# Overview on Antioxidant and Hair Growth-Promoting Effect of Curry Leaves and Bitter Melon

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Abstract: Curry leave, a type of leafy vegetable and bitter melon, an edible fruit both can be used as herbal remedy that could to effective natural treatment. The murraya koenigii belongs to family Rutaceae while Momordica charantia L. belongs to family Cucurbitaceae. The chemical constituent present in curry leaves are mahanimbine, koenine, koenigine and koenimbine while in bitter melon gallic acid, catechein, coumarin and rutin are present. They both possesses various therapeutic properties such as antioxidant, antidiabetic, anticancer, hepatoprotective, antiobesity, antinflammatory, antimicrobial and antifungal. As they both show above pharmacological activities, their combination may produce higher antioxidant activity that can be used for the treatment of hair problems (hair greying, alopecia) which are caused due to reactive oxygen species (ROS). The curry leaves is beneficial for hair growth, hair nourishment, hair thickness and the bitter melon is beneficial to improve



Mahanimbine



Koenigine

Morphological Description:

*Murraya koenigii* has dark green and brown stem which have height 2 to 2.5 m. The flowers are funnelshaped and white with sweet aromatic smell and cardiac health, for skin and hair treatment and balance blood sugar level.

Keywords: Curry leaves, Bitter melon, Bioactive component, pharmacological activities, Antioxident.

#### INTRODUCTION

Curry leaves (Murraya koenigii)

- Biological name: Murraya koenigii [1]
- ➢ Family: Rutaceae [1]
- Geographical source: It is originated from east and south part of India, Sri Lanka, and other countries in South Asia, but now it's grown in places like Africa, including Nigeria.
- Chemical constituent:



Koenine



#### koenimbine

fruits are round shaped with length of 1.4 to 1.6 cm. [1]

Murraya koenigii have various species:

- Murraya paniculata
- Murraya exotica

There are three varieties of curry leaves:

- Regular
- A dwarf variety
- Third variety (gamthi)

Taxonomical Classification [1, 2]

Kingdom: Plantae	
Sub-kingdom: Tracheobionta	<b> </b>
Division: Magnoliophyta	
Class: Magnoliospida	
Subclass: Rosidae	
Family: Rutaceae	
Species: Murraya koeniggi L. Spreng	

Chemical composition	Nature	Percentage
Koenimbine	Indole Alkaloid	2.33
Koenine	Indole Alkaloid	2.44
Koenigine	Indole Alkaloid	2.89
Mahanimbine	Carbazole Alkaloid	0.0113
Tocopherol	Alcohol	2.788
Carotene	Terpene	0.89
Lutein	Xanthophyll	0.25-0.59
Bismurrayafoline E	Carbazole Alkaloid	0.76-1.23
Bispyrafoline	Carbazole Alkaloid	0.34-0.98
O-methyl murrayanine	Carbazole alkaloid	2.45-2.99

## Table 1: Bioactive components of *Muarrya koenigii* [2]

Pharmacological Activity:

The *Murraya koenigii* is also known as multipotential medicinal plant due to its various pharmacological activities. Murraya koenigii helps prevent tooth decay, boosts digestive enzyme activity, reduces total cholesterol levels, works as a fever reducer, enhances memory, and aids in wound healing. Additionally, the curry tree displays properties such as insecticidal, phagocytic, anti-parasitic, cholesterol-lowering, pain-relieving, and vasodilatory effects. [3] It is commonly used in home remedies.



The curry leaves have various properties as below:

### 1) Antioxidant property:

It is tested that carbazole alkaloids found in the leaf extract of *M.koenigii* using dichloromethane and

found that it can fight off free radical like DPPH. Researchers have discovered two carbazole alkaloids, mahanimbine and koenigine displayed antioxidant effect and also had a strong ability to eliminate free radical.[4,5]

Table 2: Antioxidant constituents

Constituent[V]	Source	Biological activity
lutein	Leaves	Antioxidant
		activity
Tocopherol	Leaves	Antioxidant
		activity
Carotene	Leaves	Antioxidant
		activity
koenimbine	Leaves	Antioxidant
		activity

2) Antidiabetic property:

Mahanimbine a chemical constituent of M. koenigii was found to be have antidiabetic property. Mahanimbine lowers blood sugar level by making insulin work better. It boost the release of insulin from beta cells in the islets of Langerhans or by enhancing the absorption of glucose in body. Mahanimbine was found to have effect in inhibiting alpha amylase. Mahanimbine demonstrated significant inhibition of alpha amylase and slight inhibition of alpha glucosidase in comparison to acarbose. [4,6]

## 3) Anticancer property:

Koenoline, found in the root bark, showed cancer fighting activity when tested on KB cells. MN displayed cytotoxic and anti-migratory effects on human breast cancer MCF-7 cells by promoting cancer cell apoptosis. MN hinders cancer cell proliferation by inducing programmed cell death. In the presence of MN, MCF-7 cells underwent apoptosis, triggering cell death signals that regulated mitochondrial membrane potential through the downregulation of Bcl2 and upregulation of Bax. The process of cell death was enhanced by the notable release of reactive oxygen species (ROS). MN reduced the movement of cancer cells by decreasing the levels of MMP-2 and -9. MN, a prominent component derived from natural sources, shows promise as a potential candidate for the development of anti-breast cancer drugs. It should be further investigated as a primary compound for drug discovery in this field. [4,7]

## 4) Antiobesity and antihyperlipidemic activities:

The extracts from *Murraya koenigii* leaves, known as dichloromethane (MKD) and ethyl acetate (MKE), were found to lower body weight gain and total cholesterol levels in the blood. The level of total cholesterol (TC) are greatly reduced by the antiobesity and antihyperlipidemic effects that were noticed. The components in this extract are connected to the carbazole alkaloids, Mahanimbine. Bioactive compounds such as flavonoids and phenolics contribute to the redistribution of lipoproteins (Patel et al., 2013). These compounds help lower total cholesterol (TC) levels by two main mechanisms: decreasing fat absorption in the digestive tract and enhancing the excretion of fat in feces. [4,8]



### 5) Hepatoprotective activity:

Mahanimbine, Girinimbine and Isomahanimbine are carbazole alkaloids that have a combined effect. Murrayazoline, Murrayazolidine, Mahanine, ascorbic acid,  $\alpha$ -tocopherol and minerals like zinc, copper, and iron are also present in the extract.The dried bark powder's acetone extract provided strong protection for liver cells when compare to others. [4,9]



### 6) Antimicrobial and Antifungal activity:

Murrayanine, girinimbine and mahanimbine found in stem bark have been proven to show activity against human pathogenic fungi. Fresh leaves components like Mahanimbine, murrayanol and mahanine shows antimicrobial and topoisomerase I and II inhibitory activity. Methanolic, ethanolic and aqueous extract of curry leaves were tested for their antimicrobial effect. The petroleum ether, chloroform, ethyl acetate and ethanol extract of root of *murraya koenigii* plant is effective against microbial activity. [4,10]

Industrial Uses: [11,12]

- Sun protection cream
- Aromatherapy in cosmetic industry
- Oral health (mouthwashes)

- Skin lightening and rough skin improving creams
- Reduces dark spot and pigmentation(curry leaf oil)
- It is used as facial mask (curry hydrasol)

Bitter Melon (Momordica charantia L.)

Morphological Description:

Bitter melon is widely consumed by people around the world in various form, including as vegetable or medicinal product. It is known for its high nutritional value containing abundant protein, mineral, and vitamin. [10]

Taxonomical Classification

Kingdom:Plantae	
Division: Magnoliophyta	
Class: Magnoliosida	
Order:Violes	
Family: Cucurbitaceae	)
Species: Charantia	

Bioactive components of *Momordica charantia* L. The Bitter melon consists of various chemical

composition such as chlorophyll a, chlorophyll b, carotenoids, mineral like potassium, magnesium, calcium, iron and zinc. It also have phenolic compounds and flavonoids.

## Table 3: Phenolic compounds[10]

Phenolic compounds	Fresh bitter melon	Dried bitter melon
(mg/100g)		With bitterness
Gallic acid	1.927	1.667
Catechein	4.637	0.712
Catechol	20.570	6.902
Caffeic acid	1.564	0.491
Coumarin	5.601	1.449
Benzoic acid	75.990	31.635
Pyrogallol	79.27	39.73
Vanillic acid	7.989	2.503
Salicylic acid	11.480	3.534
Cinnamic acid	0.335	0.131

### Table 4: Flavonoids compounds [10]

Flavonoid compounds	Fresh bitter melon	Dried bitter melon
(mg/100g)		With bitterness
Rutin	11.05	7.17
Hispertil	5.64	1.55
Apigenin	3.70	0.38
Acacetin	63.94	46.08

In 2000, Drewnowski and Gomez-carneros found that the bitter melon shows high antioxidant properties due to presence of phenol, flavonoids, isoflavones, terpenes, anthroquinones and glucosinolates with also possesses bitter taste. Gallic acid, a phenolic compound contributes highest antioxidant activity.[10]

Gallic acid:



Gallic acid, also known as 3,4,5-trihydroxybenzoic acid, was first identified by Carl Wilhelm Scheele in 1786 during his examination of grey substance with a sour taste found in oak apple extract. Initially undervalued, it is now recognized as a significant phenolic acid.[13]

Physical and chemical properties of gallic acid[13]

Pr	operty name	Property characteristics	
• Cl	nemical structure	C7H6O5	
• M	olecular weight	170.12g/mol	
• Pł	sical state	solid	
• Aj	ppearance	Fine crystal, white yellowish or pale	
• M	elting point	250-253° C	
• Sc	blubility in water	12g/L(20 <sup>0</sup> C)	
• 0	dor	odorless	
• D	ensity	1.694g/cm <sup>3</sup>	

Sources of gallic acid:[13]

- 1. Raspberry
- 2. Strawberry
- 3. Grape juice(black and green)

- 4. Blackberry
- 5. Black and white currant
- 6. Golden root
- 7. Guava leaf
- 8. Wild liquorice root

Pharmacological activities:

Gallic acid have numerous biological properties in which antioxidant property is dominant. Following are the pharmacological properties:



Figure 1: Pharmacological activity

#### 1) Antioxidant activity:

The effectiveness of gallic acid an antioxidant was tested in different ways. It was checked for its ability to counteract an artificial radical (DPPH), reduce metal ion, protect fluorescein and prevent oxidation. The result showed that gallic acid has a powerful antioxidant effect in all of these tests.

The antioxidant power of gallic acid is linked to how many hydroxyl group are in its ring structure. Additionally, gallic acid ability to boost the activity of enzyme like superoxide dismutase, catalase, glutathione reductase, and glutathione peroxidase, vitamin C, vitamin E, play a role in its antioxidant action.

In numerous studies about testing how well certain substance or combinations can fight off harmful molecules in the body, gallic acid is often used as the standard antioxidant. This means it serves as a comparison for how effective other antioxidants are.[13]



#### 2) Anti-inflammatory activity:

Gallic acid helps to decrease pro-inflammatory factor in our body by reducing the activity of enzymes like inducible nitric oxide synthase and myeloperoxidase, which are responsible for causing inflammation. Research has discovered that gallic acid can lower the disease activity index and reduce damage to the colon and stomach at different doses. Additionally, studies have shown that gallic acid can stop the release of certain substances that contribute to inflammation in the body. It was also found that gallic acid has antiinflammatory properties by blocking a signaling pathway i.e. NF-Kb pathway which promotes inflammation in the body.[13]

#### 3) Anticancer properties:

Some research showed that gallic acid can make cancer cells die in different types of cancer like lung,

cervical, oral, prostate, melanoma, leukemia, lymphoma, colon, pancreatic and breast cancer. By stopping tumors from growing, gallic acid fights against cancer. This happens because gallic acid affects the way reactive oxygen species are made, stops mitochondria from working, controls proteins that cause cell death, stops the growth of cancercausing genes, and prevents matrix metalloproteinases from working. Gallic acid is capable of demonstrating cytotoxic and antitumor properties by influencing the balance between antioxidants and pro-oxidants. It can promote cell cycle arrest, autophagy, and apoptosis by triggering the caspase pathway and producing reactive oxygen species (ROS). Furthermore, it can reduce invasion and metastasis by lowering the expression and activity of matrix metalloproteinases. [13,14]

# 4) Antimicrobial properties:

Due to its three hydroxyl groups, gallic acid is considered harmful to microorganisms. Studies have shown that gallic acid fights against bacteria like Salmonella typhimurium, Staphylococcus aureus, Helicobacter pylori, Campylobacter spp., Escherichia coli and Pseudomonas. Experts think that gallic acid can damage bacterial cells membranes, leading to permanent changes in permeability, rupture, pore formation and a decrease in negative surface charges. As a result, essential cell components may leak out. Alkaloids, glycosides, volatile oils, tannins, phenolics, and flavonoids are compounds found in BG fruits that contribute significantly to their antimicrobial properties. [13,15]

# 5) Anti-platelets activity:

The main reasons for atherosclerotic diseases is platelets aggregation and its activation. The gallic acid is considered to stop platelets and white blood cells from aggregation, as well as reduces P-selectin expression. The anti-platelet activity of gallic acid is concentration dependent. It is also responsible for preventing the rise in calcium levels inside the cells and decreases the phosphorylation process linked with this phenomenon. [13]

# Medicinal Uses of Bitter melon: [16]

- Bitter melon improve immune cell function in people with cancer so is said to be an immuno modulator.
- Bitter melon treats dyspepsia and stimulates a sluggish digestive system.
- The fresh juice of bitter melon lower blood sugar values and keep insulin maintain.
- Bitter gourd juice strengthen the liver so can be used to prevent jaundice.
- Bitter melon juice could potentially help alleviate hangover symptoms by detoxifying and nourishing the liver.

Marketed products and their uses:

Sr. no.	Name of formulation	Name of ingredient	Company	Uses
1	Curry leave powder	Curry leaves	Natural and	Hair growth
			herbal product	
2	Plant based vitamin	Curry leaves, Papaya,	Himalayan	Boots
	B6 capsule	Guava, amla	organics	haemoglobin
3	Hair growth oil	Curry leaves, fenugreek,	RUBZ	Hair nourishment
		basil, bhringraj extract		
4	Curry leaf serum	Curry leaf, vegan biotin,	Love beauty and	Improve hair
		anagain	planet	thickness

Table 5: Curry leaves (Marketed products)

 Table 6: Bittermelon (Marketed products)

Sr. no.	Name of	Name of ingredient	Company	Uses
	formulation			
1	Karela tea	Bitter melon, lemon grass,	Olinda	Balance blood
		ginger, green tea		sugar level
2	Kerala pickle	Bitter gourd, mustard oil,	Fidra product	Improve cardiac
		garlic and other spices		health
3	Bitter gourd thokku	Bitter gourd, salt, oil, red	Malnad's	Help in skin and
		chilli	nisarga	hair improvement

4	Bitter melon	Bitter melon (stem and fruit)	Himalaya	Balance blood
	capsule		company	sugar level

#### CONCLUSION

*Murraya koenigii* and *Momordica charantia* L. has been extensively studied worldwide for their medicinal properties treat a number of diseases like diabetes, dyslipidemia, obesity and certain cancer. They both contains chemicals like triterpenes, alkaloids, flavonoids and phenolic compounds which shows properties to fight against microbes, ulcer and act as high source of antioxidants. By the above we can say that, the combination of curry leaves and bitter melon may give a better antioxidant action so can be used for inhibition of scavenging free radical causing greying of the hair. This means that curry leaves and bitter melon should be studied for their chemical properties and potential health benefits.

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