A review: Anti diabetic medicinal plants used for diabetes mellitus

G Arumugam¹, P Manjula², N Paari²*

¹Department of Biochemistry, Adhiparasakthi College of Science, Kalavai, Vellore
²Dr. N. Paari’s Diabetic Centre, MKB Nagar, Chennai-600039

ABSTRACT

Aim of the present study is evaluated various medicinal plants used for antidiabetic activity. Diabetes mellitus is one of the most common non-communicable diseases globally. It is the fourth leading causes of death in the most developed countries and there in substantial evidences that it in epidemic in many developing and newly industrialized nations. This posing a serious threat to be met within 21st century. Since ancient time plants have been exemplary source of medicine. Ayurveda and other Indian literature mentioned the used of plants in treatment of various ailments. Out of an estimated 250 000 higher plants, less than 1% have been screened pharmacologically and very few in regard to diabetes mellitus. Systematic studies on the folklore medicinal plants that combat diabetes mellitus are scanty.

1. Introduction

Diabetes mellitus is a common and very prevalent disease affecting the citizens of both developed and developing countries. It is estimated that 25% of the world population is affected by this disease. Diabetes mellitus is caused by the abnormality of carbohydrate metabolism which is linked to low blood insulin level or insensitivity of target organs to insulin[1]. Despite considerable progress in the treatment of diabetes by oral hypoglycemic agents, search for newer drugs continues because the existing synthetic drugs have several limitations. The herbal drugs with antidiabetic activity are yet to be commercially formulated as modern medicines, even though they have been acclaimed for their therapeutic properties in the traditional systems of medicine[3]. Type 2 diabetes usually occurs in obese individuals and is associated with hypertension and dyslipidemia. Thus the treatment aims to reduce insulin resistance and to stimulate insulin secretion. Diabetes is a metabolic disorder where in human body does not produce or properly use insulin, a hormone that is required to convert sugar, starches, and other food into energy. Diabetes mellitus is characterized by constant high levels of blood glucose (sugar). Human body has to maintain the blood glucose levels at a very narrow range which is done with insulin and glucagon. The function of glucagon is causing the liver to release glucose from its cells into the blood for the production of energy. Type 1 Diabetes leads to inability to release insulin results in low rates of glucose uptake into muscles and adipose tissue[3]. Traditional medicine (herbal) is used for treatment of diabetes in developing countries where the cost of conventional medicines is a burden to the population[4]. Despite the introduction of hypoglycemic agents from natural and synthetic sources, diabetes and its secondary complications continue to be a major medical problem. Many indigenous Indian medicinal plants have been found to be useful to successfully manage diabetes. One of the great advantages of medicinal plants is that these are readily available and have very low side effects. Plants have always been an exemplary source of drugs and many of the currently available drugs have been derived directly or indirectly from them.

The ethnobotanical information reports about 800 plants that may possess antidiabetic potential[5]. Several herbs have shown antidiabetic activity when assessed
using presently available experimental techniques[6]. This review article enumerates some medicinal plants possessing antidiabetic activity and elucidating their mechanisms of action such as Brassica juncea (B. juncea), Combretum micranthum (C. micranthum), Elephentopus scaber (E. scaber), Gymnema sylvestre (G. sylvestre), Lirioper spinosa (L. spicata), Parinari excelsa (P. excelsa), Ricinus communis (R. communis), Sarcopoterium spinosum (S. spinosum), Smallanthus sonchifolius (S. sonchifolius), Swertia punicea (S. punicea), Vernonia anthelmintica (V. anthelmintica) etc. and method of experiment on animals and therapeutic efficiency of plant extracts were exploited. Some of the important anti–diabetic potential herbal plants sources are given in the Table 1.

### 2. Antidiabetic effect of folklore medicinal plants

#### 2.1. Brassica juncea

It is commonly used spice in various food items in Tamilnadu. B. juncea is a traditional medicinal plant which belongs to family Cruciferae. B. juncea aqueous seed extract has a potent hypoglycemic activity which was investigated in STZ induced diabetic male albino rat. Doses which have hypoglycemic activity was reported as 250, 350, 450 mg/kg[7].

#### 2.2. Eugenia jambolana

Eugenia jambolana (E. jambolana) popularly known as Jamun or Indian blackberry has been indicated in

<table>
<thead>
<tr>
<th>S.No</th>
<th>Plant name</th>
<th>Family</th>
<th>Parts used</th>
<th>Type of extract</th>
<th>Activity</th>
<th>References</th>
</tr>
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<td>Antidiabetic</td>
<td>[15]</td>
</tr>
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<td>Bark</td>
<td>Methanol</td>
<td>Antidiabetic</td>
<td>[19]</td>
</tr>
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<td>3</td>
<td>Axonopus compressus</td>
<td>Poaceae</td>
<td>Leaves</td>
<td>Methanol</td>
<td>Antidiabetic</td>
<td>[13]</td>
</tr>
<tr>
<td>4</td>
<td>Berberis vulgaris</td>
<td>Berberidaceae</td>
<td>Root</td>
<td>Aqueous</td>
<td>Hypoglycaemic</td>
<td>[14]</td>
</tr>
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<td>5</td>
<td>Brassica juncea</td>
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<td>Aqueous</td>
<td>Hypoglycemic</td>
<td>[7]</td>
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<td>6</td>
<td>Caesalpinia digyna</td>
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<td>Root</td>
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</tr>
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<td>7</td>
<td>Catharanthus roseus</td>
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<td>Methanol</td>
<td>Hypoglycemic</td>
<td>[16]</td>
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<td>Gentianum erythreum</td>
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<td>Leaf</td>
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<td>Antidiabetic</td>
<td>[17]</td>
</tr>
<tr>
<td>9</td>
<td>Chaenomeles sinensis</td>
<td>Rosaceae</td>
<td>Fruits</td>
<td>Ethyl acetate</td>
<td>Antidiabetic</td>
<td>[18]</td>
</tr>
<tr>
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<td>Antihyperglycemic</td>
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<td>[21]</td>
</tr>
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<td>Cyclocarya paliaris</td>
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<td>Bark</td>
<td>Aqueous, PE, chloroform, ethyl Hypoglycemic acetate &amp; n–butanol</td>
<td>[22]</td>
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<td>Dillenia indica</td>
<td>Dilleniaceae</td>
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<td>Methanolic</td>
<td>Antidiabetic</td>
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<td>Berries</td>
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<td>Alcoholic</td>
<td>Antidiabetic</td>
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<td>Verbenaceae</td>
<td>Whole plant</td>
<td>Methanol</td>
<td>Antidiabetic and</td>
<td>[26]</td>
</tr>
<tr>
<td>17</td>
<td>Lithocarpus polystachyus</td>
<td>Fagaceae</td>
<td>Leaves</td>
<td>Ethanol &amp; Aqueous</td>
<td>Hypoglycemic</td>
<td>[27]</td>
</tr>
<tr>
<td>18</td>
<td>Marrubium vulgare</td>
<td>Lamiaceae</td>
<td>Aerial part</td>
<td>Methanol</td>
<td>Hyperglycemia &amp;</td>
<td>[28]</td>
</tr>
<tr>
<td>19</td>
<td>Ocimum sanctum</td>
<td>Lamiaceae</td>
<td>Aerial part</td>
<td>Hydroalcoholic</td>
<td>Antidiabetic</td>
<td>[29]</td>
</tr>
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<td>20</td>
<td>Opatnia streptacantha</td>
<td>Cactaceae</td>
<td>Leaves</td>
<td>Ethanol</td>
<td>Antihyperglycemia</td>
<td>[30]</td>
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<td>21</td>
<td>Psidium guajava</td>
<td>Myrtaceae</td>
<td>Fruits</td>
<td>Ethanol</td>
<td>Antihyperglycemic</td>
<td>[31]</td>
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<td>22</td>
<td>Semecarpus anacardium</td>
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<td>nut</td>
<td>Milk</td>
<td>Antidiabetic</td>
<td>[32]</td>
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<td>23</td>
<td>Prosopis glandulosa</td>
<td>Fabaceae</td>
<td>Whole plant</td>
<td>Gelatine/Jelly</td>
<td>Antidiabetic</td>
<td>[33]</td>
</tr>
<tr>
<td>24</td>
<td>Ophiopogon japonicus</td>
<td>Asparagaceae</td>
<td>Root</td>
<td>Ethanol</td>
<td>Hypoglycemic</td>
<td>[34]</td>
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<tr>
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<td>Aqueous</td>
<td>Antihyperglycemic</td>
<td>[35]</td>
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<tr>
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<td>Solanum torvum</td>
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<td>Antihyperglycemic</td>
<td>[36]</td>
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<td>Cassia auriculata</td>
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<td>Aqueous</td>
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<td>[37]</td>
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<td>28</td>
<td>Zygophyllum album</td>
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<td>Váxiex negundo</td>
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<td>Leaves</td>
<td>Methanol</td>
<td>Antihyperglycemic</td>
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<tr>
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<td>Vaccinium schinperi</td>
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<td>aerial parts</td>
<td>Methanolic</td>
<td>Antihyperglycemic &amp;</td>
<td>[40]</td>
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<tr>
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<td>Leaves</td>
<td>Hexane</td>
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<td>[41]</td>
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<td>aqueous</td>
<td>Antidiabetic</td>
<td>[42]</td>
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<tr>
<td>33</td>
<td>Solanum xanthocarpum</td>
<td>Solanaceae</td>
<td>Leaves</td>
<td>Aqueous and Methanol</td>
<td>Antihyperglycemic</td>
<td>[44]</td>
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</table>
Ayurveda, an ancient system of Indian medicine, for use in DM. In accordance to its claimed anti-diabetic effect in traditional medicine, *E. jambolana* has been reported to have hypoglycemic effects both in experimental models and clinical studies[8].

2.3. *Coccina grandis*

Hypoglycemic activity was evaluated in alcoholic extracts of *Coccinia grandis* (*C. grandis*) leaves. Alcoholic extract 600 mg/kg bw was injected orally to mice. Oral administration of alcoholic extract of leaves of *C. grandis* showed significant hypoglycemic effect on blood glucose level in normal fasted rats[9].

2.4. *Alangium lamarckii*

Antidiabetic effect of alcoholic extract of *Alangium lamarckii* (*A. lamarckii*). Alcoholic leaves extract 250 and 500 mg/kg bw was used for these studies. *A. lamarckii* have significant antidiabetic activity in STZ-nicotinamide induced diabetic rat[10].

2.5. *Albizia odoratissima*

Antidiabetic effect of methanolic bark extract of *Albizia odoratissima* (*A. odoratissima*) in alloxan induced diabetic mice. The methanolic extracts were fed to the animals at a dosage of 250 and 500 mg/kg body weight. The significant reduced in the levels of serum cholesterol, triglycerides, SGOT, SGPT, alkaline phosphatase and decrement of total proteins in alloxan induced albino mice[11].

2.6. *Artemis sphaerocephala* Krasch

Antioxidant effect of *Artemis sphaerocephala* (*A. sphaerocephala*) gum on STZ induced diabetic rat. Levels of serum and liver tissue thiobarbituric acid reactive substances (TBARS) and +OH were increased in STZ induced rat. The activity levels of liver and serum superoxide dismutase were decreased. After administration of extract of *A. sphaerocephala*, levels of TBARS and +OH were decreased in serum and liver tissue. The significant increments in the levels of liver and serum SOD. *A. sphaerocephala* is very good antioxidant activity[12].

2.7. *Axonopus compressus*

The anti–diabetic effect of the methanolic leaf extract of the plant. Diabetes was induced in the rats by injection of alloxan. Methanolic leaves extract 250, 500 and 1 000 mg/kg bw was used for these studies. Methanolic leaf extract of *Axonopus compressus* (*A. compressus*) at all

2.8. *Berberis vulgaris*

Hypoglycaemic effect of *Berberis vulgaris* (*B. vulgaris*) L. in streptozotocin-induce diabetic rats. *B. vulgaris* is a traditional medicinal plant which belongs to family Berberidaceae. The results indicated that water extract and saponins shows significant hypoglycemic effect. The serum cholesterol and serum triglycerides levels were significantly increased[14].

2.9. *Caesalpinia digyna*

Antidiabetic effect of bergenin from the roots of *Caesalpinia digyna* (*C. digyna*). The levels of plasma total cholesterol (TC), triglycerides (TG) and LDL-C were significantly increased, whereas levels of (HDL-C) were significantly decreased in diabetic rats when compared to control. After administration of bergenin (10 mg/kg; p.o.) the lipid profile were significantly increased when compared with that of glibenclamide (10 mg/kg; p.o.). The activity levels of antioxidant enzymes such as SOD and Cat were decreased. The level of TBARS was significantly increased in diabetic rat compared to control rat. The administration of bergenin (10 mg/kg; p.o.) significantly increased the SOD and CAT respectively and reduced TBARS level. Bergenin is very good antidiabetic properties[15].

2.10. **Catharanthus roseus**

Hypoglycemic effect of the methanolic leaf extract of *Catharanthus roseus* (*C. roseus*) in alloxan induced diabetic rats. The levels of blood glucose were significantly decreased when compared with Control rat. The blood glucose lowering effect of *C. roseus* methanolic extract was more pronounced than Glibenclamide and Metformin[16].

2.11. **Centaurium erythrea**

Diabetes was induced by a single dose of STZ (65 mg/kg) administered by intraperitoneal way. The oxidative stress was measured by tissue MDA. The estimation of pancreas antioxidant enzymes such as superoxide dismutase (SOD), catalase (CAT), and glutathione peroxidase (GPx). A significant decrement in the levels of pancreas tissue TBARS was recorded in diabetic treated rats when compared to that of normal animals. The activity levels of pancreas antioxidant defense enzymes viz. SOD, CAT,
GPx and GST were significantly increased in the diabetic treated animals. Antioxidant effect of the aqueous leaf extract of *Centaurium erythrea* (*C. erythrea*)[17].

2.12. *Chaenomeles sinensis*

Ethyl acetate fraction of *Chaenomeles sinensis* (*C. sinensis*) (Thouin) Koehne fruits is very good Antidiabetic effect. *Chaenomeles sinensis* is belongs to family Rosaceae. Doses which have antidiabetic activity were reported as 50 and 100 mg/kg body weight[18].

3. Conclusion

In this review we discussed about folklore medicinal plants for the treatment of Diabetes mellitus. Folklore medicinal plants are mostly used for rural areas; because the availability of lavish amount of medicinal plants those areas. Therefore, treating diabetes mellitus with plant derived compounds which are accessible and do not require laborious pharmaceutical synthesis seems highly attractive. In the present review an attempt has been made to investigate the antidiabetic medicinal plants and may be useful to the health professionals, scientists and scholars working in the field of pharmacology and therapeutics to develop antidiabetic drugs.

Conflict of interest statement

We declare that we have no conflict of interest.

References


