

## Experimental Evidence of Antidiabetic Herbs

### Research Article

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### Abstract

Plant drugs play an important role in the development of single chemical entities for therapeutic purposes. The economically developed countries are evincing keen interest in the so called alternative systems, in which remedies based on herbal drugs are playing an important role. The role of herbal medicine in the management of lifestyle diseases, including diabetes has become the focus of experimental and clinical research globally. The new breed of plant-derived products are produced, standardised and clinically evaluated just like the conventional pharmaceuticals. During last three decades the herbs mentioned in Ayurvedic materia medica were subjected to preclinical and clinical screening for their antidiabetic activity. In this paper experimental evidence collected about 38 Ayurvedic medicinal plants are reviewed. Among these *Azadirachta indica*, *Eugenia jambolana*, *Ficus benghalensis*, *Gymnema sylvestris*, *Inula racemosa*, *Momordica charantia*, *Ocimum sanctum*, *Pterocarpus marsupium*, *Trigonella foenum graecum* and *Withania somnifera* are found to have significant role in reducing hyperglycemia. In India these herbs are frequently prescribed for controlling diabetes.

### Introduction

Drugs delineated in alternative systems are attracting much attention for diseases with no or inadequate drugs for treatment in modern medicine, such as for metabolic and degenerative disorders. Most of these disorders have multifactorial etiology. In such conditions the combination of drugs acting at a number of targets simultaneously is likely to be more effective than drugs acting at one target and one target- one drug paradigm is not likely to be satisfactory in such cases. A herb contains many secondary metabolites (alkaloids, glycosides etc) which act on many targets and help to achieve comprehensive and significant therapeutic benefits. Traditional Ayurvedic formulations contain an impressive array of plants, many of which have been scrutinised by modern scientific methods. The first

Ayurvedic herb which attracted international attention was *Rauvolfia serpentina* when it was found to have twin effects on lowering hypertension and acting as tranquiliser. Since then, scientists have shown a keen interest in producing scientific validation of herbal claims recorded in various texts of indigenous medicine. In view of the increasing rate of non communicable diseases like diabetes, hypertension, obesity, osteoarthritis etc several medicinal plants are considered indicated in these conditions for preclinical and clinical evaluation. Diabetes, one of the important conditions of metabolic syndrome, has become the area of research for identifying the potentialities of antidiabetic activity of medicinal plants. Ayurvedic classics namely *Charaka Samhita* and *Sushruta Samhita*

described the disease condition known as Madhumeha which is more akin to diabetes [1, 2]. A critical review of screened antidiabetic herbs indicate that many a plants have significant role to play in controlling Diabetes. In current clinical practice these herbs are being prescribed for the management of non-insulin dependent Diabetes (Type 2). So far none of these drugs are evaluated in Type 1 Diabetes. Toxicity studies carried out of antidiabetic herbs established their safety profiles. Some of the important findings reported with regard to antidiabetic herbs are being adopted in current clinical practice.

## Materials and Methods

The most authentic Ayurveda text books and standard journals wherein the information with regard to claims and their scientifically validated data is taken up to carry out the review.

Some of the important medicinal plants which are subjected to pharmacological evaluation in normal and diabetic rats . mice, rabbits and dogs for their antidiabetic activity are *Achyranthes aspera*, *Adhatoda vasica*, *Aegle marmelos*, *Aloe vera*, *Andrographis paniculata*, *Azadirachta indica*, *Butea monosperma*, *Caesalpinia bonduc*, *Cannabis sativa*, *Cassia fistula*, *Coccinia indica*, *Curcuma longa*, *Embelia ribes*, *Embilica officinalis*, *Eugenia jambolana*, *Ficus benghalensis*, *Gymnema sylvestre*, *Hedychium spicatum*, *Inula racemosa*, *Mallotus philippensis*, *Momordica charantia*, *Moringa oleifera*, *Nelumbo nucifera*, *Ocimum sanctum*, *Phyllanthus fraternus*, *Picrorhiza kurroa*, *Piper longum*, *Psoralea corylifolia*, *Pterocarpus marsupium*, *Pueraria tuberosa*, *Punica granatum*, *Swertia chirayita*, *Terminalia bellirica*, *Terminalia chebula*, *Tinospora cordifolia*, *Trigonella foenum-graecum*, *Withania somnifera*, *Zingiber officinale* [3, 4, 5].

## Discussion

Out of the several herbs reported to possess antidiabetic activity, the following drugs are being prescribed in clinical practice in India

1. *Andrographis paniculata*: The ethanolic extract of leaf suppressed the elevated glucose levels in normal and ST2- diabetic rats after glucose tolerance test. Andrographolide, one of the main phytoconstituents significantly lowered the plasma glucose levels [5].

2. *Azadirachta indica*: In several experimental models neem leaf aqueous extracts has shown moderate

hypoglycaemic activity. It is a famous drug used by urban and rural populations in India [6].

3. *Coccinia grandis*: The aqueous extract of leaves displayed significant hypoglycemic action in streptozotocin induced diabetic rats as well as carbohydrate metabolic enzymes and the quantity of liver and skeletal muscle glycogen [7]. In a clinical study the whole plant dried extract ( aqueous) not only lowered blood glucose levels in severe diabetes, but also raised serum concentrations of enzymes glucose-6- phosphatase and lactose dehydrogenase and lowered the concentration of lipoprotein lipase. From these results it was concluded that *Coccinia grandis* is similar to that of insulin.

4. *Eugenia jambolana*: In several investigations on the antidiabetic activity of the seeds(ethanolic) on alloxan-induced diabetic rabbits, it was observed that the drug causes a significant fall in fasting blood sugar levels with increase of serum insulin, muscle and liver glycogen [8].

5. *Momordica charantia* : Unripe fruit juice , aqueous extract of fruit powder, acetone extract of fruit powder, powdered seeds and alcoholic extract of leaves have shown significant hypoglycaemic activity in various experimental models( rabbits and dogs) comparable to that of Tolbectomide and glibenclamide. Clinical trials with those dosage forms confirmed its antidiabetic activity. Mechanism of action is considered due to higher glucose utilisation in liver and decreased insulin resistance because of the increase in GLUT4 protein content in the plasma membrane of the muscle [9].

6. *Pterocarpus marsupium*: Aqueous extracts and decoction of heartwood and bark exhibited significant hypoglycaemic activity in various animal models (rats and rabbits). Clinical trials on newly diagnosed or untreated NIDDM patients(extract 2-4 g/patient/12 weeks) shown controlled fasting and post prandial blood glucose levels [10].

7. *Tinospora cordifolia*: Ethanolic extract of the stem exhibited significant hypoglycaemic activity in alloxan induced diabetic rats. In another study aqueous, alcoholic and chloroform extracts of leaves showed useful effect in alloxan induced rabbits. Roots also have shown to possess antidiabetic action [11].

8. *Trigonella foenum-graecum* Linn: The hypoglycemic effect of defatted seed extract has been demonstrated in experimentally induced diabetes in mice,

rats and dogs. A number of controlled cross over clinical trials have been conducted on patients of Type I and Type II diabetes. In both types, oral intake of defatted seed powder with meal led to improved glycaemic control. (G Y Yeh et al, Diabetic care, 26, 1277, 2003). In another study, defatted fenugreek powder (50 g twice a day) with meal for 10 days administered to both the types led to significant decrease in blood glucose (fasting and postprandial) [12].

9. *Withania somnifera* (Linn.) Dunal: This is the most potential herb containing more than 45 withanolides isolated from leaves, fruits and roots. *Withania somnifera* is extensively studied for various activities like immunomodulatory, anabolic, antiinflammatory, adaptogenic, chemopreventive, neuroprotective and neuroregenerative activities. In a clinical appraisal, the study conducted on Type II diabetes demonstrated hypoglycaemic and hypocholesterolaemic activities [13, 14]. It is a known fact that herbs are generally safe and devoid of severe adverse reactions. The toxicity studies carried out on these reported antidiabetic herbs clearly indicate that the screened herbs are safe and not producing any side effects. Among 38 reported herbs nine herbs are identified as important drugs in the management of diabetes and several pharmaceutical companies of India are promoting their proprietary medicines with these herbs. The published data about these drugs indicate that most of these herbs are useful in the management of non insulin dependent diabetes (NIDDM). Adequate clinical evidence is lacking about the herbs useful for the management of Type I diabetes.

Ayurvedic classics advocated two drugs as the prime combination for the management of Prameha (includes Diabetes) namely Dhatri (Indian gooseberry) and Haridra (turmeric) [15]. These two are reported to have hypoglycaemic activity and are useful to prevent diabetic nephropathy. Another group known as Triphala (*Terminalia chebula*, *Terminalia bellirica* and *Embolica officinalis*) is reported to improve vision of the eye [16]. This combination is very useful to prevent Diabetic retinopathy. Among the reported hypoglycemic drugs, two drugs namely *Withania somnifera* and *Picrorhiza kurroa* are having nerve regenerative action, which may be helpful to prevent diabetic neuropathy.

In a nutshell the reported herbal hypoglycaemic and antidiabetic drugs are capable of controlling glycaemic levels in diabetes and play a pivotal role in preventing

diabetic complications like neuropathy, nephropathy and retinopathy.

## Conclusion

To conclude, herbal drugs like modern antidiabetic drugs can control the disease condition successfully when lifestyle modifications with regard to diet and exercise are strictly followed. Most of the diabetics repose a lot of confidence in the diabetic pill and ignore the lifestyle modifications. The management becomes more comprehensive and meaningful only when proper care is taken about diet and exercise in addition to usage of antidiabetic drugs. Charaka Samhita (1000BC) explicitly described that the disease Prameha (includes diabetes) is having nature of recurrence (Anushanga). This recorded evidence clearly confirms that Diabetes is incurable and managed only by palliative therapy.

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