



A BRIEF ON DIABETIC, AND ANTIDIABETIC PLANTS FOUND IN EASTERN UTTAR PRADESH

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Received -05-04-2013; Reviewed and accepted -20-04-2013

ABSTRACT

Traditional Medicines derived from medicinal plants are used by about 60% of the world's population. This review focuses on Indian Herbal drugs and plants used in the treatment of diabetes, especially in India. Diabetes is an important human ailment afflicting many from various walks of life in different countries. In India it is proving to be a major health problem, especially in the urban areas. Though there are various approaches to reduce the ill effects of diabetes and its secondary complications, herbal formulations are preferred due to lesser side effects and low cost. A list of medicinal plants with proven antidiabetic and related beneficial effects and of herbal drugs used in treatment of diabetes is compiled. These include, *Allium sativum*, *Eugenia jambolana*, *Momordica charantia*, *Ocimum sanctum*, *Phyllanthus amarus*, *Pterocarpus marsupium*, *Tinospora cordifolia*, *Trigonella foenum graecum* and *Withania somnifera*. One of the etiologic factors implicated in the development of diabetes and its complications is the damage induced by free radicals and hence an antidiabetic compound with antioxidant properties would be more beneficial. Therefore information on antioxidant effects of these medicinal plants is also included.

Key words: medicinal plant, India, antidiabetic, antioxidant, diabetes.

INTRODUCTION

Diabetes is a metabolic disorder where in the human body does not produce or properly uses insulin, a hormone that is required to convert sugar, starches, and other food into energy. Diabetes mellitus is characterized by constant high levels of blood glucose (sugar). The human body has to maintain the blood glucose level at a very narrow range, which is done with insulin and glucagon. The function of glucagon is causing the liver to release glucose from its cells into the blood, for the production of energy.

There are three main types of diabetes:

- Type 1 diabetes
- Type 2 diabetes
- Gestational diabetes

Type 1 and Type 2 diabetes impede a person's carefree life. When the breakdown of glucose is stopped completely, the body uses fat and protein for producing the energy. [1] Due to this mechanism symptoms like and excessive weight loss can be observed in a diabetic. Desired blood sugar of human body should be between 70 mg/dl -110 mg/dl at fasting state. If blood sugar is less than 70 mg/dl, it is termed as hypoglycemia and if more than 110 mg/dl, it's hyperglycemia.

Diabetes is the primary reason for adult blindness, end-stage renal disease (ESRD), gangrene and amputations. Overweight, lack of exercise, family history and stress increase the likelihood of diabetes. When blood sugar level is constantly high it leads to kidney failure, cardiovascular problems, and neuropathy. Patients with diabetes are 4 times more likely to have coronary heart disease and stroke. In addition, Gestational diabetes is more dangerous for pregnant women and their fetus.

Though, Diabetes mellitus is not completely curable but, it is controllable to a great extent. So, you need to have thorough diabetes information to manage this it successfully. The control of diabetes mostly depends on the patient and it is his/her responsibility to take care of their diet, exercise, and medication. [2] Advances in diabetes research have led to better ways of controlling diabetes and treating its complications. Hence they include:-

- New improved Insulin and its therapy, (external and implantable insulin pumps) have advanced well to manage elevated blood sugars without any allergic reactions.
- The oral hypoglycemic drug controls diabetes type 2.

- New improved blood glucose monitor (a new device for self-blood glucose monitoring), and hemoglobinA_{1c} laboratory test to measure blood glucose control during previous 3 months.
- Effective availability of the treatments for affected body organs due to diabetes.

Better ways to manage mother and its fetus health during the gestational diabetes phase

DISCUSSION

Diabetes Causes

Type 1 diabetes: Type 1 diabetes is believed to be an autoimmune disease. The body's immune system attacks the cells in the pancreas that produce insulin.

-A predisposition to developing type 1 diabetes may run in families, but genetic causes (a positive family history) is much more common for type 2 diabetes.

-Environmental factors, including common unavoidable viral infections, may also contribute.

-Type 1 diabetes is most common in people of non-Hispanic, Northern European descent (especially Finland and Sardinia), followed by African Americans, and -Hispanic Americans. It is relatively rare in those of Asian descent.

-Type 1 diabetes is slightly more common in men than in women.

Type 2 diabetes: Type 2 diabetes has strong genetic links, meaning that type 2 diabetes tends to run in families. [3] Several genes have been identified and more are under study which may relate to the causes of type 2 diabetes. Risk factors for developing type 2 diabetes include the following:

- High blood pressure
- High blood triglyceride (fat) levels
- Gestational diabetes or giving birth to a baby weighing more than 9 pounds
- High-fat diet
- High alcohol intake
- Sedentary lifestyle
- Obesity or being overweight
- Ethnicity, particularly when a close relative had type 2 diabetes or gestational diabetes: certain groups, such as African-Americans, Native Americans, Hispanic Americans, and Japanese Americans, have a greater

risk of developing type 2 diabetes than non-Hispanic whites.

Gestational diabetes

Aging: Increasing age is a significant risk factor for type 2 diabetes. Risk begins to rise significantly at about age 45 years and rises considerably after age 65 years. **Glucose intolerance during pregnancy.**

Gestational diabetes is high blood sugar (diabetes) that starts or is first diagnosed during pregnancy.

Causes, incidence, and risk factors

Pregnancy hormones can block insulin from doing its job. When this happens, glucose levels may increase in a pregnant woman's blood [4].

- You are at greater risk for gestational diabetes if you:
- Are older than 25 when you are pregnant
- Have a family history of diabetes
- Gave birth to a baby that weighed more than 9 pounds or had a birth defect
- Have sugar (glucose) in your urine when you see your doctor for a regular prenatal visit
- Have high blood pressure
- Have too much amniotic fluid
- Have had an unexplained miscarriage or stillbirth
- Were overweight before your pregnancy

Mechanism of Action

- Insulin receptors consist of 2 extracellular α and transmembrane β subunit linked by a disulfide bond.
- A subunit contains insulin binding site and β have tyrosine protein kinase activity.
- Binding of insulin to α subunit induces aggregation and internalization of the receptor along with bound insulin molecule.
- This activates tyrosine protein kinase activity of β subunit.
- Tyrosine residue of β subunit gets autophosphorylated.
- Hence the activity of this subunit to phosphorylate tyrosine residue of insulin receptor substrate protein (IRS1, IRS2) is increased.
- In a cascade of phosphorylation and dephosphorylation reaction is set into motion resulting in stimulation or inhibition of enzyme involved in the rapid metabolic function of insulin. Treatments include
 - (1) Agents which increase the amount of insulin secreted by the pancreas,
 - (2) Agents which increase the sensitivity of target organs to insulin, and
 - (3) Agents which decrease the rate at which glucose is absorbed from the gastrointestinal tract.

Common symptoms of both major types of diabetes

Fatigue: In diabetes, the body is inefficient and sometimes unable to use glucose for fuel. The body switches over to metabolizing fat, partially or completely, [5] as a fuel source. This process requires the body to use more energy. The end result is feeling fatigued or constantly tired.

Unexplained weight loss: People with diabetes are unable to process many of the calories in the foods they eat. Thus, they may lose weight even though they eat an apparently appropriate or even excessive amount of food. Losing sugar and water in the urine and the accompanying dehydration also contributes to weight loss.

Excessive thirst (polydipsia): A person with diabetes develops high blood sugar levels, which overwhelms the kidney's ability to reabsorb the sugar as the blood is filtered to make urine. Excessive urine is made as the kidney spills the excess sugar. The body tries to counteract this by sending a signal to the brain to dilute the blood, which translates into thirst. The body encourages more water consumption to dilute the high blood

sugar back to normal levels and to compensate for the water lost by excessive urination.

Excessive urination (polyuria): Another way the body tries to get rid of the extra sugar in the blood is to excrete it in the urine. This can also lead to dehydration because excreting the sugar carries a large amount of water out of the body along with it.

Excessive eating (polyphagia): If the body is able, it will secrete more insulin in order to try to deal with the excessive blood sugar levels. Moreover, the body is resistant to the action of insulin in type 2 diabetes. One of the functions of insulin is to stimulate hunger. Therefore, higher insulin levels lead to increased hunger and eating. Despite increased caloric intake, the person may gain very little weight and may even lose weight.

Poor wound healing: High blood sugar levels prevent white blood cells, which are important in defending the body against bacteria and also in cleaning up dead tissue and cells, from functioning normally. When these cells do not function properly, wounds take much longer to heal and become infected more frequently. Also, long-standing diabetes is associated with thickening of blood vessels, which prevents good circulation including the delivery of enough oxygen and other nutrients to body tissues.

Infections: Certain infection syndromes, such as frequent yeast infections of the genitals, skin infections, and frequent urinary tract infections, may result from suppression of the immune system by diabetes and by the presence of glucose in the tissues, which allows bacteria to grow well [6]. They can also be an indicator of poor blood sugar control in a person known to have diabetes.

Altered mental status: Agitation, unexplained irritability, inattention, extreme lethargy, or confusion can all be signs of very high blood sugar, ketoacidosis, hyperosmolar hyperglycemia nonketotic syndrome, or hypoglycemia (low sugar). Thus, any of these merit the immediate attention of a medical professional. Call your health care provider or 911.

Blurry vision: Blurry vision is not specific for diabetes but is frequently present with high blood sugar levels.

Exams and Tests

Doctors use special tests in diagnosing diabetes and also in monitoring blood sugar level control in known diabetics.

If the patient is having symptoms but is not known to have diabetes, evaluation should always begin with a thorough medical interview and physical examination. The healthcare provider will about symptoms, risk factors for diabetes, past medical problems, current medications, allergies to medications, family history of diabetes or other medical problems such as high cholesterol or heart disease, and personal habits and lifestyle.

A number of laboratory tests are available to confirm the diagnosis of diabetes.

Finger stick blood glucose: This is a rapid screening test that may be performed anywhere, including community-based screening programs.

A fingerstick blood glucose test is not as accurate as testing the patient's blood in the laboratory but is easy to perform, and the result is available right away.

The test involves sticking the patient's finger for a blood sample, which is then placed on a strip. The strip goes into a machine that reads the blood sugar level. These machines are only accurate to within about 10% of true actual laboratory values.

Fingerstick blood glucose values may be inaccurate at very high or very low levels, so this test is only a preliminary screening study. This is the way most people with diabetes monitor their blood sugar levels at home.

Fasting plasma glucose: The patient will be asked to eat or drink nothing for 8 hours before having blood was drawn (usually first thing in the morning). If the blood glucose level is greater than or

equal to 126 mg/dL without eating anything, they probably have diabetes.

If the result is abnormal, the fasting plasma glucose test may be repeated on a different day to confirm the result or the patient may undergo an oral glucose tolerance test or a glycosylated hemoglobin test (often called "hemoglobin A1c") as a confirmatory test.

If fasting plasma glucose level is greater than 100 but less than 126 mg/dL, then the patient has what is called impaired fasting glucose, or IFG. This is considered to be pre-diabetes. The patient does not have diabetes, but they are at high risk of developing diabetes in the near future.

Oral glucose tolerance test: This test involves drawing blood for a fasting plasma glucose test, then drawing blood for a second test at two hours after drinking a very sweet drink containing 75 grams of sugar.

If the blood sugar level after the sugar drink is greater than or equal to 200 mg/dL, the patient has diabetes.

If the blood glucose level is between 140 and 199, then the patient has impaired glucose tolerance (IGT), which is also a pre-diabetic condition.

Glycosylated hemoglobin or hemoglobin A1c: [7] This test is a measurement of how high blood sugar levels have been over about the last 120 days (the average lifespan of the red blood cells on which the test is based).

ANTIDIABETIC HERBAL SURVEY

Table 1: Following antidiabetic plants are commonly found in eastern Uttar Pradesh [8] [9] [10] [11].

Latin Name	Common name	Uses
Aegle marmelos	Bael Tree, Bengal Quince Bael, Belgin	Diabetes, jaundice, cholera and asthma (leaves); tonic, coolant with antibiotic properties (leaves, fruits and root); fruit valuable for its rich nutritive, sweet, aromatic mucilage and pectin contents – very good for all kinds of stomach disorders; root bark given in case of poverty of seminal fluid, palpitation of heart and melancholia
Alpinia galanga	Greater Galangal, Siamese Ginger,	Aromatic rhizomes recommended for the treatment of diabetes;
Borassus flabellifer	Palmyra Palm, Desert Palm, Tad, Tal	Fresh, sweetish juice obtained from cuts made in the flowering stalk is given in diabetes after slight fermentation
Butea monosperma	Bengal Kino, Flame of the Forest, Dhak	Leaves, flowers and seed anti-diabetic, diuretic, tonic, and aphrodisiac; they induce fall in the amount of blood-sugar and so are given for the treatment of glycosuria; kino (resinous gum) is aphrodisiac and also used in medicines for throat troubles; kino is secreted in cavities between the wood and bark, and oozes out after incisions have been made; in the air the resin hardens into a solid reddish mass
Cassia auriculata	Tanner's Cassia, Avari, Tangedu, Taroda	This plant is given in diabetes with excellent results; flower buds are specially preferred; decoction of the flowers, flower buds and seed is an excellent remedy for diabetes;
Cassia sophera	Senna Sophera, Banar, Bas-ki-kasuda, Kasaundi	Infusion of bark and powdered seeds with honey are good remedy for diabetes; also aphrodisiac tonic, blood purifier and throat cleanser
Ceiba pentandra	Kapok Tree, White Cotton Tree, Safed Samel	Juice of roots (stimulant, tonic) is highly valued as a cure for diabetes;
Curcuma longa	Turmeric, Haldi	Turmeric with the juice of amla (phyllanthus emblica) is very useful to treat diabetes and jaundice;
Ficus benghalensis	Banyan Tree, Bargat	Infusion of bark in water (1:10) is a specific remedy for diabetes, as it reduces blood sugar
Ficus glomerata	Fig Tree, Gular	Bark and fruits taken with honey are very useful in diabetes; pulverized seeds mixed with honey are a specific remedy for diabetes
Helecteres isora	East India Screw Tree, Marophali, Dhamni	Root bark and pods provide good cure of diabetes
Gymnema sylvestris	Gurmaar	Most effective herbal drug to cure diabetes; also useful in cardiac and ophthalmic problems; also cures impotency
Madhuca indica	Butter Tree, Hohwa Tree, Mahua	Decoction of bark is prescribed in diabetes mellitus with good results
Mangifera india	Mango Tree, Am	A powder made of the dried tender leaves is beneficially given in diabetes
Momordica charantia	Bitter gourd, Bitter melon, Karela	Leaves and fruits anti-diabetic, blood purifier and hypoglycaemic; bitter melon increases the number of beta cells by the pancreas, thereby improving the body's ability to produce insulin;

Excess blood glucose hooks on to the hemoglobin in red blood cells and stays there for the life of the red blood cell.

The percentage of hemoglobin that has had excess blood sugar attached to it can be measured in the blood. The test involves having a small amount of blood drawn.

A hemoglobin A1c test is the best measurement of blood sugar control in people known to have diabetes. A hemoglobin A1c result of 7% or less indicates good glucose control. A result of 8% or greater indicates that blood sugar levels are too high for too much of the time.

The hemoglobin A1c test is less reliable to diagnose diabetes than for follow-up care. Still, a hemoglobin A1c result greater than 6.1% is highly suggestive of diabetes. Generally, a confirmatory test would be needed before diagnosing diabetes.

The hemoglobin A1c test is generally measured about every three to six months for people with known diabetes, although it may be done more frequently for people who are having difficulty achieving and maintaining good blood sugar control.

This test is not used for people who do not have diabetes or are not at increased risk of diabetes.

Normal values may vary from laboratory to laboratory, although an effort is under way to standardize how measurements are performed.

Musa paradisica	Banana, Kela	Cooked flowers are given in diabetes with good results
Phyllanthus emblica (Emblica officinalis)	Emblc Myrobalan, Amla, Amlaki	Fruits and seeds very useful in diabetes.
Pongamia pinnata	Indian Beech, Poonga Oil Plant, Karanj, Kiramal, Papar	Flowers are useful as a remedy for diabetes
Syzygium cumini	Black Plum, Indian Blackberry, Jamun, Jambolan	Fresh or dried powdered seeds most effective in diabetes mellitus and glycosuria; they quickly reduce sugar in urine, a liquid extract from fresh seeds is particularly suitable.
Terminalia chebula	Chebulic myroblan, Black myroblan, Harada	Fruits anti-diabetic, alterative, tonic for anaemia, antibilious; stimulates liver activity; mild, safe and an efficient laxative to cure all digestive disorders; bark is useful as cardiac tonic, raises blood pressure, and as an effective diuretic
Trigonella foenum-graceum	Fenugreek, Methi	Water-soaked seeds are useful to treat diabetes;
Zingiber officinale	Ginger, Adrak	Rhizome taken with sugar candy is a good remedy in diabetes.

CONCLUSION

By the whole survey, I conclude that the plants I found in various part of eastern Uttar Pradesh play an avital role for the treatment of diabetic and for the betterment of human beings. Diabetes is a metabolic disorder which can be considered as a major cause of high economic loss which can, in turn, impede the development of nations. Moreover, uncontrolled diabetes leads to many chronic complications such as blindness, heart failure, and renal failure. In order to prevent this alarming health problem, the development of research into new hypoglycemic and potentially antidiabetic agents is of great interest. The families of plants with the most potent hypoglycaemic effects include: Leguminosae (11 species), Lamiaceae (8 sp.), Liliaceae (8 sp.), Cucurbitaceae (7 sp.), Asteraceae (6 sp.), Moraceae (6 sp.), Rosaceae (6 sp.), Euphorbiaceae (5sp.) and Araliaceae (5 sp.)

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