various countries]

Phytochemicals	Biological Activities	References	Country
Compounds with polyphenols	Antioxidant, Cardioprotective, Neuroprotective and Antihyperglycemic		India, Spain, China
Flavonoids	Antioxidant, anti-inflammatory, immunomodulatory, cardioprotective, antiviral, and antibacterial anti-parasitic and anti-bacterial	63,43, 26,44, 32	India, Brazil
Saponins	Antitumor, Antioxidative, Anti-inflammatory antidiabetic, neuroprotective	63,43, 26,44, 41	India, U.S.A
Alkaloids	Antiadipogenic, antihyperglycemic, antioxidant	63,43, 26, 58, 11	India, China, Korea
Anthocyanins	Cardiovascular diseases, cancers, neurodegenerative disorders, and aging associated bone loss	26, 13, 30	India, Lithuania (Europe), U.S.A
Coumarins	Antioxidants, antitumor	63,43, 26, 33	India, Iraq

Tannins/gallic tannins	Antiulcerative, anti-inflammatory, antioxidant, antidiabetic, anticancer and cardioprotective	63,43,26, 44, 20, 51	India, Egypt, Brazil
Steroids	-	43 ,26	India
Diterpenes	Antiobesogenic, antihyperlipidemic and anticarcinogenic	43, 31, 14	India, Switzerland, Austria
Phytosterol	Antihyperlipidemic anticancer antiapoptotic cardioprotective and anti-inflammatory	63, 44, 42	India, Nigeria
Quinones	-	63	India
Terpenoids	Anti-inflammatory, antitumor and antiparasitic	63	India, Poland
Anthraquinones	Diuretic, antibacterial, antiulcer anti-inflammatory anticancer and antinociceptive	63	
Pregnane glycosides	Antidiabetic, Anti-obesity, antinociceptive, antiulcer, anti-inflammatory, antiarthritis, wound healing activities	21,62	India, Italy, Egypt
Pregnane steroids	-	21	India
Trigonelline	Anti-inflammatory, antioxidant, antipathogenic, and antiaging	62, 65	Italy, China
Glycosides	-	34	-

Table: 3: Biological Activities Attributed to C. *fimbriata*

Bioactive compounds	**Mechanism**	**Reference**
Pregnane glycoside	Lowering or increasing pancreatic insulin production are two effects of pregnancy glycoside.	2
Quercetin	Encourage **the glucose transporter's** movement when it is taking in **glucose.**	15
Saponin	Increases insulin production and reduces oxidative stress.	1

ANTI-HYPERGLYCEMIC ACTIVITY

Diabetes currently affects 3% of the global population, and by 2025, it is expected to increase to 6.3%. According to statistics the disease will have impacted 79.4 million people in India alone by 2030 [54]. Many pharmacological drugs are used to treat diabetes. Despite the availability of a variety of oral hypoglycemic medications and insulins injections for the treatment of diabetes mellitus, an increase in people are looking for natural anti-diabetic therapies with fewer side effects [12]. Currently available allopathic drugs can lower blood sugar levels while raising the risk of obesity and hyperandrogenism. All around the world, medicinal plants are used to treat diabetes mellitus because they are less harmful, less expensive, and have fewer side effects. The relevance of research on medications made from conventionally used medicinal plants has increased as a result [35]. The main factors that contribute to the hypoglycemic impact of pregnane glycoside are its capacity to lower intestinal glucose absorption or increase insulin production in the pancreas. Important phytochemical components of *Caralluma fimbriata* that have been researched for their potential therapeutic effects against a variety of pathological conditions and metabolic disorders include flavone glycosides, pregnane glycosides, saponins, triterpenoids, and other flavonoids. Pregnane glycosides, which are steroidal compounds conjugated with sugar moiety, are the secondary metabolites of *Caralluma fimbriata* [17]. Commercially, *Caralluma fimbriata* extract (CFE) is offered in several nations, including Australia and New Zealand [24].

To ascertain the modulatory effects of the *Caralluma fimbriata* extract on glucose metabolism and suppression of amylase, major enzyme activities and changes in glycogen content (liver and muscle) were examined in diabetic rats fed a high-fat diet. The results shown that *Caralluma fimbriata* extract metformin administration prevented changes in the activity of glucose metabolism enzymes and markedly improved the levels of glycogen in the liver and muscle of High Fat Diet -fed rats. Additionally, these groups showed a reduction in myofiber breakdown and fat deposition. According to these findings, *Caralluma fimbriata*

Extract is effective in regulating glucose metabolism associated with intake of high-calorie diets [25]. The efficacy of *C. fimbriata* Extract to reduce blood sugar was the subject of another study. In order to conduct amylase and glucosidase inhibitory tests, controlled acarbose was added to the *C. fimbriata* leaf extract at various dosages (1-1000 g/mL). The extract (100 g/mL), metformin, and insulin served as the control drugs in a glucose uptake experiment. The activity of enzymes involved in glucose metabolism was considerably reduced by *Caralluma fimbriata* extract. *Caralluma fimbriata* Extract had the highest glucose absorption rate, measuring 100 g/mL (66:32:0:29%). Metformin (10 g/mL), at 74:44:1:72%, and insulin (10 mM), at 85:55:1:14%, came in second and third, respectively. The results indicating CFE is safe were backed by the IC50 values of 1000 g/mL for the plant extract and 1000 mM for metformin in the tested cell line [54].

CONCLUDING REMARKS

The 260 species that comprise the genus *Caralluma* have all been widely used to treat a variety of illnesses. *Caralluma* species have yielded a variety of bioactive compounds that have been utilized to treat diseases like cancer, diabetes, obesity, and hypertension. One of these species is *Caralluma fimbriata*, a native, wild, edible, and succulent shrub that resembles a cactus at the side of the road. Research on the nutritional and medicinal value of *Caralluma fimbriata* has shown that it has significant amounts of bioactive compounds that have been shown to lower hyperglycemia. Therefore, more of this underutilized crop must be grown for regular dietary consumption.

FUTURE PROSPECTIVE

Caralluma fimbriata is still the topic of little investigation, according to the data from the summary of this review. Therefore, more research on this remarkable medicinal plant and its allegedly active macromolecules is required to confirm it to address serious health issues present in both developed and developing countries, further phytochemical and pharmacological research should be conducted, along with more work on creative approaches to use CFE in diet or supplements. Further studies are encouraged to determine this plant's medicinal potential against diabetes because it has not yet received enough attention in the fields of food and biomedicine.

CONFLICTS OF INTEREST

Authors say they have no competing interests.

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AUTHORS' CONTRIBUTION

All authors reviewed the Manuscript and K. W. Pawar acted as project supervisor.

A.I TOOLS

The authors utilized Turnitin and Grammarly during the writing process to check for plagiarism and rectify any errors in grammar. The writers took full responsibility for the publication's content after using this tool and reviewed and amended it, as necessary.

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