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Research Paper

"Herbal Drugs Used In the Treatment of Diabetes Mellitus"

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ABSTRACT
Diabetes mellitus is becoming a common metabolic disorder which has serious threat to public health in the world. There are chemicals and biochemical agent that helps in controlling diabetes but there is no permanent remedy available which helps to get recovered completely from this disorder. By conducting large number of research work, numerous traditional medicines have been found for diabetes. Substances and extracts isolated from different natural resources especially plants have always been a rich arsenal for controlling and treating diabetes problem and complication arising due to it.This review article is intended to provide an overview of herbal drugs used in the treatment of diabetes mellitus.It has focused on the types,symptoms,pathophysiology,diagnosis and treatment of diabetes mellitus by using herbal drugs. The present study was based on Diabetes, its cure & herbal products available in market.
Keywords: *Diabetes mellitus, Herbaldrugs, AntidiabeticDrugs, Polyherbal formulations*

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I. 1.Introduction:

The condition known today as diabetes (usually referring to diabetes mellitus) is thought to have been described in the Ebers Papyrus (1550 BC). Ayurvedic physicians (5th/6th century BC): first noted the sweet taste of diabetic urine, and called the condition madhumeha ("honey urine").

The term "diabetes" traces back to Demetrius of Apamea (1st century BC). For a long time, the condition was described and treated in traditional Chinese medicine as xiāokě "wasting-thirst").Physicians of the medieval Islamic world, including Avicenna, have also written on diabetes. Early accounts often referred to diabetes as a disease of the kidneys.In 1674, Thomas Willis suggested that diabetes may be a disease of the blood. In 1794, Johann Peter Frank is credited with distinguishing diabetes mellitus and diabetes insipidus .In regard to diabetes mellitus, Joseph von Mering and Oskar Minkowski are commonly credited with the formal discovery (1889) of a role for the pancreas in causing the condition.[1]

II. Diabetes Mellitus:

Diabetes mellitus is a non-infectious endocrine disorder which is characterized by the disturbance in metabolism of carbohydrate and associated with hypoglycemia [2] [3]. It is linked with developing of various serious diseases like micro vascular (nephropathy, retinopathy, nephropathy) and macro vascular (peripheral vascular diseaseand coronary heart diseases) [4]. Diabetes mellitus also known as diabetes which was observed as diseases related with "sweet urine" and muscle loss. Glucose blood levels are maintained by insulin which is a hormone released from the pancreas. When these level increases, insulin is produced from the pancreas and maintained the level of glucose. In diabetic patients, the production of insulin is absent or less which causes hyperglycemia [5].

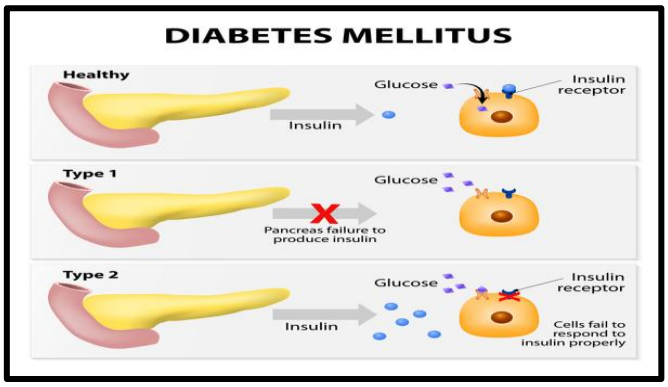


Figure No.1 :Diabetes Mellitus

2.1 Types of Diabetes mellitus:

Diabetes mellitus are three types Type 1, Type 2 and gestational diabetes mellitus.

❖ **Type 1 Diabetes mellitus:** Type 1 Diabetes mellitus is known as insulin dependent diabetes mellitus or juvenile onset diabetes, which is due to total loss of function of β cell of islets of Langerhans which are present in pancreas. A common underlying factor in the development of type 1 diabetes is a genetic susceptibility. Risk factors are less well defined for Type 1 diabetes than for Type 2 diabetes, but autoimmune, genetic, and environmental factors are involved in the development of this type of diabetes.

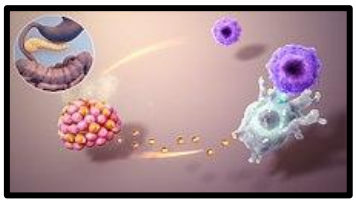


Figure no. 2 :Autoimmune attack in type 1 diabetes.

❖ **Type 2 Diabetes mellitus:** Type 2 Diabetes mellitus is known as insulin non dependent diabetes mellitus or adult-onset diabetes, which is temporary loss of β cell mass and it is due to genetic predisposition and mostly occur in obese persons and associated with high blood pressure and high cholesterol levels. The aim of treatment of type 2 diabetes mellitus is decreases the insulin resistance and increases insulin secretion. Risk factors for Type 2 diabetes include older age, obesity, and family history of diabetes, prior history of gestational diabetes, impaired glucose tolerance, physical inactivity, and race/ethnicity.

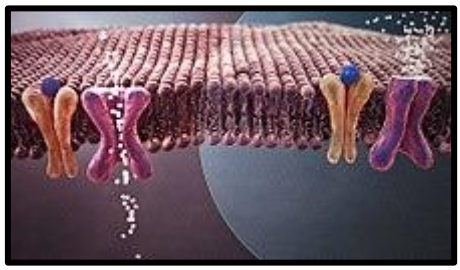


Figure No.3 Reduced insulin secretion and absorption leads to high glucose content in the blood.

❖ **Gestational diabetes:** Gestational diabetes is a type of diabetes which present with hyperglycemia in pregnant women. The secretion of placental hormones causes insulin resistance, leading to hyperglycemia. It usually appears in 2-4% pregnancies in 2nd or 3rd trimester After delivery, blood glucose levels in women with GDM usually return to normal or later on develop type 2 diabetes. [6].

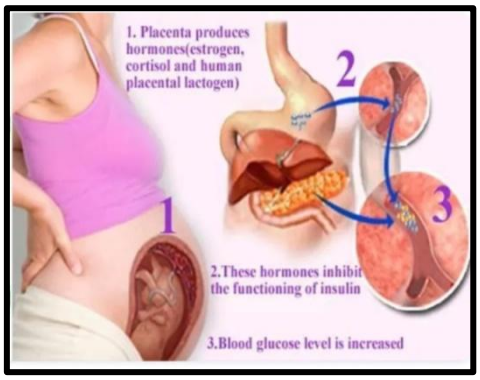


Figure no.4: Gestational diabetes

2.2 Symptoms of diabetes mellitus are[6]:
Polydipsea, Polyuria, Polyphagia, Fatigue,Nausea, Vomiting, Impotence in men, Slow healing wound, Blurred vision.

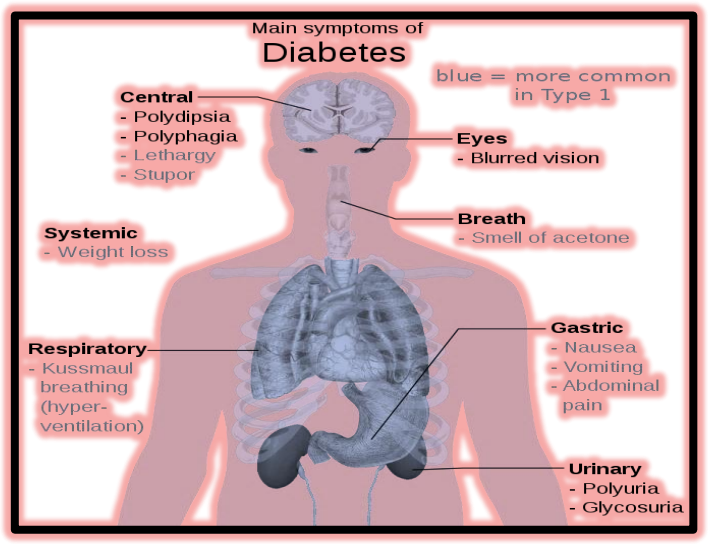


Figure no. 5: Symptoms of diabetes mellitus

2.3Pathopysiology: Diabetes Mellitus has different courses of pathophysiology because of it has several types:

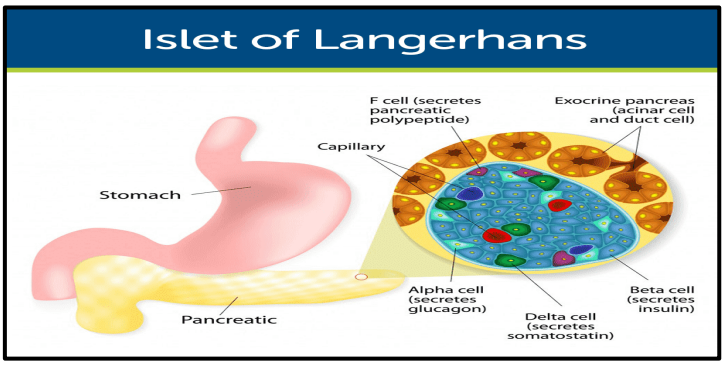


Figure no. 6: Islet of Langerhans

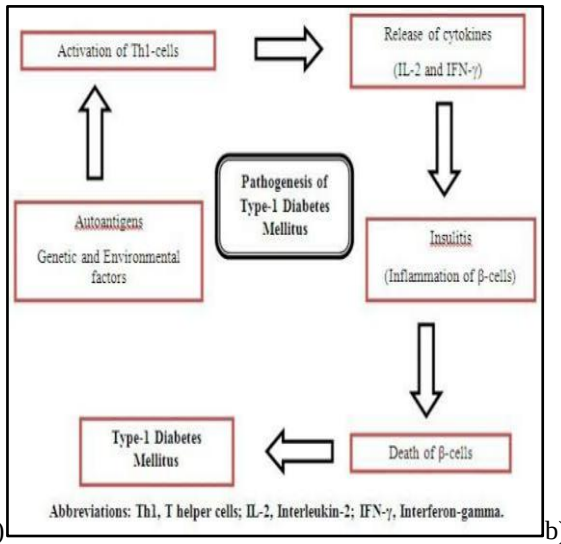
- ❖ Insulin is secreted by beta cells in the pancreas and it is an anabolic hormone.
- ❖ When we consume food, insulin moves glucose from blood to muscle, liver, and fat cells as insulin level increases.
- ❖ The functions of insulin include the transport and metabolism of glucose for energy, stimulation of storage of glucose in the liver and muscle, serves as the signal of the liver to stop releasing glucose,

enhancement of the storage of dietary fat in adipose tissue, and acceleration of the transport of amino acid into cells.

❖ Insulin and glucagon maintain a constant level of glucose in the blood by stimulating the release of glucose from the liver.

2.3.1 Pathophysiology of type 1 diabetes mellitus:

Type 1 diabetes mellitus is characterized by destruction of the pancreatic beta cells.A common underlying factor in the development of type 1 diabetes is a genetic susceptibility. Destruction of beta cells leads to a decrease in insulin production, unchecked glucose production by the liver and fasting hyperglycemia. Glucose taken from food cannot be stored in the liver anymore but remains in the blood stream.The kidneys will not reabsorb the glucose once it has exceeded the renal threshold, so it will appear in the urine and be called glycosuria. Excessive loss of fluids is accompanied by excessive excretion of glucose in the urine leading to osmotic diuresis.There is fat breakdown which results in ketone production, the by-product of fat breakdown.

a) 

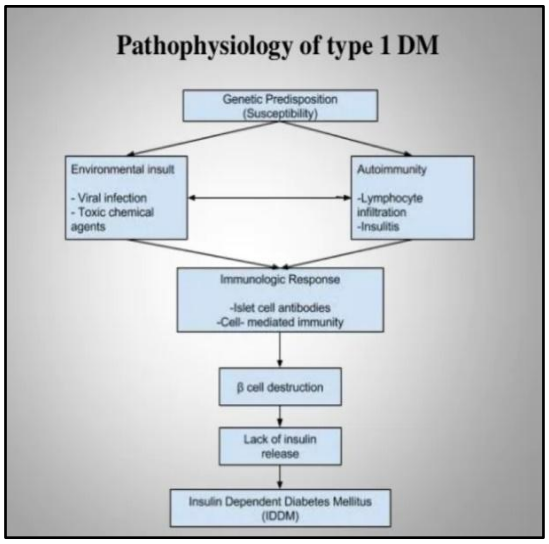
b) 

Figure no.7: a) and b) pathophysiology of type 1 diabetes mellitus

2.3.2 Pathophysiology of type 2 diabetes mellitus:

Type 2 diabetes mellitus has major problems of insulin resistance and impaired insulin secretion.Insulin could not bind with the special receptors so insulin becomes less effective at stimulating glucose uptake and at regulating the glucose release.There must be increased amounts of insulin to maintain glucose level at a normal or slightly elevated level.However, there is enough insulin to prevent the breakdown of fats and production of ketones.Uncontrolled type 2 diabetes could lead to hyperglycemic, hyperosmolar nonketotic syndrome.

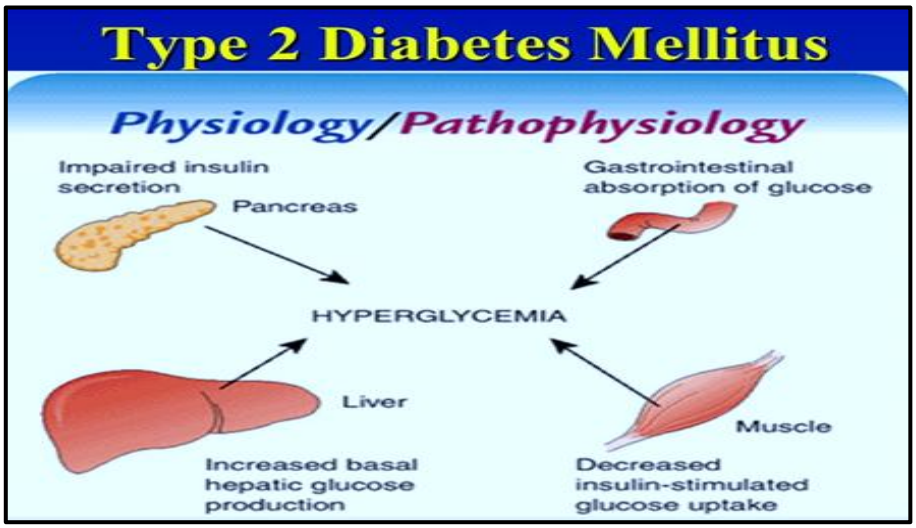


Figure no.8 : Pathophysiology of type 2 diabetes mellitus

2.4 Diagnosis of diabetes mellitus:

❖ The diabetes can be measured by analyzing the blood sugar levels.

❖ The blood sugar level in healthy man on fasting are 80 mg/dl and in postprandial state is up to 160 mg/dl.

❖ Different test for diagnosed of diabetes in laboratory are finger prick blood sugar test, fasting blood sugar, glucose tolerance diagnostic test, glycohemoglobin [7].

III. HERBAL DRUGS

"Herbal formulation mean a dosage form consisting of one or more herbs or processed herb(s) in specified quantities to provide specific nutritional, cosmetic benefits, and/or other benefits meant for use to diagnose treat, mitigate diseasesof human beings or animals and/or to alter the structure or physiology of human beings or animals". Herbal preparations are obtained by subjecting whole plant, fragmented or cut plants, plants parts to treatments such as extraction, distillation, expression, fractionation, purification, concentration or fermentation. These include comminuted or powdered herbal substances, tinctures, extracts, essential oils, expressed juices and processed exudates.[8]

3.1 Advantages[9]

1. Mostly herbal drugs are well tolerated by the patient, having fewer unintended consequences and fewer side effects than traditional medicine, and may be safer to use.
2. Herbal drugs are more effective for long-standing health complaints that don't respond well to traditional medicine.
3. Herbs are available without a prescription. Simple herbs, such as peppermint and chamomile, can be cultivated at home.

3.2Limitations[9]

1. An herbalist would not be able to treat serious trauma, such as a broken leg, nor would he be able to heal appendicitis or a heart attack as effectively as a conventional doctor using modern diagnostic tests, surgery, and drugs.
2. Self treatment with herbal drugs may consist of many risk factors. Moreover with no proper direction of doses may lead to overdose.
3. Consumption of herbal drugs without correct identification of plant i.e. use of wrong part of plant may lead to poisoning.
4. All herbal drugs are not safe; some may be poisonous or may cause allergenic reactions.
5. Curing period is usually longer in comparison to conventional medication. Immense patience while undergoing herbal treatment is needed.

IV. Antidiabetic drug:

Antidiabetic drugs are those which are used for the treatment of diabetes mellitus.

4.1 Mechanism of Action of Herbal Anti-diabetics [10,11,12]

The antidiabetic activity of herbs depends upon variety of mechanisms. The mechanism of action of herbal anti-diabetic may be:

- α –amylase inhibition.
- Inhibition in renal glucose reabsorption.
- Stimulation of insulin secretion from beta cells of islets or/and inhibition of insulin degradative processes.
- Cortisol lowering activities.
- Insulin resistance reduction.
- Providing certain necessary elements like calcium, zinc, magnesium, manganese and copper for the β -cells.
- Regenerating and/or repairing pancreatic β cells.
- Increasing the size and number of cells in the islets of Langerhans.
- Stimulation of insulin secretion.
- Stimulation of glycogenesis and hepatic glycolysis.
- Inhibition of β -galactocidase and α–glucocidase.
- Protective effect on the destruction of the β cells.
- Improvement in digestion along with reduction in blood sugar and urea.

4.2 Polyherbal Formulations for Diabetes:
Polyherbal formulations for diabetes are shown in figure no.9

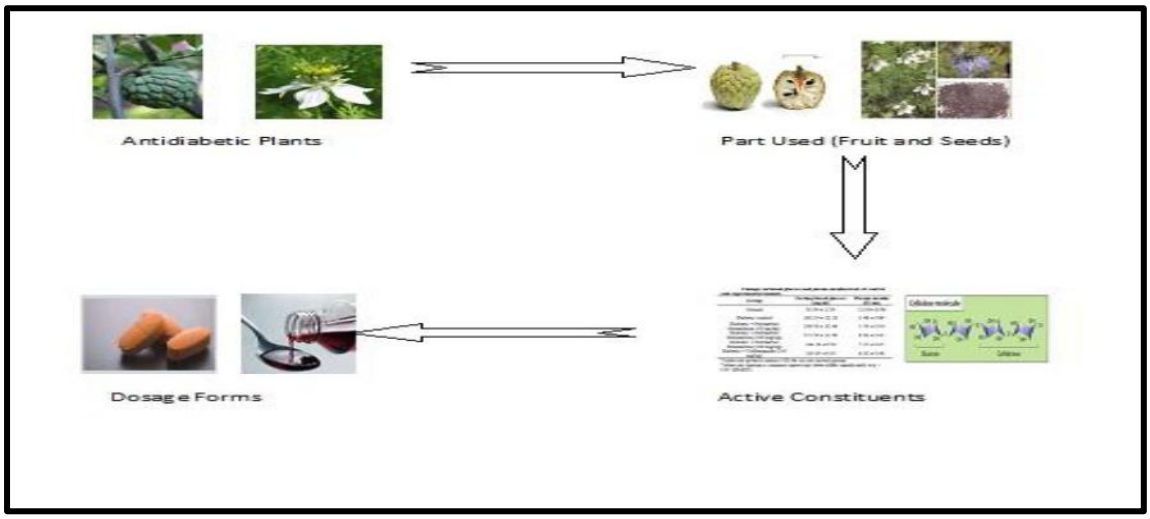


Figure no.9: Polyherbal formulations for diabetes

4.3 Advantages of herbal formulation:
Advantages of herbal formulation are shown in figure no.10

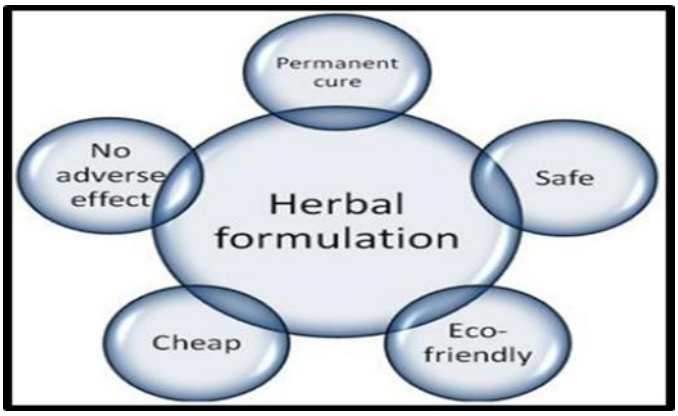


Figure no.10: Advantages of herbal formulations

4.4 Herbal Remedy:

According to world ethanobotanical 800 medicinal plants are used for the prevention of diabetes mellitus. Clinically proven that only 450 medicinal plants possess anti diabetic properties from which 109 medicinal plants have complete mode of action. In ancient time doctor and lay person used traditional medicinal plants with their active constituents and properties for the treatment of various diseases such as heart diseases, cancer and diabetes. There is a long history of traditional plants used for the control of diabetes in India and China.

There are various books available such as "**CharakaSamhita"** and **"SusrutaSamhita"** which explains phytopharmacology features of diabetes and its adverse effect [13].

Synthetic drugs which are used for treatment of diabetes are associated with various adverse effect such as sickness, vomiting, dysentery, alcohol flush, migraine, swelling, malignant anemia and faintness.

Herbal drugs are proved to be a better choice over synthetic drugs because of less side effects and adverse effects. Herbal formulations are easily available without prescription. These herbal drugs are used for life threatening disease. These drugs are also used when chemical drugs are ineffective in treatment of disease. These are natural and safe drugs i.e. there is no toxic effects. Herbal drugs permanently cure person and treat the disease while synthetic drugs are not permanently cured the diseases. Herbal formulations contain natural herbs and fruits and vegetables extract which are beneficial in treatment of various diseases without any adverse effects.

On the other hand chemical drugs are prepared synthetically and have side effect also. Herbal formulations are cheap as compared to allopathic medicines.

Herbal formulations are Eco friendly. Herbal formulations are produced from natural products while allopathic medicines are produced from chemical and chemically modified natural products. Herbal formulations are available without prescription while allopathic medicines are available with prescription.[14] [15].

4.5 Traditional herbal Anti diabetic drugs:

Currently the medicinal plants and herbs are being used in extract forms for their anti diabetic activity. Various clinical studies confirmed that medicinal plants extracts shows anti diabetic activity and restoring the action of pancreatic β- cells.Herbal drugs used for the treatment of diabetes mellitus were shown in table no.1 [16,17,,18,19,20,21,22,23,24,25,]:

Table No.1: Herbal drugs used for the treatment of diabetes mellitus

Srno.	Plant species	Family	Common name	Plant part	Active constituents	Mode of action
1.	**Allium cepa**	Lilliaceae	Onion	Dried powder	Dipropyl disulphide oxide	Stimulating the effects on glucose utilization and antioxidant enzyme
2.	**Allium Sativum**	Lilliaceae	garlic	Petroleum ether extracts of bulbs	Allypropyl disulphide oxide	Improve plasma lipid metabolism and plasma antioxidant activity
3.	**Aloe borbadensis**	Asphodelaceae	Ghikanwar	Leaf pulp extract	β-sitosterol, Campesterol	Improvement in impaired glucose tolerance
4.	**Andrographispaniculata**	Acanthaceae	Kalmegh	Ethanolic extract of plant	Kalmeghin	Increases the glucose utilization and lower plasma glucose
5.	**Annona squamosal**	Annonaceae	Sharifa	Leaf extracts	Liriodenin, moupinamide	Improve glucose tolerance
6.	**Azadirachitaindica**	Meliaceae	Neem	Leaf extracts	Azadirachitinnimbin	Glycogenolytic effect due to epinephrine action was blocked
7.	**Brassica juncea**	Bassicaceae	Mustard	Aqueous extract	Sulforaphane	Increase activity of glycogen synthetase
8.	**Cjanuscajan**	Fabaceae	Arhar	Seed	2'-2'methyl cajanone, isoflavones, cajanin, cahanones	Significant reduction in serum glucose level
9.	**Caricapapaya**	Caricaceae	Papaya	Aqueous seed extract	Papain, chymopapin	Lowered fasting blood sugar, triglyceride,total cholesterol
10.	**Carumcarvi**	Apicaceae	Caraway	Aqueous extract of seed	Furfurolcarvone	Significant decrease in blood glucose level
11.	**Cassia auriculata**	Leguminosae	Tannercassia	Aqueous extract of seed	Limonene, terpinol	Enhapces the activity of hepatic hexohinase, phosphofruictokinase
12.	**Catharanthusroseus**	Apocynaceae	Vinca	Hot water decoctis of leaves	Catharanthaine,	Lowering of glycemia
13.	**Cocciniaindica**	Curcurbitaceae	Baby watermelon	Ethanolic extract of whole plant	Glutamic acid, Asparagine	Lower blood glucose level due to suppressed glucose synthesis
14.	**Coraiandrumsativum**	Apicaceae	Coriander	Seed extract	p-cymene linalol	Increases the activity of β-cells and decrease serum glucose
15.	**Cinnamomum cassia**	Lauraceae	Cinnamon	Bark	Cinnamaldehydeeugenol	Increases the sensitivity of insulin receptor
16.	**Cinnamomumtamala**	Lauraceae	Tejpat	Leaf extract	Linalool	Insulin release from pancreatic β - cells
17.	**Curcuma longa**	Zingiberaceae	Turmeric	Powdered form	α-phellantrene, tripinolene	Lowers blood sugar, increases glucose metabolism and potentiates insulin activity

18.	**Eugenia jambolena**	Myrataceae	Jamun	Pulp of fruit	Oleanolic acid, ellagic acid	Inhibited insulinase activity from liver and kidney
19.	**Ficusbengalensis**	Moraceae	Bargad	Alcoholic extracts of stem bark	Leucodelphinidin	Enhanced insulin secretion from β-cells
20.	**Ficushispida**	Moraceae	Daduri	Alcoholic extracts of leaves	Ficustriol,Omethyltylophorinidine	Reduce the blood glucose level and increased the serum insulin level
21.	**Gymnenasylvestre**	Asclepidaceae	Gudmar	Dried leaves	Dihydroxygymnemic triacetate	Increase the serum G peptide level which monitor the release of endogenous insulin
22.	**Mangiferaindica**	Anacardiaceae	Mango	Leaves extract	β-carotene	Reduction in the intestinal absorption of glucose
23.	**Momordicacharantia**	Curcurbitaceae	Bittr gourd	Fresh green leaves	Charantin, sterol	Activates PPARs α and y and lower the plasma apo β-100 in mice fed with high fat diet
24.	**Musa paradisiacal**	Musaceae	Banana	Flower	β-Sitosterol, Leucocyanidin, Syringin	Decrease the blood glucose and glycosylated hemoglobin levels and increase in total hemoglobin
25.	**Ocimum sanctum**	Labiateae	Tulsi	Entire herbs	Eugenol	Increased insulin release
26.	**Panax ginseng**	Araliaceae	Ginseng	Root extract	Ginsenosidesprotopanaxadiol	Inhibit α - glycosidase activity and decrease glucose absorption
27.	**Phyllanthusemblica**	Euphorbiaceae	Amla	Methanolic extract of leaf	Phyllanthin	Reduction of glycemia
28.	**Punicagrantum**	Puniaceae	Pomegranate	Methanolic seed extracts	Punicalagin, punicalin	Decrease of glycemia
29.	**Swertiachirata**	Gentinaceae	Chirata	Entire herbs	Methyl swertianin	Lower blood glucose level
30.	**Termineliaarjuna**	Combertaceae	Arjuna	Dried stem	Arjunic acid, arjunolic acid	Decrease the blood glucose level and decrease the activities of G6P
31.	**Terminiliacatappa**	Combertaceae	Almond	Petroleum ether fruit extract	Omega-9 fatty acid	-
32.	**Tinosporacardifolia**	Menispermaceae	Gulvel	Aqueous extract of root	Tinosporone, tinosporic acid	Decrease of glycemia and brain lipids
33.	**Trigonellafoenumgraecum**	Fabaceae	Methi	Ethanolic extract of leaves	4- hydroxy isoleucine	Stimulate the secretion of insulin, reduce insulin resistance and decrease blood sugar levels
34.	**Zingibeofficinalis**	zingiberaceae	Sunth	Rhizome,	Gingerol, shogaol	Increases insulin level

4.6 Herbal plants used for diabetes mellitus: Herbal plants which are used for treatment of diabetes mellitus are explained below:

❖ **Acacia arabica: (Babhul)**

It is found all over India mainly in the wild habitat. The plant extract acts as an antidiabetic agent by acting as secretagouge to release insulin. It induces hypoglycemia in control rats but not in alloxanized animals. Powdered seeds of Acacia arabica when administered (2,3 and 4 g/kg body weight) to normal rabbits induced hypoglycemic effect by initiating release of insulin from pancreatic beta cells [26].

Figure no. 11: Herbal plantused **(Babhul)**for antidiabetic

❖ **Allium cepa: (onion)**

Various ether soluble fractions as well as insoluble fractions 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 activities of liver hexokinase, glucose 6-phosphatase and HMG Co A reductase [27,28]. When diabetic patients were given single oral dose of 50 g of onion juice, it significantly controlled post-prandial glucose levels .

Figure no. 12: Herbal plant**Allium cepa: (onion)** used for antidiabetic

❖ **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 yellow 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 of exudates of Aloe barbadensis leaves showed hypoglycemiceffect in alloxanized diabetic rats. Single as well as chronic doses of bitter principle of the same plant also showed hypoglycemic effect in diabetic rats. This action of Aloe vera and its bitter principle is through stimulation of synthesis and/or release of insulin from pancreatic beta cells . This plant also has an anti-inflammatory activity in a dose dependent manner and improves wound healing in diabetic mice [29].

Figure no. 13:Herbal plantaloevera used for antidiabetic

❖ **Azadirachtaindica: (Neem)**

Hydroalcoholic extracts of this plant showed antihyperglycemicactivity in streptozotocin treated rats and this effect is because of increase in glucose uptake and glycogen depositionin isolated rat hemidiaphragm. Apart from having anti-diabetic activity, this plant also has anti-bacterial, antimalarial, antifertility, hepatoprotective and antioxidanteffects [30].

Figure no. 14:Herbal plantneem used for antidiabetic

❖ **Mangiferaindica: (Mango)**

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 eithernormoglycemic 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 Mangiferaindicapossess hypoglycemicactivity. This may be due to anintestinal reduction of the absorption of glucose [31].

Figure no.15:Herbal plantmango used for antidiabetic

❖ **Momordicacharantia: (bitter gourd)**

Momordicacharantia is commonly used as an antidiabeticand antihyperglycemic agent in India as well as other Asian countries. Extracts of fruit pulp, seed, leaves and whole plant was shown to have hypoglycemic effect in

various animal models. Polypeptide p, isolated from fruit, seeds and tissues of M. charantia showed significant hypoglycemic effect when administered subcutaneously to langurs and humans .Ethanolic extracts of M. charantia (200 mg/kg)showed an antihyperglycemic and also hypoglycemic effect in normal and STZ diabetic rats. This may be because of inhibition of glucose-6-phosphatase besides fructose-1, 6- biphosphatase in the liver and stimulation of hepatic glucose- 6-phosphate dehydrogenase activities [32].

Figure no.16::Herbal plant (bitter gourd) used for antidiabetic

❖ **Ocimum sanctum: (holy basil)**

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 significant reduction in blood sugar level in both normal and alloxaninduced diabetic rats [30]. Significant reduction in fasting blood glucose, uronic acid, total amino acid, total cholesterol, triglyceride and total lipid indicated the hypoglycemic and hypolipidemic effects of tulsi in diabetic rats [33]. Oral administration of 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. Renal glycogen content increased 10 fold while skeletal muscle and hepatic glycogen levels decreased by 68and 75% respectively in diabetic rats as compared to control.This plant also showed antiasthemitic, antistress, antibacterial,antifungal, antiviral, antitumor, gastric antiulcer activity, antioxidant, antimutagenic and immunostimulantactivities.

Figure no. 17: Herbal plant tulsi (holy basil) used for antidiabetic

❖ **Phyllanthusamarus: (bhuiawala)**

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 Phyllanthusamarus was found to have potent antioxidant activity. This extract also reduced the blood sugar in alloxanizeddiabetic rats [34]. The plant also shows antiinflammatory, antimutagenic, anticarcinogenic, antidiarrhoeal activity.

Figure no. 18:Herbal plant Phyllanthusamarus used for antidiabetic

❖ **Trigonellafoenumgraecum: (fenugreek)**

It is found all over India and the fenugreek seeds are usually used as one of the major constituents of Indian spices. 4-hydroxyleucine, a novel amino acid from fenugreek seeds increased glucose stimulated insulin release by isolated islet cells in both rats and humans [35]. Oral administration of 2 and 8 g/kg of plant extract produced dose dependent decrease in the blood glucose levels in both normal as well as diabetic rats [36]. Administration of fenugreek seeds also improved glucose metabolism and normalized creatinine kinase activity in heart, skeletal muscle and liver of diabetic rats. It also reduced hepatic and renal glucose-6-phosphatase and fructose – 1,6-biphosphatase activity. This plant also shows antioxidant activity .

Figure no.19:Herbal plant fenugreek used for antidiabetic

❖ **Tinosporacordifolia: (Guduchi)**

It is a large, glabrous, deciduous climbing shrub belonging to the family Menispermaceae. It is widely distributedthroughout India and commonly known as Guduchi. Oral administration of the extract of Tinosporacordifolia (T. cordifolia) roots for 6 weeks resulted in a significant reduction in blood and urine glucose and in lipids in serum and tissues in alloxan diabetic rats. The extract also prevented a decrease in body weight. T. cordifolia is widely used in Indian ayurvedic medicine for treating diabetes mellitus . 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 elicit significant antihyperglycemiceffect in different animal models, its effect was equivalent to only one unit/kg of insulin . It is reported that the daily administration of either alcoholic or aqueous extract of T. cordifolia decreases the blood glucose level and increases glucose tolerance in rodents .[37,38]

Figure no.20:Herbal plant guduchi used for antidiabetic

4.7Herbal marketed formulations of diabetes mellitus:

Currently there are many poly herbal formulations in Indian market are used in different form such as Vati, Churna, Arkh, Quathetc for the treatment of diabetes which are shown below. [39]. These formulations mayconsist aqueous extract or powders of the various plants part which are used for the treatment of diabetes. These formulationsare called as poly herbal formulation because they contain 3 to25 herbs in the formula.Major

formulations used in Ayurveda are based on herbs used as decoctions, infusion, tinctures and powders. Drug formulation in Ayurveda (As mention in Ayurvedic treatise like CharakaSamhita, SushrutaSamhita) is based on two principles: (a). Use as single drug, and (b). Use of more than two drugs. When two or more herbs are used in formulation they are known as polyherbal formulation.[40]Different polyherbal formulations available in market:

Figno.21:SharangDyab-TeaFig no.22: Herbal Hills JambuFig no.23: Stevia-33

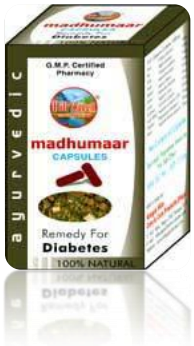


Fig.no.24: Diab-FIT **Fig.no.25 :Madhumar Capsule** **Fig.no26 : Daya Stone powder**

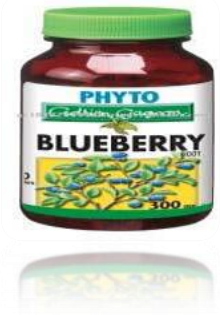


Fig.no.27 : Blue berry **Fig no.28 : Episulin** **Fig.no.29:Chandraprbha vati**

Fig.no.30:Misthinachurna

V. Conclusion

Diabetes is a metabolic disorder which can be considered as a major cause of high economic loss which can inturn impede the development of nations. Moreover, 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 interest. 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.There is increasing demand by patients to use the natural products with antidiabetic activity. This paper has presented various anti-diabetic plants that have been pharmacologically tested and shown to be of some value in treatment of Diabetes Mellitus. The effects of these plants may delay the development of diabetic complications and correct the metabolic abnormalities.The aim of present review is to establish the use of plants, plant parts or extract in curing diabetes mellitus. It also collates available data on plants with hypoglycemic effects. In the present investigation, interest is focused on experimental studies performed on hypoglycemic Plants and their bioactive components.

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