Abstract: Antihyperglycemic activity of whole plant aqueous extract in alloxan induced diabetic rats along with reduction of glycosylated haemoglobin and glucose-6-phosphatase activity in liver. Mechanism may be mediated through an insulin release mechanism or due to alteration in hepatic and skeletal muscle glycogen content and hepatic glucokinase, hexokinase, glucose-6-phosphate and phosphofructokinase levels in diabetic mice.

Keywords: Plant, Hypoglycemic activity, Family, Alloxan

Introduction: Indian medicinal plants with hypoglycemic activity:

1. Eugenia jambolana Lam.

Common name: Indian black berry

Family: Myrtaceae

Activity with route of administration/dosage:

i. Hypoglycemic activity of pulp extract of the fruits in normal as well as STZ diabetic rats upon oral administration.

ii. Blood glucose lowering activity of aqueous seed extract (2.5 and 5.0 g/kg body weight p.o. for 6 weeks) along with an increase in total haemoglobin and antioxidant activity in diabetic rats.

iii. The blood glucose lowering activity of alcoholic extract (100 mg/kg p.o.) in alloxan diabetic
rats along with reduction in urine sugar and lipids in serum and tissues.3

iv. Hypoglycemic effect of aqueous, alcoholic extracts and lyophilized powder (200 mg/kg per day) of the plant in hyperglycemic animals.4

v. Antihyperglycemic and antihyperinsulinemic activity of aqueous extracts (400 mg per day) in fructose fed rats.5

vi. Reduction in plasma glucose concentration by the extract (200 mg/kg) upon administration for 50 days in STZ induced diabetic mice.6

vii. Hypoglycemic activity of ethanolic seed extract in alloxan-induced diabetic rabbits along with hypolipidemic effect.7

viii. Hypoglycemic activity of ethanolic whole seeds, kernel (100 mg/kg of body weight) and seed coat extracts in streptozotocin-induced diabetic rats.8

ix. Hypoglycemic activity of inorganic trace elements, obtained from the seeds in streptozotocin-induced diabetic rats.9

tax. Antioxidant activity of ethanolic seed kernel extract in streptozotocin-induced diabetic rats upon oral administration.10

xi. Blood glucose lowering activity of seed powder in streptozotocin diabetic female albino Wistar rats at a dose of 250, 500 or 1000 mg/kg, orally.11

**Reported mechanism of action:**

May be mediated through an insulin release mechanism1 or due to alteration in hepatic and skeletal muscle glycogen content and hepatic glucokinase, hexokinase, glucose-6-phosphate and phosphofructokinase levels in diabetic mice.4 It also enhances serum insulin activity7 and exhibits normoglycemia and better glucose tolerance.8

**2. Enicostemma littorale**

**Common name:** Blume

**Family:** Gentiaceae
Activity with route of administration/dosage:

i. Antihyperglycemic activity of whole plant aqueous extract in alloxan induced diabetic rats along with reduction of glycosylated haemoglobin and glucose-6-phosphatase activity in liver.12

ii. Insulin enhancing activity of a single dose of aqueous extract of plant (15 g dry plant equivalent extract per kg) in alloxan-induced diabetic rats.13

iii. Glucose lowering activity of aqueous extract (2 g/kg p.o.) daily for 6 weeks in neonatal non-insulin-dependent diabetes mellitus (NIDDM) rats along with a decrease in the elevated cholesterol, triglyceride and creatinine levels.14

iv. Reduction in glycosylated haemoglobin, liver glucose-6-phosphatase activity and significant increase in serum insulin levels of the diabetic rats by aqueous extract.15

v. Antioxidant activity of the whole plant aqueous extract (1 and 2 g/kg) in alloxanized rats upon oral administration for 45 days.16

Reported mechanism of action:

Enhances glucose-induced insulin release from isolated rat pancreatic islets, mediated through K (+)-ATP channel-dependent pathway.13

3. Ficus bengalensis L.

Common name: Banyan tree

Family: Moraceae

Activity with route of administration/dosage:

i. Hypoglycemic activity of ethabolic bark extract and a glucoside isolated from the plant in normal and alloxan diabetic rabbits.17

ii. Blood glucose lowering activity of bark extract in processes (Kumar and Augusti, 1989) streptozotocin-induced diabetic animals upon oral administration
and enhancement of serum insulin levels in normoglycemic and diabetic rats.18

iii. Blood sugar lowering activity of a dimethoxy derivative of leucocyandin 3-O-beta-d-galactosyl cellobioside isolated from the bark in normal and moderately diabetic rats along with an increase in serum insulin in the diabetic rats at a dosage of 250 mg/kg for a 2 h period upon oral administration.19

iv. Antihyperglycemic activity of dimethoxy derivative of perlargonidin 3-O-alpha-l rhamnoside (250 mg/kg, single dose study and 100 mg/kg/day long term study) in moderately diabetic rats. Hypoglycemic and serum insulin raising activity in normal and moderately diabetic dogs during a period of two hours.20, 21

v. Hypoglycemic, hypolipidemic and serum insulin raising effects of glycoside of leucopelargonidin isolated from the bark in moderately diabetic rats.22

vi. Hypoglycemic activity of Leucodelphinidin derivative in normal and alloxan diabetic rats at a dosage of 250 mg/kg.23

Reported mechanism of action:

Stimulates insulin secretion from beta cells of islets of langerhans 18, 20, 21 and inhibits insulin degradative processes. 19

4. Hibiscus rosa sinensis L.

Common name: China Rose

Family: Malvaceae

Activity with route of administration/dosage:

i. Hypoglycemic activity of single dose of ethanol extract of the plant in glucose-loaded rats at 120 min and blood glucose lowering effect after repeated administration for seven consecutive days at 30, 90 and 120 min after glucose loading.24

ii. Hypoglycemic activity of alcoholic leaf extract (250 mg/kg p.o. for seven consecutive days)
in glucose induced hyperglycemia model in rats.

iii. Blood glucose lowering activity of ethanol flower extract in streptozotocin induced diabetic rats along with a reduction in total cholesterol and serum triglycerides.

Reported mechanism of action:
Stimulates insulin secretion from pancreatic beta cells and increases utilization of glucose, either by direct stimulation of glucose uptake or via the mediation of enhanced insulin secretion.

5. Helicteres isora L.

Common name: Screw tree
Family: Sterculiaceae

Activity with route of administration/dosage:

i. Plasma glucose lowering activity of ethanolic root extract (300 mg/kg, after 9 days of administration) in insulin resistant and diabetic C57BL/KsJdb/db mice associated with a reduction in plasma triglyceride level.

ii. Antihyperglycemic activity of butanol root extracts (250 mg/kg) in glucose loaded rats.

Reported mechanism of action:
Acts through insulin-sensitizing activity.

6. Ipomoea batatas (L.)

Common name: Sweet potato
Family: Convolvulaceae

Activity with route of administration/dosage:

i. Hypoglycemic effect of the plant against diabetic Zucker fatty rats and inhibition of the increased blood glucose level in a glucose tolerance test in rats.

ii. Postprandial glucose suppression effect (reduced blood glucose level by 16.5% at 30 min) of
Peonidin 3-O-[2-O-(6-O-E-feruloyl-beta-d-glucopyranosyl)-6-O-Ecaffeoyl-beta-d-glucopyranoside]-5-O-beta-d-glucopyranoside, a diacylated anthocyanin, isolated from storage roots in male 8-week-old Sprague-Dawley rats upon single oral administration.30

Reported mechanism of action:
Reduces insulin resistance 29 and possibly acts by maltase inhibition, not by sucrase or glucose transport inhibition at the intestinal membrane.30

ii. Hypoglycemic activity of Mangiferin (10 and 20 mg/kg, i.p. once daily for 28 days) in STZ induced diabetic rats and improvement in oral glucose tolerance in glucose-loaded normal rats upon chronic administration (10 and 20 mg/kg, i.p.) for 14 days.32

Reported mechanism of action:
Possibly acts through intestinal reduction of the absorption of glucose 31 as well as pancreatic and extrapancreatic mechanisms.32

7. Mangifera indica L.
Common name: Mango
Family: Anacardiaceae
Activity with route of administration/dosage:
i. Hypoglycemic activity of aqueous leaf extract (1 g/kg p.o.), given along with as well as 60 min before glucose administration in streptozotocin-induced diabetic rats.31

8. Momordica cymbalaria
Common name: Hook
Family: Cucurbitaceae
Activity with route of administration/dosage:
i. Blood glucose level reducing activity of fruit powder in fasted alloxan-induced diabetic rats after a treatment for 15 days.33
ii. Blood glucose lowering effect of aqueous fruit extract in alloxan diabetic rats.34

iii. Antihyperglycemic activity of aqueous fruit extract (0.5 g/kg dose for 6 weeks) in alloxan-induced diabetic rats upon oral administration.35

**Reported mechanism of action:**

May act by increasing hepatic glycogen.33

**9. Mucuna pruriens**

**Common name:** Velvet bean

**Family:** Leguminosae

**Activity with route of administration/dosage:**

i. Blood glucose lowering activity of powdered seeds (0.5, 1 and 2 g/kg) in normal rabbits and hypoglycemic activity of the seed (1 and 2 g/kg body weight) in alloxan-diabetic rabbits.36

ii. Blood glucose lowering activity of plant extract (200 mg/kg) upon daily oral feeding for 40 days in STZ-diabetic mice.37

iii. Antihyperglycaemic effect of alcohol extract of the plant (100, 200 and 400 mg/kg/day) in alloxanized rats and insignificant glucose lowering effect in streptozotocin (STZ) diabetic mice.38

**Reported mechanism of action:**

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.36

**10. Morus alba L.**

**Common name:** White mulberry

**Family:** Moraceae

**Activity with route of administration/dosage:**

i. Hypoglycemic activity of hot water extract of leaves in fasted and non-fasted streptozotocin
induced diabetic mice at a dose of 200 mg/kg, i.p.39

ii. Degranulation effect of leaf-extract on the beta cells of islets of langerhans of rabbits upon chronic subcutaneous administration.40

Reported mechanism of action:
Acts by increasing glucose uptake.39

11. Acacia Arabica

Common name: Curry-leaf tree

Family: Rutaceae

Activity with route of administration/dosage:

i. Fasting as well as post-prandial blood sugar lowering effect of leaf-powder in Type II diabetic patients upon administration for a period of 1 month.41

ii. Blood sugar lowering effect of the leaves in normal rats when administered as a diet (10%, v/v) for 60 days.42

12. Ocimum sanctum L.

Common name: Holy Basil

Family: Lamiaceae

Activity with route of administration/dosage:

i. Hypoglycemic activity of 70% ethanolic leaf extract in normal, glucose fed and STZ diabetic rats, orally. The extract also potentiated the action of exogenous insulin in normal rats.43

ii. Fasting blood glucose level reducing activity of the leaf powder, given along with food for 1 month, in normal and diabetic rats.44

iii. Plasma glucose lowering activity of plant extract (200 mg/kg for 30 days) in STZ induced diabetic animals revealing the effect of the extract on three important
enzymes of carbohydrate metabolism, namely glucokinase, hexokinase and phosphofructokinase.45

iv. Glucose and cortisol lowering activity of the plant in male mice.46

**Reported mechanism of action:**

Acts by cortisol inhibiting potency.46

13. *Punica granatum* L.

**Common name:** Pomegranate

**Family:** Punicaceae

**Activity with route of administration/dosage:**

i. Blood glucose lowering activity of a 50% (v/v) ethanolic flower extract in glucose fed and alloxanized hyperglycemic rats.47

ii. Hypoglycemic activities of methanolic seed extract (150, 300 and 600 mg/kg p.o.) in streptozotocin diabetic rats at the end of 12 h.48

iii. Plasma glucose lowering activity of methanolic extract of the flowering part in non-fasted Zucker diabetic fatty rats.49

**Reported mechanism of action:**

Inhibits intestinal alpha-glucosidase activity, leading to antihyperglycemic property.49


**Common name:** Salacia

**Family:** Celastaceae

**Activity with route of administration/dosage:**

i. Blood glucose lowering effect of aqueous decoction in fasted animals with improved glucose tolerance in laboratory animals.50, 51

ii. Hypoglycemic activity of plant tea in type II diabetic patients in a randomised single centre double blind cross over clinical trial.52

**Reported mechanism of action:**

Inhibits alpha-glucosidase activity.50, 51
15. **Salacia Oblonga Wall.**

**Common name:** Salacia  

**Family:** Celastaceae

**Activity with route of administration/dosage:**

i. Serum glucose lowering activity of aqueous methanolic extract of the roots in sucrose and maltose loaded rats and alpha-glucosidase and aldose reductase inhibitory activities of water soluble and ethyl acetate soluble fractions of the aqueous methanolic extract in same animal model.53  

ii. Antihyperglycemic, antihypoinsulinemic and antioxidant activity of petroleum ether extract of the root bark in streptozotocin diabetic rats.54  

iii. Antihyperglycemic effect of water extract in the obese Zucker rat (OZR) (genetic model of Type II diabetes) along with the effect on cardiac fibrosis upon chronic administration.55  

iv. Plasma glucose and serum insulin reducing activity of the extract (1000 mg/kg) along with an alpha glucosidase inhibitory activity in a double-masked randomized cross over clinical study in healthy adults.56

**Reported mechanism of action:**

Acts through inhibition of alpha-glucosidase activity.53

16. **Swertia chiravita**

**Common name:** Indian Gentian  

**Family:** Gentianaceae

**Activity with route of administration/dosage:**

i. Blood glucose lowering activity of hexane fraction of 95% ethanol extract (250 mg/kg) in fed, glucose loaded and tolbutamide pretreated animals.57  

ii. Insulin releasing effect of the hexane fraction of the plant (250 mg/kg body weight p.o. per day for 28 days) in albino rats along with a significant rise in liver glycogen.58
iii. Blood sugar lowering activity of swerchirin, (1,8-dihydroxy-3,5-dimethoxyxanthone), isolated from hexane fraction of the plant in fasted, fed, glucose loaded and tolbutamide pretreated albino rats. 

iv. Blood sugar lowering effect of Swerchirin (50 mg/kg p.o.) in healthy and streptozotocin treated (35 mg/kg i.v.) Charles Foster strain albino rats.

**Reported mechanism of action:**

Stimulates insulin release from islets of Langerhans by depleting aldehyde-fuchsin stained beta-granules and immunostained insulin.

17. *Scoparia dulcis* L.

*Common name:* Sweet Broomweed

*Family:* Scrophulariaceae

**Activity with route of administration/dosage:**

i. Hypoglycemic activity of aqueous leaf extract (0.15, 0.30 and 0.45 g/kg body weight for 45 days p.o.) in experimental diabetic rats along with a reduction in glycosylated haemoglobin and an increase in total haemoglobin.

ii. Blood glucose, sorbitol dehydrogenase, glycosylated pancreatic islets (Latha et al., 2004a) hemoglobin, thiobarbituric acid reactive substances, hydroperoxides reducing and plasma insulin, glutathion peroxidase, glutathion S-transferase enhancing activities of aqueous plant extract (200 mg/kg) in the liver of streptozotocin adult diabetic male albino Wistar rats.

iii. Plasma insulin and plasma antioxidants enhancing activity of aqueous extract for 6 weeks at a dose of 200 mg/kg p.o. in diabetic rats.

iv. The insulin secretagogue activity of the plant extracts in isolated mice pancreatic islets at a dose of 10 mg/ml.

v. In vitro insulin secretagogue activity of the extract of this plant in rat insulinoma cell lines.
(RINm5F cells) treated with streptozotocin.65

**Reported mechanism of action:**

Suppresses glucose influx into the polyol pathway leading to increased activities of antioxidant enzymes and plasma insulin and decreases activity of sorbitol dehydrogenase.62 Also potentiates insulin release from pancreatic islets.64

**Conclusion:**

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**Reference:**


Hypoglycemic effect of Swerchirin from the hexane fraction of Swertia chirayita. Planta Medica 57, 102–104.


