

# A Review on Diabetes and Ethno medical Remedies to Treat It

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**Abstract**-In 21<sup>st</sup> century, the pace of lifestyle is amplified on a high extent. Thus several factors are to be taken under consideration for a healthy living. Although many diseases or disorders come on the way, one disorder which cannot be replaced by anyone, that is DIABETES. Diabetes is one of the major public health concerns over the world. It is thus now considered to be one of the most common health hazard of which optimal control is still not possible. It is growing at a faster rate second after cancer. Hyperglycemia or Diabetes at persisting level leads to kidney problems, cardiovascular disease and vision problems. A substantial number of plants were subjected to clinical trials and were found operative. Moreover, from the past few years it has been found that some plant constituents showed anti-diabetic effect and they have been isolated from those hypoglycemic plants. This review focuses mainly on diabetes, plants used as anti diabetics, constituents isolated from these plants, various mechanisms through which herbs act against diabetes

**Keywords:** Diabetes mellitus, common health hazard, kidney problems, underlying remedies.

## I. INTRODUCTION

Diabetes mellitus (DM) is one of the collective metabolic disorder. Approximately 2.82% of the people around the world suffer from this disease and it may cross 5.40% by the year 2025. The number of people with type 2 Diabetes mellitus is increasing in every country with 75-80% of people with DM living in urban and economical countries. Deceased 4.65 million deaths in 2011[1]. India leads the world with largest number of diabetic subject and being termed as “diabetes capital of the world”. According to the Diabetes Atlas 2006 published by the International Diabetes Federation, the number of people with diabetes in India currently around 41 million is expected to rise to 70 million by 2025.[2]. In 2000, India (31.7 million) topped the world with the highest number of people with diabetes mellitus then followed by China (20.8 mn) at second place and the United States (17.7 mn) at third place.

Diabetes is a chronic disease characterized by hyperglycemia and glucose intolerance. It is caused by lack of or ineffective production of insulin by pancreas which results in rise or fall in concentrations of glucose in the blood. It can cause damage to many of body organizations particularly blood vessels, eyes, kidney, heart and nerves

[3]. Diabetes mellitus has been categorized into three types they are:

- Type-1 diabetes (T1D)
- Type-2 diabetes (T2D)
- Gestational diabetes mellitus

T1D, also called as the insulin-dependent diabetes mellitus (IDDM), displays due to the autoimmune damage of the  $\beta$ -cells which then leads to the cessation of insulin production. T1D is also called the “juvenile diabetes”. T2D also called as the adult-onset diabetes or non-insulin-dependent diabetes mellitus (NIDDM) among humans is caused by low levels or absence of insulin or insulin resistance (IR) [4]. Gestational diabetes mellitus (GDM) is defined as glucose intolerance of varying aspects which is first diagnosed, during pregnancy and may or may not persist after birth [5,6].

•Type 1 diabetes: An autoimmune disease in which the immune system inaccurately destroys the insulin-making  $\beta$  cells of the pancreas. It typically develops more slowly than other forms of diabetes.

•Type 2 diabetes: A disorder of metabolism in which, the pancreas makes insulin primarily and then the body is not capable in utilizing this insulin.[7]. Type 2 diabetes is by far the most common form of diabetes. Type 2 diabetes mellitus (T2DM) is a chronic disease characterized by insulin resistance, which leads to hyperglycemia. The key features of type 2 diabetes is insulin resistance associated with obesity due to the release of free fatty acids (FFA) and their release of inflammatory cytokines from the adipose tissue. The decreased ability of insulin to manage glucose metabolism is known as insulin resistance [8].

Gestational Diabetes Mellitus (GDM) occurs in approximately 7% of pregnancies and there is a greater risk of sickness to mother, fetus and neonates. Constructive care and monitoring is necessary for this. Women with the history of gestational diabetes mellitus (GDM) are at high risk for type 2 diabetes mellitus and various heart problems during the next years after delivery.[9,10]

## II. FACTORS CAUSING DIABETES

T1DM is mainly stimulated by environmental factors. The main factors that account to the development of insulin resistance (T2DM) include obesity [11], physical inactivity, and smoking. Body weight is one of the most vital risk factor in T2DM. Obesity is an independent risk factor for dyslipidaemia, hypertensional so increases the risk of heart problems in patients with T2 DM [12]. Age is another factor that is associated with T2DM. The ability of pancreas to secrete insulin is disposed to be much higher in younger people than the older one. Hypertension and high cholesterol also contribute to T2DM. Variation in the gene structure and defect in the insulin receptors also contribute to Type 2 Diabetes mellitus.

## III. SIGNS AND SYMPTOMS OF DIABETES

Diabetes often goes unobserved because symptoms can be recognized to many other causes. Some of the recognizable symptoms are:

- Excessive thirst (polydipsia)
- Excessive urination (polyuria) and dehydration
- Excessive hunger or appetite (polyphagia)
- Unusual weight loss [13]

## IV. TREATMENT OPTIONS FOR DIABETES

The treatment for diabetes mainly involves the regulation of blood sugar levels and to prevent diabetic complications. Medicines, diet, and exercise are included in treatment. Life style changes and oral anti-diabetic medications are recommended for initial treatment of DM [14]. Many drugs available in the market like glipizide, glimepiride and metformin etc.

Insulin therapy is mandatory for T1D because cells cannot produce insulin. Although cells produce insulin hormone in type 2 diabetes but they do not respond normally to insulin. In such cases insulin therapy helps cells to overcome the resistance to insulin. Continuous subcutaneous insulin infusion (CSII) is useful therapy for delicate T1D worldwide. The frequency of hypoglycemia was decreased and improved glycemic variability was achieved with CSII therapy which is beneficial to pregnant women with diabetes [15,16].

## V. NEED & SCOPE OF ALTERNATIVE PLANT REMEDIES

Although number of synthetic drugs and medications are available one needs to focus on diet and regular exercise. So basically for diabetes the recommended treatment is oral anti-diabetic supplements which show its effects by various mechanisms. On the other hand these treatments have their own drawbacks leading to toxicity in the body. Sulfonylureas lose its effectiveness by almost 50% over

a period of 5-6 years. It also shows some side effects such as liver toxicity, weight gain, bloating, flatulence, abdominal pain and major in lack in working of glucosidase inhibitor. According to literature two-thirds of the medications is not safe for young adults. Also, with increasing incidence of diabetes mellitus all over the world and due to adverse effects of synthetic drugs, there is a pure need of natural and economical remedies.[17]

## VI. NATURAL REMEDIES FOR LOWERING BLOOD SUGAR LEVEL

It is estimated that more than 200 species of plants exhibit anti-diabetic properties, including many common plants, such as fenugreek seeds, neem extract, garlic, waxgourd, lotus root and bitter melon. These have been successful in lowering the blood sugar level.

### 1. *Trigonella foenum-graecum*: (Fenugreek-Methi)

Active constituent: Saponins, Amino Acids

It is found all over India and the fenugreek seeds are usually used as the spice of choice in Indian kitchens. 4-hydroxyisoleucine, an essential amino acid from fenugreek seeds which increases stimulation of insulin from isolated islet cells in humans [18]. Oral administration of 2 and 8g/kg of plant extract produced dose-dependent decrease in the blood glucose levels [19]. Administration of fenugreek seeds also improves glucose metabolism and normalizes creatinine kinase activity in heart, skeletal muscle and liver. It also reduces hepatic and renal glucose-6-phosphatase and fructose-1,6-bisphosphatase activity [20].

### 2. *Ocimum sanctum*: (Holy basil- Tulsi)

Active constituents: Eugenol, Cinnamyl Acetate, Beta Elemene

It is commonly known as Tulsi. Since ancient times, this plant is known for its medicinal properties. The aqueous extract of leaves of *Ocimum sanctum* showed decreased level of sugar in blood [21]. Determined decreased levels in fasting blood glucose, uronic acid, total amino acid, total cholesterol and total lipid indicated the hypoglycemic and hypolipidemic effects of tulsi [22]. This plant also shows anti-asthmatic, anti-stress, anti-bacterial activities.

### 3. *Azadirachta indica*: (Neem)

Active constituents: Alkaloids: Nimbidin, Nimbin

Hydroalcoholic extracts of this plant showed anti-hyperglycemic activity and this effect is because of increase in glucose uptake and glycogen deposition [23,24]. Apart from having anti-diabetic activity, this plant also has anti-bacterial, anti-malarial and antioxidant effects [25].

### 4. *Aloe vera* / *Aloe barbadensis*

Active constituents: Phytosterols, saponins

Aloe, a popular houseplant, has a multi purpose folk remedy. The plant can be separated into two basic products: gel and latex. Aloe vera gel is the leaf pulp mucilage, aloe latex, commonly referred to as "aloe juice," is a bitter yellow exudate from the pericyclic tubules just beneath the outer skin of the leaves. Extract of aloe gum effectively increases glucose tolerance [26]. For the treatment of chronic conditions Aloe vera shows efficient hypoglycemic effects. This action of Aloe vera and its bitter principle is through stimulation of synthesis and/or release of insulin from pancreatic beta cells [27].

#### 5. *Allium cepa* : (onion)

Active constituents : Organo sulphurs : Allyl propyl disulfide

*Allium cepa* is also known to have antioxidant and hypolipidaemic activity. Various ether soluble fractions as well as insoluble fractions of dried onion powder show anti-hyperglycemic activity. Administration of a sulfur containing amino acid from *Allium cepa*, S-methylcysteine sulfoxide (SMCS) shows significant controlled blood glucose as well as lipids in serum and tissues and normalizes the activities of liver hexokinase, glucose-6-phosphatase and HMG Co-A reductase. [28,29].

#### 6. *Allium sativum* : (Garlic)

Active constituents: Organosulphurs: Alliin, Allicin. Diallyl disulfide, Ajoene

This is an eternal herb cultivated throughout India. Allicin, a sulfur-containing compound is responsible for its pungent odor and it has been shown to have significant hypoglycemic activity [30]. This effect is thought to be due to increased hepatic metabolism, increased insulin release from pancreatic beta cells and/or insulin sparing effect [31]. S-allylcysteine sulfoxide (SACS), the precursor of allicin and garlic oil, is a sulfur containing amino acid, which controls lipid peroxidation better than insulin. It helps in stimulation of beta cells.

#### 7. *Mangifera indica* : (Mango)

Active constituent: Polyphenolics: Mangiferin

The leaves of this plant are used as an antidiabetic agent in Nigerian folk medicine, although when aqueous extract given orally it does not alter blood glucose level. However, anti diabetic activity was seen when the extract and the glucose is administered simultaneously. The results indicate that aqueous extract of *Mangifera indica* possess hypoglycemic activity. This may be due to an intestinal reduction of the absorption of glucose [32].

#### 8. *Eugenia jambolana* : (Indian gooseberry, jamun)

Active constituents : Pigment and Flavanoid: Anthocyanins, Kaempferol

In India components of *Eugenia jambolana* is used as a household remedy for diabetes. This also forms a major constituent of many herbal formulations for diabetes. Anti hyperglycemic effect of aqueous and alcoholic extract as well as lyophilized powder shows reduction in blood glucose level. The extract of jamun pulp showed the hypoglycemic activity. The oral administration of the extract resulted in increase in serum insulin levels. Insulin secretion was found to be stimulated on incubation of plant extract with isolated islets of Langerhans from normal as well as diabetic animals. These extracts also inhibited insulinase activity from liver and kidney [33].

#### 9. *Momordica charantia* : (Bitter melon)

Active constituents: Glycosides, Alkaloids

*Momordica charantia* is commonly used as an antidiabetic agent in India as well as other Asian countries. Extracts of fruit pulp, seed, leaves and whole plant shows hypoglycemic effect. Polypeptide, isolated from fruit, seeds and tissues of *M. charantia* showed significant hypoglycemic effect when administered subcutaneously on humans [34]. Ethanolic extract of *M. charantia* (200 mg/kg) showed an anti hyperglycemic effect. This may be because of inhibition of glucose-6-phosphatase, fructose-1,6-bisphosphatase in the liver and stimulation of hepatic glucose-6-phosphate dehydrogenase activities [35].

#### 10. *Black cumin* : (Kalijeri, somraj)

Active constituents : Flavonoids : Gallic acid, Ferulic acid

The phenolic extract of kalijeri seeds containing a mixture of phenolic flavonoid compounds like gallic acid, quercetin, kaempferol showed significant inhibition of intestinal glycosidase activity, human salivary amylase and also reduced postprandial hyperglycemia thus indicating anti-hyperglycemic effect. [36]

#### 11. *Phyllanthus amarus* : (Bhuiamala)

Active constituents: Tannins, Flavonoids

It is a herb of height up to 60 cm, from family Euphorbiaceae. It is commonly known as Bhuiamala. It is scattered throughout the hotter parts of India, mainly Deccan, Konkan and south Indian states. Traditionally it is used in diabetes therapeutics. Methanolic extract of *Phyllanthus amarus* was found to have potent antioxidant activity. This extract also reduces the blood sugar level in humans [37]. The plant also shows anti-inflammatory, antimutagenic, anticarcinogenic, anti diarrhoeal activity.

#### 12. *Coccinia indica* : (Baby watermelon)

Active constituent: Resins , Alkaloids

Dried extracts of *Coccinia indica* (C. indica) (500 mg/kg body weight) were administered to diabetic patients for 6 weeks. These extracts restored the activities of enzyme lipase (LPL) that was reduced and glucose-6-phosphatase and lactate dehydrogenase, which were raised in untreated diabetics [38]. Oral administration of 500 mg/kg of C. indica leaves showed significant hypoglycemia.

### 13. *Caesalpinia bonducella*: (Bondocnut, Nata Karanja)

Active constituents: Triterpenoids, saponins

*Caesalpinia bonducella* is widely distributed throughout the coastal region of India and used ethnically by the tribal people of India for controlling blood sugar. Both the aqueous and ethanolic extracts showed potent hypoglycemic activity in chronic type II diabetic models. The aqueous and 50% ethanolic extracts of *Caesalpinia bonducella* seeds showed anti-hyperglycemic and hypolipidemic activities [39]. The anti-hyperglycemic action of these extracts may be due to the blocking of glucose absorption. The drug has the potential to act as anti-diabetic as well as anti-hyperlipidemic [40].

### 14. *Capparis decidua*:

Active constituents: Terpenoids , glucosides

This is found throughout India, especially in dry areas. Hypoglycemic effect was seen. This extract also induces lipid peroxidation significantly in erythrocytes, kidney and heart. C. decidua was also found to alter superoxide dismutase and catalase enzyme levels to reduce oxidative stress [41].

### 15. *Aegle marmelos*: (Bengal Quince, Golden apple)

Active constituent: Tannins

Administration of aqueous extract of leaves improves digestion and reduces blood sugar and urea, serum cholesterol. Along with exhibiting hypoglycemic activity, this extractable prevented peak rise in blood sugar at 1h in oral glucose tolerance test. [42]

## VII. CONCLUSION

Based on this review, there is insufficient evidence to actively recommend or discourage use of any particular supplement, although most appeared to be generally safe. Preliminary evidence of several herbs and supplements suggest that further research may be warranted.

All the drugs discussed in this review have exhibited significant clinical & pharmacological activity. The potency of herbal drugs is significant & they have negligible side effects than the synthetic anti-diabetic drugs. As we further our understanding of herbs and

dietary supplements, we might begin to develop a framework for a medical system capable of incorporating those complementary therapies proven to be beneficial.

Scientific validation of several Indian plant species has proved the efficacy of the botanicals in reducing the sugar level. Thus further investigation is required to get the best from nature.

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