INDIGENOUS REMEDIES FOR DIABETES MELLITUS

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ABSTRACT

Diabetes mellitus (DM), a global public health problem, is now emerging as an epidemic world over. According to a widely accepted estimation, the number of diabetic patients would reach 366 million by the year 2030. India now has the world's largest diabetic population, encompassing an estimated 35 million people out of an overall population of 1 billion. In just over 20 years (i.e. 2025) the country will have almost 200 million people (approximately 15% of the population) affected by diabetes or its precursor1. Diabetes mellitus is a group of syndrome characterized by hyperglycemia altered metabolism of lipids, carbohydrates and proteins with an increase risk complications from vascular disease2. It was reported that there is a higher incidence of retinopathy, neuropathy, nephropathy etc. together with diabetes. A wide spread pathological change is thickening of capillary membrane, increase in vessel wall matrix and cellular proliferation resulting in vascular complication like lumen narrowing, early atherosclerosis, sclerosis of glomerular capillaries, retinopathy, neuropathy and vascular insufficiency.

It may affect the disruption of carbohydrate and fat metabolism3. Diabetes is a metabolic disorder where in human body does not produce or properly uses insulin, a hormone that is required to convert sugar, starches, and other food into energy4. Human body has to maintain the blood glucose level 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. The condition may be multifactorial origin in which heredity, age, sex, pregnancy, obesity, autoimmune, infections and emotional disturbances may be important. It may precipitated by pancreatic disorders, hormonal disorders (e.g. acromegaly and cushing syndrome), or by administration of drugs (corticosteroids or diuretic, especially thiazides)5. There are mainly acromegaly and cushing syndrome), or by administration of drugs

INTRODUCTION

Diabetes mellitus (DM), a global public health problem, is now emerging as an epidemic world over. According to a widely accepted estimation, the number of diabetic patients would reach 366 million by the year 2030. India now has the world's largest diabetic population, encompassing an estimated 35 million people out of an overall population of 1 billion. In just over 20 years (i.e. 2025) the country will have almost 200 million people (approximately 15% of the population) affected by diabetes or its precursor1. Diabetes mellitus is a group of syndrome characterized by hyperglycemia altered metabolism of lipids, carbohydrates and proteins with an increase risk complications from vascular disease2. It was reported that there is a higher incidence of retinopathy, neuropathy, nephropathy etc. together with diabetes. A wide spread pathological change is thickening of capillary membrane, increase in vessel wall matrix and cellular proliferation resulting in vascular complication like lumen narrowing, early atherosclerosis, sclerosis of glomerular capillaries, retinopathy, neuropathy and vascular insufficiency.

It may affect the disruption of carbohydrate and fat metabolism3. Diabetes is a metabolic disorder where in human body does not produce or properly uses insulin, a hormone that is required to convert sugar, starches, and other food into energy4. Human body has to maintain the blood glucose level 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. The condition may be multifactorial origin in which heredity, age, sex, pregnancy, obesity, autoimmune, infections and emotional disturbances may be important. It may precipitated by pancreatic disorders, hormonal disorders (e.g. acromegaly and cushing syndrome), or by administration of drugs (corticosteroids or diuretic, especially thiazides)5. There are mainly two types of diabetes—Type 1 and Type 2. In Type 1 diabetes, in the absence of pancreatic b cells the hormone insulin is not produced while Type 2 diabetes mellitus (T2DM), is characterized by a progressive impairment of insulin secretion by pancreatic b-cells and by a relative decreased sensitivity of target tissues to the action of this hormone6. Gestation diabetes mellitus (GDM) is glucose intolerance being recognized during pregnancy. It can complicate pregnancy leading to prenatal morbidity and mortality, so clinical detection important. In India, indigenous remedies have been used in the treatment of DM since the time of Charaka and Sushruta (6th century BC). The ethnobotanical information reports about 800 plants that may possess anti-diabetic potential. Several such herbs have shown anti-diabetic activity when assessed using presently available experimental techniques. The present review, deals with some selective Indian medicinal plants having pharmacologically established hypoglycemic potential.

Keywords: Diabetes mellitus, indigenous remedies

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Name Of Plant</th>
<th>Part Used</th>
<th>Model Used</th>
<th>Reported Mechanism of Action</th>
<th>Reference</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Acacia arabica (Lam.) Muhl. ex Wild.</td>
<td>Seed, powdered seed (2, 3 and 4 mg/kg)</td>
<td>Normal rats, alloxan rats, rabbits</td>
<td>Acts through release of insulin from pancreatic beta cells.</td>
<td>12,13</td>
</tr>
<tr>
<td>2</td>
<td>Aegle marmelos (L.) Correa ex Roxb.</td>
<td>root bark (1 ml/100mg), aqueous leaf extract</td>
<td>Normal fasted rats,</td>
<td>Increases utilization of glucose</td>
<td>14-16</td>
</tr>
</tbody>
</table>
| 3 | *Allium cepa* L.  
**Common name:** Onion  
[FAMILY: Alliaceae] | ether soluble fraction of onion (0.25 mg/kg p.o.), ethanol, petroleum ether and ethyl acetate extract (0.25 mg/kg) | **STZ** rats | Lowers blood glucose level | 17-19 |
| 4 | *Allium sativum* L.  
**Common name:** Garlic  
[FAMILY: Alliaceae] | leaf pulp extracts | **STZ** rats | Maintains glucose homeostasis by controlling the carbohydrate metabolizing enzymes and stimulates insulin release from pancreatic beta cells. | 22-24 |
| 5 | *Aloe vera* (L.) Burm.f.  
**Common name:** Aloe  
[FAMILY: Liliaceae] | aerial parts (100 mg/kg, orally) | **Alloxan** rabbits | Inhibits glucose re-absorption or increase in peripheral glucose utilization | 25 |
| 6 | *Artemisia pallens* Wall  
**Common Name:** Davana  
[FAMILY: Compositae] | ethanolic leaf-extract (350 mg/kg, orally) | **STZ** rats and **alloxan** rabbits | Lowers blood glucose level | 26-27 |
| 7 | *Boerhavia diffusa* L.  
**Common name:** Life Plant  
[FAMILY: Nyctaginaceae] | Andrographis paniculata  
**Common name:** King of Bitter  
[FAMILY: Acanthaceae] | Andrographis paniculata extract | **STZ** rats | Prevents glucose absorption from gut. | 28-30 |
| 8 | *Boerhavia diffusa* L.  
**Common name:** Tar vine  
[FAMILY: Nyctaginaceae] | Hydro alcoholic plant extract, crude ethanolic extract of the plant whole plant, oil fraction | **STZ** rats, **alloxan** albino rats | Inhibits action of epinephrine on glucose metabolism, resulting in increased utilization of peripheral glucose | 31-34 |
| 9 | *Cassia auriculata* L.  
**Common name:** Tanner’s Cassia  
[FAMILY: Leguminosae] | aqueous leaf extract (100, 200 and 400 mg/kg) | **STZ** rats | Suppresses enhanced glucoseogenesis during diabetes and enhance utilization of glucose through increased glycolysis. In addition to pronounced alpha-glucosidase inhibitory actions resulting in a significant and potent lowering of blood glycemic response | 39 |
| 10 | *Caesalpinia bonducuella* (L.) Roxb.  
**Common name:** Chinese Cinnamon  
[FAMILY: Caesalpiniaceae] | aqueous and 50% ethanolic seed extracts | **STZ** rats | Increases plasma insulin levels and improves glucose tolerance | 37-38 |
| 11 | *Citrullus colocynthis* (L.) Schrad.  
**Common name:** Common Melon  
[FAMILY: Cucurbitaceae] | aqueous extract (300 mg/kg) | **Normal** rabbits, **STZ** rats | Exerts an insulinotropic effect | 41-42 |
| 12 | *Coccus indicus* Wight & Arn.  
**Common name:** Ivy gourd  
[FAMILY: cucurbitaceae] | alcoholic leaf extract | **Guinea pig**, **Alloxan dogs** | Suppresses glucose synthesis, through depression of the key gluconeogenic enzymes glucose-6-phosphatase and fructose-1,6-bisphosphatase and enhances glucose oxidation by shunt pathway through activation of its principal enzyme glucose-6-phosphate dehydrogenase. Also has an insulin secretagogue effect and acts like insulin by correcting elevated enzymes in glycolytic pathway and restoring LPL activity in lipolytic pathway with control of hyperglycemia in obesity | 43-48 |
| 13 | *Casearia esculenta* Roxb.  
**Common name:** Carilla Fruit  
[FAMILY: Flacourtiaeae] | root extracts (300 mg/kg p.o.) | **STZ** rats | Exhibits significant reduction in blood glucose level, a decrease in the activities of glucose-6-phosphatase and fructose-1,6-bisphosphatase and an increase in the activity of liver hexokinase, resulting in potent hypoglycemic activity | 49 |
| 14 | *Catharanthus roseus* (L.) G. Don.  
**Common name:**  
[FAMILY: Apocynaceae] | ethanolic leaf extract | **STZ** rats | Increases metabolism of glucose and | 50-52 |
<table>
<thead>
<tr>
<th>Common name</th>
<th>Family</th>
<th>Extract/Plant Part</th>
<th>Animal model</th>
<th>Effect</th>
<th>References</th>
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<tr>
<td>Don</td>
<td>Madagascar periwinkle [Family: Apocynaceae]</td>
<td>extract (500mg/kg), dichloromethane: methanol extract of leaves and twigs (500 mg/kg p.o., for 7 and 15 days)</td>
<td>Enhances secretion of insulin either from the beta cells of Langerhans or through extrapancreatic mechanism</td>
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<td>19 Camellia sinensis Kuntze</td>
<td>Green tea [Family: Theaceae]</td>
<td>hot water extract of green tea</td>
<td>Increases insulin activity</td>
<td>53-54</td>
<td></td>
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<td>20 Chamomile nobile [Family: Asteraceae]</td>
<td></td>
<td>aqueous extract of leaves</td>
<td>STZ rats</td>
<td>55</td>
<td></td>
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<td>21 Coscinium fenestratum [Family: Menispermaceae]</td>
<td></td>
<td>alcoholic extract/steam barks</td>
<td>STZ rats</td>
<td>56</td>
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<td>22 Enicostemma littorale Blume</td>
<td>Green tea [Family: Gentianaceae]</td>
<td>aqueous extract of plant</td>
<td>Alloxan rats</td>
<td>57-58</td>
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<td>23 Eugenia jambolana Lam.</td>
<td>Indian black berry [Family: Myrtaceae]</td>
<td>pulp extract of the fruits, alcoholic extract (100 mg/kg p.o.)</td>
<td>STZ rats, alloxan rats</td>
<td>59-64</td>
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<td>24 Egyptian Morus alba</td>
<td>Banyan tree [Family: Moraceae]</td>
<td>alcoholic extract</td>
<td>STZ rat</td>
<td>65</td>
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<tr>
<td>25 Ficus religiosa L.</td>
<td>Banyan tree [Family: Moraceae]</td>
<td>bark extract</td>
<td>STZ rats, alloxan rats</td>
<td>66-70</td>
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<tr>
<td>26 Hibiscus rosa sinensis L.</td>
<td>China Rose [Family: Malvaceae]</td>
<td>ethanol extract of the plant, alcoholic leaf extract (250 mg/kg p.o. for seven days consecutive)</td>
<td>Alloxan rats</td>
<td>71-72</td>
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<td>27 Helicteres isora L.</td>
<td>Screw tree [Family: Sterculiaceae]</td>
<td>ethanolic root extract (300 mg/kg after 9 days of administration)</td>
<td>Mice</td>
<td>Acts through insulin-sensitizing activity</td>
<td>73-74</td>
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<td>28 Hintonia standleyana</td>
<td>Banyan tree [Family: Rubiaceae]</td>
<td>methanolic extract</td>
<td>STZ rat</td>
<td>75-76</td>
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<tr>
<td>29 Hypoxis hemerocallidea</td>
<td>Banyan tree [Family: Hypoxidaceae]</td>
<td>Aqueous extract</td>
<td>STZ mice, rat</td>
<td>77</td>
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<td>30 Leonotis leonurus</td>
<td>Lamiastrum [Family: Lamiaceae]</td>
<td>Aqueous extract/leaves</td>
<td>STZ mice, rat</td>
<td>78</td>
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<td>31 Lepidium sativum</td>
<td>Brassicaceae</td>
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<td>32 Lycium barbarum</td>
<td>Solanaceae</td>
<td>Isolated compounds /fruits</td>
<td>STZ rat</td>
<td>80-81</td>
<td></td>
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<tr>
<td>33 Mangifera indica L.</td>
<td>Mango [Family: Anacardiaceae]</td>
<td>Aqueous leaf extracts (1 g/kg p.o.)</td>
<td>STZ rats</td>
<td>82-83</td>
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<tr>
<td>34 Momordica charantia [Family: Cucurbitaceae]</td>
<td>Bitter gourd [Family: Cucurbitaceae]</td>
<td>fruit powder, aqueous fruit extract (0.5 g/kg dose for 6 weeks)</td>
<td>Alloxan rats</td>
<td>May act by increasing hepatic glycogen</td>
<td>84-85</td>
</tr>
<tr>
<td>35 Mucuna pruriens (L.)</td>
<td>Velvet bean [Family: Leguminosae]</td>
<td>powdered seeds (0.5, 1 and 2 g/kg), plant extract (200 mg/kg), alcoholic extract of the plant (100, 200 and 400)</td>
<td>Alloxan rabbits, STZ mice</td>
<td>Possibly acts through stimulation of the release of insulin and/or by a direct insulin-like action due to the presence of trace elements like manganese, zinc, etc.</td>
<td>86-88</td>
</tr>
<tr>
<td>36</td>
<td><em>Morus alba L.</em></td>
<td>mg/kg/day</td>
<td>Mice</td>
<td>Acts by increasing glucose uptake</td>
<td>89</td>
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<tr>
<td>37</td>
<td><em>Murraya koenigii (L.)</em></td>
<td>200 mg/kg</td>
<td>Normal rats</td>
<td>Increases glycogenesis and decreases glycogenolysis and gluconeogenesis</td>
<td>90-91</td>
</tr>
<tr>
<td>38</td>
<td><em>Malmea depressa</em></td>
<td>aqueous extract, ethanolic extract, n-butanol fraction/roots</td>
<td>STZ rats</td>
<td>Glucose</td>
<td>92</td>
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<tr>
<td>39</td>
<td><em>Mangifera indica</em></td>
<td>ethanolic extract, isolated compounds</td>
<td>STZ rats</td>
<td>Glucose</td>
<td>93</td>
</tr>
<tr>
<td>40</td>
<td><em>Momordica charnitia</em></td>
<td>ethanolic leaf extract, plant extract (200 mg/kg for 30 days)</td>
<td>STZ rats</td>
<td>Glucose</td>
<td>94-95</td>
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<tr>
<td>41</td>
<td><em>Ocimum sanctum</em></td>
<td>ethanolic flower extract, plant extract (200 mg/kg for 30 days)</td>
<td>STZ rat</td>
<td>Inhibits intestinal alpha-glucosidase activity, leading to antihyperglycemic property</td>
<td>99-100</td>
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<td>42</td>
<td><em>Punica granatum</em></td>
<td>ethanolic flower extract, plant extract (200 mg/kg for 30 days)</td>
<td>STZ rat</td>
<td>Glucose, glycosylated hemoglobin</td>
<td>101-102</td>
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<td>43</td>
<td><em>Piper betle</em></td>
<td>ethanolic extract, leaves</td>
<td>STZ rat</td>
<td>Glucose, lipids, insulin</td>
<td>103</td>
</tr>
<tr>
<td>44</td>
<td><em>Psidium guajava Linn.</em></td>
<td>ethanolic extract, leaves</td>
<td>STZ rat</td>
<td>Glucose, lipids, insulin</td>
<td>104</td>
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<td>45</td>
<td><em>Raphanus sativus</em></td>
<td>ethanolic extract, leaves</td>
<td>STZ rat</td>
<td>Glucose, lipids, insulin</td>
<td>105</td>
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<tr>
<td>46</td>
<td><em>Retama raetam</em></td>
<td>ethanolic extract, leaves</td>
<td>STZ rat</td>
<td>Glucose</td>
<td>106</td>
</tr>
<tr>
<td>47</td>
<td><em>Syzygium cordatum</em></td>
<td>ethanolic extract, leaves</td>
<td>STZ rat</td>
<td>Glucose, hepatic glycogen</td>
<td>107</td>
</tr>
<tr>
<td>48</td>
<td><em>Salacia reticulata</em></td>
<td>ethanolic extract, leaves</td>
<td>STZ rat</td>
<td>Glucose, hepatic glycogen</td>
<td>108</td>
</tr>
<tr>
<td>49</td>
<td><em>Scoparia dulcis</em></td>
<td>ethanolic extract</td>
<td>Zucker rat (OZR)</td>
<td>Acts through inhibition of alpha-glucosidase activity</td>
<td>109</td>
</tr>
<tr>
<td>50</td>
<td><em>Salacia Oblonga Wall.</em></td>
<td>ethanolic extract</td>
<td>Zucker rat (OZR)</td>
<td>Acts through inhibition of alpha-glucosidase activity</td>
<td>110</td>
</tr>
<tr>
<td>51</td>
<td><em>Swertia chirayita</em></td>
<td>ethanol extract (250 mg/kg)</td>
<td>STZ rat</td>
<td>Stimulates insulin release from islets of Langerhans by depleting aldehyde-fuchsin stained beta-granules and immunostained insulin</td>
<td>111-112</td>
</tr>
<tr>
<td>52</td>
<td><em>Syzygium alternifolium</em></td>
<td>Aqueous extract/seed</td>
<td>Alloxan rats</td>
<td>Glucose</td>
<td>113</td>
</tr>
<tr>
<td>53</td>
<td><em>Swertia chirayita</em></td>
<td>Aqueous extract/seed</td>
<td>Alloxan rats</td>
<td>Glucose</td>
<td>114-115</td>
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## CONCLUSION

The incidences of modern lifestyle diseases like Type 2 diabetes widely prevalent in industrialized countries are on the rise in developing countries. The burden of T2DM is enormous when the widely prevalent in industrialized countries are on the rise in developing countries. The incidences of modern lifestyle diseases like Type 2 diabetes widely prevalent in industrialized countries are on the rise in developing countries. The burdens of T2DM are considered. Due to economic constraints, providing modern medical healthcare in developing countries such as India is still a far-reaching goal. Out of an estimated 250,000 higher plants, less than 1% has been screened pharmacologically and very few in regard to DM. Therefore, it is prudent to look for options in herbal medicine for diabetes as well. The goals of medicine no matter to which group it belongs, are the same i.e. the welfare of the patient. One can look towards a future of integrated medicine and hope that research in alternative medicine will help identify what is safe and effective rather than marginalizing, unorthodox medical claims and findings.

## REFERENCES


