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Review Pape

Role of an Important Medicinal Plant *Inula racemosa* Hook. F. in Diabetes: A Review

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Abstract
Diabetes mellitus (DM), both insulin-dependent DM (IDDM) and non-insulin dependent DM (NIDDM) is a common and serious metabolic disorder throughout the world. Traditional plant treatments have been used throughout the world for the therapy of diabetes mellitus. Among many medications and other alternative medicines, several herbs have been known to cure and control diabetes; additionally they have no side effects. History showed that medicinal plants have been used in traditional healing around the world for a long time to treat diabetes; this is because such herbal plants have hypoglycaemic properties and other beneficial properties, as reported in scientific literature. Inula racemosa Hook. F. is one such plant which plays an important role in maintaining proper functioning of pancreas and liver and thus this plant can be considered as better alternate for treating diabetes and preventing its complications as it has many hypoglycemic properties and other beneficial properties.

Key words: *Diabetes mellitus Medicinal plants Anti-diabetic Insulin, Herbals, Hypogylcemic*

Introduction

Ancient scholars of Ayurveda knew Diabetes Mellitus some 3000 years back and had mentioned this disease as *"Madhumeha"*. In terms of Ayurveda, Diabetes is a type of metabolic kaphadosa in which insufficient or lower functioning level of Agni give rise to a tendency towards increased blood sugar level. The association of frequent urination with a sweet tasting substance in the urine was first reported in Charak Samhita. Our ancient Hindu physicians have mastered the science of managing this disorder with effective balance of *'Aushada'* (some herbs or plant food sources) i.e. medicine, *'Ahar'* in modern terms therapeutic diets and *'Vihar'* that is exercise. (Arora, *et. al.,*2011). Diabetes is a diseased state in which body either does not properly use or produce insulin in sufficient amount. Insulin is a hormone secreted in the body by pancreas for converting sugar into energy. Diabetes is of two types: Type-I i.e. Insulin Dependent Diabetes Mellitus (IDDM) in which body fails to produce sufficient insulin and Type-II, i.e. Non Insulin Dependent Diabetes Mellitus (NIDDM) in which body fails to properly use this hormone. It is predicted that by 2025 about 300 million people will suffer from Diabetes worldwide and it will be among top 10 killers in the world. At present about 100 million people are suffering worldwide form this disease, as per a study about 20 million Indian people are suffering from this disease, which still could be a possible under estimate of total sufferings and out of which 95% are suffering from type-II (Arora, *et. al.,*2011).

Diabetes mellitus is a chronic metabolic disease with different aetiologies (Defronzo, 1992).It is ranked seventh among the leading causes of death and third when all its fatal complications are taken into account. Diabetes mellitus has become a common disease of the world (Trivedi, *et. al.,* 2004). It is adisease in which the body is unable to produce or unable to properly use and store glucose (a form of sugar). Glucose backs up in the bloodstream-causing one's blood glucose or *"sugar"* torise too high. It is a metabolic syndrome of multiple etiologies characterized by chronic hyperglycemia with abnormalities in carbohydrate, fat and protein metabolism due to defect in insulin secretions. India is facing a diabetic explosion and the exact cause of which is unknown but both genetic and life style factors can be blamed. The country has the world's largest diabetic population, about 25 million, and the number is predicted to rise to 35 million by 2010 and to 57 million by 2025 (Sicree, *et.al.,* 2006). The rapid growth of this disease is due to heredity, endocrine imbalance, dietary imprudence, after effects of infection, obesity, severe and continued mental stress, reduction in physical labor large differences in social structure etc. which provide a productive atmosphere for diabetes (Raghuram, *et. al.,* 2003). According to the International Diabetes Federation (IDF), the number of individuals with diabetes in 2011 crossed 366 million, with). It is a disease in which the body is unable to produce or unable to properly use and store glucose (a form of sugar). Glucose backs up in the bloodstream an estimated 4.6 million deaths each year (Dong, *et.al.,* 2012). The Indian subcontinent has emerged as the capital of this diabetes epidemic. The reported prevalence of diabetes in adults between the ages of 20 and 79 is as follows: India 8.31%, Bangladesh 9.85%, Nepal 3.03%, Sri Lanka 7.77%, and Pakistan 6.72% (Unwin, *et.al.,* 2011).

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 present with characteristic symptoms such as thirst, polyuria, blurring of vision and weight loss (WHO Expert Committee on Diabetes Mellitus, 2000).

Types of diabetes mellitus

*Insulin Dependent Diabetes Mellitus (IDDM, Type 1):*It is probably an autoimmune disorder. Antibodies that destroy β cells of islets of Langerhans in the pancreas and are often detectable in blood. Insulin in circulation is low or absent, more prone to ketosis. This type is less common and has a low degree of genetic predisposition. The disease is usually found before the age of 40 (Bastaki, 2005).

Non-Insulin Dependent Diabetes Mellitus (NIDDM Type 2): There is no loss in β cell mass, insulin in circulationis low, normal or even high degree of genetic predisposition,generally has a late onset past middle age, often found after the age of 40. The main cause of the disease is abnormality in gluco-receptor of β cells so that they respond at higher glucose concentration, reduced sensitivity of peripheral tissues to insulin in insulin receptors. Many hypertensives are hyperinsulinemic but normoglycemic exhibit insulin resistances, and excess of hyperglycemic hormones (glucagons) causes obesity due to relative insulin deficiency. Insulin is a hormone discovered in 1921 by Banting and Best. It is synthesized in the β cells of pancreas islets. Diabetes mellitus is a common metabolic disease, caused by lack of insulin. One of the chief functions of insulin is to act on the cell membrane rendering it more permeable to the transport of glucose. Thus a deficiency of insulin results in buildup of glucose in the blood and a deficiency of the necessary glucose in the cell.

Gestational diabetes (Type 3): It refers to initial recognition of glucose in tolerance during pregnancy, usually in the second or third trimester. It occurs in about 4% of all pregnancies. Patients with GD have a 30% to 50% chance of developing DM, usually type 2 DM (Singh, *et.al.,* 1985).

Plants with Anti-Diabetic Potential
There is an increasing demand of patients to use the natural antidiabetic agents. This is more because insulin cannot be used orally and oral hypoglycemics have many side reactions and toxicity besides that after certain period synthetic oral hypoglycemic do not remain effective in lowering the blood sugar in chronic stage of diabetes. A number of plants have been claimed as hypoglycemic agents but in all Inula racemosa Hook. F. is most commonly used (Satyavati, 1987).

In the Ayurvedic text, I. racemosa has been recommended for chest pain, cough and dysponea (Singh, *et.al.,* 1976). Water decoction of the root has been reported not only to lower the fasting blood glucose in normal rabbits, but also to protect the rabbit against glucose included hyperglycemia (Tripathi, *et.al.,* 1979 and Tripathi, *et.al.,* 1974). Its crude extract is clinically used for the management of angina pectoris (Tripathi, *et.al.,* 1988). The petroleum ether extract of the root has been reported to lower plasma insulin and glucose level. This extract also showed negative inotropic and negative chronotropic effects on frog heart (Tripathi, *et.al.,* 1995). Endocrine response of ethanol roots extract of I. racemosa was evaluated in relation to glucose homeostasis in rats. It was found that alcoholic extract of the roots of I. racemosa lowers blood glucose level and enhances liver glycogen without increasing plasma insulin level in rats (Singh, *et.al.,* 1985).

Antidiabetic effect of I. racemosa roots powder was performed in 15 patients of age above 35 years suffered from the complications of diabetes mellitus like polyurea, polydypsia and polyphagia etc. have been selected for clinical study. All the patients were treated with 1 table spoonful of I. racemosa roots powder three times in a day for three months duration. The response was estimated on the parameter of Joslin's Clinica. After the treatment blood glucose level of all patients was found to be normal (Gholap and Kar, 2003). Roots of I. racemosa was evaluated for the amelioration of corticosteroid (dexamethasone) induced hyperglycaemia in mice. Corticosteroid administration in the animals increased the serum glucose level. Roots of I. racemosa decreased the serum concentrations of the thyroid hormones tetraiodothyronine (T4) and triiodothyronine (T3) in corticosteroid-induced hyperglycaemic mice which was found comparable with standard drug ketoconazole. Findings of the results suggest that hypoglycemic effect of the extract was mediated through its cortisol inhibiting potency (Gholap and Kar, 2004).

Ethanol extract of the roots of I. racemosa was evaluated for the effect on glucose metabolism in albino rats. Blood glucose, plasma insulin and liver glycogen levels were measured after 2, 4, 8, 16 and 24 hours of drug administration. At a dose of 400 mgkg−1, b.w. plasma glucose level decreased after 4 hours of drug administration and returned to normal at 16 hours. Liver glycogen level was increased significantly as compared to control group at 4 hours after drug administration. A significant reduction in plasma insulin level was observed 4 hours after drug administration, and returned to normal at 8 hour, and remained low upto 16 hours (Chaturvedi, *et.al.,* 1995). Water decoction of the root of I. racemosa has been reported not only to lower the fasting blood glucose in normal rabbits, but also to protect the rabbit against glucose included hyperglycemia (Singh, *et.al.,* 1976).

Chronic treatment with methanol root extract of I. racemosa produced significant reduction in blood sugar level in alloxan-induced hyperglycemia model as compared to alloxan treated animals. The body weight, food intake, water intake and urine output were significantly reversed to normal by methanol extract of I. racemosa treatment (Ajani, *et.al.,* 2009).Singh *et.al.,* (1985) used this root with *Cinnamom umtamala* leaves and found it to be very effective for diabetes. Tripathi and Chaturvedi (1995)

observed that alcohol extract lowered blood glucose and enhanced liver glycogen without an increase in plasma insulin. It may be due to enhanced insulin synthesis. It had no effect on the adrenal gland.

Chaturvedi *et.al.,* (1995) studied its effect on glucose levels in albino rats. Ethanol extract, 400 mg/kg, lowered plasma glucose level four hours after administration. It increased the concentration of liver glycogen and reduced the concentration of plasma insulin, which returned to normal after four hours. In a research by Ajani *et.al.,* 2009, to evaluate the antidiabetic effect of methanolic extract of Inula racemosa root in rats. The effect of the chronic treatment of (28day) methanolic extract of Inula racemosa (syn.: Puskarmoola) (300 mg/ kg, p.o.) roots on alloxan-induced hyperglycaemia was investigated in Wistar albino rat. Along with blood sugar level, the effect on MDA, SOD and GSH levels of liver, kidney and heart homogenate were determined. Chronic treatment with the methanolic extract of Inula racemosa resulted into significant reduction in blood sugar level. Also the MDA levels were found to be higher and SOD and GSH levels were found to be lower in drug treated animals than in control animals. The food intake, water intake and urine output was found to rise whereas body weight find to fall in drug treated hyperglycaemic animals. However, in the animals such rise was not observed in all these parameters. On the basis of these findings, it can be assumed that the methanolic extract of roots of Inula racemosa possess significant hypoglycaemic and antioxidant property in alloxan induced hyperglycaemia modal in rats (Ajani, *et.al.,* 2009)

According to Tripathi et. al. 1988, the petroleum ether extract of roots lowers plasma insulin and glucose levels within 75 min of oral administration to albino rats and it significantly counteracts adrenaline-induced hyperglycemia in rats. The extract further shows negative inotropic and negative chronotropic effects on frog heart. All these findings indicate that one of the constituents of I.racemosa may have adrenergic beta-blocking activity (Tripathi, *et.al.,* 1988). 35 patients of Maturity onset diabetes mellitus having the complaints of polyureapolydypsia and polyphagia etc. have been selected. For the diagnosis of diabetes mellitus the fasting and 1st hour and 2nd hour post parandial blood sugar were estimated. Patients were classified into two groups. 20 patients were treated with powder of C. Tamal leaves in the dose of 2 TSF T. D. S. and 15 patients were treated with Inula racemosa in the dose of 1 TSF T. D. S. for the period of three months. The response was estimated on the parameter of Joslin's Clinica in C. Tamal group 50% cases were in good control. 33.33% were in fair control and 16.67% cases were in poor control. Inula racemosa treated group 100% cases were in good control. Thus it can be inferred that both of the drugs are useful in the treatment of Diabetes mellitus of Maturity onset. However, the response of Inula racemosa is better as compared to C. Tamala (Singh, *et.al.,* 1985)

Conclusion

Currently, many countries face large increases in the number of people suffering from diabetes. The World Health Organization estimated that about 30 million people suffered from diabetes in 1985 and the number increased to more than 171 million in 2000. It is estimated that the number will increase to over 366 million by 2030 and that large increases will occur in developing countries, especially in people aged between 45 and 64 years (Wild, et. Al., 2004). In spite of the presence of known anti diabetic medicine in the pharmaceutical market, remedies from medicinal plants are used with success to treat this disease. Many traditional plant treatments for diabetes are used throughout the world. Plant drugs and herbal formulations are frequently considered to be less toxic and free from side effects than synthetic ones. Based on the WHO recommendations, hypoglycemic agents of plant origin used in traditional medicine are important. I. racemosa has been reported to produce significant hypoglycemic effect. The attributed anti-hyperglycemic effects of the plants are due to its ability to restore the function of pancreatic tissues by causing an increase in insulin output or a decrease in the intestinal absorption of glucose. Hence, treatment with herbal plants has an effect on protecting β-cells and smoothing out fluctuation in glucose levels.

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