

## PHYTOPHARMACOLOGICAL ASPECTS OF MANIHOT ESCULENTA CRANTZ (CASSAVA) - A REVIEW

Bahekar S\*, Kale R

Department of Pharmacology, Mahatma Gandhi Institute of Medical Sciences, Sewagram, Wardha, Maharashtra 442102, India,  
Email - drsatishbahekar@rocketmail.com

Received -02-02-13; Reviewed and accepted -16-02-13

### ABSTRACT

The plant kingdom has been the best source of remedies for curing a variety of diseases since ancient times. Plants continue to serve as possible sources for new drugs and chemicals derived from various parts of plants. *Manihot esculenta* Crantz, popularly known as cassava is one of the most neglected medicinal herbs found all over the world. It is not so commonly used in herbal medicine because of some of its potentially toxic components, but still various literatures have mentioned that this plant has numerous medicinal indications. Generally roots and leaves of this plant have been used in various parts of world for dietary as well as medicinal purposes. Though neglected, this is one of the most useful medicinal plants. In this review, we have tried to highlight various phytochemicals found and medicinal uses of this neglected plant.

**Key words:** *Manihot esculenta* Crantz, cassava, medicinal plants, antioxidants.

### INTRODUCTION

Plants with various medicinal properties have been source of attraction for many scientists all over the world since thousands of years. Millions of plants have been studied extensively since ancient times for various phytochemicals and their possible medicinal uses in various disease conditions in human beings. Even modern day treatment strategies do not underestimate potential of herbs for various chronic illnesses. Recently there has been a tremendous increase in the use of plant based health products in developing as well as developed countries resulting in an exponential growth of herbal products globally.

In the present era of drug development and in discovery of newer drug, molecules of many plant products are evaluated on the basis of their traditional uses. *Manihot esculenta* Crantz, popularly known as cassava is also one of these plants with various medicinal properties. *Manihot esculenta* Crantz is a woody shrub of the *Euphorbiaceae* family, native to South America, is extensively cultivated as an annual crop in tropical and subtropical regions for its edible starchy & tuberous root which is a major source of carbohydrates. It is the third largest source of food carbohydrates in the tropics.<sup>1,2</sup> It is a major staple food in the developing world, providing a basic diet for around 502 million people.<sup>3</sup> Plant root is a good source of carbohydrates, but a poor source of protein.<sup>4</sup> There are several different species of cassava, but generally is differentiated as sweet and bitter types. No systematic studies have been reported for phytochemical and pharmacological aspects of *Manihot esculenta* Crantz; hence an effort has been made here to establish the same.

### TAXONOMY OF MANIHOT ESCULENTA CRANTZ

Besides the usual botanical classification, medicinal plants can be classified according to the part used, habit, habitat, therapeutic value etc., But the botanical classification is the most comprehensive and scientific classification which is as follows:

**Kingdom:** Plantae

**Order:** Malpighiales

**Family:** *Euphorbiaceae*

**Subfamily:** *Crotonoideae*

**Tribe:** Manihoteae

**Genus:** *Manihot*

**Synonyms** *Cassava, manioc, yuca, tapioca, mandioca, shushu, muk shue, cassave, maniok, tapioka, imanoka, maniba, kasaba, katela boodin, sweet potato tree, Brazilian arrowroot.*

### Plant Parts Used

The whole plant specially roots, leaves, and stem.



Figure 1: *Manihot esculenta* Crantz plant

### MORPHOLOGY

**Plant:** This is a tall semi-woody perennial shrub or tree, which can grow up to 7 m high, having single to few stems, sparingly branching.<sup>5</sup> The outer bark is smooth, light brown to yellowish grey in colour while inner bark is cream-green in colour and wood is soft in consistency.<sup>5</sup>

**Leaves:** Petiole light greenish to red in colour. Leaves are dark green above and pale light greenish grayish underneath, sometimes variegated and pedicels are light green to red.<sup>5</sup>

**Fruit:** Somewhat subglobose, green (to light yellow, white, dark brown), smooth, and with 6 longitudinal wings.<sup>5</sup>

**Roots:** Grows in clusters of 4-8 at the stem base. Roots are from 1-4 inches in diameter and 8-15 inches long. The pure white interior is firmer than potatoes and contains high starch content. The roots are covered with a thin reddish brown fibrous bark that is removed by scraping and peeling.

**Stem:** Single to few stems, sparingly branching; branchlets light green to tinged reddish, nodes reddish. The outer bark is smooth, light brown to yellowish grey & inner bark is cream-green in colour.

### PHYTOCHEMISTRY

The *Manihot esculenta* Crantz plant is rich in various macro and micronutrients.<sup>6,7</sup> It also contain various antioxidant like  $\alpha$ -carotene.<sup>8</sup> Additionally, plant also contains vitamin C, vitamin A,

anthocyanins (flavonoids), saponins, steroids and glycosides.<sup>6,8</sup> In addition to beneficial chemical compounds, leaves also contain toxic substances, which are associated with the high concentration of cyanogenic glycosides.<sup>9</sup> Younger plants have higher cyanogenic glycoside content than that of mature leaves.<sup>10</sup> Ten antioxidant compounds like *coniferaldehyde*, *isovanillin*, *6-deoxyjacareubin*, *scopoletin*, *syringaldehyde*, *pinoresinol*, *p-coumaric acid*, *ficusol*, *balanophonin* and *ethamivan* were isolated and identified for the first time from stems of cassava by an activity-guided isolation and were found to have DPPH scavenging capacity and ABTS free radical scavenging ability.<sup>21</sup>

#### MEDICINAL PROPERTIES

The parts of the plant *Manihot esculenta* Crantz that are commonly utilized are the roots and leaves. In Nigeria, it is used for the treatment of ringworm, tumor, conjunctivitis, sores and abscesses.<sup>9</sup> Leaves have also been used against many disorders, such as rheumatism, fever, headache, diarrhea and loss of appetite.<sup>11</sup> Leaves of this plant also reportedly have shown anti-hemorrhoid, anti-inflammatory<sup>12</sup> and antimicrobial activity.<sup>13</sup> A study in Nigeria showed that oral administration of an aqueous leaf extract to rats induced anti-inflammatory and analgesic effects.<sup>14</sup> The flavonoid fraction and volatile flavonoid compounds of this plant is thought to have anti-inflammatory and analgesic effects.<sup>15</sup> It has also been proved experimentally that methanolic extract of *Manihot esculenta* Crantz showed most potent anthelmintic activity.<sup>16</sup> Study conducted by Cesar N. Tsumbu revealed that plant extract of *Manihot esculenta* Crantz provided first insights into the antioxidant and antiradical properties in a model of a complete lipid peroxidation.<sup>17</sup> Medicinally, the poisonous juice of this plant is boiled down to a syrup and given as an aperients.<sup>18</sup> Fresh rhizome made into a poultice is applied to sores.<sup>18</sup> The flour cooked in grease, the leaf stewed and pulped, and the root decocted as a wash are said to be folk remedies for tumors.<sup>18</sup> Reported to be antiseptic, cyanogenic, demulcent, diuretic and poison, plant is a folk remedy for abscesses, boils, conjunctivitis, diarrhea, dysentery, flu, hernia, inflammation, marasmus, prostatitis, snakebite, sores, spasm, swellings of testicles.<sup>19</sup> Various literature studies also have mentioned various uses of this plant like the leaves can be used as a styptic, while the starch mixed with rum has been used for skin problems, especially for children.<sup>19</sup> Other indigenous uses include preparations for fever and chills, to treat sterile women and as an application for sore muscles.<sup>19</sup> In one study, extracts from the leaves of the plant were found to exhibit broad spectrum antibacterial activity but no specific antibacterial agents were isolated nor identified.<sup>20</sup> Due to presence of various antioxidants, this plant can be used as natural antioxidants and alternatives to synthetic antioxidants.<sup>21</sup>

#### CONCLUSION

Phytochemical and pharmacological investigations studied out in the plant in various literature sources reveal its multidisciplinary usage. It is very essential to have a proper documentation of medicinal plants and to know their potential for the improvement of health and hygiene through an eco-friendly system. *Manihot esculenta* Crantz, most popularly known as cassava is one of the most forgiving and adaptable plants. It is not so commonly used in herbal medicine, but indigenous people do employ it for various purposes. Because some of its potentially toxic components, sometimes it is considered as non edible and toxic in various parts of the world. But, it is definitely one of the most useful medicinal plants. Various phytochemicals presents in this plant and numerous medicinal uses of this neglected plant have been highlighted in this review. Further pharmacological experiments should be performed in the plant to extend to the next level of clinical trial to generate novel drugs. This might prove helpful to use its immense therapeutic efficacy as a potent phytomedicine.

#### REFERENCES

1. Food and Agriculture Organization of the United Nations. Available from: <http://www.fao.org/ag/agp/agpc/gcds/>

2. Claude Fauquet and Denis Fargette. African Cassava Mosaic Virus: Etiology, Epidemiology, and Control. *Plant Disease* 1990; 74(6):404-11.
3. Food and Agriculture Organization of the United Nations. 1995. Available from: <http://www.fao.org/docrep/u8480e/U8480E01.htm>.
4. Food and Agriculture Organization of the United Nations 2000. Available from: <http://www.fao.org/docrep/x8200e/x8200e05.htm>.
5. Plant Fact Sheet/Guide Coordination Page. Available from: <http://plant-materials.nrcs.usda.gov/intranet/pfs.html>.
6. Fasuyi AO. Nutrient composition and processing effects on cassava leaf (*Manihot esculenta* Crantz) antinutrients. *Pakistan J Nutr* 2005;4:37-42.
7. Chavez AL, Bedoya JM, Sanchez, Iglesias, Ceballos, Roca W. Iron, carotene, and ascorbic acid in cassava roots and leaves. *Food Nutr Bull* 2000;21:410-3.
8. Okeke CU, Iweala E. Antioxidant profile of *Dioscorea Rotundata*, *Manihot Esculenta*, *Ipoemea Batatas*, *Vernonia Amygdalina* and *Aloe Vera*. *J Med Res Technol* 2007;4:4-10.
9. Isnatin Miladiyah, Ferdiyanto Dayi, Sufi Desrini. Analgesic activity of ethanolic extract of *Manihot esculenta* Crantz leaves in mice. *Univ Med*. January-April 2011;30(1).
10. Hidayat A, Zuraida N, Hanarida I. The cyanogenic potential of roots and leaves of ninety nine cassava Cultivars. *Indonesian J Agric Sci* 2002;3:25-32.
11. Yuniarti T. *Ensiklopedia tanaman obat tradisional*. Yogyakarta: Media Pressindo, Yogyakarta; 2008.
12. Okpuzor J, Oloyede AM. Anti-inflammatory, antipyretic and anti-diarrhoeal properties of an antihemorrhoid tri-herbal pill. *Nature Sci* 2009;7:89-94.
13. Popoola, Yangomodou, OD, Akintokun AK. Antimicrobial activity of cassava seed oil on skin pathogenic microorganism. *Res J Med Plant* 2007;1:60-4.
14. Afolabi L, Adeyemi OO, Yemitan OK. Cassava leaves have anti-inflammatory and analgesic principles, which justify its use in traditional African medicine. *J Ethnopharmacol* 2008;119:6-11.
15. Hashemi VAH, Ganhadi S, Mosavi D. Analgesic and antiinflammatory effects of total extract, flavonoid fraction, and volatile. *J Res Med Sci* 2000;5:17-27.
16. Jayasri P, Narendra Naik D, A. Elumalai. Evaluation of anthelmintic activity of *Manihot esculenta* leaves. *Int J Curr Pharm Res* 2011;3(4):115-16.
17. Cesar N. Tsumbu et. al. Antioxidant and Antiradical Activities of *Manihot esculenta* Crantz (Euphorbiaceae) Leaves and Other Selected Tropical Green Vegetables Investigated on Lipoperoxidation and Phorbol-12-myristate-13-acetate (PMA) Activated Monocytes. *Nutrient* September 2011;3(9):818-38.
18. James A. Duke. 1983. *Manihot esculenta* Crantz. *Handbook of Energy Crops*. unpublished. Available from: [http://www.hort.purdue.edu/newcrop/duke\\_energy/Manihot\\_esculenta.html](http://www.hort.purdue.edu/newcrop/duke_energy/Manihot_esculenta.html)
19. Cassava, Manioc, Yuca, (*Manihot esculenta*) - History and Uses - Sacred Earth Ethnobotany Resources. Available from: <http://www.sacredearth.com/ethnobotany/plantprofiles/cassava.php>
20. 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):216-20.
21. Bo Yi et.al. Antioxidant Phenolic Compounds of Cassava (*Manihot esculenta*) from Hainan. *Molecules* 2010; 16:10157-67.

**Support:** Nil

**Conflicts of interest:** None Declared.