

Exploring the Potential of Curry Leaves for their Therapeutic Action

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Abstract. Curry leaves (*Murraya koenigii*), which are valued for their aromatic flavour, have been a mainstay of Indian cuisine for ages. These leaves are becoming more well known for their potential to affect metabolic pathways in addition to their gastronomic value. The molecular mechanistic potential of curry leaves in relation to metabolic control is examined in this abstract. Curry leaves contain a variety of bioactive substances, such as antioxidant, anti-inflammatory agent, and substance that modulate insulin sensitivity, which have potential to have an effect on crucial metabolic processes. Their contribution to the management of oxidative stress, inflammation, blood sugar, cholesterol, weight, gut health, liver function, thermogenesis, and appetite regulation is discussed in this work. Although encouraging, more study is necessary to completely clarify the mechanism of action and to determine the efficacy of curry leaves in metabolic disorder.

1 Introduction

Murraya koenigii, commonly known as curry leaf or kari-patta in Indian dialects and it is also known as Mitha Neem in Hindi, and Karuveppilei in Tamil Nadu and Surabhinimba in Sanskrit in Bangali as Barsunga, belonging to Family Rutaceae which represent more than 150 genera and 1600 species.[1] Curry tree is the source of curry leaves which is commonly found in forest as undergrowth. Curry leaves are glossy, pointy, almond shaped pinnate leaves with a sweet and pungent fragrance.

2 Plant description

Tree: *Murraya koenigii* is a tiny spreading shrub or tree that is semi-deciduous, unarmed, scented, and has a trunk that may grow up to 81 cm (27 inches) in diameter. It has a strong woody stem that is both slender and dark green to brownish in colour. The primary stem has a 16-centimetre diameter.

Flower: The curry leaf's blooms are small, white, fragrant, funnel shaped, complete, ebracteate, hypogynous, persistent, inferior, green, corolla, polypetalous, androecium, polyandrous, lanceolate, stigma, bright, sticky, and style, each cluster bears 60 to 90 blooms at a time after flowering all at once, each flower has a diameter of 1.12 cm when fully opened, a 5-lobed calyx, petals that are 5 in number and have a length of 5 mm, and ten stamens.

Leaf: Curry leaves are known for their distinctive aroma and have glossy, smooth leaves with lighter coloured undersides. Each of the 11-22 leaflets in the pinnate, exstipulate, reticulate-venated leaves are between 0.39 and 0.79 inches in width and 0.89 to 1.57 inches in length. The leaves are ovate-lanceolate with an oblique base. Short stalked, alternating, gland-dotted, and with a 0.5 cm long petiole, the leaflets are serrated on the leaf edges. 20,31 approximately 480 g of yield per bush were detected after three to four pickings.

Stem and Bark: The stem of *Murraya koenigii* is brown to dark green in colour, with dots on the bark like small nodes on it. The main stem has a girth of 16 cm up to 6 meters in height and a diameter of 15 to 40 cm when the bark was peeled off longitudinally to reveal the white wood beneath.

Fruit: The *Murraya koenigii* produce fruits in clusters that range from 32 to 80 in number. The fruits are tiny, ovoid or sub-globose, green in colour, and contain one or more seeds that are enclosed in a thin pericarp. The fruits are edible, ripen to a purple-black colour, and measure 1 to 1.2 cm in diameter and 1.4 to 1.6 cm in length. They produce 0.76% of a yellow volatile oil. Curry leaf fruits are 11 mm long and weigh approximately 445 mg [2].



Fig.1 Curry tree with Leaf, fruit, flower, bark, and stem

Table.1 Taxonomical Classification

Kingdom	Plantae
Sub kingdom	Tracheobionta
Super division	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Rosidae
Family	Rutaceae
Genus	<i>Murraya J. Koenig ex L</i>
Species	<i>Murrayakoenigii (L.) Spreng</i>

3 Phytochemistry of *M. koenigii*

There are many phytochemicals have been isolated from the leaves, roots, and stem bark of *M. koenigii*. *M. koenigii* extracts of leaves, root, stem bark, fruits, and seeds have yielded alkaloids, flavonoids, terpenoids, and polyphenols. The plant leaves contain a large amount of proximate composition; the moisture is 63.2%, protein is 8.8%, carbohydrate is 39.4%, total nitrogen is 1.15%, fat is 6.15%, total sugars are 18.92%, starch is 14.6%, and crude fibre is 6.8%. The leaves have been reported as a significant source of several vitamins, such as vitamin A (B-carotene) [3].

4 Region

The curry leaf originated in the Indian subcontinent, particularly the Andaman and Nicobar Islands, Sri Lanka, and Bangladesh [4]. Indian immigrants then spread the curry leaf to other regions of the world.

It is currently cultivated in a number of tropical and subtropical location, including Australia, south Africa, India, Sri Lanka, Bhutan, Nepal, Malaysia, southern, China, Guangdong, southern Hainan, southern Yunnan, Laos, Vietnam, Thailand, the Mariana islands, Vanuatu, New Caledonia, and the Ryuku island.

Region 1: This area is restricted to subtropical woods that stretch from Jammu and Kashmir, Himachal Pradesh, and Uttarakhand to the terai region utter Pradesh and Bihar along the sub- Himalayan foothills.

Region 2: This area is to limited tropical moist and dry deciduous woods, as well as tropical evergreen and semievergreen forests, in the northeastern states.

Region 3: This area is limited to central India and include the Sundarbans delta, the Satpur ranges, the Malaya Giri, the Dandakaranya, and the Vindhyan ranges, as well as the Chot Nagpur, Hazaribagh, and Ramgarh plateaus.

Region 4: This region is limited to eastern India, primarily covering the eastern ghat [4-5].

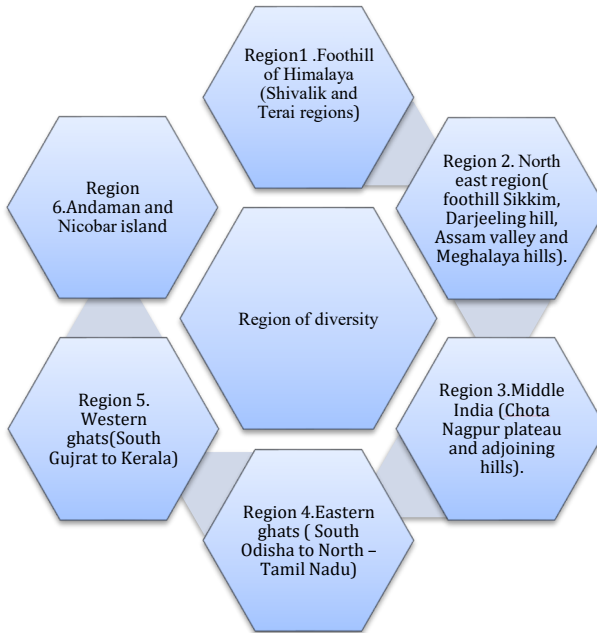


Fig.2 Region map of curry leaves [4]

5 Distribution

Although *Murrayakoenigiis* commonly farmed in south-east Asia, some regions of the United States, and Australia, it is native to the east and south of India, Pakistan, Sri Lanka.

It can grow in the Andaman Islands and all of India up to a height of 1500 to 1655 meters above sea level. 14 the damp woods between 500 and 1600 meters (15-500 feet) high can be found in Guangdong, Shainan, S Yunnan (Xishuangbanna), Bhutan, Laos, Nepal, Pakistan, Sri Lanka, Thailand, and Vietnam, among other Asian countries. Curry leaves travelled Malaysia, 16,17 south Africa, and reunion island with south Indian immigration. 3,4 only two of the 14 species in the genus *Murraya* that are known to exist worldwide – *Murrayakoenigii* (*spreng*) and *Murraya* [6].

6 Growing season

Throughout the spring, summer, and rainy season, the curry leaf plant will produce blooms and lush green leaves. In the winter, while the tree is resting, the leaves fall off. They require fertilizer during the month of summer and prefer full sun and well – drained soil that should be on the dry side. 23,24 The fruiting season was seen to last from the end of June to the end of august, with July being the month with the greatest amount of fruit production. In India, leaf harvesting began 15 months after planting, with subsequent leaf collections occurring every two to three months. 25 outdoor growth requires protection from freezing in cold regions like southern California, south Texas, and south Florida, handle the tiny seeds carefully.

7 Traditional uses

This plant, the curry leaf tree, is mentioned as having significant application in easter Asian traditional medicine. The Indian diet include to enhance appetite and digestion. The leave can be applied to treat rashes and animal bite that are poison. The branches of curry leaves are frequently used to clean teeth as well as to strengthen gums [4].

8 Medicinal uses

A well-known medicinal plant is *Murrayakoenigii*. According to Kumar et al. (1999), the plant contains a variety of essential oils, including- pinene (39.93%), sabinene (13.3%), and trans caryophyllene (9.02%) which has been shown to have antibacterial activity against bacillus subtilis, proteus vulgaris, and Corynebacterium pyogenes. The plant's leaves, fruits, roots, and bark contain carbazole alkaloid, which have antidiabetic, anticancer, antibacterial and antioxidant activities (Shyamlal, 2005). In rats, castor oil- induced diarrhoea and PGE2- induced enter pooling are inhibited by the bioactive carbazole alkaloid kurryam (I), koenimbine (II) koenine (III), and which are produce by the N-hexane seeds extract (mandal et al., 2010). Three bioactive carbazole alkaloid, Mahanine, Mahanimbine and Marryanol, were extracted from fresh leaves using acetone and have amazing antibacterial and topoisomerase I properties [7].

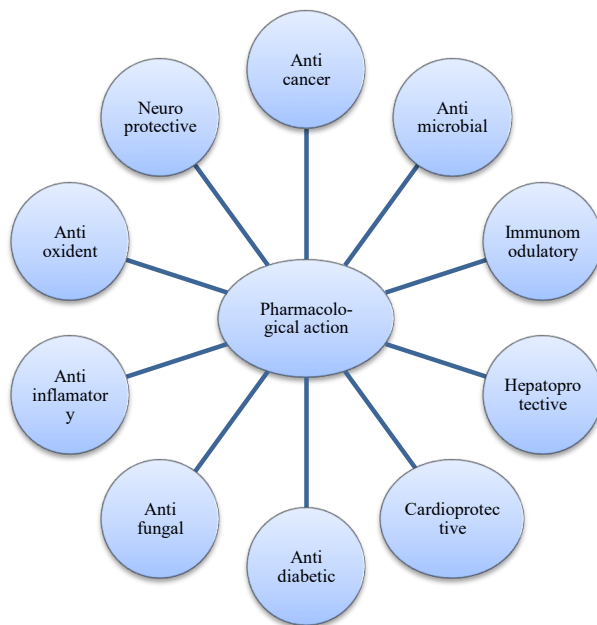


Fig.3 Pharmacological Action of *Murraya Koenigii*

9 Nutritional factor

Table.2 Nutritional profile [7]

Particular	Content (per 100g)
Calories	266 kcal
Total carbohydrate	4.1 g
Dietary Fiber	16.83 g
Sugar	0.6 g
Total fat	0.27 g
Saturated fat	0.04 g
Mono unsaturation fat	0.04 g
Poly unsaturation far	0.57 g
Protein	7.4 g
Vitamin D	177 IU
Riboflavin	0.07 mg
Vitamin B6	0.57 mg
Folate	177 ug
Calcium	659 mg
Iron	8.67 mg
Magnesium	182 mg
Phosphorus	83.29 mg
Potassium	584 mg

Sodium	18.66 mg
Zinc	1.18 gm
Copper	0.46 mg

10 Chemical Constituent of Curry Tree

10.1 Alkaloids

Alkalis are natural compounds that have at least one nitrogen atom in a heterocyclic ring. Defining them is complex, due to the fact they do not present to homogeneous organization of compounds from any point of view, whether chemical, biochemical or physiological. But for the truth that they're all nitrogen-containing compounds, there may be no widespread definition that suits all alkaloids.

Table.3 Details of alkaloid phytoconstituents

Constituent	Molecular Formula	Plant Part	Activity	Pharmacological Action On
Koenigicine	C ₂₀ H ₂₁ NO ₃	Leaves	Neuro-Protective Activity	Decreasing Glycemic Level
Koenigine	C ₁₉ H ₁₉ NO ₃	Leaves and stem bark	Anti-oxidant	Increases The Gsh Content in The Liver and Reduction in Hepatic Malondialdehyde in Kidney
Mahanimbicine	C ₂₃ H ₂₅ NO	Leaves	Anti-Amnesic	Protect Against the neurodegenerative diseases
Isomahanimbine	C ₂₃ H ₂₅ NO	Leaves and roots	Anti-Analgesic Activity	Anti-Nociceptive Effects
Koenimbidine	C ₂₀ H ₂₁ NO ₃	Leaves and roots	Anti-Diabetic, Anti-Amnesic	Decreases Oxidative Stress by Acting on Paraoxonase 1 Activity or Protect Against the neurodegenerative diseases
Bismurrayafoline E	C ₄₈ H ₅₆ N ₂ O ₄	Leaves	Radiation Protection Activity	Increases Glutathione, Its Enzymes Levels and Decrease the Chromosomal Damage
Isomahanine	C ₂₃ H ₂₅ NO ₂	Leaves, seeds, and fruits	Cytotoxicity, Effect on Dental Caries anti-oxidant, anti-microbial, anti-diabetic, and hyperlipidemic	Inhibition Of Cavity Formation or Oxidative Stress Inducer
Mahanimbicine	C ₂₃ H ₂₇ NO ₂	Leaves and seeds	Anti-oxidant, anti-microbial, anti-diabetic, and hyperlipidemic	Decreases Oxidative Stress By Acting On Paraoxonase 1 Activity
Pyrafoline-d	C ₂₃ H ₂₅ NO ₂	Leaves and stem bark	Anti-cancer and anti-bacterial	Increase The Death Of Cancerous Cell Proteasome Inhibitor
Mahanimboline	C ₂₃ H ₂₅ NO ₂	Leaves	Cytotoxicity, anti-oxidant, anti-microbial, anti-diabetic, and hyperlipidemic	Increases The Gsh Content in The Liver and Reduction in Hepatic Malondialdehyde in Kidney
Mukonicine	C ₂₀ H ₂₁ NO ₃	Leaves	Anti-oxidant	Increases The Gsh Content in The Liver and Reduction in Hepatic Malondialdehyde in Kidney
Isolongifolene	C ₁₅ H ₂₄	Leaves	Anti-oxidant and neuroprotective	Increases The Gsh Content in The Liver and Reduction in Hepatic Malondialdehyde in Kidney or Decreasing Glycemic Levels
9-Formyl-3-methyl	C ₁₄ H ₁₁ NO	Roots and	Anti-oxidant	Increases The Gsh Content in The

carbazole		stems		Liver and Reduction in Hepatic Malondialdehyde in Kidney
Mahanimbinol	C ₂₃ H ₂₇ NO	Stems bark	Anti-Trichomonal Vasodilation	Act Against Trichomonas Gallinae or By Acting on Negative Chronotropic Effect
Mukoic acid	C ₁₄ H ₁₁ NO ₃	Stem bark	Anti-oxidant	Increases The Gsh Content in The Liver and Reduction in Hepatic Malondialdehyde in Kidney
Murrayanine	C ₁₄ H ₁₁ NO ₂	Stem bark	Anti-oxidant	Increases The Gsh Content in The Liver and Reduction in Hepatic Malondialdehyde in Kidney
Mukoenine-A	C ₁₈ H ₁₉ NO	Roots and stem bark	Anti-Diarrheal Activity	Prostaglandin E2-Induced Enter Pooling and Reduction In Gastrointestinal Motility
Murrayafoline A	C ₁₄ H ₁₃ NO	Roots	Cytotoxicity, Effect Digestive System and anti-inflammatory	Stimulates Digestive Enzymes or Cox-Inhibitory Property
Girinimbine	C ₁₈ H ₁₇ NO	Roots, stem bark, and seeds	Anti-tumour Anti-Trichomonal	Act against Trichomonas Gallinae
Murrayacine	C ₁₈ H ₁₅ NO ₂	Stem and bark	Anti-Diabetic	Decreases Oxidative Stress by Acting OnParaoxonase 1 Activity
Murrayazoline	C ₂₃ H ₂₅ NO	Stem and bark	Cytotoxicity and anti-tumour	Increase The Death Of Cancerous Cell Proteasome Inhibitor
O-Methylmurrayamine A	C ₁₉ H ₂₀ NO ₂	Leaves	Anti-oxidant and neuroprotective	Increases The Gsh Content in The Liver and Reduction in Hepatic Malondialdehyde in Kidney or Decreasing Glycemic Levels
Koenimbine	C ₁₉ H ₁₉ NO ₂	Leaves, seeds, and fruits	Cytotoxicity and anti-diarrhoea	Prostaglandin E2-Induced Enter Pooling And Reduction In Gastrointestinal Motility
Murrayanol	C ₂₄ H ₂₉ NO ₂	Leaves, roots, and fruits	Effect On Dental Caries	Inhibition Of Cavity Formation
Mahanimbine	C ₂₃ H ₂₅ NO	Leaves, roots, seeds, and fruits	Cytotoxicity, Anti-Oxidation activity, anti-microbial, and anti-cancer	Increases The Gsh Content in The Liver and Reduction in Hepatic Malondialdehyde in Kidney or Increase the Death Of Cancerous Cell Proteasome Inhibitor
Mahanine	C ₂₃ H ₂₅ NO ₂	Leaves, stem bark, and seeds	Cytotoxicity, anti-microbial, Anthelmintic Activity and anti-cancer	Cause Paralysis or Act Against Inflammatory Cells and The Collagen Deposition Was Reduces

10.2 Flavonoids

Flavonoids are phenolic secondary metabolites created via plant life as a defence mechanism. It is responsible for the improvement of colouration and smell in fruits and flora. It's far widely known for its antioxidant, anti-inflammatory and anti-cancer homes. Flavonoids are categorised as flavones, flavanols, flavanones, flavanols, and anthocyanins. Among them, anthocyanins are the principal flavonoids in pigmented rice types.

Table.4Details of flavonoids phytoconstituents

Constituent	Molecular Formula	Plant Part	Activity
Quercetin	C ₁₅ H ₁₀ O ₇	Leaves	Anti-bacterial
Apigenin	C ₁₅ H ₁₀ O ₅	Leaves	Anti-cancer
Kaempferol	C ₁₅ H ₁₀ O ₆	Leaves	Anti-oxidant, Anti-inflammatory

Rutin	C ₂₇ H ₃₀ O ₁₆	Leaves	Anti-bacterial
Catechin	C ₁₅ H ₁₄ O ₆	Leaves	Vasodilating activity
Myricetin	C ₁₅ H ₁₀ O ₈	Leaves	Anti-cancer, Anti-diabetic
4-O-β-d-Rutinosyl-3-methoxyphenyl-1-propanone	C ₂₂ H ₃₂ O ₁₂	Leaves	Inflammatory Cytokinn's
1-O-β-d-Rutinosyl-2(R)-ethyl-1-pentanol	C ₁₉ H ₃₆ O ₁₀	Leaves	
8-Phenylethyl-O-β-d-rutinoside	C ₂₀ H ₃₀ O ₁₀	Leaves	

10.3 Phenolic Compounds

Polyphenols consist of phenolic acids, flavonoids, tannins, lignans, and coumarins. Phenols are herbal antioxidants and the organization of phytochemicals most abundant in entire grains, and they are available in numerous forms: insoluble, soluble, conjugated, insoluble, and esterified. The various phenolic acids in entire grains, protocatechuic acid, p-coumaric acid, ferulic acid, Sinopic acid, and vanillin have been the main phenolics of rice.

Table.5Details of phenolic phytoconstituents

Constituent	Molecular Formula	Plant Part	Activity
Selin-11-en-4α-ol	C ₁₅ H ₂₆ O	Leaves and bark	Anti-bacterial
2-hydroxy-4-methoxy-3,6-dimethylbenzoic acid	C ₁₀ H ₁₂ O ₄	Bark	

Table.6Details of terpenes phytoconstituents

Constituent	Molecular Formula	Plant Part	Activity
Bornyl Acetate	C ₁₂ H ₂₀ O ₂	Leaves, Stems, Roots	Analgesic effect
β-Pinene	C ₁₀ H ₁₆	Leaves	antibacterial, antidepressant, cytotoxic, and antimicrobial
Carotene	C ₄₀ H ₅₆	Leaves	Cancer treatment
Chrysanthenyl Acetate	C ₁₂ H ₁₈ O ₂	Leaves, Stem	Analgesic effect
Citral	C ₁₀ H ₁₆ O	Leaves, Stems	Antifungal, antibacterial
β-Phellandrene	C ₁₀ H ₁₆	Leaves	Anti inflammatory
Di pentene	C ₁₀ H ₁₆	Leaves	Anti inflammatory
Juniper Camphor	C ₁₅ H ₂₆ O	Leaves	Antidiarrheal, anti-inflammatory,
Linalool	C ₁₀ H ₁₈ O	Leaves, Stems, Roots	Local anaesthetics
Sabinene	C ₁₀ H ₁₆	Stem and leaves	Anti-microbial activity
α-Terpinene	C ₁₀ H ₁₆	Leaves	Anti-oxidant

Table.7Details of sesquiterpene phytoconstituents

Constituent	Molecular Formula	Plant Part	Activity
α-Humulene	C ₁₅ H ₂₄	Leaves	Anti-depressant effects, sedative
α-Copaene	C ₁₅ H ₂₄	Leaves	Anti-oxidant
Aromadendrene	C ₁₅ H ₂₄	Leaves	Analgesic effect
Iso Caryophyllene	C ₁₅ H ₂₄	Leaves, Stems	Anti-carcinogenic
Gurjunene	C ₁₅ H ₂₄	Leaves	Anti-bacterial agents
Dehydro Aromadendrene	C ₁₅ H ₂₄	Leaves, Stems, Roots	Anti-oxidant
Cubenol	C ₁₅ H ₂₆ O	Leaves, Stems	Anti-microbial and anti-oxidant
Cis-Caryophyllene	C ₁₅ H ₂₄	Leaves	Hepatoprotective, neuroprotective

Δ -Cadinene	C ₁₅ H ₂₄	Leaves	Anti-microbial agent
Cadinene	C ₁₅ H ₂₆	Leaves	Anti-microbial agent
β -Selinene	C ₁₅ H ₂₄	Leaves, Stems	Anti-microbial agent
β -Caryophyllene	C ₁₅ H ₂₄	Leaves, Seeds	Anti-bacterial and anti-oxidant
β -Bisabolene	C ₁₅ H ₂₄	Leaves	Anti-oxidant activity

Table.8Details of alcohol phytoconstituents

Constituent	Molecular Formula	Plant Part	Activity
Tocopherol	C ₁₅ H ₂₄	Leaves	Anti-oxidant
Steary Alcohol	C ₁₈ H ₃₈ O	Stems, Leaves, Roots	Anti-microbial effect
Menthol	C ₁₀ H ₂₀ O	Leaves	Cytotoxic effect in cancer
Frnesol	C ₁₅ H ₂₆ O	Leaves	Anti-microbial, antitumor and anti-oxidant
β -Terpineol	C ₁₀ H ₁₈ O	Leaves	Anti-oxidant, anti-cancer
Cis-2-Cyclohexen-1-Ol	C ₁₀ H ₁₈ O	Leaves	Anti-oxidant
β -Eduesmol	C ₁₅ H ₂₆ O	Leaves	Anti-cancer and treat neurogenic inflammation
β -Costol	C ₁₅ H ₂₆ O	Leaves	Antiviral and neuroleptic

Table.9Details of essential oil

Constituent	Molecular Formula	Plant Part	Activity
α -Thujene	C ₁₀ H ₁₆	Leaves	Anti-ageing
3-Carene	C ₁₀ H ₁₆	Leaves	Anti-oxidant, antimicrobial
Camphene	C ₁₀ H ₁₆	Leaves	Anti-cancer
Allyl(methoxy)dimethylsilane	C ₆ H ₁₄	Leaves	Anti-cancer
β -Myrcene	C ₁₀ H ₁₆	Leaves	Anti-cancer
α -Phellandrene	C ₁₀ H ₁₆	Leaves	Sedative agent
m-Cymene	C ₁₀ H ₁₄	Leaves	Anti-oxidant, anti-inflammatory
Limonene	C ₁₀ H ₁₆	Leaves	Anti-cancer
Eucalyptol	C ₁₀ H ₁₈ O	Leaves	Anti-cancer
(E)-Ocimene	C ₁₀ H ₁₆	Leaves	Anti-fungal and anti-cancer
cis-Sabinenehydrate	C ₁₀ H ₁₈ O	Leaves	Immunomodulatory, anti-inflammatory
Linalool	C ₁₀ H ₁₈ O	Leaves	Local anesthetics
4-Terpineol	C ₁₀ H ₁₈ O	Leaves	Strong antimicrobial agents
Naphthalene	C ₁₀ H ₈	Leaves	Anti-diabetic, anti-hypertension
Terpinyl acetate	C ₁₂ H ₂₀ O ₂	Leaves	Antimicrobial effect
cis-Piperitol	C ₁₀ H ₁₈	Leaves	Analgesic medicine
Isobornyl acetate	C ₁₂ H ₂₀ O ₂	Leaves	Antimicrobial effect
Neryl propionate	C ₁₃ H ₂₂	Leaves	Antimicrobial effect
Eudesma-4(14),11-diene	C ₁₅ H ₂₄	Leaves	Antimicrobial effect
d-Cadinene	C ₁₅ H ₂₄	Leaves	Insecticidal activity
Nerolidyl acetate	C ₁₇ H ₂₈ O ₂	Leaves	Anti-microbial agent
Caryophyllene oxide	C ₁₅ H ₂₄ O	Leaves	Anti-microbial and anti-carcinogenic
Cubenol	C ₁₅ H ₂₆ O	Leaves	Anti-oxidant and anti-microbial agent
α -Cadinol	C ₁₅ H ₂₆ O	Leaves	Anti-fungal and hepatoprotective agents
Phytol	C ₂₀ H ₄₀ O	Leaves	Cytotoxic effect, metabolism modulators, anti-microbial effect

11 Potential uses of curry leaves

Curry leaves may be used to treat a variety of medical issues. Following are some advantage of curry leaves that were discovered in several studies:

11.1 Potential uses of curry leave for diabetes

Dusane et al. (2012) investigated the effectiveness of curry leaves in controlling blood sugar in an animal model. The sugar level was significantly lower. The leaf extract's ability to reduce blood levels may aid with blood sugar levels. This action could be similar to that of insulin, which would lower the blood sugar levels either by boosting pancreatic insulin production or by increasing the uptake of glucose by cells as a result of particular enzymes. This demonstrated that curry leaves might be useful for treating diabetes. [8] [9]

11.2 Potential uses of curry leaves for high cholesterol

Curry leaves considerable decreased the total cholesterol and triglyceride(fat) level in an animal study done by Xie et al. in 2006. Curry leaves may have a hypolipidemic (lipid- lowering) effect in decreased cholesterol and fat metabolism. It may help to reduce cholesterol and low density-lipid (bad cholesterol). These studies, however, are insufficient to fully comprehend the impact on people. On the advantage of curry leaves in controlling cholesterol level in the human body, additional information is needed. Therefore, it is best to see a doctor before using curry leaves to check your cholesterol[8][10].

11.3 Potential uses of curry leaves for skin

Curry leaves and their essential oils have the advantage of perhaps acting against inflammatory cell. They might exhibit wound healing activity when administered to external, superficial wounds such skin eruption, burns and bruises. For skin whitening, brightening and moisturizing rough skin, lotion and other formulations containing the essential oils from leaves may be utilized. Additionally, curry leaf oil may be useful for treating skin conditions like athlete's foot, boils, acne, pimple, itching, and ringworm [7][8]. More research is required to determine the curry leaves' beneficial benefits on preserving skin health. as a result, before ingesting any herbal medicines composed of curry leaves, consumers should get medical advice.

11.4 Potential uses of curry leaves for the liver

The extract of curry leaves greatly boosted the activity of the liver enzyme that assist the oxidation of lipids in the liver, additionally, the extract demonstrated liver- protecting properties that reduced liver damage [12].

11.5 Potential uses of curry leaves for the cancer

In A549 cells, the carbazole alkaloid girinimbine, which is obtained from *Murrayakoenigii*'s roots, induces cell death by apoptosis in a dose- dependent manner. Furthermore, author hypothesizes that the girinimbine-induced cell death may occur via the traditional mitochondrial pathway, which involves the release of cytochrome C and caspase-dependent apoptosis²³. Additionally, it was discovered that the root bark's koenoline had anticancer properties against KB cell culture and that stem's carbazole alkaloid had an impact on the proliferation of the HL-6024 human leukaemia cell line [11].

12 Side effect of curry leaves

No significant study has been conducted that provide evidence of curry leaves' negative impacts on people.[14] However, certain animal model studies by Xie et al. (2006) revealed localized gastrointestinal discomfort [10]

13 Precaution to take with curry leaves

Curry leaf usage is generally safe.[15] However, general safety measure must be taken to prevent any issues.[16] For those taking blood pressure medications, medical counsel is required.[17] According to a number of study findings, taking curry leaf extract and blood pressure medication simultaneously may have unfavourable effects.[18] The extract's ingredients may interact with the medication, causing low blood pressure. Therefore, it is best to refrain from combing the two medications. The seeds of the *Murrayakoenigii* are poisonous in nature and should not be consumed for any region [13].

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