

A REVIEW ON MEDICINAL USES OF AMARANTHUS VIRIDI'S

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ABSTRACT

Amaranthus viridis, a member of the Amaranthaceae family, is commonly referred to as green amaranth, slender amaranth, pigweed, tropical green amaranth, and in India as “chowlai.” The plant grows widely across diverse climates and has long been incorporated into Ayurvedic practice, especially as a remedy for fever and inflammatory conditions. Traditionally, it has also been used in the management of ulcers, diabetes, asthma, anemia, skin ailments, liver disorders, gastrointestinal problems, and high cholesterol. Beyond its role as a leafy vegetable and weed of cultivation, *A. viridis* is valued for its rich phytochemical content. Analyses of its leaves have identified amino acids such as lysine, arginine, histidine, cystine, phenylalanine, leucine, isoleucine, valine, threonine, methionine, and tyrosine, along with bioactive compounds including flavonoids, phenolic acids, betalains, saponins, and

squalene. These constituents are thought to underlie its reported anti-inflammatory, antifungal, antiseptic, and anticancer activities. Because of this diverse chemistry, the species has attracted interest for potential applications in pharmaceutical, nutraceutical, and cosmetic industries. In addition, several amaranth species are cultivated not only for their tender leaves but also for their edible seeds, which provide both nutrition and energy.

KEYWORDS: *Amaranthus viridis*, anti-inflammation, anti-diabetic, anti-cancer,

phytochemical, anti-oxidant, antifungal, Hypertension.

INTRODUCTION

In India, *Amaranthus viridis* is popularly referred to as Rajgira (“royal grain”) or Randana (“God’s own grain”). It is a fast-growing annual herb characterized by a slender, upright, light-green stem that typically reaches 60–80 cm in height. Both the leaves and seeds are nutrient-rich, supplying proteins, dietary fiber, vitamins, and minerals. The species thrives under warm and humid conditions due to its C₄ photosynthetic mechanism is a CO₂-concentrating process that boosts photosynthetic efficiency, which allows efficient growth in tropical environments. Although its primary center of diversity is Asia, today it is found in many hot and moist regions across the globe, with more than 60 species of the genus *Amaranthus* distributed in tropical areas worldwide. Traditionally, *A. viridis* has been valued not only as a food plant but also for medicinal purposes. Folk medicine records its use as an emollient, astringent, and anthelmintic, as well as in the treatment of excessive menstrual bleeding, constipation, diarrhea, and other gastrointestinal complaints. It has also been described as a “blood purifier.” In addition, amaranth oil derived from the seeds has been investigated for its potential benefits in managing hypertension and coronary heart disease.^[1,2]

Amaranthus is widely used in treating various diseases which includes Anemia, digestive issues, inflammation, diabetes, skin problems, cancer, liver disorders, cardiovascular health, diarrhea, respiratory issues and gastro intestinal issues. *Amaranthus* possess anti-fungal, anti-septic and anti-oxidant properties. *Amaranthus* seeds consists of various proteins, fats, and amino acids. Seeds are significantly used to reduce labor pain. It is soft, green leaves are rich in vitamins, minerals, and anti-oxidants, making it a popular in traditional diets and herbal remedies. *Amaranthus* is rich in essential nutrients such as vitamin A, vitamin C, calcium, Iron and dietary fiber, the plant is commonly consumed as a leafy vegetable. The plant can grow rapidly in poor soils and in low requirement for maintenance offer possibilities for sustainable agriculture and green cover management in urban areas.^[3,4]

For centuries, traditional medicine systems such as ayurveda, siddha and various African practices have used this plant to treat a variety of health conditions. It has been applied to reduce inflammation control fever, heal skin wounds, and even soothe urinary tract infections. *Amaranthus* leaves are used to make poultices for wounds and boils, decoctions are consumed to relieve digestive troubles, and in some regions, it is even used to treat malaria symptoms,

skin conditions and urinary issues. This nutritional profile makes it a naturally for fighting against malnutrition, especially in low income or rural areas. The plant grows quickly, does not need much care, and can even improve soil fertility making it popular in sustainable farming practice.^[5]



Fig 1: AMARANTHUS VIRIDI'S.

TAXONOMICAL CLASSIFICATION

Kingdom	plantae
Sub kingdom	Tracheobionta
Super division	Spermatophyta
Division	magnoliophyte
Class	Magnoliopsida
Sub class	caryophyllidae
Order	Caryophyllales
Family	Amaranthaceae
Genus	Amaranthus
Species	Viridis

CHEMICAL CONSTITUENTS

Chemical Constituents	Examples
Flavonoids	Quercetin, Kaempferol, Rutin
Phenolic acids	Gallic acid, Ferulic acid, Caffeic acid, Chlorogenic acid
Saponins	Triterpenoid saponins
Proteins & Amino acids	Lysine, Albumin, Globulin
Polysaccharides	Starch, Dietary fibers, Mucilage
Sterols	Beta sitosterol, Stigmasterol
Vitamins	Vitamin A, Vitamin C
Minerals	Calcium, Potassium, Iron, Magnesium ^[6]

Morphology

Amaranthus viridis is an erect herb that can grow up to about one meter in height. The plant bears small green flowers, usually sessile and unisexual, accompanied by bracts and bracteoles, with a superior ovary. Its fruit is typically wrinkled, enclosing a single glossy black seed that measures roughly 1 mm in diameter.^[4]



Fig 2: Plant of *Amaranthus viridis*.



Fig 3: Fruit of *Amaranthus*.



Fig 4: Inflorescence of *Amaranthus*.

Medicinal uses

S.NO	DISEASE	MECHANISM OF ACTION	REFERENCE
1.	Hypertension	The plant exhibits anti- hypertensive action which mainly inhibits the Renin Angiotensin Aldosterone System (RAAS) and increase in the Nitric oxide levels (NO) which results in the vasodilation, therefore reduces the blood pressure or hypertension of an individual.	[7]
		Amaranthus Proteins generate an enzyme named Alcalase which releases anti-hypertensive peptides, that can effectively reduce the Systolic Blood Pressure in Hypertensive rats thereby inhibiting the ACE, this	[8]

		mechanism brings down the formation of Angiotensin II which is a potent vasoconstrictor, leads to the reduction in blood pressure.	
		Metabolites of Arachidonic acid in the kidney plays a crucial role in Blood Pressure regulation. Rats were sacrificed and kidney tissues were collected to evaluate the activity of two main enzymes which are associated in the Arachidonic acid metabolism, namely cytochrome p450 (cyp) and soluble epoxide hydrolase (SEH). Medium and high doses of quercetin keep out the elevated levels of blood pressure in Hypertensive rats and inhibits the action of cyp4A. High doses of quercetin can inhibit the activity of soluble epoxide hydrolase in renal cortical cytosols.	[9]
2.	Inflammation	Amaranth hydrolysates inhibit the lipopolysaccharide induced inflammation in human and mouse macrophage and thereby preventing the nuclear factor kappa – light chain (NF-KB) signalling pathway, and there by reducing the production of inflammatory mediators like TNF- alpha (Tumour Necrosis Factor) and IL-6 (Interleukins).	[10]
		Viridis leaf extract plays a major role in the inhibition of key enzymes which plays a crucial role in treating inflammation. The leaf extract was an effective inhibitor of Hyaluronidase, lipoxygenase and xanthine oxidase enzyme which further leads to the lowering of inflammation.	[11]
		Quercetin which is a flavonoid, inhibits the lipopolysaccharide (LP) and Induced Tumor Necrosis Factor (TNF- α) which are produced in macrophages that occurs through modulation of several signalling pathways which include NF-KB, VNK, AKT and Lps-induced interleukins.	[12]
3.	Hypercholesterolemia	In rabbit studies, inclusion of Amaranthus Viridis extract in a high cholesterol diet significantly reduced total cholesterol, low density lipoprotein (LDL), triglyceride levels, while boosting high density lipoprotein (HDL) the good cholesterol.	[13]
		The leaf extract shows good inhibition of hydroperoxides, 2,2-diPhenyl-1-picrylhydrazyl (DPPH), Nitric Oxide (NO), Ferric Ion radicals in various concentrations. The enzymes named lipoxygenase, hyaluronidase and xanthine oxidase enzymes are capably inhibited by Amaranthus viridis leaf extract, then it modifies cholesterol metabolism by retarding HMG-CoA reductase.	[14]
4.	Cancer	The ethyl ether extract of Amaranthus viridis L. had significant anti-cancer activity against colon (HT-29) and liver (HepG2) cancer cells. The treatment led to increased production of reactive oxygen species (ROS),	[14]

		changes in the expression of the caspase-3 gene, and alterations in key regulatory proteins like Bax and Bcl-2. It also caused the cancer cells to halt their normal cycle, ultimately reducing their ability to survive and grow.	
		Ethyl ether fraction of <i>Amaranthus viridis</i> was tested invitro for anti-cancer activity against Human colon cancer HT-29 cells, which significantly inhibits human colon cancer HT-29 cells growth in a dose dependent manner by inducing G0/G1 phase arrest and apoptosis. Cell death induced by EA displayed characteristics of apoptosis and correlated with generation of reactive oxygen species and enhanced expression of caspase 3 and the Bax/Bcl -2 ratio in HT-29 cells treated with ethyl ether.	[15]
		Kaempferol (KMF), an active chemical Constituent of <i>Amaranthus Viridis</i> acts as an inhibitory compound to inhibit the proliferation of various cancer cells through cell cycle arrest KMF-dependent inhibition of cancer cells proliferation is done through the arrest of various phases of cell cycle and inhibition of cell cycle transition points which includes G0/G1 transition.	[16]
5.	Diabetes	The methanolic extract of <i>Amaranthus viridis</i> (MEAG) was given to experimental animals. The statistical data designated a notable increase in body weight, decrease in blood glucose after treatment with methanolic extract of leaves of <i>Amaranthus viridis</i> . High density lipoprotein (HDL) cholesterol level was raised when treated with extract. The extracts play a crucial role in reducing the increased blood glucose levels.	[17]
		Ethanollic extract of aerial parts of <i>Amaranthus viridis</i> was evaluated and tested. Ethanollic extract is temporize by increasing glucose adsorption, decrease glucose diffusion rate and moderately Inhibits the alpha amylase which further exhibits the Anti-diabetic activity.	[18]
		The methanolic extract of <i>Amaranthus viridis</i> (MEAV) leaves inhibits the alpha-amylase activity and has an ability of glucose entrapment. Methanolic extract of <i>Amaranthus viridis</i> leaves manifest the highest glucose retention ability. Studies provided that MEAV reduces the blood glucose levels.	[19]
6.	Antioxidant	The methanol extract of <i>Amaranthus viridis</i> has been found to effectively bind with metal ions like iron (Fe^{2+}), which are known to trigger the formation of harmful free radicals through chemical reactions such as the Fenton reaction. By doing so, it helps bring down the overall production of reactive oxygen species (ROS) in the body.	[20]

		<p>The certain alkaloids extracted from <i>Amaranthus viridis</i> helps to protect human red blood cells from damage caused by hydrogen peroxide, a common source of oxidative stress. These alkaloids helped maintain the activity of important antioxidant enzymes like superoxide dismutase, catalase, glutathione peroxidase, and glutathione-S-transferase. They also preserved non-enzymatic antioxidants such as glutathione, vitamin C, and vitamin E, which are crucial for protecting cells. Additionally, the alkaloids reduced the buildup of malondialdehyde, a marker of cell membrane damage caused by oxidation. Overall, the study suggests that these alkaloids support the body's natural defense systems and help reduce or even repair oxidative damage in red blood cells.</p>	[21]
		<p>In this study, anti-oxidant activity of methanolic extract of <i>Amaranthus Viridis</i>'s has significantly restored the malondialdehyde (MDA) and reduced levels of glutathione (GSH), catalase (CAT) and total thiols. These findings support the plant potential as a source for Developing hepatoprotective agents which aim to preventing or treating liver disorders and other stress related diseases.</p>	[22]
7.	Liver Disorder	<p>Methanolic extract of <i>Amaranthus viridis</i> exhibits the hepatoprotective activity by scavenging free radicals and thereby reducing the oxidative stress and which further decreases the elevated liver marker enzymes (serum glutamate oxaloacetate transaminase and serum glutamate pyruvate transaminase and serum glutamate oxaloacetate transaminase), bilirubin (total bilirubin and direct bilirubin) and restores albumin (AIB), total protein (TP) levels.</p>	[22]
		<p><i>Amaranthus viridis</i> aqueous leaf extract on rats may be help to preserve intracellular glutathione (GSH) levels in acetaminophen intoxicated animals enhancing cellular defense by neutralizing hydroxyl radicals and detoxifying acetaminophen's harmful intermediates through GIT-mediated mechanism. These findings support the plant potential as a source for developing hepatoprotective agents which aim to preventing or treating liver disorders and other stress related diseases.</p>	[23]
		<p>The ethanolic extract of <i>Amaranthus viridis</i>, especially at a concentration of 50%, can help protect the liver from chemical-induced damage. This has been tested using substances like d-galactosamine/lipopolysaccharide (d-GalN/LPS) and carbon tetrachloride (CCl₄), both known to cause serious liver injury in animal studies. The ability of <i>Amaranthus viridis</i> to prevent the rise in certain liver enzymes that typically indicate liver</p>	[24]

		<p>damage. These include: AST (Aspartate Transaminase) ALT (Alanine Transaminase) SALP (Serum Alkaline Phosphatase) LDH (Lactate Dehydrogenase) GGT (Gamma-Glutamyl Transferase) Total Bilirubin By keeping these markers closer to normal levels, Amaranthus viridis supports liver health and helps reduce the severity of liver injury.</p>	
8.	Diarrhoea	<p>Methanolic root extract of Amaranthus viridis exhibits spasmolytic activity in isolated chicken ileum which leads to the relaxation of smooth muscle tissue there by reducing intestinal spasms, extracts also contributes its beneficial potential to relieve cramps and slow down the hyperactive bowel movement which is associated with Diarrhoea.</p>	[25]
9.	Alzheimer's	<p>This experiment aims to evaluate the potential anti-Alzheimer's activity of Amaranthus viridis linn leaves Extract in rats. This finding recommends that Amaranthus viridis linn leaves extract reveals significant anti- Alzheimer's activity, probably through the mechanism involving inhibition of acetylcholinesterase. This study highlights the plant as a natural therapeutic agent for Alzheimer's disease.</p>	[26]

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