

Traditional Indian Origin Plants For Diabetes Treatment And Respective Choice of Solvents For Extraction

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Abstract- Present number of Diabetes worldwide is 150 million and this is likely to increase to 300 million or more by the year of 2025. Though there are many medicines (chemical formulations) available for the ailment of this complicated disease, herbal medicines and patho-pharmacology has a tremendous welcome and being a pavement for a chemical free (or less chemical) world. Nevertheless many scientific research reported number of medicinal plants for the treatment of diabetes this review contains a list of few important traditional herbs, specifically from the origin of India (South). Along with the basic guideline for the solvents used on these plant extracts. The information provided in this review will be useful for the researchers to analyze the matter of economical South Indian herbs for Diabetes and their respective solvents.

Keywords- Diabetes, Indian herbs, Solvents, Anti-diabetic Plants, Phytochemical Screening.

I. INTRODUCTION

Diabetes is a great threat to health that is getting worse and causing greater impacts on adults in developing countries. ^[1] Out of 246 million people residing in developing countries, 80% are diabetic, according to World Health Organization (WHO). ^[2] Though diabetes is not recorded as the cause of death, it is believed to be the fifth leading cause of death in 2000 after communicable diseases, cardiovascular disease, cancer and injuries. ^[3] Type 2 – diabetes (non-insulin dependent diabetes) has increased due to changes lifestyle, increasing prevalence of obesity, and ageing of populations. According to WHO, more than 70% of world's population uses medicinal and traditional plants to satisfy. ^[4] Medicinal plants and herbal therapy provides better results for the prevention and curation of the complicated disease diabetes mellitus. ^[5] Specifically, polyherbal therapy provides a vast key for the treatment of diabetes with minimum side effects thereby using the plants secondary metabolites.

II. MEDICINAL PLANTS USED FOR DIABETES

Allium sativum (Garlic)

Garlic (*Allium sativum* L., *Liliaceae*) is a common spicy flavoring agent used since ancient times. It has been cultivated in all over Iran for its characteristic flavor and medicinal properties. ^[6] Reports from many recent studied revealed that garlic possess therapeutics and pharmacological properties. Its major protective effects have been well established with many epidemiological studies and animal experiments. Scientific reports have shown that commercially available garlic preparations in the form of garlic oil, garlic powder, and pills are widely used for certain therapeutic purposes, including lowering blood pressure and improving lipid profile. ^[7] Clinically used glibenclamide (a sulphonylurea drug) is known to lower the serum glucose by stimulating b-cells to release insulin.

Ocimum sanctum (Krishna Tulsi)

Ocimum sanctum Linn. (Labiata), commonly known as holy basil, has made important contribution to the field of science from ancient times as also to modern research due to its large number of medicinal properties. *Ocimum sanctum* has been described as of two types i.e., vanya (wild) and gramya (grown in homes). Although having identical usage, the former has darker leaves. ^[8] It is an herbaceous plant found throughout the south Asian region is used medicinally in catarrhal bronchitis, bronchial asthma, dysentery, dyspepsia, skin diseases, chronic fever, haemorrhage and helminthiasis, and topically for ringworms. ^[9] It is also effectively used for lumbago, hiccough, ophthalmia, gastric disorders, genitourinary disorders, skin diseases, various forms of poisoning and psychosomatic stress disorders. The leaf is claimed to possess hypoglycemic and anti hyperglycaemic effects in experimental animals. ^[10]

Ocimum gratissimum (Rama Tulsi)

Ocimum gratissimum is the second species of tirtava, also called Cattu- tirtava or Rama-tulsi. The plant is five or six feet in height, which is growing in sandy soils and the roots are fibrous, black, stalks quadrangular, slightly hairy, striated with a furrow and knotted.^[11] Leaves are very broad, round or oblong, serrate in the margin thin larger than those of the *Ocimum sanctum*, having very strong and pleasant smell and also sharp taste; usually arise in both twos and threes or solitarily. Flowers are the same, but white; in the incised petal from white to light green. Four white stamens are present whose apices is also having the bifurcate style (white). Calycis large and striated apex with the nerve of the tongue shaped petal. Seeds are round, dark red, verging on brown.

It's an ornamental aromatic shrub possessing medicinal properties. It is used as a mosquito repellent and is cultivated as a culinary herb. The seeds are used for curing headache.^{[12][13]} The boiled roots heals fever with cough and the oil extracted from the root is expectorant which promotes the digestion of food, prevents the spoiling of the liver, promotes urine and helps in strangury (painful retention or difficulty in discharging urine), gout, pleuritis, cleanses phlegmatic and cough fluids, destroy the gas, smeared around the temple relieves headache.^{[14][15]}

***Vinca rosea* (Periwinkle)**

Vinca rosea (*C. roseus*) Linn. (*Apocynaceae*) is an herbaceous subshrub also known as Madagascar periwinkle, *Vinca rosea*, or *Lehnera rosea* worldwide. It is cultivated mainly for its alkaloids, which are having anticancer activities.^[16] The two classes of active compounds in *Vinca* are alkaloids and tannins. *Catharanthus roseus* produces more than 100 monoterpenoids indole alkaloids (TIA) in different organs.^[17] The leaves and stems are the sources of dimeric alkaloids, vinacristine and vinblastine that are indispensable cancer drugs, while roots have antihypertensive, ajmalicine and serpentine.^[18] The leaves are used traditionally in various regions of the world including India, West Indies as well as Nigeria to control diabetes.^[19] The leaves have been known to contain 150 useful alkaloids among other pharmacologically active compounds. Significant anti hyperglycemic and hypotensive activity of the leaf extracts (hydroalcoholic or dichloromethane-methanol) have been reported in laboratory animals.^[20] Fresh leaf juice of *C. roseus* has been reported to reduce blood glucose in normal and alloxan diabetic rabbits.^[21] Leaves and twigs of *Catharanthus roseus* have been reported to have hypoglycaemic activity in streptozotocin induced diabetic rats.^[22]

***Momordica charantia* (Bitter guord)**

In traditional medicine of India, different parts of the *Momordica* plant are used for treatments for diabetes (particularly Polypeptide-p, an insulin analogue), as a stomachic, laxative, antibilious, emetic, anthelmintic agent, for the treatment of cough, respiratory diseases, skin diseases, wounds, ulcer, gout, and rheumatism.^[23] With regard to the use of *Momordica charantia* for diabetes, several animal studies and small-scale human studies have demonstrated a hypoglycemic effect of concentrated bitter melon extracts.^[24] In addition, a 2014 review shows evidence that *Momordica charantia*, when consumed in raw or juice form, can be efficacious in lowering blood glucose levels.^[25]

Significant reduction of blood glucose level and increased concentration of plasma insulin have been observed in diabetic rats that were treated with fruit juice of *Momordica charantia*. The observed effect was due to an increase in the number of beta cells in treated animals compared to untreated one. The phytochemical momordicin, charantin, and a few compounds such as galactose-binding lectin and insulin-like protein isolated from various parts of this plant have been shown to have insulin mimetic activity.^[26] Aqueous extract of unripe fruits of *Momordica charantia* has also been shown to partially stimulate insulin release from isolated beta-cell of obese-hyperglycemic mice suggesting that the insulin-releasing action is the result of perturbations of membrane functions.^[27] *Momordica charantia* increases the renewal of partial cells in the pancreas or may permit the recovery of partially destroyed cells and stimulates pancreatic insulin secretion.^[28]

***Trigonella foenum-graecum* (Fenugreek)**

Fenugreek promotes digestion, induces labor, and lowers blood sugar levels in diabetes. A 2016 meta-analysis combining the results of 12 small studies, of which only three were high quality, found that fenugreek may reduce some biomarkers in people with diabetes and with pre-diabetic conditions, but that better quality research would be required in order to draw conclusions.^[29]

4-Hydroxyleucine, a novel amino acid from fenugreek seeds increased glucose stimulated insulin release by isolated islet cells in rats, mice and humans.^[30] *Trigonella foenum-graecum* has been observed to cause glucose-induced insulin release in vitro and in vivo.^[31] A specific amino acid, hydroxyisoleucine, which represents 80% of the free amino acids in *Trigonella foenum-graecum* seeds, may possess insulin-stimulating properties.^[32] It helps to improve insulin sensitivity, which is presumed to be due to the effects of fiber, which slows carbohydrate metabolism resulting in reduced insulin levels and lowered blood glucose.^[33] Anti-

hyperglycemic effect of the extracts, powder and gum of *Trigonella foenum-graecum* seeds and leaves have been linked to delayed gastric emptying caused by the high fiber content, inhibition of carbohydrate digestive enzymes and stimulation of insulin secretion.^{[34][35]}

III. CHOICE OF SOLVENTS

Selection of solvents according to the plants used is the most crucial step, as the solvents and extracts provides the foremost step of any research studies. They paves the basic analysis and guides further with the profile of plant's bioactive compounds or metabolites. Multiple solvents have been commonly used to extract phytochemicals, and scientists usually employs a dried powder of plants to extract bioactive compounds and eliminate the interference of water at the same time. All the compounds have structure and groups that enter the reaction mixture forming complex structures. Generally plant extractions are carried out with ethanol/methanol or acetone/water.^[36] The second stage involves the dryness of extracts to which various other solvents are added for evaporation that basically involves water and ethanol.^[37] The Solvents used for the extraction of biomolecules from plants are chosen based on the polarity of the solute of interest. A solvent of similar polarity to the solute will properly dissolve the solute. Multiple solvents can be used sequentially in order to limit the amount of analogous compounds in the desired yield.^[38] The main solvents for the above discussed herbs mainly consists of ethanol, methanol, hexane, ethyl acetate, acetone, petroleum ether, water. Ethanolic fractions are usually considered for the good results of GC-MS analysis, whereas aqueous fraction are considered to be poor.^[39] Methanolic extracts are the better solvents for the phytochemical analysis. For the in vivo studies, rat feeds are often mixed with hydro- solvents (hydro-alcoholic) in order to avoid toxic effects for the animals and its organs.

The polarity, from least polar to most polar, of a few common solvents is as follows:

Hexane < Chloroform < Ethylacetate < Acetone < Methanol < Water.

IV. CONCLUSION

As per Indian herbal system, there exists an enormous varieties of plants to treat and prevent diabetes. Only few of them have been scientifically proven and there are still more to be explored. Solvent selection plays a major role in the extraction of herbal plants and fruitful results. All the above mentioned plants are reported to control diabetes and their complications. Future studies may target isolation,

purification, and characterization of bioactive compounds present in these plants. The outcome of such studies may provide a starting point for development of potential ant diabetic drugs. This review may be helpful in the management of diabetes.

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