



Review Article

TRADITIONAL MEDICINAL PLANTS USED IN THE TREATMENT OF DIABETES MELLITUS: A REVIEW

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ABSTRACT

Diabetes mellitus (DM) is a non-communicable disease which affects hundreds of millions of peoples in the world. This disease leads to serious problem over time if it is not properly managed. The current review is aimed at providing a comprehensive review from different research articles carried out on traditional medicinal plants/herbs used for the treatment/ management of diabetes. Several plants have been used for the management of diabetes mellitus. The search was done in Google Scholar, pub med, and Science Direct databases using the key words diabetes, traditional medicine, anti-diabetic, medicinal plants, management and anti-hyperglycemic effects of diabetes. In this review, *Allium cepa* L., *Allium sativum* L., *Aloe vera* (L), *Lepidium sativum* L., *Oxalis corniculata* L., *Ricinus communis* L., *Thymus schimperi* Ronniger, *Trigonella foenum graecum* L and *Zingiber officinale* Roscoe found to have repeatedly positive impact for the management of diabetes. Thus, it is very important to utilize those medicinal plants for the diabetic patients as an alternative choice for the management of diabetes.

Keywords: Diabetes mellitus; traditional medicinal plants; treatment; herbal medicine

INTRODUCTION

Diabetes mellitus is one of the most non communicable diseases that are caused as a result of pancreases gland disorder. Reports showed that Diabetes mellitus affects 200 million people of the world's population and is projected to rise to over 366 million in the year 2030.^{1,2} Diabetes mellitus is an epidemic disease that affects the people of both the developed and developing countries.³ In Ethiopia; about 1.3 million Diabetes mellitus aged between 20 - 79 years with a prevalence rate of 2.9 % were estimated. This data is expected to rise to 1.8 million by 2030.² The recent community-based study showed 6% prevalence of diabetes in Ethiopia.⁴

Diabetes mellitus is caused by the abnormality or dysfunction of carbohydrate metabolism. Diabetes mellitus is characterized by hyperglycemia with alteration of carbohydrates, protein and fat metabolism, resulting from defects in insulin secretion or sensitivity of insulin to body cells or both.⁵ Defect of insulin secretion or insulin action results in increased level of blood glucose concentration. The elevated level of blood glucose level causes acute complications like hyperglycemia and chronic complications in many organs, which may lead to increase the risk of atherosclerosis, renal failure, nerve damage, coronary heart disease and blindness resulting in increasing disability.⁶

Classifications of Diabetes mellitus

Clinically diabetes mellitus classified in to three types; Type I diabetes, Type II diabetes and gestational diabetes mellitus.⁷

Type I Diabetes mellitus /Insulin dependent diabetes mellitus/

The Type I Diabetes or juvenile diabetes is happening as a result of failure of pancreas to produce insulin. Without insulin, the cells of the body are unable to utilize the glucose which is needed for energ.⁸ Therefore; insulin dependent diabetes mellitus is treated with exogenous insulin injection every day so as to control the blood glucose level.⁹

Type II Diabetes mellitus /Non-insulin dependent diabetes mellitus/

The onset of type II diabetes or adult-onset diabetes results as a result of fails to use insulin properly. This causes glucose (sugar) to accumulate in the blood stream.⁸ Non-insulin dependent diabetes mellitus is treated with synthetic oral hypoglycemic agents like sulphonyl urea's and biguanides.⁹ In addition this type of Diabetes mellitus can be treated by changing lifestyle just like doing exercise, avoiding fatty foods and etc.

Gestational Diabetes mellitus

Gestational Diabetes is a form of diabetes consisting of high blood glucose levels during pregnancy and goes away after the baby is born. It develops towards the middle of the pregnancy as a result of the changes in the mother's hormones.⁸

Traditional Medicinal plants for the Management of Diabetes mellitus

Plants are the main sources of important drugs. Most of the currently available drugs are directly derived from different

plants. The ethnobotanical information reports about 800 plants that may possess anti Diabetes mellitus potential. Several herbs have shown anti Diabetes mellitus activity when assessed using presently available experimental techniques.¹⁰

Currently, various medicinal plants have been reported to be useful in the treatment and management of Diabetes mellitus worldwide. Plant products have potential medicinal bioactive substances and received significant attentions to cure different diseases.¹¹ Different experimental studies on medicinal plants have been used empirically as anti-diabetic remedies. Due to the cost of modern medicine is not affordable, readily available and a continuous complication, the use of traditional medicine is highly practiced in developing countries.^{10,12}

In Ethiopia traditional medicinal plants and their products are playing greater role for the management of Diabetes mellitus. The knowledge of traditional medicine for the management is transferred orally from generation to generation and thus this knowledge is not well known by the community because it is not well documented and collected. Therefore, it is very important to collect and document the knowledge before such a precious wealth is lost. The present review is aimed to enumerate some

traditional medicinal plants that have a medical importance in the management of Diabetes mellitus from different scientific articles.

Reason for the Need of Herbal Medications

At this time many peoples in different parts of the world including Ethiopia are suffering from non-communicable diseases such as diabetes. Herbal medicines have a long history both in developed and developing countries.

Various studies on medicinal plants used in treatment of non-communicable disease such as diabetes have shown promising findings. Moreover, herbal medicines are used for the treatment of diabetes were effective, economically fair and easily accessible for the community.

Different herbs such as *Allium cepa* L., *Allium sativum* L., *Aloe vera* L., *Lepidium sativum* L., *Oxalis corniculata* L., *Ricinus communis* L., *Thymus schimperii* Ronniger, *Trigonella foenum-graecum* L. and *Zingiber officinale* Roscoe were reviewed in this paper. It is shown as in detail on medicinal herbs with Anti diabetic activity (Table 1).

Table 1: List of medicinal plants used for anti-diabetes mellitus

Scientific name	Family name	Vernacular name (Tigrigna)	Growth form	Parts used	Source	References
<i>Allium cepa</i> L.	Liliaceae	Keyih shingurti	Herb	Leaf, Bulbs	Cultivated	13
<i>Allium sativum</i> L.	Alliaceae	Tsaeda shingurti	Herb,	whole plant, Bulbs and lobe,	Cultivated	14
<i>Aloe vera</i> L.	Liliaceae	Ere	Herb	Juice, Gum and Fresh leaf	Wild	15
<i>Lepidium sativum</i> L.	Brassicaceae	Shimfa	Herb	whole plant	Cultivated	16
<i>Oxalis corniculata</i> L.	Oxalidaceae	Chew mirakut	Herb	whole plant	Wild	17
<i>Ricinus communis</i> L.	Euphorbiaceae	Guile	Herb	Seed	Wild	18
<i>Thymus schimperii</i> Ronniger	Lamiaceae	Tesne	Herb	Stem, leaf, Whole plant,	Wild	19
<i>Trigonella foenum graecum</i> L.	Fabaceae	Abeake	Herb	Seed, whole plant	Cultivated	20
<i>Zingiber officinale</i> Roscoe.	Zingiberaceae	Zingible	Herb	whole plant	Cultivated	21

Selected medicinal plants used for diabetes mellitus

Allium cepa L. (onion)

It is a perennial herb belonging to the *Liliaceae*. The parts of the plant used are the fresh or dried bulbs, commonly known as onion, which are commercially cultivated worldwide. Various ether soluble fractions as well as insoluble fractions of dried onion powder show anti-hyperglycemic activity in Diabetes mellitus rabbits.

The increasing dosage (200, 250 and 300 mg/kg) of *A. cepa* aqueous extracts showed significant ($P < 0.05$) reductions in the blood glucose levels of diabetic rats after 6 weeks of treatment as compare to control rats. *A. cepa* at 200 mg/kg decreased fasting blood glucose levels by 62.9% (292.3 ± 29.0 to 108.2 ± 4.6); at 250 mg/kg it decreased fasting blood glucose levels by 69.7% (296.3 ± 37.8 to 89.8 ± 4.3) whereas at 300 mg/kg it reduced it by 75.4% (297.8 ± 37.5 to 73.4 ± 3.0). *Allium cepa* is also known to have antioxidant and hypolipidaemic activity.¹⁴

Allium sativum L. (garlic)

(Liliaceae) it is a perennial herb cultivated throughout worldwide including Ethiopia. There was significant reduction in serum glucose, total cholesterol, triglycerides, urea, uric acid, creatinine levels as a result of oral administration of garlic whereas elevated serum insulin in diabetic rats ($P < 0.05$). Comparison made

between the action of garlic extract and glibenclamide (600 mg/kg), the known anti diabetic drug indicated that garlic extract was effective than that observed with glibenclamide.¹⁴ This sulfur-containing compound is responsible for its pungent odor and it has been shown to have significant hypoglycemic activity.

Aloe vera (L) Burm

It grows in arid climates and is widely distributed in Africa and other arid areas. *Aloe vera* gel at 200 mg/kg possesses significant anti diabetic, cardio protective activity in diabetic rats. The extract of aloe gum potentially enhances glucose tolerance both in normal and diabetic rats. Treatment of chronic exudates of *Aloe barbadensis* leaves showed hypoglycemic effect in alloxanized diabetic rats.

The results revealed highly significant decrease ($p > 0.01$) in blood glucose, and highly significant increase in both liver glycogen content and serum insulin level in the diabetic group treated with aqueous extract of *A. vera* when compared with the diabetic untreated group.¹⁵ This plant also has an anti-inflammatory activity in a dose dependent manner and improves wound healing in diabetic mice.¹⁵

Lepidium sativum L.

Administration of lepidium extract showed a significant reduction in glucose, creatinine, and alkaline phosphatase levels. *L. sativum*

was reduced elevated level of cholesterol to nearly normal range. In addition, when compared to diabetic control significant reduction in malondialdehyde levels was observed.

After 16 days of oral administration of aqueous *Lepidium sativum* extracts, significant reduction in blood glucose levels was observed in the streptozotocin-induced diabetic rats. Blood glucose was significantly elevated ($P < 0.05$) in diabetic rats compared with normal control rats. In diabetic rats, oral administration of aqueous *Lepidium sativum* extract (20 mg/kg of body weight) lowered blood glucose significantly ($P < 0.05$).

Cholesterol level was found to be increased significantly ($P < 0.05$) in diabetic rats compared with the normal control rats. A significant decrease was observed after the administration of *Lepidium sativum* extract in diabetic rats. The creatinine level increased significantly ($p < 0.05$) in diabetic rats when compared with the normal control rats. Oral administration of aqueous extract of *Lepidium sativum* offered a significant decrease in the creatinine level compared with diabetic rats.¹⁶

***Oxalis corniculata* L.**

The anti-diabetic property of the extract has shown increasing trend with increase in dose and there was a gradual decrease in blood glucose levels with increased period of exposure to the test drug. Oral administration of aqueous extract of *Oxalis corniculata* at a dose of 100 mg /kg bodyweight showed significant decrease in blood glucose after ten days treatment indicated anti diabetic potentials of the extract.¹⁷

***Ricinus communis* L.**

The ethanolic extract of roots of *R. communis* (RCRE) was investigated along with its bioassay protocol. By Administration of the effective dose (500 mg/kg b. w) of RCRE to the diabetic rats for 20 days possess favourable effects not only on fasting blood glucose, but also on total lipid profile and liver and kidney functions. Amongst all fractions the R-18 fraction suggests the significant anti hyperglycaemic activity. There is no significance difference in different biochemical levels such as alkaline phosphatase, serum bilirubin, creatinine, serum glutamate oxaloacetate transaminases, serum glutamate pyruvate transaminases in extracts of *R. Communis*. Moreover, administration of the extract of *R. Communis* at a dose of 10 g/kg b. wt was showed total protein. Thus *R. communis* is a potential phytomedicine for diabetes.¹⁸

***Thymus schimperi* Ronniger**

The oral administration of aqueous extract of *T. schimperi* leaves (500 mg/ Kg/day) for 6 weeks in salt-sucrose induced hypertension produced significant ($p < 0.05$) reduction in systolic blood pressure. The oral administration of aqueous extract of *T. schimperi* (250, 500, 750 and 1000 mg/Kg) showed positive diuretic activity at 5 hours. The aqueous extract of *T. schimperi* (750 and 10000 mg/Kg, orally) significantly increased Na^+ , K^+ and Cl^- content of urine in 5 hours urine and additionally essential oil of *T. schimperi* (1 and 1.5 ml/kg) showed significant kaliuretic effect.¹⁹

***Trigonella foenum-graecum* L. (fenugreek)**

It is an annual aromatic herb belonging to the family Fabaceae. The parts of the plant used are the dried ripe seeds, which contains mucilage and a variety of other secondary metabolites from fenugreek seeds increased glucose stimulated insulin release by

isolated islet cells in both rats and humans. The supplement of the botanical extract significantly ($p < 0.05$) decreased blood glucose level in the diabetic rats when compared to the diabetic control rats. The oral administration of the botanical extract significantly ($p < 0.05$) reduced the serum cholesterol level in alloxan-induced diabetic rats compared with the diabetic control rats.²⁰

Oral supplementation of 2 and 8 g/kg of botanical extract showed dose dependent decrease in the blood glucose levels in both normal and diabetic rats. Administration of fenugreek seeds also improved glucose metabolism and normalized creatinine kinase activity in heart, skeletal muscle and liver of diabetic rats. It also reduced hepatic and renal glucose-6-phosphatase and fructose – 1, 6-biphosphatase activity.²⁰

***Zingiber officinale* Roscoe.**

Six weeks administration of ethanol extract of *Z. officinale* revealed significant reduction in fasting serum glucose level when compared to diabetic control rats (serum glucose, M + SD, mmol/l: 6.9 + 1.0 vs. 8.5 + 0.7, $p = 0.002$). Serum total cholesterol ($p = 0.036$) and TG level was reduced by 22% and 11% after 6 weeks of administration of *Z. officinale* in comparison to the initial day respectively. Protective HDL cholesterol is increased by 27% and atherogenic LDL cholesterol is reduced by 80% ($P = 0.04$) in comparison to baseline level. Serum insulin level for extract treated groups increases by 92% in comparison to the baseline value and glycogen level is also increased significantly ($p = 0.002$) in comparison to normal control rats.²¹

CONCLUSION

Modern medicines, despite providing effective treatment choice, can induce several undesirable side effects and contraindications. Several years back before the invention of modern medicine (Insulin); traditional medicines from herbs/plants have been used in the treatment and management of diabetes. The present review has presented comprehensive details of anti-diabetic plants used in the treatment and management of diabetes. All the plants discussed in the present review have exhibited significant clinical and pharmacological activities with minimum side effects when they compared with the modern medicines. Moreover, the plants/herbs used for the traditional mode of management of diabetes may also contribute for the invention of new drug which induced minimum side effects. Therefore, more investigations must be carried out to evaluate the mechanism of action of medicinal plants with anti-diabetic effect.

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