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Potential of medicinal plants in management of diabetes: An updates

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Abstract

Phytochemical means plant derived chemicals they are defined as bioactive nutrient present in plant in fruits, vegetables, grains, and other part of plants that may provide advantageous health benefits across basic nourishment. Medicinal plants are used in the treatment of various illness due to the presence of therapeutically important phytochemicals. Sometimes in patients with diabetes mellitus, the levels of antioxidant parameters are found to decrease, hence in many studies phytochemicals are suggested to improve the insulin sensitivity. Some phytocompounds such as flavonoids, prophenyl phenols, are also found effective in the complications of diabetes. The major challenging issue in diabetes management is the obstruction of various complications that remain the main cause of diabetes-related mortality. This review mainly focuses on the relationship between diabetes mellitus and preventive roles of various phytochemicals on diabetes.

Keywords: Diabetes; Classification; *Aloe vera; Allium cepa; Gymnema sylvestre*

Graphical Abstract

1. Introduction

Now a days, medicinal plants-based formulation has gained much more attention of various researchers across the world. The popularity of herbal plants or medicines are not only because of easily availability but also worldwide patient compliance and esthetic value. Even today, peoples from tribal areas and villages are mostly depends on the use of

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traditional system of medicine for the treatment of various diseases or disorders. Some of the medicinal plants that are commonly used are Withania somnifera (ashwagandha), Capsicum annuum (capsicum), Hypericum perforatum (St. John's wort), Aloe barbadensis (Aloe vera), Oroxylum indicum, etc. Other plants or parts their of used as condiments includes Allium sativum (garlic), Allium cepa (onion), Elettaria cardamomum (cardamonm), Cuminum cyminum (cumin), Myristica fragrans (nutmeg], Pipper nigrum(black pepper), Madhuca indica etc are also being used in the kitchen [1-16].

They not only finds their use in t Phytochemicals from the Greek word Phyto means plant are biologically active, naturally occurring chemical compounds detected in plants, which provide health benefits for humans further than those allotted to macronutrients and micronutrients [17]. They protect plants from illness and damage and provide to the plant's color, aroma, and flavor. In general, the plant chemicals that keep safe plant cells from environmental hazards such as pollution, stress, pressure, the rush of air UV exposure, and pathogenic attacks are called phytochemicals [18].

In broad-ranging dietary phytochemicals are found in fruits, vegetables, legumes, whole grains, nuts, seeds, fungi, herbs, and spices [19]. Recently, it is known that they have a part in the protection of human health when their dietary intake is significant. Broccoli, cabbage, carrots, onions, garlic, entire wheat bread, tomatoes, grapes, cherries, strawberries, raspberries, beans, legumes, and foods are common sources. Phytochemicals gather in different parts of the plants, such as in the roots, stems, leaves, flowers, fruits, or seeds [20]. World Health Organization (WHO) says that world's 80% population, presently uses medicines of plant origin for their prime health care [20].

Diabetes could be a illness that happens once your glucose, conjointly referred to as blood glucose, is just too high. Glucose is your main supply of energy and comes from the food you eat. Insulin, an endocrine harmone secreted by the exocrine gland, helps aldohexose from food get into your cells to be used for energy. Generally in diabetes your body doesn't build enough of any hypoglycemic agent or doesn't use hypoglycemic agent well, aldohexose then stays in your blood and doesn't reach your cells [22]. Polygenic disease could be a chronic disorder of sugar, fat and super molecule metabolism characterized by enlarged fast [23].

Studies conducted in Asian nation within the last decade have highlighted that the prevalence of polygenic disease is increasing speedily within the urban population. DM maybe one among the oldest diseases far-famed to man [24-26]. The enlarged glucose in DM results in several complications like metabolic changes, enlarged aerophilous stress, vessel and urinary organ diseases [27].

2. Classification of Diabetes

There are many different forms of diabetes mellitus. So far, scientists have been evaluating, and classifying some of these species, and to determine its prevalence in the general population. The most common types of diabetes are type 1, type 2, and gestational diabetes [28]. Type 1 diabetes are due to the auto-immune-cells which are destroyed, it usually leads to absolute insulin deficiency. If you have type 1 diabetes, your body doesn't produce insulin. Your immune system attacks and destroys cells in the pancreas that produce insulin [29].

Type 1 diabetes is usually diagnosed in children and young adults, but can occur at any age. People with type 1 diabetes must use insulin every day in order to stay alive [30]. Type 2 diabetes are due to the progressive loss of insulin secretion by the cells, which is often, due to insulin resistance. If you have type 2 diabetes, your body doesn't produce or use insulin well. Type 2 Diabetes can develop at any age, even during childhood. However, this type of diabetes usually occurs in middle-aged and older people.

Type 2 is the most common form of diabetes. Gestational diabetes was diagnosed in the second or third trimester of pregnancy, which is clearly not the overt diabetes prior to pregnancy. Some women develop diabetes during pregnancy. In most of the cases, this type of diabetes can be fixed after the baby is born. However, if you have gestational diabetes, you are more likely to develop type 2 diabetes later in life [30-34].

3. Medicinal Plants

Following medicinal plants have a vast potential in the treatment of various ailments due to the presence of therapeutically important phytochemicals. All the plants listed in this review are native to Asian countries and are routinely used by the traditional practitioners for the treatment of diabetes.

3.1. Syzygium cumini

Syzygium cumini (family myrtaceae) is likewise called *syzygium jamunum* and *Eugenia cumini*. Other common place names are jambul, black plum, java plum, Indian blackberry, jamblang, jamun and many others. The jamun has obtained some distance extra popularity in folk medicine and within the pharmaceutical exchange than in every other area [35-36]. Medicinally, the fruit is said to be astringent, stomachic, carminative, antiscorbutic and diuretic moreover, a fruit extract confirmed antimicrobial and cytotoxic activities and may potentially be used on normal antimicrobial merchandise [37]. Some of the patients had shown manipulate of blood sugar ranges when they had been placed on jamun remedy indicating a terrific response to the treatment, whereas others did now not show any development after the treatment [38-39].

3.2. Aloe vera

Aloe Vera may be a common name for *Aloe barbadensis*, that is that the most widely-used species of aloe. Aloe, a well-liked flora, includes a long history as a utile folks remedy. The plant will be separated into 2 basic products: gel and latex. Aloe vera gel is that the leaf pulp or mucilage, aloe latex, normally spoken as "aloe juice," may be a bitter yellow exudate from the pericyclic tubules simply to a lower place the outer skin of the leaves [40-44].

3.3. Zingiber officinale

Zingiber officinale, regularly called Ginger, belongs to the family of family *Zingiberaceae* and is taken into account to be a very important spice with multitudinous health advantages. The rhizomes of ginger are used historically for the treatment of cardiovascular disease, diabetes, arthritis, sprain, muscular aches, sore throats, fever, cramps, gingivitis, toothache, asthma. Ginger shows effective glycaemic management properties in diabetes [45].

The mechanisms underlying these actions area unit related to the inhibition of key enzymes dominant macromolecule metabolism and accumulated internal secretion release/sensitivity, leading to increased aldohexose uptake in peripheral fat and musculus tissues. The outstanding super molecule lowering effects of ginger additionally contribute to up the internal secretion resistant condition. the foremost active ingredients in ginger area unit the pungent principles, gingerols, and shogaol. Ginger has shown outstanding protecting effects on diabetic liver, kidney, eye, and neural system complications [46-49].

3.4. Allium cepa

The species onion L., normally called onion, has been for a protracted time thought-about a member of the family *Liliaceae* family however consistent with newer compartmentalization schemes the genus Allium belongs to the Amaryllidaceae, taxonomic category Allioideae. Allium cepa is additionally antioxidant and hypolipidaemic activity. Administration of a sulfur containing aminoalkanoic acid from onion, S-methyl amino acid sulphoxide (SMCS) to alloxan iatrogenic diabetic rats considerably controlled glucose yet as lipids in blood serum and tissues and normalized the activities of liver hexokinase, aldohexose 6-phosphatase and HMG Co A enzyme [39-41].

Onion is made in many phytonutrients that square measure recognized as necessary components of the Mediterranean diet however it's received attention conjointly for its biological properties and potential application within the treatment and interference of variety of diseases a large style of phytochemicals as well as the flavonoids, alkaloids, sulfides, saponins, polysaccharides, polyphenols, and several other compounds of the sulfur containing amino acids amino acid are known as main constituents of those plants [42-44].

3.5. Allium sativum

The species *sativum.*, usually known as Garlic, belong to the family *Amaryllidaceae.* The vital herbs that are used from earlier period as ancient drugs. This result is assumed to flow from to redoubled internal organ metabolism, redoubled hormone unleashes from exocrine gland beta cells and/or hormone frugal result. S-allyl cystein sulfoxide (SACS), the precursor of allicin and garlic oil, may be a sulfur containing aminoalkanoic acid, that controlled super molecule peroxidation higher than glibenclamide and hormone. SACS additionally stirred *in vitro* hormone secretion from beta cells isolated from traditional rats with the exception of this, alliaceous plant exhibits antimicrobial, antitumour and cardioprotective activities [45-51].

Figure 1 Plants and plant's products with anti-diabetes activity

3.6. Azadirachta indica

The species *Azadirachta indica.* regularly called as a Neem belongs to the family Meliaceae. Apart from having anti-diabetic activity, this plant also has anti-bacterial, antimalarial, antifertility, hepatoprotective and antioxidant effects. The non-wood products of neem like flowers, leaves, bark, fruits, seeds (oil, cake), and gum also find various uses. The Neem plant shows various biological activities like antibacterial, antifungal, insecticidal and other activities. It causes hypoglycemia and peroxidation of lipid metabolites while increasing the enzymatic activities of glutathione peroxidases, catalases and superoxide dismutases to enhance the antioxidation [52-60].

3.7. Coriandrum sativum

Coriandrum sativum L., a member of the Apiaceae family, is a commonly used food ingredient possessing medicinal as well as nutritional properties. Administration of ethanolic stem and leaves extract of coriander to alloxan-induced diabetic. Sub-chronic administration of aqueous extract of coriander seeds to hyper-caloric diet fed Merionesshawi rats resulted in normalization of blood glucose levels with improved insulin resistance and decreased levels of total cholesterol and triglycerides [60-61].

3.8. Gymnema sylvestre

Gymnema derives from the Greek words gymnos and name meaning "naked" and "thread", respectively. The Hindi and Urdu name gurmar, mean "sugar destroyer". The leaves and extracts contain gymnemic acids, the major bioactive constituents that interact with taste receptors on the tongue to temporarily suppress the taste of sweetness [62-65].

3.9. Acacia arabica (Babhul)

The antidiabetic effects of hydroalcohiolic extracts of Acacia Arabica investigated in diabetic rats. The Alloxan monohydrate was used to induce the diabetes in normal rats. The plant extract acts as an antidiabetic agent by acting as secret gouge to release insulin. A. arabica when administered (2, 3 and 4 g/kg body weight) to normal rabbits, induces hypoglycemic effect by initiating release of insulin from pancreatic beta cells [66]. For all plants, see Fig. 1 and for important phytoconstituents refer Table 1.

Table 1. Active Phyoconstituents and their structure with pharmacological activity

Plant	Active constituent	Pharmacological activity
Syzygium cumini	(–)-Epicatechin (Flavonoid)	Hypoglycemic, anti-oxidant activity, Anti-hyperglycemic effect
	Marsupsin	Hypoglycemic, anti-oxidant activity, Anti-hyperglycemic effect
Aloe vera (L.)	Lophenol (Phytosterols)	Anti-hyperglycemic activity with protective effect on pancreas, liver and smallintestine.
	24-Methylene Cycloartanol	Hypoglycemic activity, Hypoglycemic and reduced HbA1c
Zingiber officinale	Gingerol	Antiinflammatory, antidiabetic, antidyslipidemia, hypotensive, vasodilator, antiobesity, anticancer agent
	Shogaol	Antiinflammatory, antidiabetic, antidyslipidemia, hypotensive, vasodilator, antiobesity, anticancer agent
Allium cepa	SMCS	S-Methyl cysteine sulfoxide (SMCS) showed antidiabetic, Hyperlipidemic activity.
	Diphenylamine	Anti-hyperglycemic activity, insulin resistance in high fat diet.
Allium sativum	Alliin	S-allyl cysteine (SACS) showed beneficial effect on antioxidant system; SACS showed anti-diabetic activity.
	Allicin Diallylthiosulfinate	Allicin lowered the blood pressure and improved lipid profile in hyperlipidemic, hyperinsulinemic Anti-diabetic activity.
Azadirachta indica	β-Sitosterol (steroid) Gymnemic acids IV (R1 = tigloyl, R2= H, R3 = glucuropyranosyl	Hypoglycemic activity, Hypoglycemic and restricted oxidative stress, Anti-hyperglycemic activity. Reduced intestinal glucosidase activity, ant hyper glycemic properties, Anti-diabetic activity
Coriandrum sativum L	Maltase (α- glucosidase) Alanine.	Anti-hyperglycemic, Anti-diabetic activity
Gymne masylvestre	Gymnemic acid Saponin	Anti-hyperglycemic effect, Anti-diabetic activity,
Acacia arabica	Tannin, Flavonoids	anti-microbial, anti-plasmodial, antioxidant activity Anti-diabetic activity.

4. Analysis of phytochemicals

There are many analytical tools that can be used for the analysis of various phytochemicals in different plants. These methods include UV-spectrophotometry, gas chromatography, HPLC, HPTLC, etc [67-111].

5. Conclusion

As whole world is facing a problem of diabetes, use of plant based medicines has established itself as a ray of hope for in treatment of it with patient safety and better acceptance. Using the herbal medicines, we can keep the control on blood sugar level. It is quite evident from this review that the phytochemicals discussed are important in management of all types of types of diabetes. In addition, there is urgent need to explore such types of more plants that could show anti-diabetic activity.

Compliance with ethical standards

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Disclosure of conflict of interest

The author declares no conflict of interest.

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