

A Review on *Manihot Esculenta* Species

Lavi Jain¹, Kaustubh Tripathi², Surya Prakash DV^{3,*}

Abstract

Manihot esculenta, which is commonly known as Cassava, is a woody shrub that provides a high source of carbohydrate. It is an annual crop native to tropical and subtropical regions of the world. Nigeria is the largest producer of the cassava plant. The parts of the plant like leaves, roots, stems, etc are consumed in a variety of ways as they have been shown to possess activities like analgesic, anti-inflammatory, anti-helmentic, anti-diabetic, antipyretic, hepatoprotective, relaxing, antimutagenic, and anti-cancer. Calories, proteins, fats, carbohydrates, phosphorus, iron, vitamin B, vitamin C, and starch are among the nutrients found in the plant. The leaves contain vitamin A, vitamin B1, calcium, iron, phosphorus, fat, starch, calories, and proteins. The stem also consists of enzymes, calcium oxalate, tannins and peroxidase. The cassava plant is also rich in saponin, flavonoid, alkaloids, and other phytochemicals. In many regions of the world, it is widely considered a medicinal plant. The extracts of leaves show a promising antidiarrheal activity. It is also used for the treatment of many infectious diseases. The roots of cassava are eaten raw, boiled, and even used as an alternative to wheat flour in the processes of baking. The pesticidal activity of *Manihot esculenta* has also been determined and the results suggested that the plant also has pesticidal activity. The leaves act as a natural remedy and the extract helps in skincare and healing. It is also an excellent wound healing remedy as it contributes to wound repair, cell replacement, bone health, memory enhancement, and the body's metabolic function.

Keywords: *Manihot esculenta*, saponin, flavonoid, antioxidant, anticancer

INTRODUCTION

Cassava is the common name for *Manihot esculenta*, a woody shrub. It comes under the Euphorbiaceae family. It is considered a highly rich source of carbohydrates after Rice and Maize. Cassava is an annual crop cultivated in tropical and subtropical regions, it is cultivated majorly for its starchy edible tuberous roots. Cassava is largely produced in Nigeria making Nigeria its largest producer [1]. The cassava plant is 1.5 meters to 3 meters in height. It possesses smooth and alternate leaves, the plant contains calories, proteins, fats, carbohydrates, phosphorus, iron, vitamin B, vitamin C, and starch, among other nutrients. Vitamin A, Vitamin B1, calcium, iron, phosphorus, fat, starch, calories, and proteins are all found in the leaves. Tannins, enzymes, peroxidase, and calcium oxalate

*Author for Correspondence

Surya Prakash

^{1,2}B.Tech Student, Department of Biotechnology, Meerut Institute of Engineering and Technology (MIET), Meerut, Uttar Pradesh, India

³Assistant Professor, Department of Biotechnology, Meerut Institute of Engineering and Technology (MIET), Meerut, Uttar Pradesh, India

Received Date: June 08, 2021

Accepted Date: July 29, 2021

Published Date: August 20, 2021

Citation: Lavi Jain, Kaustubh Tripathi, Surya Prakash DV. A Review on *Manihot Esculenta* Species. Research & Reviews: Journal of Botany. 2021; 10(2): 6–10p.

are also contained in the stem. Cassava is a basic dietary source in many parts of the world. Its roots are eaten raw, boiled, or processed to produce a wide variety of granules, paste, flour, etc. The leaves are also consumed directly. The roots of cassava are also used as an alternative to wheat flour for baking. Steroids, vitamin C, vitamin A, anthocyanins (flavonoids), saponins, α -carotene, and glycosides are all antioxidant compounds contained in the plant [2]. Several saponin- and flavonoid-containing plants have been shown to have analgesic, anti-inflammatory, antipyretic, and antimicrobial properties in previous studies. Apart from the plant's nutritional benefits, the leaves of the plant, seed oil, and peels of the tuber have been

stated to show medicinal properties against a variety of animal and human ailments caused by microbes [3]. Cassava leaves, which are eaten as a vegetable in some Asian and African countries, have recently been discovered to be analgesic, antimicrobial, and antioxidant agents in vivo. *M. esculenta* aqueous leaf extracts have good in vitro antifungal efficacy against *B. theobromae* and *A. niger*, according to a report by John M. Ehiobu and Gideon I. Ogu published in 2018. The antifungal activity was comparable to a reference chemotherapeutic agent, called Camabez. The properties showing antifungal activities of the extracts were linked to flavonoids, saponins, and tannins, which were present in comparatively high concentrations in the plant extracts. Plant-based phytomedicines have shown great promise in the treatment of difficult-to-treat infectious diseases [4]. From both the drug development and Phytomedicine perspectives, the potential for developing antimicrobials into medicine appears to be promising. A recent study proposed by Amaza I. B 2021 showed that Cassava peels can be used in livestock feed as a source of magnesium and iron. Anti-nutrient values were all below the threshold of lethal levels, indicating that they were safe for animal consumption. According to research, micro-propagated plants contain a variety of phytochemicals as well as bioactive compounds. These bioactive compounds are most commonly used to treat inflammation, cancer, oxidative stress, and microbial infection, among other diseases. As a result of micropropagation, a large number of bioactive compounds will be formed. Furthermore, important antioxidant and cytotoxicity activity findings were recorded by V. Chinnadurai, et al. 2019.

Phytochemicals

Plants generate biochemicals as a result of their primary or secondary metabolism, these are known as phytochemicals. Phytochemicals usually have biological activity in the plant host and help the plant grow or defend itself against pests, diseases, or rivals. Cassava contains various phytochemicals like alkaloids, flavonoids [5], triterpenoids, tannins, cardiac glycosides, anthraquinone, phlorotannins, saponins, and anthrocyanosides. These phytochemicals are shown in Table 1.

Table 1. Phytochemicals of *Manihot esculenta*

S.N.	Part of Cassava Plant	Phytochemicals Present
1.	Roots	Phenols, Glycosides, Tannins, Alkaloids, Flavonoids, Steroids.
2.	Peels	Tannins, Saponins, Phytate, Alkaloids, Oxalate, Hydrogen Cyanide, Trypsin inhibitor.
3.	Leaves	Tannins, Alkaloids, Flavonoids, Phenols, Saponins, Cardiac glycosides, Steroids

Medicinal Uses

Cassava is observed to be poisonous in nature due to the presence of cyanogenic glycosides. This compound is responsible for the formation of cyanide which is harmful for consumption by the human body. To avoid acute toxicity the recommended consumable safety levels of cyanide should be less than 10 mg/kg dry matter. Even though cassava possesses harmful compounds, it also has been observed to show significant medicinal uses worldwide. The ethanolic extract of Cassava leaves has important antidiarrheal efficacy, as it reduces intestinal fluid retention and gastrointestinal motility [6]. These may be linked to the antidiarrheal properties of different phytoconstituents found in the leaves. In research by Abuh et al. 2020, Biochemical indicators have improved as a result of increasing the content of *Manihot esculenta* cyanide extract. Some biochemical indicators, such as ALT, AST, and ALP activity, which is related with hepatic necrosis in rats, were greater in the groups that received *M. esculenta* cyanide extract compared to the control group, suggesting a change in hepatic functioning. Plants' medicinal and pharmacological actions often necessitate secondary metabolites [7]. Both Cassava extracts include secondary metabolites such as alkaloids, flavonoids, tannins, hormones, and triterpenoids. Alkaloids are naturally produced nitrogen-containing chemical molecules having antibacterial activity. Flavonoids and tannins are antioxidant phenolic chemicals with anti-inflammatory, anticarcinogenic, and anti-mutagenic properties. Triterpenoids have shown antipyretic, hepatoprotective, relaxing, and anti-diabetic properties [8]. M. Thiagarajan and M.

Suriyavathana 2010 in their study proposed that plant-based phytomedicines have demonstrated considerable potential in the prevention of difficult-to-treat infectious diseases. From both the drug discovery and Phytomedicine perspectives, the scope for developing antimicrobials into medicine seems to be promising. The findings showed that the plant extract can be proposed as a viable antibacterial agent against dangerous bacterial strains. Cassava extract can be advised in the future to maximize its strong antimicrobial activity against dreadful microbial infections because it has a very successful and promising outcome against microbial infections.

Other Uses

Cassava is a major crop in many countries. It has found its way to be useful in many forms. Cassava flour is mostly used to produce porridge by boiling it with water. Meal, cookies, desserts, and drinks are among the products that can be made from either sweet or bitter cassava roots. Cassava leaves are usually cooked to produce a dark green vegetable similar to spinach that can be seasoned with a variety of spices. Rheumatism, headaches, ulcers, cold medications, diarrhea, larvae, and increased resilience may all be treated with cassava leaves [9]. It's also used as a natural remedy that you can drink straight from a bottle of water. Roots are refined into several granules, pastes, flours, and other items, or eaten raw or boiled. Proteins and vitamins A and B are contained in the leaves, which are often eaten as green vegetables. Apart from the plant's nutritious advantages, plant leaves, seed oil, and peels of tuber have been stated to have shown medicinal properties against a variety of human and animal illnesses caused by microbes [10]. Cassava peels hold the essential to delivering a readily available and nutritious supply of food for domestic animals, due to new developments for drying, grating, and storing those.

Pharmacological Activity

The interaction of drugs with proteins, enzymes, receptors, nucleic acids, and bio membranes determines their pharmacological activity. Cassava leaves, which are eaten as a vegetable in some Asian and African countries, have recently been discovered to be analgesic, antimicrobial, and antioxidant agents in vivo. The various cassava plant parts also possess different pharmacological activities. These are the following-

Antioxidant Activity

Natural antioxidants, also known as phytochemical antioxidants, such as phenolic, flavonoid, anthocyanin, and carotenoid, present in cassava plants. It shows a variety of functions that help avoid tuber degradation and prolong shelf life [11]. Antioxidants properties of cassava plants were not only deduced from the flesh but also the peel of the cassava root. The cassava plant is presumably capable of counteracting the effects of oxidants (free radicals), meaning that the leaves can influence the inflammatory process, which also involves free radicals in its pathophysiology.

Antidiarrheal Activity

According to different studies tannins, polyphenols, reducing sugars, saponins have shown antidiarrheal activities. Polyphenols have antidiarrheal properties due to their ability to interact with and inhibit the cytochrome P450 system [12].

Anti-Inflammatory Activity

Cassava leaves consist of high phytochemical constituents such as saponins and flavonoids that help in various diseases such as rheumatism, fever, headache, diarrhea, haemorrhoid, inflammatory activity [13]. Flavonoid fraction and volatile flavonoid compounds of cassava plants are believed to have anti-inflammatory properties.

Cytotoxicity Activity

Toxins are found in cassava leaves such as acetone, hydrocyanic acid, oxalic acid, saponin, and tryptophan, which are linked to a high concentration of cyanogenic glycosides. In vitro studies shows

cytotoxicity activity of cassava plants to cure human colon carcinoma cell line through MTT assay [14]. Cassava leaves help to treat ringworm, tumor, conjunctivitis, sores, and abscesses.

Analgesic Activity

Medicinal Components of Cassava plants centred a lot of attention on their analgesic activity. Researchers examined that ethanolic extract of cassava leaves (*Manihot esculenta* Crantz) shows analgesic effect in mice [15]. When opposed to the control group, a drug is said to have analgesic efficacy if it can reduce the number of writhing of the experimental animals by more than half. Different studies show that the saponins in cassava leaves are very much responsible for analgesic activity.

Nutritional Activity

Compounds such as phytate, polyphenols, tannins, oxalate, alkaloids, and saponins are found in cassava, especially in the peels and stems. Cassava tubers have a wide range of physicochemical compositions, which affects their nutritional value. Cassava is an important source of nutrition for both urban and rural communities in many nations [16]. Cassava cultivars in the Amazon region have a high content of free sugars. These cultivars are ideal for the fermentation to the production of ethanol and organic acids in industries.

Pesticidal Activity

Researchers used three different solvents to test the pesticide activity of *Manihot esculenta* plant extracts: petroleum ether, ethyl acetate, and ethanol. Three different concentrations of these are tried on adults of *Sitophilus oryzae*. As a result, the fatality rate in the ethyl acetate extract is greater. After a 48-hour treatment [17], the mortality rates of ethanol and petroleum ether extract are comparable. As a result, the pesticide activity of *Manihot esculenta* ethyl acetate extract is greater than the other two extracts of *Manihot esculenta*.

Wound Healing

Cassava leaves contain amino acids that are beneficial to skin wound repair, cell replacement, bone health, memory enhancement, and the body's metabolic function [18]. It's also used as a natural remedy that you can drink straight from a bottle of water.

CONCLUSION

Cassava, or *Manihot esculenta*, is a carbohydrate-rich woody plant. The cassava plant is the most widely grown in Nigeria. Plant components such as leaves, roots, and stems are ingested in a number of ways because they have been found to have anti-inflammatory, anti-cancer, anti-diabetic, antipyretic, hepatoprotective, anti-helmentic, and other properties. The plant contains calories, proteins, lipids, carbs, phosphate, iron, vitamin B, vitamin C, and starch, among other nutrients. Vitamin A, vitamin B1, calcium, iron, phosphate, fat, carbohydrate, calories, and proteins are all found in the leaves. Saponin, flavonoid, alkaloids, and other phytochemicals are abundant in cassava. It shows an excellent pharmacological activity and is commonly regarded a medicinal herb in many parts of the world. Cassava roots are consumed raw, cooked, and even used as a substitute for wheat flour in baking procedures. *Manihot esculenta*'s pesticidal activity was also investigated, with the results indicating that the plant has pesticidal properties.

REFERENCES

- 1 Thambi, Mity, and Tom Cherian. Pesticidal activity of the leaves of *Manihot esculenta* against the pest *Sitophilus oryzae*. *The Pharma Innovation*, Part A. 2015; 4(6): 15-18p.
- 2 Suresh, R., M. Saravanakumar, and P. Suganyadevi. Anthocyanins from Indian cassava (*Manihot esculenta* Crantz) and its antioxidant properties. *International Journal of Pharmaceutical Sciences and Research*. 2011; 2(7): 1819-1828p.
- 3 Abdelsamed I. Elshamy, Abd El-Nasser G. El Gendy, Abdel Razik H. Farrag, Jihan Hussein, Nadia A. Mohamed, Walaa A. El-Kashak, Simona Nardoni, Francesca Mancianti, Marinella De

- Leo & Luisa Pistelli. Shoot aqueous extract of *Manihot esculenta* Crantz (cassava) acts as a protective agent against paracetamol-induced liver injury. *Natural product research*. 2020; 1-5p.
- 4 Miladiyah, Isnatin. Analgesic activity of ethanolic extract of *Manihot esculenta* Crantz leaves in mice. *Universamedicina*. 2011; 30(1): 3-10p.
 - 5 Ehiobu, John M., and Gideon I. Ogu. Phytochemical content and in vitro antimycelial efficacy of *Colocasia esculenta* (L), *Manihot esculenta* (Crantz) and *Dioscorea rotundata* (Poir) Leaf Extracts on *Aspergillus niger* and *Botryodiplodia theobromae*. *Journal of Horticulture and Plant Research*. 2018; 9-18p.
 - 6 Thiagarajan, M., and M. Suriyavathana. Phytochemical and antimicrobial screening of *Manihot esculenta* Crantz varieties Mulluvadi I, CO3 root bark. *International Journal of Biotechnology and Biochemistry*. 2010; 6(6): 859-864p.
 - 7 Amaza, I. B. Determination of proximate composition, amino acids, minerals and phytochemical profile of Cassava (*Manihot esculenta*) peel from sweet cassava variety grown in Yobe State of North Eastern Nigeria. *Nigerian Journal of Animal Production*. 2021; 48(1): 124-134p.
 - 8 Olsen, Kenneth M., and Barbara A. Schaal. Evidence on the origin of cassava: phylogeography of *Manihot esculenta*. *Proceedings of the National Academy of Sciences*. 1999; 96(10): 5586-5591p.
 - 9 Abuh, Amodu, Reuben Agada, and Dluva Thagari. Effect of *Manihot esculenta* and *Manihot utilissima* Cyanide Extract on Some Biochemical Parameters of Albino Rats. *Asian Journal of Research in Biochemistry*. 2020; 13-28p.
 - 10 Isaac-Bamgboye, F. J., Enujiugha, V. N., & Oluwamukomi, M. O. In-vitro Antioxidant Capacity, Phytochemical Characterisation, Toxic and Functional Properties of African Yam Bean (*Sphenostylis stenocarpa*) Seed-Enriched Cassava (*Manihot esculenta*) Product (Pupuru). *European Journal of Nutrition & Food Safety*. 2020; 12(3): 84-98p.
 - 11 Bahekar, Satish E., and Ranjana S. Kale. Antidiarrheal activity of ethanolic extract of *Manihot esculenta* Crantz leaves in Wistar rats. *Journal of Ayurveda and integrative medicine*. 2015; 6(1): 35-40p.
 - 12 Vajjiram Chinnadurai, Periannan Viswanathan, Kandasamy Kalimuthu, Ammasai Vanitha, Venkatachalam Ranjitha, Arivalagan Pugazhendhi. Comparative studies of phytochemical analysis and pharmacological activities of wild and micropropagated plant ethanol extracts of *Manihot esculenta*. *Biocatalysis and Agricultural Biotechnology*. 2019; 19: 101166.
 - 13 Nadjam, Djirabaye, Nicolas Cyrille Ayessou, and Aliou Guissé. Physicochemical Characterization of Nine Cassava (*Manihot esculenta* Crantz) Cultivars from Chad. *Food and Nutrition Sciences*. 2020; 11(7): 741-756p.
 - 14 Esther Ekeledo, Sajid Latif, Adebayo Abass, Joachim Müller. Antioxidant potential of extracts from peels and stems of yellow-fleshed and white cassava varieties. *International Journal of Food Science & Technology*. 2021; 56(3): 1333-1342p.
 - 15 Salvador, E. M., Vanessa Steenkamp, and Cheryl Myra Ethelwyn McCrindle. Production, consumption and nutritional value of cassava (*Manihot esculenta*, Crantz) in Mozambique: An overview. 2014; 6(3): 29-38p.
 - 16 Okeke CU, Iweala E. Antioxidant profile of *Dioscorea rotundata*, *Manihot esculenta*, *Ipoemea batatas*, *Vernonia amygdalina* and *Aloe vera*. *J Med Res Technol* 2007; 4:4-10p.
 - 17 Jayasri P, Narendra Naik D, A. Elumalai. Evaluation of anthelmintic activity of *Manihot esculenta* leaves. *Int J Curr Pharm Res* 2011; 3(4): 115-16p.
 - 18 Zakaria ZA. The in vitro antibacterial activity and brine shrimp toxicity of *Manihot esculenta* var. Sri Pontian (Euphorbiaceae) extracts. *Int. J. Pharmacol* 2006; 2(2): 216-20p.