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EXPLORING CERTAIN HERBS FOR DEVELOPING A POTENTIAL HERBAL FORMULATION FOR DIABETES MELLITUS

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Abstract:- According to the WHO definition, herbal medicines contain plant parts or plant material in the crude or processed state as active ingredients. Similarly, the European Medicines Evaluation Agency (EMEA) defines herbal medicine products as preparations containing exclusively herbal drugs or herbal drug preparations as active substances. Herbal drugs are plants or plant parts in an unprocessed state which are used for a medicinal or pharmaceutical purpose.

Key Words:-Herbal Drugs, WHO, EMEA, Traditional Medicine Programme

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Introduction:-Herbal Medicine sometimes referred to as Herbalism or Botanical Medicine, is the use of herbs for their therapeutic or medicinal value. Medicinal plant synthesizes a variety of chemical constituents, eliciting beneficial activity on human body either internally or externally. According to the WHO definition, herbal medicines contain plant parts or plant material in the crude or processed state as active ingredients. Similarly, the European Medicines Evaluation Agency (EMEA) defines herbal medicine products as preparations containing exclusively herbal drugs or herbal drug preparations as active substances. Herbal drugs are plants or plant parts in an unprocessed state which are used for a medicinal or pharmaceutical purpose. Before a generally accepted definition of "herbal medicinal products" was established by the respective European guidelines, several attempts had been made in literature to define what should be meant by the expression, which are as following:

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i) Herbal medicinal products are regarding the active substances more or less enriched preparations of plants or herbal drugs, which besides contain other concomitant substances exerting or not exerting therapeutic activity.

ii) Herbal medicinal products are those medicinal products which, as active substances, solely contain herbal drug preparations, such as comminuted parts of plants, extracts and pressed juices or distillates of plants. Isolated plant constituents such as digitoxin or menthol, as well as homeopathic medicinal products, are not regarded as herbal medicinal products.

iii) Herbal medicinal products are complex preparations of herbal origin, i.e. galenic preparations of plants used within the sense of allopathic therapy. Isolated biogenic pure substances and complex preparations obtained from plants intended for use within alternative therapies such as homeopathy.[1,2,3]

WHO GUIDELINES FOR ASSESSMENT OF HERBAL MEDICINES

The World Health Assembly (WHA) drew attention to the fact that the population in many developing countries relies on traditional medicine for their primary health care and felt the importance of standardized products. Based on the WHA resolutions, the major objectives of the Traditional Medicine Programme of the World Health Organization (WHO) are:

i) To facilitate the integration of traditional medicine into National health care system.

ii) To promote the rational use of traditional medicine through development of technical guidelines and international standards in the field of herbal medicine.

iii) To act as a clearing house for the dissemination of information on various forms of traditional medicine (WHO TRM).[4]

Herbal medicinal products have become a component of the International Conference on Drug Regulatory Authorities (ICDRA), which concluded that WHO should consider preparing model guidelines containing basic elements of legislation and registration. As per WHO consultation which drafted the “Guidelines for the Assessment of Herbal Medicines”, the objectives of these guidelines was to define basic criteria for the evaluation of quality, efficacy and safety of herbal medicinal products,

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and thereby to assist National Regulatory Authorities, Scientific Organizations and Manufacturers to undertake an assessment of the documentation, of the submission and/or the dossiers in respect of such products.[5] The requirements for pharmaceutical assessment include issues such as Identification, Galenic forms, Analytics and Stability. The safety assessment should minimally consist of the documentation of safety based on experience. Toxicological studies should only be indicated where safety concerns are existing. The Guidelines of Herbal Medicines WHO's Traditional Medicine Programme started preparing a technical document entitled "Model monographs of widely used medicinal plants" for primary health care.[6] The information given in the monographs consists of summaries of the Botanical Characteristics, Quality Control and Major active chemical constituents of each plant, summaries of Clinical Applications, Pharmacology, Posology, Contraindications and precautions as well as potential adverse reactions :- The purpose of this document is:

i) To provide scientific information on the Efficacy, Safety and Quality control/quality assurance of widely used medicinal plants in order to facilitate their appropriate use in Member states.[7]

ii) To provide models to assist Member States in developing their own monographs or formularies for these and other herbal medicines.[8]

iii) To facilitate information exchange among Member States.

STANDARDIZATION OF HERBAL DRUGS AND EXTRACTS

All Modern synthetic drugs are prepared using pure synthetic materials; reproducible manufacturing techniques and acceptable chemical assay of the drugs, which are given in Pharmacopoeias having adequate quality control. In contrast, herbal medicines of plant origin are prone to contamination, deterioration and variation in compositions, thus posing problems for quality control and testing of these herbal drugs and hence improper standardized products.[9] Standardization of these herbal products is an essential measurement for ensuring the quality control of the herbal drugs. Several factors like environment, genetic methods of cultivation, collection, preparation, storage etc., affect the quality of the herbal drugs. The Pharmacopoeia standards in Ayurvedic Pharmacopoeia of India are not adequate enough to ensure the quality of plant materials

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and the subsequent products. Therefore, Chemical methods, Instrumental methods and Thin Layer Chromatographic analysis would determine the proper quality of plants materials. Therefore, in-house specifications for the plant materials should be developed to enable the quality control of herbal products.[10] Standardization is used to describe all measures, which are considered during the manufacturing process and quality control leading to a reproducible quality. Standardization expression also encompasses the entire field of study from birth of a plant to its clinical application.[11] Standardization is the basic pre – requisite for consistent efficacy of herbal medicinal product. Irrespective of the question of whether the active constituents of an herbal drug are known or not, every manufacturing process resulting in an herbal medicinal product has to be submitted for standardization.[12]

This standardization comprises standards relating to the following (Stuttgart 2003 CRC press):

i) The herbal drug or raw materials.
ii) The extraction solvent.
iii) The manufacturing process.
iv) In process controls.
v) The herbal drug preparation.

The constituents of Standardized Herbal preparations are classified into three categories:

1. Therapeutically active constituents: Chemically defined substances or groups of substances, which, in an isolated state, exert the same or similar therapeutic effect as the total extract.[13]
2. Active constituents: Chemically defined substances or groups of substances which, in an isolated state, do not exert the same therapeutic effect as a total extract, but which are accepted to contribute to the therapeutic activity of the herbal drug preparation.[14]
3. Markers: Chemically defined substances or groups of substances, which only serve analytical purposes.

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a) Characteristic markers: these are markers suitable for standardization of medicinal plants (e.g. batch to batch control)

b) Ubiquitous marker: occur ubiquitously in plants, suitable for assay (e.g. batch to batch control).

DIABETES:-

Herbal medicines are used to treat many ailments. One of the most important usages is in treating diabetes. It has become a growing problem in the present world with every ten seconds; a person dies from diabetes related causes across the world (The Times of India, Bangalore, and Wednesday, March 21, 2007). The prevalence of NIDDM is increasing exponentially, its prevalence in more affluent societies is spectacular and of general concern.[15] It has recently broken the age barrier and appears even in younger people. It is a chronic metabolic disorder and robs persons of their energy and vitality. Diabetes mellitus is one of the most common chronic diseases and a major contributor to the development of cardio vascular diseases.[16] It is due to a deficiency or a failure of normal action of insulin. Improper metabolism of glucose leading to uncontrollable glucose and fatty acid accumulation in human body is due to faulty functioning of number of enzymes, cells and gene responsible to manage glucose concentration in the human body.[17] Its management through drugs is possible, but plants can also offer cheap and economic home relief. *Diabetes mellitus* is now recognized as a serious global health problem. Westernized cultures are showing a sharp rise in NIDDM The prevalence of NIDDM is increasing exponentially. It is estimated that more than 300 million people in the world will have diabetes by the year 2025 (Diabetes Prevention Program Research Group, 1999). At present, approximately 18 – 20 million people are diabetic in India, and it is projected that by 2025, there will be 20 – 60 million diabetics in India, Diabetes mellitus is a group of metabolic diseases characterized by hyperglycemia arising as a result of a relative or absolute deficiency of Insulin secretion, resistance to insulin action, or both. Diabetes is an ailment in which the body does not produce or properly use insulin. Insulin is a regulatory hormone required for energy management. The cause of diabetes continues to be anonymity, although both genetics and environmental factors such as obesity and lack of exercise appear to play roles.[18]

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Plants having hypoglycemic and/or antihyperglycemic potential:

In Ayurveda about 800 plants have been reported possessing antidiabetic potential The brief of some plants having hypoglycemic and/or antihyperglycemic potential is as follows:- ***Acacia arabica*** **(Lam.) Muhl. ex Willd.**(*Mimosaceae*) known as Babul in Hindi and Indian Gum Arabic tree in English, has been used to treat high cholesterol and diabetes ***Aegle marmelos*** **(L.) Correa ex Roxb**.(*Rutaceae*) is known as Bael in Hindi. Methanolic extract of *A. marmelos* has been studied on a battery of targets glucose transporter (Glut-4), peroxisome proliferator activator receptor gamma (PPARγ) and phosphatidylinositol 3' kinase (PI3 kinase) involved in glucose transport. Where it was found active at 100 ng/ml dose comparable with insulin and rosiglitazone ***Allium cepa*** **(L.)** (*Liliaceae*) commonly known as Pyaj in Hindi and Onion in English, has been used to treat diabetes and is reputed to lower blood sugar levels.[19] Oral administration of its fraction to alloxan-induced diabetic rabbits improved their glucose tolerance. After 7 days treatment, the more active hypoglycemic fraction was about half as active as phenformin in lowering the fasting blood sugar of alloxan-diabetic rabbits.[20] ***Allium sativum*** **(L.)** (*Alliaceae*) is commonly known as Lahasun in Hindi and Garlic in English. Its ethanol extract at the doses of 0.1, 0.25 and 0.5 g/kg body weight was orally given to normal and streptozotocin-induced diabetic rats for 14 days. The level of serum glucose, total cholesterol, triglycerides, urea, uric acid, creatinine, aspartate amino transferase (AST) and alanine amino transferase (ALT) were found decreased. The antidiabetic effect of the extract was found to be more than glibenclamide ***A. paniculata*** **Nees** (*Acanthaceae*) is commonly known as Kalmegh in Hindi and King of bitters in English. Andrographolide, a principle present in *A. paniculata* has been suggested to increase glucose utilization in peripheral tissues via an insulin-dependent mechanism ***Annona squamosa*****(L.)** (*Annonaceae*) is commonly known as Sharifa or Sitafal in Hindi and Sugar apple or Custard apple in English.[21] Aqueous leaf extract has shown hypoglycemic activity in streptozotocin nicotinamide induced diabetic rats. At the dose of 350 mg/kg, ethanol leaf extract has been found to possess hypoglycemic as well as antihyperglycemic potential in normal, streptozotocin-induced diabetic rats and alloxanized rabbits ***Areca catechu*** **(L.)** (*Arecaceae*) is known as Supari in Hindi and Betel nut in English. Subcutaneous administration of its alkaloid fraction at 0.05-0.5 mg/kg in alloxanized rabbits showed significant hypoglycemic effect Arecoline, isolated from its nuts, reported to have hypoglycemic activity ***Azadirachta indica*** **A. Juss.** (*Meliaceae*) is commonly known as Neem.[22]

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Studies showed that petroleum ether extract of neem seed kernel (NSK) and husk (NSH) showed significant protection against the oxidative damage induced by STZ in heart and erythrocytes of rats ***Barleria lupulina* Lindl.** (*Acanthaceae*) commonly known as Snake bush in English, its methanol extract of aerial parts showed a pronounced blood-glucose-lowering potential in streptozotocin-induced hyperglycemic rats. The extract at dose of 200 mg/kg body weight exhibited maximum activity at 12 h of administration ***Beta vulgaris* (L**) (*Chenopodiaceae*) is known as Chukander in Hindi and Garden beet in English. Its isolated vulgaroside IIIV have shown to ameliorate glucose tolerance in rats. .***Biophytum sensitivum* (L.) DC.** (*Oxalidaceae*) is called as Lajjalu in Hindi and Life plant in English. Its leaf extract has been proved to show antihyperglycemic effect in alloxan-induced diabetic male rabbits. It was however found ineffective in severe diabetes ***Boerhaavia diffusa* (L)** (*Nyctaginaceae*) is known as Punarnava in Hindi. As per it was found more effective than glibenclamide in the treatment of diabetic rats.[23] ***Bombax ceiba* (L)** (*Bombacaceae*) is known as Semul in Hindi and Red silk cotton tree in English. A flavonol glucoside-Shamimin,isolated from the leaves of *B. ceiba* the has been reported to possess significant hypoglycemic activity at dose of 500 mg/kg in rats ***Cajanus cajan* (L) Millsp.** (*Fabaceae*). Its common name is Tuvar in Hindi and Red gram in English. Oral administration of graded doses of aqueous extract of *C. cajan* leaves in streptozotocin-induced Type-2 diabetic rats showed significant increase (14.3 %) fasting blood glucose levels of normal rats ***Camellia sinensis* Kuntze** (*Theaceae*) known as Tea, its hot water extract significantly reduced the blood glucose level. The effect was found to be both preventive and curative on experimentally produced diabetes in rats.[24] The green as well as black tea both possess antidiabetic activity ***Casearia esculenta* Roxb.** (*Flacourtiaceae*) is known as Saptarangi in Hindi. Its root extract exhibited significant hypolipidemic and antiperoxidative activity in red blood cells of streptozotocin-induced diabetic rats ***Catharanthus roseus* (L.) G. Don.** (*Apocynaceae*) is called as Sadabahar in Hindi and Madagascar periwinkle in English. According to administration of aqueous extracts of *V. rosea* flowers and leaves have been found to regulate the blood sugar level in alloxan-induced diabetic male albino rats.[25] Its isolated alkaloids - catharanthine, vindoline and vindolinine lower blood sugar level .***Curcuma longa* (L.)** (*Zingiberaceae*) is known as Haldi in Hindi and Turmeric in English. Ethanol extract of its rhizomes significantly suppressed the increased blood glucose level in Type-2 diabetic mice.[26]The extract stimulated human adipocyte differentiation in a dose-dependent manner and showed human peroxisome proliferator activated

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receptor (PPAR-γ) ligand-binding activity in a GAL4-PPAR-γ chimera assay.***Cynodon dactylon*** **Pers.** (*Poaceae*) is known as Doob in Hindi. At a dose of 500 mg/kg, its aqueous extract lowered blood glucose level around 31% after 4 hour of administration in normal rats.[27]

Enicostemma littorale **Blume** (*Gentiaceae*) is known as Chhota Chirata in Hindi and White-head in English. Aqueous extract of *E. littorale* increased HDL levels and decreased serum cholesterol, triglyceride, LDL, VLDL, LDL/HDL ratio in rats fed with hypercholesterolemic diet ***Eugenia uniflora*** **(L.)** (*Myrtaceae*) is known as Surinam Cherry or Brazilian Cherry in English. Ethanol extract of its leaves inhibited the increase in plasma glucose level and plasma triglyceride level ***Ficus bengalensis*** **Linn.** (*Moraceae*) is known as Bargad in Hindi and Banyan in English. 50 mg/kg of hot water and ethanol extract of its bark and aerial roots when given orally to normal rabbits and alloxan-induced mildly diabetic and severely diabetic states daily for three days, a significant antidiabetic activity was observed.***Ficus racemosa*** **Linn.** (*Moraceae*) is known as 'Gular' in Hindi. α-amyrin acetate, isolated from its fruits at the dose of 100 mg/kg body weight, lowered the blood glucose levels by 18.4 and 17.0% at 5 and 24 hour, respectively, in sucrose challenged streptozotocin-induced diabetic rat. ***Glycyrrhiza glabra*** **(L.)** (*Fabaceae*) is known as Licorice. Glycyrrhizin, isolated from licorice root showed potential antihyperglycemic effect that was comparable with glibenclamide.***Gymnema sylvestre*** **R. Br.** (*Asclepiadaceae*) known as Gurmar or Gurmarbooti in Hindi, its leaves extract lowers the blood glucose level in normal fasting, glucose fed hyperglycemic and diabetic rats compared with placebo-treated animals.***Hibiscus rosa-sinensis*** **L.** (*Malvaceae*) is known as Gudhal in Hindi and Shoe flower in English. In streptozotocin-induced diabetic rats, oral administration of its ethanol flower extract lowered the total cholesterol and serum triglycerides by 22 and 30%, respectively. The hypoglycemic activity of this extract is comparable to that of glibenclamide.***Indigofera mysorensis*** **Rottler ex DC.** (*Fabaceae*). Study showed that the antidiabetic effect of the ethanol extract of *Indigofera* is due to its insulin sensitizing property and is clearly different from that of sulfonylurea or acarbos***Lactuca indica*** **(L.) (***Asteraceae***)** is called as Indian Lettuce. Lactucain C and lactucaside have shown significant hypoglycemic activity.***Mangifera indica*** **(L.)** (*Anacardiaceae*) is known as Aam in Hindi and Mango in English. Its aqueous leaf extract at the dose of 1 g/kg p.o. showed hypoglycemic effect when given 60 min. prior to glucose administration in streptozotocin-induced diabetic rats. ***Memecylon umbellatum*** **Burm.** (*Melastomataceae*) is commonly known

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as Anjani in Hindi. Oral administration of alcohol extract of its leaves (250 mg/kg) caused a significant reduction in the serum glucose levels in normal and alloxanized rats at 30, 60 and 90 min after administration .***Momordica charantia* (L.)** (*Cucurbitaceae*) is known as Karela in Hindi and Bittergourd in English. Its anti-diabetic potential is well established in streptozocin or alloxan induced diabetic animals. *M. charantia* displays insulin-like properties, remarkably stimulates glycogen storage by the liver and improves peripheral glucose uptake.***Morus alba* (L.)** (*Moraceae*) is known as Shehtut in Hindi and White Mulberry in English. Hot water extract of its leaves showed hypoglycemic activity in fasted and non-fasted STZ diabetic mice at the dose of 200 mg/kg.***Murraya koeingii* (L.) Spreng.** (*Rutaceae*) commanly is called Meethi Neem in Hindi. One month oral administration of its aqueous leaves extract in STZ induced severe diabetic rats, at the dose of 300 mg/kg body weight shown antihyperglycemic and hypolipidemic effect. ***Nelumbo nucifera* Gaertn.** (*Nymphaeaceae*) is known as Kamal in Hindi and Lotus in English. Ethanol extract of its rhizome suppressed blood glucose levels in normal, glucose-fed hyperglycemic, insulin-treated and diabetic rats. ***Ocimum sanctum* (L.)** (*Lamiaceae*) is called as Tulsi in Hindi and Basil in English. The hypoglycemic effect of the alcohol extract of its leaves was investigated in both normal and alloxan-induced diabetic rats. In addition, the extract also showed a favorable effect on glucose disposition in glucose fed hyperglycemic rats. ***Pterocarpus marsupium* Roxb.** (*Fabaceae*) is commonaly known as Vijaysar in Hindi and Indian Malabar in English. Pterostilbene (trans-3, 5-dimethoxy-4 hydroxystilbene), a constituent derived from its wood caused hypoglycemia in dogs at the dose of 10 mg/kg. ***Ricinus communis* (L.)** (*Euphorbiaceae*) known as Eranda or Gandharva hasta in Hindi and Castor in English, 50% ethanol extract of its roots at the dose of 500 mg/kg body weight caused maximum lowering of the fasting blood glucose, both in normal as well as Type-1diabetic animals. ***Salacia reticulata* Wight.** (*Celastaceae*) is called as Kothala himbutu.[28] Aqueous extracts of its stems decreases fasting blood glucose levels. Results demonstrate that it exerts its effect by gluconeogenic gene regulation in traditional diabetic medicine.***Sida cordifolia* (L.)** (*Malvaceae*) is known as Bala, an important drug of Ayurveda. The methanol extract of its roots was found to possess significant hypoglycemic activity.***Stevia rebaudiana* Bertoni** (*Asteraceae*) is known as Cheeni Tulsi, a plant sweetner. Stevioside, a active constituent of *S. rebaudiana* reported to counteracts the glyburide-induced desensitization of the pancreatic β-cells function in mice. The findings indicate that stevioside does not influence basal insulin secretion but counteract the suppressed

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glucose-stimulated insulin release induced by glyburide.***Terminalia catappa*** **(L.)** (*Combretaceae*) is known as Badam in Hindi and Indian Almond Tree in English. Its methanol and aqueous extracts exhibited significant antihyperglycemic activities in alloxan-induced hyperglycemic rats without significant change in body weight. ***Trigonella foenum graecum*** **(L.)** (*Fabaceae*) is commonly known as fenugreek in English and Maithi in Hindi. Galactomannan, extracted from *T. foenum* reported to reduce postprandial blood glucose response, as well as it reduces intestinal absorption of low or high concentrations of glucose and hence it is good for the benefit of blood glucose management.***Tinospora cordifolia*** **(Thunb.) Miers** (*Menispermaceae*) is known as Giloe in Hindi. Treatment with plant extract showed significant antihyperglycemic activity in mild to moderate degree of hyperglycemia. ***Withania coagulans*** **Dunal** (*Solanaceae*) is called as "Paneer ke phool"in Hindi and Vegetable Rennet in English. At the dose of 1 g/kg, aqueous extract of fruits of *W. coagulans* significantly lowered the blood sugar and serum cholesterol, in streptozotocin-induced diabetic rats after 7 days of treatment. ***Zingiber officinale*** **Roscoe** (*Zingiberaceae*) is commonly known as Adrak in Hindi and Ginger in English. Its treatment produced a significant increase in insulin levels and a decrease in fasting glucose levels in diabetic rats.[29]

Indian Antidiabetic Herbal Formulations

Many marketed formulations are used by diabetic patients on the advice of the physicians. Diabecon from 'Himalaya' is reported to increase peripheral utilization of glucose, increases hepatic and muscle glucagon contents, promotes β-cells repair and regeneration and increases peptide level. It has antioxidant properties and protects β-cells from oxidative stress and exerts insulin like action by reducing the glycated hemoglobin levels, normalizing the micro albumin urea and modulating the lipid profile. It minimizes long term diabetic complications. Epinsulin (Swastik Formulations) contains epicatechin, a benzopyran, as an active principle, increases the cAMP content of the islet, which is associated with increased insulin release. Epicatechin plays a role in the conversion of proinsulin to insulin by increasing cathepsin activity.[30]Additionally it has an insulin-mimetic effect on osmotic fragility of human erythrocytes and it inhibits Na/K ATPase activity from patient's erythrocytes. It corrects the neuropathy, retinopathy and disturbed metabolism of glucose and lipids and maintains the integrity of all organ systems affected by diabetes. The preparation has been reported to be a curative for diabetes, non insulin dependent diabetes mellitus (NIDDM) and a good adjuvant for

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insulin dependent diabetes mellitus (IDDM), in order to reduce the amount of needed insulin. It is advised along with existing oral hypoglycemic drugs and is known to prevent diabetic complications. It has gentle hypoglycemic activity and hence induces no risk of being hypoglycemic.

Pancreatic Tonic and Ayurvedic herbal supplement is a mixture of traditional Indian Ayurvedic herbs currently available as a dietary supplement.Bitter gourd powder (marketed by Garry and Sun) lowers blood and urine sugar levels. It increases body's resistance against infections and purifies blood. Apart it is an antidotal, antipyretic, tonic, appetizer, stomachic, antibilious and laxative. Used in native medicines of Asia and Africa, the Bitter gourd is specifically used as a folk medicine for diabetes. It contains bitter glycosides, saponins, alkaloids, reducing sugars, phenolics, oils, free acids, polypeptides, sterols, 17-amino acids including methionine and a crystalline product named p-insulin. It is reported to have hypoglycemic activity in addition to being antihaemorrhoidal, astringent, stomachic, emmenagogue, hepatic stimulant, anthelmintic and blood purifier.Dia-Care (Admark Herbals Ltd.) is claimed to be effective for both Type-1, Type-2 diabetes within 90 days of treatment and cures within 18 months. Persons taking insulin was eventually be liberated from the dependence on it. The whole treatment completes in 6 phases, each phase being of 90 days for which approx. 5 grams powder is mixed with 1/2 glass of water, stirred properly and kept overnight and only the water and not the sediment is to be taken in the morning on empty stomach. To the remaining marc fresh water is added and kept for the whole day and is consumed half an hour before dinner. The taste of the drug is very bitter. It is a pure herbal formula without any side effects. Diabetes-Daily Care™ (Nature's Health Supply) is a Unique, natural formula, which effectively and safely improves sugar metabolism. Diabetes Daily Care TM formulated for Type-2 diabetics contains all natural ingredients in balanced proportion and optimal for the body's use. Gurmar powder from *G. sylvestre* (Garry and Sun) is an anti-diabetic drug, suppresses the intestinal absorption of saccharides, and prevents blood sugar fluctuations. It stimulates insulin secretion and has blood sugar reducing properties. It blocks sweet taste receptors when applied to tongue in diabetes to remove glycosuria. It deadens taste of sweets and bitter things like quinine, (effects lasting for 1 to 2 hours). Besides having these properties, it is a cardiac stimulant and diuretic and corrects metabolic activities of liver, kidney and muscles.[31]

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DIABETA, (Ayurvedic Cure) is a formulation based on ancient Aurvedic references is an antidiabetic with combination of proven anti-diabetics, fortified with potent immunomodulators, antihyperlipidemics, antistress and hepatoprotective herbal drugs has been corroborated through modern research and clinical trials. It acts on different sites in many ways to effectively control the factors and pathways leading to diabetes mellitus. It attacks the various factors, which precipitate the diabetic condition, and corrects the degenerative complications, resulted due to diabetes. Their preparation is safe and effective in managing diabetes mellitus as a single agent supplement to synthetic antidiabetic drugs. Diabeta helps overcome resistance to oral hypoglycemic drugs when used as adjuvant to cases of uncontrolled diabetes. It confers a sense of well-being in patients and promotes symptomatic relief of complaints like weakness, giddiness, pain in legs, body ache, polyuria and pruritis. Syndrex (Plethico Laboratory) containing extracts of germinated fenugreek seed. An ingredient of traditional formulations over 1000 years is being studied for its mechanism of antidiabetic drug on animal model and on cultured islet. Thus many plants have been used individually or in formulations for treatment of diabetes and its complications. The major problems the herbal formulations is that neither the active ingredients are well defined nor their molecular interaction, are known which help to [analyze therapeutic efficacy and standardize the product. Efforts are now being made to investigate mechanism of action of some of these plants using model systems.[32]

Compiled antidiabetic herbal formulations:

Aavirai kudineer is made up of *Cassia auriculata*, *Cassia fistula*, *Salacia prinoides*, *Cyperus rotundus*, *Saussurrea lappa*, *Eugenia jambolana* and *Terminalia arjuna*.

Dia-Care contained *Sanjeevan Mool,Himej, jambu beej, Kadu, Namejav, Neem chhal.*

Diabetes-Daily Care are composed of *Alpha Lipoic Acid, Cinnamon, Chromax, Vanadium, Fenugreek, Gymnema sylvestre, Momordica, Licorice Root.*

Diagon tablets are composed of *Eugenia jambolana*, *Andrograpis paniculata*, *Tinospora cordifolia*, *Curcuma longa*, *Berberis aristata*, *Vetiveria zizanoides*, *Strychnos potatorum*, *Mimosa pudica* and *Gymnema sylvestre*.

Diamed contains *Azadirachta indica*, *Cassia auriculata* and *Momordica charantia*.

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Dianex is made up of *Gymnema sylvestre*, *Eugenia jambolana*, *Momordica charantia*, *Azadirachta indica*, *Cassia auriculata*, *Aegle marmelos*, *Withania somnifera* and *Curcuma longa*.

Diasulin comprises of *Casssia auriculata*, *Coccinia indica*, *Curcuma longa*, *Momordica charantia, Scoparia dulcis*, *Gymnema sylvestre, Emblica officinalis*, *Syzgium cumini*, *Tinospora cordifolia* and *Trigonella foenum graecum*.[33]

Diaveda capsule composed *Trigonella foenum-graecum*, *Emblica officinalis*, *Curcuma longa*, *Melia azadiract Gymnema sylvestris*, *Tribulus terrestris*, *Tinospora cordifolia*, *Syzygium cumuni*, *Azadirachta indica*, *Terminalia belerica*, *Terminalia chebula*, *Piper nigrum*,*Piper longum* and *Zingiber offcinalis*.

DWN-12 includes *Strychnos potatorum*, *Terminalia chebula*, *Emblica officinalis*, *Terminalia belerica*, *Salacia reticulata*, *Pterocarpus marsupium*, *Piper longum*, *Coscinium fenestratum*, *Tribulus terrestris*, *Syzigium cumini*, *Rhabdia lyuoides* and *Elettaria cardamomum*.

Epinsuline contains *Vijaysar(Pterocarpus marsupium).*

GlucoCare included *Glycyrrhiza glabra*, *Asparagus racemosus*, *Pterocarpus marsupium*, *Gymnema sylvestre*, *Momordica charantia* and *Commiphora mukul*.

Gluco-essentials capsules contains *Vaccinium myrtillus*, *Gymnema sylvestris*, *Momordica charantia*, *Cinnamomum zeylanicum*, *Trigonella foenum graecum*, *Panax Viscum alba*, *Amorphophallus konjac*, *Hydrastis cadensis*, *Ocimum basilicum*, *Cynara scolymus*, *Plantago ovata*, *Pfaffia paniculata* (Brazilian ginseng) and *Arctostaphylos uva - ursi*.

Glucolib contains *Eugenia jambolana*, *Gymnema sylvestris*, *Aegle marmelos*, *Melia azadiracta*, *Momordica charantia*, *Enicostema littorale* and *Trigonella foenum graecum*.

Glucomap tablets comprises *Enicostema littorale*, *Phyllanthus niruri*, *Eugenia jambolana*, *Melia azadiracta*, *Terminalia arjuna*, *Asphaltum*, *Aegle mermelos* and *Momordica charantia*.

Glucova contains *Pterocarpus marsupium*, *Enicostema littorale*, *Eugenia jambolana* and *Tinospora cordifolia*.

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Hyponidd tablets contains *Momordica charantia, Swertia chirata, Melia azadiracta, Tinospora cordifolia, Gymnema sylvestre, Enicostemma litterole, Emblica officinalis, Eugenia jambolana, Cassia auriculata* and *Curcuma longa*.

Madhumeha churna is prepared from *Azadirachta indica, Cassia auriculata, Cassia auriculata, Gymnema sylvestre, Eugenia jambolana, Eugenia jambolana, Zizyphus mauritiana, Curculigo orchioides, Melochia corchorifolia, Michelia champaca, Cynodon dactylon, Murraya koenegii, Acacia catechu, Cassia fistula, Salacia oblonga* and *Momordica charantia*.

Mersina capsules are preapared from *Gymnema sylvestre, Momordica charantia, Cassia auriculata, Syzigium cumini, Phyllanthus emblica, Melia azadiracta, Trigonella foenum graecum, Coccinia indica, Tinospora cardifolia* and *Potassi carbonas*.

Pancreas tonic includes *Tinospora cordifolia, Sygigium cumini, Melia azadiracta, Momordica charantia, Gymnema sylvestra, Pterocarpus marsupium, Aegle mermelos* and *Cinnamomum zeylanicum*.

Tincture of Panchparna making up *Coccinia indica, Cocculus villosus, Catharanthus roseus, Gymnema sylvestre* and *Momordica charantia*.[34]

CONCLUSION

Phyto therapy for Phyto therapy for diabetes has been followed all over the World successfully. Herbs are used to manage Type 1 and Type II diabetes and their complications. The plants mentioned above have been considered for their possible hypoglycemic activity. Scientific validation of several Indian plant species has proved the efficacy of the botanicals in reducing the blood sugar level. However, there are numerous other plants still await scientific inquiry, which have mentioned in the indigenous systems of medicine for health care all over the world. A large number of plants, screened for their antidiabetic effect, have yielded certain interesting leads as mentioned above, but till to date no plant-based drug has reached such an advanced stage of investigation or development as to substitute or reduce the need for the currently-available oral synthetic drugs. However, the interest in herbal drug research continues with an expectation that some day or the other, we would be able to bring a safer and more effective compound with all the desired parameters of a drug that could replace the synthetic.

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