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Nutritional and Medicinal Insights into *Pterocarpus marsupium*: A Review Study

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Abstract

Background: Therapeutic herbs are naturally occurring plants with medicinal properties. India is home to a variety of these herbs. One of the important herbs found in India is *Pterocarpus marsupium*. **Aim:** To review the potential benefits of *Pterocarpus marsupium* in the treatment of Human diseases and review the nutritional properties. **Methods:** The methodology adopted for this review was the process of selecting relevant studies from various scientific databases like PubMed, Web of Science, Google Scholar, and Research Gate. The search terms, including *P. marsupium* and various medicinal properties, were used to acquire the literature. **Discussion:** This potential of the plant is due to the presence of various therapeutic compounds such as phenols and flavonoids. **Conclusion:** Further research should be done to explore the full potential of this plant and the product development of food products so that human beings can benefit from it.

Major Findings: This plant has proven to be beneficial for various types of human diseases like diabetes, cardiovascular diseases, hepatic diseases, hypertension, and gastric diseases. This plant also has nutritional qualities like antioxidants, anti-ageing, etc.

Keywords: Anti-inflammatory, Antioxidant, Diabetes, Herbs, *Pterocarpus marsupium*

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1. Introduction

Flora has proven to be a Time-tested offering for human beings, as it has therapeutic benefits[1]. Therapeutic herbs have been used for the treatment of various ailments since the ancient period[2]. The utilisation of therapeutic herbs has been inclined towards those plants that have been used in previous times[3]. The World Health Organisation describes these herbs as therapeutic modalities for individuals residing in emerging economies[2]. India has proven to be a digital herbarium for the whole planet, as there are 21000 herbs that are utilised for therapeutic benefits, whereby 2500 are grown in India[4]. One such plant is *P. marsupiu*, which is attributed to the Fabaceae family[3]. The purpose of this review is to explore the various ethnomedicine, their phytoconstituents, and the pharmacological properties of *P. marsupium*. This comprehensive review will help in conducting future studies for the prevention and treatment of many non-communicable diseases. As the available literature of the herb has displayed the pharmacological and therapeutic effects of the herb, this review also focuses on linking these effects with the bioactive compounds causing these effects.

Although *P. marsupium* has been well researched for its antidiabetic and anti-inflammatory properties, the available literature lacks an understanding of the pharmacological effects in the context of the phytoconstituents present in different parts of the herb. Existing literature on therapeutic outcomes of the administration of the herb does not identify and correlating the compounds responsible for the bioactivity of the herb.

1.1 *Pterocarpus marsupium*

Pterocarpus marsupium is a medicinal and very versatile plant found in Sri Lanka and India[4,5]. In

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India, this plant is available in Bihar, Madhya Pradesh, Gujarat, and Orissa. This plant has also been known as the Indian Kino or *Vijaysar*[6]. *P. marsupium* trees grow medium to large in height, reaching 15-30 meters[7]. A variety of human ailments have been treated by home remedies utilising the components of this tree[3]. Components in this tree of high usage value are heartwood, leaves, flowers, bark and gum[1]. This tree possesses an abundance of pharmaceutically utilitarian bioactive components[5]. The ethanolic extract of the plant is found in the availability of compounds like phytochemicals, alkaloids, coumarins, flavonoids, glycosides, terpenoids, tannins, phenols, saponins, and steroids[2]. Past research has proved this plant conserves an abundance of polyphenolic and flavonoid compounds that have good medicinal benefits, so they are considered the major contents of phytochemicals[3]. Phenolic components present in this herb are β-sitosterol, lupenol, aurone glycosides, and epicatechins.

1.2 Traditional Applications of *Pterocarpus marsupium*

Pterocarpus marsupium, commonly known as *Vijaysar* or Indian *Kino* in India, Sri Lanka and Nepal, has a long history in ayurvedic and traditional medicine. The decoctions and tumblers made from the heartwood of the herb have been used in the treatment of diabetes. The bark, leaves and flowers of the herb have also been used for the treatment of various conditions such as leprosy, skin conditions, diarrhoea, fever, and bronchitis in *Ayurvedic* medicine[8].

2. Materials and Methods

This review paper is designed to acquire and evaluate the research literature on the herb *P. marsupium* and its effects on various diseases. A thorough search was conducted on the electronic databases PubMed, Scopus, Research Gate, Web of Science, and Google Scholar. Various search terms were used for the selection of data, including *P. marsupium* and its properties. The data analysis was conducted on 11th July 2024 on the database PubMed. The literature search conducted using the terms *P. marsupium* and medicinal retrieved a total of 8 articles and the plant search with antioxidants also retrieved the same number of articles, the same search with plant and diabetes and pharmacological retrieved 11 articles, with anti-inflammatory retrieved 5 articles, with nutritional, and antiaging retrieved 1 article per search, with biomedical and cancer retrieved 2 articles per search, lipids and antimicrobial retrieved 3 articles per search. The articles analysed were published from 2014 to 2024. Free-text available articles were analysed. A total of 55 articles were acquired from this search after the removal of duplicates from each search. 21 articles were obtained, out of which two articles were excluded, one with respect to the language barrier and one was not relevant to the study. A total of four articles were selected from Google Scholar, and one was obtained from Scopus, as shown in Figure 1.

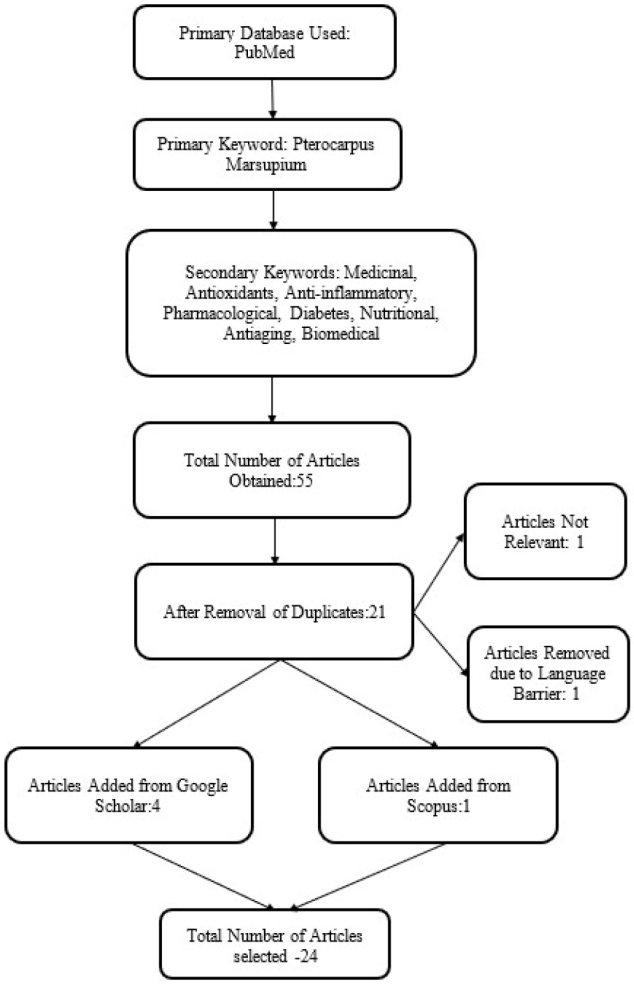


Figure 1. Flowchart demonstrating the literature search and screening process for the review.

3. Results

The results were formulated after reviewing 24 freely available articles on *P. marsupium* in the following different sections.

3.1 Nutritional and Medicinal Properties

Pterocarpus marsupium has numerous nutritional properties, such as antioxidant, anti-inflammatory, antimicrobial, etc. Despite this, all parts of the plant are utilised in the therapeutic management of different diseases such as Diabetes, Hypertension, diarrhoea, piles, etc, as home remedies[9]. The properties of different parts of the plant are shown in Table 1.

3.1.1 Antioxidant Activity

A number of researchers have validated the antioxidant potential of this plant's extracts. The phenolic compounds present possess free hydrogen, embarking on high antioxidant potential. This high antioxidant capacity could be identified by the proximity of tannins, flavonoids, along polyphenols[2]. Compounds like quercetin, curcumol, trans-pterostilbene, formononetin, and Epicatechin present in the methanol extract of this herb display their antioxidant activity by preventing free radicals[10]. The antioxidant activity of epicatechin has an IC_{50} value of 1.56 µg/mL[11]. The antioxidant potential of Quercetin has also been reported. The antioxidant potential of this compound increases with an increase in concentration[12]. Multiple investigations have revealed that the compound pterostilbene has displayed antioxidant capabilities in animal and human studies. This compound is known to reduce the cell species that are capable of reacting with oxygen[13]. In a study by Yan W *et al.*, Pterostilbene treatment in rats led to an increase in the levels of superoxide dismutase, glutathione peroxidase, and glutathione. Acetone and isopropyl alcohol and ethanol extracts obtained from the stem, bark, wood, and leaves of this herb presented high antioxidant potential[2,10,14]. Comparative phytochemical examination revealed a better radical scavenging potential of Acetone extract and Isopropyl alcohol extract than ethanol extract[2]. In a study by Majeed M *et al.*, the intervention of *P. marsupium* extract led to higher glutathione levels by 11% in comparison to the placebo group.

Table 1. Different parts of *Pterocarpus marsupium* and their ethnomedicinal uses

Part of the Plant	Ethnomedicinal Uses
Stem / Phloem/Bark	Diarrhoea, dysentery, neurological disorders, piles, diabetic anaemia
Leaves	Dermatological disorders, haemorrhage, arthritis, gastrointestinal disorders
Wood	Diabetes mellitus, body pain
Bark	Diuretic agent
Flowers	Fever[4,5]

3.1.2 Anti-inflammatory Activity

An accountable proportion of diseases in human beings is the work of oxidative stress, along with inflammation[13]. Acetone and isopropyl alcohol extract and methanol and aqueous extract acquired from the stem of the plant have revealed anti-inflammatory potential, which was time and dose-dependent[2]. Pterostilbene is a substance available in the heartwood of the plant, which is widely known for a variety of nutritional properties, one of which is anti-inflammatory potential[15]. Pterostilbene is capable of preventing the activity of the Cyclooxygenase enzyme. This enzyme is mainly responsible for inducing inflammation in our body by transforming arachidonic acid into prostaglandin[6]. The anti-inflammatory activity of the plant extracts by albumin denaturation was done by Manne A *et al.*, which resulted in prohibiting the denaturation by 63.52%.

3.1.3 Antiaging Activity on Skin

Many herbs possess capabilities to provide an anti-ageing and radiance-boosting effect. Pterostilbene and resveratrol are natural compounds found in *P. marsupium*'s heartwood. Pterostilbene is seen to have better antioxidant capacities in comparison to resveratrol. Pterostilbene, in some studies, is reported to possess antioxidant activity, due to which it reduces oxidative stress produced by the Ultraviolet B rays. This has also been incorporated into the therapy for grey hair, cutaneous disorders, boils, and sores. This compound is also very useful for preventing damage caused to the skin by ultraviolet B rays[16]. In a study by Majeed M *et al.*, a 0.4% pterostilbene cream was composed, which proved to be positively efficacious in declining skin ageing signs and promoting uniform

complexion. It was found that Pterostilbene is capable of inhibiting activities like melanogenesis, tyrosinase, anti-collagenase, and anti-elastase.

As Methoxy groups are found in pterostilbene compounds, they are known to escalate the lipid solubility and transportation of molecules through the membrane, which accelerates their activity. This compound locates the free radicals and declines the oxidative stress by decreasing the reactive oxygen and escalating the antioxidants. It reduces the production of proinflammatory cytokines that can lead to antiaging[16].

3.1.4 Antimicrobial Activity

The liquid obtained from the heartwood of this plant holds many polyphenolic components, which possess antimicrobial potential. These phenols and polyphenols are toxic to the microorganisms present. The methanolic extract of the bark of this plant displayed inhibitory potential towards disease-causing microorganisms such as *Pseudomonas aeruginosa, Bacillus subtilis, S. aureus, Salmonella typhi, E. coli, Klebsiella pneumoniae, Micrococcus* and *Proteus mirabilis*[14]. Ethanolic extract of the plant exhibited antibacterial potential against *Staphylococcus aureus* and *Bacillus cereus.* While no antibacterial capacity was observed against *E. coli* and *Salmonella Typhi*[2]. The ethanolic extract has displayed antimicrobial potential at variable doses[17].

3.1.5 Analgesic Activity

Analgesic activity has been observed in different extracts of the plant, such as methanolic, ethyl acetate, and petroleum ether obtained from the leaves of the plant. An analgesic potential is also observed in the ethanolic extract of the plant 250mg dose revealed 61.11% analgesic potential, while a lower dose showed lesser analgesic activity[2]. The strongest analgesic activity was observed in the methanol extract. The bark extract of this plant displayed identical analgesic potential when compared to the drug Pentazocine[17,18].

3.1.6 Hypoglycemic Activity

Diabetes Mellitus is a lifestyle condition affecting the metabolic health of individuals around the globe by either low production of insulin or resistance caused by it[18]. *P. marsupium* has a well-established antidiabetic potential. A study working with Methanolic heartwood extract of *P. marsupium* showed rich quantities of Flavonoid and Phenolic compounds. Quercetin possesses hypo-diabetic properties. Compounds such as myristic acid, succinic acid, isoeugenol, etc. were found. Isoeugenol has been proven to stimulate the Activated Protein Kinase, which leads to the enhancement of glucose absorption in rats[19]. The hypoglycemic activity of isoeugenol was determined to be higher than that of eugenol, which was 47.9% at a dose of 10mg/kg[20]. Succinic acid enhances the expulsion of insulin by increasing the function of pancreatic beta cells[19]. The compound Pterostilbene found in this herb has shown a decline in insulin production by the glucose-activated pancreatic beta cells, providing an antidiabetic potential[21,22]. This compound is also known to possess lipid-reducing activity[22]. Pterostilbene showed the hypoglycemic effect by stabilising the blood glucose levels at 5-6 mmol/l[20]. Magnesium Oxide Nanoparticles in the methanolic extract of this herb have displayed the capability of suppressing the activity of the alpha-amylase enzyme, which is responsible for the conversion of starch to glucose[10.14]. α-glucosidase is an enzyme responsible for the substantial elevation of Postprandial Blood glucose levels in human beings suffering from type 2 diabetes. *P. marsupium* possesses inhibitory capabilities against the α-glucosidase enzyme[10]. Supplementation of these plant extracts has shown an increase in the serum insulin levels, which in turn showed a decrease in the blood glucose levels in Wistar rats[23]. GlycaCare-II is a herbal medicine formulated through a combination of 6 herbs, one of which is *P. marsupium,* which displayed positive results in the hyperglycemia indexes and also no effect on other biochemical markers, while metformin exhibited an increase in the bilirubin levels along with creatinine levels. This study was done on individuals recently diagnosed with diabetes mellitus[24]. In another study, a Polyherbal drug was created with a combination of five herbs, which included *P. marsupium*. This drug has been beneficial in reducing serum insulin and blood glucose, which could positively affect insulin resistance[25]. A study on Glycation-induced protein cross-linking inhibitory potential of different herbs provided positive results with *P. marsupium* latex by displaying a strong inhibitory potential[26].

3.1.6 Diabetic Cataract Prevention Activity

Diabetic cataracts can be stated as the most prevalent source of vision dysfunction. Regarding the formation of cataracts, Aldose Reductase is an accountable enzyme. The reformation of glucose into sorbitol is carried out by this enzyme. The sorbitol formed accumulates inside the epithelial tissues present in the lens of the eye, which makes it vital to restrict this process to prevent the formation of diabetic cataracts. The elements found in *Pterocarpus marsupium*'s bark, such as polyphenols and flavonoids, are capable of decreasing the action of Aldose Reductase. The elements of this plant serve as a defence mechanism in the prevention of diabetic cataracts. The study resulted in the inhibition of the activity of this enzyme by 79.3%[18].

3.1.7 Anti-cancer Activity

The latest research has stated the high potential of free radicals in fatal diseases like diabetes and oncological diseases. Epicatechin is an element available in the Methanolic extract of the plant *P. marsupium*[10]. Epicatechin is a flavonoid that is an essential part of human dietary intake. This compound is also available in other foods such as green tea and cocoa. This compound is known for its anti-cancer activity[22]. This activity of epicatechin is identified in Human colorectal cells by prohibiting the growth of these cells by 95% with the use of a blend of panaxadiol with this compound[27]. The anticancer activity of Pterostilbene found in *P. marsupium* is also well documented for its anticancer potential[6,24]. A bunch of studies also revealed that the pterostilbene compound does not display any cytotoxic capabilities in human cells, and also protects and suppresses particular kinds of oncological diseases[6]. Pterostilbene is also documented to show an antitumor effect by activation of apoptosis[9]. This compound is reported to suppress the activity of various cervical cancer cells such as HeLa, CaSki, and SiHa cells[28].

3.1.8 Anti-hypertensive Activity

An organically available stilbenoid is present in *P. marsupium,* named 3'-Hydroxypterostilbene, which is easily accessible in Central Asia. This compound has been adopted as the Herbal treatment for hypertensive patients in China's Northwest Region[16]. In an experimental study by Kosuru R *et al.*, the compound pterostilbene was administered to fructose-fed diabetic rats, resulting in a decrease in hypertension. It also led to a decrease in the Mean atrial pressure.

3.1.9 Hypolipidemic Activity

The compound Pterostilbene has been stated as a hypolipidemic agent[4]. This compound may regulate atherosclerosis caused by the consumption of a diet high in fat by limiting the proinflammatory cytokines[29]. It has been reported in recent research that extracts obtained from the Heartwood of this plant can decrease excessive fat build-up among the adipocyte cells[6]. GlycaCare-II, a multi-herbal medicine for the management of diabetes, revealed the potential for improving dyslipidemia as it displayed a significant improvement in lipid levels[24]. The ethanolic extract of the plant has shown efficacy as a hypolipidemic agent by decreasing the levels of Low-density lipoprotein, very low-density lipoprotein, triglycerides, and total cholesterol without influencing High-density lipoprotein[17]. In a clinical trial by Grover JK *et al.*,[30] the oral dose of the plant bark extract with a fructose diet led to a much lesser increase in serum triglyceride levels when compared to only a fructose diet.

3.1.10 CardioProtective Activity

The presence of 5,7,2-4 tetrahydroxy isoflavone 6-6 glycoside, an antioxidant detected in the aqueous extract of the plant, is potentially presumed to inhibit the occurrence of cardiovascular disorders. Digoxin is among the highly impactful cardiotonic medicines, but it demonstrates some side effects such as gynecomastia, dysrhythmic heartbeat, and disrupted kidney activity. Some studies on this plant's aqueous extract show better outcomes than digoxin in reducing heartbeat, which states it as a safer and better alternative to the drug[6]. The compound Epicatechin found in this plant, when tested for cardiotonic potential, displayed a capability to increase the heart rate[17]. It has also been observed that the administration of the compound Pterostilbene found in this plant also resulted in cardioprotective effects such as a decrease in the myocardial infarct size, apoptosis, and oxidative stress.

3.1.11 Neuroprotective Activity

The compound pterostilbene has revealed a positive impact on the Central Nervous System by preventing the alterations caused by ageing in our brains[31].

Table 2. *Pterocarpus marsupium*'s bioactive Compounds and their phytochemical properties

Property	Compound	Dosage	Effectiveness	References
Antioxidant	Pterostilbene	Middle cerebral artery occlusion + Pterostilbene 25mg/kg	Increased levels of superoxide dismutase- 102.34 ± 7.54 U/mg protein, CAT- 28.85 ± 1.33 U/mg protein, glutathione peroxidase- 33.73 ± 4.34 U/mg protein, glutathione-1.34 ± 0.45 U/mg protein and decreased levels of malonaldehyde- 89.45 ± 3.45 U/mg protein, 8-Hydroxy-2′-deoxyguanosine-0.28 ± 0.05 µg/mg protein	36
Anti-inflammatory	Epicatechin	100 µg/ml *Pterocarpus marsupium* Chitosan Nanoparticles	Prohibited Albumin Denaturation by 63.52%	5
Anti-Aging	Pterostilbene cream	Pterostilbene IC 50 µg/mL	Melanogenesis Inhibitory activity-0.55, Tyrosinase inhibitory activity-7, Anti-Collagenase-125, Anti-Elastase activity-50	16
Antidiabetic	Isoeugenol	10mg/kg	This led to a reduction in blood sugar by 47.9%	20
	Pterostilbene	According to results acquired from *in vitro* studies	Blood glucose metabolized at 5-6 mmol/L for 16 hours while insulin metabolized at the same for 4 hours then increased	37
Diabetic Cataract	Phenols, Flavonoids, and Tannins	8g/kg *Pterocarpus marsupium* Bark extract	Inhibition of Aldose reductase enzyme by 79.30%	18
Anti-cancer	Quercetin Epicatechin	30 ug/ml 20 µM panaxadiol combined with 150, 200, and 250 µM of the compound	Prohibiting the Phytochemical oxidation of more than 50% at pH 6.5This resulted in the prohibition of the growth of cells by 51%, 97%, and 95%.	12,27
Anti-Hypertensive	Epicatechin3′-Hydroxypterostilbene	IC_{50} ~1.56 µg/mL20mg/kg	2,2-diphenyl-1-picrylhydrazyl radical scavenging in the methanolic extract dose of Pterostilbene with corn starch and fructose diet, when compared with control, resulted in lower mean atrial pressure: corn starch control-108.50 ± 12.21, Pterostilbene- 106.30 ± 14.45, Fructose control- 123.90 ± 8.13, 109.60 ± 7.31	11,38
Hypolipidemic	Pterostilbene creamPolyphenols and Flavonoids	Pterostilbene IC 50 µg/mL1g/kg Bark extract	Melanogenesis Inhibitory activity-0.55, Tyrosinase inhibitory activity-7, Anti-Collagenase-125, Anti-Elastase activity-5066% fructose diet leads to triglyceride levels of 90.96ng/dl compared to diet+ bark, which leads to 80.4 ng/dl	16,30
Cardioprotective	Pterostilbene	20 and 40mg/kg	Decreased Myocardial Infarct size was seen to be 29.08±1.84%, 20.63±1.37% while without treatment was 53.76±2.17%	38

Table 2. Continued...

Property	Compound	Dosage	Effectiveness	References
Neuroprotective	Pterostilbene	20% Pterostilbene in Polyvinylpyrrolidone	Prohibition of the activity of acetylcholinesterase. enzyme activity by 39.1% and butyrylcholinesterase by 76.9%	[29]
Hepatoprotective	Pterostilbene	50mg/kg	Reduced hepatotoxicity caused by acetaminophen decrease in alanine aminotransferase, aspartate aminotransferase, alkaline phosphatase, total and direct bilirubin by 61%, 70%, 57%, 54% and 72%.	[32]

Pterostilbene, when consumed through diet, has shown this effect. Pterostilbene is also proven to counteract memory impairment resulting from streptozotocin administration. This compound, when administered at a dosage of 120mg/kg, alleviated the pathological alterations caused by Alzheimer's[29]. In a study by Rosiak N *et al.*,[29]. This compound suppressed the activity of enzymes acetylcholinesterase and butyrylcholinesterase. The acetylcholinesterase enzyme and butyrylcholinesterase enzyme are responsible for the cholinergic neurotransmission. Acetylcholine is required for memory, muscular control and cognitive functionality. The suppression of the activity of these enzymes is required in Alzheimer's and Parkinson's diseases to enhance cognitive function.

3.1.12 Gastrointestinal Activity

Heartwood juice obtained from *Pterocarpus marsupium* has been utilised in the treatment of diseases like gastritis, ulcers, and jaundice[14]. Ethanolic extract of the plant, when administered at a dose of 250-500mg/kg, helped in reducing the intensity and frequency of diarrhoea[9].

3.1.13 Hepatoprotective Activity

The hepatoprotective capability of the ethanolic extract of the plant's leaves was assessed against Paracetamol-induced liver damage. The extract displayed hepatoprotective capacity by reducing the levels of aspartate transaminase, alkaline phosphatase, alanine transaminase, lactate dehydrogenase, total cholesterol, and serum bilirubin, helping in reviving the liver functions to a normal value. The effect caused by 400mg/kg of extract was similar to the effect of 100mg of silymarin[9]. The compound Pterostilbene is shown to protect from hepatic damage in acute liver failure caused by the use of drugs[29]. This compound is also known to reduce the damage caused by acetaminophen and reduce the levels of alanine aminotransferase, aspartate aminotransferase, alkaline phosphatase, total and direct bilirubin, total cholesterol, and triglycerides while improving the levels of albumin and HDL-cholesterol[32].

3. Discussion

Pterocarpus marsupium has proven to be one of the most useful herbal plants that can provide alternatives to Western medications, as many medicines are expensive and reported to exhibit side effects. This herb exhibits a range of therapeutic benefits because of numerous phytochemical compounds. The compounds found in this plant that provide such medicinal properties are flavonoids and polyphenols such as Pterostilbene, Epicatechin, Quercetin, 5,7,2-4 tetrahydroxy isoflavone 6-6 glycoside, etc[6,10,15]. All of these compounds have different medicinal properties, shown in Table 2. These compounds contain various potentials in human disorders. All these naturally existing compounds in this plant are capable of managing or improving various diseases, reducing inflammation, and have great antioxidant potential.

Compounds present, such as pterostilbene, epicatechin, and quercetin, are responsible for the antioxidant effect. *In vivo* studies show an increase in the antioxidant markers such as superoxide dismutase, glutathione, and glutathione peroxidase. The antioxidant activity not only provides cellular protection but also

has a property in improving several diseases such as diabetes, cancer, and cardiovascular diseases[10,13]. The anti-inflammatory activity of compound Pterostilbene by the inhibition of cyclooxygenase activity indicates a synergistic combination between antioxidant and anti-inflammatory activity, which would help in reducing inflammation by reducing oxidative stress [6,15]. Antimicrobial and analgesic activity, though not studied much, has also been reported. Antimicrobial activity by the inhibition of various bacterial species by the polyphenolic compounds, which damages the microbial cell structure[17]. The analgesic activity aligned with this would provide additional benefits to antimicrobial activity. The most prominent pharmacological activity of this herb is its antidiabetic activity. Isoeugenol, succinic acid, quercetin, and pterostilbene are the compounds that contribute to greater insulin secretion, increased glucose uptake, and α-amylase and α-glucosidase inhibition, which collectively provide antidiabetic potential[10,19,21]. The compound pterostilbene has also been reported to possess hypoglycemic effects, antilipidemic and antihypertensive outcomes[4,16]. Other properties of this herb, such as anticataract, anticancer, cardioprotective, neuroprotective, gastrointestinal, and hepatoprotective activities, are interconnected to a reduction in oxidative stress, inflammation, and lipid balance[9,18,22,29,31].

The antioxidant and anti-inflammatory effects of the herb synergistically help in the reduction of oxidative stress and decline in pro-inflammatory markers such as TNF-α[33]. This proposes that the reduction in oxidative stress can also help in the reduction of inflammation. The major component of this plant, Pterostilbene, has been proven to reduce reactive oxygen species and inflammatory markers such as TNF-α and IL-6. This compound has also been effective for autoimmune conditions or conditions similar to autoimmune conditions, such as colitis and arthritis[34,35]. This proves that the *P. marsupium* plant may have therapeutic effects in autoimmune disorders because of the presence of various bioactive compounds. As the relevant data available on this is limited, more studies need to be conducted on this.

4. Conclusion

The studies reviewed in this article highlight the therapeutic potential of *Pterocarpus marsupium*. This plant is well-acknowledged for its medicinal and nutritional properties in Ayurvedic medicine. The therapeutic potential of this plant has been seen in various lifestyle disorders like diabetes, hypertension, cardiovascular diseases, and Hepatic disorders. It also provides great antioxidant potential. The presence of natural compounds provides this plant with therapeutic potential. This review reveals these promising findings. This combination of nutritional and pharmacological properties reveals that the therapeutic potential of this herb is not because of a single bioactivity but through the synergistic work of all the bioactive components.

The findings of this review should explicate certain limitations. First, only a limited number of studies were available, out of which only free full-text articles were added to the study, which had a restricted exploration of additional studies. Second, although various *in vivo* and *in vitro* studies are available, human trials of this herb remain scarce, which makes it difficult regarding setting optimal dosage and long-term safety.

Many medicines required in the treatment of these diseases display various side effects, so they are not considered to be safe for consumption for a long period of time, which makes it vital to introduce such herbal medicinal plants into the diet. This could be done by developing a product from the plant. This plant has potential therapeutic benefits, but human studies on the administration of this plant are a vital topic for future research to further examine the potential of this plant and create economical food products or nutraceuticals from this herb to provide a healthier and better alternative to allopathic medicine.

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Author Contribution

Conceptualisation- Mahak Sharma; Methodology- Stuti Sharma; writing—original draft preparation- Stuti Sharma; writing, review and editing-Stuti Sharma, Mahak Sharma; visualisation- Mahak Sharma; Supervision- Mahak Sharma. All authors have read and agreed to the published version of the manuscript.