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# *Mucuna pruriens* (Egbara) in Nutritional Food Security: A Review

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**Abstract**

Heightened level of global food insecurity has necessitated the exploration of less utilized crops like *Mucuna pruriens*. *Mucuna pruriens*, a leguminous plant with a rich history in traditional medicine and agriculture, has garnered attention for its multifaceted botanical attributes, nutritional composition, and versatile applications. This review synthesizes current knowledge on the botany of *Mucuna pruriens*, exploring its taxonomy, morphology, and ecological preferences. The plant's ability to thrive in various agroclimatic conditions underscores its potential as a resilient and valuable resource. In addition to its botanical aspects, this review covers proximate composition of *Mucuna pruriens*, highlighting its role as a source of essential nutrients: proteins, carbohydrates, minerals, and vitamins. The review also elucidates the diverse uses of *Mucuna pruriens* across different cultures and industries. In traditional medicine, the plant has been employed for its neuroprotective, anti-diabetic, and aphrodisiac properties. Furthermore, its potential as a sustainable alternative in agriculture was explored, with the ability to enhance soil fertility through nitrogen fixation and serve as a valuable forage for livestock. Its food uses, though limited, were also documented. As global interest in improving food security through lesser-known crops grow, *Mucuna pruriens* emerges as a promising legume for further research and utilization.

**Keywords**: Food, protein, velvet bean, amino acid

## Introduction

Globally, the food insecurity situation is worsening owing to increasing population, climate change, shortage of fertile land and high prices of available staples (Katoch, 2020). This has resulted in high incidence of hunger and malnutrition, a situation in which children and women, especially pregnant and lactating women are most vulnerable (Kumar and Pandey, 2020). Food insecurity will likely escalate in developing nations in Africa and Asia due to large population expansion with a corresponding demand for food production which buttresses the seriousness of the food insecurity problem (FAO, 2017). Katoch (2020) noted that there is no singular solution in addressing the problem of food shortage and crises. The high dependence of many nations on major conventional legumes and animal-based sources for their protein need and nutrition has also resulted in a disproportionate increase in their prices (Nwaoguikpe *et al.*, 2011) and decreasing food security (Katoch, 2020). In essence, pieces of information from underutilized foods will definitely be of great value in the struggle for food security. *Mucuna pruriens* is one of such lesser known and underutilized legumes with fairly good nutritional profile. *Mucuna pruriens* seed contains: crude protein (24 - 31.44 %), carbohydrate (42.79 - 64.88 %), lipid (4.1 - 14.39 %), crude fibre (5.3 - 11.5 %), ash (2.9 - 5.5 %) (Pathania *et al.*, 2020). It also contains good amounts of potassium (806 - 2,790 mg/100g) and vitamin $B_1$ (147.4 µg/ml) (Udengwu *et al.*, 2018). With regard to amino acid profile, *Mucuna pruriens* seed contains up to 4.72g/100g of valine, 1.24g/100g of cystine, 0.78 /100g of methionine, 7.24g/100g of isoleucine, 6.04g/100g of leucine, 4.41g/100g of tyrosine, 4.48g/100g for phenylalanine, 5.78g/100g of Lysine, 3.33g/100g for histidine, 1.01/100g of tryptophan, and 7.74/100g of arginine (Daffodil *et al.*, 2016)

Additionally, much of the research and publications on *Mucuna pruriens* has been in the pharmaceutical industry rather than food industry because of the presence of L-3, 4-dihydroxylphenylalamine (L-DOPA; a non-protein Amino Acid) which is used in Parkinson's disease management (Eze *et al.*, 2017). To that end, the aim of this review was to synthesize existing knowledge regarding the botany, nutritional composition and uses of *Mucuna pruriens* so as to foster its better utilization in improving food security.

**Botany, species and common names of *Mucuna pruriens***

*Mucuna pruriens* is of the family Leguminosae/Fabaceae, subfamily; *Faboideae*, genus; *Mucuna*, species; *pruriens* (Pathania *et al*., 2020). In the *plantae* kingdom, *Mucuna* is second to the largest group of flowering plants which is made up of 600 genera (Natarajan *et al*., 2012) and about 150 species (Pathania *et al*., 2020).
The most common species are *M. deeringiana Merrill*, *M. utilis Wallich*, *M. pruriens*, *M. hassjoo*, *M. Capitata*, *M. nivea*, *M. diabolica and M. aterrima Holland* (Pathania *et al*., 2020). The cardinal variance in cultivated species is based on the pubescence on the pod, colour of the seed and the duration to the harvest of the pod (Lampariello *et al*., 2012).

The common English names for *Mucuna pruriens* are velvet bean, cowage, cowitch and Lyon bean (Avoseh *et al*., 2020). It is also commonly known as *Kiwanch* and *Konch* in Hindu, *Atmagupta* or *Kapikacchu* in Sanskrit, *Poonaikkaali*in Tamil, *Alkushi* in Bengali, *Khaajkuiri* in Marathi (Kumar and Saha, 2013), *Alkusa*, *Alkui*, *Kivanch*, *Khaja-Kuhali*, *Kawaanch*, *Pilliadagu*, *Guli*, *Kawanchi*, *Majram*, *Poonaikkate*, *Kavanch*, *Nayikuruma*, *Kavach*, *Kivanch*, *Punaikkali*', *Dulagondi*, *Shoriyanam Kuhili* and *Nasugunni Khavalyavali* (ThyagaRaju *et al*., 2017). In Nigeria, the Yoruba's call it *Ewe Ina* or *Werepe* while the Igbos refer to it as *Egbara* or *Agbara* (Avoseh *et al*., 2020; Ashidi *et al*., 2019; Onweluzo and Eilitta, 2003).

**Description of leaves, flower, fruit and seed of *Mucuna pruriens***

*Mucuna pruriens* is a shrub with an annual cycle and a characteristic climbing nature of up to 15 m long (Kumar and Saha, 2013). It has a fuzzy hair which disappears at old age (Pathania *et al*., 2020). The leaves are trifoliate (Pathania *et al*., 2020), stipulate, alternate in most cases and range from bipinnately or palmately compound to simple with leaflets of about 2-3 mm (ThyagaRaju *et al*., 2017). Two or more flowers occupy the flower heads which take the form of panicles that are axially arranged; its flower lengths have the range of 15-32 mm with a Lavinder, purple or white colour (Kumar & Saha, 2013). *Mucuna pruriens* fruits of about 10 cm long is made up of curved longitudinal pods which often contain 4 to 6 seeds and is thickly covered with a continuous pale-brown or grey trichomes (Eze *et al*., 2017). The fruits elicit irritating blisters or itching when they touch the skin of humans (Eze *et al*., 2017). The responsible compounds for the irritation exhibited by the hairs of *Mucuna pruriens* pods are Mucunain and Serotonin (Kumar & Saha, 2013; Eze *et al*., 2017). The seeds of *Mucuna pruriens* have shiny black or brown colour, ovoid in shape, about 12 mm in length (Eze *et al*., 2017), 0.8-1.3 cm width and 4-6.5 cm thick (Kumar & Saha, 2013).

**Distribution, Cultivation and yield of *Mucuna pruriens***

*Mucuna pruriens* is a tropical legume that originated from southern China and eastern India where it is grown as green vegetables (Lampariello *et al*., 2012). It is native to carribbean, India and Africa (Ashidi *et al*., 2019). *Mucuna pruriens* plant has wide distribution all over the world, but has more predominance in tropical and subtropical regions of the world (Asia, Africa, West Indies, tropical America, pacific Islands and USA) (Fung *et al*., 2011; Pathania *et al*., 2020). It is largely distributed in South East Asia like Bangladesh, India, Sri Lanka and Malaysia (Lampariello *et al*., 2012; Kumar and Saha, 2013). In Nigeria, it is common in the South-West regions (Ashidi *et al*., 2019).

*Mucuna pruriens* is hardy, and tolerates harsh environmental conditions like high soil acidity, drought and low soil fertility, but strives poorly in cold and wet soils (Pugalenthi *et al*., 2005). It grows better at lower attitudes (< 1,600 m), warm and moist conditions, soil pH of 5-8, rainfall of > 400 mm and annual temperature of 19-27 $^oC$ (Kumar and Saha, 2013; Pugalenthi *et al*., 2005). The seed yields up to 1.3-2.4 tonnes/ha, total biomass of 20-30 tonnes/ha and dry matter of 7-9 tonnes/ha (Pugalenthi *et al*., 2005). *Mucuna pruriens* is disease resistant, suppresses weed, lowers nematodes infestation and serves as green manure (Pugalenthi *et al*., 2005).

**Proximate Composition of *Mucuna pruriens***

Proximate composition involves nutrients and water that the food is made up of which include moisture, crude protein, lipid, crude fibre, ash and carbohydrate. Moisture is the main constituents of cells, tissues, organs and it is vital for life (Jyoti *et al*., 2018). Moisture represents the amount of water present in food. It is usually determined by measuring the weight loss of a sample after drying it. Moisture acts as a solvent, reaction medium and reactant as well as a carrier for nutrients (Jyoti *et al*., 2018). Water aids in cellular homeostasis, maintains the vascular volume and allows blood circulation which are essential for function of all organs and tissues of the body (Jyoti *et al*., 2018).
Food proteins are very complex polymers of amino acids (Onwuka, 2018). Proteins are common components of all cells and it is important for biological functions and cell structure (Nielsen, 2017). Adequate protein intake is important for keeping the muscles, bones, and tissues healthy. Protein plays key role in many biochemical

processes and systems in the body such as blood clotting, body fluid balance, immune system responses, hormones, enzyme systems, growth and development, especially during childhood, adolescence, and pregnancy (Nielsen, 2017). Lipids are a group of heterogenous substances that are usually soluble in ether, hexane, chloroform and other organic solvents, but poorly soluble in water (Onwuka, 2018). This group of substances includes triacylglycerols, diacylglycerols, monoacylglycerols, free fatty acids, phospholipids, sterols, carotenoids and vitamins A and D (Onwuka, 2018). The functions of lipids in the body include: storage of energy in the body which is mainly used during starvation, fasting or exertion and being part of the structural elements of cells, such as cell membranes (Okaka *et al*., 2002).

Dietary fiber is the sum of the indigestible components of a food or food product. Most, but not all, fiber is the raw material of plant cell walls (cellulose, hemicellulose, lignin) and is therefore composed mainly of polysaccharide molecules (Nielsen, 2017). Dietary fiber is the edible portion of a plant or similar carbohydrate that is resistant to digestion and absorption in the human small intestine with complete or partial fermentation in the large intestine (Nielsen, 2017). Sources of fiber in food include: Barley oat bran, parsley, green beans, carrots, raisins, prunes, apricots, soy bran, high fiber cereal. The functions of fiber in the body include the following; Fiber promotes positive physiological effects such as relaxation and/or lowering of blood cholesterol and/or lowering of blood sugar (Nielson, 2017). Getting enough fiber from a variety of foods will help protect against colon cancer, while helping to keep blood lipid levels within normal limits, thereby reducing the risk of obesity, high blood pressure and heart disease (Nielsen, 2017). Ash is the residue that remains after all moisture has been removed and organic materials (fats, proteins, carbohydrates, vitamins, organic acids, etc.) are completely burnt around 500 °C (Onwuka, 2018). It is regarded as the total mineral content of food (Okaka *et al*., 2002; Nielsen, 2017). The functions of ash (minerals) in the body include being part of tissue structure formation, like in bone and teeth, help maintain acid-base balance, keeping the body pH neutral and the regulation of body processes, such as in enzyme systems (Okaka *et al*, 2002). Carbohydrates occur naturally in plants and animals (Okaka *et al*., 2002). They are formed mainly in green plants by different biosynthetic pathways from the products of photosynthesis. Carbohydrates serve as a primary source of energy (sugar) or storage fuel (starch and glycogen), but also form support structures in plants and some animals (cellulose and chitin) (Okaka *et al*., 2002). Other functions of carbohydrates include building macromolecules and sparing protein (Okaka *et el*., 2002).

*Mucuna pruriens* seed contains good amount of carbohydrate, protein and crude fibre. *Mucuna pruriens* seed has a range of the following proximate parameters: 21-38% crude protein, 42.79 - 64.88% carbohydrate, 4.1 - 14.39% crude lipid, 5.3 - 11.5% crude fibre and 2.9-5.5% ash content (Pathania *et al*., 2020).

Raw seed of *Mucuna pruriens* contains 10.99% moisture, 25.34% crude protein, 5.94% crude lipid, 4.69% crude fibre, 3.82% ash and 49.22% total carbohydrate (Ezegbe *et al*., 2023). The proximate composition of *Mucuna pruriens* seed flour as determined by Tavares *et al*. (2015) were as follows: 43.12% protein, 37.19% starch, 5.64% crude fibre, 7.00% lipids, 8.20% moisture, 3.10% ash and 384.24 Kcal of energy. Natarajan *et al.* (2012) documented that eight species of *Mucuna* (*M. cochinchinensis, M. Jaspeada, M. veracruz, M. gigantean, M. monosperma, M. pruriens, M. solanei and M. utilis)* contain the following nutrients: crude protein (24.00-31.44%), carbohydrate (42.79-64.88%), crude lipid (4.1 – 14.39%), crude fibre (5.3 – 11.5%) and ash (2.9-5.5%).

The proximate composition of two accessions of *Mucuna pruriens* Var *utilis* for white and black coloured seed coat accessions as documented by Daffodil *et al*. (2016) are as follows: 10.25% and 10.85% for moisture, 29.53% and 28.75% for crude protein, 8.04% and 8.26% for lipid, 8.66% and 8.68% for crude fibre and 4.22% and 5.72% for ash.The proximate composition of the seeds of three accessions of *Mucuna pruriens* Var. *pruriens* was also assessed by Fathima *et al.* (2010). Accordingly, the three accessions (Saduragiri, Siruvani and Thallaina) had the following composition respectively: moisture contents were 10.21, 9.48 and 9.78 g/100g , crude protein was 32.48, 28.80 and 29.40 g/100g, , crude lipid was8.50, 7.66 and 8.94g/100g , total dietary fibre was 7.41, 6.20 and 6.78 g/100g, , ash was4.10, 4.30 and 4.52 g/100g..

Kalidass and Mohan (2011) carried out a research during which the proximate composition of accessions of *Mucuna pruriens* Var. *pruriens* was determined. From the results of their research, the moisture content range was 10.18 to 11.56 g/100g, crude protein from 27.51 to 31.24 g/100g, total dietary fibre from 6.52 to 9.47 g/100g, crude lipid from 6.57 to 8.80 g/100g and ash from 4.34 to 6.00 g/100g.

**Amino acid profile of *Mucuna pruriens* seed**

Amino Acids are basic units for protein synthesis and are made up of an amino group and a carboxylic group (Akram *et al*., 2011). Amino Acids play fundamental roles in regulating multiple processes related to gene expression, including modulation of the function of the proteins that mediate messenger RNA (mRNA) translation (Akram *et al*., 2011). The amino acid profile of foods entails both the essential (indispensable) amino acids and the non-essential amino acids (Fitriyah *et al*., 2021; Xiao and Guo, 2022). Essential amino acids consist of histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan and valine while the non-essential amino acids include proline, arginine, tyrosine, cystine, alanine, glutamic acid, glycine, serine and aspartic acid (Fitriyah *et al*., 2021). Humans can endogenously synthesize non-essential amino acids (Xiao and Guo, 2022) and more importance is usually attached on essential amino acids rather than the non-essential amino acids as the former cannot be synthesized by the body but rather gotten from food. Among all the essential amino acids; leucine, isoleucine and valine are known as branched-chain Amino Acids (BCAAs) and have aliphatic side chains (a central carbon atom bonded to 3 or more carbon atoms) (Xiao and Guo, 2022). BCAAs make up approximately 40% of the body's total amino acid requirements and have received a great deal of attention over the past decade for their ability to stimulate protein synthesis and influence metabolism (Xiao and Guo, 2022). Essential amino acids have been demonstrated not only to be protein building blocks, but also to function as signaling molecules that regulate multiple biological processes (Xiao and Guo, 2022). Histidine is a basic amino acid with an imidazole side chain and the histidine content of various proteins varies from 73% of total amino acids in the histidine-rich protein of Plasmodium lophurae to virtually no histidine in some mammalian elastins (Brosnan and Brosnan, 2020). Histidine is one of the least abundant amino acids in all proteins in the human body (Brosnan and Brosnan, 2020). Isoleucine, as one of the branched chain amino acids, is also critical in physiological functions of the whole body, such as growth, immunity, protein metabolism, fatty acid metabolism and glucose transportation. Isoleucine can improve the immune system, including immune organs, cells and reactive substances (Gu *et al.*, 2019). Leucine is one of the fundamental essential amino acids which cannot be synthesized by the body and must be gotten through dietary sources. Leucine, an essential amino acid is recognized as a key anabolic stimulus and can be directly involved in the regulation of muscle protein synthesis both on a substrate and signal transduction level (Zhao *et al*., 2021). Lysine is an essential amino acid which implies that the body must receive it through dietary sources. It is one of the 20 amino acids that serve as the building blocks of proteins within the human body (Li *et al*., 2013). L-methionine is a type of amino acid - the building blocks of protein and it has great significance in human health because our bodies cannot synthesize it; we have to get it from our diet (Parker *et al*., 2021).. Phenylalanine can be found in foods like wheat germ, oats, milk products, and meats or taken as a supplement. Phenylalanine is a basic building block for proteins, and can be changed into tyrosine, but tyrosine cannot change back into phenylalanine. This protein acts like a special enzyme that uses oxygen to help with the transformation (Akram *et al.*, 2022). Threonine, also called α-amino-β-hydroxybutyric acid, is an important amino acid that animals must get from the food they eat. It helps with making proteins, using energy, and absorbing nutrients in their bodies (Tang, 2021). L-tryptophan is a special amino acid that produces many important substances in the body. The chemicals produced from tryptophan affect how the body works in different ways (Badawy, 2019).Valine is also one of the essential amino acids, which implies that it cannot be produced by the body and must be obtained through dietary sources (Ahmad *et al.*, 2021). Valine plays a significant role in muscle metabolism (Ahmad *et al.*, 2021).

The record from Kalidass and Mohan (2011) shows that five accessions of *Mucuna pruriens* seed contain notable essential amino acids (EAAs) of great importance and also some non-essential amino acids too. The amino acid composition of *Mucuna pruriens* seed is comparable to those of many legumes consumed in the tropics (Pugalenthi *et al*., 2005). Kalidass and Mohan (2011) reported a glutamic acid value range of 8.78 to 13.10 g/100g, aspartic acid range of 12.70 to 16.40 g/100g, serine range of 3.34 to 4.93 g/100g, threonine range of 4.08 to 5.28 g/100g, proline range of 2.50 to 4.54 g/100g, alanine range of 3.60 to 5.84 g/100g, glycine range of 4.17 to 5.12 g/100g, valine range of 3.33 to 6.30 g/100g, cystine range of 1.12 to 2.20 g/100g, methionine range of 0.54 to 1.10 g/100g, isoleucine range of 2.54 to 5.30 g/100g, leucine range of 5.17 to 6.50 g/100g, tyrosine range of 2.43 to 5.11 g/100g, phenylalanine range of 3.13 to 4.80 g/100, lysine range of 4.85 to 5.40 g/100g, histidine range of 2.23 to 4.31 g/100g, tryptophan range of 0.78 to 1.21 g/100g and arginine range of 2.52 to 5.38 g/100g.

Raw *Mucuna pruriens* seed contains valine (7.60 mg/100mg), phenylalanine (6.51 mg/100mg), methionine (0.78 mg/100mg), glutamic acid (19.30 mg/100mg), isoleucine (8.80 mg/100mg) and leucine (10.42 mg/100mg) (Bhat *et al*., 2008). Other amino acids determined in raw *Mucuna pruriens* seed include aspartic acid (17.40 mg/100mg), serine (6.10 mg/100mg), threonine (5.21 mg/100mg), proline (7.40 mg/100mg), alanine (4.95 mg/100mg), glycine (6.21 mg/100mg), cystine (1.61 mg/100mg), tyrosine (7.51 mg/100mg), lysine (8.98mg/100mg), histidine (3.30 mg/100mg) and arginine (9.60 mg/100mg) (Bhat *et al*., 2008).

The concentrations of amino acids (g/100g) in white and black coloured accessions of *Mucuna pruriens* seed as evaluated by Daffodil *et al*. (2016) are as follows: 12.60 and 12.80g/100g for glutamic acid, 11.28 and 13.30 g/100g for aspartic acid, 4.64 and 4.83g/100g for serine, 3.54 and 3.68g/100g for threonine, 3.19 and 3.50g/100g for proline, 4.26 and 4.06g/100g for alanine, 5.12 and 5.94g/100g for glycine, 3.63 and 4.72g/100g for valine, 1.11 and 1.24g/100g for cystine, 0.78 and 0.64g/100g for methionine, 6.68 and 7.24g/100g for isoleucine, 5.24 and 6.04g/100g for leucine, 3.31 and 4.41g/100g for tyrosine, 4.03 and 4.48g/100g for phenylalanine, 5.20 and 5.78g/100g for lysine, 2.94 and 3.33g/100g for histidine, 1.01 and 0.76g/100g for tryptophan, and 7.74 and 7.06g/100g arginine for white and black coloured accessions respectively.

Fathima *et al.* (2010) also determined the amino acid profile of three accessions of *Mucuna pruriens*. The amino acids values (g/100g) are as follows for Saduragiri, Siruvani and Thallaianai accessions respectively: 14.11, 13.50 and 10.38 of glutamic acid, 2.98, 12.44 and 13.11 of aspartic acid, 4.40, 3.50 and 4.24 of Serine, 3.78, 4.12 and 3.56 of threonine, 2.80, 4.04 and 2.44 of proline, 4.24, 4.94 and 5.12 of alanine, 5.95, 4.44 and 4.90 of glycine, 3.90, 4.06 and 3.56 of valine, 0.54, 0.73 and 1.01 of cystine, 1.24, 0.68 and 0.74 of methionine, 5.94, 6.94 and 6.24 of isoleucine, 7.24, 6.30 and 5.94 of leucine, 4.94, 5.01 and 4.24 of tyrosine, 3.98, 3.44 and 4.01 of phenylalanine, 6.01, 5.68 and 6.61 of lysine, 4.44, 3.60 and 2.90 of histidine, 0.88, 0.92 and 0.56 of tryptophan, 5.06, 5.94 and 6.66 of arginine.

Gurumoorthi *et al*. (2013) reported various concentrations of amino Acids (g/100g protein) for *Mucuna pruriens* seed which include glutamic acid, aspartic acid (12.35), serine (5.1), threonine (4.8), proline (6.5), alanine (5.81), glycine (5.5), valine (6.35), cystine (0.5), methionine (1.28), isoleucine (4.5), leucine (6.96), tyrosine (2.9) phenylalanine (3.97), tryptophan (0.82), lysine (6.02), histidine (3.81) and arginine (4.7).

**Uses of *Mucuna pruriens* seed**

*Mucuna pruriens* seed and leaf have been used traditionally in various ways both as food, and also in pharmacology, medicine and agricultural practices. *Mucuna pruriens* have been majorly used for food, feed (forage and seeds) and environmental services (Chikagwa-malunga *et al.,* 2009)**.**

**Utilization as food:**

Although *Mucuna pruriens* has been used as food in a number of ways, there exists limited documented account of its use as food and in food formulations. Its utilization as food has been largely limited as a result of the fact that it contains some antinutritional factors (Ezegbe *et al*., 2023).

The use of *Mucuna pruriens* seed as food have been reported in Nigeria, Ghana, Malawi, Brazil, India and Philippines, Mozambique, Zambia, Sri Lanka and Indonesia as well as in Central America (Sathiyanarayanan and Arulmiozhi, 2007; Pugalenthi *et al*., 2005; Onweluzo and Eilitta, 2003; Jorge *et al.*, 2007). More and wider food uses have been identified in Africa and Asia. As documented by Adebowale and Lawal (2003). *Mucuna pruriens* seeds are consumed by some tribes (Igbo people) in south Eastern Nigeria as an accompaniment to main dishes or main dishes themselves (Onweluzo and Eilitta, 2003). Research has also shown promising potentials of the use of *Mucuna pruriens* seed in food products like *Mucuna* gums (Sridhar and Bhat, 2007).

In Africa, Asia, America and Pacific Islands, its pods are consumed as vegetables, while in India, the mature seeds are customarily eaten as food by the southern India hill tribe (the Kanikkars) after boiling repeatedly (Lampariello *et al.*, 2012). The green pods and mature seeds are boiled and eaten in Himayas and Mauritius (Lampariello *et al*., 2012).

In Nigeria, the seeds of *Mucuna pruriens* is used for soup thickening in rural areas of the southern region. It is cooked and the dark tough cover is removed before use (Achinewhu, 1982). It can also be toasted for 5 to 10 minutes, grinded and used in combination with other thickners in preparation of soups (Sridhar and Bhat, 2007). In Enugu State, Nigeria, *Mucuna pruriens* seeds are used to prepare porridge by repeatedly parboiling it three times in excess water and discarding the water after 30 minutes of each boiling cycle, after which additives like salt, pepper, onion and palm oil are added after the final parboiling cycle and continuously stir-cooked until the menu is thick (Onweluzo and Eilitta, 2003).

In Ghana, *Mucuna pruriens* seeds are consumed in small quantities (10 to 15 seeds per day) by using them in daily soup preparations in which they are boiled for a minimum of 40 minutes after which the water would be discarded, the seed coat removed and then finally ground into a fine paste (Onweluzo and Eilitta, 2003). In southern Ghana, *Mucuna cochinchinensis* and *Mucuna utilis* are pounded or cracked, boiled for about 40 minutes, drained, dehulled, grinded into paste, mixed with other additives (chillies, onions, meat, etc) to prepare soup which is consumed together with starchy foods (Sridhar and Bhat, 2007).

In south India, it is eaten by low-income persons after soaking overnight followed by long period of cooking (Onweluzo & Eilitta, 2003). In Northeast India, the seeds of premature or mature pods of *M. pruriens* are soaked in water, boiled or roasted and eaten in combination with salt or alone (Udedibie and Carlini, 1998).

In Java, Indonesia, it is largely used in the production of Tempeh; a fermented staple food (Onweluzo & Eilitta, 2003). In Central America, it is roasted and grinded to make coffee substitute and the bean is also cooked and eaten as vegetable (Sathiyanarayanan and Arulmiozhi, 2007). It has been tried out in the preparation of Mucuna gums for beef burgers wherein it significantly lowered shrinkage, improved stability and water holding capacity (Sridhar and Bhat, 2007).

**Utilization in Agriculture**

*Mucuna pruriens* has been documented to have high resistance to plant diseases, though it is susceptible to some plant pests and diseases (Pugalenthi *et al*., 2005). *Mucuna pruriens* suppresses weeds through overpowering them and also show some level of allelopathy (Pugalenthi *et al*., 2005). It has also been found effective for the control of some parasitic nematodes in plants (Pugalenthi *et al*., 2005; Appiah *et al*., 2015). Research has shown that *Mucuna pruriens*, a leguminous plant, exhibits remarkable nitrogen-fixing capabilities which has positioned it as a choice plant for improving the nitrogen level of soils with low nitrogen levels for cultivation purposes (Makhaye *et al*., 2021). *Mucuna pruriens* is used in soil nitrogen fixation in the range of 333-495 mg N/plant (Appiah *et al*., 2015). In intercropping systems involving maize and *Mucuna pruriens*, the fast-growing legume accumulates nutrient through nitrogen fixation and protects the soil from heavy rains in the wet season (Lorenzetti *et al*., 1998). Once ashed into a thick mulch, the *Mucuna pruriens* foliage protects the soil from erosion and prevents weed germination. *Mucuna pruriens* also has a positive effect on soil moisture (Lorenzetti *et al*., 1998). Vines and foliage can be used as pasture, hay or silage for ruminants, while pods and seeds can be ground into a meal and fed to both ruminants and monogastrics (Eilitta and Carsky, 2003). Pods with their seeds can be ground into a rich protein meal and can be fed to all classes of livestock, though in limited amounts in monogastrics (Chikagwa-Malunga *et al*., 2009).

**Utilization in Pharmacology and medicinal practices**

In terms of pharmacological properties, *Mucuna pruriens* seed extract has proven to be neuroprotective, anti-oxidative, anti-inflammatory, anti-hypertensive, anti-diabetic, anti-venom and anti-cancerous (Choowong-in *et al*., 2022)

*Mucuna pruriens* seed has been effectively used as an aphrodisiac; to increase libido in both men and women because of its dopamine content, increase testosterone and stimulate growth hormone (Pugalenthi *et al*., 2005; Amira *et al*., 2014). Furthermore, *M. pruriens* seed has been proven to improve semen quality and antioxidant enzymes in seminal plasma of infertile men (Choowong-in *et al*., 2022). In rodents, *M. pruriens* could reduce the damages of sperm DNA and testicular mitochondria (Choowong-in *et al*., 2022). It is otherwise known locally as Thai Mhamui in traditional Thai folk medicine and is used in treating erectile dysfunction (Choowong-in *et al*., 2022). The control of menstrual anomalies in women had been reported (Kavitha and Thangamani, 2014).

*Mucuna pruriens* possess anti-inflammatory, antispasmodic, analgesic, hypocholesterolemic and diuretic properties (Nwaoguikpe *et al.,* 2011). Kavitha and Thangamani, (2014) explored the use of *M. pruriens* in the control of constipation, ulcers, fever and tuberculosis. In India and West African countries, *Mucuna pruriens* seeds are traditionally used for the treatment of snakebites (Pugalenthi *et al*., 2005). *Mucuna pruriens* is one of the plants that have been shown to be active against snake venom and, indeed, its seeds are used in traditional medicine to prevent the toxic effects of snake bites, which are mainly triggered by potent toxins such as neurotoxins, cardiotoxins, cytotoxins, phospholipase A2 (PLA2), and proteases (Guerranti *et al.,* 2008). The mechanisms of the protective effects exerted by *M. pruriens* seed aqueous extract were investigated in detail in a study involving the effects of *Echis carinatus* venom (Guerranti *et al.,* 2008). *In vivo* experiments on mice showed that protection against the poison is evident at 24 h (short term) and 1 month (long term) after injection of *M. pruriens* seed aqueous extract (Guerranti *et al.,* 2008). *M. pruriens* seed aqueous extract protects mice against the toxic effects of *Echis carinatus* venom through an immune mechanism. *M. pruriens* seed aqueous extract contains an immunogenic component, a multiform glycoprotein, which stimulates the production of antibodies that cross-react with (bind to) certain venom proteins (Mukesh *et al.,* 2017).

*M. pruriens* seeds can be used at a dose of 500 mg/kg to reduce plasma glucose level (Suresh *et al.,* 2013). These and other data demonstrated that the amount of seeds necessary to obtain a significant antidiabetic effect contain a total of approximately 7 mg of d-chiro-inositol (Suresh et al., 2013). The antidiabetic properties of *M. pruriens* seed ethanol/water 1:1 extract are most likely due to d-chiro-inositol and its galacto derivatives. The seed extract of *M. pruriens* at doses of 100 and 200 mg/kg body weight reduced oral glucose load from 127 to

75 mg after 2 h of oral administration. In another experiment, there was reduction of blood glucose from 250 to 90 mg in streptozotocin diabetic rats after 21 days. The investigation suggested that the antidiabetic activity may be due to its dietary fiber content (Mukesh *et al.,* 2017).

*Mucuna pruriens* seeds are effective in the management of Parkinson disease (Natarajan *et al.*, 2012). The seed powder of *Mucuna pruriens* has been reported to be more beneficial to Parkinson's patients than the synthetic drug when it is used for long term (Mukesh *et al.,* 2017). An n-propanol extract of *M. pruriens* seeds yields the highest response in neuroprotective testing involving the growth and survival of DA neurons in culture (Mukesh *et al*., 2017). Interestingly, n-propanol extracts, which contain a negligible amount of L-DOPA have shown significant neuroprotective activity, suggesting that a whole extract of *M. pruriens* seeds could be superior to pure L-DOPA with regard to the treatment of Parkinsonism (Mukesh *et al.,* 2017). The dopamine content in brain tissue is reduced when the conversion of Tyrosine to L-DOPA is blocked. L-DOPA, the precursor of dopamine, can cross the blood-brain barrier and undergo conversion to dopamine, restoring neurotransmission (Liu *et al.,* 2016).

Extracts from *Mucuna pruriens* have shown to be effective in inhibiting microbial proliferation (Kumar *et al.,* 2009). Antimicrobials of plant origin have enormous therapeutic potential. Phytochemical compounds are reportedly responsible for the antimicrobial properties of certain plants (Ogundare and Olorunfemi, 2007). Crude methanol extract of *M. pruriens* leaves have been shown to have mild activity against some bacteria, probably due to the presence of phenols and tannins (Ogundare and Olorunfemi, 2007). The methanol extract of *M. pruriens* leaves is mainly effective against *Escherichia coli, Salmonella typhi, Bacillus subtilis,* and *Shigella dysenteriae.* The antimicrobial potency, evaluated by zone of inhibition where *E. coli* showed higher zone of inhibition (2.8 cm) than *B. subtilis* zone of inhibition (2.1 cm) (Kumar *et al.,* 2009).
The roots are used in traditional medicine to manage ulcers, nephropathy, constipation strangury, elephantiasis and dropsy (Natarajan *et al*., 2012). The leaves are also used in the control of ulcers, inflammation and helminthiasis as well as blood tonic (Natarajan *et al.,* 2012).

## Conclusion

*Mucuna pruriens* is a legume with good nutritional composition and has great applications in the pharmaceutical industry, but underutilized as food and in food formulations due to dearth of information regarding its food applications. The detailed review of the botany, proximate composition, amino acid profile and uses of *Mucuna pruriens* provides valuable insights into the nutritional and food applications of this valuable plant. The comprehensive examination of its crude fibre, ash, lipids, proteins, and carbohydrates allows us to appreciate the richness of *Mucuna pruriens* as a potential dietary supplement. *Mucuna pruriens* holds promise as a source of essential nutrients, including proteins with a favorable amino acid profile. The relatively low lipid content may also be of interest to those seeking plant-based dietary options. Furthermore, understanding the carbohydrate and crude fibre composition contributes to the broader understanding of its potential role in managing blood sugar levels. The unique composition of *Mucuna pruriens* offers promising insight for applications in sustainable agriculture, medicine, and nutrition and overall well-being. More research and documentations regarding its utilization in food systems are required as broader research and exploration hold the key to unlocking the full range of benefits offered by this remarkable plant.

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