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Review: Medicinal Plants on Anti-Diabetic Activity

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ABSTRACT: Rich herbs for antidiabetic drugs are suggested as a potential but undiscovered potential source. Diabetes Insulin deficiency has been used since ancient times to detect sugar in the blood and urine. Many synthetic substances were found either alive or indirectly from plant sources. Current review of plants with antidiabetic properties. Although many trees It is recommended that further pharmacological and chemical research be carried out to clarify the exact mechanism Hypoglycaemic action.

Keywords: diabetes mellitus, herbs, antioxidants

I. INTRODUCTION

Diabetes mellitus According to WHO, the term diabetes mellitus is defined as a metabolic disorder of multiple etiology characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action, or both. The effects of diabetes mellitus include long-term damage, dysfunction and failure of various organs. Diabetes mellitus may have the characteristic symptoms such as thirst, polyuria, blurred vision and loss of weight.[1]

Diabetes mellitus, one of the most common endocrine metabolic disorders has caused significant morbidity and mortality due to microvascular (retinopathy, neuropathy, and nephropathy) and macrovascular (heart attack, stroke and peripheral vascular disease) complications.

TYPES OF DIABETES

In general considerations, all forms of diabetes are categorized under the two major forms of diabetes i.e. Type 1 and Type 2 diabetes:

Type 1 Diabetes

Type 1 diabetes is considered as an autoimmune disorder where the body's defense mechanisms fail to recognize the self-pancreatic cells and produce immune mechanisms against them, thus destructing the insulin-producing Beta cells. The chances of occurrence of this form of diabetes is generally rare when compared with other forms of diabetes and is generally seen in around 5- 10% of diabetic populations. Auto destruction of beta cells in type-1 diabetes is caused by islet cell autoantibodies, insulin directed antibodies, autoantibodies towards Glutamic Acid Decarboxylase or GAD or antibodies directed towards the tyrosine phosphatases. When diagnosed with Type-1 diabetes, multiple antibodies towards pancreatic cells are detected in the patient's blood. Association with HLA gene is also suspected to act as a predisposing factor for the cause of this type of diabetes. Destruction of Beta cells in type-1 diabetes may vary from patient to patient. Destruction may be rapid in some individuals as in case of infants and children or slow as in case of adults and elderly. The first sign of type-1 diabetes in children and adolescents is the appearance of ketoacidosis in diagnosis. Moderate hyperglycemia leading to severe hyperglycemia and ketoacidosis in the presence of infections may also occur in some children. Adult patients tend to retain the residual beta cell functions to prevent ketoacidosis for several years by completely depending on external insulin and live at a lower risk of ketoacidosis. Multiple genetic predispositions are thought to induce autoimmune destruction of β-cells. Patients of Type-1 diabetes also remain at a higher risk of developing other autoimmune disorders that may include Graves' disease, Hashimoto's thyroiditis, Addison's disease, vitiligo, celiac sprue, autoimmune hepatitis, myasthenia gravis, and pernicious anemia.A small proportion of type-1 patients may have chronic insulinopenia and are much prone to ketoacidosis but show no symptoms of an autoimmune disorder. This form of diabetes is strongly inherited but is not HLA associated. Such patients may also suffer from frequent ketoacidosis with varying degree of

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insulin levels between episodes of ketoacidosis. The requirement of insulin in the affected individuals with this type of diabetes may vary.

Type 2 Diabetes

Type-2 or adult-onset form of diabetes affects a majority of the population (around 90-95%) and is characterized by insulin resistance and relative insulin deficiency. These patients generally do not need insulin replacement for their survival. A majority of type-2 diabetes patients suffer from obesity that leads to additional insulin resistance. In non-obese type-2 diabetes patients, body fat distribution occurs predominantly in the abdominal region. Ketoacidosis is a rare condition in type-2 diabetes; although infection or stress factor may lead to ketoacidosis in such patients. Patients with type-2 diabetes are at a higher risk of developing macrovascular and microvascular complications. Insulin levels in such patients appear to be normal, the higher blood glucose levels even in the presence of insulinleads to the conclusion that beta cells are functional and the elevation in glucose levels is due to some other factor. While resistance to insulin can be improved with therapeutic approaches or by lifestyle modifications such as weight reduction, complete restoration of the normoglycemic condition is seldom observed. Age, obesity, hypertension and lack of physical activities may increase the risk of type-2 diabetes. Gestational diabetes (a form of conditional diabetes) may also take the form of permanent type-2 diabetes after childbirth in women if proper measures are not taken. Association of type-2 diabetes with genetic predispositions is strongly believed to exist although clear mechanisms are poorly understood in this case. Common symptoms of diabetes include frequent urination, excessive thirst, increased appetite, fatigue, blurred vision, slow wound healing, weight loss – regardless of increased appetite (type 1), tingling, pain, or numbness of hands/feet (type 2).

TRADITIONAL USES AS ANTI-DIABETIC MEDICINE

After an extensive literature search, it was observed that various parts of the plants are used for the treatment of diabetes and the parts included are leaves, barks, seeds, fruits, stems, flower and in some cases whole plants. Maximum of the plants are used with water and consumed in the early moment of the day.

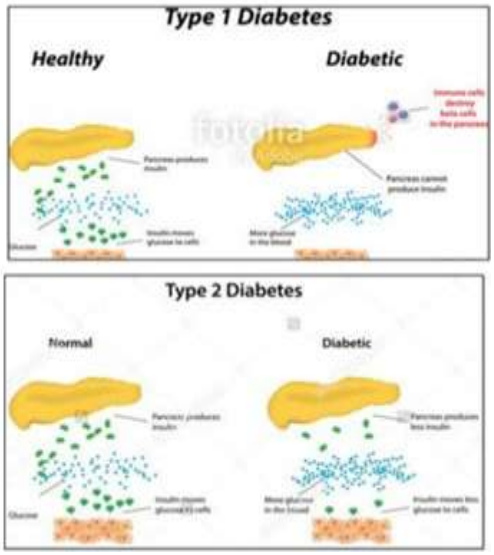

Fig no :1 Diabetes mellitus

Antidiabetic medicinal plants constituents and mechanism of action

To understand how plant constituents can be hypoglycemic in animals, it is advantageous to consider the reasons why compounds with hypoglycemic activity present in plants. Generally, investigations of medicinal agents from plants fixate on plant secondary metabolites. It has been hypothesized that bioactive plant secondary metabolites may assume a part in chemical defense mechanisms. While the exact mechanisms that may be included in chemically interceded coevolution amongst plants and herbivores or pathogenic living beings are disputable, it has been recommended that natural selection would guarantee the survival for reproduction of those individuals of a varieties having the gene coding for generation of a toxin, while individuals without the toxin would be expended. Glucose is the metabolic vitality source and most vital biosynthetic portents in plants, so glucose undergoes stockpiling and mobilization under hormonal control in plants as it does in animals. Now the questions at our mind for natural products chemists are which biological species offered these compounds, what is the molecule structure and how potent are they as medicinal agents?

Most hypoglycemic plant constituents, such as alkaloids, phenolic acids and amino acids, inhibit insulinase in vitro and are hypoglycemic in vivo in normal rats. The wide kind of chemical classes indicates that a variety of mechanisms might be involved in the lowering of the blood glucose level. Moreover, some of these constituents may have

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therapeutic potential, while others may produce hypoglycemia as a side-effect of their toxicity.

MEDICINAL PLANTS WITH ANTI DIABETIC ACTIVITY

1. Gymnemasylvestre

Gymnemasylvestre (GS) is one of the important medicinal herbs and possess anti hyperglycemic activity, often used to supplement patients having DM. The herb GS cultivated in southern region Asia and the East Indies. The GS plant root and leaves possess medicinal value but, the exact mechanis is still not clear. Besides the plant extracts has the ability to distinguish sweet taste, increase enzyme activity responsible for the glucose uptake and utilization. The GS extract kindle pancreatic cell functionalities and increase insulin release. Studies are reported that GS extract lowered blood sugar level, and to possess antisweet and hepatoprotective activities. Recent study reported that GS leaf extract exhibited anti hypoglycemic activity and lowered blood cholesterol level in streptozotocin-induced diabetic rats.

2. Rubia cardifolia

Rubia cardifolia (RC) is found in upper Ghats in evergreen forest up to 3500m above the sea level. RC has been known from traditional medicine with their therapeutic activity towards various ailments. It has several therapeutic values includes blood purifier and hence is extensively used against blood, skin and urinary diseases. The root has some peculiar characteristics includes sweet, acrid, bitter and astringent with following medicinal values such as antidysenteric, antipyretic, analgesic, antiinflammatory, antiseptic, constipating, diuretic, anodyne, galactopurifier, and rejuvenating tonic. Based on the above said properties the GS extract has been used to treat variety of ailments in the modern pharmacopeia.

3. Berberis aristata

Berberis aristata belongs to Berberidaceae family, it has been found Ayurveda medicines as one of a prominent herbs due to their various pharmacological activities including fever, stress, cooling laxative to children, heart and liver tonic. It has been found in literature that Berberis aristata showed potential action for following indications including febrifugal, hypotensive, immunostimulating. The herb berberis aristata also showed following pharmacological activities including, anti-hemolytic, anti-plasmodal, hypolipidemic activity, anti-granuloma activity.

4. Swertia punicea

The whole plant used for diabetic mellitus. The family name is Gentianaceae. Eurasia And western North America is the origin of plant.The action mechanism of hypoglycemic effect of S. punicea was confirmed by the improvement of insulin resistance in the mice with diabetes.

5. Combretum Micranthum

The leaves are useful for the treatment of diabetic mellitus. The family name is Combretaceae. Africa is the origin of the plant. The hypoglycemic activity of this plant's extract was tested by using glucose tolerance and fasting blood sugar assessment in normal rats. The aqueous extract of C. micranthum leaf was has potential antidiabetic property for both type 1 and type 2 diabetes mellitus.

6. Sarcopoterium spinosum

The root are useful for the treatment of the diabetic mellitus. The family name is Rosaceae. The aqueous extract of S. spinosum root may produce antidiabetic effect on progressive hyperglycemia in genetically diabetic mice. The aqueous root extract of the plant shows insulin-like actions in targets tissues.

7. Ficus religiosa

Ficus religiosa, commonly known as peepal in India, belongs to family Moraceae. Ficus religiosa has been reported to be used in the traditional system of Ayurveda for the treatment of diabetes. F. religiosa has been shown to possess a wide spectrum of in vitro and in vivo pharmacological activities: antidiabetic, hypolipidemic, anticonvulsant, anti-inflammatory, analgesic, antimicrobial, antiviral, antioxidant, antitumor, antiulcer, antianxiety, anthelmintic, antiasthmatic, immunomodulatory, estrogenic, endothelin receptor antagonist, apoptosis inducer, cognitive enhancer, and antihypertensive.

8. Eugenia jambolana

Eugenia jambolana (black plum or jamun) belongs to the family Myrtaceae.Themost commonly used plant parts are seeds, leaves, fruits, and bark. Eugenia jambolana is an evergreen tropical tree of 8 to 15 m height, with smooth, glossy turpentine-smelling leaves. The bark is scaly gray, and the trunk is forked. There are fragrant white flowers in branched clusters at stem tips and purplish-black oval edible berries. The berries contain only one seed. The taste is generally acidic to fairly sweet but astringent. This tree is known to have grown in Indian subcontinent and in other regions of South Asia such as Nepal, Burma, Sri Lanka, Indonesia, Pakistan, and Bangladesh from

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ancient time. Jamun has been reported to be used in numerous complementary and alternative medicine systems of India and, before the discovery of insulin, was a frontline antidiabetic medication even in Europe. The brew prepared by jamun seeds in boiling water has been used in the various traditional systems of medicine in India.

9. Momordica charantia

Momordica charantia (bitter gourd or karela) belongs to the family Cucurbitaceae. Fruit as a whole and fruit's seeds are the parts most frequently used for therapeutic benefits. Momordica charantia is a popular fruit used for the treatment of diabetes, cardiovascular diseases, and related conditions amongst the indigenous population of Asia, South America, and East Africa. It is often used as a vegetable in diet. Bitter gourd contains bioactive substances with antidiabetic potential such as vicine, charantin, and triterpenoids along with some antioxidants. Several preclinical studies have documented the antidiabetic and hypoglycaemic effects of Momordica charantia through various hypothesised mechanisms. Several studies have demonstrated antibacterial, antiviral, anticancer, and antidiabetic activities, in Momordica charantia; however, the antidiabetic activity has been widely reviewed. In several animal studies, bitter gourd has been reported to ameliorate the metabolic syndrome, where diabetes is one of the risk factors. In a study conducted on Taiwanese adults, a significant reduction in waist circumference, improvement in diabetes, and symptoms of metabolic syndrome has been observed.

10. Acacia arabica

Acacia arabica (babul) is used in the traditional Indian system of medicine for the treatment and management of diabetes. When powdered seeds extract was administered to rats in varying doses of 2, 3, 4g/kg; hypoglycemia was observed in control rats but not in alloxanised rats. The plant extract was found to be secretagogue and requires functioning beta cells for activity. Plant extract initiates insulin release from beta cells.

11. Adansonia digitata

Different plant parts of Adansonia digitata including leaves, bark and fruits are used in traditional African system of medicine for the management of diabetes. The plant is also consumed as a regular food. For its wide range of medicinal properties, the plant is also referred to as "the small pharmacy or chemist tree.". When methanolic stem bark extract of Adansonia digitata was administered to streptozotocin-induced diabetic Wistar rats, an appreciable reduction in glucose levels was observed that was comparable to controlled rats. Progressive increase in dose resulted in varying hypoglycemic action of extract. When a dose of 100mg/kg was administered, a significant reduction in glucose levels was observed after 1, 3, 5 and 7 hours of extract administration. A dose of 200 mg/kg reduced the blood glucose levels significantly after 3, 5 and 7 hours of administration. A dose of 400 mg/kg showed hypoglycemic action after 5 and 7 hours of administration, compared to control normal saline. The results were suggestive of potential hypoglycemic activity of plant extract.

12. Acorus calamus (Acoraceae)

Oral administration of methanolic extract of A. calamus rhizome restored the levels of blood glucose in Streptozotocin induced diabetic rats after 21 days. Further, lipid profile glucose 6-phosphatase, fructose 1, 6 bis phosphatase levels and hepatic markers enzymes were decreased.

13. Aegle marmelos (Rutaceae)

The aqueous extract of leaves at dose 1gm/kg for 30 days are controlled blood glucose, body weight, liver glycogen. The extract was comparison to insulin in restoring blood glucose and body weight to normal levels. Consequently, the active principle of marmelos extract had similar hypoglycaemic effect to that of insulin.

14. Afzelia Africana (Leguminosae)

The anti diabetic properties of aqueous extract from stem bark of Afzeliaafricana. The dose was 200 mg/kg that was reduced blood glucose level. In addition of hyperglycaemia, it also prevents various complication of diabetes.

15. Alstoniascholaris (Apocynaceae)

The extract of bark of Alstoniascholaris has found to anti diabetic and anti hyperlipidemic activity in induced diabetes in rats. Four week treatment with extract of bark dose 150 mg/kg and 300 mg/kg. Ameliorated the alterations in fasting blood glucose, serum triglyceride, serum cholesterol, liver glycogen, glycosylated haemoglobin and body weight in diabetic rats.

16. Anacardium occidentale (Anacardiaceae)

Oral administration of doses 35, 175 and 250 mg/kg are reduce blood glucose levels in diabetic rats. Hexane and ethyl acetate fractions are the most prominent actions suggesting the presence of non polar and polar hypoglycaemic compounds in the plant.

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17. Annona squamosa (Annonaceae)

The aqueous extract of roots of Annona squamosa dose of 250 mg/kg and 500 mg/kg body weight. It reduces the blood glucose level and effects were compared with the glibenclamide.

II. CONCLUSION

Following extensive literature research, pharmacological studies in animal specimens in all plants have been shown to be effective against diabetes. But the extent to which the anti-diabetic effect wears out in human settings is ques-tionable. In order for these plants to become a source of antidiabetic drugs, extensive chemical research and clinical trials are needed to find potential lead compounds. Therefore, the field of anthropological medicine has recently attracted the attention of scientists to identify plants with antidiabetic effects that are useful for humans.

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