

# A Review on Male Fertility Improving Behaviour of “*Mucuna pruriens*” (Seeds)

Sandeep Kumar Singh<sup>1</sup>, Dr. Umesh Pratap Singh<sup>2</sup>

<sup>1</sup>M. Pharm Student

<sup>2</sup>Director

**Abstract:** *Mucuna pruriens* belonging to family (Fabaceae) is a therapeutic valuable agent and it is normally utilized into clinical practice in India. It has been shown that its seeds are potentially of substantial medicinal importance. There are in vitro, in vivo and literature reviews to demonstrate beneficial medicinal effects of *M. pruriens* in worldwide. This study aims to systematically review the scientific literature and provide a comprehensive summary on the effect of *M. pruriens* on sperm parameters with idiopathic infertility. Different parts of the plant are used in Ayurvedic research since ancient period due to their excellent medicinal values and cure many diseases such as bone fractures, cough, dog-bite, madness, pain, pleuritis, ring worm, scorpion sting, snake-bite, sores and syphilis, and is anticholesterolemic, antiparkinson, antidiabetic, aphrodisiac, anti inflammatory and antimicrobial, also used for the treatment of menstruation disorders, constipation, edema, fever, tuberculosis, etc. The seeds of *Mucuna pruriens* contain alkaloids, glycosides, reducing sugars, saponins, tannins, terpenoids, calcium, phosphorus and potassium, polyphenolic substances, protease inhibitor, phytic acid, and L-dopa is a major constituent present in whole herb.

**Keywords:** infertility treatment, *Mucuna pruriens*, sperm health, Ayurvedic medicine, medicinal plants

## 1. Introduction

Much work has been done over the years for restoring impaired fertility. Some compounds thus employed are mainly of endocrinal in composition such as thyroid cytomel, glucocorticoids, and low doses of androgens eg. mesterolone, Hmenopa, gonadotropin and clomiphene citrate and long acting testosterone esters. Apart from hormones, metal ions and other substances, medicinal plants are also being employed for restoring impaired fertility. Herbal plant ingredients have been found to be more efficient and with lesser side effects.

Infertility is conventionally diagnosed following unprotective sexual intercourse by a couple over a period of one year or longer, without conception. According to WHO, about 72.4 million people are affected and further suggests that half of 9% of couples struggling to conceive are attributable to men. Spermatogenic failure in men possibly involves several contributors such as age, oxidative stress, life style, pathological complications, nutritional deficiency, toxicity, exposure to endocrine disruptors such as estrogens etc. which could compromise fertility by affecting sperm count, sperm motility, semen volume and penile erection. Identification of a particular cause and effect relationship in each affected individual is not possible, therefore, a large number of these individuals are labeled as idiopathic (65–80%) followed by a situation of normal spermogram in which causes remain unknown (10–20%). Hormonal and sperm transport may account for another 10%. Highly directed therapies such as hormonal intervention have shown poor success. This forces a large number of subjects to choose expensive treatment options such as in vitro methods, which a large section of the infertile population fails to afford. Ancient Indian medicinal literature, Ayurveda, cites the use of a large number of plant products by men when the contemporary methods of treatment were not common/available.

*Mucuna pruriens* which form the basis of this research is claimed to have many therapeutic roles including fertility improvement activity in male are validated in this research on the basis of several pre existing studies.

**Mucuna** is a tropical legume known as velvet bean, cowitch and by other common names. The plant originally came from Eastern India and Southern China, where it was at one time widely cultivated as a green vegetable crop. *M. pruriens* has been reported to possess anti-diabetic, anti-neoplastic, anti-microbial, aphrodisiac, and learning and memory enhancing properties & found to be used for overcoming problems of impotence and restoring fertility in men. The exact mechanism of its action remains elusive, but possibly it is the result of its anti-oxidant, adaptogenic and general nutritional properties. Reactive oxygen species (ROS) is now well established to regulate normal sperm function, however, over-production of ROS may result in oxidative stress causing significant adverse impact on semen quality and male fertility. *M. pruriens* seed powder and seed extract both have been reported to be effective in combating the stress mediated compromise in spermatogenesis by maintaining the antioxidant level. MP is a rich source of LDOPA and variety of alkaloids, fatty acids, amino acids, minerals and several nutritional elements.

### Taxonomy of *Mucuna*

**Kingdom:** Plantae, Planta, Planter, Plants, Vegetal.

**Sub Kingdom:** Tracheobionta, Vascular Plants.

**Division:** Magnoliophyta. (Angiosperms)

**Class:** Magnoliopsida (Dicote, Dicotyledon)

**Sub class:** Rosidae.

**Order:** Fabales

**Family:** Leguminosae

**Sub Family:** Fabaceae

**Genus:** *Mucuna*

**Species:** *pruriens*

**Biochemical Constituents / Phytoconstituents**

Secondary Metabolites	Result
Alkaloid	++
Anthraquinone	+++
Cardiac Glycoside	+
Saponin	+++
Phylobatanins	+
Flavonoid	+++
Phenols	-
Steroids	-
Terpenoids	-
Tannin	+++

Mucuna seeds are recognized for producing the distinctive nonprotein amino acid 3 (3,4 dihydroxyl phenyl)-l-alanine (l-Dopa), a powerful precursor to neurotransmitters that is thought, at least in part, to be accountable for the toxicity associated with Mucuna seeds. Additionally, it comprises various other compounds such as glutathione, lecithin, gallic acid, and beta-sitosterol. The pods, seeds, leaves, and roots contain indole-3-alkylamines-N, N-dimethyltryptamine. The leaves possess 6-methoxyharman, while serotonin is exclusively found in the pods. The seeds also contain oils, including stearic, oleic, linoleic, and palmitic acids. Given the high content and toxic nature of l-Dopa, it poses a greater concern than other antinutrient factors present in Mucuna. Whole pods can have up to 4% l-Dopa, with this concentration diminishing as they mature.

**Key mechanisms of action:**

- 1) **Hormonal regulation:** Mucuna's main bioactive compound, L-DOPA, is thought to influence the hypothalamus-pituitary-gonadal axis by increasing the release of gonadotropin-releasing hormone (GnRH), which in turn stimulates the pituitary gland to produce LH and FSH, leading to enhanced testosterone production and spermatogenesis.
- 2) **Antioxidant activity:** Studies suggest Mucuna possesses antioxidant properties, which can help neutralize harmful free radicals in the seminal plasma, protecting sperm membranes from oxidative stress that can impair sperm quality and motility.
- 3) **Mitochondrial function:** Research indicates that Mucuna may improve mitochondrial function in sperm cells, contributing to better energy production and improved motility.
- 4) **Apoptosis regulation:** By modulating apoptotic pathways, Mucuna may help reduce the rate of programmed cell death in developing sperm cells, potentially increasing sperm count.

**Pharmacological properties of velvet beans****Antioxidant property:**

M. pruriens have been proved for its antioxidant ability due to its phytochemical composition such as alkaloids, saponins, flavonoids, coumarin, and alkylamines.

**Anti-inflammatory activity:**

The bioactive components, including L-DOPA, proanthocyanidin, phytic acid, tannin, polyphenols, flavonoids, and terpenoids, have been identified as key bioactive molecules contributing to anti-inflammatory

effects. These metabolites alleviate inflammation by crossing the blood-brain barrier and acting on disorders of the central nervous system. Neuroinflammatory conditions such as Alzheimer's and Parkinson's diseases are managed through the significant inhibition of protein denaturation that leads to inflammation, along with enhanced membrane stability.

**Antimicrobial activity:**

Phytochemicals including L-DOPA, polyphenols, flavonoids, 1,2,3-propanetriol, monoacetate, butyl 2-methyl butanoate, palmitic acid, linoleic acid, stearic acid, 4 hydroxy-2,2,6-trimethylcyclohex-2-enone, 2-ethylacridine, and bis(2-ethylhexyl) phthalate have demonstrated antimicrobial properties against skin microbiota such as *Pseudomonas aeruginosa*, *Escherichia coli*, *Bacillus subtilis*, *Staphylococcus aureus*, and *Candida albicans*. The antimicrobial effects showed significant inhibitory actions against the three enzymes related to skin: collagenase, elastase, and hyaluronidase and are utilized in maintaining the balance of skin barrier function, preventing skin aging, and enhancing skin health.

**Anti-diabetic property:**

It enhances the effect of insulin by influencing the secretion of insulin from the  $\beta$  cells in the islets of Langerhans. Low amounts of phytic acid play a crucial role in managing diabetes. It offers significant health advantages for individuals with type II diabetes by decreasing the time it takes to digest starch. It reduces blood glucose levels by prolonging gastric emptying time. Pure phytic acid components, such as sodium phytate, have been shown to lower the glycemic index.

**Anti-hypertensive property:**

The mucuna seeds contain phenolic compounds such as gallic acid, caffeic acid, chlorogenic acid, rutin, and quercetin, which have been linked to various degenerative diseases, including cardiovascular issues such as myocardial infarction, atherosclerosis, hypertension, and cardiotoxicity. Mucuna seeds exhibit hypotensive properties that reduce acetylcholinesterase (AChE) levels and show significant inhibitory effects on monoamine oxidase (MAO), arginase, and acetylcholinesterase in L-NAME induced hypertensive male Wistar rats.

**Antiparkinson property:**

It has been noted that M. pruriens may help alleviate catalepsy due to the presence of l-dopa in its seeds. The extract of M. pruriens used for treating Parkinson's disease (MPE) is believed to contain approximately 12.55% l dopa, especially when compared with equivalent doses of l-dopa.

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