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# CURRENT TRENDS OF MEDICINAL PLANTS WITH POTENTIAL ANTIDIABETIC ACTIVITY: A REVIEW

**KEY WORDS:** Diabetes, Medicinal plants, Blood glucose, etc.

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**ABSTRACT**

Diabetes is a metabolic disorder primary characterized by a loss of glucose homeostasis, due to disorders of carbohydrate, fat and protein metabolism, resulting from defects in insulin production, insulin secretion, insulin action. It can be cause organ damages. Medicines that are derived from plants are the best body balancers. They can be used to treatment of many diseases such as diabetes, asthma, eczema, etc., and can be used for maintaining body general health. In Indian pharmaceutical system of medicine, many of the medicinal plants have identified potential use as the blood glucose lowering agents.

**Summary & Conclusion:**

Diabetes mellitus is a syndrome, primarily indicated by loss of glucose homeostasis resulting from defects in insulin secretion, insulin action both resulting in impaired metabolism of glucose and other energy-producing fuels such as lipids and proteins [72].The global prevalence (age-standardized) of diabetes has nearly doubled since 1980, rising from 4.7% to 8.5% in the adult population. Diabetes caused 1.5 million deaths in 2012. Globally 7.1 million deaths could be attributed to high blood pressure, 4.4 million to high cholesterol, and 2.6 million to excessive body weight [5]. Type 2 diabetes is more frequent than type 1 in adults. Every plant material is not safe for the treatment of Diabetes mellitus so need to inspected the toxic effect of these plants before utilization. Isolate and test the active components from the potent active antidiabetic plant and there is the essential need for clinical research on the new drug available in the market with less side effects.

This review paper exhibits the usefulness and the concern on medicinal plants in the drive to demonstrate their anti diabetic effects and the responsible bioactive agents. This review also covers the common name of a plant, the parts that are usually used as a remedy sources, extracts, doses, and a test model.

## INTRODUCTION

### Diabetes Mellitus

Diabetes mellitus is the highly non infectitous diseases to hit the globe in the present millennium [1, 2, 3, 4]. According to WHO (2016) the global prevalence (age-standardized) of diabetes has nearly doubled since 1980, rising from 4.7% to 8.5% in the adult population [5]. Diabetes caused 1.5 million deaths in 2012. WHO (2002) reported that globally 7.1 million deaths could be attributed to high blood pressure, 2.6 million to excessive body weight, and 4.4 million to high cholesterol. Type 2 diabetes is more frequent than type 1 in adults [4, 6] and is mostly characterized by peripheral insulin resistance [6] and inadequate functional mass of -cells [7, 8].

This may cause long-term damage to organs, like as the nerves, kidneys, eyes, liver, heart and blood vessels. High complexity in some of these organs can lead to death [9]. Over the last century human food habits and life style have been highly changed which lead to various chronic diseases. Many of the serious problems and diseases in the human health caused by diabetes milletus [10]. Glucagon is a hormone that resist the action of insulin. It is secreted when glucose level falls in blood. Glucagon increases blood glucose concentration, partially by stimulating the breaking down of stored glycogen in the liver by a pathway known as glycogenolysis. Gluconeogenesis is the production of glucose in the liver from non-carbohydrate precursors such as glycogenic amino acids [11]. Blood-glucose level controlled by the both insulin and glucagon, pancreatic endocrine hormones within the body in an adequate level based on the body needs. Normally, insulin is secreted by the -cells found at the islets of Langerhans in response to high levels of blood sugar. It provide the capability of muscle, red blood cells, and fat cells to absorb sugar out of the blood and consume it in other metabolic processes, which restore the sugar levels to the normal level [12].

### Causes of Diabetes

The causes of diabetes may be the family history, Genetic makeup, ethnicity, life style, health and environmental factors during pregnancy. [13, 14]

### Types of Diabetes Mellitus

There are three types of diabetes-

#### 1. Type -I or Insulin Dependent Diabetes Mellitus:

Type 1 (IDDM) develop in patients when there is low secretion or no secretion of insuline. Consequently, they are in need for a replacement therapy of insulin for survival. Type 1diabetes are two major forms (i) type 1a (90% of type 1) and (ii) type 1b (10% of type 1). Type 1a cause immunological destruction of pancreatic ß cells associated with diseases such as Addison's disease, Grave's disease and Hashimoto's thyroiditis [15, 16].

#### 2. Type II Diabetes Mellitus

Type II diabetes mellitus (Non insulin-dependent diabetes) are a less capability of insulin to stimulate glucose uptake in peripheral tissues, insulin resistance and the inability of the pancreatic -cell to secrete insulin sufficientely, -cell failure. The liver, skeletal muscle and adipose tissue are the major site of insulin in type 2 diabetes [17].

#### 3. Gestational Diabetes Mellitus

It is more common among obese women and women with a family history of diabetes. It generally resolves once the baby is born, however, after pregnancy, 5-10% of women with gestational diabetes are found to have type II diabetes and 20- 50% of women have a chance of developing diabetes in the next 5-10 years [18, 11, 1, 19, 20]. Gestational diabetes, blood glucose level rise during pregnancy, is a significant disorder of carbohydrate metabolism due to hormonal changes during pregnancy, which can lead to rise blood glucose in genetically predisposed individuals.

### Complications of diabetes mellitus

Diabetes mellitus is a chronic disease that may cause to highly complications over a period of time [21]. These complications are in below-

Retinopathy , which may cause the blindness in eyes

Neuropathy, which may cause the, among other things, ulceration of the foot requiring amputation

Nephropathy, which may cause the kidney failure and the need for dialysis

Cerebro vascular disease, which may cause the stroke

Coronary heart disease, which may cause the heart attack

**Management of Diabetes**

Smoking cigrette and consuming of alcohole are the important lifestyle factors that are responsible for diabetes [22]. Overweight or fatness is also known as one of the main risk factor of diabetes [23].

Therapy targets In the initial phase of management of diabetes,

therapy targets should be determined and fully discussed with the person with diabetes.

Dietary treatment Treatment cannot be active unless sufficient attention is given to ensuring appropriate nutrition. Diet is a fundamental part of management in every case.

Exercise Insulin secretion improves and weight reduced by physical exercise, thus decrease blood glucose levels.

Meal planning The estimation of dietary intake and individual requirements of those patient who suffering from diabetes should be made as part of the initial management. This task is the answerability of an skilled dietician, in consultation with the treating physician, under optimal situation.

Basic educational requirements The person who suffer from diabetes should acquire sufficient knowledge [24].

**Medicinal Plants with Potential Anti diabetic Activity**

Recently, some medicinal plants have been found highly useful in diabetes mellitus worldwide and used empirically as anti diabetic and anti hyperlipidemic remedies. Even the presence of known anti diabetic medicine in the market, diabetes and the related complications continued to be a major medical problem. Those plants which shows the antidiabetic activity are attributed to their ability to restore the function of pancreatic tissues by causing an increase in insulin output or inhibit the intestinal absorption of glucose or to the facilitation of metabolites in insulin dependent processes [25]. Phenolic compounds, flavonoids, terpenoids, coumarins, glycopeptide, alkaloids, steroids, and other constituents are rich in plant products tend to show reduction in blood glucose levels [26].

For the humankind, medicinal plants are most important therapeutic aid for alleviating ailments.

Last of the 2500 years, there have been highly traditional systems of medicine like as Chinese, Ayurvedic, and the Unani, born and practiced, more in the eastern continent. These traditions are still blooming, since; approximately 80% of the people in the developing countries trusted on these systems of medicine for their primary health care needs [27]. All the plants contain valueable substances that can be used for therapeutic purposes, of which are precursors for the synthesis of drugs [28]. A lots of research work has been carried out on the medicinal herbs and it have definite action on the respiratory, digestive, nervous, circulatory and urinary systems; as well as the sexual organs, the skin, vision, hearing and taste [29].

**Ocimum sanctum (Lamiaceae)**

Ocimum sanctum L. It is commonly known as Tulsi (holy basil). It belongs to the family of Labiateae or Lamiaceae. Since ancient times, this plant is known and widely used for its medicinal properties. The aqueous and alcohol extract of leaves shows significant reduction in blood sugar level in both normal and diabetic rats and enhanced releasing the insulin action [30, 31]. It significantly reduce the fasting blood glucose, uronic acid, total amino acid, total cholesterol, triglyceride and total lipid indicate the hypoglycemic and hypolipidemic effects of tulsi in diabetic rats [32]. Orally administration of plant extract (200 mg/kg) for 30 days leads to reduced the glucose level in plasma. Renal glycogen content increases 10 fold while skeletal muscle and hepatic glycogen levels decreases by 68 and 75% respectively in diabetic rats as compared to control [33]. Tulsi also shows antioxidant, antibacterial, antifungal, antiviral, antiasthemitic, antistress, antitumor, gastric antiulcer activity, antimutagenic and immunostimulant activities [34].

**Momordica charantia (Cucurbitaceae)**

A well-known (bitter melon) plant belonging to family Cucurbitaceae. M. charantia is commonly known as vegetable insulin. This plant widely used in folk therapy for the treatment of diabetes. Oral administration of this plant sucrose tolerance test showed the administration of aqueous extract (AE), methanol fraction (MF) or methanol insoluble fraction (MIF) each significantly decrease the plasma glucose levels at 30 min as compared with control sample. [35, 36]. Other resulted anti hyperglycemic agents isolated from M. charantia comprise the sterol glucoside mixture charantin segregate from fruit and the pyrimidine nucleoside vicine sufficient in the seeds [36].

**Psidium guajava (Myrtaceae)**

An indigenous medicinal plant used to control diabetes in Indian System of Medicine [37]. It is commonly known as Guava and belonging to family Myrtaceae. Psidium guajava rich in vitamins B1, B2, B6, vitamin C, free sugars (glucose, fructose and sucrose) and carotene. Oral administration as well as intraperitoneal injection of aqueous leaves extract to alloxan-induced diabetic rats has exhibit beneficial effect not only on blood glucose but also on body weight, glucose and ketone level of urine and pancreatic tissues showing a marked inhibitory activity on protein tyrosine phosphatase [38]. While, the methanolic extract exhibited the hypoglycemic effect in type II diabetes. Flavonoid glycosides exemplified by pedunculagin, isostrictinin and strictinin are the strong constituents, that have been used in clinical treatment of diabetes for the improve insulin sensitivity [39].

**Trigonella foenumgraecum (Fabaceae)**

It is generally known by Fenugreek seeds and is belonging to family Fabaceae. It is excellent for the presence of mucilage, proteins, proteinase inhibitors, steroid saponins and saponin-peptide esters, sterols, flavonoids, nicotinic acid, coumarin, trigonelline and volatile oil [40]. Trigonella foenumgraecum is the complementlly used to backing non-insulin dependent diabetes mellitus. Fenugreek shows various activities like antidiabetic, antioxidant, anticarcinogenic, antiulcer, antifertility, immunomodulatory and many more discussed last three decades [41]. Fenugreek used as an herb and as a spice and cultivated all the countries as a semiarid crop. Administration of the defatted seed of this plant decreased fasting and postprandial blood levels of glucagon, glucose, insulin, somatostatin, triglycerides, total cholesterol, while increased HDL-cholesterol levels. The absorption of seed fiber of T. foenumgraecum reduced sugar absorption rate, delaying gastric emptying, thus obstruct the increase glucose levels in blood after meals also stimulates insulin receptor sites to burn cellular glucose at high-fiber diet. Its chemical analysis reported that galactomannan constituted the major ingredient that of the seed fiber to which the antidiabetic activity may be responsible [42, 43, 44]. Seeds of the fenugreek act as an orally highly effective hypoglycemic agent may be achieved through enhancing insulin synthesis and its secrete from the beta pancreatic cells of the islets of Langerhans. The therapeutic role of Trigonella powdered seed in type 1 diabetes mainly responsible for the degradation of lipid and glucose metabolizing enzyme activities to normal levels, thus stabilize the glucose homeostasis in the liver and kidney [45].

**Cannabis Sativa**

The Cannabis sativa (marijuana) plant contains components that are called cannabinoids. It is belonging to the family Cannabaceae. Cannabinoids are known to have a variety of potential therapeutic effects which include analgesic, antiinflammatory and immunosuppressive properties [46, 47]. Cannabis efffectively decreased growth rates, increased liver weights (diabetic only), decreased left rectus femorus muscle mass, increased total plasma cholesterol levels, increased plasma triglyceride levels (diabetic only), reduced hepatic and skeletal muscle glycogen content (only significant in diabetic hepatic tissue), reduced blood glucose levels (normal group, but not significant) [48].

**Aegle marmelos (Rutaceae)**
It is generally known as Bael/Golden apple and is belonging to family Rutaceae. Bael is mostly used for the treatment of diabetes mellitus. In the Indian traditional system of medicine, the Ayurveda widely used the bark, roots, leaves, seeds and fruits of the Aegle marmelos [49]. Aegle marmelos leaf extract is used in Indian system of medicine as an antidiabetic agent. Methanolic extract of Aegle marmelos is reduced the blood sugar in alloxan induced diabetic rats. Reduction in blood sugar examine on 6th day after continuous administration of the extract and on 12th day sugar levels were found to be reduced by 54%. This result revealed that Aegle marmelos extract effectively reduced the blood glucose in diabetes induced by alloxan and it also exhibited antioxidant activity [50]. The antihyperlipidemic and antihyperglycemic effects of the alcoholic leaves extracts of Aegle marmelos L. This research exhibited that after administration of A. marmelos leaves extract at different doses, the blood glucose level, triglycerides, total cholesterol, LDL decreased and HDL level increased [51].

**Hibiscus rosa chinensis (Malvaceae)**
It is generally called china rose belonging to family malvaceae. Alcoholic leaf extract has shown hypoglycemic activity in hyperglycemic rats given the dose after 7 days. Hypoglycemic activity of single dose of ethanol extract of plant in glucose loaded rats at 120 min and blood glucose lowering effect after repeated administration for seven consecutive days at 30, 90, and 120 min after glucose loading. Stimulates insulin secretion from pancreatic beta cells and increases utilization of glucose either by direct stimulation of glucose uptake or the mediation of enhanced insulin secretion [52].

**Mentha piperita ( Lamiaceae)**
Mentha piperita commonly known as peppermint and belonging to the family Lamiaceae. It is a oldest known medicinal plant species, "medicinal plant of the year 2004", known as "heirba Buena" meaning good herb. Peppermint is a natural hybrid with highly therapeutic uses apart from containing other potential uses (as flavoring agent from chewing gum to after dinner mints, in cosmetics and pharmaceutical products). Mentha piperita commercially used the all parts: leaf, whole plant [53]. Peppermint exhibited significantly decreased levels of glucose, cholesterol, LDL-c, and triglycerides and significant increase in HDL-c levels when treated the diabetic offspring of rats. The use of the M. piperita juice has potentially treated in the prevention of diabetes mallitus, dyslipidemia, and its complications [54].

**Syzigium cumini (Myrtaceae)**
Syzigium cumini or Eugenia jambolana commonly known as 'jamun', and belonging to the family Myrtaceae. Syzigium cumini is highly consumed in several regions of India for the treatment of various diseases [55]. Oral administration of petroleum ether, acetone, methanol, chloroform, and water extracts of Syzigium cumini (100 mg/kg, p.o.) for 21 days caused a decrease in fasting blood sugar (FBS) in diabetic rats. Cuminoside is the main constituent of S. cumini. Cuminoside caused a significant decrease in fasting blood sugar level, lipidperoxidation level, and enhance the levels of antioxidant enzymes (reduced glutathione, superoxide dismutase, and catalase) in the blood of diabetic rats [56]. Syzygium cumini is highly used in traditionally of medicine to treat diabetes in India. A compound, the putative antidiabetic compound mycaminose was identified and isolated from Syzigium cumini. seed extract. The compound 'Mycaminose' and ethyl acetate and methanol extracted produced significantly reduce the blood glucose level [57].

**Prosopis cineraria (Fabaceae)**
Prosopis cineraria, locally known as "Khejri". It has an important place in economy of Indian desert. "Khejri" is the lifeline of desert [58]. Prosopis cineraria member of the family Fabaceae, has a old history of use in herbal medicine in arid and semi-arid regions in greater parts of India Burma and Sri Lanka. Since all parts of the tree are useful, and the called 'Kalptaru' [59]. Treatment of diabetic animals with crude ethanolic extract of bark of Prosopis cineraria (P. cineraria) for 45 days, significantly lowered blood glucose level, elevated hepatic glycogen content and maintained body weight and lipid-profile parameters towards near normal range [60]. Bark of Khejri tree is used in the treatment of asthma, bronchitis, dysentery, leucoderma, leprosy, muscle tremors and piles [61, 62]. Moreover bioactive compounds such as flavonoids, alkaloids, diketones, phenolic contents, free amino acids, patulitrin, spicigerin, prosogerin A, B, C, D, lipids, b-sitosterol, sugars and vitamins have been isolated and detected from various parts of the plant [63, 64].

**Azardirachta indiaca (Meliaceae)**
It is generally called as neem belonging to the family meliaceae. Azadirachta indica is the most useful medicinal plant in India. It's all parts are useful. It contains anti-inflammatory, antibacterial, antiarthritic, hypoglycemic, antiulcer, antifungal, antimalarial, antitumour and diuretic properties [65]. The phytochemical components reported are alkaloids, tannins, coumarin, proteins, stigmasterol, flavonoids, polyphenols, saponins and sugars [66].

**Onion (Allium cepa) (Liliaceae)**
Allium cepa is commonly known as onion and is a member of the liliaceae family. It is native to Eurasia but now cultivated in the worldwide, due mostly to people taking it with them as a staple food wherever they migrated. On the basis of Experimental and clinical evidence, onion consists of an active ingredient called allyl propyl disulphide (APDS). Allyl propyl disulphide (APDS) has been exhibit to obstracle the breakdown of insulin by the liver and possibly to stimulate insulin production by the pancreas, thus increasing the amount of insulin and reducing levels of sugar in the blood [67].

**Withania somnifera (Solanaceae)**
It is commonly known as Ashwagandha, is a perennial plant belonging to the family Solanaceae. The pharmacological effects of the roots of W. somnifera are hold responsible to the presence of withanolides, a group of steroidal lactones. Ayurvedic and Unani systems are used the Ashwagandha leaves for the treatment of tumors and tubercular glands. Hypoglycaemic and hypolipidaemic effects of Withania somnifera root extract (WSREt) and Withania somnifera leaves extract (WSLEt) were examined in alloxan-induced diabetic rats. Treatment of the diabetic rats with Withania somnifera root extract (WSREt), Withania somnifera leaves extract (WSLEt) and glibenclamide restored the changes of the parameters to their normal level after eight weeks of treatment, signify that WSREt and WSLEt possess hypoglycaemic and hypolipidaemic activities in alloxan-induced diabetes mellitus (DM) rats [68].

**Lawsonia inermis (Lythraceae)**
Lawsonia inermis usually known as mehndi and belonging to the family Lythraceae, a common plant in Asia which has been broadly used in traditional medicine as a aid (cure) for diabetes. Thus a study was started with the aim of evaluate the effect of Lawsonia inermis leaves extract on blood glucose level in alloxan induced diabetic mice. The result indicate that the feeding of 0.8gm per kg body weight of inermis leaves extract reduced the glucose concentration from 194 mg per dilution to normal condition after 14th day. Similar results also obtained on total cholesterol concentration and triglycerides concentration [69].

**Morus alba ( Moraceae)**
It is a known as mulberryand belonging to the family Moraceae. Oral administration of flavonoids rich Morus alba 70% alcoholic root bark extract showed the hypoglycemic activity in STZ diabetic rats. It significantly reduced the concentration of the blood-sugar level through protection of pancreatic beta cells from being degenerated and diminishing lipid peroxidation through reduction of lipid peroxides. Its phytochemical inspection revealed the presence of 4 hydrophobic flavonoids namely morusin, cyclomorusin, neocyclomorusin, and kuwanon E, a 2-arylbenzofuran, moracin M, and two triterpenes, betulinic acid and methyl ursolate that may account for its antidiabetic potency [70].Herbal medicines are best body balancers that help to regulate the body functions properly, can be used to support balance process of our body and provide the nutrients that the body fails to receive due to poor diet or environmental deficiencies

in the soil and air. They are used to treat many diseases such as diabetes, asthma, eczema, premenstrual syndrome, rheumatoid arthritis, migraine, menopausal symptoms, chronic fatigue, and irritable bowel syndrome, etc., and may used for maintaining general health issues. Herbal preparations are showed the best results when taken under the guidance of a trained professional. When used correctly, taken under the guidance herbal medicines are considered safer than conventional medications. The use of herbs is widespread and growing, In fact, herbs are always the alternative medicine and primary source [71].

## Conclusion

Diabetes mellitus is a syndrome, primarily indicated by loss of glucose homeostasis resulting from defects in insulin secretion, insulin action both resulting in impaired metabolism of glucose and other energy-producing fuels such as lipids and proteins [72].The global prevalence (age-standardized) of diabetes has nearly doubled since 1980, rising from 4.7% to 8.5% in the adult population. Diabetes caused 1.5 million deaths in 2012. Globally 7.1 million deaths could be attributed to high blood pressure, 4.4 million to high cholesterol, and 2.6 million to excessive body weight [5]. Type 2 diabetes is more frequent than type 1 in adults. Every plant material is not safe for the treatment of Diabetes mellitus so need to inspected the toxic effect of these plants before utilization. Isolate and test the active components from the potent active antidiabetic plant and there is the essential need for clinical research on the new drug available in the market with less side effects.

This review paper exhibits the usefulness and the concern on medicinal plants in the drive to demonstrate their anti diabetic effects and the responsible bioactive agents. This review also covers the common name of a plant, the parts that are usually used as a remedy sources, extracts, doses, and a test model.

## Future Prospects

The rapidly spreading incidence of diabetes mellitus is a serious threat to human health in all around the world. Recently, new bioactive drugs have been isolated from plants and have exhibit anti-diabetic activity with more effective than the oral hypoglycaemic agents used in clinical therapy. In the recent some years, more attention has been drawn towards identification of plants with anti-diabetic ability that may be useful to man [25].They can be also provide clue for the development of a new and best oral drugs for the treatment of diabetes mellitus [73]. Drugs of the plants have been known to be safe and cheaper and plant play the key role to manage the diabetes mellitus [74, 75, 76].

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