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Evaluation of Antihyperglycemic Activity of *Pterocarpus Marsupium* Roxb - A Critical Review

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Abstract

Pterocarpus marsupium, also referred to as Indian Kino or Vijaysar, is an Ayurvedic wood used to treat type 2 diabetes and other metabolic conditions. The heartwood and bark of this tree, which has long been valued for its ability to control blood sugar, are undergoing extensive research to determine and confirm their antidiabetic qualities. Pterocarpus marsupium (PM), also known as Gammalu in Sinhala, belongs to the Fabaceae family. It is widely used for industrial products and as a medicinal herb in Ayurveda. The pharmacological effects of PM and its bioactive constituents are the main topic of this narrative review. Diabetes is a non-communicable disease that has recently emerged as one of the major health issues. It is usually characterized by a state of poorly managed sugar and fat metabolism balance. It is the fourth most common cause of mortality in the majority of developed nations, and if left unchecked, it will spread to many other developing nations. Approximately 70% of people on the planet take conventional medicines made from various horticulture plants. This analysis focuses on the usage of Indian herbal medicines and offers a list of biomedical herbs that are used in Ayurveda as antidiabetics and marketing preparations for formulations of diabetes mellitus, particularly in India. Bija, or *Pterocarpus marsupium*, is a well-known medicinal herb in India. has been widely used in the Ayurvedic medical system for a long time. Numerous biological activity of the plant have been discovered. The P. marsupium tree can be used commercially since it has certain therapeutic properties. Aside from the chemistry of *P. marsupium* compounds, significant advancements in the biological activity and therapeutic uses of *P. marsupium* have been made during the past fifty years. It is today regarded as a valuable source of distinctive natural goods for the creation of industrial products as well as medications to treat a variety of illnesses. The current study used extracts made using optimal conventional and non-traditional extraction techniques to evaluate the anti-diabetic efficacy of *Pterocarpus marsupium Roxb*. heartwood in alloxan-induced diabetic rats. *Pterocarpus marsupium* heartwood aqueous and ethanol extracts were made using both non-traditional techniques like ultrasound-assisted extraction (UAE) and microwave-assisted extraction (MAE) and conventional techniques like infusion, decoction, maceration, and percolation. This study assesses the impact of *P. marsupium* ethanolic bark extract on streptozotocin-induced diabetic rats. Rats were given streptozotocin (50 mg/kg) intraperitoneally (ip) to induce diabetes. The animals were split up into five groups (n=6) and given various treatments: Group I: vehicle (normal control); Group II: diabetic control; Group III: glibenclamide (1 mg/kg bw, oral), a common antidiabetic medication; and Groups IV and V: ethanolic root extract (200 mg and 400 mg/kg bw, orally, respectively). After 28 days of treatment, blood samples were taken and tested for SGPT, SGOT, and blood glucose. During the course of therapy, the ethanolic root extract of *P. marsupium* at doses of 200 and 400 mg/kg bw significantly reduced blood glucose and serum enzyme levels (SGPT and SGOT). Additionally, the extracts at doses of 200 mg/kg and 400 mg/kg improved body weight. Blood glucose levels were found to be lowered by alcoholic extract and other PM components. *Pterocarpus marsupium Roxb* (Fabaceae) is a well-known medicinal plant that is used in a variety of human ailments. The ethanolic extract of *P. marsupium* was administered to albino rats after diabetes mellitus was induced by alloxan (150 mg 1 kg body weight), and its complications were reduced. Wistar albino rats were used to test the antidiabetic effects of ethanol extracts of *Pterocarpus marsupium* wood, bark, and a combination of wood and bark. Albino rats were given alloxan monohydrate (150 mg/kg, i.p.) to cause diabetes. For a duration of 14 days, rats with diabetes were given a single daily dose of ethanol extracts of *Pterocarpus marsupium* wood and bark

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at a dose of 150 mg/kg of body weight, respectively, and combined extracts of wood and bark at a dose of 150 + 150 mg/kg of body weight. The most prevalent kind of diabetes is type 2 diabetes. With over hundreds of millions of patients globally, diabetes mellitus is a major source of disease and mortality among Indians and people worldwide. *Pterocarpus marsupium* is a powerful antidiabetic and blood sugar regulator used in Ayurvedic medicine.

Keywords: *in-vivo study, in-vitro study,* anti-diabetic, medicinal plant.

I. Introduction:

Diabetes mellitus is a long-term endocrine condition in which the body's capacity to control blood sugar (glucose) is compromised either by the pancreas producing insufficient amounts of insulin or by the body's incapacity to utilize insulin efficiently. This leads to consistently elevated blood glucose levels, which can harm the heart, kidneys, eyes, nerves, and other organs if left untreated. Type 2 diabetes affects about 537 million adults worldwide, and in India, it affects about 77 million individuals, or approximately 9% of the population. There is a demand for safer herbal medicines due to the prevalence of type 2 diabetes worldwide. *Pterocarpus marsupium*, the scientific name for Vijaysar, is a medium-to-large deciduous tree that is indigenous to the Indian subcontinent, which includes parts of India, Nepal, and Sri Lanka. Often called the Malabar Kino or Indian Kino Tree, it is an important part of traditional Ayurvedic medicine because of its strong anti-diabetic qualities. Vijaysar (Pterocarpus marsupium) has been shown in numerous studies to have antihyperglycemic actions, suggesting that it may be used as a natural treatment for "Madhumeha" diabetes. This plant's ability to effectively decrease blood sugar levels is attributed to its numerous pharmacological properties and abundance of bioactive chemicals. Water is traditionally kept overnight in tumblers made of Vijaysar wood, which causes the water to turn reddish-brown. It is thought that drinking this water on an empty stomach will help control diabetes[1]. One such plant with several pharmacological effects that has been utilized to cure various illnesses is *Pterocarpus marsupium* (PM), also known as Gammalu in Sinhala. It is a medium-to-large-sized tree that can reach a height of 30 meters[2]. In the biomedical industry, a lot of medications and supplements were explored for treating diabetes, despite the fact that they do have some positive effects because of their long-lasting side effects. Therefore, natural therapeutic biomedical goods with growing performance that encourages the potential and tonic to improve the immune response by raising consumption, antibacterial capacity, and antistress qualities. Diabetes mellitus is a severe and noticeable illness that affects people in both developed and underdeveloped countries. A quarter of the world's population is expected to be affected by this illness. Diabetes mellitus is brought on by problems with glucose metabolism that are associated with low blood insulin levels or insensitivity of specific organs to insulin[3]. The world of plants gives us a fascinating insight into how useful they are in today's world; in fact, some plants may be able to treat conditions like diabetes and skin conditions, proving that plants are valuable in today's world as others have long since discovered. The importance of our plant world should not be overlooked as technology develops in the modern era. For over 2000 years, *P. marsupium* has been recognized in India and its surrounding nations as one of the most adaptable medicinal plants with a broad range of biological activity. Since ancient times, every part of the tree has been utilized as a home cure for a variety of human illnesses. *P. marsupium* has become a cynosure of modern medicine due to its widespread usage in homeopathic, ayurvedic, and unani medicine[4]. Deciduous and evergreen woods in central, western, and southern India are home to Pterocarpus marsupium Roxb[5]. Diabetes mellitus is a chronic illness brought on by a hereditary or acquired insulin insufficiency that causes hyperglycemia. Over time, diabetes complications such nephropathy, retinopathy, neuropathy, and heart issues emerge. Diabetes develops as a result of multiple pathogenic mechanisms. These include defects that lead to resistance to insulin action and autoimmune destruction of the pancreatic β-cells, which results in insulin shortage. Insulin's insufficient impact on target tissues is the root cause of the anomalies in the metabolism of proteins, fats, and carbohydrates in diabetes. At one or more sites in the intricate pathways of hormone activity, insufficient insulin secretion and/or decreased tissue responses to insulin lead to deficient insulin action[6]. The plant *Pterocarpus marsupium* is used to cure a number of illnesses, such as sores, headaches, skin disorders, stomach pain, and antihyperglycemic[7]. Fever is treated with flowers, diarrhea is treated with gum kino, toothaches are treated with fluor Albus, flux, and bark, which also serves as an astringent. Its wood and medicinal bark are its main uses. Diabetes is one of the leading causes of death worldwide and

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is widely distributed. According to the World Health Organization, this figure will significantly increase by 2025, at which point China and India may each have to deal with 50 million afflicted people. An estimated 150 million individuals globally had diabetes in 2000, and by 2010, that number is predicted to rise to 220 million. Diabetes is a significant and expanding public health issue[8]. It is one of the key medications used in traditional Ayurvedic medicine for the treatment of diabetes mellitus in several parts of India[9]. Diabetes mellitus is a metabolic disease that is first defined by a loss of glucose homeostasis and abnormalities in the metabolism of proteins, fats, and carbohydrates brought on by deficiencies in either insulin action or production, or both. Long-term harm to organs like the kidneys, liver, eyes, nerves, heart, and blood vessels may occur if blood glucose levels are elevated for an extended length of time. Diabetes is associated with a number of chronic complications, including nephropathy, neuropathy, retinopathy, and cardiovascular diseases. Individuals with diabetes have a 20-fold increased risk of renal failure, a 25-fold increased risk of blindness, a 20-fold increased risk of amputation, and a 2–6-fold increased risk of coronary heart disease[10]. The current review article focuses on the Evaluation of Antihyperglycemic activity of *Pterocarpus Marsupium Roxb*.

II. Methodology:

Hingwasiya S et al (2025)[1]

In Vivo Animal Studies:

Following the treatment of *Pterocarpus marsupium* extract (100–400 mg/kg), rats and mice with diabetes caused by streptozotocin or alloxan demonstrated significant decreases in fasting and postprandial glucose, improved OGTT outcomes, and restored body weight, serum enzymes, and insulin levels. Within four weeks, postprandial glucose decreased from about 301 mg/dL to about 112 mg/dL (100–200 mg/kg dosage). 100 to 200 mg/kg Aqueous heartwood extract decreased TNF alpha and fasting/postprandial glucose by 21. Wood and bark extracts had strong hypoglycemic effects. Under fructose load, extract enhanced the metabolic profile in rats with PIT. Ethanol extract (12 g/kg) shown similar benefits against dexain-induced insulin resistance when compared to pioglitazone.In rat models, silver nanoparticles improved the antidiabetic benefits.

In Vitro Studies:

In HepG2 liver cells under stress caused by high glucose levels, the extract from methanol-infused heartwood has been demonstrated to considerably strengthen the defense mechanisms against reactive oxygen species (ROS) and facilitate the uptake of glucose, suggesting a possible therapeutic role in metabolic dysfunctions. The significance of dosage in the regulation of glucose metabolism at the cellular level is further highlighted by the observation that phenolic C-glycosides extracted from the n-butanol fraction have a remarkable ability to enhance glucose transport in C2C12 skeletal muscle cells. This enhancement occurs in a manner that is directly proportional to the increasing doses administered.

Human and Clinical Evidence:

In type 2 diabetics, wood extract's glycemic control mirrored that of tolbutamide, according to a double-blind RCT12. Adding 2–4 g/day of Pterocarpus marsupium wood powder effectively reduced fasting and postprandial glucose and HbA1c with no side effects, according to a 12-week open-label research in 56 type 2 diabetes patients (on glimepiride/ +/ metformin ± pioglitazone). Extracts have demonstrated COX2 inhibition and metabolic advantages in healthy volunteers in a small number of clinical investigations.

Basnayake PI et al (2024)[2]

Anti-diabetic activity:

In Ayurveda, PM is frequently used as an anti-diabetic medication. PM heartwood and latex are frequently used to cure diabetes in Sri Lanka. Although there is little scientific data to support the use of PM latex as an anti-diabetic medication, one teaspoon taken daily is said to be beneficial. A Sri Lankan Ayurvedic medicine prepared from different anti-diabetic herbs and using PM latex has been granted a patent.

Faria Fatima et al (2020)[3]

Pterocarpus marsupium Roxb., a deciduous tree popular in Sri Lanka and India, is well-known in Ayurveda for its sensitivity and therapeutic properties. Heartwood extracts from P. marsupium are used to treat diabetes and are said to contain a variety of pharmacological substances. However, research revealed that the flavonoid fraction from *P. marsupium* causes the pancreatic beta cells to degranulate. Its bark contains a defensive and restorative compound called epicatechin, which is used to resist insulin and convert proinsulin into

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insulin. However, extensive research on P. marsupium's antidiabetic and other therapeutic qualities in conjunction with plant-isolated bioactive chemicals will aid in the creation of novel medications with few side effects to treat a variety of illnesses.

Yogesh Badkhane et al (2010)[4]

Anti-diabetic and antioxidant activity:

P. marsupium has distinctive pharmacological characteristics, such as blood glucose-lowering action and beta cell regeneration and protective qualities. Over the past 50 years, several experiments on humans and animals have replicated these results. Rats, dogs, and rabbits with induced diabetes and subsequent therapy with different P. marsupium extracts have all been employed in animal experiments. In each of these investigations, it was discovered that P. marsupium repopulated the islets and reversed the damage to the beta cells, resulting in a virtually full restoration of normal insulin output. Hyperglycemia and insufficient endogenous insulin secretion or activity are the hallmarks of diabetes mellitus, a metabolic disease. It is a prevalent illness that affects more than 124 million people globally. Through a number of processes, persistent hyperglycemia during diabetic circumstances results in the generation of free radicals or compromised antioxidant defenses. Additionally, there is compelling evidence that diabetes alters the activity of antioxidant enzymes in different tissues. Antioxidants that can neutralize free radicals have been shown in numerous studies to be useful in both preventing experimentally caused diabetes in animal models and lessening the severity of diabetic consequences. Additionally, diabetic patients who took antioxidant supplements were better protected against damage caused by free radicals. According to recent evaluations, some herbal plants have both antioxidative and antidiabetic properties, and using them appropriately in the diet may help lower the oxidative load in people with diabetes mellitus. In order to overcome the oxidative load in diabetes, different plant or herb extracts with both antidiabetic and antioxidant activity would have a greater therapeutic effect than other treatments.

Manish Devgan et al (2013)[5]

Preparation of extracts Conventional method:

Using a variety of traditional techniques, including infusion, maceration, decoction, and percolation, the powdered heartwood of Pterocarpus marsupium was extracted (aqueous and ethanol).

Non conventional methods:

Ultrasound-assisted extraction (UAE): An ultrasonic bath (Model No. UCB-5200 D, Macro Scientific Works Pvt Ltd., India) was used to perform the UAE (aqueous and ethanol). The simplex search method was used to optimize the aqueous extraction.

Microwave-assisted extraction (MAE):

A microwave (Model No. MG-555 f, LG, India) was used to perform the MAE (aqueous and ethanol). Using a constant microwave power of 100% (1350W), several tests were conducted to optimize the irradiation period in the aqueous extraction. The early paper provides a brief description of the extract procedures.

Experimental animals:

Male Sprague-Dawley (220–250 g) rats that were 10–12 weeks old on average were used. They came from animals that were bred in-house. These were maintained in colony cages at a temperature of 22±3ºC, a standard relative humidity of 30–70%, a 12-hour light-dark cycle, and 12–15 air changes per hour. All animals had unrestricted access to the Aqua Guard filtered water. Rat feed pellets (Vetcare/Nutrilab) were given to the animals. The rat study was authorized by the Institutional Animal Ethics Committee (BIO IAEC 216-10/4). The most recent recommendations for the treatment of lab animals were followed when conducting the study.

Experimental design:

Pterocarpus marsupium heartwood's anti-diabetic properties were evaluated in both normal and alloxan-induced diabetic rats. Evaluation of plant extracts on healthy, normal rats: Five sets of eight rats each were used. Group 2: standard rats (gliclazide, 25 mg/1000 g, oral); Group 3-5: test rats (extracts, 250 mg/1000 g, oral by gavage); and Group 1: control rats (sterile normal saline, 1 ml/100 g) (Mukhtar, 2005). The blood samples were obtained using the tail vein procedure. The amount of blood glucose was measured using the Accuchek strip test at 0 hours prior to, 1 hour following, and 3 hours following the administration of the vehicle, gliclazide, and plant extracts.

Evaluation of extracts in alloxan induced rats:

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Diabetes was induced by a single intraperitoneal injection of alloxan monohydrate (120 mg/1000 g) in sterile saline. The mice were given seven days to acquire diabetes. Animals with blood glucose levels more than 200 mg/dl on day seven were classified as having diabetes.

Acute treatment:

Six sets of eight rats each were created from the hyperglycemic rodents. Group 1 was a normal control, Group 2 was a diabetic control, Group 3 was given gliclazide, a common antidiabetic medication, and Groups 4–6 were given extracts orally. The dosage was the same as it was for typical rats. Blood glucose levels were measured at 0 hours prior to, 1 hour following, and 3 hours following the administration of the extract, vehicle, and reference medication.

Sub-acute treatment:

The extract and conventional medications were given for ten days (o.d.) in sub-acute mode. On days three, seven, and ten, blood samples were taken through the tail vein one hour and three hours after day one. Samples' glucose levels were quantitatively estimated using the Accuchek strip method.

Body weight estimation:

Body weight measurements were taken on the first day prior to the administration of the test item and following the conclusion of the tenth day of administration.

Statistical analysis

The mean ± standard error (S.E.) is used to express all values. Student's t test, one-way analysis of variance (ANOVA), and Dunnet's t test were used for statistical analysis. A significant p-value was defined as one that was less than 0.05.

Abhishek N et al (2017)[6]

Induction of diabetes with Streptozotocin:

With the exception of group I, every animal received a single intraperitoneal injection of streptozotocin (50 mg/kg body weight) in normal saline to induce diabetes. Animals with blood glucose levels more than 200 were chosen for the investigation after two days of streptozotocin administration. For the full 30 days, the entire course of medication was administered orally once every day.

Experimental Design:

Five groups of six Wistar albino rats (150–200g) of either sex will be randomly selected. The following will be the distribution of the various groups. Group I: Vehicle normal control. Group II: 50 mg/kg of STZ for diabetic control. Group III: Reference Standard (50 mg/kg of STZ plus 5 mg/kg of glibenclamide). Group IV: Animals with diabetes (STZ 50 mg/kg + PMEE low dosage). Group V: Animals with diabetes (high dose of PMEE + STZ 50 mg/kg). Evaluation: Beginning on the first day of treatment, a retro orbital puncture was used to get blood every week, and the Accu-Chek Active glucose monitoring kit was used to determine the glucose level. Blood was drawn on the 30th day after therapy; serum was extracted and utilized to estimate a number of biochemical parameters, including body weight, fasting glucose, SGPT, and SGOT. Analysis of Statistics: Mean±SEM was used to express all of the data. One-way ANOVA was used to examine the statistical significance across groups, and Dunnett's multiple comparison test was then used. Statistical significance was defined as a P value of less than 0.05.

Rituraj Rajjan Singh et al (2024)[7]

Antidiabetic Activity:

One of the many medicinal plants used to treat diabetes is *Pterocarpus marsupium*, an ayurvedic herb that has been widely utilized for thousands of years. It typically possesses blood glucose-lowering, beta cell-protective, and regenerating properties. PM completely restores normal insulin secretion by repairing the damage to the beta cells and replenishing the islets. Blood glucose levels were found to be lowered by alcoholic extract and other PM components.

R. Kalaivani et al (2011)[8]

Animal care and monitoring:

For this investigation, 25 healthy adult Swiss albino rats weighing between 150 and 200 grams were employed. They were provided regular diet and kept in polypropylene cages. They were kept in regular conditions at room temperature. Each of the four experimental groups—Group I (normal control), Group II (Alloxan-induced diabetic control), Group III (Alloxan-induced diabetic + P. marsupium treated), and Group IV (Alloxan-induced diabetic + Glibenclamide treated)—contained six rats.

The principles of the Institutional Animal Ethics Committee, which was established in line

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with its directives for the Control and Supervision of Experiments on Animals (No. 265/CPCSEA), were followed in the maintenance and treatment of the animals.

Plant material and Preparation of extract:

Between April and May of 2009, *Pterocarpus marsupium* leaves were gathered from the S.T.E.T. women's college campus in Mannargudi. For seven to ten days, the gathered plants were shade-dried. Using a Soxhelt apparatus, the powder (100 grams) of the provided samples was extracted using 500 milliliters of 95% ethanol by continuous hot percolation until the extraction was finished and employed for this investigation.

Biochemical Assays:

Rats that had fasted overnight were given a single intraperitoneal injection of a newly made aqueous solution of alloxan monohydrate (SD Fine Chemicals Pvt. Ltd., Biosar) at a dose of 150 mg/kg to induce hyperglycemia. Similar volumes of normal saline (2 milliliters per kilogram of body weight) were given to control rats. Six groups of six rats each were created from the rats. Group I was the control and was given regular saline. The diabetic control group was Group II, which received 150 mg/kg of alloxan. Plant extract (200 mg/kg) was administered to Group III. Glibenclamide (5 mg/kg) was administered to Group IV. The course of treatment lasted for fourteen days. Plasma levels were estimated at the end of the fourteenth day.

All experimental animals' tail tip veins were used to draw blood samples, and fasting blood glucose strips1 were acquired at regular intervals, such as on day 0 (before to alloxan injection), day 7, and day 14 (after alloxan injection in groups II, III, and IV) of the experiment. The normal control group's (Group I) fasting blood glucose level was also assessed concurrently. The orthotoluidene method was used to estimate blood glucose.

A.Maruthupandian et al (2011)[9]

Preparation of plant extract for antidiabetic studies:

The wood and bark of *Pterocarpus marsupium* were shade-dried at room temperature before being ground into a powder in a Wiley mill. A Soxhlet apparatus was used to extract 100 grams of powdered *Pterocarpus marsupium* wood and bark using ethanol. In accordance with conventional protocols, the extract was put through a qualitative test to identify different phytochemical ingredients. A rotary evaporator was used to concentrate the ethanol extracts. Studies on antidiabetes were conducted using the concentrated ethanol extract.

Animals

For this study, 180–240g male Wistar albino rats in good health were employed. The animals were kept in typical environmental conditions with a temperature of 25±2°C and a light/dark ratio of 12:12. The normal pellet meal (Goldmohur brand, MS Hindustan Lever Ltd., Mumbai, India) and unlimited water were fed to the rats.

Induction of experimental diabetes

Rats were given a simple intraperitoneal dosage of alloxan monohydrate (150 mg/kg) to induce diabetes. Two days following the alloxan injection, rats with glycosuria and hypoglycemia (blood glucose levels between 200 and 260 mg/100 ml) were selected for the investigation. Every animal was kept at room temperature in plastic cages with free access to water and a pellet meal.

Experimental design

A total of 24 rats—18 diabetes surviving rats and 6 normal rats—were used in the study. They were split up into four groups of six rats each. Group I: Untreated, normal rats. Group II: Control rats with diabetes Group III: *Pterocarpus marsupium* wood ethanol extract (150 mg/kg body weight) was administered to diabetic rats. Group IV: Pterocarpus marsupium bark ethanol extract (150 mg/kg body weight) was administered to diabetic rats. Group V: Standard glibenclamide (600µg/kg body weight) was administered to diabetic rats. Drug Group VI: *Pterocarpus marsupium* wood and bark ethanol extract (150+150 mg/kg of body weight) administered to diabetic rats.

Biochemical analysis

At the conclusion of the 14-day experiment, the animals were beheaded. After collecting blood, sera were separated by centrifugation at 3000 g for ten minutes. The O-toluidine technique was used to measure serum glucose. The Enzyme Linked Immunosorbant Assay (ELISA) kit was used to measure the amount of insulin.

Statistical analysis

Student t-test statistical approaches were used to evaluate the data. A p value of less than 0.01

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and 0.05 was considered significant for the statistical tests.

Sivanageswararao Mekala et al (2020)[10]

Extraction of Pterocarpus marsupium

The seeds are gathered, cleaned, dried in the shade, ground into a coarse powder, and then run through 40 mesh sieves. For 72 hours, the coarsely ground materials were extracted using petroleum ether, ethyl acetate, and ethanol in that order. The extracted extract solutions were collected individually, and a vacuum pump was used to concentrate the extract under low pressure (<45℃) in order to completely remove the solvent. The sample's pure organic portion was so produced and kept between 4 and 5 ℃ until it was needed. The ethanolic extract yield was gathered and weighed. Rats were given 2000 mg/kg body weight orally as part of an acute toxicity study. No mortality or clinical symptoms were present, and post-mortem exams revealed no notable anomalies. Even at large doses, *Pterocarpus marsupium* did not cause harm to rats.

Induction of diabetes in rats:

Rats were given a single intraperitoneal injection of gabapentin (150 mg/kg) to establish experimental diabetes following an overnight fast. Fresh gabapentin was made by dissolving 150 mg of the drug in a regular saline solution. To combat the drug-induced hypoglycemia, the animals were permitted to consume a 20% glucose solution. Fasting plasma blood glucose was measured 48 hours after gabapentin administration. For anti-diabetic activity, animals with plasma glucose levels more than 250 mg/dl were chosen.

Experimental design

After receiving approval from the Institutional Animals Ethics Committee (IAEC), the study was conducted. In this investigation, thirty rats were employed. They were split up into five groups, each consisting of six animals. The medication or vehicle was given for 21 days starting on the day the diabetes was induced. The medication or vehicle was given orally (p.o.) in an aseptic setting. The following was the treatment plan:

- **Group I- Normal control group:** Normal saline (10 ml/kg) and no medication were given to normal rats.
- **Group II- Disease control group:** Normal saline (10 ml/kg) and no medication were given to diabetic rats. A single intraperitoneal dose of gabapentin (150 mg/kg) was used to produce experimental diabetes.
- **Group III :** Metformin (150 mg/kg, p.o.) was given to diabetic rats as a regular medication.
- **Group IV :** Pterocarpus marsupium (100 mg/kg, p.o.) was given to rats with diabetes.
- **Group V:** *Pterocarpus marsupium* (200 mg/kg, p.o.) was given to diabetic rats. The rats were given a drug and vehicle for twenty-one days.

Collection of blood:

After a 12-hour fast, rats' tails and retro-orbital venous plexus were used to draw blood samples on the first, seventh, fourteenth, and twenty-first days. The blood was centrifuged to extract serum. Blood glucose, triglycerides, serum cholesterol, HDL cholesterol, LDL cholesterol, and total proteins were all biochemically estimated using the serum. A glucose oxidase-peroxidase (GOD-POD) kit was used to determine blood glucose levels. Following the collection of blood samples and the pancreas, all of the animals were slaughtered on the twenty-first day. The anti-oxidant characteristics were studied using the isolated pancreas.

Estimation of blood glucose

The GOD-POD method was used to estimate blood glucose using a glucose kit that was purchased from Span Diagnostics. Glucose is oxidized by GOD to produce H2O2 and glucoronic acid. When the enzyme peroxidase is present, phenol, 4-aminoantipyrine (4-AAP), and released H2O2 combine to generate colored quinoneimine dye. A colorimeter is used to quantify the dye's absorbance at 505 nm, which is directly correlated with the sample's glucose concentration.

III. Conclusion:

An effective example of converting traditional herbal knowledge into proven scientific treatments is Pterocarpus marsupium. Active compounds including pterostilbene and epicatechin found in its heartwood extracts have a variety of effects on glucose metabolism. Pterocarpus marsupium has strong preclinical and rising clinical evidence supporting the efficacy of Vijaysar as an adjuvant for type 2 diabetes. Reduced inflammation and oxidative stress, lipid-modulating advantages,

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concurrent α-cell regeneration and insulin upregulation, and repeated glucose-lowering effects in several animals. There was less evidence regarding PM's collective pharmaceutical ownership.

This plant might be the key to creating innovative therapies for a range of diseases that have few unfavorable side effects. As a result, we conclude that this plant can be utilized as both a superior treatment and an alternate source for a variety of illnesses. However, more advanced study is required to make it a better medication of the future. Pharmaceutical research initiatives heavily rely on natural resources, which are still seen to be excellent candidates for study and development. Additionally, a lot of pharmaceutical plants include a wealth of bioactive chemicals with potent pharmacological action that are noticeably absent of undesirable side effects. There is currently a huge increase in knowledge regarding the biological activity of several biomedicinal plants.

However, because it is present in plant extracts that comprise a wide range of phytochemical ingredients, it is impractical to specify the output of a multi-component mixture. Secondary metabolites could be used as lead compounds in the search for new groups of possibly safer and more effective antidiabetic drugs. According to the review of the literature, P. marsupium is a versatile medicinal plant that is a unique source of many different kinds of chemicals with different chemical structures. Extensive research is required to fully utilize these chemicals' therapeutic potential to fight diseases because very little has been done on their biological activity and potential medical uses. In summary, the heartwood aqueous extract of *Pterocarpus marsupium* exhibits strong antidiabetic action, supporting the plant's traditional use in the treatment of diabetes mellitus. *Pterocarpus marsupium* root ethanolic extract is proven to be more beneficial in treating diabetes mellitus, as evidenced by its statistically significant p-value < 0.001 in rats with diabetes produced by streptozotocin. ACAE's anti-diabetic action may be caused by boosting insulin's effects and encouraging the pancreatic beta cells to secrete more insulin. According to this study, *P.marsupium* ethanolic extract has a strong anti-diabetic impact and may be utilized to effectively control diabetes. Numerous human ailments have been treated using *Pterocarpus M.* Diabetes is still managed with wooden tumblers, which are seen to be a miraculous treatment. In the current investigation, Swiss albino rats with alloxan-induced diabetes were used to test the antidiabetic properties of an ethanolic extract of *P. marsupium* leaves. According to reports, alloxan significantly reduces the islets of Langerhans' β-cells that produce insulin, resulting in hyperglycemia. Glycogenolysis and/or gluconeogenesis may be the cause of the elevated blood glucose levels in diabetic rats relative to normal ones. To sum up, our work has demonstrated the antidiabetic properties of *P. marsupium* wood, bark, and mixed ethanol extracts. *Pterocarpus marsupium* at 100 mg/kg and 200 mg/kg considerably decreased the blood glucose level on every day of blood collection in the current investigation.

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Conflict of Interest:

No conflicts of interest have been declared by the author. This article's writing and content are entirely the author's responsibility.

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