Based Therapies for Diabetes Mellitus: A Natural Approach to Glycemic Control

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***Abstract*—Diabetes mellitus, the most common endocrine disorder globally, is a bunch of metabolic diseases marked via chronic hyperglycemia because of impaired insulin secretion or function. While conventional treatments are widely used, their associated side effects have led to increased interest in alternative therapies, particularly herbal medicines with anti-hyperglycemic properties. Traditional healthcare systems worldwide have long utilized medicinal plants to manage diabetes, yet many of these botanicals remain scientifically unexplored. Although several plants have demonstrated promising anti-diabetic effects, plant-based remedies have not yet advanced to replace conventional drugs. Continued research focusing on the standardization of dosages and the identification of active compounds is essential for the integration of herbal treatments into mainstream diabetes care. This growing field holds the potential for developing effective, natural alternatives for long-term glycemic control.**

I. INTRODUCTION

"Passing through" is the etymological meaning of the phrase diabetes. 'Dia' means through, and 'betes' means pass. These two Greek words are the origin of the word diabetes. [1] Diabetes mellitus is a non-infectious illness characterized by carbohydrate metabolic disturbances that cause hypoglycemia. [2]

It was noted that "sweet urine" and muscle atrophy are signs of diabetes. Insulin, which is produced via the pancreatic beta cells, keeps maintain normoglycemia. When When blood sugar increases, the beta cells of the pancreas react by secreting insulin, which maintains a steady blood glucose level. The result of diabetics producing little to no insulin is hyperglycemia. [3]
Diabetes mellitus can be categorized into three primary types: type 1, type 2, and type 3. Additionally, there is gestational diabetes, which occurs during pregnancy. Type 1 diabetes is too identified as insulin-dependent diabetes mellitus. This kind of diabetes is brought on by defective pancreatic islets of Langerhans contain beta cells. Insulin-independent diabetes, remains caused by a transient reduction in beta cell mass. It is inherited and particularly prevalent in obese people. [2]

It is associated with elevated cholesterol levels. When type 2 diabetes is treated, insulin production rises and insulin resistance falls. Hyperglycemia in expecting moms is a hallmark of gestational diabetes, a type of diabetes mellitus. In 2–4% of pregnancies, it usually manifests in the second or third trimester. [4]

Diabetes is a chronic disease considered by elevated not eat and postprandial blood sugar stages. Globally, the occurrence of diabetes mellitus is expected to have risen 5.4% by 2025, up from 4% in 1995. [5] Diabetes is a complicated disease that causes many complications and calls for a range of treatment approaches. Diabetes patients may either produce insufficient amounts of insulin or their cells may not respond to it. If a patient had a total insulin deficiency, they were given insulin shots. Type 1 diabetes is treated with sulphonylureas, which block ATP-sensitive potassium channels and trigger the release of insulin from the pancreas. With biguanides, insulin resistance is reduced. [6]

According to a 2016 International Diabetes Foundation [IDF] poll, there are currently over 415 million diabetics international, and through 2040, that number is prophesied to increase near 642 million. [7]

Diagnosis of diabetes mellitus
Diabetes mellitus can be detected via testing blood glucose level. In the most of healthy people, blood sugar levels can reach 160 mg/dL after meals and are

80 mg/dL while fasting. One of the available diagnostic tests is glycohemoglobin. [8]

Pathophysiology of diabetes mellitus

One important aspect of the Diabetes pathogenesis is Stress caused by oxidation. Oxidative distress is characterized by a deficit in the production of species that are reactive to oxygen, which can operate as either free of enzymes or catalytic is called antioxidants. Reactive oxygen compounds encompass non-radical entities such as peroxide that contains hydrogen as well as free radicals like hydroxyl, peroxyl, and superoxide.

Antioxidants contain trace elements, carotenoid, Glutathione reductase along with vitamins A, C, and E function as antioxidants. Lipoprotein cholesterol of low density becomes oxidatively modified by reactive oxygen species. These reactive oxygen species may promote a number of harmful pathways that have a substantial impact on the development of diabetes. Important pathways include the glucosamine route, the electron transport chain, and sorbitol aldose reductase.

Amylin, pancreatic beta cell dysfunction, atherosclerosis, and advanced glycation end products can all result from stimulating these pathways and mechanisms of action. Cell defence against oxidative stress has been shown to be significantly influenced by certain DNA sequence binding factors and associated negative regulators. [9]

Herbal Remedy

For medical professionals, the most urgent issue is how to manage diabetes mellitus without having unintended consequences. 800 plants are utilised to treat illnesses, accordingtothediabetic benefits in clinical research; on ly 109 of these plants have a full mode of action. Traditional medicinal plants with active ingredients W orld Ethnobotanica diabetes.

First 450 medicinal plants have been found to Have insulin-sensitizing effect were employed by physicians.

Malignant anaemia, oedema, migraines, vomiting, diarrhoea, and fainting can all result from Man-made therapeutics used to regulate glucose in diabetics. Because they have less negative effects and side effects than synthetic treatments, Herbal therapies have been identified as a promising substitute.

Prescription-free herbal formulas are easily accessible. When chemical medications don't work to treat life-threatening illnesses, they are used. Medications made from herbs are safe and natural. Unlike manufactured drugs, herbal remedies are permanent cures for illnesses. Herbal remedies for diabetes mellitus include natural herbs, herbal fruits, and vegetable extracts that don't cause any negative side effects. Contrarily, chemical drugs are produced and have adverse consequences. The cost of herbal formulations is lower than that of allopathic drugs. [11]

LIST OF IMPORTANT HERBAL PLANTS HAVING ANTIDIABETIC POTENTIAL

S. No.	Plants name	Family	Active constituents	Mechanism of action	Part of plants
1.	Allium sativum	Lilliaceae	Allicin	enhance plasma lipid metabolism and antioxidant activity.	Bulb
2.	Carica papaya	Caricaceae	Papain, chymopapin	Lower levels of triglycerides and fasting blood sugar	Seed
3.	Aegle marmelos	Rutaceae	Aegle marmelosine	Boost the pancreatic β cells' performance.	Leaves
4.	Curcuma longa	Zingiberaceae	α-phellantrene, tripinolene	decreases blood sugar, enhance glucose metabolism, and may activate insulin.	Powdered form
5.	Cinnamomum cassia	Lauraceae	Cinnamaldehyde eugenol	enhances the insulin receptor's sensitivity	Underground stem
6.	Eugenia jambolana	Myratceae	Oleanolic acid, ellagic acid	inhibited the kidney's and liver's insulinase activities.	Pulp of fruit
7.	Cinnamomum tamala	Lauraceae	Linalol, β-caryophyllene	In the kidney and liver, insulinase	Leaf

				activity was suppressed.	
8.	Ocimum sanctum	Labiatea e	Eugenol	Elevated secretion of insulin	Wh ole pla nt
9.	Phyllanthus emblica	Euphorb iaceae	Phyllant hin	decrease in blood sugar levels	Lea f
10.	Mangifera indica	Anacardi aceae	β-carotene α-carotene	decreased intestinal absorption of glucose	Lea ves ext ract
11.	Coriandrum sativum	Apiacea e	Linalool p-cymene	reduces serum glucose and raises β-cell activity.	See d ext ract
12.	Catharanth us roseus	Apocyna ceae	Vincristi ne vinblasti ne	Bringing down the glycaemic	Lea f juic e
13.	Aloe borbadensis	Liliaceae	β-sitosterol	increases inadequate glucose tolerance.	Lea f pul p ext ract
14.	Allium cepa	Liliaceae	Dipropyl disulphi de oxide	boosting the intake of glucose while enhancing antioxidant activity and plasma lipid metabolism .	Dri ed po wd er
15.	Azadirachta indica	Meliacea e	Azadirac hitin nimbin	Epinephrin e's glycolytic effect was avoided.	Lea f ext ract s
16.	Annona squamosa	Annonac eae	Lirioden in	Boost your ability to tolerate glucose.	Lea f ext ract
17.	Brassica juncea	Brassica ceae	Sulforap hane	Boost the production of glycogen.	Aq ueo us see d ext ract
18.	Coccinia indica	Cucurbit aceae	Glutami c acid Asparagi ne	reduced blood glucose levels as a result of glucose synthesis inhibition.	Eth ano lic ext ract of wh ole pla nt
19.	Cinamomu m cassia	Lauracea e	Eugenol	increases sensitivity to insulin receptors	Bar k
20.	Zingiber officinalis	Zingiber aceae	Gingerol shogaol	raises insulin levels.	Rhi zo me
21.	Trigonella foenum	Fabacea e	4-hydroxy isoleucin e	reduce insulin resistance, increase insulin synthesis, and decrease blood sugar.	Eth ano lic ext ract of lea ves
22.	Terminalia arjuna	combert aceae	Arjunic acid, Arjunoli c acid	lowers G6P activity and blood glucose levels.	Dri ed ste m
23.	Ficus bengalensis	Moracea e	Leucode lphinidin	increased release of insulin from cells.	Ste m bar k
24.	Murraya koenigii	Rutaceae	Glycolip ids Phospho lipids	reduces gluconeoge nesis and glycogenol ysis while increasing glycogenesi s.	Lea ves ext ract
25.	Hibiscus rosa-sinesis	Malvace ae	Polyphe nols Anthocy nins	Start releasing insulin from the pancreatic β-cells.	Flo wer s
26.	Camellia sinensis	Theacea e	Catechin s caffeine	action against hyperglyce mia An Antioxidant	Lea ves
27.	Emblica officinalis	Phyllant haceae	Gallic acid Ascorbic acid Catechol	Reduce the peroxidatio n of lipids.both hypoglyce mic and antioxidant.	Fru its
28.	Eugenia uniflora	Myrtace ae	Caroteno ids Querceti n	Lipase activity is inhibited by hypoglyce mia.	See ds
29.	Swertia chirayta	Gentiana ceae	Swertam arin swerchir in	Encourage the islets to release more insulin.	Ro ots

(Table.1)
Herbal Plants with Antidiabetic Properties and Associated Therapeutic Effects

For the treatment of diabetes, a variety of herbal therapies are recommended. Most of these mixes contain medicinal plants. Table 1 lists a number of medicinal plants' anti-diabetic and associated qualities [41].

Eugenia jambolana (Jamun / Java Plum)

(Fig.1)

Family-Myrtaceae
Common name-Indian gooseberry
Geographical source-India, Srill Lanka
Active constituent - anthocyanins, tannins, gallic acid, and flavonoids,
In our country, decoctions of eugenia jambolana kernels are used in home treatment for reduce diabetes. Eugenia jambolana has an antihyperglycemic action and lowers blood sugar levels. Eugenia jambolana was also shown to have anti-asthmatic, antistress, antibiotic, antifungal, antiviral, antitumor, stomach anti-ulcer, antioxidant, reducing mutation risks and promoting immune properties. [42]

Momordica charantia (Bitter guard)

(Fig 2)

Family-Cucurbitaceae
Common name-Bitter Gourd
Geographical source-India
Active constituent - Charantin, vicine, glycosides, and polypeptide-p
Momordica charantia is a popular anti-diabetic medication in India. Plant extracts, fruit pulp, seeds, and leaves all have anti-hyperglycemic properties. M. charantia has a strong hypoglycemia impact delivery via the subcutaneous route to humans also langurs. M. charantia ethanolic extract (200 mg/kg) reduce blood sugar volume in both usual and STZ-diabetic mice. This inhibits the liver's fructose-1, 6-biphosphatase, and glucose-6-phosphate enzymes while growing the action of hepatic glucose-6-phosphate dehydrogenase. [43]
Aloe Vera and aloe barbadence

(Fig 3)

Family- Liliaceae
Common name-Aloe vera, True Aloe,
Geographical source-Africa
Active constituent - polysaccharides like acemannan and glucomannans
Aloe Vera gel, sometimes known as "aloe juice," is a mucilage or pulp made from leaves. Gel and latex are the two main parts of the plant that may be separated. Increased glucose tolerance can be achieved by using aloe gum extract. The pericyclic tubules that produce the bitter yellow liquid known as aloe juice are located just beneath the leaf's outermost layer of epidermis. [44] Aloe barbadensis leaves had a hypoglycemic impact on diabetics. Aloe Vera promotes the production of insulin by the pancreatic cells of beta. [45] The aloe plant are also helps diabetic mice heal their wounds and has anti-inflammatory properties. [46]

Trigonela foenum graecum (fenugreek)

(Fig 4)

Family-Fabaceae
Common name-Methi
Geographical source - Europe and Western Asia

Active constituent - 4-hydroxyisoleucine and steroidal
A frequent component of Indian species, fenugreek seeds can be found all around the country. Fenugreek seeds contain a new amino acid (4-hydroxyleucine) that raises blood sugar levels by stimulating the release of insulin from isolated human islets. [47] By restoring normal heart and muscular creatinine kinase activity, fenugreek seed administration improved glucose metabolism. Furthermore, fenugreek decreased the liver and kidneys' actions of fructose-1, 6-bisphosphatase, and glucose-6 phosphatase. [48]

Ocimum sanctum (holy basil)

(Fig.5)

Family -Lamiaceae
Common name -Tulsi
Geographical source - India
Active constituent - Methyl eugenol, rosmarinic acid, ursolic acid.
Ocimum sanctum, commonly referred to as tulsi, has held traditional significance for centuries herb's medicinal qualities have been acknowledged. The aqueous extract of Ocimum sanctum leaves dramatically reduced blood sugar levels. [49] The hypoglycemic effects of tulsi resulted in notable decrease in blood sugar, uronic acid, amino acid concentration, cholesterol, triglycerides, and total lipid content [50] Giving Tulsi extract orally at a dose of 200 mg/kg for 30 days led to a reduction in plasma glucose levels by around 9.06% and 26.4% respectively, this days 15 and 30 of the experimentation. Its antistress, antibacterial, antifungal, antiviral, anti-mutagenic, antioxidant, stomach antiulcer, biostimulant, and antiasthmatic properties were also demonstrated. [50]

Coccinia indica

(Fig.6)

Family - Cucurbitaceae
Common name - Ivy Gourd.
Geographical source - Africa and Asia
Active constituent - Saponins, flavonoids, sterols, alkaloids, tannins.
For six weeks, diabetics were given a dried extract of C. Subjects received 500 mg/kg body weight of indica.The enzym lipoprotein lipase (LPL) was restored by this extract, which raised untreated diabetes and lowered glucose-6-phosphate lactose dehydrogenase. When taken orally, Coccinia indica leaves showed a significant hypoglycemic effect. [53]

Allium Sativum

(Fig.7)

Family - Amaryllidaceae
Common name - Garlic
Geographical source - Central Asia
Active constituents- Alliin, allicin, ajoenes, vinyldithiins,
In India, this perennial herb is grown all around. Its strong aroma comes from a sulfur component, and it has been shown to have significant hypoglycemic effects. By encouraging the production of insulin by the pancreatic beta cells, it achieves this. [54] In contrast to sucrose controls, Oral dosing with 10 ml/kg/day of garlic homogenate in water was carried out and reduced fasting blood glucose and serum triglyceride levels while increasing Hepatic glucose reserves and free-form amino acids levels. [55]

Allium cepa

(Fig.8)

Family - Amaryllidaceae
Common name - Bulb onion or common onion.
Geographical source - Iran and Pakistan
Active constituents- phenolic acids, and ascorbic acid.
properties. 50 g of onion juice taken orally dramatically reduced postprandial glucose levels. [56] onion juice. [56]

Carica papaya:

(Fig.9)

Family - Caricaceae
Common name - Papaw
Geographical source - Southern Mexico and Central America
Active constituents- Saponins, glycosides, flavonoids, phenolic compounds,
Carica papaya extract reduces Blood sugar and serum cholesterol values observed in the body and facilitates wound healing.

Catharanthus roseus

(Fig.10)

Family - Apocynaceae
Common name - Madagascar periwinkle, periwinkle, rosy periwinkle, and vinca.
Geographical source -Native to the island of Madagascar in the Indian Ocean.
Active constituents-vincristine, Vinblastine, vindoline, and catharanthine
Vinca roseus is another name for this plant, which is a member of the Apocynaceae family. Methanolic preparations of Catharanthus roseus leaves and twigs reduce blood sugar levels. Oral delivery of leaf material at 500 mg/kg body weight was carried out and twig extract effectively reduced blood glucose levels. [58]

Mangifera indica

(Fig.11)

Family -Anacardiaceae
Common name - Mango
Geographical source - Myanmar, Bangladesh, and northeastern India.
Active constituent-Phenolic acids, flavonoids, carotenoids, and vitamins like ascorbic acid.
Often referred to as a mango, it belongs to the Anacardiaceae family. Mangifera indica leaf extract (250 mg/kg) provides anti-diabetic effects.
Nigerian traditional medicine uses the plant's leaves as an antidiabetic, although oral aqueous extract did not change blood glucose levels in rats with normoglycemia or streptozotocin-induced diabetes. Nevertheless, antidiabetic effects were shown when the extract and glucose were given at the same time, as well as when the extract was given to the rats 60 minutes prior to the glucose. According to the findings, Mangifera indica aqueous extract has hypoglycemic properties. This might result from a decrease in intestinal glucose absorption [38].

POLYHERBAL MARKETEDFORMULATIONS

Diabetic patients frequently take the many anti-diabetic herbal formulations available on Traditional Indian medicine includes various forms like Vati, Churna, Arkh, and Quath in its commercial offerings and others, on the recommendation of their physicians. [60] important herbal mixtures Available in the form of traditional decoctions and plant-based tinctures, infusions, and powders. Two tenets form the foundation of Ayurvedic medicine:

(a) Given in monotherapy form, and (b) as a combination of multiple drugs. Polyherbal compositions contain more than two drugs. [60]
The market offers a wide variety of polyherbal formulations, such as:

Diabeta Plus:-

Effective immunomodulators, antihyperlipidemic, anti-stress, and hepatoprotective plant extracts are added to an anti-diabetic capsule-based ayurvedic treatment.
Diabeta's formulation consists of derived from olden Ayurvedic texts. It is a safe and efficient treatment that helps Used as a supportive treatment to mitigate resistance to standard oral hypoglycemics in uncontrolled diabetic patients. [61]

1. Active Constituents

The primary herbal ingredients in Diabeta Plus include:

- **Gymnema sylvestre** (Gurmar)
- **Pterocarpus marsupium** (Vijayasar)
- **Syzygium cumini** (Jamun)
- **Momordica charantia** (Bitter melon)
- **Catharanthus roseus** (Madagascar periwinkle)
- **Shilajit (Asphaltum)** – commonly included though often not listed, implied by similar formulations.

2. Mechanism of Action

1. **β-Cell Regeneration & Insulin Secretion**
   Acts on pancreatic β-cells, potentially regenerating them and boosting endogenous insulin production.

2. **Insulin-Mimetic Effects**
   Constituents mimic insulin action, enhancing glucose uptake in peripheral tissues and improving oral glucose tolerance.

3. **α-Glucosidase Inhibition**
   Gymnema and Jamun slow carbohydrate absorption, lowering post-meal glucose spikes.

4. **Antioxidant & Hepatoprotective Actions**
   Bitter melon and other herbs offer antioxidant protection and are reputed to support liver health and reduce oxidative stress.
5. **Immunomodulatory & Antihyperlipidemic**
   Some components support lipid lowering and immune response, helping overall metabolic health.

3. Clinical Efficacy & Treatment Regimen

- **Herbal mechanistic evidence**:
  - Studies affirm gymnemic acid, epicatechin, jamun alkaloids flavonoids, and triterpenes have hypoglycemic activity.
  - Formulation claimed to decrease insulin resistance, polyuria, pruritus, and pain.
- **Dosage Guidelines**:
  - Suggested dose: 2 capsules twice daily before meals for non-insulin dependent individuals; 4–6 capsules twice daily for insulin-dependent ones.
  - Other sources recommend 1–2 capsules daily after meals, based on commercial labeling .
- **Empirical effectiveness**:
  - Used as monotherapy or adjunct, reported to improve fasting/post-prandial glucose, lipid profile, and symptomatic comfort.

4. Side Effects & Adverse Effects

- **Generally well tolerated**
  Herbal blends are usually mild; no serious adverse events reported.
- **Possible mild effects**
  May cause slight gastrointestinal upset (e.g., nausea), tolerable in most users.
- **Drug interactions & precautions**
  As a hypoglycemic, it may cause low blood sugar, especially when combined with conventional antidiabetic drugs—monitor glucose levels carefully.
- **Specific contraindications**
  There's little data for use in pregnancy, lactation, children, or with specific comorbidities—consult a physician prior to use.

Dia-Care Churna

Dia-Care is made by Admark Herbals Ltd. works in 90 days for together Type 1 and Type 2 diabetes. There are six phases of the treatment, each lasting ninety days. Before filtering, combine around 5g (1 teaspoon) powder with ½ glass of water, swirl thoroughly, and let sit overnight. Filtrate is taken without food in the morning. [63]

Active Constituents

Dia-Care is a multi-herbal Ayurvedic powder combining 20+ ingredients. Commonly listed components include:

- Jambubeej (*Eugenia jambolana*, Jamun)
- Neem bark (*Azadirachta indica*)
- Guduchi (*Tinospora cordifolia*)
- Methi seeds (*Trigonella foenum graecum*)
- Karela (*Momordica charantia*)
- Gudmar (*Gymnema sylvestre*)
- Kariyatu (*Swertia chirata*)
- Amla (*Emblica officinalis*)
- Mamejava (*Enicostemma littorale*)
- Plus: Haridra (turmeric), Gokshur, Pippali, Shilajit, Ashwagandha, Jeera, Sindha namak, Sunth, Nagod, Glycyrrhiza, Haldi, among others.

2. Mechanism of Action

Dia-Care combines herbs with complementary antidiabetic effects:

1. ↓ **Blood Glucose**:
   - Gymnema, Jamun, bitter melon, neem, and methi seed exert hypoglycemic action via improved insulin secretion, insulin receptor sensitivity, and modulation of carbohydrate metabolism.
2. **Antioxidant Activity**:
   - Ingredients like amla, turmeric, Guduchi, and neem scavenge free radicals and reduce oxidative stress.
3. **Lipid/Metabolic Support**:
   - Gokshur, gudmar, turmeric, and coriander support healthy lipid profiles and metabolic processes.
4. **Immune Modulation**:
   - Tinospora, turmeric, amla, and ashwagandha stimulate immune responses .
5. **Digestive & Hepatic Support**:
   - Spices like ginger, pippali, cumin, and Shilajit support digestion, liver detoxification, and glycemic regulation.

3. Treatment Timeline & Dosage

- **Initial response** typically appears within 3–4 weeks: ~75% report improved energy, reduced urination, and cramping.
- ~15–20% respond in 4–6 weeks, ~5% may take up to 12 weeks; a small percentage may require longer than 6 months.
- **Dosage**:
  - Standard: 3 g powder (approx 1 teaspoon), 1–2 times daily with lukewarm water before meals.
  - Alternative regimen: Take a soaked/latent powder solution (overnight steep) on an empty stomach.
- **Adjusting other meds**:
  - Monitor blood sugar every ~3 days; gradually taper conventional hypoglycemic agents or insulin as levels improve.

4. Side Effects & Adverse Effects

- **Common early effects**:Mild gastrointestinal discomfort or loose stools during the first 7–10 days due to the bitter taste; typically resolves as the gut adjusts.
- **Generally well tolerated**:No serious adverse reactions reported; no harmful interactions with conventional drugs noted.
- **Precautions**:May potentiate hypoglycemia when used with other antidiabetic medications—requires cautious dose adjustments.
  Limited data in pregnancy, pediatric use, or severe comorbid conditions—advise medical consultation.

Diabecon:

"Himalaya" manufactures a substance that enhances β-cell regeneration, liver and muscle function, and glucose intake. Diabecon is a safe drug that helps diabetics prevent long-term complications like retinopathy.

It also improved Clearance of both solid and semi-liquid exudates due to its anti-inflammatory qualities. Patients with NIDDM and IDDM may benefit from using Diabecon in addition to traditional treatment. [62]

Active Constituents

Diabecon is a multi-herbal formulation containing over 30 natural ingredients. Key components include:

- Gymnema sylvestre (gymnemic acids)
- Pterocarpus marsupium (epicatechin)
- Momordica charantia, Shilajit, Syzygium cumini, Tinospora cordifolia

2. Mechanisms of Action

1. **β-cell Regeneration & Insulin Secretion**
   - Enhances pancreatic β-cell repair and increases C-peptide/insulin
2. **Insulin-Mimetic and Sensitizing Effects**
   - Promotes glucose uptake in peripheral tissues; improves hepatic insulin responsiveness.
3. **α-Glucosidase Inhibition**

- Epicatechin delays carbohydrate absorption, reducing post-meal glucose spikes.

4. **Antioxidant & Anti-glycation Action**
   - Inhibits protein glycation and advanced glycation end-products (AGEs), protecting against chronic complications.
5. **Reduced Hepatic Gluconeogenesis**
   - Controls liver glucose production and increases glycogen synthesis

3. Clinical & Pre-clinical Evidence

Animal:
- Alloxan/STZ-diabetic rats treated with Diabecon (2 g/kg) showed significant glucose reduction, normalized enzyme profiles, antioxidant improvements

In vitro:
- Diabecon significantly inhibited glycation of albumin—blocks AGEs formation

Human Trials & Meta-analysis:
- PubMed-indexed review (354 patients) confirms reduced FBS, HbA1c, and post-prandial glucose with Diabecon; no deaths or serious organ toxicity; rare hypersensitivity or mild hypoglycemia observed.
- Double-blind RCTs (Mohan et al., Kohli et al., Seshaiah et al.) consistently demonstrated significant glycemic improvements as monotherapy or adjunct
- One study noted improved insulin and C-peptide levels

4. Treatment Rate & Dosage
- New-onset Type 2 diabetes (monotherapy): **2 tablets, twice daily before meals**
- As add-on with usual hypoglycemics/insulin: **1 tablet, twice daily before meals**
- Typical course duration: **3–6 months**, assess monthly.

5. Side Effects & Adverse Effects
- **Generally Safe**:
  - No serious hepatic, renal, or hematological toxicity reported in humans or 90-day animal studies (NOAEL ≥500 mg/kg/day).
- **Mild Effects**:
  - Rare gastrointestinal upset, mild hypoglycemia, and occasional allergic reactions.
- **Drug Interactions**:
  - Animal data suggest no significant PK interaction with glimepiride; some pharmacodynamic synergism occurs.
- **Precautions**:
  - Monitor when combined with conventional hypoglycemics to avoid hypoglycemia.
  - Not evaluated in pregnancy, lactation, or pediatrics.

Dianex:

When given orally at various doses, including 100, 250, and 500 mg for up to six weeks, Dianex was reported to elicit hypoglycemia activity in rats used to test a polyherbal formulation for antidiabetic efficacy. [64]

1. Active Constituents

Dianex is a **polyherbal formulation** comprising aqueous extracts of:
- **Gymnema sylvestre**
- **Eugenia jambolana** (Jamun)
- **Momordica charantia** (Bitter melon)
- **Azadirachta indica** (Neem)
- **Cassia auriculata**
- **Aegle marmelos** (Bael)
- **Withania somnifera** (Ashwagandha)
- **Curcuma longa** (Turmeric).

2. Mechanism of Action

a. Hypoglycemic Effect & Glucose Tolerance
- Reduces blood glucose in both normal and streptozotocin-induced diabetic mice acutely (2–6 h) and chronically (6 weeks).
- Enhances oral glucose tolerance in diabetic and healthy mice.

b. Pancreatic & Metabolic Benefits
- Promotes β-cell / islet regeneration—improves insulin secretion and C-peptide.
- In long-term studies, restored body weight and **reduced lipid markers** (triglycerides, cholesterol) as well as **liver and kidney enzyme levels** (ALT, AST, urea, creatinine).

- Increased hepatic glycogen and protein content in diabetic mice.

c. Antioxidant & Tissue Protection

- Free radical scavenging (ABTS+, DPPH, hydroxyl) in vitro.
- Histopathology confirmed reduced STZ-induced pancreatic and liver damage.

3. Treatment Efficacy (Preclinical & Clinical)

a. Animal Studies

- **Acute dose** (100–500 mg/kg) in mice: significant hypoglycemic action observed.
- **Long-term treatment** (250–500 mg/kg: 6 weeks): normalized biochemical and histological markers.

b. Human Study

- **Open-label, non-randomized clinical trial** (N = 37 completers; 11 monotherapy, 26 add-on):
  - Over **24 weeks**, saw significant reductions in HbA1c, fasting plasma insulin, insulin resistance, blood pressure.
  - No changes in liver, renal, or hematological safety parameters.

4. Dosage & Treatment Regimen

- **Animal dose translation**: 250–500 mg/kg/day in mice → human equivalent roughly 4–8 mg/kg/day (approx. 280–560 mg/day for a 70 kg adult).
- **Clinical use**: Typically, 1–2 tablets **three times daily before meals** (as per Unexopharma).

5. Side Effects & Adverse Effects

a. Safety in Animals

- No acute toxicity up to 10 g/kg in mice; subacute safety up to 2.5 g/kg in rats over 30 days.

b. Human Safety

- In the 24-week clinical trial, no adverse biochemical or clinical effects noted—entirely well-tolerated.
- Mild symptoms sometimes: gastrointestinal upset (occasional), no serious adverse events reported.

Benefits of herbal remedies over allopathic ones:

- The body's natural healing processes are not interfered with by herbal medications.
- Long-term advantages: to increase their efficacy, herbal medications frequently include dietary, relaxation, and exercise advice.
- Enhanced immunity through correcting bad habits and encouraging natural healing.
- A strong immune system, a nutritious food, and a healthy lifestyle can all lead to better nutrition and metabolism.
- Herbal remedies can be administered as prescribed by a trained professional and have few side effects.

Current scenario on Diabetes in India

According to a 2016 estimate According to the International Diabetes Federation (IDF), diabetes currently affects 415 million people globally, with According to Aroma World, 61.3 million Indians aged 20 to 79 suffer from diabetes. According to the most recent data from 2010, 285 million people globally (6.6%) between the ages of 20 and 79 have diabetes.

By 2030, 438 million individuals (7.8% of the adult population) are predicted to have diabetes. [65] Global healthcare costs for diabetes prevention and treatment, as well as its aftereffects, are projected to reach at least $376 billion in 2010. By 2030, this sum is expected to approach USD 490 billion. Eighty percent of people in emerging countries have diabetes, with China and India accounting for the majority of cases. In 2010, there were an estimated 50.8 million diabetics in India; by 2030, that figure is expected to increase to 87.0 million. The World Health Organization (WHO) reports that diabetes affects 2.7% of persons in cities and 5.6% of those in rural areas. [66] The "top 10" countries in the world for the total number of diabetics from 2010 to 2030 are listed in the table below.

Country	2030 (millions)	2010 (millions)	Country	Rank
India	87.0	50.8	India	1.
China	62.6	43.2	China	2.
U. S	36.0	26.8	U. S	3.
Pakistan	13.8	9.6	Russian Federation	4.
Brazil	12.7	7.6	Brazil	5.
Indonesia	12.0	7.5	Germany	6.
Mexico	11.0	7.1	Pakistan	7.
Bangladesh	10.4	7.1	Japan	8.
Russian federation	10.3	7.0	Indonesia	9.
Egypt	8.6	6.8	Mexico	10.

(Table.2)

CONCLUSION

Being the most frequently occurring endocrine ailment, diabetes mellitus affects millions of people globally. It remains a class of metabolic syndromes considered by abnormalities in insulin secretion or activity that result in hyperglycemia. People all throughout the world have successfully treated a variety of medical ailments with herbal remedies. Many diabetics are resorting to alternative therapies with anti-hyperglycemic qualities as a result of the negative effects of allopathic medications.

Herbal medicine is a popular alternative treatment for decreasing blood sugar. The countless additional plants that have been incorporated into conventional healthcare systems around the world, however, have not yet been thoroughly studied. Plant-based drugs haven't developed enough, nevertheless, to completely replace or reduce the need for current drugs. As this page discusses, numerous plants have been studied for possible anti-diabetic benefits, yielding some fascinating results.

However, research on herbal medicines continues in the hopes that we can eventually create a molecule that satisfies all the criteria for a drug and can replace synthetic ones. Recently, there has been a surge in interest in herbal plant Medicinal therapies are vital. In diabetes management, the prescribed drugs aim to regulate creation of standardized dosages as well as the extraction and identification of the active components from herbal plants can be crucial.

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