

Kapikacchu: The Brain Medicine

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ABSTRACT

Ancient civilizations throughout the world have survived for so many years, on the wisdom of nature in every field. Natural ways of living and managing disease have been the mainstay of all these cultures. In today's era too almost 80% of the world population relies on herbal medicine to sustain their health care needs. Herbal medication in the form of folklore medicine or home remedies is the mainstay of disease cure in Asian, African continents as continues to be the first line of treatment in mild to moderately severe illnesses.^[1,2] Kapikacchu (*Mucuna pruriens* Linn.) is an important herb mentioned in the Ayurvedic medical literature.^[3] The plant is beneficial in parkinsonism, male infertility, neurological disorders etc. The negative effects are caused due to the exposure to the pod hair that's known to cause skin allergy, basically irritation and itching. That explains the name Kapikacchu. *M. pruriens* is widely used to manage impotency. The aphrodisiac properties of this herb are known to improve the semen quality in terms count and quality, motility etc.,^[4] and is also useful in the management of diabetes mellitus and known to possess antitumour properties too. The seeds exhibit multi-systemic functions like inflammatory arthritis, diabetes mellitus, neurological disorders like parkinson's disease, fever and inflammations.^[5,6] This review study is an attempted to provide detailed information about this herb collected from various Ayurvedic texts and its corelative studies through the lens of pharmacology in terms of its phytoconstituents and pharmacological actions.

Keywords: Kapikacchu, *Mucuna pruriens*, Neurotransmitter, Phytoconstituents.

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INTRODUCTION

Mucuna pruriens, known by its Sanskrit name kapikacchu, is an adaptogenic tonic, mostly used in treating degenerative neurological and muscular disorders, in boosting reproductive and fertility health and improve the overall emotional status of an individual.

The beautiful herb with its velvety pods is a natural source of levo-dopa. Levo-dopa or L-dopa is the essential precursor to neuro-transmitter dopamine. Owing to this, kapikacchu is also used in many psychological or psychosomatic disorders, to uplift mood and impart a general sense of wellbeing to an individual. According to the clinical texts of Ayurveda, it is cold in potency, nourishing to the tissues, imparts strength and vigour to the mamsa dhatu (muscle tissue), supports the functioning of the majja dhatu (nervous system), and also enhances the functions of the shukra dhatu (the reproductive system). Ayurvedic clinicians, widely use kapikacchu to treat various disorders ranging from Vatavyadhis, Mamsagata vata (muscular atrophies), Karshya

(Debility), Vandhyatva (infertility), Daurbalya (weakness/fatigue) etc.^[7]

NIRUKTI OF KAPIKACCHU

The plant is well known by its two Sanskrit names,

Kapikacchu, meaning-kapi-a monkey, kacchu-itch. 'So the one who induces itching like that of monkey,'

Atmagupta, Atma-self, gupta-a secret, which means "secret self," hinting at the value of the seed concealed within the allergenic seedpod.^[7,8] Scientifically it is called as *Mucuna pruriens*, it belongs to fabaceae and medicinal the seeds are used.^[9]

VERNACULAR NAMES^[10]

Across various Indian languages, the names for this herb mostly refer to the velvety coating of hair that covers the elongated seedpods which, upon touching, cause severe itching and irritation of the skin.

English-Cow hedge, magic velvet bean.

Sanskrit - Atmaguptaa, Kapikacchhu, Kapilomaa, Kapii, Markkati, Vaanari.

Hindi-Kevancha, Kauncha.

Gujarati-Kavacha.



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AYURVEDIC PROPERTIES^[10]

Property	Description
RAS	Madhur, tikta.
GUNA	Gurutva (heavy), snigdhatva (unctuous).
VIRYA	Ushna (hot).
VIPAKA	Madhur.
PRABHAV	Vrushya (aphrodisiac).
KARMA	Vata-pittahar.

SYNONYMS^[7]

The main names of this herb in Sanskrit are Kapikacchu and Atmagupta as described earlier.

Due to its physical attributes it also is known as Kapi, Kapiloma, Vanari Svarupa, Markati, etc

The morphological characteristics are described in the names like Roma-valli, Adhyand Rrusyaprokta etc.

Due to ability to self-protect from predators due to its hairy pods, it is known as Atmagupta, Svagupta, Gupta Svayangupta etc.

Owens to its Karma (actions) it is known as Vrissy, Shotha, Harshini, Dusparsha, Kandura etc

BOTANICAL DESCRIPTION^[7-11]

Mucuna is a creeper or a vine that grows throughout the Indian subcontinent, particularly in the tropical areas. It is seen in the tropical regions of African continent and the Caribbean areas. Being a member of the Fabaceae family (or leguminous herbs), it shows characteristic delicate lavender or purplish flowers and fuzzy hair-covered pods, each encapsulating multiple large beans.

It is an annual, woody, perennial twiner producing through its perennating roots, with slender terete branches, which when are younger, usually coated with fine short hair, that is white in colour, but as it matures the hair thin out.

DISTRIBUTION^[8]

This plant can typically be found growing wild in India, from the Himalayan ranges all the way down to the Cape of Comorin in the plains, and all the way up to 3,000 feet in elevation in the

highlands. It is widespread in the states of Bengal and Assam, as well as the Khasi ranges and the Deccan, and it can also be found along the coasts of both the east and the west.

PHYTOCHEMICAL PROPERTIES

Additionally, to the lower levels of sulfur-containing amino acids in *M. pruriens* seeds, the presence of irritants and toxic factors may overall decrease the nutritional quality of the seeds. These factors mainly comprise of the oligosaccharides, polyphenols, phytate, cyanogenic glycosides, lectins, trypsin inhibitors, saponins, some alkaloids etc. Tannins are able to bind to proteins, thereby bringing down their digestibility.

M. pruriens' main phenolic is L-dopa (5%), with low quantities of methylated and non-methylated tetrahydroisoquinolines (0.25%). Four alkaloids identified from such extracts are mucunine, mucunadine, prurienine, and prurieninine. Figure 1 depicts the chemical structures of some of these molecules.

Mucuna pruriens seeds contain glutathione, gallic acid, and beta-sitosterol. Mucunine, dine, prurienine, and prurieninine bases. Indole-3-alkylamines-N and Ndimethyltryptamine are other bases isolated from pods, seeds, leaves, and roots. Leaves provided 6-methoxyharman. Only pods revealed serotonin. Seed oils contain palmitic, stearic, oleic, and linoleic acids.

GC-MS analysis revealed photochemicals like n-hexadecanoic acid (48.21%), squalene (7.87%), oleic acid (7.62%), ascorbic acid (3.80%), and octadecanoic acid (6.21%). The seed also contains (-) 3-methoxy-1, 1-dimethyl-6, 7-dihydroxy-1,2,3,4-tetrahydroquinoline and (-) 3-methoxy-1, 1-dimethyl-7,8-dihydroxy-1,2,3,4-tetrahydroquinoline.

It also contains serotonin (5-hydroxytryptamine, 5-HT), 5-HTP, nicotine, N,N-dimethyl tryptamine (DMT), bufotenine, and 5-imethoxyN,N-DMT (5-MeO-DMT) (5-MeO-DMT-n-oxide). The mature seeds contain 3.1-6.1% L-DOPA, trace amounts of serotonin, nicotine, Bufotonine, 5-MeO-DMT-n-oxide, and beta-carboline. Leaves contain 0.5% L-DOPA, 0.006% DMT, 0.0025% 5-MeO-DMT, and 0.003% DMT n-oxide.^[12-16]

ACTIONS OF MUCUNA IN AYURVEDA

Although, it is well-known for its affinity for the nervous system and the reproductive organs, kappikachu's benefits extend throughout the whole body:

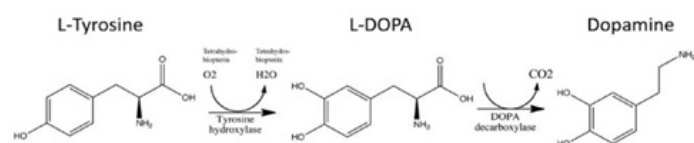
According to Ayurveda it is known to be Vrushya (aphrodisiac), Bruhmani (nutritive), Vata shamak (pacifies Vata), Pittasranashini (reduces pitta and rakta aggravation, checks bleeding), balya (promotes strength), bahumala (increases fecal matter), dushta vrananashini (promotes wound healing) etc.

The oil is known to be heavy, hot in potency, sweet and astringent in properties. The root increases uterine contractions and thereby may induce menstruation or abortion. It has analgesic,

a) N-terminal amino acid sequence of protein spots of gpMuc fraction

Spot No.	aa											
	1	2	3	4	5	6	7	8	9	10	11	12
A												
gp1	K	D	D	K	E	P	V	K	D	T	D	G
gp2	K	D	D	K	E	P	V	K	D	T	D	G
gp4	K	D	D	K	E	P	V	K	D	T	D	G
B												
gp3	K	D	D	K	E	P	V	R	D	T	K	K
C												
gp5	K	N	D	G	E	L	V	R	D	T	Y	G
gp7	K	N	D	G	E	L	V	K	D	T	Y	G
gp6	K	N	D	G	E	L	V	K	D	T	Y	G

b) Tyrosine and L-DOPA precursor of Dopamine



c) Structure of cyclitols

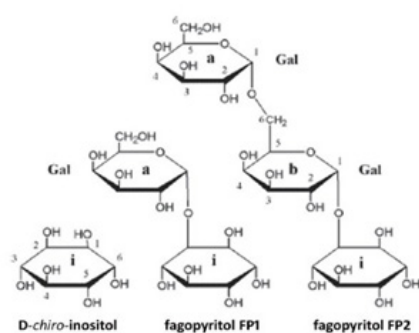


Figure 1: Chemical Structures of Molecules.

anthelmintic, nerve, diuretic, rejuvenative, aphrodisiac, astringent, carminative properties.^[17-19]

The benefits can be summed as below:

- Promotes healthy nervous activity.
- Supports normal brain functions and enhances intellect.
- Enhances mood and overall wellbeing.
- Supports motor skills and coordination.
- Revitalizes the reproductive system.
- Supports healthy digestion and elimination.
- Provides significant nutritional content and maintains blood sugar levels.
- Natural source of levodopa (L-dopa). Dopamine plays an important role in behaviour, cognition, voluntary movements, sleep control, mood, memory, and learning.
- Helps in controlling worms.
- *Mucuna* helps in improving the libido.
- It is very helpful in increasing the muscle mass of the body naturally.

- It reduces psychological stress and seminal plasma lipid peroxide levels, as well as improving sperm count and motility.

TRADITIONAL USES^[17-19]

Root, leaf, and seed are the plant parts used.

Traditional treatments for several disorders include *Mucuna pruriens*, and it is used in many different ways in all of its sections.

Roots

Bitterness, emollient, stimulant, purgative, aphrodisiac, diuretic, emmenagogue, anthelmintic, febrifuge, and tonic are some of the qualities that root possesses. Roots can also be stimulating. According to Ayurvedic theory, they are beneficial in conditions where pitta and vata have become imbalanced. Nephropathy, strangury, dysmenorrhea, amenorrhea, elephantiasis, dropsy, neuropathy, consumption, ulcers, fever, and delirium are some of the conditions that roots are still used to treat in Ayurvedic medicine.

Leaves

The leaves can help with ulcers, inflammation, helminthiasis, cephalgia, and general debility. They also have aphrodisiac, anthelmintic, and tonic properties.

Seeds

It is used to treat worms, dysentery, diarrhoea, snakebite, sexual debility, cough, tuberculosis, impotence, rheumatic illnesses, muscle soreness, gonorrhoea, sterility, gout, delirium, dysmenorrhea, diabetes, and cancer in Ayurvedic medicine practiced in India. It is utilized in India as an aphrodisiac, emmenagogue, and uterine stimulant. Additionally, it is utilized as a nerve tonic, diuretic, and blood purifier. Nescafé is a substitute for coffee that is made by roasting and crushing *Mucuna* beans in Central America. This process has been going on for decades. The bean is prepared by cooking it in the same manner as one would prepare a vegetable. In Brazil, people have taken the seed to treat Parkinson's disease, edema, impotence, intestinal gas, and worms. It has also been used to treat edoema. This substance is both a nerve relaxant and a diuretic.

It is applied topically in order to treat ulcers. The seeds have properties that are described as astringent, laxative, anthelmintic, aphrodisiac, alexipharmic, and tonic. They are beneficial in the treatment of gonorrhoea, consumption, sterility, vata vitiation, and general weakness. Vermifuge properties can be found in both the blossoms and the hairs. *Mucuna* seed powder is a treatment for Parkinson's disease that is employed in the Ayurvedic medical system.

SOME STUDIES EXHIBITING THE PHARMACOLOGICAL ACTIONS

Aphrodisiac Activity

According to the findings of this particular study, taking Kapikacchu Churna causes a significant increase in the number of sperm. There was a discernible rise in the level of improvement seen in seminal parameters such as volume, pH, motility, and so on. It showed a slight change in Non-Progressive sperm (NP), but the slow linear progression of sperm didn't experience a Significant Shift (SLP). On the other hand, there was a discernible rise in the levels of sexual desire, penile rigidity, erection quotient, and duration of ejaculation following an orgasmic experience.^[20]

Antioxidant Activity

The many different parts of this plant contain phenols in their total form, which may have some potential as an antioxidant. When the capability of this plant to scavenge free radicals was evaluated using the method of nitric oxide scavenging, results that were comparable to those obtained were found. The alcohol extract had an antioxidant activity that was comparable to that of normal ascorbate and the total phenol content.^[21,22]

Anti-microbial Activity

The anti-bacterial activity of the methanolic extract of the whole plant was demonstrated against both gram-positive and gram-negative organisms. *E. coli*, *Salmonella typhi*, *Bacillus subtilis*, and *Shigella dysenteriae* are among the pathogens that are effectively eradicated by this extract. *Escherichia coli* had a Zone of Inhibition (ZI) that was 2.8 centimeters larger than *Bacillus subtilis* when the antibacterial potency was measured using the Zone of Inhibition (ZI) (2.1cm). *Mucuna*, when combined with *Carica papaya*, was found to be an effective treatment for inhibiting the growth of protozoa in fish, according to the findings of another study.^[23,24]

Anti-Parkinson's Activity

Levodopa, a precursor to the neurotransmitter dopamine found in its seeds, has been demonstrated to be just as effective in treating Parkinson's disease as pure levodopa/carbidopa. Several *in vivo* researches that were conducted in rats and humans have shown these results. Hussain *et al.* studied the significant effect of *Mucuna pruriens* over L-DOPA in parkinsonism in animal model. Even L-Dopa free fraction of seed showed significant anti-parkinsonism activity.^[25-27]

Anti-venom activity

Fung *et al.* (2010) found that the anti-venom activity of *M. pruriens* seeds reduced the neuromuscular and cardiovascular depressive effects of *Naja sputatrix* venom in rats that had been pre-treated with the seeds.^[28] According to the same group of researchers who conducted the study, the effects of the venom

of the *Calloselasma rhodostoma* were comparable to those of a three-week intra-peritoneal administration of *M. pruriens* aqueous extract. Following a period of three weeks, intravenous injections of *Calloselasma rhodostoma* venom were administered to rats in order to conduct research on a variety of pharmacology parameters, including blood pressure, heart rate, respiration rate, and muscle twitch tension. When compared to the group that served as the control, all of the pharmacological reactions seen in the treated groups were found to have a significantly reduced occurrence. The seed component displayed a potent antivenom effect, which may have been caused by the presence of a greater number of phytochemicals.^[29]

Hypoglycaemic Activity

Using diabetic, normal, and glucose load condition rat models produced with streptozotocin allowed researchers to assess the hypoglycaemic efficacy of seeds aqueous extract. After two hours of oral treatment, the seed extract of *M. pruriens* decreased the oral glucose load from 127 to 75 mg%. In a different experiment, after 21 days, streptozotocin-diabetic rats' blood glucose levels decreased from approximately 250 to 90 mg%. The results of the earlier study revealed that the dietary fibre content may be responsible for the antidiabetic activity.^[17] The increase in blood glucose level is said to be caused by creatinine, urea, and cholesterol. In a related experiment, they noticed that the cholesterol and creatinine levels were lower in the streptozotocin-diabetic rats. They clarified that the cause of this hypo-cholesteric activity is due to Squalene being present.^[30]

Neuroprotective effect

The application of *M. pruriens* cotyledon powder to the nigrostriatal tract of 6-OHDA-lesioned rats resulted in a significant increase in the activity of brain mitochondrial complex I (*in vitro*). The levels of endogenous levodopa, dopamine, norepinephrine, and serotonin were significantly restored in the substantia nigra. The neurorestorative effect of *M. pruriens* cotyledon powder was hypothesized to be caused by an increased complex I activity, in addition to the presence of NADH and co-enzyme Q.^[31]

Learning and memory enhancement

According to the findings of a study conducted by Poornachandra *et al.* on Wistar male rats, *Mucuna pruriens* showed significant activity on the development of learning skills and memory. Memory retrieval results on the 17th day showed an increase of 15% and 35%, respectively, in rats that received extract solely during memory retrieval sessions and animals that got extract during both training and memory retrieval sessions.^[32]

TYPES OF KAPIKACCHU

Here are two kinds of Kapikacchu plants: wild and cultivated, with the wild version having higher clinical value than the cultivated equivalent. Some clinical texts define the two categories as

Sveta Bija (white seeded) and Krisnabija (yellow seeded) (Black seeded).^[33]

CLASSICAL CATEGORIZATION OF KAPIKACCHU^[7]

CHARAK SAMHITA – Balya group of herbs (tonics), Madhuraskandha (sweet tasting herbs).

SUSHRUT SAMHITA – Vidarigandhadigana, Vatasamshamaniya gana.

ADULTERATION

Although adulteration was uncommon, *Mucuna utilis* was frequently utilised as a replacement in different parts of India where *Mucuna pruriens* is grown.^[34]

TOXICITY STUDIES

The acetone extract of the root was 1.93 times more poisonous to insects than the extract of *Jatropha curcas* Linn. seeds. On touch, the hairs on fresh/dry pods can cause severe irritation. Mucanin may potentially cause blisters/dermatitis. The use of unprocessed, raw VB in human and chicken diets is frequently accompanied by harmful effects. Neurotoxicity, behavioural abnormalities, and severe vomiting have been observed in humans by Infante *et al.*^[35] and Miller *et al.*^[36]

SOME IMPORTANT PREPARATION^[37]

Reproductive disorders-Mushalyadi churna, Manamath Rasa, Ikshuradi lehyam, Vanari vatika, Kameshwar modak Ashwagandha ghritam, Shatavaradi modak, Mahakameshwar modak Rativallabh modak Godhumadya ghritha.

Neurological disorders-Mashabaladi Kashaya.

Debilitative disorders/Bleeding disorders-Amritprash ghritha.

SOME CASE STUDIES

The case study demonstrates the utility of Ayurvedic therapeutic options in the management of Parkinson's disease. Panchakarma procedures, particularly Madhutailika vasti, are very advantageous in such manifestations, successfully improving musculoskeletal flexibility and motions. It alleviates the weakness and impairment caused by Parkinson's disease. The medications utilised in this study, principally Kapikacchu, are totally herbal in nature, have no side effects, are easily available, efficacious, safe, and produce good results.^[38]

In this case study, a 27-year-old woman sought Ayurvedic treatment after being anxious to conceive for two years after a regular and satisfying marital relationship. She was diagnosed with unexplained hyperprolactinemia and hyperemic cervix. Agnimandhya detected the participation of vitiated Vata

and Kapha based on a detailed history. Orally, she was given samshamani vati and kapikacchu churna, as well as panchavalka taila yonipichu.^[39]

CONCLUSION

The study of herbal medicine encompasses the subject of pharmacology, which is the study of "Drugs," including their origin, physical and chemical characteristics, modes of action, absorption, distribution, biotransformation, excretion, and therapeutic applications. In many different domains, the pharmacological examination of herbal medicine is still in its relatively early stages. According to the findings of this review, the pharmacologically active plant known as *Mucuna pruriens* is being researched for a variety of different applications. With the exception of L-DOPA and a few alkaloids, there are still only a small number of mechanisms and bioactive principles that underlie the activity.

The use of plant extracts and the composition of those extracts necessitates the quality assurance of herbal treatments to ensure that they are both safe and effective. Even though there have been significant advancements made in the production of herbal products, the quality control aspects of many herbal medicines, both in their raw and processed forms, are still in their infancy. This is the case despite the fact that there have been significant improvements. This is due to the complexity of the components that make up plants.

It is possible for the concentration of a single element in herbal remedies to vary significantly depending on factors such as their geographical origin, climate, soil, harvest season, processing methods, and other variables. In the realm of analyzing the efficacy of herbal remedies, chromatographic techniques are typically applied solely to the determination of a small number of constituents.

One of the most powerful Rasayanas in all of Ayurveda is called Kapikacchu. A nutritive tonic known as kpicchu is used extensively in Ayurvedic medicine both as an aphrodisiac and to promote healthy functioning of the reproductive system. It does this while also bolstering and toning the reproductive organs, which leads to an increase in sexual vitality. The use of Kapikacchu has been shown to increase a man's virility, stamina, and overall control. It raises testosterone levels, which in turn increases the number of sperm in the body. It helps women maintain a healthy libido as well as their fertility. The vitality of Kapikacchu nourishes the whole body and soothes the nerves, making it an effective vata rejuvenator. In addition to this, it is a natural source of the precursor to the neurotransmitter dopamine known as levodopa (L-dopa). As a result of the fact that it can act in multiple directions, it is possible to demonstrate that a magical pharmaceutical product does in fact exist.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ABBREVIATIONS

SLP: Slow linear progress of sperm.

SUMMARY

Ancient civilizations across the globe have endured for so many years thanks to the knowledge of nature in every discipline. All of these cultures have relied heavily on natural methods of disease prevention and treatment. Over 80% of the world's population continues to rely on herbal medicine to meet their health care needs. Herbal medicine in the form of folklore medicine or home remedies is the mainstay of disease treatment in the Asian and African continents, as well as the first-line treatment for mild to moderately severe conditions.

In Ayurvedic medical literature, Kapikacchu (*Mucuna pruriens* Linn.) is a prominent herb. The herb is good for conditions such as parkinsonism, male infertility, and neurological problems. Exposure to pod hair, which is known to cause skin allergy symptoms such as irritation and itching, is responsible for the negative effects. So, the name Kapikacchu is explained. *M. pruriens* is commonly employed to treat impotence. It is known that the aphrodisiac properties of this herb improve the quality of sperm in terms of quantity, quality, motility, etc. It is also useful in the treatment of diabetes mellitus and has antitumor characteristics. The seeds have multiple systemic functions, including the treatment of inflammatory arthritis, diabetes mellitus, neurological disorders such as Parkinson's disease, fever, and inflammation.

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