

Role of Plants in Diabetes Management -A review

N. S. Kadam

Datta Meghe Institute of Engineering Technology & Research, Wardha, India

Abstract

Diabetes is one of the prevalent endocrine disorders which cause long term complications that have serious effects on body metabolism. It is caused due to deficiency of insulin which is a hormone produced by pancreas, an organ placed near stomach. Insulin helps glucose to get into cells of our body thereby handling all the glucose metabolic activities. In diabetes, either our body doesn't use insulin in adequate amount to be used for energy or it doesn't make enough insulin to regulate blood sugar level. If such condition remains untreated, high blood glucose levels can cause serious health complications particularly for heart, kidneys and blood vessels. Different parts of the plant extracts or phytochemicals are useful to control diabetic activities or stimulating different mechanisms in reducing diabetes. Plant extracts contains phytochemicals like flavonoids, polyphenols, alkaloids, steroids, tannins and carbohydrates which can be extracted, isolated and found to be rich source for an anti diabetic molecules. The present review focused on role of plants and their phytochemicals in prevention and diabetes management.

KEYWORDS: Diabetes, Insulin, Phytochemical.

Introduction:

Diabetes, also known as Diabetes mellitus is one of the common metabolic endocrine disorders which are characterized by hyperglycemia resulting due to increased glucose or sugar level in blood. It is also caused due to diminished secretion of insulin or insulin action in the body, resulting in symptoms like thirst and blurred vision, high urine production, weakness, changes in body metabolism, dysfunction and failure of organs like kidneys, eyes, heart and blood vessels. The World Health organization (WHO) estimated that diabetes will be the seventh leading cause of death in 2030¹.

Diabetes has been rising more rapidly and has risen to 422 million in 2014 and till date the figure is rapidly growing all over the world². Two types of diabetes have been known, Type I: is characterized by deficient insulin production and requires daily administration of insulin. It was previously known as insulin-dependent which usually occurs in childhood or early adult age is caused due to beta cell destruction. Symptoms of Type I diabetes include excessive excretion of urine (polyuria), weight loss, thirst (polydipsia), vision changes, constant hunger and fatigue. Type II: also called non-insulin-dependent diabetes, results from the body's insufficient use of insulin. Type 2 diabetes comprises the majority of people with diabetes around the world, and is largely the result of excess body weight and physical inactivity and usually

occur in people more than 40 years of age. Symptoms may be similar to those found in type 1 diabetes². Diabetes is becoming one of the rapidly growing disease within next 25 years .There are many factors contributing to cause of increase in percentage of disease among youngsters like, improper diet, changing lifestyle, nutritional value, obesity etc.

Role of Plants in prevention of Diabetes

Common Indian plants and their extracts have been found to be important sources of phytochemicals like, flavonoids, polyphenols, alkaloids, steroids, tannins and carbohydrates which are beneficial for treatment of several diseases including diabetes. About 45,000 varieties of Plant species and 7500 different species of medicinal plants have been officially recorded by India³. Among all plants most frequently used for treatment of diabetes are Fenugreek i.e. Methi(*Trogonella foenumgraecum*), Gurmar (*Gymnema sylvester*), Jamun(*Syzygium cumini*), Guduchi (*Tinospora codifolia*), Karela (*Momordica charantia*) in addition to this some other plants are Mango(*Mangifera indica*), Chirata(*Swertia chirayita*), Tulsi(*Ocimum sanctum*), Neem(*Azadiracta indica*) are also used in treatment of diabetes^{38,39,40}.

The hypoglycemic activity of phytochemicals in plants decreases the effect on alpha amylase or different blood glucose parameters which are responsible for development of diabetes. Since last few years there has been rapid increase in research in herbal medicines in prevention and management of diabetes because of their natural origin and less side effects⁴⁻⁹. Biological actions of different plant extracts and their products are used as alternative medicine to treat diabetes. In this review article, an attempt has been made to compile and show the importance of common plants and their phytochemicals used for anti diabetic effects in prevention and management of diabetes.

Table 1: List of Plants and their phytochemicals having anti diabetic activity.

Sr. No.	Botanical Name	Common Name	Phytochemicals/Chemical constituent	Parts
Chemical constituents in plants -Fruits:				
1	<i>Mangifera indica</i> (Anacardiaceae) ^{10,11,12}	Mango tree	Flavonoids, Mangeliferin, Phenolics	Fruit
2	<i>Anona squamosa</i> (Annonaceae) ^{13,14,15}	Custard apple, Sitaphal	Flavonoids	Fruit
3.	<i>Carica papaya</i> (Caricaceae) ¹⁰	Papaya	Flavonoids, Alkaloids, Saponin	Fruit
4.	<i>Punica granatum</i> (Punicaceae) ¹⁰	Pomegranate	Tannin	Fruit

5.	<i>Terminalia catappa</i> (Combretaceae) ^{10,16,17,18}	Indian almond	Phenolics	Fruit
6.	<i>Eugenia jambolana</i> (Asteraceae) ^{19,20,10,11}	Jamun	Alkaloids, glycoside- Jambolin	Fruit
7.	<i>Momordica charantia</i> (Cucurbitaceae) ^{21-27,10,11}	Bitter melon, karela	Triterpenoids, steroid, alkaloid, and phenolic.	Fruit
8.	<i>Artocarpus heterophyllus</i> (Moraceae) ^{28,29,10,11}	Jackfruit	Sapogenin	Fruit
9.	<i>Psidium guajava</i> (Myrtaceae) ^{30,31,10,11}	Guava	Terpen, Flavonoid, Polysaccharide	Fruit
10.	<i>Persea americana</i> (Lauraceae) ^{10,11}	Avocado, Naspati	Fat, Protein, Mineral, Vitamin	Fruit
Chemical constituents in plants -Other Parts:				
11.	<i>Glycine max</i> (Fabaceae) ^{10,11}	Soya beans	3-O-methyl D-chiro inositol	seed
12.	<i>Aegle marmelos</i> (Rutaceae) ^{32,10,11}	Bael	Aegelin, Coumarin , Flavonoid, Alkaloid	Leaf, seed, fruit
13.	<i>Murraya koenigii</i> (Rutaceae) ³¹	Curry leaf	Carbazole, Alkaloid	Leaf
14.	<i>Allium Cepa</i> (Alliaceae) ^{11,33}	onion	S methyl sulphane	Bulb
15.	<i>Allium sativum</i> (Alliaceae) ^{11,33}	Garlic	Diallyl disulphide oxide, S-allyl cysteine, S- allyl mercaptotctstein	Bulb
16.	<i>Azadiracta indica</i> (Meliaceae) ^{10,11}	Neem	Nimbidin	Leaf, seed
17.	<i>Beta vulgaris</i> (Chenopodiaceae) ¹¹	Beetroot	Polydextrose	Root
18.	<i>Brassica juncea</i> (Brassicaceae) ¹¹	Mustard	Isorhamnetin diglucoside	seeds
19.	<i>Capsicum frutescenes</i> (Solanaceae) ^{10,11}	Chilli	Capsaicin	Fruit
20.	<i>Cinnamomum zeylanicum</i> (Lauraceae) ^{10,11}	Cinnamon	Cinnamaldehyde	Bark, Seed

21.	<i>Cajanus cajan</i> (Leguminosae) ¹¹	Pigeon pea	Alkaloids, flavonoids, anthraquinones and reducing sugars, saponins, tannins	Seeds
22.	<i>Coriandrum sativum</i> (Apiaceae) ^{34,11}	Coriander	Alanine	Leaf
23.	<i>Cuminum cyminum</i> (Apiaceae) ^{34,11}	Cumin seeds	Aldehyde	Seeds
24.	<i>Curcuma longa</i> (Zingiberaceae) ²⁶	Turmeric	Curcuminoid	Root
25.	<i>Zingiber officinale</i> (Zingiberaceae) ³⁵	Ginger	Gingerol	Bulb
26.	<i>Ficus carica</i> (Moraceae) ^{10,11,28,29}	Anjir	Invert sugar	Leaf, Fruit
27.	<i>Ocimum sanctum</i> (Lamiaceae) ¹¹	Holy basil, Tulsi	Eugenol	Leaf
28.	<i>Vaccinium angustifolium</i> (Ericaceae) ^{10,11}	Wild berry	Anthocyanoside	Leaf, Fruit
29.	<i>Piper betle</i> (Piperaceae) ³⁶	Pan	Tannins, phenyl, alkaloid, sugar	Leaf
30.	<i>Triticum vulgare</i> (Poaceae) ^{37,11}	Wheat	Albumin	Whole plant

Discussion:

Diabetes is increasing all over the world rapidly. Large number of plants and herbs are available and clinically studied in recent years which show potential chemical constituent that improved blood sugar control which has increase the faith of people to use natural plant extracts to prevent and manage diabetes. In this review paper an attempt has been made to compile few commonly available and reported plants for hypoglycemic activity from India from various scientific journals. The presents review revealed 30 plant species belonging to 16 different families having anti diabetic properties which reduces glucose, glycosylated haemoglobin, lipid, insulin and oxidative stress. A novel chemical constituent from fenugreek seeds namely 4-hydroxyisoleucine is found to anti-hyperglycemic amino acid. In order to control and prevent this health problem, the development of research for new hypoglycemic and anti diabetic chemical constituents are of great importance. Diabetes medications are designed to lower blood sugar levels when diet and exercise alone aren't sufficient for managing diabetes. Managing diabetes should also encompass keeping blood pressure and cholesterol levels under control, maintaining

weight and proper nutritional diet. Although all the plant have been showing and proved to be active for anti diabetic activity many other plants have not been well characterized. More research must be carried out to identify and evaluate the efficacy, toxicity, and mechanism of action of phytochemicals or chemical constituent I in different plants with anti diabetic effect.

Conclusion: This paper has presented some commonly available plants in our daily life used in the treatment of diabetes mellitus. Plants have always been found to be source for different chemical constituents for the treatment of various type of complications of diabetes milletus. Still much research has to be carried out in identification of chemical constituents present in various plant species. Change in lifestyle and proper food choices with essential nutrients can help us in prevention and management of diabetes. More investigation is to be carried out to determine the exact cause and mode action of phytochemical on disease.

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