

Pharmacological Activities of *Vigna Unguiculata (L) Walp.* A Review

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ABSTRACT

Vigna Unguiculata (L) Walp belongs to the family Fabaceae. Which is commonly known as Cow pea. It mainly distributed in India, Central America, China and Africa. *Vigna Unguiculata (L) Walp* has been of keen interest in phytochemical and Ayurvedic research due to its excellent medicinal values. In the present review an attempt has been made gather the information related to phytochemical compositions, nutrient composition and Pharmacological uses. Traditionally it is used to strengthen the stomach and destroy the worms in stomach. They exhibits antioxidant and free radical scavenging activities. They also exhibits Antibacterial activity against both the Gram positive and Gram negative organisms. Useful in jaundice, menstrual disorders, epilepsy, anorexia, constipation. This paper reports on its Pharmacological activities like Anthelmintic, Antibacterial, Antioxidant, Antinociceptive and Antidiabetic activities. This review is in a narrative format and consists of publications pertinent to *Vigna Unguiculata (L) Walp* available in public domain.

Keywords: *Vigna Unguiculata (L) Walp*, taxonomy, morphology, chemical constituents, pharmacological activities.

INTRODUCTION

The Health Organization reported that 80% of the world population relies chiefly on traditional medicines involving the use of plant extracts or their active constituents. India with its mega-biodiversity and knowledge of rich ancient traditional systems of medicine (Ayurveda, Siddha, Unani, Amchi and local health traditions) provide a strong base for the utilization of a large number of plants in general healthcare and alleviation of common ailments of the people.¹

Vigna Unguiculata (L) Walp which is most commonly called as "cow pea" is an edible legume of the family Fabaceae with high protein contents. It is one of the ancient crop known to man. It is cultivated around primary for seed, but also as a vegetable, cover crop and fodder. It is widely grown all over the world though it is perceived to have originated from Africa.² It is a major staple food crop in sub-Saharan Africa, especially in the dry savanna regions of West Africa & Brazil.^{3, 4} Nigeria is one of the world prime producers of Cowpea.⁵ The seeds & leaves are a major source of plant proteins and vitamins for man, feed for animals. The little leaves and immature pods are eaten as vegetables. It forms part of the human diet due to it has high amount of carbohydrates (56-67%), protein (20.5-31.7%), fibre (4%) and fats (1.14-3.03%) that can fulfill the human essential

nutritive necessities when complemented with cereals.^{6, 7}

Some health benefits of cowpea include, toning the spleen, stomach and pancreas helps induce urination and relieves damp conditions like leucorrhoea. Cowpea is rich in potassium with good amount of calcium, magnesium and phosphorus. It also has small amount of iron, sodium, zinc, copper, manganese and selenium. Cowpea is rich in vitamin A & C and also has appreciable amount of thiamin, riboflavin, niacin, vitamin B6 and pantothenic acid as well as small amount of foliate. Cowpea shoots and leaves are rich sources of calcium, phosphorous and Vitamin B.⁸ These nutrients provided by cowpea makes it extremely valuable especially where many people cannot afford animal proteins such as meat and fish. We can evaluate nutritional composition and functional properties of some recombinant inherited lines of Cowpea to establish potential usage.^{9, 10}

Cowpea plant is good for fixing atmospheric nitrogen for increasing soil organic matter content and improving soil structure after soil incorporation useful to increase phosphorus availability in the soil. Good tolerates heat and drought, moderate shade, and low fertility soils. Cowpea can be used for the production of high quality food when mixed with crops such as corn or it can be used for rotational grazing. The

seeds of cowpea are major source of protein and other nutrients. It is cultured for its undeveloped pods and full-grown seeds and is eaten by people all around the world, especially in the developing nations.^{11, 12} Its amino acid complements those of cereals, while mineral contents: calcium and iron are higher than that of meat, fish and egg and the iron content equates that of milk; the vitamins- thiamin, riboflavin, niacin (water soluble) and their levels compare with that found in lean meat and fish which make them.

Many researchers have showed that daily consumption of 100–135gm of dry beans reduces serum cholesterol level by 20% thereby, reducing the risk for coronary heart diseases by 40%. Besides its health related benefits, beans are inexpensive, considerably cheaper and due to their physicochemical and functional attributes, legume starches can be used as nutritional ingredients in the same way as starches from cereals and tubers. Medicinally it has been used as astringent, appetizer, laxative, aphrodisiac, diuretic, anti-hyperglycemic, antinociceptive, galactagogue, liver tonic. They exhibit antioxidant and free radical scavenging activities. They also exhibit Antibacterial activity against both the Gram positive and Gram negative organisms. Useful in jaundice, menstrual disorders, epilepsy, anorexia, constipation.¹³

Taxonomical classification

Kingdom: Plantae
 Division: Angiosperm
 Class: Eudicots
 Subclass: Rosids
 Order: Fabales
 Family: Fabaceae
 Genus: Vigna
 Species: Unguiculata



Fig. 1: *Vigna Unguiculata* (L) Walp

Synonyms^{14, 15}

English: Cowpea
 Hindi: Lobia, Kulathi, Kurathi
 Sanskrit: Mahamasah, Rajamasah
 Tamil: kaattulundu, karamani
 Marathi: Alasunda
 Telugu: Alasandalu, Kaaramanulu
 Kannada: Alasande
 Malayalam: Vellapayar
 Urdu: Kulthi
 Tulu: Lattane

Distribution: India, Central America, China and Africa. In India mostly cultivated, in Uttar Pradesh, Chotanagpur, Assam and in southern states of Tamil Nadu, Karnataka, Andhra Pradesh.

Plant Morphology: Herbaceous annual with twining stems varying in erectness and bushiness. Leaves trifoliate, petioles 2.5 to 12.5 cm long. Central leaflet hastate, 2.5 to 12 cm long, smooth, lateral leaflets irregular. Flowers in axillary racemes on stalks 15 to 30 cm long. Pod pendulous, smooth, 10 to 23 cm long with a thick curved beak and 10- to 15-seeded. Seeds 4 to 8 mm long, 3 to 4 mm broad, variable in size and colour.

Chemical constituents: Generally plant contains Carbohydrates (56-67%), Proteins (20.5-31.7%), Fats (1.14-3.03%) vitamins, minerals, soluble and insoluble dietary fibers with varying amount of glycosides, alkaloids, flavonoids, tannins, polyphenols, saponins, vignalin, the aglycone part of which belongs to the oleanane series of triterpenoids identified as soyasapogenol B. Besides saponin cycloartenol, stigmasterol, oleanolic acid acetate and sitosterol β -D-glycosides.¹⁶

Medicinal Uses

The seeds are edible and used as the source of dietary protein. They also used to strengthen the stomach and destroy the worms in stomach. The plant is used in measles, smallpox, adenitis, burns and sores. Decoction or soup is used in affection of the liver and spleen, intestinal colic, in leucorrhoea and menstrual disorder, urinary discharges. It is used as astringent, appetizer, Antipyretic, Diuretic, laxative, aphrodisiac, diuretic, anti-hyperglycemic, antinociceptive, galactagogue and liver tonic. It exhibits thrombolytic, antisickling, antioxidant and free radical scavenging activities. Also exhibits Antibacterial activity against both the Gram

positive and Gram negative organisms. Useful in jaundice, epilepsy, anorexia, constipation. Globulin fraction of the seed showed hypolipidaemic effects in rats. Ayurvedic pharmacopoeia of India recommends the

PHARMACOLOGICAL STUDIES

Anthelmintic activity

Vigna Unguiculata (L) Walp. seeds are coarse powdered and exhaustively with hot solvent (Soxhlet) extraction by ethanol and maceration with chloroform water I.P. Five concentration (10-100 mg/ml) of ethanolic and aqueous extracts were studied for anthelmintic activity by using *Edriluseuginiae* earthworms. Both aqueous and ethanolic extracts showed paralysis and death of worms in concentration (10-100mg/ml) dependent manner. Alcoholic extract of *Vigna Unguiculata (L) Walp* showed significant activity than aqueous extract. Piperazine citrate (10mg/ml) and distilled water were included in the assay as standard drug and control respectively. The result showed seeds of *Vigna Unguiculata (L) Walp* possessed potential anthelmintic activity.¹⁸

Antibacterial activity

Aqueous and ethanolic extracts of seeds of *Vigna Unguiculata (L) Walp* were studied for antibacterial activity and was tested against Gram positive bacteria, *Bacillus subtilis* and Gram negative bacteria, *Escherichia coli* by agar well diffusion method. Different concentrations (100 µg/ml, 200 µg/ml and 300 µg/ml) of the extracts were incorporated into the wells. Both the extracts showed concentration dependent activity against the microorganisms investigated. The results showed the highest positive antibacterial activity with an inhibition diameter of 22 mm in case of aqueous extract of 300 µg/ml concentration, against the Gram negative bacteria; *Escherichia coli*. The *E.coli* species were found to be more sensitive than that of the *Bacillus subtilis*. The aqueous extract exhibited more antibacterial activity against both the Gram positive and Gram negative organisms than that of the ethanolic extract.¹⁹

Antioxidant activity

In screening of antioxidant activity of the methanolic extracts of cowpea (*Vigna unguiculata (L) Walp.*) seeds. Phenolic compounds present in the extracts showed the antioxidant and antiradical properties when investigated using a linoleic acid peroxidation model, FRAP, ORAC and TRAP assays, as well

decoction of dry seeds in calculus and amenorrhoea. Presence of vitamin A in the green pods makes them a valuable diet for children. Green leaves may be used in vitamin C deficiency.¹⁷

as DPPH, hydroxyl, nitric oxide and superoxide radical scavenging activity. The HPLC analysis of the cowpea extracts showed the presence of neochlorogenic acid, chlorogenic acid and caffeic acids. The results indicated that methanolic extract of the cowpea resembled in the aforementioned activities those from other leguminous seeds and pulses.²⁰

Antinociceptive activity

Antinociceptive activity was examined through the observation of decrease in abdominal constrictions in intraperitoneally administered acetic acid-induced pain model in mice. Administration of methanol extract of beans results in dose dependent and significant decreases in blood glucose levels in glucose-loaded mice. The tests for antinociceptive activity results, that the methanolic extract decreases the number of abdominal constrictions by 30.0, 33.3, 36.7, and 43.3%, respectively in all above four doses. This study concluded that the beans can be a good source for alleviating pain and for lowering blood sugar in diabetic patients.²¹

Antimicrobial activity

The antimicrobial activity of *Vigna unguiculata (L)Walp* seed oil was investigated against five Gram positive bacteria (*Bacillus megaterium*, *Bacillus subtilis*, *Sarcinalutea*, *Salmonellatyphi* and *Staphylococcus aureus*) and four Gram negative (*Escherichia coli*, *Shigelladysenteriae*, *Shigellasonnei*, *Shigellashiga*) and four fungi (*Penicillium spp.*, *Mucor spp.*, *Candida albicans* and *Aspergillusfumigatus*). Oil at the concentration of 400 µg/disc showed the highest activity against *Sarcinalutea* (19±0.1 mm) and *Staphylococcus aureus* (16±0.1 mm). Oil is active against the three tested fungi namely *Penicillium spp.*, *Mucor spp.* and *Candida albicans* but showed no sensitivity against *Aspergillusfumigatus*.²²

Antidiabetic activity

The seed oil of *Vigna Unguiculata (L) Walp* was investigated for its anti-diabetic activity against alloxan monohydrate induced diabetes in rats. Levels of blood glucose, TC, TGs, LDL, ALT, AST and ALP decreased and HDL increased in

alloxan induced diabetic rats after treatment with 200 mg/kg barbati seed oil for 21 days. The study reported that the seed oil of cow pea may be very useful for the improvement of the complications of diabetes.²³

Hypocholesterolemic activity

The seeds of *Vigna Unguiculata (L) Walp* was investigated for its Hypocholesterolemic activity in Wistar rats. Rats were grouped and fed a high fat diet with 20% Bombay (BO), 20% MI 35 (MI), 20% Cowpea extract, 20% Dawala (DA) in comparison with 20% casein (HFD). Serum total cholesterol, non-HDL cholesterol, triacylglyceride and glucose concentrations were analyzed. Serum lipids and glucose concentrations in cowpea fed rats were significantly lower ($P < 0.05$) than HFD. Therefore, raw cowpea produced significant hypolipidemic and hypoglycemic effects in Wistar rats.²⁴

Antiviral and antifungal activity

The *vigna unguiculata (L) Walp* seeds were examined for the presence of various proteins and amino acids with antiviral and antifungal potency. The two proteins, designated α - and β -antifungal proteins according to their elution order from the CM-Sepharose column, were capable of inhibiting human immunodeficiency virus (HIV) reverse transcriptase and one of the glycohydrolases associated with HIV infection, α -glucosidase, but β -glucuronidase was not repressed. The ability of the proteins was also demonstrated in order to retarding mycelial growth of a variety of fungi, and α -antifungal protein being proved more potent in most cases. β -Antifungal protein was highly active in only one instance. Both antifungal proteins had low cell-free translation-inhibitory activity.²⁵

Antisickling activity

Natural plant products have been used in Nigerian folk medicine in the management of sickle cell anemia by inhibiting sickling. This work was therefore aimed at investigating the Antisickling potential of the ethanol seed extract of *Vigna unguiculata* used in the Nigerian herbal medicine with a view of proposing an effective herbal recipe for the management of sickle cell disease. Sickling inhibition test, sickling reversal test and polymerization test were carried out using standard methods. The results of the antisickling test showed that *Vigna unguiculata* had significantly ($p < 0.05$) higher antisickling effect than Hbss control. The result of the

polymerization showed that, extracts significantly ($p < 0.05$) increased delayed time before polymerization at 50, 25 and 12% concentrations compared to the control. From the results, the extracts *Vigna Unguiculata* have shown to be therapeutically beneficial in the management of sickle cell disease and thus it is strongly recommended by this study to be developed into supplements for the management of sickle cell disease.²⁶

Thrombolytic activity

Inquisition with methanolic extract of *Vigna unguiculata (L) Walp* (seeds) was carried out to determine the thrombolytic potential of this plant. Five different concentration (2mg/ml, 4mg/ml, 6mg/ml, 8mg/ml, and 10mg/ml) of methanolic extract was used to evaluate thrombolytic activity. In-vitro Thrombolytic model was used. The plant showed significant clot lysis, i.e. concentrations 12.01 ± 1.50 , 16.48 ± 2.31 , 24.88 ± 1.49 , 31.24 ± 0.68 , 40.33 ± 3.64 at 2mg/dl, 4mg/ml, 6mg/ml, 8mg/ml, 10mg/ml respectively, while the standard (streptokinase) and negative control (distilled water) showed 58.41 ± 3.71 and $2.56 \pm 1.23\%$ clot lysis respectively. It is clear that *Vigna unguiculata (L) Walp* (seed) methanolic extract showed thrombolytic activity significantly while comparing with standard.²⁷

CONCLUSION

Medicinal plants have the ability to synthesize a wide variety of chemical compounds that are used to perform important biological functions. The above plant contains enormous phytochemical constituents. The extensive survey of literature revealed that *Vigna Unguiculata (L) Walp*, is an important medicinal plant with diverse pharmacological spectrum. The pharmacological studies reported in this review confirm the therapeutic value of *Vigna Unguiculata (L) Walp*. The plant possesses various activities such as anthelmintic, antibacterial, antioxidant, free radical scavenging, antinociceptive, antimicrobial, antidiabetic, hypocholesterolemic, antiviral, antifungal, antisickling and thrombolytic activity. Hence, this plant provides a significant role in the prevention and treatment of a disease.

REFERENCES

1. Pandey MM, Rastogi S, Rawat AK; Indian herbal drug for general healthcare: An overview. Internet J Altern Med. 2008; 6:1.

2. Nweke, K. World literature on cowpea (*Vigna unguiculata* (L.) Walp). Annals of Library Science and Documentation. 1988; 35(1): 26-31.
3. Asare A T, Agbemafle R., Adukpo G E., Diabor E., Adamtey K A. Assessment of functional properties and nutritional composition of some cowpea (*Vigna unguiculata* (L.) Walp) genotypes in Ghana. Journal of Agricultural and Biological Science. 2013; 8(6): 465-469.
4. Archana, V, Jawali N. Genetic variation and relatedness in *Vigna unguiculata* revealed by microsatellites. Barc Newsletter. 2007; 285: 190.
5. Ogunlade I, Ogunleye R T, Osasona I. Chemical Composition, Antioxidant Capacity and Total Phenolic Content of the Flours Obtained from Cow Pea (*Vigna unguiculata*) Varieties Commonly Consumed in Nigeria. 2014; 5.
6. Bejarano A, Ramírez-Bahena M H, Velázquez E, Peix A. *Vigna unguiculata* is nodulated in Spain by endosymbionts of Genisteeae legumes and by a new symbiovar (vignae) of the genus Bradyrhizobium. Systematic and Applied Microbiology. 2014; 37(7): 533-540.
7. Segura-Campos M R, Chel-Guerrero L A, Betancur-Ancona D A. Purification of angiotensin-I converting enzyme inhibitory peptides from a cowpea (*Vigna unguiculata*) enzymatic hydrolysate. Process Biochemistry. 2011; 46(4): 864-872.
8. Agugo U A, Okere T O, Anya K M. Investigating the nutrient composition and anti-nutritional factors of Akidi (*Vigna unguiculata*), IOSR. 2013; 5(4): 3235.
9. Khusniyati E, Sari A A, Yueniwati Y, Noorhamdani N, Nurseta T, Keman K. The effects of *Vigna unguiculata* on cardiac oxidative stress and aorta estrogen receptor- β expression of ovariectomized rats. Asian Pacific Journal of Reproduction. 2014; 3(4): 263-267.
10. Fall L, Diouf D, Fall M A, Badiane F A, Gueye M. Genetic diversity in cowpea [*Vigna unguiculata* (L.) Walp.] Varieties determined by ARA and RAPD techniques. African Journal of Biotechnology. 2003; 2(2): 48-50.
11. Murillo-Amador B, Troyo-Diequez E, García-Hernández J L, Lopez-Aguilar R, Avila-Serrano N Y, Zamora-Salgado S, Kaya C. Effect of NaCl salinity in the genotypic variation of cowpea (*Vigna unguiculata*) during early vegetative growth. Scientia Horticulturae. 2006; 108(4): 423-431.
12. Singh M, Singh A, Singh S, Tripathi R S, Singh A K, Patra D D. Cowpea (*Vigna unguiculata* L. Walp.) as a green manure to improve the productivity of a menthol mint (*Mentha arvensis* L.) intercropping system. Industrial Crops and Products. 2010; 31(2): 289-293.
13. Perumal Siddhuraju, Klaus Becker. The antioxidant and free radical scavenging activities of processed *Vigna Unguiculata* (L) Walp seed extracts. Food Chem. 2007; 101(1): 10-9.
14. <http://plants.usda.gov/core/profile?symbol=VIUN>
15. Singh A, Dwivedi B, Raghaw P, Singh R, Pant P, Padhi MM. Review on Standardization and Phytochemical of *Vigna unguiculata*. IJPRS, 2015; 4(2): 506-516.
16. Onwuliri VA, Obu JA. Lipids and other constituents of *Vigna unguiculata* and *Phaseolus vulgaris* grown in northern Nigeria. Food Chem. 2002; 78(1): 1-7.
17. Khare CP. Indian Medicinal Plants: An Illustrated Dictionary. Springer Science and Business Media. 2008; 222-223.
18. Maisale AB, Patil MB, Jalalpure SS, Attimarad SL. Phytochemical properties and Anthelmintic activity of *Vigna Unguiculata*. J Pharm Sci Innovat. 2012; 1(2): 51-2.
19. Doppalapudi Sandeep. Evaluation of Antibacterial activity of seed extract of *Vigna Unguiculata*. Int J Pharm Pharm Sci. 2014; 6(1): 75-7.
20. Muhammad Zia-Ul-Haq, Shakeel Ahmad, Ryszard Amarowicz, Vincenzo De Feo; Antioxidant Activity of the Extracts of Some Cowpea (*Vigna unguiculata* (L) Walp.) Cultivars Commonly Consumed in Pakistan. Molecules 2013 5; 18(2): 2005-17.
21. Tazin TQ, Rumi JF, Rahman S, Al-Nahain A, Jahan R, Rahmatullah M. Oral glucose tolerance and antinociceptive activity evaluation of methanolic extract of *Vigna unguiculata*. World journal of pharmacy and pharmaceutical sciences, 2014; 3(8): 28-37.

22. Mohammad Ashraduzzaman, Mohammad AshrafAlam, ShahanzKhatun, NurulAbsar. Antimicrobial activity of *Vigna Unguiculata (L) Walp.* International J of Biotechnology for Wellness Industries.2016; 5(3):70-75.
23. Ashraduzzaman MD, Alam MA, Khatun S, Banu S, Absar N. *Vigna unguiculata* Linn. Walp. Seed oil exhibiting antidiabetic effects in alloxan induced diabetic rats. Malaysian journal of pharmaceutical sciences, 2011; 9(1): 13-23.
24. Pabodha Weththasinghe, Ruvini Liyanage, Janak Vidanarachchi, Oshini Perera, Barana Jayawardana. Hypocholesteolemic and Hypoglycemic effect of Cowpea (*Vigna Unguiculata (L) Walp*) incorporated experimental diets in Wistar rats (*Rattus Norvegicus*). Agriculture and Agricultural Science Procedia. 2014; 2: 401-405.
25. Ye XY, Wang HX, Ng TB. Structurally dissimilar proteins with antiviral and antifungal potency from cowpea (*vigna unguiculata*) seeds. Life Sci, 2000; 67(26): 3199– 3207.
26. Egba I S, Emmanuel N T, Ogugua N V, Ndohnui N N. Antisickling potential of the ethanol seed extracts of *Vigna Unguiculata* and *Vigna Subterranean*. International Journal of Biochemistry and Biotechnology ISSN: 2169-3048. 2012; 1(9): 226-229.
27. Md. Saddam Hussain, Mohammad Salim Hossain, Mohammad Tohidul Amin, Md. Shalahuddin Millat. In vito thrombolytic potential of methanolic extract of *Vigna unguiculata Linn* (seed). Journal of Pharmacognosy and Phytochemistry. 2016; 5(3): 129-131.