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REVIEW ARTICLE

Use of Medicinal Plants for Pre diabetic Blood Sugar Level Control

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ABSTRACT

Medicinal Plants are being used for the treatment and prevention of diseases including diabetes since long time as compared to conventional medicines. Pre-diabetes is a condition with 'impaired glucose tolerance'. If not dealt properly and timely, may develop into type-2 diabetes and type-1 diabetes over time which is the major public health concerns over the world. However, it is possible to halt or reverse the progression of pre-diabetes, or at least delay the development of diabetes by the use of herbs and botanical ingredients. Active lifestyle and intake of diabetes preventing herbal medicines can offer pre-diabetics a healthy life. A detailed overview of diabetes preventing herbs and botanical ingredients is presented here that help in regulation of blood glucose levels without causing adverse side effects to the body.

Keywords: Herbs, Spices, Pre-diabetes, Blood sugar, Insulin and Glucose.

INTRODUCTION

The health condition, in which the level of blood sugar is elevated than normal yet not high enough to be classified as diabetes, is medically termed as pre-diabetes. Another term used to describe the same condition is – 'impaired glucose tolerance'. Symptoms of pre-diabetes include frequent urination, excessive thirst, excessive appetite, unexplained weight loss, and delay in healing of your wounds and sores. Among the other symptoms of pre diabetes, sense of dizziness, frequent fatigue, blurred vision, a depressed outlook, and an overall feeling of being unwell are included. Prediabetes is a condition that affects a significant number of people across the whole globe. Majority of the cases suffering from prediabetes, if left unattended, develop type 2 diabetes and type 1diabetes over time. However, it is possible to halt or reverse the progression of pre -diabetes, or at least delay the development of diabetes. People with prediabetes are often deficient in vitamins and nutrients that are needed to help the body function properly. Studies have shown that most prediabetics are vitamin D-insufficient. Supplementing with vitamin D can help ensure calcium absorption in the body and can also help control high blood pressure, obesity and diabetes (Kanetkar, *et. al*, 2007).

Five phytosterol compounds isolated from aloe vera gel namely lophenol, 24-ethyl lophenol, 24-methyl-lophenol, cycloartanol and 24-methylene-cycloartanol have been known to show anti-hyperglycemic effects in type-2 diabetes (Tanaka *et al*., 2006). It improves responsiveness of the body tissues towards insulin which makes insulin more effective. (Misava *et al*., 2008)

There has been a great deal of research surrounding diabetes over the years, due to the fact that there are a large number of sufferers worldwide. Patients often struggle to make the necessary lifestyle changes to control blood sugar levels, and current medications have limitations and can have adverse gastrointestinal side effects. Clinical studies and research have often recommended the use of a natural or a herbal cure for diabetes, rather than relying solely on drugs. Traditional herbs may offer a new option for managing blood sugar levels, either alone or in combination with other treatments.

1. Banaba (*Lagerstroemia speciosa*)

Common Name: Commonly it is known as Queen's flower, pride of India, giant crape-myrtle, queen's crape-myrtle,

Family: Lythraceae.

Queen's flower is a deciduous tropical flowering tree growing up to 50 feet tall, it has smooth rounded, red-orange leaves having higher levels of corosolic acid. The flowers are racemes and are pink, purple or purplish - pink. The fruit is oval, about one inch long and splits in six pieces when mature; the seeds are small and have winged flaps.

Properties

- Lowers blood sugar levels (hypoglycemic effect)
- Facilitates glucose transport into cells and
- Reduces amount of triglycerides.

Mode of action

The roots are used for stomach problems. Tea of the leaves is used against diabetes mellitus and for weight loss. Banaba leaves are able to lower blood sugar due to, among other phytochemicals; acid (triterpenoid glycoside). This is not the only active phyto-chemical, though. The phyto-chemicals in the leaves of Banaba work at the molecular level by fine-tuning the damaged insulin receptor, which is the cause of insulin resistance. Banaba also contains concentrations of dietary fiber and minerals such as magnesium and zinc.

It helps the body handling glucose and is as such also effective in weight loss and against obesity. The hypoglycemic (blood sugar lowering) effect is similar to that of insulin, which induces glucose transport from the blood into body cells. The tea is therapeutic against ailments such as diabetes, kidney and urinary problems. The taste is pleasant and smooth; in Japan it is known as "slimming tea."Banaba can also be applied against gout (metabolic arthritis); the leaves contain Valoneic Acid Dilactone (VAD). This acts as an inhibitor of xanthine oxidase to lower uric acid levels.

2. Bitter Melon (*Momordica charantia*)

Common Name : It is commomly known as Aampalaya, arsorossie, balsam pear, balsampfel, balsamina, b, bitter melon, bitteremelone, bitter gourd, karela, , muop dang, pomme de merveille, pomo balsam,.

Family: Cucurbitaceae

It is a tender perennial, herbaceous tropical vine belonging to the family Cucurbitaceae. The fruit is edible when harvested and cooked. Its taste is bitter. Bitter melon has twice the potassium of bananas and is also rich in Vitamin A and C. It is a monoecious climber with dark green, deeply lobed leaves with hairs on it. The dioeciously flowers are yellow and the fruits oblong and lumpy with a light green to greenish-white, waxy skin. Bitter melon seems to be supportive in HIV; several proteins (such as alpha and beta momocharin) have HIV inhibitory effects in vitro. However, they are not cytotoxic.

Properties:

- Hypoglycemic (lowering blood sugar) properties
- Enhancing cell uptake of glucose
- Promotes insulin release
- Potentiates the effect of insulin
- Reduces total cholesterol and triglycerides

Mode of Action

Lectins from Bitter melon have shown good antilipolytic and lipogenic activity. Map 30 is a specific protein in bitter melon that is useful in treating HIV infection. There is another smaller variety Balsam apple (*M. balaminal*), which has seeds surrounded by a bright red pulp. These seeds are small and black. The juice of this plant appears to beabortifacient. In traditional Chinese medicine, the vegetable is used as an appetite stimulant and as a treatment for gastrointestinal infection and against cancer (breast). Bitter melon is also hypoglycemic (has blood sugar- lowering effects). It is very effective against type 2 diabetes and has no known side effects (Basch *et al*., 2003).

It has been proven to increase the number of beta cells (those which produce insulin) in the pancreas and is natural support for diabetes. Certain components of Bitter melon resemble the chemical structure of the hormone insulin, needed to keep the blood sugar level in balance. Bitter melon is just as effective as the prescription-only drug Glibenclamide (Glyburide) at reducing blood sugar levels but without causing any adverse effects. This plant has many therapeutic properties and is used against fever, stomachache, diabetes-mellitus and hypertension.

3. Bitter wood (*Quassia amara*)

Common Name: Commonly known as Surinam wood, amargo, kwassi, bitterwood, quassia wood, pau amarelo, pau quassia, quassiaamarga, quassia, palomuneco,

Family :Simaroubaceae

Amargo is a small indigenous tree to Suriname, 6 to 18 feet tall. The evergreen compound leaves mostly consist of 3 to 5 and often 7, uneven feathered, single leaves. The leaf stalk and axis are winged, and the stem, stalks and nerves are red. The racemes exist of beautiful small cherry-red flowers; out of each flower arise 5 oval, red-brown fruits which turn black as they ripen. The red fruits contain each a single seed.

Properties:

- Stimulates the liver and among other properties, controls the blood sugar

Mode of Action

The bark contains many phytochemicals, which are 50 times bitterer than quinine. Amargo contains the phyto-chemical quassin, the bitterest substance found in nature. It is utilized for stomach, gallbladder and digestive problems. Quassiamarin, a phytochemical that has demonstrated antileukemic - and anti-tumorous properties is also found in this plant. Antibacterial and antifungal properties of this plant are impressive and higher than the drugs Ampicillin (Principen) and Tioconazole (Vagistat-1). Quassin has also prophylactic activity against lice. It is used in cases of anorexia nervosa, is effective in chronic diseases of the liver and has anti - malaria activity. Its extract has been shown to be potentially valuable in the treatment of diabetes and associated dyslipidemia.

4. Silk Cotton Tree (*Ceiba pentandra)*

Common name - Kapok tree, silk cotton tree, ceiba de lana, bois coton, kapokier, pacae, sumauma, kankantri.

Family : Malvaceae

It is very large majestic tree, with a conspicuously buttressed trunk. The kapok tree grows more than 200' tall; with widely spreading branches, it is the tallest tree of the Amazon rainforest. The trunk can become more than 9' in diameter. This deciduous tree is host to numerous aerial plants, insects, birds, frogs and other animals. The silk cotton tree is cultivated for kapok. This floss is light and fluffy, resistant to water and decay. It is used as a stuffing in life jackets. While still on the tree, the fruits burst open exposing the cotton like substance, which is the kapok of commerce. The small, brown seed, in betted within the fluffy kapok, is blown away in the wind for many miles. Oil from the seeds is used in edible products and the ground seeds in animal feed.

Properties:

- Hypoglycemic effect

Mode of Action

Ceiba pentandra bark decoction has been used as a diuretic, aphrodisiac, and to treat headache, as well as type II diabetes. It is used as an additive to some versions of the hallucinogenic drink Ayahuasca.

5. Holy Basil (*Ocimum sanctum*)

Common name - Holy Basil, Tulsi, Tulasi, Kemangen.

Family: Lamiaceae

Holy Basil is a tropical, much branched, annual herb, up to 18 inches tall; it grows into a low bush. It is considered sacred by the Hindus; it has small leaves and a hairy stem with a strong smell and purple flowers and has a sweet-camphoraceous fragrance.

There are two varieties: a red - and a green one. Red holy basil has a stronger smell. This plant, originally from India, grows abundantly in Suriname. Apart from the religious significance, it also has substantial medicinal meaning and is used in Ayurvedic treatment.

Properties:

- May have a positive effect on fasting blood sugar and on blood sugar following meals.

Mode of Action

Tulsi has antimicrobial properties since it is also anti - inflammatory due to the oil eugenol, present in the leaves. It is useful in respiratory tract infection. The Ursolic acid present in holy basil, has anti-allergic properties. The plant can play a role in the management of immunological disorders such as allergies and asthma. The juice of the leaves is used against diabetes, fever and as an antidote for snake and scorpion bites. It's anti-spasmodic properties, relieves abdominal pains and helps in lowering the blood sugar level.

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

Common name: Little triangle, Methi, Saagmethi, Kasurimethi, ,Trigonelle, Mithi, Methika, Fenugriek, Meti, Uluva.

Family : Fabaceae

Properties:

- Fenugreek is an herb found all over India and its seeds are usually used as one of the major constituents of Indian spices.
- Fenugreek is used to treat numerous health problems, including insulin resistance, diabetes, poor appetite, inflammation, digestive problems and menopausal symptoms.
- It is known to have anti-ulcer, anti-carcinogenic, anti-diabetic, immune modulatory, anti-oxidant and anti-fertility activities.

Mode of Action

4-hydroxyleucine, a novel amino acid from fenugreek seeds increases glucose stimulated insulin release. In animal experiments, it has been shown that oral administration of plant extract decreased the blood glucose levels. Administration of fenugreek seeds improved glucose metabolism and reduced hepatic and renal glucose-6-phosphatase and fructose −1,6-biphosphatase activity. Diosgenin, 4-hydroxyisoleucine and fiber component of the plant are known to exert beneficial effects on glucose tolerance, inflammation and insulin action.

This mechanism of action is due to restoration of pancreatic beta cells, down regulation of enzyme involved in hepatic gluconeogenesis and glucose export, up regulation of hepatic glucokinase. Diosgenin is also known to restore normal pancreas morphology, improved serum glucose and insulin concentrations, increased amounts of antioxidant enzymes and enhanced PPARγ expression. This is associated with decreased production of pro inflammatory mediators TNF-α, Monocyte chemoattractant protein 1 (MCP-1) and NO.

7. **Garlic (*Allium sativum*)**

Common name: Aignon, wild onion, lehsun, lassan, cultivated garlic, Russian Penicillin, snake grass.

Family: Amaryllidaceae

Properties:

- It is a bulbous perennial herb that grows up to 1.2 m (4 ft) in height. It produces hermaphrodite flowers.
- Allicin, a sulfur-containing compound is responsible for its pungent odour and it has been shown to have significant hypoglycemic activity.
- *Allium sativum* exhibits antimicrobial, anticancer, antioxidant and cardio protective activities.
- Garlic supplements play positive role in blood glucose, total cholesterol, high and low density lipoprotein regulation in management of type 2 diabetes.

Mode of Action

It is used to prevent diabetes associated complications. Allicin (allyl-2-propene thiosulfinate or diallylthiosulfinate) as an important bioactive compound of garlic has effect on increased insulin secretion and release of C-peptide from pancreatic beta cells (Jain and Vyas, 1975) Decreased insulin resistance is brought about by garlic and its antioxidant effect is due to sulfur containing compounds in it.

8. Cinnamon (*Cinnamomum verum*)

Common name: Dal chini, korunda, kurandu, kayumanis

Family : Lauraceae

Properties:

- Apart from lowering the risks associated with complications of diabetes, Cinnamon helps lower the risk of heart diseases and Alzheimer's disease.
- Cinnamon also reduces serum triglycerides, LDL cholesterol, and total cholesterol.

Mode of Action

Cinnamon improves blood glucose control in people with type 2 diabetes. The most active compound in cinnamon, known as methylhydroxychalcone, a polymer imitates the effects of insulin increases glucose metabolism and effectively lowers blood glucose levels by transporting glucose into the cells. It inhibits the activity of glycogen synthase. It also increases the insulin sensitivity thereby making insulin more efficient in moving glucose into the cells (Jarvill *et al.*, 2001). Extract of Cinnamon also increases the phosphorylation of insulin receptors and decreasing of tyrosine phosphatase activity (Olefsky, 2000).

CONCLUSION

There is a continuous rise in the prevalence of diabetes cases. Major cause is our eating habits and sedentary lifestyle, even gestational diabetes is not uncommon. Active lifestyle and proper medical intervention can prevent progression to diabetes. Natural God gifted herbs that prevent diabetes have no bad side effects unlike the man-made market pharmaceuticals and food enhanced chemicals. Incorporating these herbs in our daily routine can surely help pre-diabetics stay healthy for longer time without progressing to type 2 diabetes (Martens, 1995).

Although the above described herbs have potential to help pre-diabetics maintain lower blood sugar and reach a Hemoglobin A1c goal of < 7.0, but much more research is needed. Active ingredients and mechanisms of action need to be elucidated. Major hindrance in amalgamation of herbal medicine in modern medical practices is lack of scientific and clinical data proving their efficacy and safety. There is a need for conducting clinical research in herbal drugs, developing simple bioassays for biological standardization, pharmacological and toxicological evaluation, and developing various animal models for toxicity and safety evaluation. It is also important to characterize the active component/s from these plant extracts.

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