

OVERVIEW OF DIABETES MELLITUS WITH HERBAL DRUGS AND ITS MARKETED FORMULATION TO TREAT DIABETES.

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Abstract –

Diabetes mellitus is the common metabolic disorder characterized by hyperglycemia due to defect in insulin secretion, insulin action or both. The population of 2.8% suffers from this disease throughout the world and it may cross 5.4% by the year 2025. It is also a prevalent disease affecting the citizens of both developed & developing countries. There are lot of synthetic chemical agents like Sulfonylurea, Biguanides, Thiazides etc. available in market to control and treat diabetic patients. But total recovery from diabetes has not been reported till date. India has about 45000 plants species possessing medicinal properties. Herbal medicines have shown good clinical practice in the therapy of diabetic mellitus. In this paper our aim is to present review various herbs that are used in the traditional system of medicine & have shown hypoglycemic activity and various branded herbal formulations available in the market as diabetic remedies are discussed.

KEYWORDS: - Diabetes mellitus, Herbal antidiabetic drug, Polyherbal formulation.

Introduction –

Diabetes in present available therapies include insulin and various oral antidiabetic agents such as Sulfonylureas, Biguanides, α -glucosidase inhibitors and Glinides. Allopathic drugs used for the treatment of diabetes have their several side effect and adverse effect like hypoglycemia, nausea and vomiting, hyponatremia, flatulence, diarrhea or constipation, alcohol flush, headache, weight gain, lactic acidosis, pernicious anemia, dyspepsia, dizziness and joint pain. So instead of allopathic drugs, herbal drugs are of great choice which are having less or no side effect and adverse effects. The World Health Organization (WHO) has listed 21,000 plants, which are used for medicinal purposes around the world. Among these 2,500 species are in India out of which 150 species are used commercially on a fairly large scale. India is the largest producer of medicinal herbs and is called as "Botanical garden" of the world.

In this review an attempt has been made to compile the reported hypoglycemic plants available in different scientific journals and may be useful to the health professionals, scientists and scholars working in the field of pharmacology and therapeutics to develop evidence based alternative medicine to cure different kinds of diabetes in man and animals. The importance and the interest placed on medicinal plants in the drive to demonstrate their antidiabetic effects.

History –

and the responsible bioactive agents. This review also covers the information common name of plant, the parts that are commonly used, active chemical constitution, dose and polyherbal formulations.

- Diabetes is a Greek word it means "Siphon".
- Aretaeus the Cappadocian a Greek physician during 2nd century A.D. (Anno Domini) named the condition diabainein.
- He described patients who were passing too much water (polyuria) like a siphon.
- In 1675 Thomas Willis added mellitus to the term although it is commonly referred to simply as diabetes.
- Mel in Latin means "honey", the urine & blood of people with diabetes has excess glucose & glucose is sweet like honey then diabetes mellitus could literally mean "siphoning of sweet water".¹
- Indian physician called it Medhumeha (honey urine) because it affected ants. The ancient Indian physician, Sushruta & the surgeon Charaka (400-500 A.D.) were able to identify the two types later to be named Type I & Type II diabetes²⁻³.
- In 1869 Paul Langerhans, working on his medical doctorate, identified the cells that came to be known as the "Islets of Langerhans". However, the name Insulin for the secretion of the islets (Latin, insula=island), which could bring down blood glucose levels, was coined only in 1909 AD & 1910 AD individually by be Mayer Schaefer respectively.⁴⁻⁵ In 1921, Banting Best and Collip, working, in Macleod's Laboratory ligated the pancreatic duct causing the destruct of the exocrine pancreas while leaving the islets intact in their elegant animal experiments, by using canine insulin extracts to reverse induced diabetes, they conclusively established that the deficiency of insulin was the cause of diabetes.⁶

Definition –

Diabetes is a group of metabolic disorders in which there is high blood sugar levels over a prolonged period & this condition that result from lack of the hormone Insulin in a person's blood or insulin production is inadequate.

Determination of diabetes.

- There are three possible tests are required for determination of diabetes, prediabetes (this condition arises when your blood glucose level is higher than normal but it's not high enough to be considered diabetes) or neither.
- A) The A1C (Glycated hemoglobin) test (Hemoglobin A1C or Hb A1c)-
 - Measurement of HbA1C gives us an idea of how much sugar is present in the blood stream for the preceding three months. In most labs the normal range is 4% - 5.9%
 - At least 6.5% means diabetes
 - Between 5.7% & 5.99% means prediabetes.
 - Less than 5.7% means normal.
- B) Fasting Plasma Glucose Test or Fasting Blood Glucose Test –
 - It is easy to perform & convenient. After the person has fasted overnight (at least 8hrs) a single sample of blood is drawn & sent to the laboratory for analysis. This can also be done accurately using a glucose meter.
 - At least 126 mg\dl means diabetes
 - Between 100 mg\dl and 125.99 mg\dl means prediabetes.
 - Less than 100 mg\dl means normal when fasting blood glucose stays above 100 mg\dl but in the range of 100-126 mg\dl, this is known as Impaired Fasting Glucose (IFG).
- C) Oral Glucose Tolerance Test. –

The oral glucose tolerance test is a gold standard for meeting the diagnosis of type 2 diabetes. It is still commonly used for diagnosing gestational diabetes & in conditions of pre – diabetes such as polycystic ovary syndrome. With an oral glucose tolerance test the person fasts overnight (at least 8 but not more than 16 hrs.)

Then 1st the fasting plasma glucose is tested. After this test the person receives an oral dose (75grams) of glucose. The glucose is in a sweet – testing liquid that the person drinks. Blood samples are taken at specific intervals to measure the blood glucose.

- At least 200mg\dl means diabetes.
- Between 140 & 199.9 mg\dl means prediabetes.
- Less than 140 mg\dl means normal. People with glucose levels between normal & diabetic have Impaired Glucose Tolerance (IGT) or insulin resistance.

People with impaired glucose tolerance do not have diabetes but are at high risk for progressing to diabetes. ⁷⁻⁹.

Types of diabetes:

1) Type 1 diabetes. -

- Insulin dependent diabetes is one of the most serious metabolic disorder, it has an autoimmune basis & is characterized by destruction of the pancreatic β -cells.
- A chronic condition in which pancreas produces little or no insulin.
- Formerly known as juvenile diabetes this form generally develops in children & young adults.
- Sometimes develop insulin resistance because of weight gain or genetic factors ¹⁰⁻¹¹.

2) Type 2 diabetes. –

It formerly referred to as non-insulin dependent diabetes mellitus(NIDDM). NIDDM for adult – onset diabetes. Type 2 DM consist of dysfunctions characterized by hyperglycemia & resulting from the combination of resistance to insulin action, inadequate insulin secretion, & excessive or inappropriate glucagon secretion¹². Eventually the pancreas cannot produce enough insulin to respond to the body's need for it.

Type 2 diabetes is by far the most common form of diabetes accounting for 85 to 95% of cases in developed nations developing nations. According to the International Diabetes Federation.

3) Gestational diabetes. –

A temporary metabolic disorder that any previously nondiabetic women can develop during pregnancy usually the 3rd trimester hormonal changes contribute to this disease along with excess weight & family history of Diabetes. About 4% of pregnant women develop gestational diabetes, according to the American Diabetes Association.

It is defined as carbohydrate intolerance during gestation. It is crucial to detect women with GDM because the condition can be associated with several maternal & fetal complications such as macrosomia, birth trauma, cesarean section & hypocalcemia, hypoglycemia & hyper bilirubinemia in new born¹³.

Antidiabetic drugs –

Antidiabetic drugs are medicines developed to stabilize & control blood glucose levels amongst people with diabetes¹⁴⁻¹⁵.

Classification of Antidiabetic Drugs –

Sr. No.	Class	Mechanism of action	Side effect	Contraindications	Example
1	Biguanide	These agents decrease the amount of glucose produced by the liver. i.e. enhances the effect of insulin.	Lactic acidosis, weight loss, diarrhea, abdominal cramps, reduced vit. B ₁₂ absorption.	Chronic kidney disease, liver failure	Metformin ¹⁶
2	Sulfonylureas	Increase insulin secretion from pancreatic β cells i.e. drugs stimulate the pancreas to make more insulin.	risk of hypoglycemia, weight gain, agranulocytosis, hemolysis.	Obesity, cardiovascular comorbidity, sulfonamide allergy	Glyburide, Glimepiride, Glibenclamide, Tolbutamide
3	Meglitinides	these agents stimulate the pancreas to make more insulin i.e. insulin secretion from pancreatic β -cells	hypoglycemia, weight gain	severe renal or liver failure	Nateglinide, Rapaglinide
4	DPP-4 inhibitors	inhibit GLP-1 degradation promotes glucose-dependent insulin secretion	Gastrointestinal complaints, pancreatitis, headache, dizziness, arthralgia	liver failure, renal failure.	Saxagliptin, Sitagliptin
5	GLP-1 agonists	Direct stimulation of the GLP-1 receptor	Nausea, increased risk of pancreatitis & possibly pancreatic cancer.	preexisting, symptomatic gastrointestinal motility disorders	Liraglutide, Albiglutide, Exenatide
6	Glucosidase inhibitors	Reduce intestinal glucose absorption	Flatulence, diarrhea, feeling of satiety	inflammatory bowel disease, severe renal failure.	Acarbose, Miglitol & Voglibose.
7	Thiazolidine diones ¹⁸	Reduce insulin resistance through the simulation of PPARs, increase transcription of adipokines.	weight gain, edema, cardiac failure, increased risk of bone fractures.	Congestive heart failure, liver failure	Pioglitazone.
8	Amylin analogs	Reduce glucagon release, reduce gastric emptying, increase satiety	hypoglycemia, nausea	Gastroparesis.	Pramlintide

Drug Induced Diabetes. -

Drug induced diabetes is defined as the new development at a hyperglycemic state that meets the definition of diabetes & that is due to the ingestion of a drug. In 1997 the American Diabetes Association revised the fasting glucose value from 140 mg/dl to 126 mg/dl. this increases the like hood that medications causing drug induced diabetes²⁰.

Drugs that induce diabetes. –

Drugs are grouped according to the mechanism by which they induce diabetes.

- A) Drugs that cause diabetes by interfering with insulin – production & secretion – (21-22)
 - β -receptor antagonists

- Pyriminil (vacor)
 - Pentamidine
 - Diphenyl hydantoin
 - Tacrolimus
 - Didansoine
 - L-asparaginase
 - Opiates.
- B) Drugs that cause diabetes by reducing the effectiveness (Sensitivity) of insulin-
- Glucocorticoides²³⁻²⁴
 - Megasterol acetate
 - Oral Contraceptives
 - B-receptor agonists
 - Growth hormone
 - Protease inhibitors.
- C) Drugs that act on both insulin secretion & insulin sensitivity-
- Thiazide diuretics
 - Cyclosporine.
 - Diazoxide.
 - Atypical antipsychotic.
- D) Treatments that induce diabetes by increasing nutrient flux-
- Nicotinic acid²⁵
 - Total parenteral nutrition.

These offending drugs are grouped according to the mechanism by which they induce diabetes. The first group interferes with insulin production or secretion (e.g. B-blockers), the 2nd group blocks insulin action (e.g. steroids), the 3rd group interferes with both insulin secretion & action (e.g. thiazides), & the final group increases blood glucose using mechanisms independent of insulin's actions (e.g. Nicotinic acid).

Herbal antidiabetic drugs –

Herbal medicines have existed world-wide with long recorded history, they were used in ancient Chinese, Egyptian & Indian Medicine for various therapies. The Indian Ayurvedic system has included herbals as one of its most powerful healing ingredients which are recorded in the Vedas & Samhitas.

Ayurvedic medicines are divided into three classes namely herbal, mineral & animal Among this herbal formulation has gained great importance & rising global attention recently. The World Health Organization (WHO) estimates that 80% of the world's inhabitants still rely mainly on traditional medicines for their health care²⁶.

Medicinal plants continue to be an important therapeutic aid for alleviating ailments of human kind over the last 2500 years. There has been very strong traditional system of medicine such as Chinese, Ayurvedic & the Unani, born & practiced more in the eastern continent. These traditions are still flourishing, since, approximately 80% of the people in the developing countries rely on these systems of medicine for their primary health care needs²⁷. These plants contain substances that can be used for therapeutic purpose of which are precursors for the synthesis of drugs²⁸. A lot of research work has been carried found to have definite action on the nervous, circulatory, respiratory, digestive & urinary systems; as well as the sexual organs, the skin, vision, working & task²⁹.

Recent therapy for diabetes includes insulin & various oral hypoglycemic agents such as sulfonylureas, metformin, glucosidase inhibitors troglitazone, etc. but these are reported to produce serious adverse side effects such as liver problems lactic acidosis & diarrhoea³⁰. It is currently affecting around 143 million people³¹ and the number of those affected is increasing day by day. By 2030 it is predicted to reach 366 million population world wide³¹.

About 800 plant species have been reported to possess antidiabetic properties several plant species have been used for prevention or management of diabetes by the native Americans, Chinese, south Americans & Asian indians³². The study showed that Asian & African continents have 56% & 17% share of the worldwide distribution of therapeutic herbal plant respectively³³. Biological actions of the plants are related to chemical composition that are rich in phenolics, alkaloids, flavonoids, terpenoids, coumarins glycosides usually show positive effects. On the other hand, many conventional changes for treatment of diabetes such as metformin are secretagogues which have a plant origin³⁴.

Medicinal herb used in Ayurveda for antidiabetic property.

Sr. No.	Family	Botanical name	Common /Sanskrit name	Parts used	Active chemical constituents (antidiabetic)	Dose mg/kg	Ref.
1	Araceae	<i>Acorus calamus</i>	Vacha, sweet flag calamus	Radix	α and β Asarones	400-800mg/kg	36,37
2	Annonaceae	<i>Annona squamosa</i>	Shubha Sugar Apple	Leaves	Oxophoebine, reticuline, Flavonoids- quercetins-o-glucoside	350mg/kg	41-42
		<i>Polyalthia longifolia</i>	Ashoka	Bark	Terpenes, Flavonoids, Phenolic Comp. Resin	250mg/dl	116
3	Acanthaceae	<i>Barleria lupulina</i>	Vishalyakarani	Aerial Parts	Essential oil	200mg/kg	48-49
		<i>Hygrophila auriculate</i>	Kokilaksa, Marsh barbell	Aerial parts	Flavonoids, Steroids, Tannins	200 and 400mg/kg	79
		<i>Barleria prionitis Linn</i>	Saireyaka	Leaf, root	Sterols, Saponins, Tannins, Flavonoids	200 mg/kg	108
		<i>Adhatoda vasica</i>	Adulsa	Leaves	Terpenoids	50-100mg/kg	114
4	Apiaceae	<i>Carum carvi</i>	Krishna jiraka, caraway	Fruit	Volatile oil, Resin, Carvone	1g/kg	58
		<i>Ferula asafetida</i>	Hing	Roots	Resins, Gum	50 mg/kg	116
5	Asteraceae	<i>Stevia rebaudiana</i>	Sugar leaf	Whole plant	Stevioside, Rebaudioside A, B, C&D	2 gm/ kg	116
6	Amranthaceae	<i>Amaranthus viridis linn</i>	Tanduliyaka	Leaf	Flavonoids	200 & 400mg/kg	117
7	Apocynaceae	<i>Catharanthus roseus</i>	Red Periwinkle	Whole plant	Vinculin, Alkaloid	1 gm/kg	106
		<i>Ichnocarpus frutescens</i>	Black Creeper	Leaves	Phenylpropanoids, Coumarines, Alkaloids, Flavonoids	50mg/kg	116
8	Anacardiaceae	<i>Rhus coriaria</i>	Sicilian sumac	Fruit	Limonene, Nonanal, Dec-2-enal	400mg/kg	103
		<i>Anacardium occidentale Linn</i>	Kaju	Entire plant	Flavonoids, Terpenoid, Coumarin, Phenolic Comp.	100-800mg/kg	113
		<i>Mangifera indica</i>	Mango	Leaf, stem, bark, fruit.	Mangiferin, Xanthones, Triterpenes, Flavonoids	100-200mg/kg	115
		<i>Sclerocarya birrea</i>	Jelly plum	Stem bank	Tannin, Alkaloids	100-800 mg/kg	116
9	Araliaceae	<i>Panax ginseng</i>	Asian ginseng	Root, fruit	Saponin	150mg/ kg	100

		<i>Acanthopanax senticosus</i>	Siberian ginseng	Stem bark	Phenolic Comp.	200mg/ kg	116
10	Asteraceae	<i>Matricaria chamomilla</i>	Babuna, german chamomile	Aerial part	Quercetin, Abisabolol, Terpenoids	500mg/ kg	82
		<i>Tridax procumbens</i>	Jayanti veda, dhaman grass	Whole plant	Flavonoids, Alkaloids	250mg/ kg	95
11	Asclepiadaceae	<i>Gymnema montanum</i>	Modhunashini	Leaves	Gymnemic acid, Gymnema-saponin	200-400mg/ kg	74-75
		<i>Caralluma sinaica</i>	Makad shing	Root	Pregnane glycoside, Russelioside-B.	200mg/ kg	116
12	Berberidaceae	<i>Barberis aristata</i>	Daru haridra	Root	Alkaloids, Flavonoids, Imidazoline	200mg/ kg	48-49
13	Brassicaceae	<i>Brassica juncea</i>	Rajika, mohair, Mustaed greens	Leaves	Glycoside, Singrin, Isothiocyanate	50& 200mg/ kg	53
		<i>Raphanus sativus</i>	Mulaka, Japanese	Root sprout	Sterols, Rasatiol, Triglycerides	300mg/ kg	91
14	Chenopodiaceae	<i>Beta Vulgaris</i>	Palakya, beetroot	Root	Pectin, Polydextrose	2gm/kg	51
15	Capparaceae	<i>Capparis spinosa</i>	Himsra, caperbush	Fruit	Triterpenoids, Flavonoids, Alkaloids	200 & 800 mg/kg	57
16	Costaceae	<i>Costus speciosus</i>	Kemuka, Crape ginger keukand	Root	Polyphenol, β -amyrin Flavonoids Camphene	300-450mg/ kg	68
		<i>Costas igneus</i>	Pushkarmula, spiral flag	Leaves	Triterpenoids, Flavonoids, Steroids, Tannins	500mg/kg	67
17	Caesalpinaceae	<i>Cassia auriculata</i>	Avartaki, Ranawara, avaram senna	Leaves, flowers	Triterpenoids, Flavonoids, Glycoside	0.45gm /kg	60
		<i>Cassia glauca</i>	Peeta, Aragvadh	Leaves, bark	Chrysophanol, B-sitosterol, Glycoside	500mg/ kg	61
		<i>Cassia occidentalis linn</i>	Kasamarda	Whole plant	Flavonoids	200mg/ kg	107
18	Curcubitaceae	<i>Coccinia indica</i>	Ivy-gourd	Whole plant	Lupeol, Cucurbitacin-B, β -amyrin	150mg/ kg	105
		<i>Citrullus vulgaris</i>	Dindisha, water melon	Peel of fruit	Terpenoids, Tannins, Flavonoids, Alkaloids	100mg/ kg	63
		<i>Momordica charantia</i>	Bitter gourd, karela	Fresh green leaves	Momorcharin, Momordicin	10-20mg/kg	114
		<i>Cucumis metuliferus</i>	Jelly melon	Fruit	Fatty acid, β -carotene	1000- 1500 mg/kg	115
		<i>Bryonia laciniosa</i>	Shivalingi	Seed	Saponin	250 & 500	116
19	Caricaceae	<i>Carica papaya</i>	Papaya	Fruit	Saponin, Tannin, Alkaloids, Flavonoids	100- 400 mg/kg	80
20	Combretaceae	<i>Terminalia catappa</i>	Kshudrabija, desabadama	Fruit, bark	Phenolic Comp.	400mg/ kg	94
		<i>Terminalia chebula</i>	Haritaki, Hirda	Seeds	Shikimic, Gallic, Triacotanoic, Palmitic acid, β -sitosterol	200mg/ kg	99
		<i>Terminalia bellerica</i>	Behda	Fruits	Tannin, Glycosides, Coumarin	20mg/k g	114
21	Cyperaceae	<i>Cyprus rotandus</i>	Nagarmotha	Rhizome	Phenolic Comp.	500mg/ kg	114

22	Cactaceae	<i>Opuntia dillenii</i>	Tuna, prickly pear	Fruit	Polysaccharide	100, 200, 400mg/kg	115
23	Dioscoreaceae	<i>Dioscorea alata</i>	Purple yam	Tuber root	Hydro-Q chromene, Dioscorine	100-200mg/kg	102
24	Euphorbiaceae	<i>Emblica officinalis</i>	Amakaki Amla	Fruit	Tannoid, vit.C	300mg/Kg	70
		<i>Phyllanthus Amarus</i>	Bhuiawala	Whole plant	Phenolic Comp, Flavonoids, Steroid, Tannins Terpenoids, Alkaloids.	150, 300 & 600 mg/kg	115
		<i>Jatropha Cureas</i>	Physic nut	Leaves	Essential oil	200,300 mg/kh	116
		<i>Securinega Virosa</i>	Bushweed	Leaves	11-o-acetyl Bergenin, Quercetin, Kaemferol,	100mg/Kg	115
25	Ebenaceae	<i>Diospyros lotus</i>	Date plum	Fruit	Phenolics	150-1000mg/kg	115
26	Ericaceae	<i>Vaccinium myrtillus</i>	Blueberry	Leaves	Quercetin, Catechins	0.15g to 18g/kg	115
27	Fabaceae	<i>Tamarindus indica</i>	Tatul tree	Seed, fruit	Flavonoids, Polysaccharide	200mg/kg	62
		<i>Butea monosperma</i>	Bastard teak	Fruit	Butein, Palasonin, Stigmasterol-3	1 or 2 gm/kg	76
		<i>Phaseolus vulgaris</i>	Rajmaash, hulga, common bean, white kidney bean	Seeds, whole plant	Catechin, Terpenoids, Quercetin, Glycoside, Flavonoids	200mg/kg	88
		<i>Pterocarpus marsupium roxb.</i>	Beejaka	Heart wood	Flavonoids,	200mg/kg	117
		<i>Ougeinia oojeinensis</i>	Sandan	Bark, root	Alkaloids, Glycosides, Tannins, Flavonoids, Phenolic Comp.	200, 400 mg/kg	116
		<i>Cassia javanica</i>	Apple blossom tree	Whole plant	Flavones, Rhamnoside, Javanine	0.5g/kg	116
28	Ganodermataceae	<i>Ganoderma lucidum</i>	Reishi mushroom	Fruit	Polysaccharide	25-100mg/kg	96
29	Gentianaceae	<i>Swertia chirata</i>	Chirait	Entire herbs	Swerchirin, Gentianine, Zanthone, Mangiferin.	100-200mg/kg	114
30	Leguminosae	<i>Adenanthera pavonina</i>	Sandal wood	Seed	Galactitol, Flavonoids, Alkaloids, Terpenoids	50, 100, and 200mg/kg	116
		<i>Pterocarpus marsupium</i>	Kutas	Dried juice of plant	Marsupium, Epicetechin	30mg/kg	114
31	Liliaceae	<i>Aloe vera</i>	Kumari, true or medicinal aloe	Aloe gel, leaves	Pseudoprototin-saponin, Prototino-saponin	10-20 ml	38, 39
		<i>Allium cepa</i>	Onion	Bulb	Allyl propyl disulphide, s-methyl cysteine sulphoxide	300 mg/kg	115
32	Lythraceae	<i>Punica granatum</i>	Daadima anar	Flower, peel of fruit	Tannin	200mg/kg	89-90
33	Lamiaceae	<i>Ocimum gratissimum</i>	Clove basil	Leaf	Flavonoids, Alkaloids,	400mg/kg	116

					Coumarin, Phenolic Comp.		
		<i>Tectona grandis</i> <i>linn</i>	Shaaka	Bark	Lapachol, Lapachonone, Deoxylapachol, Tectoquinone	2.5 and 5 gm/kg	109
		<i>Plectranthus</i> <i>amboinicus</i> <i>spreng.</i>	Karpooravalli	Leaves	Flavonoids	400 mg/kg	112
34	Lauraceae	<i>Cinnamomum</i> <i>tamala nees</i>	Tamalapatra	Leaf	Cinnam-aldehyde	200 mg/kg	117
		<i>Cinnamomum</i> <i>zeylanicum</i>	Dalchini	Leaf, bark	Cinnam- aldehyde, v. oil, Tannin, Mannitol, Calcium oxalate.	150, 200 mg/kg	116
		<i>Persea americana</i>	Avocado	Fruit	Minerals, Vitamins, Tannins, Alkaloids.	450-900 mg/kg	115
35	Loganiaceae	<i>Strychanous</i> <i>potatorum</i>	Clearing nut tree	Whole plant	Alkaloids, Phenols, Sterols, Tannins	400 mg/kg	116
36	Meliaceae	<i>Swietenia</i> <i>mahagoni</i>	Mahagani, west indian, mahogany	Bark	Fucosterol, β - sitosterol, Flavonoids, Alkaloids	250 mg/kg	92
		<i>Azadirachta</i> <i>indica</i>	Nimba, neem	Leaves, seeds,	Nimbidin	100 μ g/ 200 μ l	46, 47
37	Meni-spermaceae	<i>Cocculus</i> <i>hirsutus</i>	Patala garudi	Leaves	Total alkaloids D Trilobine, Isotrilobine, Protoquericitol	250, 500, 1000 mg/kg	104
		<i>Coscinium</i> <i>fenestratum</i>	Krishnacando Ana	Stem	Berberine, Sitosterol, Glycoside	250mg/ Kg	66
		<i>Tinospora</i> <i>cardifolia</i>	Gulvel	Stem, roots	Berberine, Starch	2.5-5.0 gm/kg	114
38	Moraceae	<i>Ficus</i> <i>religiosa</i>	Peepal tree	Bark, leaf, fruit	Phenolics, Sterols, Flavonoids	50,100 mg/kg	116
		<i>Artocarpus</i> <i>Heterophyllus</i>	Jackfruit	Fruit	Sapogenin	250- 500mg/ Kg	115
		<i>Morus alba</i>	Mulberry, Tuba, white Mulberry	Leaves	Moranoline, Trigonelline.	400- 600mg/ Kg	83
		<i>Ficus carica</i>	Falgu, Common fig	Leaves	Polyphenol, Flavonoids	0.3gm/ Kg	72
		<i>Ficus racemosa</i>	Udumbara, Cluster fig Tree or goolar	Bark	β sitosterol	250mg/ Kg	73
		<i>Ficus</i> <i>bengalensis</i>	Vata, banyan Bargad	Aerial root, stem bark	Perlargonidin0 o- α -I	250mg/4kg	71
39	Musaceae	<i>Musa sapietum</i>	Kadali banana	Flower	Flavonoids, Steroids, Glycosides	0.25g/kg	85
40	Myrtaceae	<i>Syzyginum cumini</i>	Jambu, jamun	Seeds	Anthocyanins, Alkaloids, Flavonoids	100 mg/kg	93
		<i>Psidium guajava</i>	Guava	Fruit peel	Terpen, Flavonoids, Strictinin, Polysaccharide	100- 400 mg/kg	116
41	Malvaceae	<i>Hibiscusros</i> <i>A sinensis</i>	Jaswand China rose	Leaves	Vit. B & C	200mg/ Kg	114
		<i>Abelmosch</i> <i>Us</i>	Gumbo, Ladies finger	Fruit	Carbohydrate, Gum, Tannin,	300 Mg/kg	115

		<i>Esculentus</i>			Phytosterol, Flavonoid, Phenolics		
		<i>Ceiba Pentandra Gaertn.</i>	Kootashal- Mali	Root bark	Flavonoid- epicatechin	40 & 75 Mg/kg	117
		<i>Adansonia digitate</i>	Baobab	Stem bark	Alkaloids, Flavonoids, Steroids, Tannins	100mg/ kg	116
42	Nyctaginaceae	<i>Mirabilis Jalapa linn</i>	Krishnakeli	Root	Trigonelline	4 & 8 gm/kg	117
43	Oxalidaceae	<i>Averrhoa bilimbi</i>	Cucumber Tree, Karamaranga	Leaves	Flavonoids	125mg/ kg	45
		<i>Biphytum Sensitivum</i>	Lajalu	Whole plant	Biflavones, Amentoflavone, Poly phenolic Comp.	200mg/ Kg	116
44	Oleaceae	<i>Olea europaea</i>	Jaitun, olive tree	Leaves	Oleuropeoside, Oleanolic acid	100mg/kg	86
45	Posidoniaceae	<i>Posidonia oceanic</i>	Neptune Grass	Leaves	Steroids, Ammino acid	50,150, 250mg/ kg	116
46	Polygonaceae	<i>Rumex patientia</i>	Patience dock	Seed	Phenolic Comp. Flavonoids,	200mg/ kg	116
47	Phyllanthaceae	<i>Phyllanthus reticulates</i>	Black honey shrub	Leaves	Epi-friedelanol, Pyrogallic acid, Gallic acid	500mg/kg	116
48	Piperaceae	<i>Piper longum</i>	Pimpli	Leaves, root	Alkaloids, Piperine	200mg/kg	114
49	Punicaceae	<i>Punica granatum linn</i>	Dadima	Leaf	Flavonoids, Tannins, Glycosides	500mg/kg	110
50	Poaceae	<i>Paspalum scrobiculatum</i>	Kodrava, kodra millet	Grains	Tannins, Phenolic Comp.	500mg/kg	87
51	Papilionaceae	<i>Butea monasperma</i>	Palasha, palasa	Bark, leaves, flower	Flavonoids	3gm	54,55
52	Palmae	<i>Lodoicea sechellarum</i>	Sea coconut	Fruit	Carbohydrate	2-4g/kg	11
		<i>Areca catechu</i>	Puga, Betel nut supari	Fruit	Arecoline, Arecaidine	500mg/ kg	43
53	Rutaceae	<i>Aegle marmelos</i>	Bael fruits, golden apple	Leaves, seeds, fruit	Aegeline-2, Flavonoids, Coumarin, Alkaloids	1.0g/kg	116
		<i>Feronia elephantum</i>	Wood apple	Fruit	Triterpenoids, Stigma sterol, Bioflavonoid	500mg/ kg	81
		<i>Citrus sinensis</i>	Naranga, Sweet orange	Peel of Fruit	Total polyphenols	500mg/ kg	64
		<i>Citrus paradise</i>	Karuna, grape, Fruit	Seeds	Alkaloids, Hesperidio	250mg/ kg	65
		<i>Murraya Koenigii</i>	Surabhinimb, a, curry patta	Leaves	Carbazole, Alkaloids	2.5- 5.ml/kg	84
		<i>Aegle marmelos</i>	Bilva, Bengal Quince	Fruit	Aegeline-2, Coumarin, Flavonoids,	1.0g/kg	97-98
54	Rhamnaceae	<i>Zizyphus jujuba lamk</i>	Badara	Leaves	Berberine	400 and 600mg/kg	101
55	Rhizophoraceae	<i>Bruguiera gymnorhiza</i>	Black mangrove	Root	Vomifoliol, Dioslupecin,cou maroyllupeol	250mg/ kg	116
56	Solanaceae	<i>Solanum xanthocarpum</i>	Wild eggplant, brihati, kantkari	Leaves	Solasonine, Alkaloids	100mg/ kg	116
57	Salvadoraceae	<i>Salvadora oleoides</i>	Mithijar, pilu	Aerial parts	Terpenoids, Alkaloids	150mg/ kg	116

58	Scrophulariaceae	<i>Bacopa monniera</i>	Brahmi	Aerial Parts	Brahmine, Herpestine	300mg/kg	114
59	Sterculiaceae	<i>Helicteres isora</i>	Avartani	Root, fruits, bark	Steroid, Alkaloids, Terpenoid, Carbohydrate	500mg/kg	77,78
60	Salicaceae	<i>Flacourtia jangomas Racusch.</i>	Vikankata	Leaf & stem	Flavonoids, Saponin, Tannin	400mg/kg	117
		<i>Casearia esulenta</i>	Svarnamula, Saptachakra	Root	3-Hydroxymethyl xylitol	40mg/kg	59
61	Theaceae	<i>Camellia sinensis</i>	Syanaparni, tea	Leaves	Polyphenolic Compounds	100mg/kg	56
62	Umbelliferae	<i>Anethum graveolens</i>	Shatapushpa, dill	Leaves	Terpenoids, Flavonoids	300mg/kg	40
63	Valerianaceae	<i>Valeriana wallichii</i>	Tagar	Rhizome, stolon, root	Alkaloids, Glycosides, Flavonoids, Terpenoids	300mg/kg	114
64	Zingiberaceae	<i>Curcuma longa</i>	Haridra, turmeric	Rhizome	Curcuminoid, Curcumin	200mg/kg	69

Some family: - Most of family shows potential Antidiabetic activity.

1. Acanthaceae: -

Acanthaceae family is main group flowering plants also called as Angiosperms containing more than 2500 species classified into more than 200 genera. Most of them are shrubs tropical herbs or twining vines. These plants are found in every place such as in open forests, dense forests, wet fields, marine, areas, valleys etc.

Phytochemicals of Acanthaceae family are glycosides, benzenoids, flavonoids, phenolic compound, triterpenoids, naphthoquinone, Alkaloids. This family plants shows the Antiviral, Cytotoxic, Anti-fungal, Rheumatism, Fever, Asthma, Skin disease; Diabetes, cough, Antioxidant, Hepato protective etc activity. Example-

a) *Adhatoda zeylanica* L¹⁸: -

Adhatoda zeylanica common name is Adusa, Vasaka Ethanolic lead extract of *A.zeylanica* shows the antidiabetic activity. Ethanolic extract of *A.zeylanica* reduce the blood glucose level to the normal level by alloxan induced diabetic rat with presence of Active constituent such as alkaloid (vasicine, vasicinone) orally administration disease 500mg/kg b.w. Then active control group of animals will be treated with gliclazide at a dose of 10mg/kg b.w.

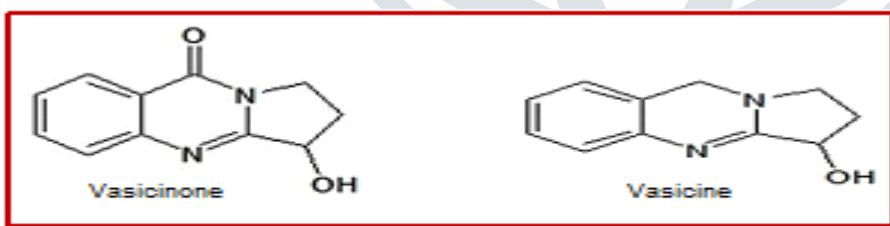
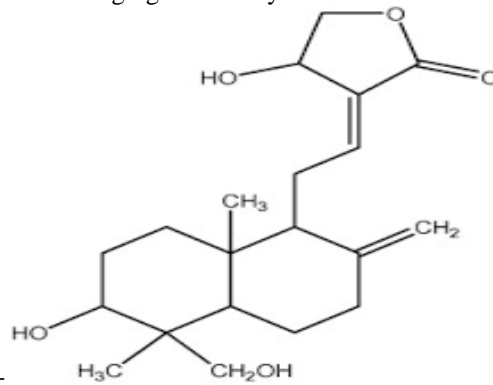


Figure 1: Chemical structure of vasicinone and vasicine

b) *Andrographis paniculate* wall. Ex. Nees¹⁹: -

A paniculata is Acanthaceae family commonly termed as kalmegh, Bhunimba whole plant extract of *A.paniculata* does not show the antidiabetic activity but chloroform root extract show the antidiabetic activity. Chloroform root extract is increase glucose metabolism in presence of active constituents such as Andrographolide, diterpenoid lactone, andrographoloid with

alloxan and STZ induced diabetic rat, dose as 300 mg/kg b.w. orally administered. Then control group of animals treated with



glibenclamide 0.040mg/kg.b.w. Structure-

Andrographolide.

Some other plant of Acanthaceae family is *Barleria prionitis* (viradanti), *Justicia beddomei* Bennet (Kala Adulsa), *Rhinacanthus nasutus* kurz (Jasmine), *Ruellia tuberosa*. (Fever root), *Thunbergia laurifolia* (kartau) its shows the potential antidiabetic activity.

2. Anacardiaceae.

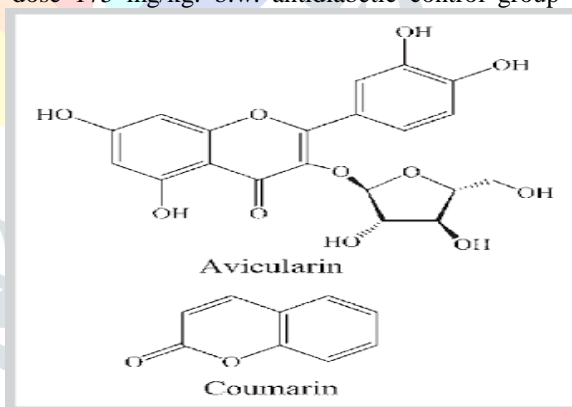
Anacardiaceae the cashew family includes approximately 800 species in 82 genera members of the family are cultivated throughout the world for their edible fruits & seeds, medicinal compounds, valuable timber.

This family is more abundant in warm or tropical regions with only a few species living in the temperate zones mostly native to tropical Americas, Africa and India.

Phytochemical on Anacardiaceae family are Phenolic comp, flavonoid, glycosides, carbohydrate etc. Anacardiaceae family plants shows Anti-inflammatory, Antiulcer, Anticancer, Antioxidant, Antidiabetic, Antihyperlipidemic action.

a) *Anacardium occidentale* Lion.¹²⁰: -

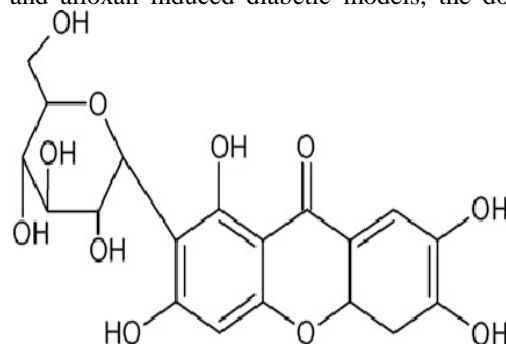
Commonly called kaju. The Pharmacological active ingredients are present in entire plant. The plant possesses both hypoglycemic and antidiabetic activity with presence of active constituent's like flavonoids, coumarin, phenolic comp. When antidiabetic activity is potential in methanolic leaf extract of plant. It using male wistar rats by STZ induce model. Decrease the blood glucose level to normal level to taken a dose 175 mg/kg. b.w. antidiabetic control group is treated sodium



pentobarbital 40mg/kg. b.w. i.p. Structure - Coumarin

b) *Mangifera indica* lion¹²¹: -

Mangifera indica is known as Aam in hindi mango in English. *M.indica* leaf extract reduce the intestinal absorption of glucose with active Phyto chemical Mangiferin (xanthone glycoside). *M.indica* leaf extract exhibited antidiabetic activity in STZ and alloxan induced diabetic models, the dose taken as 100-200mg/kg. b.w. i.p. Structure-



Mangiferin.

Other plants of anacardiaceae family are also been reported to possess antidiabetic property such as *Semecarpus anacardium* (malacca bean), *Spondias mombin* (yellow mombin), *Rhus coriaria* (Sicilian sumac) etc.

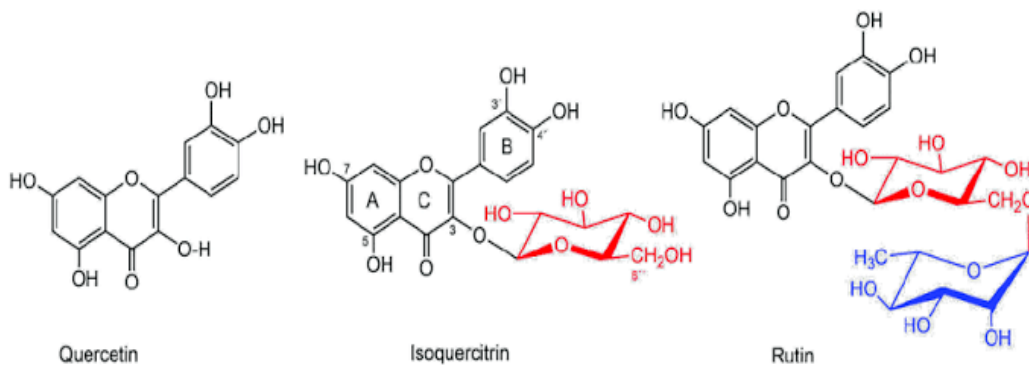
3. Malvaceae: -

The species of the family malvaceae are light loving plants and found to subtropical areas and semiarid tropics, few species are forest dwellers. Out of 244 genera and about 4225 species in the world, India represents only 24 genera and 104 species.

Biological activity reported on malvaceae family plants are Antibacterial activity, Antioxidant, Antitumor etc. Important or active phytochemicals in this family are Flavonoids, Steroids, Vit.c, Tannin, Phenolic comp., Carbohydrate, Quercetin etc. The malvaceae or the mallows is a family of flowering plants, well known members of economic importance include okra, cotton, cacao and durian. Example-

a) *Abelmoschus esculentus moench*¹²²: -

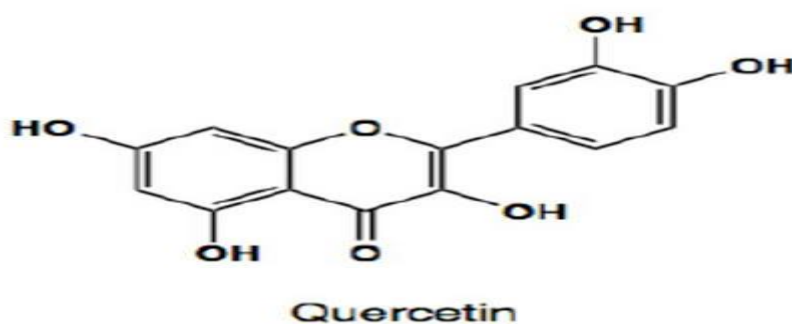
Its common name is Gumbo, musk okra or muskdana. The pharmacologically active ingredients are present in seed, leaves, fruits. The ethanolic fruit extract at the dose as 300 mg/kg orally is reported to possess antidiabetic activity with active constituents like phytosterol, flavonoid, phenolic compounds, isoquercitrin, quercetin 3-o-gentiobioside and alloxan induced diabetic mice. Initiating insulin release from pancreatic β -cells.



b) *Thespesia populnea soland*¹²³: -

It is distributed widely all over in India, commonly known as “Indian tulip tree or portia tree”. Alcoholic fruit extract of *T. populnea* shows the antidiabetic activity in presence of active phytochemicals are populnetin, herbacetin, populneol, quercetin. *T. populnea* shows antidiabetic activity with alloxan induced rat at dose 100-300mg/kg b.w. p.o, and compared with the standard drug of metformin. The *T. populnea* aqueous and alcoholic extracts have shown exhibited significant reduction in blood glucose level as well as lipid profile of diabetic rats.

Structure-



Other plants of Malvaceae family having potential antidiabetic action are, *Abutilon indicum sweet* (Indian mallow), *Hibiscus cannabinus* (Java jute), *Hibiscus platanifolius* (maple leaved mallow), *Hibiscus rosa sinensis* (gudhal or china rose), *Hibiscus tiliaceus* (wild cotton tree), *Salmalia malabarica* (silk cotton tree) etc.

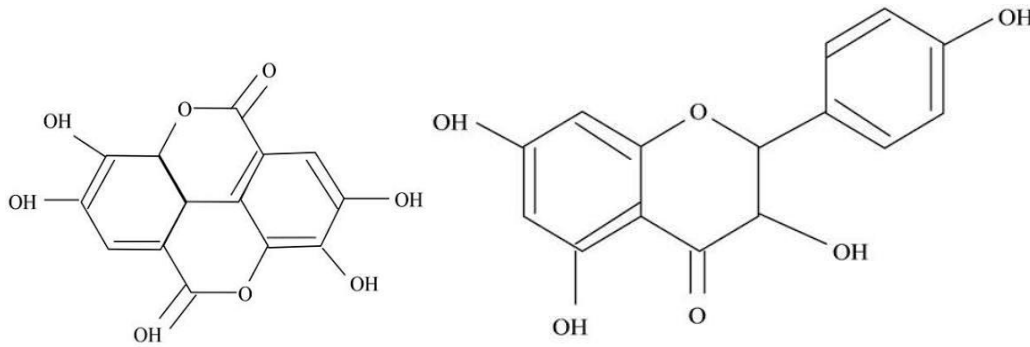
4. Myrtaceae: -

Myrtaceae or the myrtle family is a family of dicotyledonous plants placed within the order myrtales. Myrtle species are woody, contain essential oils, and have flower parts in multiples of four or five. Recent estimates suggest the myrtaceae include approximately 5950 species in about 132 genera. The family has a wide distribution in tropical and warm temperate regions of the world. The hydrocarbons and organic heterocyclic compounds produced by a plant species then the active phytochemicals are hydrocarbon compound based such as eugenol, Isoprenoid, essential oil etc. These family shows the following biological activities such as antioxidant, insecticides, antifungal, bactericidal etc. Example-

a) *Syzygium cumini* L¹²⁴: -

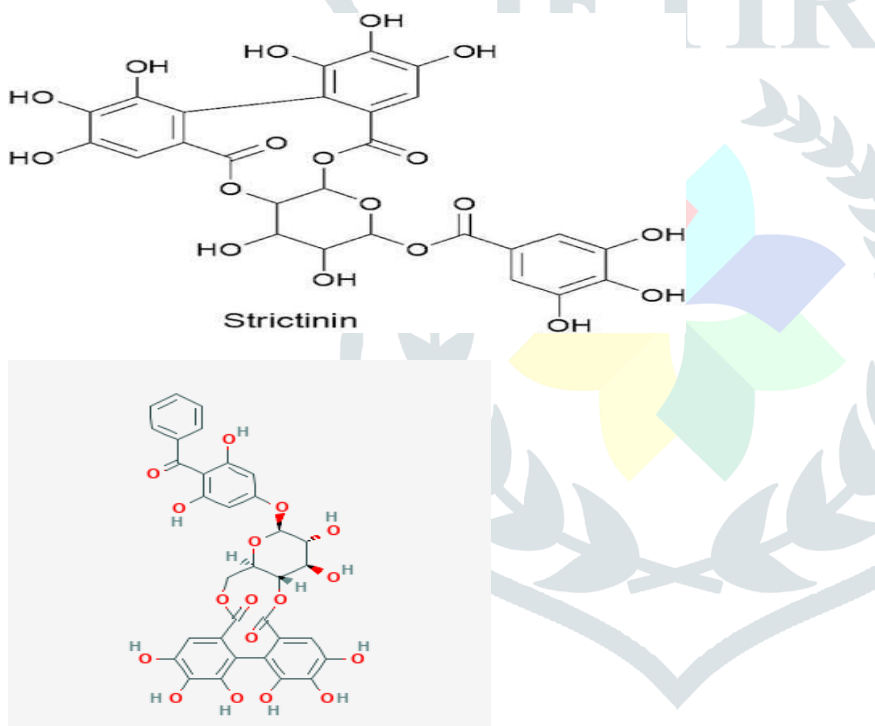
It consists of nature fruits and dried seeds of *syzygium cumini* belonging to family myrtaceae. It is commonly called as jamun, jambul. Chemical constituents are Anthocyanin, Delphinidine-3- gentiobioside, Ferulic acid and Jambosine, Jamboline. Methanolic or ethanolic seed powder and seed extract is one of the best medicines for this treatment of diabetes. It shows

antidiabetic activity with alloxan and STZ induced rats. It decreases the glucose level and increase hepatic glycogen, dosing of alloxanized rats 2.5 - 5 g/kg b.w. and 500 mg/kg b.w. of seed powder by STZ induced diabetic rats with presence of Standard drug is glibenclamide dose as 5 mg/kg b.w. Structure- Jambosine, Jamboline



b) *Psidium guajava*¹²⁵: -

The plant consists of leaves and fruits of *Psidium guajava* belonging to family Myrtaceae, known as guava. It was easy for them to use it as natural treatment for diabetes for more than two chemical constituents are flavonoid, strictinin, isostrictinin, guavin A and B, polysaccharide etc. It also decreases the glucose level by given orally 100-400 mg/kg as STZ induced diabetic rats. Aqueous and methanolic extract of *Psidium guajava* are useful for the control and treatment of diabetes. Structure – strictinin, guavin B



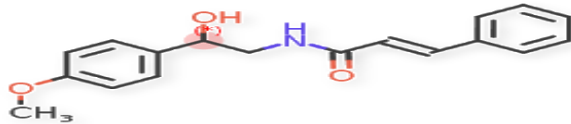
Other plants of myrtaceae family is *Eucalyptus citriodora* (lemon eucalyptus), *Eucalyptus globulus labill* (Eucalyptus), *Syzygium alternifolium walp*(shahajire) etc.

5. Rutaceae: -

Rutaceae the rue family of flowering plants, composed of 160 genera and about 2070 species. Rutaceae includes woody shrubs and trees and is distributed throughout the world, especially in warm temperate and tropical regions. A number of these plants notably members of the genus citrus are important food crops and some are grown as garden ornamentals. Rutaceae family plant used traditionally in case of gastritis, gingivitis, diarrhea, cancer, ulcer, kidney ache, gonorrhea, diabetes as well as laxative etc. The active phytochemicals are flavonoid, alkaloid, coumarin, triterpenoid, carbazole, stigma sterol, polysaccharide etc. Example-

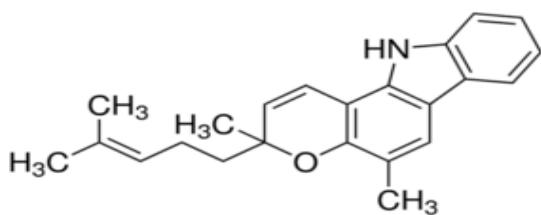
a) *Aegle marmelos*¹²⁶: -

Aegle marmelos is known as Bengal quince, bel or bilva, golden apple. *Aegle marmelos* leaf, seed, fruits ethanolic and aqueous extracts have shown antidiabetic activity. The active constituents are aegeline 2, coumarin, flavonoid, alkaloid are decreases glucose and glycosylated Hb, increase c-peptide and glucose tolerance. The *aegle marmelos* aqueous and ethanolic extract taken as p.o. or i. p. at 1 g/kg b.w. by STZ induced diabetic rat. Structure- Aegeline



b) *Murraya koenigii*¹²⁷: -

Murraya koenigii is popular in south India. It is also called as curry leaf or curry patta and is widely used as a condiment and spice in India. In normal and alloxan-induced diabetes, the aqueous extract of the leaves of *M. koenigii* produced a hypoglycemic effect. *Murraya koenigii* leaves play a role in the control of mild diabetic rats to moderate, severe, and type 1 diabetes. It suppresses blood glucose levels and is found to have a beneficial effect on carbohydrate metabolism. The active chemical constituents are Carbazole (Mahanimbine), alkaloid, flavonoid, taken as an extract dose at 2.5-5 mg/kg. Structure- Mahanimbine



Other plants of the Rutaceae family have beneficial antidiabetic action such as *Citrus limetta* (sweet lemon, mousambi), *Toddalia asiatica* Lam (orange climber), *Citrus maxima* Merr. (pomelo) etc.

6. Cucurbitaceae: -

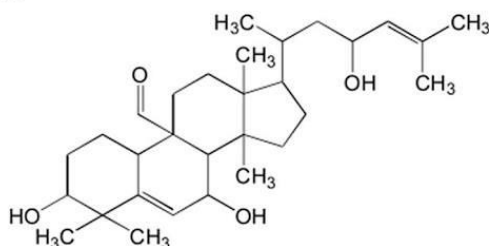
The Cucurbitaceae, also called cucurbits and the gourd family, is a plant family consisting of about 975 species in around 98 genera, mainly in tropical and subtropical regions. All species are sensitive to frost. The Cucurbitaceae family contains various phytochemicals like tannins, glycosides, terpenoids, carbohydrates, resins, carotenoids, and phytosterols. This family shows various pharmacological actions like hypocholesterolemic effect, antioxidant, wound healing, expectorant, antitumor, antimutagenic activities, antineoplastic activity, congestive heart failure, and diabetes.

a) *Momordica charantia* Linn¹²⁸: -

It is commonly known as bitter melon, Hindi - karela. Ethyl acetate and ethanol fruit extract shows the following phytochemicals such as alkaloids, carbohydrates, flavonoids, fatty acids, saponins, steroids, and terpenoids. Then *M. charantia* fruit extract reduces blood glucose levels as the present active chemical constituents are momordicin alkaloid, ascorbic acid, and charantin. The fruit extract dose taken orally 10-20 mg/kg by STZ-induced diabetic mice, and alloxan-induced diabetic rats at 50-100 mg/kg b.w. Other uses are stomachic, carminative, tonic etc.

Structure-

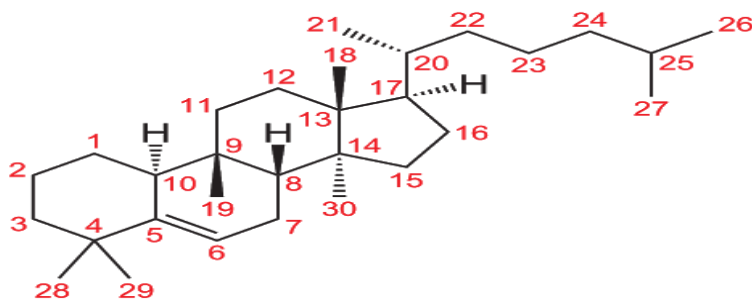
Momordicin



b) *Trichosanthes dioica* Roxb¹²⁹: -

T. dioica Roxb. is commonly called as patola and Hindi known as parwal. Aqueous extract of leaves at the dose of 800 mg/kg and 1600 mg/kg for 15 days orally exhibited significant hypoglycemic activity by stimulating insulin release from pancreatic beta cells by STZ-induced male albino rats. The standard groups are treated with glibenclamide dose of 0.5 mg/kg orally. Active phytochemicals of the aqueous extract of leaves are cucurbitacins.

Structure- cucurbitacin.



Other drugs of this family are *Citrullus colocynthis schrad* (bitter cucumber), *Coccinia indica* (ivy gourd), *Cucurbita ficifolia bouche* (Malabar gourd), *Cucurbita pepo* (pumpkins), *Telfairia occidentalis* (fluted pumpkin), *Momordica dioica roxb.* (spine gourd), *Luffa aegyptica mill.* (sponge gourd) etc.

Polyherbal formulation:

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 Charaka samhita, Sushruta samhita) is based on two principles.

- Use as single drug and
- Use of more than two drugs.

When two or more herbs are used in formulation they are known as polyherbal formulation. Different polyherbal formulation available in market.¹³⁰⁻¹³³

Sr. No.	Marketed formulation	Ingredients	Manufacturer
1	Asanand	<i>Ganasar, arguna, ladhra, kanth, karanja, shirish, palash.</i>	Ayurveda Rasashala Pune
2	Diabet capsule	<i>Curcuma longa, concinium fenestratus, strychnos, Potatorum, Tamarindus indica, Tribulus terrestris, phyllanthys reticulates.</i>	Lamedicca India Pvt. Ltd. Haryana
3	Dihar Powder	<i>Syzygium cumini, momordica charantia, emblica officinalis gymnema sylvestra, enicostemma littorale, azadirachta indica, tinospora cordifolia, curcuma longa.</i>	Rajsha Pharmaceuticals, Gujarat
4	Panvli	<i>Karvas, yashiti, panvelley, gudmar, gulvel, kanth, haldi, amla</i>	Panvelly Herbal Product, Rajkot
5	Madhumehari	<i>Vijaysar, kitaj, kulri, methi, shilajeet, trivang-nag suvarnamakshik bhasm</i>	Shrivaidyanath Jhansi, Uttar Pradesh
6	Karneem plus	<i>Karela, neem, tulsi, kulki, sounth, shudha guggul</i>	Universal Medicament Pvt. Ltd, Nagpur
7	Hyponidd	<i>Haldi, jambuphal, trivangbhasm, chirait, shilajeet, senna, amla, gudmar, kuaj, gulve.</i>	Charak Pharma Pvt. Ltd. Mumbai
8	Adcaps	<i>Haldi, jambuphal, amla, mamajov, neem, karela, vijaysar, tejbai, gulvel, sudha guggul, trivangnag, suvarnamakshikbhasm, shilajeet, Ashok, madhunashi.</i>	Doctors Pharmaceuticals, Haryana
9	Diabecon	<i>Gymnema sylvestre, pterocarpus marsupium, glycyrrhiza glabra, casearia esculenta, syzygium cumini, Asparagus racemosus, Boerhavia diffusa, sphaeranthus indicus, tinospora cordifolia, swertia chirata, tribulus terrestris, phyllanthus amarus, Gmelina arborea, gossypium herbaceum, berberis aristata, Aloe vera triphala, commiphora wightii shilajeet, momardica, haldi, charantia, piper nigrum, tulsi A butilon indicum, Rumex maritimus.</i>	Himalaya, Pune
10	Pancreatic tonic 180 cp	<i>Cinnamomum tamala pterocarpus marsupium, Gymema sylvestre,</i>	Ayurvedic herbal supplement, Pune

		<i>momordica charantia, Syzygium cumini, Trigonella foenum graceum, neem, racemosa, aegle marmetos.</i>	
11	Dia-care	<i>Sanjeevan mool, Himej, Jambu beej, kadu, namejav, neemchal</i>	Admark herbals limited, Gujrat
12	Diabetes – Daily care	<i>Appha lipoic acid, cinnamon, 4%, chromax, vanadium, fenugreek 50% extract, gymnema sylvestre 25%, momordica 7%, licorice root 20% extract.</i>	Nature's health supply, Camarillo.
13	Diabecure	<i>Juglans regia, Berberis vulgaris, Erythrea centaurium, millefolium, Taraxacum</i>	Nature beautic santé, Canada
14	Diabeta	<i>Gymnema sylvestre, vincarosea, turmeric, neem, kino tree, bitter gourd, black plum, black babhul, ginger, tinospora cordifolia</i>	Ayurvedic cure, Ayurvedic Herbal Health products,
15	BGR-34	<i>Berberis aristata, pterocarpus marsupium, gymnema, sylvestre, rubia cordifolia, Trigonella foenum graecum, Tinospora cordifolia, purified shilajatu.</i>	Aimil Pharmaceuticals, New Delhi.
16	Ayurveda alternative herbal gormula to diabetes	<i>Gurmar, karela, pushkarmool, jamun guti, neem, methika, guduchi.</i>	Chakrapani Ayurveda, Jaipur
17	Madhumeha kusumakara Rasa	<i>Suvarnayukta, mamojiaka Ghana, haridra, amalaki, shuddha shilajatu, guduchi, yashada, bhasma bilva patra swara, asana kwath.</i>	Shree Dhoothapapeshwr limited, Mumbai
18	Zpter	<i>Vijayasara, Dalchini, haridra, haritaki, bibhitaki, amalaki, chtrak, jasad, bhasma, guduchi, madhunashini.</i>	Om Pharmaceutical Limited, Bangalore
19	HypoNIDD	<i>Yashad bhasma, shilajit, karela, haridra, tarwar, amalaki, raja jambhu, mamejava meshashringi, vijaysaar, guduchi, neem, kirat, tikta.</i>	Charak Pharma, Mumbai
20	Dabur madhu Rakshak	<i>Amla, Tejpatra, vijaysar, gurmar, jamun seed, kali marich, neem leaves, methi, bahera, bhavasa dravyas, shudh shilajit, karela fruit, hareetaki.</i>	Dabur, Ghaziabad
21	Madhumehari granules	<i>Gudmar, Jamun guthali, gulvel, karela beej, khadiv, churna, haldi, amla, vijaysar, Tejpatra, shilajit, gularphal chuma, ktki, chitrak, methi, neem, bilwa patra.</i>	Baidyanath, Kolkata.

Discussion -

The term Diabetes mellitus includes several different metabolic disorders that aa, if left untreated, result in abnormally high concentration of a sugar called glucose in the blood. DM Type 1 results when the pancreas no longer produces significant amounts of the hormone insulin, usually owing to the autoimmune destruction of the insulin producing β cells of the pancreas. DM Type 2, in contrast is now thought to result from autoimmune attacks on the pancreas and insulin resistance. The pancreas of a person with type 2 diabetes may be producing normal or even abnormally large amount of insulin. The main goal of diabetes management is as far as possible, to restore carbohydrate metabolism to a normal state. Moreover, uncontrolled diabetes leads to many chronic complications such as blindness, heart disease and renal failure etc. for this, therapies developed along the principles of western medicine (allopathic) are often limited in efficacy, carry the risk of adverse effects and are often too costly, especially for the developing world. Therefore, treating diabetes mellitus with plant derived compound which are accessible and do not require laborious pharmaceutical synthesis seems highly attractive. The study revealed that 108 plant species belongs to different families were generally used for treatment of diabetes. The majority of the experiments confirmed the benefits of medicinal plants with hypoglycemic effects in the management of diabetes mellitus.

Among the plants used for the diabetes, *Annona squamosa, Momordica charantia, Morus alba, Allium sativum* and *Aegle marmelose* seems to be most common plants used to treat diabetes and are available everywhere. The detailed natural plants not only used for the treatment of diabetes, but also treated for other ailments also. The fruits were most commonly used plant parts and other parts leaf, root, stem bark, flower and whole plant are also useful for curing. Selective medicinal plant species from India and showed that they have antidiabetic activity. In addition, many of these species have a phenolic content, phytosterols, alkaloids, saponins and flavonoids etc. there are various types of phytoconstituent present in the plant material belonging to different chemical classes. Phytoconstituents like alkaloids inhibits alpha glucosidase decrease glucose transport

through the intestinal epithelium. Imidazoline compounds stimulate insulin secretion in a glucose dependent manner. Polysaccharides increase the level of serum insulin, reduced the blood glucose level of serum insulin, reduce the blood glucose level and enhance tolerance to glucose. Flavonoids suppress the glucose level, saponin stimulates the release of insulin and blocks the formation of glucose in the blood stream.

However, an overall ranking of the antidiabetic strength of these plants cannot be determined because of the different experimental methods used in various studies, we have focused to compile the data available on plants belonging to several different families to understand their therapeutic use and their potential antidiabetic activities. It requires biological testing of plant extracts, isolation of bioactive components, as well as toxicological, pharmacodynamical and ultimately, clinical studies. Indian medicinal preparations are often considered being effective due to a mixture of active ingredients rather than a single constituent. To make herbal therapies more effective, it is pertinent to isolate antidiabetic molecules, define their targets for understanding their modes of action and establish structure and function relationship for better efficacy and pharmacokinetic profile.

Conclusion –

DM (diabetes mellitus) is a syndrome, initially characterized by loss of glucose homeostasis resulting from defects in insulin secretion, insulin action both resulting in impaired metabolism of glucose and other energy-yielding fuels such as lipids and proteins. Currently, many countries face large increases in the number of people suffering from diabetes. Diabetes is possibly the world's fastest growing metabolic disease and as knowledge of the heterogeneity of this disorder increases, so does the need for more appropriate therapies. In India around 85% of diabetic patient belong to the NIDDM type. These patients are given oral hypoglycemic agents like Sulfonylureas and Metformin are available for the treatment of NIDDM. They reduce hyperglycemia by different mechanisms. Traditional plant medicines are used throughout the world for the management of diabetes because it is easily and cheaply available. The scientific validation of several plant species has proved the efficacy of the botanical in management of diabetes acting through various mechanisms. However, many herbal remedies used today have not undergone careful scientific assessment and few of them have the potential to cause serious toxic effects and major drug to drug interaction. Therefore, there is a tapping need to search and develop new herbal formulations and nutraceuticals from natural resources especially with pure phytochemicals for the treatment of diabetes and to avoid serious diabetic complications. The potency of herbal drugs is significant and they have negligible side effects than the synthetic antidiabetic drugs. There is increasing demand by patients to use the natural products with antidiabetic activity. In recent times there has been renewed interest in the plant remedies. Plants hold definite promises in the management of DM. Isolation and identification of active constituents from these plants, preparation of standardized dose and dosage regimen can play significant role in improving the hypoglycemic action.

The aim of the present study is to give complete information about diabetes and herbal plants, major family which shows the potential antidiabetic activity, its Traditional and polyherbal formulations available in market for diabetes that are alternatives to synthetic medicines. Herbal medication of diabetes is much better than allopathy. In this article there are detail information about 21 formulations and 120 plants with antidiabetic activity are mention.

Conflict of interest: -

This study was self-funded by the authors and they have no financial or proprietary interest in the subject matter or material discussed.

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