



Therapeutic Potential and Phytochemical Profile of *Mucuna Pruriens*: A Review

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ABSTRACT:

Background: This review provides an in-depth look at *Mucuna pruriens* seeds, covering their taxonomy, phytochemistry, medicinal uses, and pharmacological action. It highlights the presence of bioactive compounds like L-DOPA, nicotine, and dimethyl Tryptamine, and explores their traditional and modern uses in treating Parkinson disease. The review showcases the potential of *Mucuna pruriens* seeds for pharmaceutical applications and calls for further research to fully utilize their benefits.

Methods: Literature was gathered using SciFinder, research gate, PubMed, Google scholar, and a Books. This review provides current information on taxonomy, phytochemicals, and pharmacological effects of *Mucuna pruriens*.

Result: Phytoconstituents of *Mucuna pruriens* seeds possess a wide range of pharmacological effects such as anti-Parkinsonism, anticancer, anti-cholesterol, hypoglycemic, anti-microbial, anti-neoplastic, antioxidant effects. It is also used as a dietary supplement. It is also used as nutraceuticals for better health. It is available in many countries.

Conclusion: *Mucuna pruriens* treats Parkinson and many other diseases. It contains more amount of levodopa.

Keywords: *Mucuna pruriens*, dopamine, Parkinson, neurotransmitter, seeds

1. INTRODUCTION

The Fabaceae family includes the tropical twining herb *M. pruriens*, also known as Velvet Bean. The plant is irritating because of the serotonin (5-HT), mucunain, and protein found in its young leaves and seed pods [1]. *Mucuna pruriens* is widely utilized as a pasture crop, fallow crop, and green manure worldwide. *Mucuna pruriens* contains bioactive substances include phenolics, tannins, alkaloids, and flavonoids. [2]. The Fabaceae family (subfamily Papilionaceae) contains the genus *Mucuna pruriens* seeds, which includes many more species of legumes. *Mucuna pruriens* is an underrated wild legume that grows in subtropical regions. [3]. *Mucuna pruriens* (Fabaceae) is a popular herbal medicine for aphrodisiacs, male infertility, and neurological disorders. [4]. Accurately diagnosing Parkinson's disease has proven challenging for researchers due to its intricacy [5]. Parkinson's disease (PD), a degenerative progressive disease that affects the brain motor neurologic function, is characterized by a decline in dopaminergic neurons in the brain. The second most common condition is Alzheimer's disease. Parkinsonism has proven challenging to accurately diagnose because of its complexity [6]. The significant medicinal plant *Mucuna pruriens* can treat a wide range of ailments, such as tumor, epileptic disease, Parkinsonism disease and helminthiasis [7]. *Mucuna* seeds are highly prized in local markets due to their content of L-DOPA, which is neurotransmitter utilized in disease treatment. Parkinson's illness [8]. Powdered *Mucuna pruriens* seed also reduces cholesterol in the body [9]. *Mucuna pruriens* seed powder has been shown to reduce stress, stimulate semen secretion, and act as a restorative tonic or aphrodisiac in situations that result in weakness or loss of sexual aptitude [10]. In traditional Indian medicine, seeds are used as a tonic and to boost masculine vitality. Their anti-Parkinson actions might be due to L-dopamine. A substance that precedes dopamine or used for synthesized dopamine [11]. It has recently been discovered that the seed powder possesses anti-Parkinsonian properties since it contains L-DOPA. Dopamine is a well-known neurotransmitter in the brain. Because dopamine cannot cross blood-brain barrier and get to the action site, its concentration in brain tissue declines. [12] Vitamin E, ascorbic acid, and other antioxidants found in leafy vegetables, seeds may lessen oxidative damage associated with a number of illnesses, including as atherosclerosis, diabetes, cancer, heart problems, cataracts, and arthritis, immunological deficiencies, and aging. Antioxidants are essential for preventing disease. In addition to scavenging free radicals and preventing the production of singlet oxygen, antioxidant chemicals can also act as reducing agents and complex pro-oxidant metals. In vitro studies have shown that Levodopa dramatically increases the amounts of oxidized the compound glutathione in the brain of rat animal [13]. Investigations were conducted into the chemical makeup and nutritional advantages of *Mucuna pruriens* seeds. The ripe seeds included 525.6 g of carbs, 67.3 g of fat, 51.6 gram crude fiber, and 314.4 g of crude protein. Their calcium, potassium, and phosphate contents are higher than those of the most often consumed pulses on a daily basis. The most prevalent storage proteins were globulins and albumins, which together made up 22.7 g of seed grain per 100 g. The essential amino acid

composition of total seed containing proteins followed FAO/WHO standard pattern, with the exception of the lack of sulfo containing amino acids. Tryptophan and valine were found to be more abundant in albumins than in globulins. Nevertheless, there was insufficient cystine, methionine, or leucine in any protein fraction [14]. Dopamine has a major role in male sexual behavior and function, and higher brain levels of this neurotransmitter lead to higher libido. Decreased catecholamine levels in the brain, particularly dopamine, may affect male sexual function. *Mucuna pruriens* seed powder has been shown to improve sperm quality and act as an aphrodisiac for those who are infertile [15]. Long-term use of anti-parkinsonian drugs causes drug-induced dyskinesias (DID), which are costly and challenging to treat, in the majority of people having severe Parkinson's disease. New parkinsonism treating medications that lower or eliminate the risk of DID are therefore highly sought for. The dried powder of the *Mucuna pruriens* bean is used to treat Parkinson's disease (Kampavata) in Indian Ayurvedic medicine. According to a review of Ayurveda literature and current Ayurvedic practitioners, *M. pruriens* does not cause DID in PD patients. Natural levodopa has been found to be present in *M. pruriens*. [16].

2. TAXONOMY

It belongs to kingdom plantae and family fabaceae and its genus is *mucuna* and order fabales and this species is *mucuna prureins* [2] .

3. GEOGRAPHICAL availability of *mucuna prureins*

Mucuna pruriens is broadly distributed throughout Southeast Asia, particularly in India, Malaysia, and Sri Lanka. It also grows in Africa, and Asia. It is native to tropical areas. Low, dry, deciduous forests, hedges, and bushes can be found all over the plains of India, where *Mucuna pruriens* is widely distributed. Most of India's fourteen species of *Mucuna* are also grown in the plains of Kerala, Madhya Pradesh, as well as the foothills of the Himalayas. Andhra Pradesh, Uttar Pradesh, Sri Lanka, and the Andaman & Nicobar Islands [2]. The Fabaceae family, which includes *Mucuna pruriens*, is frequently called cowage plants. For millennia, people in India have utilized this well-known herb as a medicinal plant. The Ayurveda medicinal system originated in tropical regions and is used for a variety of reasons in traditional medicine throughout many nations. It flourishes as dry deciduous low woodlands, hedges, and bushes throughout the Indian subcontinent's plains. It is indigenous to the lower Himalayan range and all of India's tropical lowlands [17].

4. TRADITIONAL MEDICINAL USE

Bone fractures, coughs, dog bites, syphilis, ringworm, pleuritis, discomfort, snake bites, scorpion stings, sores, and mania are among the conditions that can be cured using *Mucuna pruriens* leaves. They are used to treat ulcers, leucorrhea, spermatorrhea, and as a nerve tonic and aphrodisiac. The roots are used as purgatives, diuretics, elephantiasis, and cholera remedies. Itching is caused by 5-hydroxytryptamine found in the pod hairs of *Mucuna pruriens*. Numerous properties of the plant have been studied, including its anti-inflammatory, anti-diabetic, aphrodisiac, antineoplastic, antiepileptic, antibacterial, learning and memory-enhancing, antivenom, and antihelmintic properties. The seeds have been demonstrated to have antidiabetic, antifungal, antioxidant, hypotensive, hypocholesterolemic, hypothermic, and antiparkinsonian qualities in addition to their aphrodisiac, alternative, anthelmintic, cancer, catarrh, immunomodulator, cough, and debility effects [17]. Anticholesterolemic, anti-Parkinson's, antioxidant, antidiabetic, sexually stimulating, anti-inflammatory, antibacterial, and antivenom qualities make this bean a potentially healing plant. Furthermore, it has anticancer qualities [18].

5. PHYTOCONSTITUENTS OF MUCUNA PRUREINS

It consists of many phytoconstituents like Gallic acid, β -sitosterol, linoleic acid, Glutathione, Ascorbic acid, Squalene, Arachidic acid, acid analysis (protein), [19].

6. STUDIES OF ANTI PARKINSON'S EFFECT

This plant has traditionally been used to treat neurological disorders. MP's effectiveness has led to research into its possible application in the Parkinsonism. The quantity of the Levodopa found in the seeds of *mucuna*. By the use of the animal model of parkinsonism, Hussein et al. showed that this herb works better than L-DOPA [27]. These findings show that at comparable dosages, *Mucuna* powder L-DOPA modifies the pathways of the dopaminergic system, and the inclusion of other ingredients enhances the antiparkinsonian impact and increases animal tolerance. MP has been utilized to cure of Parkinson's disease mainly in ayurvedic therapy since ancient times. Two coenzymes and L-dopa are elements of the mitochondria's electron transport chain, create MP for the treatment of Parkinson's illness. The effects of *Mucuna* were investigated in the rat model of Parkinsonism disease with lesions using (6-OHDA). *Mucuna pruriens*' antiparkinsonian properties have been extensively studied using a range of techniques. The endocarp of *Mucuna Pruriens* seeds along with 50 mg/kg of carbidopa showed effect when given to mice in their diet at a level of 5 g/kg. better than levodopa alone itself in the contralateral rotation test caused by free 6-hydroxydopamine. These findings supported the theory that the endocarp This plant may contain a number of antiparkinsonian compounds. Along with adjuvants that boost its efficacy or levodopa [2].

7. PHARMACOLOGICAL EFFECT OF MUCUNA PRURIENS

7.1 Antiparkinson's activity

Parkinsonism is treated using powdered *M. pruriens* seed, which has 4–6% levodopa. The anti-Parkinsonian effect of synthetic levodopa at the dosage was twice shown by *M. Pruriens*. Ayurvedic medicine and L-DOPA are both crucial for Parkinson's disease rehabilitation, according a clinical experiment. Patients with Parkinson's disease respond significantly faster to 30 g of mucuna seed powder. When compared to levodopa or carbidogopa, it has been proposed that natural sources of L-DOPA may ultimately be more beneficial than conventional medications for the treatment of Parkinson's disease. While having no effect on other measurements, the cotyledon powder from *M. pruriens* markedly raised brain mitochondrial complex-I activity. It also affects the activity of total monoamine oxidase [1]. The chemical structures and mechanisms of action of neuroprotective drugs vary widely. Typical processes include elevated stress, iron accumulation, inflammation, excitotoxicity, and mitochondrial malfunction [20]. The traditional Indian Ayurvedic medicinal system has traditionally employed *Mucuna pruriens* to treat Parkinson's disease [21]. Previous research has shown that *Mucuna pruriens* therapy reduces Parkinson's disease symptoms [22]. Strong therapeutic effects of an extract from the plant's seeds have been used to study a variety of neurological conditions, including Parkinson's disease (PD) [33]. Compared to synthetic levodopa therapy, supplementing with *Mucuna pruriens* cotyledon powder markedly raised endogenous levels of levodopa, dopamine, norepinephrine, and serotonin in the substantia nigra [34].

7.2 Aphrodisiac activity

It has been discovered that MP has aphrodisiac qualities [23]. By reviving the enzymatic activity and energy metabolism of their metabolic pathways, *M. pruriens* seed powder aids infertile males in regaining the appropriate balance of male reproductive hormones. SOD (super glutathione), catalase, oxide dismutase, and ascorbic acid levels are higher in the seminal plasma of infertile women after *M. Pruriens* treatment than they were before to the treatment. It significantly lowers lipid peroxide levels in seminal plasma and mental stress in addition to increasing sperm motility and count. The semen profile and biochemical markers showed that the powdered *M. pruriens* seeds increased sperm motility and spermatogenesis while lowering lipid peroxidation. The treatment altered the levels of lipids, cholesterol, triglycerides, and total phospholipids in addition to altering fructose and vitamins [1]. *Kapikacchu*, also known as *mucuna*, is a potent aphrodisiac that raises sperm count and testosterone levels. *Kapikacchu* promotes muscle growth, strength, and endurance [24]. Chronic stress is the most common cause of male infertility. Numerous velvet bean species have been shown to have notable L-DOPA levels. Thai traditional medicine has utilized the seeds of an *Mucuna pruriens*, also known as Thai Mhamui or T-MP, to treat erectile dysfunction [32].

7.3 Antidiabetic Activity

The ethanolic extract of *M. pruriens* caused hypoglycemia effects in mice and rats administered streptozotocin and alloxan. The hypoglycemic effects of an aqueous extract of *M. pruriens* seeds under normal and glucose load conditions were tested in rats with streptozotocin-induced diabetes. The results showed The aqueous extract of *M. pruriens* seeds decreased blood glucose levels in healthy rats following an oral glucose load. Oral administration of MPE seed extract. There was a notable decrease in blood sugar levels. [1].

In Brazil, Spain, Germany, and India, *M. pruriens* has been used to treat diabetes [25].

7.4 Antioxidant activity

In vivo experiments have demonstrated the ethanolic extract from *M. pruriens* seeds' antioxidant effectiveness against lipid peroxidation. The removal of super oxides and hydroxyl radicals mediates the peroxidation property. In vitro lipid analyses were performed. By peroxidizing *M. pruriens* seeds, it was demonstrated that the methanolic extract of the plant prevents ascorbate/FeSO₄ from causing peroxidation. As the concentration of the extract rose, so did the inhibition [1].

7.5 Antimicrobial activity

The antibacterial qualities of *M. pruriens* seeds and roots are investigated in this study. Hexane, petroleum ether, benzene, and water are the solvents. Root and seed extracts were tested against *Klebsiella pneumoniae* and *Staphylococcus aureus*. *Salmonella Typhi*, *Escherichia coli*, *Pseudomonas aeruginosa*, and *Bacillus subtilis* were identified using the disk diffusion method. *Erwinia carotovora*, *Pseudomonas syringae*, *Pseudomonas marginalis*, a kind of *Acruginosa*, *Xanthomonas campestris*, and high were all significantly inhibited by the methanolic extract. *Curvularia lunata*, *Fusarium oxysporum*, *Penicillium expansum*, *Rhizoctonia solani*, *Tiarosporella phaseolina*, and *Ustilagomaydis* can all be effectively treated with antifungal medications. The results demonstrated that, to varied degrees, the extracts significantly inhibited the organisms being studied [1]. The traditional technique of diffusion disc plates on agar was used to test for antimicrobial activity [26]. Extracts from *Mucuna pruriens* were found to be more effective against fungi (*C. albicans*) than against Gram-negative bacteria (*E. coli*), but less effective against Gram-positive bacteria (*S. aureus*) [27]. The lowest concentration that prevented the resazurin agent from changing color was determined to be the minimum inhibitory concentration (MIC) of *Mucuna* seed extracts [28].

7.6 Anti-depressant activity

This study explores the potential antidepressant advantages of *M. pruriens* using models of acute and chronic depression. Psychopharmacological The investigation included several days of mucuna pruriens therapy, the FS test, tail The mice were subjected to the suspension test (TST), and the olfactory rats were subjected to bulbectomy. Mucuna may have an early antidepressant-like effect, according to research. Mucuna significantly increased the antidepressant effects of fluoxetine. bupropion in TST and FST mice as well. Conversely [1].

7.7 Anti-inflammatory properties of mucuna

The study analyse the impact of a methanolic extract of *M. pruriens* on the delayed hypersensitivity reactions of mice (DTR), the in vivo mobilization of inflammatory leukocytes, and the main and secondary antibody response. The extract's ability to raise the secondary SRBC-specific antibody titre A significant antibody reaction was observed ($p < 0.05$) [1]. Rats' carrageenan-induced paw edema was successfully ($P < 0.001$) reduced by *M. pruriens* ethanolic extract, which inhibited histamines and serotonin during the early phases of inflammation [29]. Meanwhile, the antioxidant activity of tannin molecules acts as an anti-inflammatory by lowering the formation of oxidants (O₂) by neutrophils, monocytes, and macrophages. Apart from directly limiting reactive oxidants like hypochlorous acid and hydroxyl radicals (OH), blocking oxidant synthesis (O₂) also reduces the production of H₂O₂, which hinders the growth of hypochlorous acid and hydroxyl radicals [30].

7.8 Antitumour activity

For 14 days, Swiss albino mice with Ehrlich Acites Carcinoma received a single daily dose of the methanolic extract of *M. pruriens* seed. starting twenty-four hours after the tumor injection. Compared to animals treated with EAC, those treated with extract showed decreased tumor volume, packed cell volume, and viable cell count. Additionally, the extract decreased the EAC tumor-bearing mice's body weight. As the RBC count rose, the WBC count sharply decreased. counts in mice treated with extract as opposed to those treated with EAC [1].

Antioxidant and anticancer qualities are often associated because antioxidants scavenge free radicals and prevent cellular DNA damage, which can lead to the development of cancer [31].

Uses of mucuna in many other diseases

Studies have shown that the substantial amount of native protein present in *Mucuna pruriens* seeds may lead to the production of hydrolysates and peptides with biological activity. These protein derivatives may aid in the treatment of immunological abnormalities associated with chronic noncommunicable diseases like type 1 diabetes and inflammatory diseases [35]. *M. pruriens* treatment decreased MDA and triglyceride levels but left other parameters unaltered [36]. Traditional healers have traditionally used *Mucuna pruriens* (L.) DC as a therapeutic plant [37]. The suggested antioxidative treatments can be utilized to stop oxidative stress-induced neuron damage, as *M. pruriens* seed extract has demonstrated neuroprotective potential against hydrogen peroxide-induced neurotoxicity [38]. *Mucuna pruriens* has been found to have fertility-boosting and anti-lipid peroxidation qualities [39]. The spines of the seed pods of *Mucuna pruriens* (TMP) contain histamine, in contrast to other Indian species. For a long time, TMP seed has been utilized to boost aphrodisiac activity in older men with lowered libidos [40]. Helminthiasis, fever, delirium, dropsy, elephantiasis, dysmenorrhea, amenorrhea, ulcers, and neuropathy are among the conditions it can be used to treat [41]. The hemoglobin concentration was significantly increased by MP. Along with iron, MP also contains alkaloids, cardiac glycosides, saponins, and tannins [42]. Anti-inflammatory, anti-Parkinson's, depressive, antidiabetic, anticholesterolemic, anticancer, immunomodulatory, antibacterial, antiprotozoal, antifungal, analgesic, antioxidative, and antidepressant qualities are also present in the seed extract [43]. It has immuno-modulatory properties and can significantly increase immunoglobulin levels [44]. *M. pruriens* may help reduce kidney damage, one of the consequences of diabetes mellitus, according to a study that showed the nephroprotective impact of seed extract [45]. Because the seed powder contains a significant amount of L-dopa, a vital source of dopamine, it is used medicinally to treat hyperprolactinemia and Parkinson's disease [46]. MP seed had anticonvulsant qualities against electrically induced seizures, according to preliminary research [47]. A powerful medicinal herb, *M. pruriens* can treat a variety of conditions, including as cancer, epilepsy, Parkinson's disease, diarrhea, helminthiasis, ulcers, snakebite, scorpion stings, elephantiasis, and infertility [48]. One MP species that is indigenous to Thailand is *Mucuna pruriens* (L.) DC. var. *pruriens* (Fabaceae). According to Thai traditional medicine, T-MP seed has aphrodisiac and diuretic properties [49]. Male sexual desire has long been increased and depression and dysuria have been treated using *Mucuna pruriens* (L.) DC. var. *pruriens* [50]. *M. pruriens* seeds and their alleged ability to improve memory and protein [51]. To evaluate the intestinal health and anti-obesity effect of obese rats administered *Mucuna pruriens* (MP), the study focused on food consumption and somatic, biochemical, and histological markers [52]. The ability of an antibody against *Mucuna pruriens* (anti-MPE) to lessen the deadly effects of snake venom [53]. HP-200, which comprises the endocarp of *Mucuna pruriens*, has been shown to help treat Parkinson's disease [54]. MP. Although prolactin (PRL), a hormone required for lactation in women, is naturally inhibited by L-dopa, excessive synthesis (hyperprolactinemia) is a significant risk factor for breast cancer [55]. Sickle cell disease is a collection of genetic disorders that damage the hemoglobin in the blood. *Mucuna pruriens* seed extract improves sickle cell hemoglobin's solubility and oxygen-binding ability [56]. Pretreatment with *M. pruriens* extract reduces the heart problems and respiratory illnesses caused by *C. rhodostoma* venom [57]. Traditional Ayurvedic Indian medicine has traditionally utilized the seed powder of the leguminous plant *Mucuna pruriens* to treat conditions like Parkinson's [58]. The development of effective treatment strategies has been hampered by our incomplete understanding of the etiology and pathophysiology of Parkinson's disease [59]. Anecdotal evidence suggests that the tropical legume *Mucuna pruriens* may possess antihelmintic properties [60]. One of Parkinson's disease's more enduring symptoms is loss of smell. 95% of patients have it before they start having motor symptoms [61]. Thirteen known compounds (4–16) and three novel isoflavanones (1–3) were extracted from the

roots of *Mucuna pruriens* [62]. It is indigenous to tropical countries and is used to cure a variety of ailments, such as neurological, menstrual, urinary, and edema issues [63]. *M. pruriens* seeds exhibit hypoglycemic properties [64]. Bioactive peptides from *M. pruriens* that have antithrombotic and hypolipidemic effects could be utilized as nutraceuticals [65]. Hypertension is a major problem since it causes renal failure and lung fibrosis [66]. *M. pruriens* inhibits platelet aggregation, possesses antioxidant, cholesterol micellar solubility, and antihypertensive effects [67]. Its ability to cure diseases where reactive oxygen species (ROS) are significant pathogens is one of its numerous therapeutic advantages. The Fabaceae family includes the plant *Mucuna pruriens* (Mp) [68]. Levodopa is widely regarded as the "gold standard" for treating Parkinson's disease [69].

Toxicological studies of mucuna pruriens

The extract of *Mucuna pruriens* were tested for phytochemicals, blood chemistry, and acute and sub-acute toxicity. *Mucuna pruriens* leaves were macerated to produce the powder. There were no signs of damage or behavioral issues at any dose. At these dosages, *Mucuna pruriens* leaf extract is thought to be safe in the short term [70]. Little is known about the toxicological testing performed on albino rats to determine the hepatotoxic effect of the plant's aqueous leaf extract in traditional medicine, despite the fact that *Mucuna pruriens* leaves have been used traditionally to cure a range of diseases. The phytochemical examination exposed the presence of flavonoids, terpenoids, alkaloidal compounds, saponins, and minor levels of cyanogenic glycosides. The results of our analysis showed no hepatotoxic effects at the doses tested, which leads us to conclude that the aqueous leaf extract of *Mucuna pruriens* can be utilized in traditional medicine [71].

CONCLUSION

M. pruriens seeds have higher levels of levodopa, a chemical compound which is mainly required for the synthesis of the neurotransmitter dopamine. Traditional Ayurvedic medicine have traditionally utilized the *M. pruriens* herb to cure Parkinson's disease. But this plant have a lot more applications that need to be explored for possible future therapies.

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