



# Herbal Folk Medicine In The Treatment Of Diabetes Mellitus: A Review

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## ABSTRACT

The most common and serious metabolic disorder nowadays is diabetes. More than 300 million people of the world having this disease and the number is still go on increasing at a rapid rate. Long-term use of insulin and other oral hypoglycemic agents will cause many side effects and complications with heart diseases. Also diabetics are highly prone to different types of microbial infections due to low immunity. To avoid such problems herbal drugs has greater importance, Instead of using these types of allopathic formulations. According to World Health Organization, in developing countries, 80% of the population has still depended on traditional or folk medicines for prevention or treatment of diseases, because of their affordable price, clinically effectiveness and relatively low side effects than modern drugs. This review aims to focus the significance of herbal folk medicinal plants traditionally used in the prevention and treatment of diabetes mellitus in Indian Medicine.

**Keywords :** Folk medicine, Herbal medicine , Medicinal plants, Traditional plants, Diabetes

## INTRODUCTION

Diabetes mellitus is a systemic metabolic disorder characterized by hyperglycemia, hyperlipidemia, hyper aminoacidemia, and hypoinsulinaemia . It leads to decrease in both insulin secretion and insulin action [1,2]. There are 3 major types of diabetes: type 1 or insulin dependent, type 2 or non-insulin dependent, and gestational diabetes.[3,4] India is the world's second most populated country, having more people with type 2

diabetes than in any other country as the disease prevails in both genders and all age groups.[5-6] According to the 10th edition 2021 of the International Diabetes Federation (IDF) Diabetes Atlas released by the IDF, as of 2021, the total adult population in the age group of 20–79 years stands at 537 million (10.5% of the populations) today who live with diabetes, which is set to increase to 643 million (11.3% of the populations) by 2030. If this trends continue, the number will jump to a staggering 783 million (12.2%) by 2045.[7] In the absence of proper treatment,

cardiac, vascular, neurological, and renal damage and neuropathy may occur. Treatment includes diet, exercise, and medication. [8]

Currently, the main and effective treatment for diabetes is the use of insulin and hypoglycemic drugs, but these compounds also have many adverse side effects.[9] Medicinal plants have a long history of usage and today, they are being extensively used for various diseases. [10 11 12 13 14 ]

This review article reported some of the most important medicinal plants with hypoglycemic

properties in Indian traditional medicine, for the prevention and treatment of diabetes.

### Blood glucose levels

Our body accept the energy in the form of glucose. Normal range of blood sugar (fasting) and (postprandial) has been reported to the range within 109 and 130-150 mg/dl, respectively [15]. A person having high blood sugar above this limit is said to be diabetic . Not only the high blood sugar level but low Sugar level is also considered as a major health problems. [15]

**Table 1:- Different levels of blood glucose concentrations in different conditions.**

S.no.	Categories	Blood glucose levels (mg/dl)	References
1	Normal (Fasting)	70-100 mg/dl	15
2	Normal ( Post Prandial)	130-150 mg/dl	16
3	Hypoglycaemia	Below 70 mg/dl	
4	Mild	Below 40 mg/dl	17
5	Severe	Below 20 mg/dl	
6	Hyperglycaemia	Above 250 mg/dl	
7	Mild (Fasting)	>109 mg/dl	18
8	Severe (Fasting)	>165 mg/dl	

### How the herb work?

In most of the herbs, the ingredients which are responsible for pharmacological effect is not completely known. A single herb having a number of ingredients, and it is likely that they work together to show the desired pharmacological effect. The type of environment (climate, bugs, soil quality) in which the plant grew will affect its components and how and when it was harvested and processed.[19]

### Various possible mechanism of actions of herbal Anti-diabetic drugs [ 20, 21]

The anti-diabetic activity of herbal drugs are depends upon various mechanisms. The possible MOA of herbal anti-diabetic drugs can be given as:

- Reduction in insulin resistance.
- Regenerating and/or repairing pancreatic beta cells.
- Protective effect on the destruction of the beta cells.
- Increasing the size and number of cells in the islets of Langerhans
- Stimulation of insulin secretion from beta cells of islets or/and inhibition of insulin degradative processes.

- Adrenomimeticism, pancreatic beta cell potassium channel blocking, cAMP (2nd messenger) Stimulation.
- Inhibition of urinal glucose reabsorption.
- Providing certain necessary elements like calcium, zinc, magnesium, manganese and copper for the beta-cells .
- Stimulation of insulin secretion.
- Stimulation of glycogenesis and hepatic glycolysis.
- Improvement in digestion along with reduction in blood sugar and urea.
- Prevention of pathological conversion of starch to glucose.

## Herbal Drugs with anti-diabetic properties

Here the table no. 2 shows the some scientific and local hindi names of the plants used in Indian system of herbal medicine for the treatment of diabetes with their plant family, parts of plants used, bioactive compounds available and related animal studies in Indian herbal medicine. The some following plants that have been used for the prevention and treatment of diabetes in Indian herbal medicine with their anti-diabetic effects are

**1) *Eugenia jambolana*.** (black plum or jamun) belongs to the family Myrtaceae. The mainly used parts of plants are fruits, seeds, leaves, and bark. When the insulin was not discovered, It was a main herbal anti-diabetic medication even in Europe. The brew prepared by jamun seeds in boiling water has been used in the various traditional systems of medicine in India [22]. The blood glucose-lowering effect of *Eugenia jambolana* may be due to increased secretion of insulin from the pancreas or by inhibition of insulin degradation [23].



**2) *Ficus religiosa* (Peepal)** It belongs to family Moraceae. It has been reported to be used in the traditional system of Ayurveda for the treatment of diabetes [24]. It has been shown to possess a wide spectrum of *in vitro* and *in vivo* pharmacological activities: antidiabetic, hypolipidemic, anticonvulsant, anti-inflammatory, analgesic, antimicrobial, antiviral, antioxidant, antitumor, antiulcer, antianxiety, anthelmintic, antiasthmatic, immunomodulatory, estrogenic, endothelin receptor antagonist, apoptosis inducer, cognitive enhancer, and antihypertensive [25].



**3) *Momordica charantia*.** (bitter gourd or karela) It belongs to the family Cucurbitaceae. Whole fruit and fruit's seeds are the most commonly used parts in diabetes. Bitter gourd contains bioactive substances with antidiabetic potential such as vicine, charantin, and triterpenoids along with some antioxidants [26]. Several studies have demonstrated antibacterial, antiviral, anticancer, and antidiabetic activities, in *Momordica charantia* [27, 28]; however, the antidiabetic activity has been widely reviewed. The Antidiabetic and lipid-lowering properties of bitter Guard have been reported [29]. Studies showed that *Momordica charantia* can repair damaged  $\beta$ -cells there by Stimulating insulin levels [30] and also



improve sensitivity/ signaling of insulin [31]. Bitter melon is also reported to inhibit absorption of glucose by inhibiting glucosidase and suppressing the activity of disaccharidases in the intestine [32]. The blood glucose-lowering activity of karela has been reported in several animal models [33].



4) *Ocimum sanctum* (holy basil or Tulsi) It belongs to the family Lamiaceae. It is very use full herbs in several diseases. Antidiabetic properties of tulsi were appreciated in Ayurveda [34]. A significant reduction in blood glucose, glycosylated hemoglobin, and urea along with a simultaneous increase in glycogen, hemoglobin, and protein in streptozotocin-induced diabetic rats has been observed when rats were supplemented with ethanolic extract of *O. sanctum* [35]. Leaf extract of *O. sanctum* L has been reported to stimulate the physiological pathways of insulin secretion [36].



#### 5) *Trigonella foenum-graecum*.

(fenugreek, methi) It belongs to the family Fabaceae. The most common used parts of plant are Seeds and leaves. The steroids present in fenugreek have been reported to reduce blood glucose level when supplemented to diabetic rats [37]. A considerable increment of the area of insulin immunoreactive  $\beta$  cells has been observed [38]. A marked reduction in renal toxicity has been observed when fenugreek oil is incorporated in the diet of alloxanized rats [39]



6) *Pterocarpus marsupium*. (Indian kino tree, bijasar) It belongs to the family Fabaceae. Leaves, flowers, bark, gum and heart wood are most commonly used parts of plant. It is known for its antidiabetic activity [40]. Besides eliciting a strong antidiabetic property, *Pterocarpus*

*marsupium* is reported to be effective against several diseases. It is reported to be antiobesity, antihyperlipidemic [41], antiinflammatory, anthelmintic [42, 43], antioxidative, antitumorigenic and antiulcerative [44, 45].



**7) *Gymnema sylvestre* (Gurmar)** It belongs to the family Asclepiadaceae. It is a potent antidiabetic plant used in Ayurvedic preparations. Several studies have proved its antidiabetic potential in animal models [46]  
 Oral administration of *G. sylvestre* to rats has been reported to result in increased utilization of glucose and/or by decreasing mobilization of fat [47]



**8) *Allium sativum* (Garlic)** commonly called lahsun belongs to the family Amaryllidaceae. Leaves and bulb are the parts frequently used. Cardiovascular complications of diabetes are reported to be prevented by the consumption of garlic [48]. Saponins are reported to reduce serum cholesterol levels [49]. Garlic juice has been found to exert antioxidant and antihyperglycemic effects in alloxan-induced diabetic rats [50].



**Table 2:- Some popular Indian herbs used for the treatment of diabetes mellitus**

S. no.	Plant name (Hindi Name)	Botanical name /Family	Parts used	Bioactive compounds	Related animal studies	Ref.
1	Peepal (Pipar)	<i>Ficus religiosa</i> /Moraceae	Leaves, bark, fruits, roots, seeds	Flavonoids, glycosides, alkaloids, steroids, saponins, vitamin C in non-enzymatic, enzymatic constituents are catalase, peroxidase etc	Aqueous extracts of bark of peepal (50 and 100 mg/kg body weight) showed hypoglycemic effect in streptozotocin-induced diabetic rats.	51 52

2	Onion (Pyaj)	Allium Ceba /Amaryllidaceae	Whole	Alkaloids, flavonoids, cardiac glycosides, terpenes, steroids, and resins	A mixture of minerals and vitamin extract of onion juice (1 ml/100 g body weight) showed hypoglycemic activity in alloxan-induced rats.	53 54
3	Aloe vera (Ghritkumari)	Barbadensis mill /Asphodelaceae	Leaves extract	Anthraquinones, glycosides, vitamins (A, C, E), lipids, sterols, gibberlins, pseudoprototinosaponin AIII and prototinosaponins AIII	Anthraquinone extract of leaf pulp of aloe vera (300 mg/kg body weight) showed hypoglycemi effect in streptozotocin-induced adult male albino rats.	55
4	Fenugreek (Methi)	Trigonella foenum graecum /Fabaceae	Leaves and seeds	Saponins, steroids, methanol extract, gingerol, eugenol, cedrane, vanillin, zingerone.	Alkaloid extracts of fenugreek (60 mg/k g body weight) showed hypoglycemic effects in streptozotocin-induced hyperglycemic rats.	56 57
5	Bitter melon (Karela)	Momordica Charantia /Cucurbitaceae	Pulp, seeds and leaves	Triterpene, protein, steroid, alkaloid, inorganic, lipids and phenolic compounds, saponins, charantin, resins	Aqueous extract of bitter melon lowered the glyceimic response to both oral and intraperitoneal glucose load in normal mice without altering the insulin response. Aqueous extract powder of fresh unripe whole fruits at a dose of 20 mg/kg body weight reduced fasting blood glucose by 48%.	58 59
6	Holy basil (Tulsi)	Ocimum Sanctum /lamiaceae	Leaves Volatile oil,	Cirsilineol, circimaritin, isothymusin, rosmeric acid, apigenin, campesterol	Ethanollic extracts of basil leaves (200 mg/k g body weight) showed hypoglycemic effects in streptozotocin-induced male albino rats.	60
7	Gooseberry (Karaunda)	Ribes uva- Crispa / Grossulariaceae	Whole	Tannins, phenols, alkaloids, flavonoids, gallic acid, corilagin, geraniin, ellagic acid	Phenol extracts of gooseberry (13.5 mg/kg body weight) showed hypoglycemic activity in type 2 diabetic rat models.	61 62
8	Blackberry (Jamun)	Syzygium cumini or Eugeniajambolana /Myrtaceae	Leaves, roots, bark, stem, seeds	Alkaloids, flavonoids, tannins, saponins, sterols, carbohydrates, polyphenols, ellagic acid, salicyclic acid, fibre	Aqueous extract of seeds of Syzygium cumini (2.5 g and 5 g/kg body weight) showed a hypoglycemic effect in alloxan- induced diabetic rats.	63



					Ethanol extract of seeds of <i>Eugenia jambolana</i> (100 mg/kg body weight) showed hypoglycemic activity in alloxan-induced diabetic rats.	64
9	Gymnema (Gurmar)	<i>Gymnema Sylvestre</i> /Asclepiadaceae	Leaves	Steroids, terpenoids, alkaloids, flavonoids, coumarins, saponins, tannins	Leaf ethanolic extracts showed hypoglycemic activity in streptozotocin-induced diabetic rats.	65 66
10	Curry leaves (Karee patta)	<i>Murraya koenigii</i> /Rutaceae	Leaves	Carbohydrates, alkaloids, phytosterols, alcohol, flavonoids, saponins, tannins, glycosides, carbohydrates	Aqueous extracts of curry leaves (300 mg/k g body weight) showed antidiabetic activity in alloxan-induced diabetic rats. Dried powdered curry leaves (35 mg/kg body weight) showed hypoglycemic effects in streptozotocin-induced diabetic rats.	67 68 69
11	Garlic (Lehsun)	<i>Allium sativum</i> /Amaryllidaceae	Whole	Alkaloids, saponins, steroids, carbohydrates, tannins, flavonoids, terpenoids, phenolics	Minerals and vitamin extract of garlic juice (1 ml/100 g body weight) showed hypoglycemic effects in alloxan-induced diabetic rats. Garlic oil (50 mg/kg body weight) showed a hypoglycaemic effect in streptozotocin-induced white male albino rats	70 71 72
12	Guava (Amarood)	<i>Psidium guajava</i> /Myrtaceae	Leaves, flowers, bark, roots, buds, twigs, fruits skin	Oxalic acid, malic acid, amylase, phenylpropyl acetate, butenyl acetate, tannins, resins, calcium oxalate, tannic acid, flavonoids, phenolic acid	Methanol extracts of guava leaves (250 mg/kg body weight) showed hypoglycemic effects in streptozotocin and alloxan-induced diabetic mice.	73 74
13	Coriander (Dhaniya)	<i>Coriandrum Sativum</i> /Umbellifers	Leaves, roots and seeds	Flavonoids, steroids, amino acids, saponins and tannins	A Dose of 200 mg/kg and 400 mg/kg body weight of a methanolic extract of coriander showed a significant dose-dependent decrease in blood glucose level.	75 76
14	Cumin (Jeera)	<i>Syzygium cumini</i> or <i>Cuminum Cyminum</i> /Umbellifers	Seeds	Flavonoids, anthraquinones, phytosterol, saponins, steroids, tannins, Triterpenoids	Normal rats maintained on 1.25% cumin powder for 8 w showed reduction in hyperglycaemia and glucosuria.	77 78
15	Loquat (Loquat fruit)	<i>Eriobotrya Japonica</i> /Rosaceae	Fruits, dried leaves,	Triterpenes, flavonoids, glycosides, sesquiterpenes, ursolic acid, oleanolic acid, procyanidin B2, chlorogenic acid,	Ethanol extracts of seeds of loquat (8000 mg/kg body weight) showed hypoglycemic activity in Otsuka Long-Evans Tokushima fatty (OLETF)	79
16	Ginger	<i>Zingiber Officinale</i>	Whole	Flavonoids, saponins,	Ethanol extract of ginger garlic	80

	(Adrak)	/Zingiberaceae		tannins, terpenoids, phenols	powder (500 mg/kg body weight) showed a hypoglycemic effect in streptozotocin-induced diabetic rats.	81
17	Neem (Indian lilac)	Azadirachta Indica /Meliaceae	Leaves, root, stem, flowers, seeds, bark	Isoazadirolide, nimbaflavone, nimbandiol, nimbinene, nimbolide, quercetin, quercitrin	Ether extracts of neem seed (2 g/kg body weight) showed antidiabetic effects in streptozotocin-induced diabetic rats.	82 83
18	Cinnamon (Daalchini)	Cinnamomum cassia /Lauraceae	Stems, seeds	Methylhydroxychalcone, tannins, flavonoids, glycosides, terpenoids, coumarins, anthraquinones	Streptozotocin – Induced diabetic rats showed positive effects with cinnamon methanol extracts (3 g/kg body weight).	84 85
19	Mulberry (Sehtoot)	Morindacitrifolia /Moraceae And white mulberry (Morus alba)	Leaves, Fruits	Rutin, isoquercitrin, astragal, caffeic acid, ethanol, methanol, kaempferol	Terpenoids and flavonoid extract of white mulberry solids showed hypoglycemic effects in type 2 diabetic murine models of mice. Protein extracts of leaves of mulberry (35 mg/kg body weight) showed hypoglycemic effects in streptozotocin-induced diabetic rats.	86 87 88
20	Periwinkle (Sadabahar)	Catharanthus roseus or Vinca rosea /Apocynaceae	Leaves, roots, flowers	Alkaloids, bisphosphatase, fructose, superoxide dismutase, peroxidase, catalase, dichloromethane, methanol	Methanolic extracts of periwinkle (500 mg/kg body weight) showed hypoglycemic activity in alloxan diabetic rats. Organic extracts of the juice of fresh leaves of periwinkle (100 mg/kg body weight) showed hypoglycemic effects in alloxan diabetic rats.	89 90 91
21	Ginseng	Panax quinquefolius /Araliaceae	Leaves, flowers and berries	Triterpene, saponins, polyacetylenes, polysaccharides, nitrogen-containing compounds, ubiquitous, Phenolic compounds	Improvement in renal damage was observed in streptozotocin-induced diabetic rats with ginseng due to heat processing aqueous extract of ginseng (100 mg/kg body weight).	92 93
22	Olives (Jaitoon)	Olea europaea /Oleaceae	Leaves, fruits, roots	Alkaloids, terpenes, secoridoids, ethanol, oleosides, tyrosol	Aqueous extracts of olive leaves (200 mg/kg body weight) showed hypoglycemic effects in streptozotocin-induced diabetic rats. Polyphenol extracts of olive leaves (500 mg/kg body weight in form of a tablet) showed a hypoglycemic effect in streptozotocin-induced diabetic rats.	94 95 96
23	Radish	Raphanus sativus	Roots and	Acetone, acetic acid,	Aqueous extract of root juice	97



	(Moolee)	/Brassicaceae	Leaves	trifluoroacetic acid, anthocyanidin, phenols, anthocyanin, potassium chloride, sodium acetate	(300 mg/kg body weight) showed hypoglycemic effects in streptozotocin-induced diabetic rats.	98
24	Cardamom (Ilaayachee)	<i>Elettaria Cardamomum</i> /Zingiberaceae	Leaves, fruits, seeds	Flavonoids, tannins, saponins, quinone, glycoside, terpenoids, phenol, coumarins, steroids, alkaloids, anthocyanin	Flavonoid extract of cardamom, ginger and cinnamon (250 mg/kg body weight) showed hypoglycaemic activity in alloxan-induced diabetic rats.	99 100
25	Black pepper (Kali mirch)	<i>Piper nigrum</i> /Piperaceae	Seeds	Alkaloids, flavonoids, terpenes, steroids, lignans, phenolics	Aqueous extracts (300 mg/kg body weight) showed effect on antioxidant pathways in	101 102
26	Peppermint (pudina)	<i>Mentha piperita/lamiaceae</i>	Leaves	Flavonoids, phenols, terpenes	Juice of peppermint (0.29 g/kg body weight) showed anti glycaemic effects in streptozotocin induced male diabetic wistar rats.	103 104
27	Sesame seed (Til ke beej)	<i>Sesamum indicum</i> /Pedaliaceae	Seeds, Leaves	Flavonoids, protein, triterpenes, ethanol, polyphenols	Ethanol extract of sesame seeds (500 mg/kg body weight) showed hypoglycaemic activity in streptozotocin-induced diabetic rats.	105 106

### Marketed herbal products

In Indian market today a number of herbal drugs and poly herbal formulations are available in various dosage forms like tablets, capsules, churna, juices and extracts for the prevention and cure of diabetes. Some of the important herbal

formulations with their dosage, dose indications, main ingredients and health claims are given here.

**Table 3 :- Some of the Herbal medicines and their combinations available in the Indian market used in the treatment of DM**

S.no.	Medicines/Dosage	Herb present	Health claims	References
1	Herbal Hills Methi Seed Powder/once in a day	Fenugreek	Helps to treat diabetes and in proper digestion, helps to detoxify the body, supports uterine health.	107
2	Stream CP3 Capsules/1 in a day	Peepal	Helps to cure diabetes, constipation treats ear infections, prevents arthritis, and heals wounds, treat skin conditions and show antimicrobial properties.	108

3	Pitambri Karela Tablets/2 in a day, Himalaya Karela Tablets/2 in a day, Gluco Care Karela Medicine/2 in a day, Deemark Diaba Amrit/50 mg in a day	Bitter melon	Used in the treatment of DM, kidney stones, fever, reducing obesity, hypertension, cancer, improving immune functions.	109 110 111 112
4	Reese Fresh Onion Juice/50 g a day	Onion	Helps to cure DM, slower the rate of occurrence of cancer, CVDs.	113
5	Bhumija Tulsi Capsules/2 in a day, Shivalik Tulsi Capsules/1 in a day	Holy basil	Helps in diabetes fever, common cold, cough, sore throat, kidney stone and heart disorders.	114 115
6	Shri ji Neem Tablets/1-2 tablets daily, Ayurleaf Neem Capsules/1 day	Lilac	Helps to cure diabetes, treat skin infections, helps in heart diseases, in fever, breathing conditions, cure malaria.	116 117
7	Gold 350 Raw Coriander Seeds/In meal time vegetables we can add	Coriander	Helps to cure diabetes, high blood pressure, cholesterol and in urinary infections also.	118
8	Patanjali Aloe vera Juice/10-20 ml daily, Triphala Aloe vera Juice/1 cap twice a day	<i>Aloe vera</i>	Helps to treat diabetes, hypertension, skin problems, rashes, wounds and hyperlipidemia.	119 120 121
9	Piping Rock Licorice Root Liquid Extract (alcohol and sugar free)/2 ml, 2-3 times a day	Licorice root	Helps to cure diabetes, has antibacterial properties, beneficial for digestion, sooth irritation and helps relieve stomach ulcers.	122
10	Livestamin Ashwagandha Capsules/2 in a day, Herbal Hills Dia Care Churna/2 spoons in morning in empty stomach	Ginseng	Helps to cure diabetes, to treat stress, boost the immune system, enhance stamina, and reduces high cholesterol, prevention of heart disease.	123
11	Sunergetic Olive Leaf Extract/once in a day, Disano Olive Oil/can be taken with salads or in foods	Olives	Helps to cure diabetes, maintain healthy heart, helps in weight loss, improve brain health, improve skin health and helps in hormone balancing.	124
12	The vitagreen Cinnamon/1 capsule in a day, Glucocare/1 capsule in a day, Nutri flair Ceylon Cinnamon Capsules/2 in a day	Cinnamon, bitter melon and turmeric	Helps to cure diabetes, allergies, relieve cold and flu, boost energy and improves digestion.	125

13	In life Diastan/2 capsules in a day,	Gymnema , basil peepal and fenugreek	Helps to cure diabetes, maintain lipid levels in the body, promotes healthy functioning of pancreatic cells.	126
14	Madhumehari Churna/ 3-6 gms twice a day	Syzygium, Mangifera, Momordica, Gymnema, Trigonella, Aegle, Zingiber and Cassia angustifolia	Minimizes long-term diabetic complications  Reduces glucose content in the urine	127
15	Diabic Care Juice/ 30 ml empty stomach in morning and 30 ml hour after dinner.	Methi, Amla, Karela, Jamun, Kutki, Guduchi	Manage blood sugar, Boosts metabolism & improve digestion, Stimulate insulin secretion	128

## CONCLUSION

Due to high rate of increasing patients of diabetes mellitus in the whole world and for this allopathic medicines are often limited in efficacy, carry the high risk of adverse drug reactions, less trust on present day health care system & are often too costly treatment. Due to these reasons people continuously show their trust on traditional herbal medicinal system. The potency of herbal drugs is significant & they have negligible side effects than the synthetic anti diabetic drugs. Since several bioactive compounds are being extracted from traditional medicinal plants, they are in great demand in pharmaceutical industries. The phytochemical analysis and pharmacological investigations of folk medicinally important plants with taking in

view their proper conservation too, would help in developing novel drugs to treat diabetes mellitus.

In this review article an attempt has been made to focus on herbal folk medicinal plants, which may be useful to the health professionals, scientists and research scholars to develop an alternative medicine to to treat different kinds of diabetes in man & animals.

## AUTHORS CONTRIBUTIONS

All the authors have contributed equally.

## CONFLICT OF INTERESTS

We declare that we have no conflict of interest.



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