



THE PRACTICE OF USING TRADITIONAL MEDICINAL PLANTS IN MANAGING DIABETES MELLITUS - A JUSTIFIED REVIEW IN CURRENT SCENARIO

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ABSTRACT-----

Currently, the universe is experiencing a rapid systemic modification in the disease patterns resulting in a sharp increase in the non-infectious diseases and a marked drop in infectious diseases. Central obesity, hyperglycemia, hypertension, and hyperlipidemia are the diseases included in metabolic syndrome. Herbal medicines may be considered effective agents for the treatment of metabolic syndrome since these plants consist of various bioactive compounds with a synergistic effect when compared with the monotherapy of chemical agents. These complex diseases in metabolic syndrome can be managed by treatment or prophylactic therapy with these bioactive compounds. Therefore, the present study reviews various medicinal plants beneficial effects in treating diabetes mellitus, which is one among the metabolic syndromes.

KEY WORDS: Metabolic syndrome, Diabetes mellitus, Bioactive compounds, Oral hypoglycemic agents

INTRODUCTION

Currently, the universe is experiencing a rapid systemic modification in the disease patterns resulting in a sharp increase in non-infectious diseases and a marked drop in infectious diseases. This epidemiological change was studied in India by conducting a study on the global burden of diseases in 2016, which revealed around 62% of total mortality was by non-infectious disease and the metabolic syndrome [1]. In the year 1998, WHO defined several analysis criteria for metabolic syndrome, and according to it, it was defined as a complex disorder including central obesity, diabetes mellitus, increased blood pressure, and hyperlipidemia. The prevalence of metabolic syndrome in the United States was found to be 22.9% [2], and in Korea, there was an increase from 16.1% in 2007 to 17.9% in 2013, and a survey by the National Nutrient Health Department revealed the ubiquity of metabolic syndrome among adults aged 30 or more was 28.8% [3]. A survey piloted by the International Diabetes Federation in 2016 established that around 415 million people in the world were affected by hyperglycemia, and it may shoot up to 642 million in 2040. A report on the Indian population by Aroma World survey about diabetes also reported around 61.3 million people have been affected by this disease, and the age group was mainly 20-79 years. It was also stated that the same would be approximately doubled in the year of 2030 [4]. Various population-based studies carried out in India also found their presence in the range of 10-30%. India was also expressed as the diabetes capital of the world. Herbal medicines may be considered effective agents for the treatment of metabolic syndrome since these plants consist of various bioactive compounds with a synergistic effect when compared with the monotherapy of chemical agents. Therefore, these complex diseases in metabolic syndrome can be managed by a treatment or prophylactic therapy with these bioactive compounds. There are more than 1200 medicinal plants that are available for the management and treatment of diabetes mellitus [5]. The usage of these herbal medicines over thousands of years has shown remarkable benefit in both traditional and modern health care systems. Even though these herbal medicines are used as antidiabetic, antihypertensive, and hypolipidemic agents, only a few have been studied effectively by carrying out clinical trials to support their usage in the management of metabolic syndrome. Hardly a few systematic reviews on herbal medicines are available that are used in managing diabetes mellitus [6]. Therefore, the present study aims to emphasize the various herbal medicinal plants with their bioactive compounds available for treating diabetes mellitus.



METHODOLOGY

The articles published in indexed journals for the last 15 years were searched, and the information from these articles was reviewed in the present work. Ethical Approval The present research was exempted from ethical clearance.

DISCUSSION

In the current scenario, diabetes mellitus has manifested as a bigger issue globally, affecting economics and health care. In 2011, it was estimated as 4.6 million deaths every year and even covered more than 366 million the same year. Thus, the consequence of this disease has searched in using the traditional herbal medicines even 1000 years ago. According to WHO, over 21,000 plants are being used medicinally around the universe. In India, around 2500 species are being used as medicinal plants, from which 800 plants are potentially effective against diabetes [7].

Pathophysiology of Diabetes Mellitus

Diabetes mellitus is characterized by increased blood sugar levels over a prolonged period of time. The frequent urination, increased thirst, and increased appetite are the clinical symptoms of diabetes. Therefore, the disease has to be treated, or else it may lead to further complications like coronary heart diseases, chronic renal failure, damaging optic nerves, and cognitive impairment [8]. To maintain the normal plasma glucose level, several hormones like insulin, glucagon, and growth hormone are involved. Among these, insulin levels in the body and the ability of the body to use insulin play a major role [9, 10]. In type 2 diabetes, the impaired function of pancreatic beta cells results in abnormal insulin secretion and insulin resistance. In the maturity onset of diabetes of the young (MODY), the occurrence of diabetes is uncertain. It may be due to the inheritance of an autosomal dominant trait, which may cause alternation in the glucokinase gene on the chromosome. The glucokinase is an enzyme required for glucose metabolism in beta cells and the liver. The mutation in insulin and interference of proinsulin to insulin and environmental factors like aging, obesity, insufficient energy consumption, alcohol drinking, and smoking may be the other causes for diabetes [11].

Herbal Therapy

Momordica charantia (Bitter Melon)

Bitter melon, one of the regular and frequently used vegetables, particularly in parts of Vietnam, India, China, East Africa, South-North Asia, and Central and South America. The bioactive compound was effective against inflammation, viruses, cancer, bacteria, and mainly on hyperglycemia [12]. The fruits, seed, and callus contain a protein that is similar to insulin. The ethanol extract of fresh fruits produced insulin-like action, decreased glucose levels, increased insulin secretion, increased uptake of tissue glucose, reduced hepatic gluconeogenesis, and reduced the absorption of intestinal sugar. The phytochemicals are polypeptide-p, momordicoside, saponins, conjugated linolenic acid, momordin, and 9c, 11t, and 13t conjugated linolenic acids [12, 13]. The efficacy of this plant against diabetes mellitus was studied by conducting in vivo and in vitro experiments and clinical trials [14].

1.1 Ginseng

Ginseng, specifically grown in cold weather, is seen in Eastern Asia, Eastern Siberia, Northeast China, and North America. The roots, stalk, leaf, and berries of ginseng possess antidiabetic properties. The phytochemical agents are ginsenosides, panaxan, vanillic acid, and salicylates. Whole plants contain active components like amino acids, alkaloids, phenols, protein, polypeptides, and vitamins B1 and B2. The antidiabetic action is by sensitizing insulin secretion, protecting pancreatic islets, increasing glucose uptake, and intensifying insulin sensitivity [12, 13]. An animal study also proved the antidiabetic effect of this plant [15]. The root extract significantly reduced the fasting serum glucose concentration and also produced an increase in HDL-C and reduced triglycerides (TG) with no effect on TC, VLDL-C, and LDL-C in diabetic rats [16].

1.2 Allium Cepa (Allium)

Allium cepa is seen in Vietnam, China, and Egypt. The phytochemicals are quercetin, allicin (S-oxidiallyl disulfide), diallyl disulfide (allyl disulfide), allin (S-allyl-L-cysteine S-oxide), S-methyl-L-cysteine S-oxide, propanethial S-oxide, and S-mercapto-2-methpentan-1-ol. The antidiabetic effect is either by stimulating the production of insulin or by affecting the glucose absorption [12,13]. The aqueous extract of this plant in alloxan-induced rats exhibited a significant dose-dependent reduction in blood glucose levels, total serum cholesterol, and total serum lipids [17].

1.3 Allium Sativum (Allium)

Commonly known as garlic, they are used in Asia, Africa, and Europe. The bioactive compounds are alkaloids, flavonoids, cardiac glycosides, terpenes, and steroids. Sulfur-containing compounds like allicin, allin, ajoene, and diallyl sulfide are also present in this plant. The hypoglycemic effect was by increasing insulin secretion from



pancreatic beta cells, improving glucose tolerance and glycogen synthesis [12, 13]. An antidiabetic effect in humans was studied by Shefat Jahan et al. They produced significant reductions in fasting and postprandial blood sugar levels and HbA1c levels. [18]. An animal study was also conducted to prove the antidiabetic effect with aqueous-ethanolic extract [19].

1.4 Aloe vera L-Burm (Asphodelaceae)

Aloe vera are widely distributed in the islands of Cyprus, Malta, Sicily, Cape Verde, and India. Alkaloids, flavonoids, tannins, phenols, saponins, carbohydrates, vitamins, and minerals are the main constituents present in this plant. Mainly, the aloe vera water extract was used as an antidiabetic medicine [12, 13]. The meta-analysis of eight clinical trials with 470 patients, including 235 prediabetes and type 2 diabetes patients each, concluded Aloe vera improved the glycemic levels in both prediabetes and type 2 diabetes patients [20]. In another study, Aloe vera juice was used for 1 week, and marked reduction in blood sugar level was seen [21].

1.5 Trigonella Foenum-Graecum (Fenugreek)

Fenugreek seeds showed better safety and efficacy against diabetes mellitus. Currently, it is available as nutraceuticals in India. The active compounds are trigonelline, nicotinic acid, diosgenin, 4-hydroxy isoleucine, total saponins, fenugreek oil, and soluble dietary fiber. The hypoglycemic effect is by improving insulin secretion, increasing insulin sensitivity, and inhibiting intestinal glucose absorption [13]. A meta-analysis carried out in 10 clinical trials on glycemic levels found that the moderate and high doses of fenugreek were effective [22], and in diabetics-induced albino rats, a small dose (200 mg/kg body weight) was found to be effective [23].

1.6 Pterocarpus Marsupium

This is a large tree seen in India, Nepal, and Sri Lanka. They have been mainly used in Ayurveda as rasayana in diabetic patients. Anti-inflammatory, antibacterial, antioxidant, and antidiabetic properties are produced by marsupin, pterosupin, pterostilbene, flavonoids, pteroside, pteroisauoside, carsupin, and marsupol. The major part was by epicatechin by regenerating beta cells of islets of the pancreas [12]. The antidiabetic activity was confirmed by the reduction of fasting and postprandial blood sugar levels in type-2 diabetic rabbits, and the ethanolic extract produced hypoglycemic action in diabetic rats [24].

1.7 Tinospora Cardifolia

Generally known as Amrita or Guduchi, was one of the important drugs in the Indian medical system. They cover the major part of Myanmar and Sri Lanka. They were used mainly in fever, dyspepsia, and coronary disease. Alkaloids, terpenoids, essential oils, glycosides, steroids, phenolic constituents, aliphatic compounds, and polysaccharides are the important active compounds of this plant. Their medicinal properties are antiseptic, anti-inflammatory, anticancer, anti-microbial, and antidiabetic activities. Their antidiabetic effect was by regenerating beta cells by polysaccharides and increasing insulin secretion, by inhibiting glycogenolysis, and by enhancing insulin sensitivity [12]. The metabolic enzymes involved in carbohydrate metabolism and decreasing hepatic glucose 6-phosphatase, serum acid phosphatase, and lactic dehydrogenase are responsible for the antidiabetic effect [25].

1.8 Gymnema Sylvestre

This medicinal plant was seen in the forests of southern and central India and Sri Lanka. The aqueous leaf extract exhibited hypoglycemic properties by stimulating pancreatic cell production, increasing insulin secretion, enhancing insulin sensitivity and activity, reducing glucose absorption from the small intestine, and inhibiting the conversion of glycogen into glucose [12]. An open-label study showed reduced polyphagia, fatigue, fasting and postprandial glucose levels, and HbA1c levels with an additional beneficial effect of reducing the lipid levels [26]. They are used in Ayurvedic medicine for many clinical conditions like bronchial asthma, cough, leprosy, and in wounds. Their hypoglycemic effect was also proved in various animal experiments [27].

CONCLUSION

Even though a number of medicinal plants are used in Ayurveda against diabetic mellitus, there is a current requirement for a number of evidence-based studies to prove the hypoglycemic action of these medicinal plants. In the future, more clinical trials can be carried out and can encourage the practice of using herbal medicine along with allopathic drugs for a synergistic effect and further to reduce the complication due to diabetic mellitus.

Authorship Criteria

D.Sheela - Concept and design of study
Preetha selva- Reviewing the manuscripts & corrections
Conflicts of Interest : None
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