Herbal Drugs Used in Diabetes Mellitus

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Abstract

Diabetes mellitus (DM) is the most common of the endocrine disorders. It is an important human ailment, afflicting many, from various walks of life in different countries. The prevalence of diabetes mellitus is expected to reach up to 4.4% in the world by 2030. Among all type of diabetes, type 2 diabetes is main complication. Currently available treatment option in modern medicine have several adverse effects. Therefore, there is a need to develop safe and effective treatment modalities for diabetes. Medicinal plants play an important role in the management of diabetes mellitus especially in developing countries where resources are meager. This article presents a review on some reported anti-diabetic medicinal plants

Keywords: Diabetes,plants,endocrine, review.

Introduction

Diabetes mellitus is a most common disease affective the citizens of developed as well developing countries. Diabetes mellitus is mainly caused by abnormality of carbohydrate metabolism which linked with low insulin [1]. The imbalance between insulin and glucagon is one of the great reason which cause diabetes. Diabetes mellitus may also defined as a metabolic disorder characterized by hyperglycemia, hyper aminoacidemia and hyper insulinaemia which may also leads to decrease in the insulin secretions [2]. In healthy condition the pancreas important role in regulation of glucose in body. It mainly consist alpha cells which secretes glucagon, beta cells while the glucagon in the condition of low level of blood glucose, in order to maintain the normal blood glucose level [3,4]. DM is described not only as condition of madhumeha {sugar loss in urine} but also as condition Ojameha [immunity and hormone loss] in Ayurveda for treatment purpose.

Types of diabetes mellitus

There are three main types of diabetes mellitus
Type 1 Diabetes Mellitus –IDDM [beta cell destruction]
Type 2 Diabetes Mellitus-NIDDM [insulin resistance]
Gestational Diabetes Mellitus [5].

TYPE 1 Diabetes Mellitus-:Type 1 diabetes mellitus is also known as insulin dependent diabetes. It is most commoly occuring metabolic disorder and autoimmune disorder which is charactrized by the destruction of the beta cells [5]

TYPE 2 Diabetes Mellitus-:Type 2 diabetes mellitus or non insulin dependent DM is a complex hetrogeneous group of metabolic disorder which include hyperglycemias and impaired insulin action or insulin secretion.T2DM causedysfunctioning in multiple organs or tissues[5].

Gestational Diabetes-:Gestational diabetes is blood glucose elevation during pregnancy. It is a significant disorder of carbohydrate metabolism due to hormonal changes during pregnancy. This can lead to elevated blood glucose in genetically predisposed individuals. It is more common among obese women and women with a family history of diabetes mellitus. It usually resolves once the baby is born. However, after pregnancy 5-10% of women with gestational diabetes are found to have type II diabetes. About 20-50% of women have a chance of develoing diabetes in the next 5-10 years[5].

Pathophysiology of diabetes mellitus

The pancreas plays a primary role of metabolism of glucose by producing and secreting the harmones like

insulin and glucagon. The islets of langerhans produce and secrete insulin and glucagon directly into the blood. Insulin is a protien that is essential for proper regulation of glucose and for maintenance of proper glucose levels.[9] Glucagon is a harmone that opposes the action of insulin . It is secreted when blood glucose level falls. It increases blood glucose concentration, partly by stimulating the breaking down of stored glycogen in the liver by a pathway known as glycogenoysis (Fig 1) Gluconeogenesis is the production of glucose in the liver from non-carbohydrate precirsors such as amino acids[6]

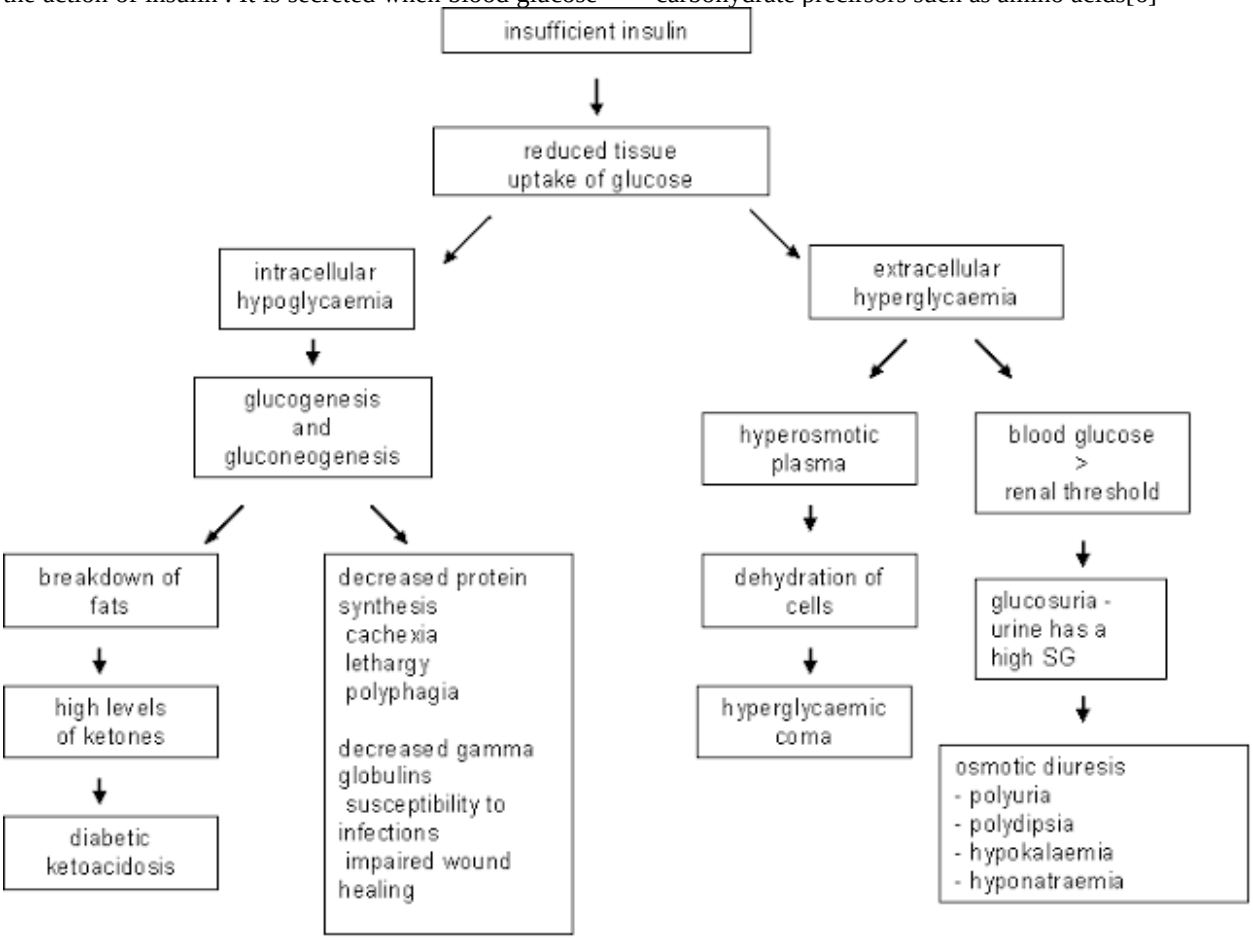

Fig 1:Outline of diabetes

Signs and symptoms of diabetes mellitis

Common symptom of diabetes include

- Feeling very thirsty
- Obesity
- Extreme fatigue
- Blurry vision
- Cuts/bruises that are slow to heal
- Weight loss – even though you are eating more [type 1]
- Tingling, pain, or numbness in the hands/feet[6].

Causes of diabetes mellitus are discussed in table1

Table 1: Causes of Diabetes Mellitus

S/NO.	CAUSES
1	Obesity/ overweight(especially excess visceral adiposity)
2	Excess glucorticoids (cushing's syndrome or steroid therapy)
3	Excess growth hormone (acromegaly)

4	Pregnancy , gestational diabetes
5	Polycystic ovary disease
6	Autoantibodies to the insulin receptor
7	Mutation of insulin receptor
8	Mutation that cause genetic obesity (e.g., melanocortin receptor mutations)
9	Lipodystrophy (acquired or genetic , asssociated with lipid accumulation in liver)

Complication of diabetes

Acute complications

- Hyperglycaemia
- Hypoglycaemia
- Diabetes Ketoacidosis

Chronic Complications

- Diabetic Retinopathy
- Diabetic Neuropathy
- Diabetic Nephropathy[1]

Diabetes diagnosis:-The blood glucose levels of a healthy man are 80mg/dl on fasting and up to 160 mg/dl in the postprandial state.A number of laboratory tests are available to conform the diagnosis of diabetes[4].

Random plasma test:-The simplest test and doesn't require fasting before taking the test. If 200 or more than 200 mg/dl of blood glucose it probably indicates diabetes but has to be reconfirmed[4].

Fasting plasma glucose test:-There should be eight hours fasting before taking this test. Blood glucose more than 126 mg/dl on two or more tests conducted on different days confirms a diabetes diagnosis [5].Fasting glucose level is determined, and then gives 75 gm of glucose, 100 gm for pregnant women. The blood is tested every 30 minutes to one hr for two or three hrs.This test is normal if your glucose level at two hrs is less than 140 mg/dl. A fasting level of 126 mg/dl or greater and two hour glucose level of 200 mg/dl or higher confirms a diabetes diagnosis [5].

Glycated proteins :-Proteins react spontaneously in blood with glucose to form glycated derivatives. The extent of glycation of proteins is controlled by the concentration of glucose in blood and by the number of reactive amino groups present in the protein that are accessible to glucose for reaction. All proteins with reactive sites can be glycated and the concentration of the glycated proteins that can be measured in blood is a marker for the fluctuation of blood glucose concentrations during acertain period. From a clinical diagnostic point glycated proteins with of these proteins to glucose for longer periods[2].

Glycated haemoglobin-:The life span of hemoglobin in vivo is 90 to 120 days. During this time glycated hemoglobin A forms, being the ketoamine compound formed by combination of hemoglobin A and glucose. Several subfractions of glycated hemoglobin have been isolated, of these,glycated hemoglobin A fraction HbA1c is most interest serving as a retrospectve indicator of the average glucose concentration. HbA 1c is recommended as an essential indicator for the monitoring of blood glucose control. The blood HbA1c≥6.5% is considered as diabetes [6]

Different plants used in diabetes mellitus are discussed in table 2

Table 2:List of plants used in diabetes mellitus [5-15]

Sr.No.	Plant	Family	Part Used
1	*Abelmoschus moschatus*	Malvaceae	Mucilage
2	*Abroma augusta*	Sterculiaceae	Leaves
3	*Abrus precatorious*	Leguminosea	Seeds
4	*Abutilon indicum*	Malvaceae	Whole Plant
5	*Acacia arabica*	Rubaceae	Seeds
6	*Acacia bilimekii*	Fabaceae	Leaves
7	*Acacia catechu*	Rubaceae	Bark
8	*Acacia farmesiana*	Fabaceae	Bark
9	*Acacia nilotica*	Fabaceae	Leaves,Bark
10	*Acacia pennata*	Rubaceae	Shoot Tips
11	*Achranthes aspera*	Amaranthaceae	Whole Plant
12	*Aconitum carmichaeli*	Ranunculacea	Roots
13	*Aconitum ferox*	Ranunculaceae	Root

14	*Aconitum palmatum*	Ranunculaceae	Roots
15	*Adhatoda vasica*	Acanthaceae	Leaves
16	*Adianthum capillus*	Polypodiaceae	Whole Plant
17	*Aegle marmelos*	Rutaceae	Flower,Leaves
18	*Aerva lanata*	Amaranthaceae	Leaves
19	*Afzelia africana*	Fabaceae	Stem Bark
20	*Ajuga iva L*	Lamiaceae	Whole Plant
21	*Ajuga remota*	Lamiaceae	Leaves
22	*Albizia amara*	Mimosoideae	Leaves
23	*Allium cepa*	Liliaceae	Stem,Tops.
24	*Allium sativum*	Liliaceae	Bulbs
25	*Aloe vera*	Liliaceae	Leaves
26	*Annona muricata*	Annonaceae	Leaves
27	*Annona squamosa*	Annonaceae	Leaves
28	*Anethum graveolens*	Apiaceae	Seeds
29	*Anthocleista voglii*	Logoniaceae	Bark
30	*Anthocleista indicus*	Rubiaceae	Bark
31	*Areca catechu*	Arecaceae	Seeds
32	*Argyreia nervosa*	Convolvulaceae	Roots
33	*Artocarpus altilis*	Moraceae	Leaves
34	*Aspargus gonocladus*	Apargaceae	Bulb
35	*Astragalus species*	Leguminosea	Roots
36	*Asystasia gaungtica*	Acanthacea	Leaves
37	*Avena sativa*	Poceae	Whole Plant
38	*Averrhoa bilimbi*	Oxalidaceae	Leaves
39	*Azadirachta indic*	Meliaceae	Seed Oil,Leaves
40	*Bacopa monnieri*	Scrophulariaceae	Aerial Parts
41	*Bambusa vulgaris*	Gramineae	Leaves
42	*Barleria noctiflora*	Acanthaceae	Whole Plant
43	*Barleria prionotis*	Acanthaceae	Leaf,Bark,Root
44	*Basella rubra*	Baselliaceae	Leaves
45	*Bauhinia rectusa*	Leguminoseae	Seeds
46	*Bauhnia variegata*	Caesalpiniaceae	Bark
46	*Bauhinia forficate*	Caesalpiniaceae	Leaves
47	*Bauhinia divaricata*	Leguminoseae	Leaves
48	*Bauhinia candicans*	Leguminoseae	Leaves
49	*Barleria lupulina*	Acanthaceae	Aerial Part
50	*Balanites aegyptiaca*	Simarubiacea	Fruit
51	*Baccharis trimera*	Myrtaceae	Leaves
52	*Averrhoa carambola*	Oxalidaceae	Leaves
53	*Atractylode japonica*	Composiyae	Rhizomes
54	*Asteracantha longifolia*	Acanthaceae	Leaves

55	*Asparagus racemosus*	Meliaceae	Roots
56	*Artocarpus heterophyllus*	Moraceae	Leaves
57	*Arthrocnemum glaucum*	Chenopodiaceae	Whole
58	*Artemisia pallens wall*	Compositae	Aerial Part
59	*Artemisia ludoviciana*	Compositae	Leaves
60	*Artemisia herba-alba*	Compositae	Leaves
61	*Artemisia dracunculus*	Compositae	Whole Plant
62	*Artemisia absinthium*	Compositae	Leves
63	*Aronia melanocarpa*	Rosaceae	Fruit
64	*Arctostaphylos uva ursi*	Ericaeae	Fruit
65	*Aralia elata seem*	Araliaceae	Root
66	*Aquilaria sinesis*	Thymelacaceae	Leaves
67	*Aquilaria agallocha*	Thymelacaceae	Stem
68	*Aporosa lindleyana*	Euphorbiaceae	Leaves
69	*Asporosa lanceolata*	Euphorbiaceae	Leaves
70	*Anthocleista voglii*	Lohoniaceae	Root
71	*Anthocleista rhizophoroides*	Logoniaceae	Bark
72	*Anthocleista nobilis*	Logoniaceae	Bark
73	*Anthemis herba alba*	Compositae	Aerial Part
74	*Andropogon citratus*	Poceae	Aerial Part
75	*Andrographis paniculata*	Acanthaceae	Whole Plant
76	*Andrographis paniculata*	Acanthaceae	Root
77	*Andrographis lineata*	Acanthaceae	Leaves
78	*Anacardium occidentale*	Anacardiaceae	Leaves
79	*Anacardium occidentale*	Anacardiaceae	Bark
80	*Amphipterygium adstringens*	Anacardiaceae	Bark
81	*Amorphophallus konjac*	Araceae	Rhizome
82	*Amomum subulatum*	Zingiberaceae	Root
83	*Amomum aromaticum*	Zingiberaceae	Root
84	*Amaranthus spinosus*	Amaranthaceae	Stem
85	*Amaranthus esculants*	Amaranthaceae	Whole Plant
86	*Amaranthus caudatus*	Amaranthaceae	Leaves
87	*Althaca officinalis*	Malvaceae	Leaves,Whole Plant
88	*Alternanthera sessillis*	Amaranthaceae	Whole Plant
89	*Alstonia scholaris*	Apocynaceae	Bark
90	*Alstonia macrophylla*	Apocynaceae	Whole Plant
91	*Akpinia galanga*	Zingiberaceae	Rhizome
92	*Aloe barbadensis*	Liliaceae	Leaves
93	*Aloe arborescens*	Liliceae	Leaves
94	*Alchemilla vulgaris*	Rosaceae	Aerial Parts
95	*Alangium salvifolium*	Alangiaceae	Leaves
96	*Agrimonia pilosa*	Rosaceae	Leaves
97	*Agrimonia eupatoria*	Rosaceae	Leaves
98	*Agarista mexicana*	Ericaceae	Aerial Parts

99	*Agapetes sikkimensis*	Ericaceae	Aerial Parts
100	*Aframomum memegueta*	Zingiberaceae	Leaves
101	*Aesculus hippocastanum*	Hippocastanaceae	Seeds
102	*Adiantum caudatum*	Petridaceae	Leaves
103	*Adansonnia digitata*	Bombacaceae	Stem Bark
104	*Acrocomia mexicana*	Leguminoses	Roots
105	*Acosmium panamense*	Leguminosea	Bark
106	*Achyrocline satureiodes*	Asteraceae	Aerial Parts
107	*Achyranthes aspera*	Amaranthaceae	Whole Plant
108	*Acanthopanax senticosus*	Araliaceae	Leaves
109	*Bauhinia varigegara*	Caesapinaceae	Flowers
110	*Benincasa hispida*	Cucurbitaceae	Fruit
111	*Berberis aristata*	Berberidaceae	Stem Bark
112	*Berberis vulgaris*	Berberudaceae	Root
113	*Bergenia stacheyi*	Saxifragaceae	Root
114	*Beta vulgaris*	Chenopodiaceae	Root Bark
115	*Bhighia sapida*	Sapindaceae	Unripe Fruits
116	*Bidens pilosa*	Asteraceae	Whole Plant
117	*Bixa orellana*	Bixaceae	Leaves
118	*Bombax ceiba*	Bombaceae	Seed
119	*Boswellia seerata*	Frankincense	Whole Plant
120	*Bougainvillea glabra*	Rubiaceae	Leaves
121	*Brassica juncea*	Brassicaceae	Seeds
122	*Brassica juncea coss*	Brassicaceae	Leaves
123	*Brassica napiformis*	Brassicaceae	Leaves
124	*Brassica nigra*	Brassicaceae	Seeds
125	*Brassica oleraccia*	Brassicaceae	Leaves
126	*Brassica rapa*	Brassicacea	Root
127	*Bryonia alba l.*	Cucurbitaceae	Roots
128	*Bryonia cretica*	Cucurbitaceae	Aerial Parts
129	*Bumelia sartorum*	Sapotaceae	Root Bark
130	*Butea monosperma*	Fabaceae	Fruits
131	*Caesalpinia crista*	Fabaceae	Seeds
132	*Caesalpinia decapetala*	Leguminosae	Seeds
133	*Caesalpinia digyna*	Leguminosae	Roots
134	*Caesalpinia sappan*	Fabaceae	Stem
135	*Caseria esculanta*	Caesalpinoideace	Roots
136	*Cajanus cajan*	Fabaceae	Seeds
137	*Calamintha macrostema*	Lamiaceae	Root
138	*Calamintha officinalis*	Lamiaceae	Aerial Parts
139	*Calamintha umbrossa*	Lamiaceae	Whole Plant
140	*Calotropis procera*	Asclepiadaceae	Latex
141	*Camellia sinesis*	Theaceae	Leaves
142	*Canarium schweinfurthi*	Burseraceae	Stem Bark

143	*Canarium zeylanicum*	Burseraceae	Bark
144	*Canavalia ensiformis*	Leguminosae	Seeds
145	*Cannabis indica*	Cannabinaceae	Whole Plant
146	*Canscora decussata*	Gentianceae	Whole Plant
147	*Cappparis decidua*	Gentianceae	Fruits
148	*Capparis incana*	Capparaceae	Leaves
149	*Capparis moon*	Capparaceae	Fruit
150	*Capparis sepiaria*	Capparaceae	Leaves
151	*Capravia biflora*	Scrophulariaceae	Leaves
152	*Carica papaya*	Caricaceae	Fruit
153	*Carissa carandas*	Apocynaceae	Fruit
154	*Carissa edulis*	Apocynaceae	Fruit
155	*Carmona retusa*	Boraginaceae	Leaves
156	*Carum carvi*	Apiaceae	Seeds
157	*Caseria glauca*	Salicaceae	Bark
158	*Cassia esculenta*	Flacourtiaceae	Root
159	*Cassia gluca*	Saliaceae	Bark
160	*Casseria zeylanica*	Flacourtiaceae	Stem Bark
161	*Cassia alta*	Fabaceae	Leaves
162	*Cassia auriculata*	Leguminoseae	Roots
163	*Cassia fistula*	Leguminoseae	Seeds
164	*Cassia occidentallis*	Caesalpiniaceae	Leaves
165	*Cassia siamea*	Fabaceae	Leaves
166	*Castela texana*	Simaroubaceae	Leaves
167	*Cecropia obtusifolia*	Moraceae	Leaves
168	*Cecropia peltata l*	Moraceae	Leaves
169	*Ceiba pentandra*	Malvaceae	Roots
170	*Ceiba pentandra*	Malvaceae	Roots
171	*Centella asiatica*	Apiaceae	Whole Plant
172	*Cephalandra indica*	Cucurbitaceae	Leaves
173	*Cephalanthus glabratus*	Rubiaceae	Wood
174	*Chamaemelum nobile*	Compositae	Leaves
175	*Cichorium intybus*	Asteraceae	Seeds
176	*Cinnamomum cassia*	Lauraceae	Leaves
177	*Cinnamomum tamala*	Lauraceae	Bark
178	*Cistanche tubulosa*	Scrophulariaceae	Whole Plant
179	*Citrullus lantatus*	Cucurbitaceae	Pulp
180	*Citrus aurantum*	Rutaceae	Peels
181	*Citrus limetta*	Ruteaceae	Peels
182	*Citrus maxima*	Ruteaceae	Peels
183	*Citrus sinensis*	Ruteaceae	Peels
184	*Clausena anisata*	Ruteaceae	Leaves
185	*Cleome aspera*	Capparidaceae	Whole Plant
186	*Clitoria termatea*	Fabaceae	Seeds

187	*Coccina grandis*	Cucurbitaceae	Whole Plant
188	*Coccina indica*	Cucurbitaceae	Leaves
189	*Cocculs cardifolia*	Menispermaceae	Stem
190	*Cocculus villosus*	Menispermaceae	Roots
191	*Cocos nucifera l.*	Arecaceae	Fiber
192	*Coffea Arabica*	Rubiaceae	Seeds
193	*Coix lachrymal*	Poaceae	Seed
194	*Convallaria majalis*	Asparagaceae	Bulb
195	*Cordia dichotoma*	Boraginaceae	Stem Bark
196	*Cordia morelosana*	Boraginaceae	Leaves
197	*Cordia myxa*	Boraginaceae	Stem Bark
198	*Carinadrum sativum*	Apiaceae	Whole Plant
199	*Corni fructus*	Comaceae	Whole Plant
200	*Cormus officinalis*	Comaceae	Fruit
201	*Costus specious*	Costaceae	Rhizome
202	*Coutarea latiflora*	Rubiaceae	Bark
203	*Crataegus Mexicana*	Rosaceae	Root
204	*Crataegus pubescens*	Rosaceae	Whole Plant
205	*Crotolaria medicaginea*	Fabaceae	Seeds
206	*Cucumis callosus*	Cucurbitaceae	Seeds
207	*Cucumis metuliferus*	Cucurbitaceae	Fruit
208	*Cucumis sativus*	Cucurbitaceae	Fruit
209	*Cucumis trigonus*	Cucurbitaceae	Fruit
210	*Cuminum cyminum*	Umbelliferae	Seeds
211	*Cuminum nigrum*	Apiaceae	Seeds
212	*Curcuma longa*	Zingiberaceae	Rhizome
213	*Cyathea divergens*	Cyatheaceae	Bark
214	*Cyclanthera pedata*	Cucurbitaceae	Shoot
215	*Cymbalaria muralis*	Crophulariaceae	Whole Plant
216	*Cynodon dactylon*	Roaceae	Whole Plant
217	*Cyperus iria*	Cyperaceae	Root
218	*Dalbergia sissoo*	Fabaceae	Bark
219	*Daucus carota*	Apiaceae	Root
220	*Decalepis root*	Apocynaceae	Root
221	*Delonix regia*	Fabaceae	Leaves
222	*Dendrobium nobile*	Orchidaceae	Stem
223	*Desurainia Sophia*	Brassicaceae	Whole Plant
224	*Desmodium motorium*	Fabaceae	Leaves
225	*Dillenia indica*	Dilleniaceae	Leaves
226	*Diospyros lotus*	Ebenaceae	Fruit
228	*Diospyros peregrine*	Ebenaceae	Bark
229	*Discorea japonica*	Diseoreaceae	Tubers
230	*Discorea batalas*	Diseoraceae	Tubers
231	*Discorea bulbifera*	Diseoraceae	Bulb

232	*Discorea rhizoma*	Diseoraceae	Tubers
233	*Dodonaea viscosa*	Sapindaecae	Leaves
234	*Eclipta alba*	Asteraceae	Leaves
235	*Eleusine coracana*	Poaceae	Seeds
236	*Ephedra elata*	Ephederaceae	Aerial Parts
237	*Eriobatrya japonica*	Rosaceae	Seeds
238	*Eruka sativa*	Brassicaceae	Seeds
239	*Erythrina indica*	Fabaceae	Leaves
240	*Erythrina variegata*	Fabaceae	Leaves
241	*Eucalyptus citriodara*	Myrtaceae	Leaves
242	*Eucalyptus globules*	Myrtaceae	Leaves
243	*Eugenia jambolana*	Myrtaceae	Fruit
244	*Ficus bengelensis*	Moraceae	Root Bark
245	*Ficus carica*	Moraceae	Leaves
246	*Ficus glomerata*	Moraceae	Bark
247	*Ficus hispida*	Moraceae	Leaves
248	*Ficus racemosa*	Moraceae	Bark
249	*Ficus religiosa*	Moraceae	Root Bark
250	*Ficus retusa*	Moraceae	Leaves
251	*Ficus sycomorus*	Moraceae	Leaves
252	*Fraxinus excelsior*	Oleaceae	Seeds
253	*Gallegan officinalis*	Leguminoseae	Leaves
254	*Ganoderma lucidum*	Ganodermataceae	Fruit
255	*Ginkgo biloba*	Ginkgooaceae	Whole Plant
256	*Ginseng radix*	Araliaceae	Root
257	*Glycine max*	Legiminoseae	Seeds
258	*Gmelina arborea*	Verbenaceae	Root
259	*Grewia asiatica*	Tiliaceae	Bark
260	*Grewia flavensis*	Tiliaceae	Leaves
261	*Grifola frondosa*	Meripilaceae	Fruit
262	*Guaiacum coulteri*	Zygophyllaceae	Bark
263	*Guaxuma ulmifolia*	Sterculiaceae	Bark
264	*Gymnema sylvestre*	Asclepiadaceae	Leaves
265	*Gynura procumbens*	Asteraceae	Leaves
266	*Hamada salicornica*	Hammamelidaceae	Whole Plant
267	*Hedychium spicatum*	Zingiberaceae	Rhizome
268	*Helicteres isora*	Sterculiaceae	Root
269	*Heritiera minor*	Sterculiaceae	Arial Parts
270	*Hintonia latiflora*	Rubiaceae	Leaves
271	*Hintonia standleyan*	Rubiaceae	Stam Bark
272	*Hoodia curror*	Apocynaceae	Stem
273	*Hordeum vulgare*	Gramineae	Seeds
274	*Humulus lupulus*	Cannabinaceae	Strobiles
275	*Hydrolea zeylanica*	Hydrangeaceae	Whole Plant

276	*Hyptis suaveolens*	Lamiaceae	Aerial Plant
277	*Hyssop's officinalis*	Lamiaceae	Leaves
278	*Ivervillea sonorae*	Curcurbitaceae	Root
279	*Inula racemoma*	Tubuliflorae	Root
280	*Ipomea aquatic*	Convolvulaceae	Whole Plant

Indian medicinal plants with antidiabetic and related benificial effects

There are many herbal remedies suggested for diabetes and diabetic complication. Medicinal plants form the main ingredients of these formulations. A list of medicinal plants with antidiabetic and related benificial effects[7].

Acacia arabica

It is found all over indian mainly in the wild habitat. The plant extract acts as an antidiabetic agent by acting as secretagouge to release insulin, it produces hypoglycemia in control rats but not in alloxanized animals. Powdered seeds of acacia arabica when administered (2,3 and 4g/kg body weight) to normal rabbits induced hypoglycemic effect by initiating release of insulin from pancreatic beta cells[8].

Aegle marmelos

Administration of aqueous estract of leaves improves digestion and reduces blood sugar and urea, serum cholesterol in alloxanized rats as compared to control. Along with exhibiting hypoglycemic activity, the extract also prevented peak rise in blood sugar at 1h in oral glucose[9].

Allium cepa

Various ether soluble fraction as well as insoluble fraction of dried onion powder show anti hyperglycemic activity in diabetic rabbits. Allium cepa is also known to have antioxidant and hypolipidaemic activity. Administration of a sulfur containing amino acid from allium cepa, S-methyl cysteine sulphoxide (smcs) (200 mg/kg for 45 days) to alloxan induced diabetic rats significantly controlled blood glucose as well as lipids in serum and tissues and normalized the activites of liver hexokinase, glucose 6-phosphatese and HMG co A reductase[10,11]. When diabetic patients were given single oral dose of 50 g of onion juice, it significantly controlled post-prandial glucose levels[12].

Allium sativum

Allium sativum is a perennial herb cultivated thriughout india. Allicin, a sulfur-containig compound is responsible for its pungent odour and it has been shown significant hypoglycemic activity[13]. This effect is thought to be due to increased hepatic metabolism, increased insulin release from pancreatic beta cells and/or insulin sparing effect[14]. Aqueous h0mogenate of garlic (10 ml/kg/day) aadministered orally to sucrose fed rabbits (10 g/kg/day in water for two monrhs) significantly increased hepatic glycogen and free amino acid content, decreased fasting blood glucose, and triglyceride levels in serum in comparison to sucrose controls[15].

Aloe vera and aloe barbadensis

Aloe, a popular houseplant, has a long history as a multipurpose folk remedy. The plant can be separated into two basic products: gel and latex. Aloe vera gel is the leaf pulp or mucilage, aloe latex, commonly referred to as " aloe juice," is a bitter yeloow exudate from the pericyclic tubules just beneath the outer skin of the leaves. Extracts of aloe gum effectively increases glucose tolerance in both normal and diabetic rats.treatment of chronic but not single dose exudates of aloe barbadensis leaves showed hypoglycemic effect in alloxanized diabetic rats[16].

Azadirachta indica

Hydroalcholic extracts of this plant showed anti-hyperglycemic activity in streptozotocin treated rats and this effect is because of increase in glucose uptake and glycogen deposition in isolated rat hemidiaphragm[17,18]. Apart from having anti-diabetic activity, this plant also has anti-bactrial, antimalarial, antifertility, hepatoprotective and antioxidant effects[19].

Caesalpinia bonducella

It is widely distributed throughout the coastal region of india and used ehtanolic extracts also increased glycogenesis therby increasing liver glycogen content[20]. Two fraction BM 169 and BM 170 B could increase secretion of insulin from isolated islets. The aqueous and 50% ethanolic extraxts of caesalpinia bonducella seeds showed antihyperglycemic and hypolipidemic activites in streptozotocin (stz)- diabetic rats[21]. The antihyperglycemic action of the seed extracts may be due to the blocking of glucose absorption. The drug has the potential to act as antidiabetic as well as antihyperlipidemic[22].

Capparis decidua

This is found throughout india, especially in dry areas. Hypoglycemic effect was seen in alloxanized rats when the rats were fed with 30% extracts of capparis is decidua (c. decidua) fruit powder for 3 weaks. This extract also reduced alloxan induced 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[23]. C.decidua additionallu showed hypolipidaemic[24].

Coccinia indica

Dried extracts of coccinia indica (c. indica) (500 mg/kg body weight) were administered to diabetic patients for 6 weaks. These extracts restored the activities of enzyme lipoprotein lipase (LPL) that was reduced and glucose-6-phosphatase and lactate dehydrogenase. Which were raised in untreated diabetic[25]. Oral administration of 500 mg/kg of c. indica leaves showed signicicant hypoglycemia in alloxanized diabetic dogs and increased glucose tolerance in normal and diabetic dogs.

Eugenia jambolana

In india decoction of kernels of eugenia jambolana is used as household remedy for diabetes. This also forms a major constituent of many herbal formulations for diabetes. Antihyperglycemic effect of aqueos and alcholic ectract as well as lyphilized powder shows reduction in blood glucose level. This varies with different level of diabetes. In mild diabetes (plasma sugar >180 mg/dl). It shows 73.51% reduction, whereas in moderate(olasma sugar>280 mg/dl) and severse diabetes (plasma sugar>400 mg/dl) it reduced to 55.62% and 17.72% respectively[13]. The extract of jamun pulp showed the hypoglycemic activity in streptozotocin induced diabetic mice within 30 min of administration while the seed of the same fruit required 24 h[26].

Mangifera indica

The leaves of this plant are used as an antidiabetic agent in nigerian folk medicine, although when aqueous extract given orally did not alter blood glucose level in either hormoglycemic or streptozotocin induced diabetic rats. However, antidiabetic activity was seen when the extract and glucose were administered simultaneously and also when the extract was given to the rats 60 min before the glucose. 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[27].

Momordica charantia

Momordica charantia is commonly used as an antidiabetic and antihyperglycemic agent in india as well as other asain countries. Extracts of fruit pulp,seed,leaves and whole plant was shown to have hypoglycemic effect in various animal models[28]. Polupeptide p, isolated from fruit, seeds and tissues of M.charantia showed significant hypoglycemic effect in normal and STZ diabetic rats. This may be because of inhibation of glucose-6-phosphate dehydrogenase activities[29].

Ocimum sanctum

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 the significantreduction in blood sugar levels in both normal and alloxan induced diabetic total cholesterol, triglyceride and total lipid indicated the hypoglycemic and hypolipidimic effects of tulsi in diabetic rats[30]. Oral administration pf plant extract (200 mg/kg) for 30 days led to decrease in the plasma glucose level by approximately 9.06 and 26.4% on 15 and 30 days of the experiment respectively[31]. Renal glycogen content increased 10 fold while skeletal muscle and hepatic glycogen levels decreased by 68 and 75% respectively in diabetic rats as compared to control[32].

Phyllanthus amarus

It is a herb of height up to 60 cm, from family euphorbiaceae known as bhuiamala. It is scattered throughout the hotter parts of india, mainly deccan, konkan and south indian states. Traditionally it is used in diabetic therapeutics,methanolic extract of phyllanthus amarus was found to have potent antioxidant activity. This extract also reduced the blood sugar in alloxanized diabetic rats[33]. The plant also shows antiinflammatory, antimutagenic, anticarcinogenic, antidiarrhoeal activity.

Pterocarpus marsupium

It is a deciduous moderated to large tree found in india mainly in hilly region.pterostilbene, a constituent derived from wood of this plant caused hypoglycemia in dogs[34,35]. Showed that the hypoglycemic activity of this extract is because of presence of tannates in the extract. Flavonoid fraction from pterocarpus marsupium has been shiwn to cause pancreatic beta cell regranulation[36]. Marsupin, pterosupin and liquiritigenin obtained from this plant showed antihyperlipidemic ctivity.[35](-) epicatechin , its active principle, has been found to be insulinogenic, enhancing insulin relase and conversion of proinsulin to insulin in vitro. Like isulin(-) epicatechin stimulates oxygen uptake in fat cells and tissue slices of various organs,increase glycogen content of rat diphragm in a dose-dependent manner[36].

Trigonella foenum graecum

It is found all over india and the fenugreek seeds are usually used as one of the major constituents of indian species. 4-hydroxyleucine, a novel amino acid from fenugreek seed increased glucose stimulated insulin release by isolated islet cells in both rats and humans[50]. Oral administration of 2 and 8 g/kg 0f plant extract produced dose dependent decrease in the blood glucose levels in both normal as well as diabetic

rats[40]. Administration of fenugreek seeds also improved glucose metabloism and normalized creatinine hepatic and renal glucose-6-phosphate and fructose-1,6-biphosphatase acivity[41]. This plant also shows antioxidant activity[43,43].

Tinospora cordifolia: (guduchi)It is the large, glabrous, deciduous climbing shrub belonging to the family menisoermaceae. It is widely distribiuted throughout Inida and commomly known as guduchi. Oral administration of the extract also prevented a decrease in body weight[44]. *T.cordifolia* is widely used in indian ayurvedic medicine for treating diabeties mellitus[45-47]. Oral administration of an aqueous T.cordifolia root extract to alloxan diabetic rats caused a significant reduction in blood glucose and brain lipids. Though the aqueous extract at a dose of 400 mg/kg could elict significant anti-hyperglycemic effect in different animal models, its effect was equivalent to only one unit/kg of insulin[48]. It is reported that the daily administration of either alcholic or aqueous extract of T.cordifolia decrease the blood glucose level and increases glucose tolerance in rodents[49].

Conclusion

Diabetes is a metabolic disorder which can be considered as a major cause of high economic loss which can in turn impede the development of nations. Morever, uncontrolled diabetes leads to many chronic complications such as blindness, heart failure, and renal failure. In order to prevent this alarming health problem, the development of research into new hypoglycaemic and potentially anti diabetic agents is of great intrest. In conclusion, this paper has presented a list of anti-diabetic plants used in the treatment of diabetes mellitus. It showed that these plants have hypoglycaemic effects.

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