

Traditional Medicinal Plants of Sariska Tiger Reserve Used in Diabetes

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ABSTRACT

Sariska Tiger Reserve, one of the 42 Tiger Reserves of India, is located near the civil district of Alwar in Rajasthan. The Sariska Tiger Reserve in Aravallis has its own importance and specific characteristics with unique biodiversity. The forest of Sariska Tiger Reserve has great diversity of flora. This paper gives an account of anti diabetic medicinal plants found in Sariska Tiger Reserve, along with their local name, family, habit and medicinal uses. Due to lack of awareness, research unsustainable utilization and encroachments on these groups of plant in this area, people of this region are unaware of the wealth of this heritage and several persistent medicinal plant species are on the verge of extinction. The present paper highlights useful ethno botanical information about the uses of these plants by the tribal of Rajasthan as food, fodder, medicine (fever, diarrhoea, diuretic, skin-problems, diabetes, hypertension, jaundice etc.), timber, fire-wood, tannin, dye, oil, fibre, alcohol, gum, resin etc.

Keywords: Sariska, Diversity, Diabetes, Medicinal Plant

1. INTRODUCTION

Rajasthan is quite rich in floristic diversity probably due to presence of different variable and diversified climatic, physiographic, edaphic and habitat conditions.¹ The Sariska tiger reserve in Aravallis has its own importance and specific characteristics endowed with unique biodiversity.² Sariska National park is situated between the latitude (76°17'-76°34'N and 27°5'-27°33'E) and longitude in the Alwar district of Rajasthan.³ It

became a wild life sanctuary in 1955 and Tiger reserve in 1982. According to Department of Forest, Government of Rajasthan the total area of the Sariska Tiger Reserve is 866.0 km², of which 302.2 km² is buffer zone and 497.8 km² is core zone. Sariska core zone is comprised of three isolated; pockets: Core-I (273.8 km²), II (126.5 km².) and III (97.5 km²). The status of the Core I has been notified as a National park in 1982. Sariska is undulating to hilly and has numerous narrow valleys. The forest being scattered and sparse over a large area on various geological and soil formation and vary greatly in composition. Sariska is very rich in biodiversity with wide spectrum of flora and ample of wild life.⁴

Anogeissus pendula (Dhok) is dominant species in the undulating area and on the hills. Boswellia serrata (Salar) Opuntia elatior (Prickly pear) and Lannea coromandelica (Garjan) grows on steep rocky areas. Acacia catechu (Khair), Zizyphus mauritiana (Bordi), Kydia calycina (Pulao) and Butea monosperma (Dhak) are found in valleys.⁵

A total number of 403 indigenous and naturalized plant species belonging to 271 genera under 86 families can be observed in Sariska Tiger Reserve. This also includes four species of Pteridophytes belonging to three genera and three families, and a species of Gymnosperm. Table 1 includes the number of families, genera and species, under Dicotyledons and Monocotyledons, Pteridophytes and Gymnosperm. Except for Poaceae (56

species) and Cyperaceae (17 species) the Monocotyledons are poorly represented. The remaining 16 species of Monocotyledons belong to 10 different families.⁶

A total of 110 species of plants representing 88 genera and 43 families in Sariska used as traditional medicine in various disorder such as fever, diabetes, diarrhoea, dysentery, skin-problems, jaundice, rheumatism etc.⁷

More over several difficult diseases have problem related with vitality, diabetes, memory loss, could be cured effectively by use of herbal medicine, which is generally not possible by the Allopathic medicines.⁸

In the present study an attempt has been made to ascertain the current status of plant species which has medicinal and economical importance for the livelihood of local peoples inside and outside the Sariska forest. Present Paper highlights the floristic richness along with ethnobotanical wealth of Sariska forest. This review focuses on Indian Herbal drugs and plants from Sariska forest used in the treatment of diabetes.

1.1 Diabetes and their management:

Diabetes is a chronic disorder of carbohydrate, fat and protein metabolism characterized by increased fasting and post prandial blood sugar levels. Diabetes mellitus is a complex metabolic disorder resulting from either insulin insufficiency or insulin dysfunction. Type I diabetes (insulin dependent) is caused due to insulin insufficiency because of lack of functional beta cells. Patients suffering from this are therefore totally dependent on exogenous source of insulin while patients suffering from Type II diabetes (insulin independent) are unable to respond to insulin and can be treated with dietary changes, exercise and medication. Type II diabetes is the more common form of diabetes constituting 90% of the diabetic population. Symptoms for both diabetic conditions may include: (i) high levels of sugar in the blood; (ii) unusual thirst; (iii) frequent urination; (iv) extreme hunger and loss of weight; (v) blurred vision; (vi) nausea and vomiting;

(vii) extreme weakness and tiredness; (viii) irritability, mood changes etc.⁹

Diabetes is rapidly growing worldwide, and affected 422 million people in 2014 and resulted in over 3 million deaths. The World Health Organization (WHO) estimated that diabetes would be the seventh leading cause of death by the year of 2030, and suggested that healthy lifestyle and right medication and regular screening can prevent and avoid the consequence of diabetes, respectively.

For many decades, medicinal plants have been beneficial resources for the treatment of several diseases, including diabetes. Some well-known drugs in current-use for diabetes have been developed from plants such as metformin drug derived from the *Galega officinalis*. Many studies have also indicated the advantages of medicinal plants in the therapeutic development, for example availability and acceptable risk-benefit ratio. Though the ethno botanical community has reported a list of anti-diabetic medicinal plants, in the search for new treatments and cures, yet more medicinal plants are being explored for their therapeutic development.¹⁰

Today, many treatments that involve the use of medicinal plants are recommended. Most plants contain carotenoids, flavonoids, terpenoids, alkaloids, glycosides and can often have anti-diabetic effects. The anti-hyperglycemic effects that results from treatment with plants are often due to their ability to improve the performance of pancreatic tissue, which is done by increasing insulin secretions or reducing the intestinal absorption of glucose.¹¹

Treatment includes diet, exercise, and medication. Currently, the main and effective treatment for diabetes is the use of insulin and hypoglycemic drugs, but these compounds also have many adverse side effects. Medicinal plants have a long history of usage and today, they are being extensively used for various diseases. There are several reasons for increasing the use of

medicinal plants. Many plants from different parts of the world have been investigated for antidiabetic effects.¹²



Fig:1 Map showing Sariska Tiger Reserve Rajasthan (Range, Village, Road)³

Table 1 Shows current status of vegetation in Sariska Tiger Reserve.²

| | Families | Genera | Species |
|------------------|----------|--------|---------|
| Monocotyledons | 13 | 59 | 90 |
| Dicotyledons | 69 | 208 | 308 |
| Total Angiosperm | 82 | 267 | 398 |
| Pteridophytes | 3 | 3 | 4 |
| Gymnosperm | 1 | 1 | 1 |
| Total | 86 | 271 | 403 |

Table 2: Vegetation and land cover in Sariska National Park.¹³

| S.No. | Vegetation/ Landcover type | Area (sq. km.) | Percentage |
|-------|-----------------------------|----------------|------------|
| 1 | Anogeissus dominated forest | 283.3 | 35.43 |
| 2 | Scrubland | 152.5 | 19.07 |
| 3 | Boswellia dominated forest | 123.5 | 15.50 |
| 4 | Agriculture/Habitation | 74.7 | 9.34 |
| 5 | Zizyphus mixed forest | 63.6 | 7.95 |
| 6 | Butea dominated forest | 47.5 | 5.94 |
| 7 | Acacia mixed forest | 32.2 | 4.02 |
| 8 | Barren land | 20.6 | 2.58 |
| 9 | Water body | 1.6 | 0.20 |
| | Total | 799.432 | 100 |

2. Medicinal Plants of Sariska Forest Used Traditionally as Antidiabetic:

2.1 *Aegle marmelos*

Aegle marmelos (Bael) fruit and leaves exhibit antidiabetic, antihyperlipidaemic and antioxidant properties. Oral administration of *Aegle marmelos* fruit extract at doses of 125 and 250 mg/kg twice daily to diabetic rats for a period of 30 days resulted in a significant increase in body weight, weight of the pancreas and insulin levels associated with a significant decrease in fasting blood glucose levels. The fruit extract treated groups showed improved functional state of the pancreatic β -cells and partially reversed the

damage caused by streptozotocin to the pancreatic islets.¹⁴

2.2 *Acacia nilotica*

Pods and tender leaves are considered very beneficial in folk medicine to treat diabetes mellitus. *Acacia nilotica* has been used traditionally for management of diabetes mellitus. The aqueous leaf extracts of *A. nilotica* showed antidiabetic activity. The intraperitoneal route of herbal extract administration was found to be more effective than the oral route. Qualitative and quantitative phytochemical screening of aqueous leaf extracts of *A. nilotica* indicated the presence of phenols, alkaloids, flavonoids, tannins and saponins.¹⁵

2.3 *Anogeissus pendula*

A study was carried out by to evaluate the antidiabetic potential of *Anogeissus acuminata* on streptozotocin-induced diabetes mellitus. In this study DM was induced in rats by injecting streptozotocin. Rats were then treated with *Anogeissus acuminata* extracts for 8 weeks at doses of 100 and 300mg/kg. After that plasma glucose levels and oxidative stress was assessed at weeks 1, 2, 4, and 8. The study results showed that Methanolic extract of AA leaves produced a hypoglycemic and antioxidant effect. Urinary function was also improved. The study concluded that *Anogeissus acuminata* leaf extract demonstrated antidiabetic and antioxidant action.^{16, 17}

2.4 *Azadirachta indica*

(Neem) is a medicinal plant, used in Ayurveda for treating various diseases, one of which is diabetes mellitus. It is known to possess antiinflammatory, antipyretic, antimicrobial, antidiabetic and diverse pharmacological properties. Hypoglycaemic effect was observed with *Azadirachta indica* when given as a leaf extract and seed oil, in normal as well as diabetic rabbits. The effect, however, was more pronounced in diabetic animals in which administration for 4 weeks after alloxan induced diabetes, significantly reduced blood glucose levels. Hypoglycaemic effect was comparable to

that of glibenclamide. Pre-treatment with *A. indica* leaf extract or seed oil administration, started 2 weeks prior to alloxan, partially prevented the rise in blood glucose levels as compared to control diabetic animals.¹⁸

2.5 *Butea monosperma*

Butea monosperma (Fabaceae), commonly known as palash, is widely used in the treatment of various diseases and disorders including diabetes.¹⁹ The antihyperglycemic activity of the ethanolic extract of *Butea monosperma* (BMEE) was studied in glucose-loaded and alloxan-induced diabetic rats. Single dose treatment of BMEE (200 mg/kg, p.o.) significantly improved glucose tolerance and caused reduction in blood glucose level in alloxan-induced diabetic rats. Repeated oral treatment with BMEE (200 mg/kg/day) for 2 weeks significantly reduced blood glucose, serum cholesterol and improved HDL-cholesterol and albumin as compared to diabetic control group.²⁰

2.6 *Carissa carandas L.*

Carissa carandas (CC) has been used in folklore medicine for treatment of diabetes. Aqueous Extract of CC (AECC) was most active and showed fall of 67.08% in fasting blood glucose from 0 to 1h in glucose tolerance test (GTT). The ED₅₀ of AECC was 300mg/kgbw in streptozotocin induced diabetic rats. Treatment of diabetic rats with ED₅₀ of AECC for 28 days significantly reduced post prandial glucose (PPG) by 33.65% ($p < 0.01$), glycosylated hemoglobin (HbA1c) by 45.79% ($p < 0.01$) and increased insulin level by 69.7% ($p < 0.05$). The results indicated that increase in insulin secretion may be partly responsible for antidiabetic effect of AECC.²¹

2.7 *Capparis deciduas*

Capparis decidua is xerophytic shrub, commonly known as Kair. Diabetes (type 2) was induced in rats of either sex, aged 48 ± 2 hrs, were injected with Streptozotocin in citrate buffer (pH 4.5) at a dose of 90mg / kg body weight intraperitoneal route. After 12-14 weeks, animals weighing above 150 gm were

selected for screening in NIDDM model, by OGTT (Oral- glucose tolerance test). For this purpose, blood was taken at 0 hrs from the tail vein from overnight (12 hrs) fasted rats and they were fed glucose at a dose of 2.5 gm /kg body weight. Then blood was taken at 30, 60 and 120 minutes intervals. The rats having blood glucose level 7-12 mmol/l at 0 hours and showing highest rise at 60 minutes with the blood sugar level 234 to 360 mg/dl, which returned to their 0 hrs value at 120 minutes, were included in the study. A significant increase in the levels of serum glucose was evident in diabetic control group. The serum glucose levels reduced by 81.4%, 60.48% and 55.43% in fruit, flower and bark extract treatments respectively.²²

2.8 *Coccinia cordifolia*

Coccinia cordifolia (synonym *Coccinia indica*), an herb that belongs to the Cucurbitaceae family and that grows abundantly in Sariska forest India, has been widely used in traditional treatment of diabetes. Roots are believed to heal illnesses associated with endocrine system disorders such as diabetes mellitus, and are used to treat intestinal troubles.^{23, 24}

2.9 *Cayratia trifolia*

Cayratia trifolia Linn. Syn. *Vitis trifolia* (Family: Vitaceae) is commonly known as Fox grape. Whole plant of *Cayratia trifolia* has been reported to contain yellow waxy oil, steroids/terpenoids, flavonoids, tannins upon preliminary phytochemical screening. The bark extract shows the antiviral, antibacterial, antiprotozoal, hypoglycemic, anticancer and diuretic activity.²⁵ Treatment of streptozotocin induced diabetic rats with ethanolic root extract (500 mg/kg) caused significant ($P < 0.01$) reduction in blood glucose (312–178 mg/dL), increase in body weight (181–219 g) and serum insulin (1.28–2.26 IU/dL). It also maintained lipid profile and tests of liver and kidney functions within normal range as compared to diabetic control rats and almost *at par* with standard drug metformin. The oxidative stress induced decline in

glutathione and catalase in liver and kidney tissues showed recovery nearly to normal level as a function of treatment. The GC-MS profile of the extract showed relatively high concentration of β -sitosterol which was characterized by different spectroscopic and chromatographic techniques.²⁶

2.10 *Dipteracanthus prostratus*

Dipteracanthus prostratus (Poir) belongs to Acanthaceae family. Wistar albino rats were used to evaluate the antihyperglycemic effect of toluene (TEDP, 100 mg/kg and 200 mg/kg, body weight) and methanolic (MEDP, 100 mg/kg and 200 mg/kg, body weight) extract of *D. prostratus*. Changes in body weight and blood glucose level were evaluated at the beginning of the experiment and on day 7, 14, and 21 subsequently. Lipid profile and histopathological examination were also performed. TEDP at 200 mg/kg produced a significant stimulating body weight and reduced blood glucose level in treated diabetic rats from day 7, apart that MEDP also showed similar activity from day 14. Furthermore, significant differences in lipid profiles by TEDP treated rats at 200 mg/kg, as compared to diabetic control and normal rats were also observed. Histopathological studies showed comparable regeneration of islet cells necrosed by Streptozotocin, by both the extracts.²⁷

2.11 *Euphorbia hirta*

Euphorbia hirta (Family-Euphorbiaceae) is widely used in traditional system of medicine to treat diabetes in India. It is reported to contain alkanes, triterpenes, phytosterols, tannins, polyphenols, and flavanoids.²⁸ Oral administration of *E. hirta* leaves extract (300 mg/kg b.w./rat/day) for a period of 30 days indicated the antidiabetic nature of the leaves extract. Assay of enzymes such as serum aspartate transaminase (AST), serum alanine transaminase (ALT) and serum alkaline phosphatase (ALP) revealed the non-toxic nature of *E. hirta* leaves. The hypoglycemic activity of the leaves extract was comparable with gliclazide, a standard reference drug.²⁹

2.12 *Gymnema sylvestris*

Gymnema is a woody climbing shrub native to India and Africa. The leaves are used to treat Diabetes. *Gymnema* has a long history of use in India's Ayurvedic medicine. The Hindi name for *Gymnema* means destroyer of sugar.³⁰ Extract from the leaves of *Gymnema sylvestre*, in controlling hyperglycaemia was investigated in 22 Type 2 diabetic patients on conventional oral anti-hyperglycaemic agents. GS4 (400 mg/day) was administered for 18-20 months as a supplement to the conventional oral drugs. During GS4 supplementation, the patients showed a significant reduction in blood glucose, glycosylated haemoglobin and glycosylated plasma proteins, and conventional drug dosage could be decreased. Five of the 22 diabetic patients were able to discontinue their conventional drug and maintain their blood glucose homeostasis with GS4 alone.³¹

2.13 *Hibiscus rosasinensis*

Hibiscus rosa-sinensis, known as Chinese hibiscus, China rose, is a species of tropical hibiscus, a flowering plant in the Hibisceae tribe of the family Malvaceae. The ethanol extract of flowers of *Hibiscus rosasinensis* at doses of 250 mg/kg and 500 mg/kg significantly reduced the blood glucose level in both acute (1, 3, 5 h) and sub acute (1, 3, 5, 7 days) treatments.³²

2.14 *Indigofera tinctoria* (Fabaceae)

In Traditional system of medicine it has medicinal properties as it is used in constipation, liver disease, heart palpitation, gout, diabetes, bitter, thermogenic, laxative, trichogenous and expectorant.³³ The methanolic extract of dried leaves of *Indigofera tinctoria* Linn showed significant decrease in blood glucose level of rabbits as estimated by Folin-Wu Method, alloxan is used as diabetes inducing agent.³⁴

2.15 *Kydia calycina*:

Kydia calycina is an evergreen tree growing 10 - 20 metres tall. Commonly known as Pula, Pattha, Pulia, belong to

family Malvaceae. Traditionally used in Boils, diabetes, febrifuge, rheumatism etc.³⁵

2.16 *Opuntia Elatior*

Opuntia elatior Mill.(Cactaceae), a folklore plant known as Nagaphani or Hathlo-thore is widely available across the globe and in India. *O. elatior* is being used traditionally in different disease condition like abscess & wound, burning sensation in the stomach, diabetes, diphtheria, asthma and anemia. The principal constituents present in the plant are β -sitosterol, opuntiol and opuntiol acetate. Plant shows notable pharmacological activities such as haematinic, anti-inflammatory, analgesic, anti-leukemic and anti-ulcer activity including its safety reports during acute toxic study.^{36,37}

2.17 *Ziziphus oenoplia*

At two different doses(200 mg/kg and 400 mg/kg b.w.) of aqueous and

ethanolic extracts were observed antidiabetic effect for 12 consecutive days. BGL was monitored after 1,3,6 and 12 days and compared with Metformin (250 mg/kg). Alpha amylase and alpha glucosidase activity of both extracts were also determined. Oral administration of both extracts showed significant ($P < 0.05$) antihyperglycemic activity in dose dependent manner in alloxan induced diabetic rats. The diabetic rats had significant ($P < 0.01$) reduction in blood glucose. The ethanolic and aqueous extract reveals the reduction in the blood glucose level, inhibition of alpha amylase and alpha glucosidase enzymes which support anti diabetic effect (reduce post prandial glucose levels) of *Z. oenoplia* and this may be due to presence of flavonoids constituents.³⁸

Table 3 Ethno medicinal Flora of the Sariska Forest used in Diabetes

| S.No | Plant name | Family & Habit | Synonym | Part used | Traditional Uses |
|------|---|-------------------|------------------------|------------------------|--|
| 1 | <i>Aegle marmelos</i> | Rutaceae (T) | Bael, Golden apple | Fruit | Fruit juice used traditionally in Diabetes, Anti oxidant ³⁹ |
| 2 | <i>Abutilon indicum</i> | Malvaceae (H) | Kanghi | Leaves, Roots | Leaf and root extract used to treat Diabetes, Fever ³ |
| 3 | <i>Acacia nilotica</i> <i>Acacia arabica</i> | Mimosaceae (T) | Babul | Gum, Bark | Powder of bark is applied externally in ulcers, Extract used in diabetes ³⁹ |
| 4 | <i>Anogeissus pendula</i> | Combretaceae (T) | Kardhai, Dhak | Stem Bark | Diabetes, Dysentery, Cough ⁴⁰ |
| 5 | <i>Azadirachta indica</i> | Meliaceae (T) | Neem | Leaves, Bark and fruit | Leaves Extract used Antiseptic, Diabetes ³⁹ |
| 6 | <i>Butea monosperma</i> | Fabaceae (T) | Palash, Fire of forest | Flower | antibacterial, antifungal, hypoglycaemic ²⁰ |
| 7 | <i>Capparis decidua</i> | Capparaceae (S) | Kair | Fruit and Twig | antidiabetic and antioxidant ²² |
| 8 | <i>Carissa carandas</i> | Apocynaceae (S) | conkerberry | | Stomachache, diabetic, anthelmintic ⁴¹ |
| 9 | <i>Cayratia trifolia</i> | Vitaceae | Amlabel | Bark | antiprotozoal, hypoglycemic, anticancer ²⁵ |
| 10 | <i>Coccinia cordifolia</i> | Cucurbitaceae (T) | Tindora, Tinda | Leaf, Fruit, Root | Antidiabetic, Hepatoprotective, asthma ²³ |
| 11 | <i>Dipteracanthus prostrates</i> | Acanthaceae (T) | Ruellia, Nees | Ariel part | antiulcer, antioxidant, Hypoglycemic ²⁷ |
| 12 | <i>Euphorbia hirta</i> | Euphorbiaceae (H) | Asthma weed | Leaf, Flower, Stem | Asthma, Hypoglycemic ⁴³ |
| 13 | <i>Gymnema sylvestris</i> | Apocynaceae (T) | Gurmar | Leaves | Hypoglycemic, Hypolipidemic, obesity ⁴⁴ |
| 14 | <i>Hibiscus rosasinensis</i> | Malvaceae (S) | Rose mallow | Leaves | Extract used for Hair growth and hypoglycaemic ³² |
| 15 | <i>Hibiscus micranthus</i> | Malvaceae (S) | Chanak | Seed, Leaf | Antifungal, Antiviral, Febrifuge, Hypoglycemic ³² |
| 16 | <i>Indigofera tinctoria</i> | Fabaceae (T) | True Indigo | Leaves | Anti Diabetic, asthma, fever ³³ |
| 17 | <i>Kydia calycina</i> | Malvaceae (T) | Bharanga, Bhoti, Pula | Bark, Leaves | Antidiabetic, skin diseases ³⁵ |
| 18 | <i>Opuntia Elatior</i> | Cactaceae (T) | Cactus, HathlaThor | Fruit, Leaf | antidiabetic, antihyperlipidemic, antioxidant ³⁶ |
| 19 | <i>Sida acuta</i> | Malvaceae (H) | Bala | Leaf, Roots | Astringent, cut, wounds, hypoglycemic ⁴⁵ |
| 20 | <i>Sida cordifolia</i> | Malvaceae (H) | country mallow | Seed, leaves, root | Aphrodisiac, gonorrhoea, anti diabetic ⁴⁶ |
| 21 | <i>ziziphus oenoplia</i> | Rhamnaceae (T) | Jackal jube | Bark | Stomachic, hyperacidity, Hypoglycemic ³⁸ |

3. CONCLUSION

In this review we discussed traditional medicinal plants from Sariska Forest Dist. Alwar for the treatment of Diabetes mellitus. Traditional medicinal plants are mostly used for rural areas. Therefore, treating hyperglycemia with plant derived product 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 from Sariska forest and may be useful to the health professionals, scientists and scholars working in the field of pharmacology, Pharmacognosy and therapeutics to develop hypoglycemic drugs.

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