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Trends in Herbal Drug Development for Glycemic Control: New Insights on Medicinal Flora in India

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Abstract
Diabetes is a metabolic disorder characterized by mild to serious endocrine dysfunction which results in widespread physiological effects. The disease is of great medical interest because of its global prevalence. A spike in blood glucose levels may be caused by insufficient or absent insulin production in the pancreas. Despite the availability of pharmacological medications to control and cure diabetes, there is no remedy to guarantee full recovery. A number of herbal cures with hypoglycemic characteristics have long been recognized in various civilizations as alternatives to modern medications. Over 21,000 therapeutic plants have been identified by the World Health Organization (WHO) to treat various disease conditions and a number of them have proven efficacy. However, only 150 of India's 2500 plant species are economically significant, despite the fact that agriculture only employs a tiny fraction of the country's total. For medicinal plants, India is among the best places in the world to find medicinal herbs owing to enormous indigenous biodiversity. This article explores both traditional and natural anti-diabetic medications and presents the current status of few commercially accessible formulations.

Keywords: Anti-diabetic, Antioxidant, Indigenous Herbs, Metabolic disorder, Hyperglycemia.

Introduction:
High blood sugar, excessive cholesterol and raised amino acid levels are the four basic causes of diabetes mellitus. (Feldman et al. 1988) Vascular disorders, such as neuropathy, renal sickness, and cardiovascular disease, have been linked to it (Strojek et al., 2003). Diabetics run the risk of a shorter lifespan and suffer from secondary complications even in various other diseases. The start and progression of both microvascular and macrovascular diseases has been linked to long-term hyperglycemia (Altan et al., 2003).

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Diabetes mellitus is a major public health issue in the modern world (Lokesh & Amit, 2006). One of the risk factors for developing NIDDM is a rapid integration into the new culture. In the last several years, NIDDM has become increasingly common among diverse populations and ethnic groups of the world (Bennett & Knowler, 2000). Biguanides, insulin-like growth factor 1 (IGF-1), and glinides are now available as diabetic therapeutic alternatives, in addition to insulin. The cost and scarcity of basic necessities plague developing countries necessitating a desperate search for alternative cures.

Hypoglycemic medicines like insulin may cause vomiting, hyponatremia, flatulence, lactic acidosis, pernicious anaemia, and weight gain. Herbal medicines offer less unfavourable side effects and consequences than conventional drugs (Suryavanshi et al., 2022). According to ethnobotanical research, Indian herbs may be used to cure diabetes. The term 'Ayurveda' is used by ayurvedic doctors to brand their goods, which are made from medicinal herbs. There is minimal scientific evidence to support the use of complementary and alternative medicine (CAM) in the treatment of type 2 diabetes (Harris & Zinman, 2000). There has been an increase in the use of more complex multi-dietary regimens in CAM diabetic trials compared to past studies. For individuals with higher baseline HbA1c values, further study is required to determine if Ayurvedic treatment may assist in the prognosis of diabetes.

Diabetes and Insulin

In our systems, simple sugars such as glucose are the major sources of energy. Once digested, glucose enters the circulation and can only enter cells with the aid of insulin. Glucose enters the cells of the body through glucose transporters which are regulated by insulin hormone. Thus, insulin which is secreted by the pancreas, is necessary for the glucose to enter cells in the body. A spike in blood sugar levels raises one's risk of diabetes. An imbalance in the amount of glucose and any defect in the ability of cells to utilize it as a source of energy might indicate diabetes (Andrew 2000). In the presence of a specific insulin receptor on the cell membrane, insulin has the ability to influence many metabolic processes, including glucose, fat, and amino acid metabolism. The reversible activation of hormone receptors has no influence on the molecular structure of insulin. Uptake of the hormone-receptor complex occurs through an endocytotic process.

Normal reprocessing of insulin receptor membranes occurs as they degenerate. When the body's principal source of energy is depleted, blood glucose levels rise. Insulin resistance occurs when glucose is unable to enter cells. Glucose is piling up in the bloodstream, unable to be metabolized. The kidneys keep blood glucose levels stable by eliminating and excreting extra sugar from the body. The fact that diabetics consume more food than their non-diabetic counterparts is well known. Glycogen synthesis, hexokinase activity, and glucose absorption have all been linked to insulin resistance.

Objective of the study

1. Glycaemic management in Type 1 Diabetes may be improved by the use of herbal plants.

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2. To identify the effectiveness of herbal plants for glycaemic control in Type 2 Diabetes
3. To provide a list of plants that are used as folk medicine for the treatment of diabetes

Classification

Type 1 diabetes (Insulin-dependent diabetes)

This form of diabetes depends on the presence of insulin in the body. In type 1 diabetes, pancreatic islets of Langerhans lose the ability to synthesize and secrete insulin which leads to rise of blood in body fluids. Increased blood sugar is called hyperglycemia and is an essential feature of diabetes. Excess blood sugar leads to the formation of ketone bodies and in type 1 diabetes patients must rely only on exogenous insulin in order to prevent ketosis and thereby extend their lives.

Type 2 diabetes (Non-Insulin-dependent diabetes)

Existence of high blood sugar levels despite the presence of excess insulin or any defect in the mechanism of insulin action eventually leads to insulin resistance. There are both hereditary and non-genetic components to T2D, making it a difficult illness to diagnose.

Other specific forms of diabetes also exist and these include:

- Juvenile Diabetes which is of early onset and affects the younger population.
- Leprechaunism, which is a genetic abnormality in insulin action.
- Exocrine pancreas diseases, such as pancreatitis
- Endocrinopathies, such as acromegaly may trigger defects in glucose metabolism.
- Hyperglcemia may be induced by drugs or chemicals, such as glucocorticoids.
- Infections, such as rubella congenita may often lead to diabetes.
- Immune-mediated diabetes in unusual forms, such as “Stiff Man” syndrome.
- Downs syndrome, for example, is a genetic abnormality linked to diabetes (Torben, 2002).

Herbal medicines

Conventional medicines and natural remedies are often used together. Nosebleeds and various gastrointestinal issues are amongst the most prevalent side effects of PHFs (Poly-herbal formulations). Low-toxicity of Ayurvedic medications is a factor responsible for their increased popularity. According to ayurvedic principles, toxins accumulate in tissue and limit blood flow, resulting in diabetes. Disruptions in the normal biological cycle as well as inadequate eating and digestion are all probable causes of diabetes according to Ayurveda. Even though the validity of such beliefs about the origin of diabetes can be questioned yet the evidence confirming the efficacy of herbal medications in diabetes and other health conditions is enormous (Edwin et al., 2006). Ayurveda practitioners offer a wide range of natural treatments, including herbal cures, to their patients. Diabetes patients may benefit greatly from a number of Ayurvedic treatments which can be further supplemented by yoga and exercise. The prescriptions of Ayurvedic drugs are rigorously based on the medical history of patients and the efficacy of Ayurvedic drugs is nowadays determined by conducting controlled clinical investigations at several medical institutions (Eddouks et al., 2003). Ginger, jamun, karela, and methi are popular alternatives for diabetics

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looking for alternative treatment options because of their antihyperglycemic characteristics. The vast majority of pharmacists are eager to address the needs of their herbal product-using clientele (patients). Herbal treatments must be thoroughly tested in the modern world to assure their quality, safety, and efficacy. Indigenous herbs used in traditional medicine as antidiabetic medications were studied for their glucose utilization in an study (Gupta et al. 1986; Grover et al., 2003). In addition, the Ayurvedic method of treatment lays great importance on proper diet in managing Diabetes (Alam & Mahpara, 2003). The purpose of this study was to compile a list of plants historically used to treat diabetes and those whose anti-diabetic properties have been scientifically shown.

Ayurvedic Herbal Remedies for Diabetes

Here is a brief list of some common recommendations made by ayurvedic practitioners to diabetics (Roman Ramos et al., 1995):

- Bitter gourd or bitter lemon juice to be taken on an empty stomach every day.
- Two turmeric capsules to be taken three times a day.
- Rose apple stones powder to be consumed daily.
- Intake of fenugreek, musta, Arjuna, triphala, ajwan, and haritaki in tiny doses combined with butter.
- Amlaki powder, haldi powder, and honey to be taken twice a day.
- Fenugreek, white pepper, and turmeric powder to be taken twice a day with a glass of milk.
- Two times a day, before lunch and supper, consumption of a mixture of bay leaf, turmeric, and aloe vera gel.

As an additional Ayurvedic treatment to the previously mentioned easy and affordable methods, Vasantkusumakarras is available. Even though it's pricey, eating it with honey or cream on a daily basis helps maintain a good blood sugar level. Blood sugar levels may be considerably reduced using the medications indicated above.

Ayurvedic practitioners recommend a diet that helps lower blood sugar levels.

- Excessive intake of sweets, carbohydrates, and dairy goods must be avoided.
- More fresh vegetables, bitter fruits, and herbs should be consumed.
- Fried barley, cornflower, oatmeal, and ghee must all be included in the diet.
- Intake of oranges and lemons to be increased.
- Consumption of a lot of green vegetables, black gram, soy, salmon, and other such foods.
- Reduces consumption of carbohydrates like rice, wheat, and sugarcane.
- Restrictions on fat intake.

Exercise and Other Ayurvedic Methods to Reduce Diabetes

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- Massage with oil
- When taking a bath, use dry ginger and cardamom.
- Drinking water that has been preserved overnight in a copper vessel.

Mechanism of Action of Herbal Antidiabetics

Herbal antidiabetic action is based on a number of processes. The mechanism of action of herbal anti-diabetics can be divided into following categories:

- Adreno mimeticism, potassium channel blockage in pancreatic beta cells, and cAMP (2^{nd} messenger) activation.
- Inhibition of glucose reabsorption in the kidneys.
- Stimulation of pancreatic islets to secrete insulin, and inhibition of insulin degradative activities.
- Lowering of Insulin resistance.
- Calcium, zinc, manganese, and copper are all essential nutrients for beta-cell health.
- Pancreatic beta cell regeneration and/or repair.
- In the islets of Langerhans, increasing the size and quantity of cells.
- Glycogenesis and hepatic glycolysis stimulation.
- Protective effect against the destruction of beta cells.
- Improvement Digestion is better, and blood sugar and urea levels are lower.
- Preventing the conversion of starch to glucose in a pathogenic way.
- β-galactocidase and α-glucocidase inhibition.
- Activities that lower cortisol levels (Hideaki et al., 2005).
- Alpha-amylase inhibition (Heidari et al., 2005).
- Preventing oxidative stress (Kokar & Mantha, 1995), which may have a role in diabetes-related pancreatic β-cell failure.

Herbs and plants may affect the human body in a variety of ways, one of which is by the use of synthetic oral hypoglycemic medicines.

Anti-Diabetic and Other Beneficial Effects of Indian Medicinal Plants

Diabetes may be treated using a number of natural therapies (Dixit et al., 2006; Pulok et al., 2006; Mohamed et al., 2006). Some of the more important herbal therapies recommended in Ayurveda are as follows:

***Acacia arabica* (Babul):**

Having a potential to release insulin, the extract of this plant is antidiabetic in nature. The beta cells in the pancreas secreted insulin when the powder of *Acacia arabica* seeds was given to normal rabbits at doses of 2, 3, and 4 g/kg body weight (Wadood et al.,1989).

***Aegle marmelos* (Bengal Quince, Bel or Bilva):**

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When leafy plant aqueous extracts were given to alloxanized rats, blood sugar, urea, and cholesterol levels were all lowered in comparison to controls (Krishnan et al.,1968) For one hour, an oral glucose tolerance test showed no increase in blood sugar levels when this extract was used.

***Allium cepa* (onion):**

Dried onion powder's soluble and insoluble components both have anti-hyperglycemic properties (Kumari et al., 1995). *Allium cepa* also seems to have antioxidant and hypolipidemic characteristics, according to research. In diabetic rats (200 mg/kg), SMCS, *Allium cepa*'s sulfur-containing amino acid, significantly regulated blood glucose, lipids in the serum and tissues, as well as normalised the activities of liver hexokinases, glucose 6-phosphatases, and HMG CoA reductase (Mathew et al., 1975). After consuming 50 grams of onion juice, diabetics saw a considerable drop in their blood glucose levels.

***Allium sativum* (garlic):**

Perennial plants like this may be found across India. Chemical allicin includes sulphur, which is responsible for its powerful fragrance and hypoglycemic effects. If this is the case, the hepatic metabolism may be affected or insulin production by pancreatic beta cells may rise. Free amino acid content in the liver increased, whereas fasting blood sugar levels and serum triglyceride levels fell in rabbits fed sucrose for two months on an aqueous garlic homogenate supplement.
Sulfur-containing amino acid precursor SACS was more efficient than glibenclamide or insulin in reducing lipid peroxidation (Sheela et al., 1992). Diabetics might get the advantages as well. Insulin production was enhanced by utilizing beta cells from healthy rats produced *in vitro* via SACS in mice. *Allium sativum* has antibacterial and anticancer properties in addition to its cardioprotective properties.

***Aloe vera* and *Aloe barbadensis*:**

For generations, the common houseplant *Aloe vera* has been used to treat a variety of ailments. The two major constituents of the plant are latex and gel. The pericyclic tubules under the leaf's epidermis secrete mucilage and latex, the two types of *Aloe vera* gel. *Aloe* gum extracts have been proven to improve glucose tolerance in both diabetic and non-diabetic rats, according to a study. Diabetic rats received one dosage of *Aloe barbadensis* leaf exudates, and the animals' blood sugar levels dropped. Diabetic mice were given a single dosage of the plant's bitter component and their blood sugar levels dropped. The bitter component of *Aloe vera* helps the pancreas' beta cells produce and release insulin more effectively. Consumption of this plant has anti-inflammatory and wound-healing properties in diabetic mice.

***Azadirachta indica* (Neem):**

Increased glucose absorption and glycogen storage in the isolated hemidiaphragm of rats treated with streptozotocin produced antihyperglycemic effects in the animals. In addition to its anti-diabetic and antibacterial properties, this plant also has antimalarial, hepatitis-protective, and antioxidant properties.

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***Caesalpinia bonducella*:**
Indian tribes employ *Caesalpinia bonducella*, a common coastal shrub, to regulate blood sugar levels. With both aqueous and ethanolic extracts, type II diabetic rats saw significant decreases in their blood sugar levels. Glycogen levels in the liver grew as a consequence of the extracts' action on glycogenesis. To increase islet insulin production in isolation, BM 169 and/or BM 170 B may be administered. Ethanolic extracts of the *Caesalpinia bonducella* seeds were given to diabetic rats at a 50% dosage to combat hyperglycemia and hypolipidemia. For the treatment of hyperglycemia, seed extracts have been suggested. No one disputes the drug's ability to cure diabetes and high cholesterol.

***Capparis decidua*:**
This may be found all across India but is more frequent in the drier regions. Alloxanized rats administered 30 percent extracts of *Capparis decidua* fruit powder developed hypoglycemia for three weeks. Researchers found that alloxan-induced lipid peroxidation was greatly reduced by utilizing this extract. In *C. decidua*, superoxide dismutase and catalase levels are lower, suggesting that it is more susceptible to the effects of oxidative stress. The effects on the body's lipid levels were also noted.

***Coccinia indica*:**
Diabetes patients received six weeks of treatment with dried extracts of *Coccinia indica*. In diabetics, the consumption of these extracts reduced and raised the activities of glucose-6-phosphatase and lactate dehydrogenase. Caryoxanized diabetic dogs treated with 500 mg/kg of *C. indica* leaves had improved glucose tolerance and lower glycemic levels.

***Eugenia jambolana* (Indian gooseberry, jamun):**
In India, the kernels of *Eugenia jambolana* are used to cure diabetes by boiling them in water. This is a key ingredient in a slew of natural diabetic treatments. Lyophilized powder, as well as aqueous and alcoholic extracts, may include antihyperglycemic effects. In extreme cases, this may be the case. There are reductions of 73.51%, 55.622%, and 17.722% in mild (plasma sugar >180 mg/dl), intermediate (plasma sugar >280 mg/dl), and severe (plasma sugar >280 mg/dl) diabetes, respectively.

Within 30 minutes of injection, diabetic rats had hypoglycemic consequences, while the seed took 24 hours to have the same effect. A study found that the extract increased insulin levels in diabetic rats (Sepha et al., 1956). A plant extract boosted insulin production in both healthy and diabetic islets. The activity of insulinase was likewise reduced by extracts from the liver and kidney.

***Mangifera indica* (Mango):**
Streptozotocin-induced diabetes had no impact on blood glucose levels after oral administration of an aqueous extract. A traditional Nigerian treatment uses the leaves of this plant to treat diabetes. When the extract and glucose were given to the rats simultaneously or 60 minutes apart, we were

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amazed to discover anti-diabetic effects. According to preliminary research, *Mangifera indica*'s aqueous extract has hypoglycemic effects. It's possible that the digestive system may be held liable for certain situations.

***Momordica charantia* (bitter gourd):**
Many Asian nations utilize it to treat diabetes and hyperglycemia. Numerous fruits and vegetables have been shown to exhibit hypoglycemic characteristics in animal studies (Miura et al., 2001). In both people and langurs, polypeptide p substantially reduced blood sugar levels by delivering it subcutaneously. The anti-hyperglycemic and hypoglycemic effects of *M. charantia* alcohol extracts were detected in rats with normal blood glucose levels as well as diabetic STZ rats. However, this has not been confirmed, it is possible that fructose-1, 6-bisphosphatase and glucose-6-phosphate dehydrogenase inhibition is involved.

***Ocimum sanctum* (Holy basil):**
It is known as Tulsi in India. It has been used as a medication from the beginning of time. In Alloxan-induced diabetic rats, aqueous extracts of *Ocimum sanctum* leaves significantly decreased blood sugar levels compared to control rats. Tulsi was shown to have hypoglycemic and hypolipidemic effects on the fasting blood glucose levels of diabetic rats, as well as uronic acid and total amino acid levels and total cholesterol and fat levels. After 15 and 30 days of study, oral therapy with plant extract (200 mg/kg) decreased plasma glucose by 9.06 and 26.4%, respectively. Glycogen reserves in diabetic rats' kidneys, liver, and pancreas were reduced by 68 to 75 percent; nevertheless, a tenfold increase in renal glycogen was found. Cancer prevention is one of its many benefits, in addition to its ability to combat infection-causing bacteria and fungi and to strengthen the immune system.

***Phyllanthus amarus* (Bhui amla):**
This is sixty centimetres tall member of Euphorbiaceae family. It's called Bhui amla in the indigenous language. This species' principal habitats are in the Deccan, Konkan, and southern parts of India, particularly Gujarat and Tamil Nadu. It has been used for decades by diabetics. It was shown that *P. amarus* methanolic extract has a significant amount of antioxidant activity. Alloxan-treated diabetic rats saw their blood sugar levels fall when they took this extract. Aside from these actions, it is a strong antidiarrhea drug that is also anti-inflammatory.

***Pterocarpus marsupium*:**
Only found in India's hilly areas, this deciduous tree is medium to large in size. The presence of pterostilbene, a chemical generated from the wood of the plant, is assumed to be responsible for the hypoglycemia-inducing activity of this extract in dogs. *Pterocarpus marsupium* contains a flavonoid that has been shown to cause pancreatic regranulation. According to this research, the antihyperlipidemic effects of marsupin, pterosupin, and liquiritigenin are all present (Sepha et al., 1956). *In vitro* studies have demonstrated that epicatechin, the active component, may increase

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insulin release and proinsulin conversion. With large doses of epicatechin, the rat diaphragm's glycogen level rises in the same way that insulin does in many organ tissues.

***Trigonella foenum graecum* (Fenugreek):**

As a common spice ingredient, wild fenugreek seeds may be found throughout India. Adding 4-hydroxyleucine to rat and human islet cell cultures treated with glucose resulted in an increase in insulin synthesis (a novel amino acid from fenugreek seeds). In healthy and diabetic rats given plant extract, doses ranging from 2 to 8 g/kg reduced blood glucose levels. Fenugreek seed extract was demonstrated to enhance glucose metabolism and restore creatinine-kinase activity in diabetic rats. The liver and kidneys' glucose-6-phosphatase and fructose 1,6-bisphosphatase activities were dramatically lowered as a result of the therapy. In addition, this plant has anti-inflammatory and antioxidant properties. Syndrex is a medicine that uses extracts of germinated seeds of fenugreek. More than a thousand years ago, it was used as a medicinal herb by the ancients of the Far East.

***Tinospora cordifolia* (Guduchi):**

This is a plant of Menispermaceae family having large glossy laves. In keeping with its name, Guduchi may be found throughout India. A reduction of glucose and lipid levels was observed in alloxan-induced diabetic mice after six weeks of oral treatment of *Tinospora cordifolia* root extract. *T. cordifolia* is often used in Indian ayurvedic medicine as a therapy for type 2 diabetes. It was shown that *T. cordifolia* root extract decreased blood sugar and cholesterol levels in diabetic rats too. When tested on a variety of animals, the aqueous insulin extract at 400 mg/kg demonstrated just one unit of anti-hyperglycemic effect. Amounts of glucose in the blood tolerance in rats may be improved with frequent administration of *T. cordifolia* extracts, whether alcoholic or aqueous.

Table 1: Indian Medicinal Plants with Antidiabetic property.

S.No.	Common name	Botanical name	Part used	Family
1	Methi	Trigonella foenum-gracecum	Seeds	Fabaceae
2	Fern	Nephoelepsis tuberosa	Bulb	Oleandraceae
3	Keukand	Costus specious	Rhizome	Costaceae
4	Indian wheat	Plantago ovata	Husk	plantaginaceae
5	Garlic	Allium sativum	Bulb	Alliaceae
6	Indian Sarsaparilla	Hemidesmus indicus	Root	Asclepiadaceae
7	Onion	Allium cepa	Bulb	Liliaceae
8	Pinyn	Acontium carmichaeii	Root	Ranunculaceae
9	Chilli	Pepper capsicum annum	Fruit	Solanaceae
10	Goat's rue	Galega officinalis	Seed	Fabaceae
11	Lingzhi mushroom	Gandoderma lucidium	Fruit	Ganodermataceae
12	Sea pea	Lathyrus japonica	Seed	Fabaceae
13	Rice	Oriza sativum	Root	Poaceae

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14	Guduchi	Tinospora cardifolia	Plant	Menispermaceae
15	Bitter gourd	Momordica charantia	Fruit	Cucurbitaceae
16	Indian kino tree	Pterocarpus marsupium	Bark	Fabaceae
17	Ginger	Zingiber officinale	Rhizome	Zingiberaceae
18	Gowar plant	Cyamospsis tetragonolobus	Fruit	Fabaceae
19	Phalsa	Grewia asiatica	Fruit	Malvaceae
20	Indian gum Arabic	Acacia arabica	Seeds	Leguminosae
21	Holy fruit tree	Aegle marmelos	Root bark	Rutaceae
22	Aloe	Aloe vera	Leaf pulp	Aloaceae
23	Davana	Artemisia pallens	Aerial parts	compositae
24	King of bitter	Andrographis paniculata	Plant	Acanthaceae
25	Neem	Azadirachta indica	Plant	Meliaceae
26	Life plant	Biophytum sensitivum	Leaf	Oxalidaceae
27	Tanners	Cassia Cassia auriculata	Flower	Leguminosae
28	Ivy Gourd	Coccinia indica	Leaf	Cucurbitaceae
29	Carilla	Casearia esculenta	Root	Flacourtiaceae
30	Mango	Mangifera indica	Leaf	Anacardiacea

Herbal Drug Formulations

Diabetics have to take a range of drugs prescribed by their physicians for keeping a check on their glucose levels (Tripathi, 2007). There is evidence that Diabecon (a Himalayan product) may increase glucose consumption in peripheral circulation, increase glucagon levels in both liver and muscle, as well as promote β-cell regeneration. Antioxidant properties of this chemical protect β-cells from oxidative stress. Micro albuminuria and glycated haemoglobin levels are reduced by this insulin-like substance. It lessens the possibility of long-term complications resulting from diabetes.

Epinsulin from Swastik formulations has Epicatechin, and Benzopyran as its active ingredients. By increasing cAMP levels, epicatechin enhances insulin release. As a result of its presence, the activity of cathepsin is enhanced, assisting in the conversion of proinsulin to insulin. This medicine also has an insulin-like effect on human erythrocyte fragility and osmotic fragility because it inhibits blood cell sodium/potassium pump function (erythrocytes). Neuropathy, retinopathy, and problems with glucose and lipid metabolism may be treated with this medication. It protects the health of all organ systems that are at risk. Some believe that it can cure non insulin-dependent diabetes mellitus (NIDDM), while others believe that it can help insulin-dependent diabetes mellitus (IDDM). Other oral hypoglycemic drugs should be used with it. Several studies have shown that it may assist diabetics avoid complications. Thus, hypoglycemia is no longer a risk.

Pancreatic Tonic (ayurvedic herbal supplement): Pancreatic Tonic, is a nutritional supplement comprising of traditional Indian Ayurvedic herbs and is very effective in treating diabetes mellitus.

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Bitter gourd powder marketed by Garry and Sun: Sugar levels in the blood and urine are reduced by using this drug. It may be used to cleanse the blood and improve the immune system so that the body is better able to withstand sickness. Many health benefits may be attributed to the bitter gourd, but here are just a handful. For treating poisonings and other maladies antipyretic and laxative properties make it an excellent choice. Asian and African folk treatments include the usage of bitter gourds. Diabetes is traditionally treated with bitter gourd in traditional folk medicine. Its powder also includes fatty acids, free acids, polypeptides, and other chemicals in addition to the amino acid methionine and the bitter glycosides and saponins (Marles et al., 1996). Antihelmintic, anti-haemorrhoidal, hypoglycemic, and stomachic emmenagogue hepatic stimulatory properties are also cited as possible advantages of the supplement.

Both Type 1 and Type 2 diabetes may be successfully treated with Dia-Care after 90 days of therapy, says Admark Herbals Ltd. Patients who are insulin-dependent will no longer be a problem. Each of the six therapy sessions is scheduled to run for ninety days in total. A teaspoon of powder and half a cup of water, combined, should be left in a warm spot overnight to work their magic. It should be taken empty stomach in the morning. Finally, 30 minutes before supper, the prescription is concluded with a glass of water. Because this medication has a strong sour flavor, it is essential that one should take enough of water with it. It has no impact on the human body since it is naturally occurring.

Using Nature's Health Supply's Diabetes-Daily Care, one can keep the blood sugar levels stable. This type 2 diabetic supplement contains all of the natural components indicated in Table 2 at the appropriate quantities.

Gurmar powder from Garry and Sun helps stabilize blood sugar levels by blocking the absorption of saccharide in the gastrointestinal tract. In addition, this binding connects the liver, kidneys, and muscles all at the cellular level. It helps the body to produce insulin, which decreases blood sugar. When injected beneath the tongue, it suppresses sweet taste receptors, helping diabetics reduce glycosuria. Due to Quinine's unpleasant taste and odor, the drug is hidden from the user's eyes (effects lasts for 1 to 2 hours). As a stimulant and diuretic, this medicine also corrects the metabolism of the liver, kidney, and muscle.

Conclusion:

In the foregoing account one can see that herbal medicines are quite effective in the management of diabetes and its complications. Many of the prescriptions from ancient Aurvedic texts have proven to be very useful and are comparable to standard medications in efficacy despite having little or no side effects (King & Rewers, 1993). There exist a number of herbal preparations which primarily aim to decrease blood glucose levels but may have several additional effects including hepatoprotective, immunomodulatory, anti-lipidemic and anti-stress properties.
Insulin has a broad variety of actions on the human body, many of which contribute to the development of diabetes. Any medication aimed at treating diabetes has to in addition to the disease's underlying causes. The mechanism of action of anti-diabetic medications is being studied

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via the use of animal models and islet cell culture. It is expected that future studies on herbal formulations will lead to development of safer drugs from herbs.

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