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Banaba Tree: A Healer of Polygenic Disease Like Diabetes

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ABSTRACT

Lagerstroemia speciosa is ordinarily known as "Pride of India" having a place with the Lythraceae family. *Lagerstroemia speciosa* or Banaba is a restorative tree customarily used to bring down glucose in the body. Its various parts show different effects on body. It is a Southeast Asian tree and generally expended in different structures by Philippinos for treatment of diabetes and kidney related ailments. Analysts have directed various *in vitro* and *in vivo* examinations that reliably affirmed the antidiabetic movement of Banaba. Researchers have recognized various parts of Banaba to be liable for its movement. Current writing is with respect to Banaba and its constituents.

Keywords: *Lagerstroemia speciosa*, Corosolic acid, Diabetes

INTRODUCTION

Lagerstroemia speciosa (Lytharceae) is a bush to enormous tree with various trunks or stems veering from simply over the ground level. The sort Lagerstroemia was first portrayed via Carlos Linnaeus. The name Lagerstroemia perceives Magnus von lagerstroem, a Swedish naturalist who gave examples from the east to Linnaeus. The normal names of Lagerstroemia speciosa are monster crape-myrtle, sovereign's crape-myrtle, Banaba plant for Philippines. It is otherwise called 'pride of India' [1]. Banaba is generally circulated in Philippines, India and Malaysia [2] (**Figures 1-3**).

Banaba incorporates a few mixes, for example, corosolic corrosive and tannins, including lagerstroemin that have impacts on the treatment of diabetes. These fixings are thought to animate glucose take-up and have insulin-like action. The last movement is believed to be optional to enactment of the insulin receptor tyrosine kinase or the restraint of tyrosine phosphatase. That is the reason Banaba is classified "common plant insulin"[2].

Figure 1. Banaba Tree.

Figure 2. Banaba flower & leaves.

Figure 3. Banaba fruit.

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COMMON NAMES

This content shows the comparable or the various names of Banaba tree in various districts of world [3,4] **(Table 1)**.

Country	Common name
Vietnam	Banaba extract, banglang
Cambobia	bang-lang
Malaya, Sabah	Bungor
Flosin B, reginin A, lagerstroemin	Byers wonderful white crapemyrtle, crape myrtle, crepe myrtle, corosolic acid, ellagitannins
Thailand	flos-reginae Retz, GlucosolTM, glucosal, intanin
India	Jarul, Arjuna
Arabi	Zahar kahwa katheb, ward al-kahwa, lailak hindi, henna hindi, berangik
Brazil	resedá-flor-da-rainha, resedá-gigante
Chinese	Bai ri hong, Da hua zi wei

DISTRIBUTION OF TREE

It was local to Asia-tropical and subtropical districts: India, Sri Lanka, Cambodia, Myanmar, Thailand, Vietnam, Indonesia, Malaysia, Philippines, Bangladesh Japan, and it was broadly developed [5,6].

DESCRIPTION OF TREE

Banaba is a deciduous tropical blooming tree, 5 to 10 meters high, now and again developing to a stature of 20 meters. Bark is smooth, dim to cream-shaded, and strips off in sporadic pieces. Leaves are smooth, huge, spatulate, elongated to elliptic-praise, 4 to 8 centimeters in width, 12 to 25 centimeters long, shedding its leaves the main months of the year. Blossoms are 6-separated, purplish lilac or mauve-pink, infrequently pink, 5 to 7.5 centimeters over, and borne in huge, terminal panicles up to 40 centimeters long. Petals are elliptical obovate or obovate, in a matter of seconds mauled, and 3 to 3.5 centimeters long; the edges are undulate and barely fimbriate. Organic product is an enormous nut-like case, obovoid or ellipsoid, and 2 to 3.5 centimeters long. Seed is pale earthy colored, with a wing 12 to 18 millimeters in length [5].

TRADITIONAL USES

The roots were utilized as astringent, energizer and febrifuge, it was likewise utilized for stomach issues. Tea of the leaves was utilized in the treatment of diabetes mellitus and for weight reduction. The leaves, blossoms and barks were utilized as laxative. Leaf decoction or mixture was utilized for bladder and kidney aggravation, dysuria and other urinary dysfunctions, for cholesterol derivation, hypertension and diabetes. Poultice of the leaves was utilized as solution for intestinal sickness, migraine and broke behaving by application over the sores. Decoction of the bark was utilized for gastrointestinal plot unsettling influence, stomachache, hematuria and wretchedness. The seeds were utilized as opiate [7-9].

ENVIRONMENTAL PREFERENCE

Climatologically, the examination region goes under the subtropical district which encounters the kind of both mild and heat and humidity. The base air temperature goes from 4.00 to 23.00 C and greatest somewhere in the range of 20.00° and 34.00° C. The normal air temperature of the most recent 20 years differed somewhere in the range of 11.64° and 27.34° C, least in January and most elevated during June, individually. The overall mugginess ran somewhere in the range of 52.11 and 85.16% during April to August, separately. The 20-year precipitation information indicated most extreme precipitation during August (568.12 mm), while least in November (3.74 mm). Daylight hours out of each day found the middle value of for most recent 20 years demonstrated most elevated in the long stretch of May (9.34 h day-1) [10].

CHEMICAL CONSTITUENTS

From the aqueous acetone leaf extract of L. speciosa, six new monomeric and dimeric ellagitannins (flosin A and B, and reginin A, B, C and D), and three new ellagitannins (lagerstannins A, B and C) were isolated and identified [11,12]. Further extraction of L. speciosa leaves with aqueous acetone led to the isolation of seven ellagitannins, ellagic acid, ellagic acid sulphate and four methyl ellagic acid derivatives, including corosolic acid, gallic acid, 4-hydroxybenzoic acid, 3- O-methyl protocatechuic acid, caffeic acid, p-coumaric acid, kaempferol, quercetin and isoquercitrin [13].Corosolic acid has been reported to decrease blood sugar levels within 60 min in human subjects [14].From leaves of L. speciosa, a new triterpenoid was isolated along with four known compounds of virgatic acid, corosolic acid, ursolic acid and β-sitosterol glucoside [15].

PHARMACOLOGICAL EFFECTS

1) Antimicrobial activity

The bioactive mixes of methanol, ethanol and chloroform concentrate of product of *Lagerstroemia speciosa* by agar well dispersion technique utilizing bacterial societies, *Staphylococcus auerus*, *Bacillus subtillus*, *Pseudomonas*

aeruginosa, *Escherichia coli* and contagious societies *Asperilgillus niger*, *Asperigillus flavus*, *Candida albicans*. They found that all the concentrates displayed moderate to great enemy of microbial movement against the test microorganisms [16].

2) Anti-obesity activity

Blood glucose levels and serum lipids were equivalent between the control diet and test diet gatherings, the fatty oil content in the liver was diminished, affirming the counter heftiness action of L. speciosa [17].

3) Anti-inflammatory activity

The mitigating movement of ethyl acetic acid derivation and ethanol leaf extricate of *Lagerstroemia speciosa*. It had been inspected utilizing the carrageenan-instigated intense irritation and formalin-prompted ongoing paw oedema tests. Ethyl acetic acid derivation removes fundamentally decreased aggravation in a portion subordinate way, which was not seen with ethanol extricate for both the intense and constant incendiary models [18].

4) Anti-oxidative activity

Antioxidants from plant origin are necessary to prevent the progression of free radical mediated disorders [19,20].

5) Diuretic activity

The ethyl acetic acid derivation, ethanol, methanol and water separates (250 mg/kg bw, orally) of *Lagerstroemia speciosa* were assessed for diuretic movement in rodents. The watery concentrates indicated better diuretic impact contrasted and different concentrates. Na+, K+ and Clexcretion and Na+/K+ Thrombolytic movement proportion was higher in fluid concentrate, trailed by ethanol, ethyl acetic acid derivation and methanol removes [21].

6) Anti-cancer activity

The cytotoxicity of the *Lagerstroemia speciosa* bloom fundamental oils were contemplated utilizing Dalton's Lymphoma Ascites cells (DLA) and Ehrlich Ascites Carcinoma cells (EAC). *Lagerstroemia speciosa* blossom fundamental oils at a grouping of 50 µl/ml delivered 13.33% and 31% cytotoxicity to DLA and EAC cells, individually [22].

The anticancer movement of corosolic corrosive confined from *Lagerstroemia speciosa* on cell reasonability and apoptosis was explored in HCT116 human colon disease cells. Corosolic corrosive was portion conditionally restrained the suitability of HCT116 cells. The highlights of apoptosis, for example, chromatin buildup, a sub-G1 top and phosphatidylserine externalization were clear after treatment with corosolic corrosive. The apoptotic cell passing prompted by corosolic corrosive was joined by the enactment of caspase-8, - 9 and-3, which was totally annulled by the pancaspase inhibitor, z-VAD-FMK. Furthermore, corosolic corrosive upregulated the degrees of favorable to apoptotic proteins, for example, Bax, Fas and FasL and down-directed the degrees of against apoptotic proteins, for example, Bcl-2 and enduring [23].

DETAIL ON ANTI-DIABETIC ACTIVITY

Introduction

Type 2 diabetes has formed into an overall pestilence [24]. Diabetes mellitus, since a long time back saw as a disease of minor significance to world prosperity, is by and by having its spot as one of the principal risks to human prosperity in the 21st century. There are two principle types of diabetes [25]. Type 1 diabetes is expected essentially to immune system interceded pulverization of pancreatic b-cell islets, bringing about supreme insulin inadequacy, Type 2 diabetes is described by insulin obstruction or potentially unusual insulin emission, both of which may prevail [26]. On combination of cinnamon and leaves of lagerstoemia speciosa in T2DM inadeq controlled with metformin [27].

TYPES OF DIABETES

- Type 1 diabetes encompasses diabetes that is primarily a result of pancreatic beta cell destruction with consequent insulin deficiency, which is prone to ketoacidosis. This form includes cases due to an autoimmune process and those for which the etiology of beta cell destruction is unknown.
- Type 2 diabetes may range from predominant insulin resistance with relative insulin deficiency to a predominant secretory defect with insulin resistance. Ketosis is not as common.
- Gestational diabetes mellitus refers to glucose intolerance with onset or first recognition during pregnancy.
- Other specific types include a wide variety of relatively uncommon conditions, primarily specific genetically defined forms of diabetes or diabetes associated with other diseases or drug use [28].

MECHANISM OF ANTI-DIABETIC DRUGS

The essential antidiabetic recommending medications can be ordered in four gatherings:

a) Drugs which in a roundabout way increment insulin discharge

b) Drugs which enact straightforwardly insulin receptors

c) Drugs which act straightforwardly as inhibitors of glucosidase

d) Drugs which diminish the liver's glucose yield

There are additionally significant four unique classes of antidiabetic drugs rely upon various instruments:

sulfonylureas, insulin-sharpening specialists, biguanides, and alpha-glucosidase inhibitors [29,30].

- Sulfonylureas act by lowering blood sugar by stimulating the beta cells in the pancreas to release more insulin. Generally, sulfonylureas are included Glucotrol (glipizide) and Amaryl (glimepiride) [31].
- Insulin sensitizers function by improving the sensitivity to insulin and work with insulin to move sugar into the cells, directly targeting for insulin resistance. They lower the amount of sugar released by the liver and make fat cells more sensitive to the effects of insulin. Two major drugs of this class are included Actos (pioglitazone) and Avandia (rosiglitazone) [29,30].
- Biguanides improve insulin's ability to move sugar into cells especially into the muscle cells. A biguanide class is included Metformin (Glucophage) which also improves control of glycemia primarily by inhibiting hepatic gluconeogenesis and glycogenolysis [32].
- Alpha-glucosidase inhibitors retard the digestion and absorption of carbohydrates in the small intestine and hence reduce the increase in blood glucose level after meals. These drugs do not cause the pancreas to produce more insulin [29,30].
- Rosiglitazone (Avandia), pioglitazone (Actos) and metformin (Glucophage) act by both reducing glucose production in the liver, and increasing insulin dependent glucose uptake in muscle cells [29-31].

MECHANISMS OF BANABA EXTRACT AND COROSOLIC ACID

The blood sugar-lowering activity of extracts prepared from the leaves of Banaba has been demonstrated in a number of animal models and clinical studies, including normal rats fed high levels of soluble starch [33], alloxan diabetic rats [34,35], male genetically obese-diabetic (KK-Ay) mice [36].

Studies indicate that the majority of antidiabetic constituents so far identified in Banaba are glucose transport enhancers [37-39].

Corosolic acid is the active component that is used to standardize Banaba extracts for many Banaba supplements [40]. Corosolic acid increase glucose transport by inducing GLUT4 translocation from low density microsomal membrane to the plasma membrane in hindlimb muscles of diabetic mice [41].

Corosolic acid also improves the endurance rates and post-dead tissue heart capacity of mice [42].

Corosolic acid might enhance glucose uptake and GLUT4 translocation through insulin receptor beta phosphorylation by inhibiting a class of protein tyrosine phosphatases (PTP1B, TCPTP, SHP1 and SHP2) in the insulin signaling pathway. The researchers also reported that corosolic acid did not affect the AMPK phosphorylation pathway that is responsible for increasing muscle cell glucose uptake by contraction or exercise [43]. Corosolic acid in Banaba reduces hyperglycemia by other means in cing GLUT4 translocation and increasing glucose transport. Corosolic acid has been reported to reduce gluconeogenesis and contribute to the anti-diabetic effects of Banaba [44].

Several studies have investigated the effects of Banaba in human subjects. Available human clinical studies of Banaba have a small sample size and are short-term. A one-year open label study with 15 human subjects reported a 16.6% decrease in fasting blood glucose and no hypoglycemia [45]. Another study utilized Banaba extract that was standardized to a 1% corosolic acid and found a 30% decrease in blood glucose after 2 weeks [46].

Fukushima [47] reported that the corosolic corrosive that was utilized was 99% unadulterated, accordingly showing that the glucose bringing impact was explicitly due down to the corosolic corrosive.

PREVALENCE AND THE ECONOMIC BURDEN

The prevalence of diabetes in India has far surpassed the capacity to treat, and that has resulted in a large number of cases remaining undiagnosed [48]. The history of diabetes in India dates back to 2500 BC where old Indian texts referred to it as ‘Madhumeha.’ This gives an insight that this disease was known since then, and that the prevalence may not have been as high as it is now [49]. The economic burden of diabetes is tremendous, with the cost for obesity in India being 1.1% of the gross domestic product [50]. Its prevalence is linked to the economic burden diabetes imposes on a population, as not only high-income countries are affected, but low-income countries are as well [51].

MANAGEMENT OF DIABETES

There is no cure for diabetes, but it can be treated and controlled. The goals of managing diabetes are to:

- Keep your blood glucose levels as near to normal as possible by balancing food intake with medication and activity.
- Maintain your blood cholesterol and triglyceride (lipid) levels as near the normal ranges as possible.
- Control your blood pressure. Your blood pressure should not go over 140/90.
- Decrease or possibly prevent the development of diabetes-related health problems [52].

CONCLUSION

L. speciosa have been focused on its leaves with more than 40 compounds of triterpenes, tannins, ellagic acids, glycosides and flavones identified. Pharmacological properties reported include antioxidant, antibacterial,

antiviral, anti-inflammatory, antinociceptive, anti-diarrheal, cytotoxic, xanthine oxidase inhibition, anti-obesity and anti-fibrotic activities. The antidiabetic properties of leaf extracts of *L. speciosa* and its compounds such as ellagitannins and corosolic acid have generated much research involving in vitro, animal and human studies [53]. Rosiglitazone with metformin as a fixed-dose combination tablet, for individuals previously balanced out on rosiglitazone and metformin, rosiglitazone with metformin mix tablets can be thought of if there is a comparable strength of the blend tablet. Blend tablets ought not be utilized to start treatment for diabetes in patients who have not recently utilized an oral antidiabetic [54].

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