

Research Article



INTERNATIONAL RESEARCH JOURNAL OF PHARMACY

www.irjponline.com

ISSN 2230-8407 [LINKING]

REVIEW ON PLANT BASED PRODUCTS AS ALTERNATIVE MEDICINE FOR MANAGEMENT OF DIABETES MELLITUS

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How to cite: M.V. JYOTHI KUMAR, M. SREEDHARAMURTHY, B. VIJAYA BHASKAR, Ch. APPA RAO¹, **REVIEW ON PLANT BASED PRODUCTS AS ALTERNATIVE MEDICINE FOR MANAGEMENT OF DIABETES MELLITUS**

. International Research Journal of Pharmacy, 2025,16:7:145-156.

Doi: <http://doi.org/10.56802/irjp.2025.v16.i07.pp145-156>

Abstract:

Diabetes mellitus is an endocrine metabolic disorder that can be considered a growing health problem in the world. An increasing number of people worldwide are being diagnosed with diabetes mellitus (DM), a metabolic condition. One of the most prominent clinical symptoms is elevated blood glucose. Clinical management of diabetes is associated with adverse side effects due to synthetic moieties, therefore alternative therapeutic agents from natural products utilized for the management of diabetes mellitus. Natural products contain a wide variety of bioactive metabolites like polyphenols, tannins, terpenes, alkaloids, glycosides, and flavonoids were found to be related to the potential plant derived therapeutic agents for the management of diabetes, when compare to existing therapeutic approaches.

Keywords: Medicinal plants, antioxidant, bioactive compounds, antilipidemic, Antihyperglycemic,

Introduction:

Diabetes Mellitus (DM) is metabolic disorders characterized by elevated glycemic levels due to insufficient insulin secretion by pancreatic β -cells and the inability of insulin sensitive tissues to respond to insulin (1). The diagnosis criteria for diabetes mellitus is fasting plasma glucose (FPG)>126 mg/dL, glycated hemoglobin (HbA1C)>6.5% and oral glucose tolerance test (GTT)>200 mg/dL (2). The International Diabetes Federation estimates that there were 783 million people affected with diabetes mellitus globally by 2045 (3). Management of diabetes by various pharmacotherapeutic products such as oral hypoglycemic agents and insulin. These synthetic moieties associate with adverse side effects during prolonged period of treatment, to minimize the adverse side effects natural product treatment came in exist for alternative therapy (4). Natural product derived secondary metabolites, such as Flavonoids, Alkaloids, ferulic acid, terpenoids pocesses an anti hyperglycemic activity in the management of diabetes (5). The commercial available drug for the management of diabetes is metformin derived from *Galega officinalis* (6,7). This review focused on importance of natural product derivates for new drug development for treatment of various diseases and disorders.

MANAGEMENT OF DIABETES MELLITUS BY NATURAL MEDICINE

Antihyperglycemic activity of *Emblica officinalis* Gaertn.

Taxanomical Classification:

Order : Geraniales
Family : Euphorbiaceae
Genus : *Emblica*
Species : *officinalis* Gearth
Local name : Amla

Emblica officinalis Gaertn (EO) belongs to the Euphorbiaceae family and also called as Indian goosbery. Whole plant parts like leaves, bark, roots, fruit, seed and flowers having

medicinal importance in traditional system of medicine. *Nain et al.*, (2012) reported that hydro methanolic extract of leaves of EO at a dosage 400 mg/kg b.w. showing significant antihyperglycemic activity in streptozotocin induced diabetes rats and pocessing protective mechanism against lipid peroxidation and free radical scavenging activity to minimal the risk of diabetic complications (8), and it contain phytoconstituents like Kaempferol, Rutin, Ellagic acid, Amlaic acid, Gallo-tannin, Kaempferol-3-O-glucoside, Phyllantidine, Astragalin, Tannin and Phyllantine (9, 10). These bioactive phytoconstituents are responsible for management of diabetes mellitus.

Antihyperglycemic activity of *Momordica charantia*

Taxanomical Classification:

Order : Cucurbitales
Family : Cucurbitaceae
Genus : *Momordica*
Species : *charantia*
Local name : Bitter Gourd

Momordica charantia (MC) belongs to family Cucurbitaceae. It widely used as vegetable, folk and herbal medicine. MC rich in bioactive compounds having anti-oxidant, anti-inflammatory, anti-cancer, anti-bacterial and anti-hyperglycemic activity (11). Saeed, F *etal.*, (2017) reported that MC juice at a dosage of 10 mL/kg/day for 14 days in streptozotocin induced diabetic rats pocesses significant antihyperglycemic activity by enhancing insulin secretion from pancreatic remnant β -cells (12). The bioactive constituent charantin present in MC may be responsible for antidiabetic activity (13).

Antihyperglycemic activity of *Trigonella foenum-graecum*

Taxanomical Classification:

Order : Fabales
Family : Fabaceae
Genus : *Trigonella*
Species : *foenum-graecum*
Local name : Fenugreek

Trigonella foenum-graecum (TF) belongs to family Cucurbitaceae. It is extensively used in traditional medicine in India, Africa, South, and central Asian countries (14). Fenugreek's contains various pharmacological properties due to presence of bioactive compounds such as polyphenols, flavonoids, alkaloids, steroids, lipids, saponins, hydrocarbons, carbohydrates, galactomannan fiber and amino acids. Previous reports supports that it consist high potential bioactive constituent like galactomannan, which play a key role in management of diabetes mellitus (15). Baset M *et al.*, (2020) reported that the antihyperglycemic property of fenugreek seed extract at a dosage of 100 mg/kg bw for the management of diabetes in STZ induced diabetic rats (16).

Antihyperglycemic activity of *Withania somnifera*:

Taxonomical Classification:

Order : Magnoliopsida

Family : Solanaceae

Genus : *Withania*

Species : *somnifera*

Local name : Ashwagandha

Withania somnifera (WS) is a woody shrub belongs to a family Solanaceae. It is a also called as Indian ginseng. Phytochemical analysis reveals the presence of alkaloids, steroids, saponins, phenolics, flavonoids, phytophenols, and glycosides (17-19). The potent bioactive constituents like withanolide A, withanolide B, withanoside IV terpenoids, withaferin A and withanone are responsible for high potential antidiabetic activity in STZ induced diabetic rats (20,21).

Antihyperglycemic activity of *Acacia arabica*

Taxonomical Classification:

Order : Fabales

Family : Fabaceae

Genus : *Acacia*

Species : *arabica*

Local name: Babul

Acacia arabica (AA) belong to the family Fabaceae, and extensively used in traditional system of medicine (22). In this plant all parts including flowers, pods, bark, gum used in medical purpose to treat various diseases and disorders (23). Acacia gum extensively used in ayurvedic medicine for the management of diabetes (24). Polyphenolic analysis reveals the presence of bioactive constituents like gallic acid, catechin, epicatechin, kaempferol-3-glucoside, arabinobiose, isoquercetin, quercetin, catechol (25 - 28). *Acacia arabica* chloroform extract at a dosage of 200 mg/kg/bw possess good antidiabetic, hypolipidemic and antioxidant properties in STZ induced diabetic rats (29).

Antihyperglycemic activity of *Artemisia amygdalina* Decne

Taxonomical Classification:

Order : Asterales
Family : Asteraceae
Genus : *Artemisia*
Species : *amygdalina* Decne
Local name : Almond Wormwood

Artemisia amygdalina (AA) is a perennial herb belongs to the family Asteraceae, extensively used in alternative system of medicine for therapeutic purpose. Six bioactive constituents are isolated from roots and shoots of *Artemisia amygdalina* which are potent anti cytotoxic in nature such ergostadien-3-ol(1), ludartin(2), 5-hydroxy-6,7,3,4-tetramethoxyflavone(3), trans-matricaria ester (4), diacetylenic spiroenol ether (5), cis-matricaria ester(6), and ergostadien-3-ol (30,31), due to presence of these bioactive compounds in thia plant having the wide range of ethanomedical properties like anti-inflammatory (32), hepatoprotective, blood pressure management, sedation, anti gastrointestinal (33,34) and potent cytotoxic activity. The hydro alcoholic extract at dosage of 500 mg/kg of b.w showed significant anti hyperglycemic and anti hyperlipidemic activity when compare to other extracts of this plant in STZ induced diabetic rats and histopathological results showed that *Artemisia amygdalina* is having capacity to regenerative or protective effected pancreatic β -cells in diabetic rats (35,36) .

Antihyperglycemic activity of *Phaleria macrocarpa*

Taxonomical Classification:

Order : Malvales
Family : Thymelaeaceae
Genus : *Phaleria*
Species : *macrocarpa*
Local name : Mahkota dewa

Phaleria macrocarpa (PM) belongs to a family Thymelaeaceae. This plant rich in bioactive constituents, which are responsible for high antioxidant and antifungal and antibacterial properties (37- 40). Biological active phytoconstituents are isolated from various parts of *P. macrocarpa* such as mangiferin, icariside C3, enzophenoicglucoside (3,4,5-trihydroxy-4'-methoxy-benzophenone-3-0- β -D-glucoside (41-42), mahkoside A, phenolic glycoside, mangiferin, palmitic acid, kaempferol-3-0- β -D-glucoside, sucrose, dodecanoic acid, ethylstearate (43) ,matairesinol, lignanspinoresinol and lariciresinol (44,45), desacetylfevicordin A, 29-norcucurbitacin ,evicordin A, fevicordin A glucoside, and fevicordin D glucoside (46-48). Azad, A. K (2020) reported ethanolic extract of *P.Macrocarpa* at a dosage of 50 mg/kg/day significant reduction of glycemic levels in diabetic rats. These results supports that, *P. macrocarpa* might involved in insulin secretion and controls diabetic complications by potent antioxidant activity. These experimental results supports *P. macrocarpa* fruit acts as good dietary source for management of diabetes mellitus (49).

Conclusion:

Medicinal plants play a key role in natural system of medicine for management of diabetes mellitus. Plants contain bioactive pharmacotherapeutic compounds such as flavonoids, alkaloids, terpenes, glycosides, which are responsible for management of diabetes. These phytoconstituents enhance the secretion of insulin from remnant pancreatic β -cells in a synergistic manner. These bioactive compounds are utilized by the pharmaceutical companies for new drug discovery for management of diabetes mellitus and its associated complications.

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