



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

# IJIRSET

International Journal of Innovative Research in  
**SCIENCE | ENGINEERING | TECHNOLOGY**



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 13, Issue 2, February 2024

**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA

Impact Factor: 8.423



9940 572 462



6381 907 438



ijirset@gmail.com



www.ijirset.com

# Exploring the Therapeutic Potential of *Murraya koenigii*: A Comprehensive Review of Medicinal Applications

Teena Rana<sup>1</sup>, Dipesh Prajapati<sup>2</sup>, Kanhiya kr. Jha<sup>3</sup>, Sachin Kumar Yadav<sup>4</sup>, Nargis Khan<sup>5</sup>

Student B. Pharm 4<sup>th</sup> year, Sunder Deep Pharmacy College, Dasna Ghaziabad, India

Asst. Professor, Sunder Deep Pharmacy College, Dasna Ghaziabad, India

Student B. Pharm 4<sup>th</sup> year, Sunder Deep Pharmacy College, Dasna Ghaziabad, India

Asst. Professor, Sunder Deep Pharmacy College, Dasna Ghaziabad, India

Asst. Professor, Sunder Deep Pharmacy College, Dasna Ghaziabad, India

**ABSTRACT:** Primary and traditional health care systems use herbal extracts due to the significant therapeutic value of their bioactive compounds. These ancient systems of medicine are deeply related to the Unani, Siddha and Ayurveda. *Murraya Koenigii*, a medicinal herb primarily originating from Asia, has considerable medicinal importance and provides a wide therapeutic range for applications. The clinical use of *Murraya Koenigii* as antipyretic, antibacterial, for gastrointestinal disorder, hepatoprotective, diabetes and its complication, excellent antioxidant and anthelmintic. All the parts of *Murraya Koenigii* like leaves, stems and bark have significant medicinal value. A lot of research has been conducted on the pharmacology and phytochemistry of *Murraya Koenigii* to explore the therapeutic potential. To compile the wide range of knowledge about *Murraya Koenigii*, this review has been prepared. This review encompasses the knowledge of phytochemical constituents and pharmacological activity of extracts of different parts of *murraya koenigii*. It also uses as an important part of Indian dishes.

**KEYWORDS:** *Murraya Koenigii*, therapeutic uses, physiological, therapeutic potential

## I. INTRODUCTION

Nutraceuticals are characterized as an added substance in food/part of a food that gives several advantages in connection with clinical or wellbeing; it helps to prevent and cure several diseases and disorders [1]. Nutraceuticals are vague adjuvant treatments that were utilized to advance health, forestall threatening cycles and control side effects. [2]. Significance of plant optional metabolites in medication, agribusiness and industry has prompted various examinations on the blend, biosynthesis and organic action of these substances. It has been assessed that more than 40% of medications have their starting points in these dynamic natural products [3,4].

No one can clearly distinguish the nutraceutical and medicinal plants because the primary character of nutraceuticals is to make healthy and play a vital role in the diet as food sources [5]. On the other hand, many medicinal plants have specific medicinal value without any nutritional value and use these plants in the specific health issue.



Figure 1- *Murraya koenigii* leaves



Figure 2- *Murraya koenigii* Plant

Murraya koenigii have high demand after for their nourishing and therapeutic value. [6]. Murraya is more popular due to its broad spectrum of medicinal properties and also because of the use of its leaves for centuries as a natural agent in various diseases and food items [7]. Old system of medicine explain the uses of several plant. Murraya koenigii leaves have different constitute due to these ingredient it is highly used in Indian diet which improve digestion and appetite.

Natural products are used to prevent and to treat several disease and improve health because of nutritive and pharmacological importance. These natural products are get high attention of scientific community and general public. Medicinal Plants with medicinal value are available and offer a cost-effective source which have lesser side effects to prepare new drugs therapy [8]. Plants was used traditionally in whole the world for the health care and for nutritive values. The medicinal components are extracts from different part of plant and methods for the extraction was used such as maceration, Decoction. The herbal medication show serious impact on current medicinal practice [9].

Herbal therapeutics have been used in the medication to treat different metabolic and disease like diabetes, tumors, cardiovascular sicknesses. Most of metabolic and non-communicable infections are connected with higher mortality [10].

#### Plant profile:

Kingdom-Plantae  
Subkingdom- Tracheobionta  
Superdivision- Spermatophyta  
Division- Magnoliophyta  
Class- Magnoliopsida  
Subclass – Rosidae  
Family- Rutaceae  
Genus- Murraya J. Koenig  
Species- Murraya koenigii

## II. TRADITIONAL USES

Murraya koenigii Spreng is Known as „Surabhinimba“ in Sanskrit and related with the group of Rutaceae. Curry leaves is called by various name by the different ethnic, In Tamil we called as Karivempu, Bengali as „Barsunga“, in Hindi we called as Kurrupatte[11] .

The barks and roots are utilize remotely to fix the chomps of the harmful creatures; the green leaves were eaten crude as a solution for looseness of the bowels, the runs [12]. Imbuement of cooked leaves were provided to stop emesis .Besides, Murraya koenigii were likewise utilized as blood purifier, tonic and remedy for stomachache and utilized as seasoning specialists in curries and chutneys[13] . Curry leaves were likewise utilized as calcium source to those having lack of calcium other than that it additionally comprise Vitamin A, Vitamin B and B2, L-ascorbic acid and iron. For the therapy of morning disorder; new squeeze of curry leaves along with lime squeeze and sugar is given and it is additionally appropriate for retching because of heartburn. On account of stomach disturbs, the curry leaves is grounded to a fine glue and blended in with buttermilk and polished off orally. A glue of curry leaves is applied on the bubbles for quick help, other than that, renal aggravation can be restored by polishing off the root as a juice .The new squeeze of curry leaves can forestall the movement of waterfall. Murraya koenigii will hold the dark shade of the hair or at the end of the day, it will forestall the untimely turning gray of the hair [14].

#### Distribution

Murraya koenigii has little spreading bush which around 2.5 meters in level, the stem is dull green to earthy in variety. As per the creator, Murraya koenigii is circulated and developed all through India. It is found from Sikkim to Garhwal, Bengal, Assam, Western Ghats and Travancore-Cochin. The seeds develop without restriction under shade or fractional shade. This curry leaves can be found in clammy backwoods of 500-1600 meters“ in level particularly in Guangdong, S Hainan, S Yunnan. Bhutan, Laos, Sri Lanka, Thailand, Nepal, Vietnam. Upon with the South India workers the curry leaves shows up to Malaysia, South Africa, and Get-together Island [15].



**Phytochemistry**

The matured curry leaves consist 63.2% of moisture, protein which is of about 1.15% of nitrogen, carbohydrate 14.6% which is of total sugars and total ash 13.06%. The bioactive components in curry leaves are oxalic acid, resin, carbazole alkaloids and the major bioactive compounds such as the koenigin, bicyclomahanimbicine, cyclomahanimbine, murrayastine, coumarine, koenidine and pypayafolinecarbazole has significant pharmacological activities and the major portion of volatile oil consist of bicyclomahanimbicine, mahanimbicine[16].

The composition of volatile compounds found in the essential oil of *Murraya Koenigii* from the state of Sabah, Malaysia as follows[17]

Volatile Compounds	Composition
Linalol	0.56%
trans-Sabinene hydrate	0.53%
trans-2-Cyclohexen-1-ol	0.48%
cis-2-Cyclohexen-1-ol	0.54%
para-Cymen-8-ol	10.31%
$\beta$ -Terpinol	2.52%
trans-Piperitol	0.40%
Chrysanthenyl acetate	0.39%
Lavandulyl acetate	1.67%
Bornyl acetate	1.68%
$\alpha$ -Copaene	0.82%
$\beta$ -Elemene	0.35%
$\beta$ -Caryophyllene	19.50%
$\alpha$ -Humulene	15.24%
Phytol	10.07%

Table 1: List of bio chemical Components of *Murraya koenigii*

All the part of *Murraya koenigii* have bioactive compounds like murrayanol, murrayagetin in roots and in the benzene extraction of root have mukoline, mukolidine and girinimbine in high concentration. Fruit of *Murraya koenigii* extraction in petroleum ether have mahanimbine and koenimbine. Seeds have of 3 bioactivecarbazole alkaloids which is koenine,koenimbine and iskurryam. The seed also contain mahanimbine, girinimbine, koenimbine, mahanine and isomahanine. *Murraya koenigii* leaves contain protein, carbohydrates, fibre, minerals, carotene, vitamin C, Nicotinic acid[8-20]. Mature leaves of the plant Contain moisture content of 63.2% and consist of various components such as 1.15% total nitrogen, 6.15% fat, 18.92% total sugars, 14.6% starch, 6.8% crude fibre, 13.06% ash, 1.35% acid insoluble ash, 1.82% alcohol soluble extractive, 27.33% cold water (20°C) extractive, and a maximum of 33.45% hot water-soluble extractive[21].

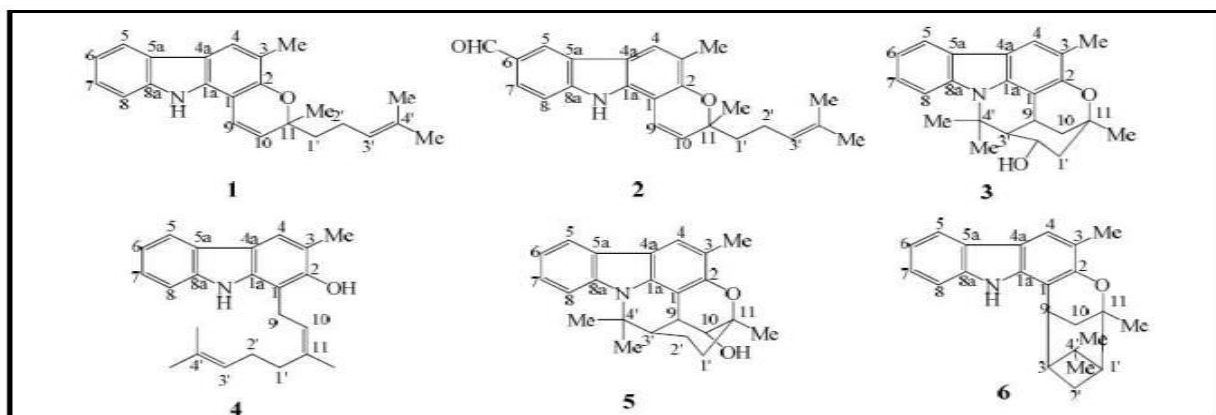


Figure 2: Chemical Structure 1. Mahanimbine (C<sub>23</sub>H<sub>25</sub>NO) 2. Murrayamine-J (C<sub>23</sub>H<sub>23</sub>NO<sub>2</sub>), 3. Murrayazolinol (C<sub>23</sub>H<sub>25</sub>NO<sub>2</sub>), 4. Mahanimbicol (C<sub>23</sub>H<sub>27</sub>NO), 5. Murrayakoeninol (C<sub>23</sub>H<sub>25</sub>NO<sub>2</sub>) and 6. Bicyclomahanimbicine (C<sub>23</sub>H<sub>25</sub>NO).

**Pharmacological activity of *Murraya koenigii*****Antipyretic**

The rodents were febrile with the parental organization of 10mg/kg of brewer's yeast and were found that the ethanol concentrate of *Murraya koenigii* leaves represents an antipyretic movement contrasted with oil ether concentrate and chloroform extract, with paracetamol portion of 150mg/kg as a standard drug [22]

**Antibacterial Activity**

The 3 carbazole alkaloids viz. mahanine, mahanimbicine and mahanimbine and natural oils from the leaves of *Murraya koenigii* were assessed for the impacts on development of five anti-microbial safe pathogenic microorganisms and three growth cell lines (MCF-7, P388 and Hela). Mahanimbine and medicinal ointment exhibited intense portion subordinate antibacterial and cytotoxic impact ( $\leq 5.0$  microgm/mL). Furthermore, critical antitumor exercises against MCF-7, Hela and P388 cell lines were additionally noted. [23,24] Complete hindrance of development of *L. innocua* was seen with both Dissolvable free microwave extraction (SFME) and customary hydro-refined oil (HD) natural ointments, at 400 and 600 microgm/mL (least inhibitory focus), individually. The SFME-rejuvenating oil at 300 microgm/mL gave 92% hindrance, showing its true capacity as a characteristic antimicrobial agent [25].

Antibacterial properties of therapeutic plants were viewed as because of tannins, alkaloids, saponins, flavonoids, sterols and triterpenes and lessening sugars [26-27].

The hexane, methanol and chloroform concentrate of the *Murraya koenigii* root were tried against *Bacillus subtilis*, *Staphylococcus aureus*, *Escherichia coli*, *Salmonella typhi* and contagious kind of *Aspergillus niger*, *Candida albicans* and *Trichophyton rubrum*. The hexane, methanol and chloroform concentrate of the base of *Murraya koenigii* was viable on every one of the tried strains and methanol remove showed more critical antimicrobial action contrasted with the others with greatest inhibitory impact on *Staphylococcus aureus* and *Trichophyton rubrum*. The *Staphylococcus aureus* were powerless to the every one of the three concentrates above, moreover the fluid concentrate of the root were viewed as incapable against the tried microorganism [28].

**Gastrointestinal Disorder**

The n-hexane concentrates of the seeds of *Murraya koenigii* showed a huge inhibitory movement against castor oil-prompted the runs and PGE2-initiated enteropooling in rodents. Furthermore, a critical lessening in gastrointestinal motility was seen in the charcoal feast test in Wistar rats [29].

**Hepatoprotective**

The methanolic concentrate of *Murraya koenigii* leaves at the portions of 200mg/kg, 300mg/kg and 500mg/kg has shown decline in the rise on hepatic marker catalysts (Aspartate transaminase, Alanine transaminase, Serum bilirubin and Basic phosphate) because of organization of carbon tetrachloride on grown-up Sprague dawley rodents. The maximal portion of 500mg/kg was tantamount to the standard medication, Silymarin, which has been utilized clinically for the treatment of the liver disease [30]. Watery concentrate of *Murraya koenigii* at the portion of 1g/kg and 2g/kg were utilized to assess the hepatoprotective movement on ethanol initiated grown-up wistar rodents. 1g/kg of the concentrate were found promising hepatoprotective action against ethanol actuated hepatitis. The fluid concentrate hinders the lipid per oxidation action and improves the cell solidness by repressing cell putrefaction. Besides, both of the concentrate dosages were found to display a similar decline in serum glutamate pyruvate transaminase (SGPT) and basic phosphatase (ALKP) not exactly L-ornithine-L-aspartate (LOLA) which act as sure control. Other than that, the serum bilirubin has no significant decrease in its endless supply of the two dosages of the extract [31].

**Diabetes and its Complication**

Antidiabetic and islet defensive Concentrates of *Murraya koenigii* brought about pancreatic beta cell assurance and practical pancreatic islets that produce insulin. This was apparent by the standardization of plasma insulin and C-peptide levels, demonstrating endogenous insulin discharge, after treatment in streptozotocin prompted diabetic Swiss mice. Indeed, even the histochemical and immunohistochemical examination recommend and islet defensive and insulin useful job. Furthermore, concentrates of *Murraya koenigii* expanded the degrees of glucose-6-phosphate dehydrogenase chemical, standardized hepatic and muscle glycogenesis, bringing about appropriate glucose usage. The degrees of post-prandial hyperglycemia were likewise diminished due to the pancreatic and gastrointestinal glucosidase inhibitory movement of the concentrates of *Murraya koenigii* [32].

### Antioxidants Activities

Restorative plants are fantastic normal cell reinforcements that can be utilized to forestall sicknesses like malignant growth, heart infections, strokes, and aggravation [33]. (e optional metabolites, phenolics, flavonoids, and carotenoids are found in practically all pieces of therapeutic plants, and they have been accounted for to have strong free extreme scroungers and cell reinforcement properties [34]. (e developing interest in cancer prevention agents from regular sources has drawn in mainstream researchers as of late, as manufactured cell reinforcements have a few incidental effects like the gamble of liver harm and carcinogenesis in creatures [35, 36]. *M. koenigii* assumes an essential part among the generally significant restorative plants used in Asian ayurvedic rehearses because of their medical advantages and remedial activities [34]. Different immediate and circuitous techniques have evaluated the cancer prevention agent exercises of the plants of the Rutaceae family. Most pieces of *M. koenigii* are accounted for to be a rich wellspring of plant polyphenols, flavonoids, and alkaloids, having a high cell reinforcement power [37-39]. A new report revealed that complete cell reinforcement action was the most noteworthy in *M. koenigii* (2691  $\mu\text{mol}$  of ascorbic corrosive/g test) among green verdant vegetables [40]. (e in vitro cell reinforcement property of leaf concentrates of *M. koenigii* has been concentrated on in various solvents/dissolvable combinations like water, methanol, hexane, water : ethanol, or chloroform with DPPH,  $\text{Fe}^{3+}$  particle lessening strategy, and hydroxy extremist searching action [41]. All examples changed in their cancer prevention agent potential relying upon the substance creation and the dissolvable. By the by, the 1:1 (water : ethanol) blend leaf separate showed the greatest cell reinforcement movement. Curiously, the 1:1 (water : ethanol) combination had the option to search roughly 90% of DPPH and hydroxyl extremists at 4-5-overlap lower concentra tions than the wide range of various tried dissolvable concentrates. (e obser vation of water: ethanol blend leaf separate with the most elevated searching action is as per a review that pre-owned reaction surface philosophy to streamline the dissolvable focus and extraction time in boosting the yield of *M. koenigii* leaf concentrates to decide the absolute phenol content and DPPH examine. (e half ethanol separate showed the most noteworthy rummaging skill and complete phenolic content [42]. (e  $\text{H}_2\text{O}_2$  searching strategy has been utilized to screen the absolute cell reinforcement action of *M. koenigii*  $\text{CH}_3)_2\text{CO}$  and petrol ether leaf removes. (e mature leaf  $\text{CH}_3)_2\text{CO}$  ex lots had a moderately more noteworthy searching movement by half contrasted with youthful leaves in petrol ether [43]. A review was made to get to the cell reinforcement action of *M. koenigii* leaves in various dissolvable concentrates, benzene, ethyl acetic acid derivation, oil ether,  $\text{CH}_3)_2\text{CO}$ , methanol, and ethanol. It was obvious that the benzene layer had the most noteworthy revolutionary searching power, trailed by ethyl acetic acid derivation and oil ether [44]. (is perception is additionally upheld in another review, where the benzene portion was found to have the most noteworthy absolute phenolic content and cancer prevention agent exercises [45]. Contrasts in extractability of the cell reinforcement com ponents in a dissolvable with different polarities make sense of the fluctuated cancer prevention agent exercises of *M. koenigii* in various solvents.

Among the green verdant vegetable the absolute cancer prevention agent movement was the most elevated in *Murrya koenigii* (2691 micromol of ascorbic corrosive/gm test) when contrasted with that of methanol concentrates of *Amaranthus* sp., *Centella asiatica* and *Trigonella foenum graecum*. [46] Studies directed by Mitra et al. 2012 show that the fluid concentrates of *Murrya koenigii* leaf present huge security to rodent heart tissue against cadmium-initiated oxidative pressure presumably because of its cell reinforcement action. The modifications found in the degrees of lipid peroxidation, decreased glutathione, protein carbonyl substance, changes in the exercises of cardiovascular cancer prevention agent and favorable to oxidant compounds, demonstrate that cadmium-actuated tissue harm was the aftereffect of oxidative pressure. This cell reinforcement movement of *Murrya koenigii* could be valuable to individuals who are presented to cadmium either naturally or occupationally [47].

### Effect on Cardiovascular Diseases-

Cardiovascular sicknesses are the main source of death on the planet. As per WHO, cardiovascular sicknesses in the old populace have made 18 million passings in the year 2016, coming about in 31% of passings in the globe [48]. Atherosclerosis is one of the major causative elements for cardiovascular infection because of the blockages that keep blood from streaming to the heart or cerebrum because of the structure up of greasy stores on the inward walls of the veins. Unusually expanded degrees of lipids in the blood, fatty substances, phospholipids, cholesterol, and cholesterol esters trigger atherosclerosis. (e various kinds of cholesterol, High-Thickness Lipoprotein (HDL), Low-Thickness Lipoprotein (LDL), and Exceptionally Low Thickness Lipoprotein VLDL, hugely affect the pervasiveness of cardiovascular sickness. Different examinations are attempted to assess the counter hyperlipidemic capability of the *M.*

koenigii leaf extricates. (e biochemical reaction of *M. koenigii* was concentrated on different sorts of cholesterol in a review with Pale skinned person rodents. (as specialists took care of Pale skinned person rodents an eating routine sustained with 20% coconut oil with 10% *M. koenigii* leaf feed for a considerable length of time. An expansion in HDL and diminished LDL, VLDL, and absolute serum cholesterol levels were seen in the trial [49]. In another review, the impact of *M. koenigii* fluid leaf concentrate of 300 mg/kg on the biochemical reaction in typical and STZ prompted extreme diabetic rodents were assessed. (results affirmed a decline of 22.9% and 37.1% of fatty oil level and 19.2% and 30.3% in complete cholesterol in typical and diabetic rodents, separately, in one month [50]. (e strength of *M. koenigii* leaf on bringing down blood cholesterol levels could be found out by different experi psychological circumstances, including the review's span, the sort of creature model or the type of *M. koenigii* leaf utilized, or the dissolvable utilized for the extraction. Another finding showed that stout diabetic ob/ob mice given 80 mg/kg watery *M. koenigii* remove for ten continuous days have signifi cantly diminished blood cholesterol levels from  $277.6 \pm 16.6$  mg/day (day 0) to  $182.0 \pm 15.3$  mg/day [51]. Likewise, the dichloromethane and ethyl acetic acid derivation concentrates of *M. koenigii* leaves brought down body weight gain in high-fat eating regimen prompted stout rodents at oral organization of 30 mg/kg/day. Creatine kinase (CK-MB) is a notable heart compound and a cardiovascular biomarker tracked down principally in the heart muscle. A review surveyed the impact of *M. koenigii* watery concentrate (180 mg/kg body weight) on pale skinned person Wistar rodents treated with Voltral tablets to build the degree of CK MB [52]. A critical diminishing of the heart chemical CK-MB was seen in rodents treated with *M. koenigii* contrasted with the gathering treated with atenolol, a medication accessible in the market as a beta blocker, further recommending a possible job of *M. koenigii* in bringing down CK-MB in myocardial localized necrosis.

#### Anthelmestic

The anthelmintic action of ethanolic and watery concentrates of *M. koenigii* leaves was inspected against *Pheretima* posthuman, and the two concentrates showed eminent movement at a centralization of 100 mg/mL.40 among the concentrates, the alcoholic concentrate displayed more critical anthelmintic action contrasted with the petrol ether extract [53].

Besides, the watery concentrate of *M. koenigii* leaves showed nephroprotective action in diabetic rodents. It caused a huge and portion subordinate decrease in serum urea and creatinine levels ( $P < 0.001$ ), while really expanding the degrees of plasma cell reinforcement limit ( $P < 0.001$ ) contrasted with the benchmark group of non-diabetic subjects. Histological investigation of the kidneys from these creatures uncovered equivalent tissue recovery worked with by the watery extract [54].

### III. CONCLUSION

*Murraya koenigii* was one of the medicinally gainful plant which has been utilized numerous century prior by our progenitors. In the ongoing globalization period, it is hard to track down a curry plant in greater part of the houses and many eating regimens has been reliant to engineered specialist as taste enhancer against curry leaves. Hence, the significance of these gainful plant ought to be underlined and the bioactive parts of *Murraya koenigii* ought to be dissected further and utilized against the infection that have been created obstruction and synergistic investigations ought to be done.

To finish up, this exhaustive survey article has introduced a careful outline of the helpful capability of *Murraya koenigii*, otherwise called curry leaves. Through a broad investigation of different examinations, the survey features the large number of pharmacological exercises exhibited by this restorative plant.

The discoveries show that *Murraya koenigii* displays outstanding cancer prevention agent, mitigating, antimicrobial, anticancer, antidiabetic, hepatoprotective, neuroprotective, and cardiovascular impacts. These helpful properties are credited to the presence of bioactive mixtures, including alkaloids, flavonoids, phenols, and terpenoids, inside the plant. The audit underlines the conventional utilization of *Murraya koenigii* for overseeing different sicknesses and highlights its true capacity for future medication improvement. Moreover, the article gives bits of knowledge into the basic components of activity and the security profile related with *Murraya koenigii* removes.

Nonetheless, further exploration is important to acquire an extensive comprehension of the sub-atomic systems included and to streamline the suitable measurements and detailing of treatments in view of *Murraya koenigii*. Thorough clinical preliminaries are fundamental to approve the adequacy and wellbeing of this plant in human subjects. In outline, the remedial use of *Murraya koenigii* shows guarantee as a characteristic other option or reciprocal treatment for a large number of sicknesses. With proceeded with examination and investigation, this important plant can possibly make huge commitments to the field of home grown medication and upgrade the wellbeing results of people around the world.

### ACKNOWLEDGEMENT

I would like to express my gratitude to the Principal and HOD of sunder Deep Pharmacy College, Ghaziabad and always beloved parents for the Support, Blessings, Love and Prayers, Mr. Dipesh Prajapati (Research guide), Support and serve me like backbone during my project and review paper. Dr. Prasoon Sexana continuously encourage for betterment and finally to the almighty God.

### REFERENCES

1. Brower, V., 1998. Nutraceuticals: poised for a healthy slice of the healthcare market? *Nat Biotechnol*, 16: 728-731.
2. Clardy, J. and C. Walsh, 2004. Lessons from natural molecules. *Nature*, 432: 829-837.
3. Kumar, A., S. Dandapat, M. Kumar and M.P. Sinha, 2013. Antipathogenic efficacy and aemolytic activity of *Calotropis procera* leaves. *World Journal of Zoology*, 8(4): 366-370;
4. Ijaz, F., Z. Iqbal, J. Alam, I.U. Rahman, Sohail, S. Rehman and S. Manan, 2015. Ethno medicinal study upon folk receipes against various human diseases in Sarban Hills, Abbottabad, Pakistan. *Global Journal of Pharmacology*, 9(1): 56-63.
5. Korver, O., 1998. Functional foods: the food industry and functional foods: some European perspectives. In T Shibamoto, J Terao, T Osawa, eds, *Functional Foods for Disease Prevention: II. Medicinal Plants and Other Foods*. American Chemical Society, Washington, DC, pp: 22-25.
6. Korver, O., 1998. Functional foods: the food industry and functional foods: some European perspectives. In T Shibamoto, J Terao, T Osawa, eds, *Functional Foods for Disease Prevention: II. Medicinal Plants and Other Foods*. American Chemical Society, Washington, DC, pp: 22-25.
7. Korver, O., 1998. Functional foods: the food industry and functional foods: some European perspectives. In T Shibamoto, J Terao, T Osawa, eds, *Functional Foods for Disease Prevention: II. Medicinal Plants and Other Foods*. American Chemical Society, Washington, DC, pp: 22-25.
8. H. Yuan, Q. Ma, L. Ye, and G. Piao, "The traditional medicine and modern medicine from natural products," *Molecules*, vol. 21, no. 5, p. 559, 2016.
9. N. Tomford, D. Senthane, A. Rowe et al., "Natural products for drug discovery in the 21st century: innovations for novel drug discovery," *International Journal of Molecular Sciences*, vol. 19, no. 6, p. 1578, 2018.
10. J. Hu, J. Wang, Q.-X. Gan et al., "Impact of red yeast rice on metabolic diseases: a review of possible mechanisms of action," *Journal of Agricultural and Food Chemistry*, vol. 68, no. 39, pp. 10441–10455, 2020.
11. Nayak A, Mandal S, Banerji A, Banerji J., Review on chemistry and pharmacology of *Murraya koenigii* Spreng (*Rutaceae*), *Journal of Chemical and Pharmaceutical Research*., 2010, 2(2), 286-299.
12. Saini S.C, Reddy G.B.S., *Murraya koenigii*, *Journal of Pharmacy and Biological Sciences*., 2013, 7(6), 15-18.
13. Sindhu R.K, Arora S., Evaluation of phenolic contents and antioxidant potential of *Murraya koenigii* (L) spreng roots, *Journal of Applied Pharmaceutical Science*., 2012, 2(11), 120-122.
14. Parul S, Javed A, Neha B, Honey J, Anuj B., Curry leaves- A medicinal herb, *Asian Journal of Pharmaceutical Research*., 2012, 2(2), 51-53.
15. Jain V, Momin M, Laddha K., *Murraya Koenigii*: An Updated Review, *International Journal of Ayurvedic and Herbal Medicine*., 2012, 2(4), 607-627.
16. Ganesan P, Phaiphan A, Murugan Y, Baharin B.S., Comparative study of bioactive compounds in curry and coriander leaves: An update, *Journal of Chemical and Pharmaceutical Research*., 2013, 5(11), 590- 594.
17. Nagappan T, Ramasamy P, Abdul Wahid M.E, Segaran T.C, Vairappan C.S., Biological activity of carbazole alkaloids and essential oil of *Murraya koenigii* against antibiotic resistant microbes and cancer cell lines, *Molecules*., 2011, 16, 9651-9664. <http://dx.doi.org/10.3390/molecules16119651>.



18. Gahlawat D.K, Jakhar S, Dahiya P., Murraya koenigii (L.) Spreng: An ethnobotanical, phytochemical and pharmacological review, Journal of Pharmacognosy and Phytochemistry., 2014, 3(3), 109-119.
19. Kumar S.R, Loveleena D, Godwin S., Medicinal property of Murraya koenigii- a review, International Research Journal of Biological Sciences., 2013, 2(9), 80-83.
20. Jain V, Momin M, Laddha K., Murraya Koenigii: An Updated Review, International Journal of Ayurvedic and Herbal Medicine., 2012, 2(4), 607-627.
21. Prakash V. and Natarajan C.P., Studies on Curry Leaf, J. Food Sci. and Technol., 11, 284-286 (1974)
22. Rageeb M.D, Usman M.D, Barhate S.D., Phytochemical evaluation and effect of antipyretic activity on Murraya koenigii Spreng. Leaves extract, International Journal of Pharmaceutical and Chemical Sciences., 2012, 1(1), 231-236.
23. Nagappan T, Ramasamy P, Wahid ME, Segaran TC, Vairappan CS. Biological activity of carbazole alkaloids and essential oil of Murraya koenigii against antibiotic resistant microbes and cancer cell lines. Molecules 2011;16:9651-64.
24. Kusuma IW, Kuspradini H, Arung ET, Aryani F, Min YH, Kim JS, et al. Biological activity and phytochemical analysis of three Indonesian medicinal plants, Murraya koenigii, Syzygium polyanthum and Zingiber purpurea. J Acupunct Meridian Stud 2011;4:75-9.
25. Erkan N, Tao Z, Rupasinghe HP, Uysal B, Oksal BS. Antibacterial activities of essential oils extracted from leaves of Murraya koenigii by solvent-free microwave extraction and hydro-distillation. Nat Prod Commun 2012;7:121-4.
26. Choudhury, S., L. Sharan and M.P. Sinha, 2013a. Pharmacological efficacy of some medicinal plants used for treatment of gastrointestinal diseases. The Ecoscan, Special issue, (3): 111-116.
27. Choudhury, S., L. Sharan and M.P. Sinha, 2013b. Phytochemical and antimicrobial standardization of the methanolic leaf extracts of Murraya koenigii Linn: Archives des Sciences, 66(6):
28. Malwal M, Sarin R., Antimicrobial efficacy of Murraya koenigii (Linn.) Spreng. root extracts, Indian Journal of Natural Products and Resources., 2011, 2(1), 48-51.
29. Mandal S, Nayak A, Kar M, Banerjee SK, Das A, Upadhyay SN, et al. Antidiarrhoeal activity of carbazole alkaloids from Murraya koenigii Spreng (Rutaceae) seeds. Fitoterapia 2010;81:72-4.
30. Parimi B.N, Mopuri R, Meriga B., The protective effect of Murraya koenigii leaves against carbon tetrachloride-induced hepatic damage in rats, Journal of Costal Life Medicine., 2014, 2(4), 313-318. <http://dx.doi.org/10.12980/JCLM.2.201414J9>.
31. Sathaye S, Amin P.D, Mehta V.B, Zala V.B, Kulkarni R.D, Kaur H, Redkar R., Hepatoprotective activity of Murraya koenigii against ethanol induced liver toxicity model in experimental animals, International Journal of Pharma and Bio Sciences., 2012, 3(1), 430-438.
32. Dusane MB, Joshi BN. Islet protective and insulin secretion property of Murraya koenigii and Ocimum tenuiflorum in streptozotocin-induced diabetic mice. Can J Physiol Pharmacol 2012;90:371-8.
33. S. Chanda and R. Dave, "In vitro models for antioxidant activity evaluation and some medicinal plants possessing antioxidant properties: an overview," African Journal of Microbiology Research, vol. 3, pp. 981-996, 2009.
34. [95] D. J. Charles, Antioxidant Properties of Spices, Herbs and Other Sources, Springer Science & Business Media, Berlin, Germany, 2012.
35. [96] H. P. Witschi, "Enhancement of tumor formation in mouse lung by dietary butylated hydroxytoluene," Toxicology, vol. 21, no. 2, pp. 95-104, 1981.
36. [97] E. M. Atta, N. H. Mohamed, and A. A. M. Abdelgawad, "Antioxidants: an overview on the natural and synthetic types," European Chemical Bulletin, vol. 6, no. 8, p. 365, 2017.
37. [98] R. Balakrishnan, D. Vijayaraja, S.-H. Jo, P. Ganesan, I. SuKim, and D.-K. Choi, "Medicinal profile, phytochemistry, and pharmacological activities of murraya koenigii and its primary bioactive compounds," Antioxidants, vol. 9, no. 2, p. 101, 2020.
38. [99] A. K. Das, V. Rajkumar, and D. K. Dwivedi, "Antioxidant effect of curry leaf (Murraya koenigii) powder on quality of ground and cooked goat meat," International Food Research Journal, vol. 18, pp. 563-569, 2011.
39. [100] D. T. Abeysinghe, K. A. H. Kumara, K. A. D. Kaushalya, U. G. Chandrika, and D. D. D. H. Alwis, "Phytochemical screening, total polyphenol, flavonoid content, in vitro antioxidant and antibacterial activities of Sri Lankan varieties of Murraya koenigii and Micromelum minutum leaves," Heliyon, vol. 7, no. 7, Article ID e07449, 2021.

40. [101] P. Gupta, A. Nahata, and V. K. Dixit, "An update on *Murraya koenigii* spreng: a multifunctional ayurvedic herb," *Journal of Chinese Integrative Medicine*, vol. 9, pp. 824–833, 2011.
41. [102] M. B. Ningappa, R. Dinesha, and L. Srinivas, "Antioxidant and free radical scavenging activities of polyphenol-enriched curry leaf (*Murraya koenigii* L.) extracts," *Food Chemistry*, vol. 106, no. 2, pp. 720–728, 2008.
42. [103] V. Sablania, S. J. D. Bosco, and M. Bashir, "Extraction process optimization of *Murraya koenigii* leaf extracts and antioxidant properties," *Journal of Food Science and Technology*, vol. 56, no. 12, pp. 5500–5508, 2019.
43. [104] R. S. Tomar, S. Banerjee, and S. Kaushik, "Assessment of antioxidant activity of leaves of *Murraya koenigii* extracts and it's comparative efficacy analysis in different solvents," *Journal of Pharmaceutical Sciences and Research*, vol. 9, pp. 288–291, 2017.
44. [105] M. Zahin, F. Aqil, F. M. Husain, and I. Ahmad, "Antioxidant capacity and antimutagenic potential of *murraya koenigii*," *BioMed Research International*, vol. 2013, Article ID 263509, 10 pages, 2013.
45. [106] S. Gupta and J. Prakash, "Studies on Indian green leafy vegetables for their antioxidant activity," *Plant Foods for Human Nutrition*, vol. 64, no. 1, pp. 39–45, 2009.
46. Gupta S, Prakash J. Studies on Indian green leafy vegetables for their antioxidant activity. *Plant Foods Hum Nutr* 2009;64:39-45.
47. Mitra E, Ghosh AK, Ghosh D, Mukherjee D, Chattopadhyay A, Dutta S, et al. Protective effect of aqueous Curry leaf (*Murraya koenigii*) extract against cadmium-induced oxidative stress in rat heart. *Food Chem Toxicol* 2012;50:1340-53.
48. WHO, Cardiovascular Diseases (CVDs), WHO, Geneva, Switzerland, 2021, [https://www.who.int/news-room/factsheets/detail/cardiovascular-diseases-\(cvds\)](https://www.who.int/news-room/factsheets/detail/cardiovascular-diseases-(cvds)).
49. S. Leelama, B. A. Khan, and A. Abraham, "Biological response in rats to the addition of *Murraya Koenigii* an assica juncea to the diet," *Plant Foods for Human Nutrition*, vol. 49, pp. 294–299, 1996.
50. A. N. Kesari, S. Kesari, S. K. Singh, R. K. Gupta, and G. Watal, "Studies on the glycemic and lipidemic effect of *Murraya koenigii* in experimental animals," *Journal of Ethnopharmacology*, vol. 112, no. 2, pp. 305–311, 2007.
51. J.-T. Xie, W.-T. Chang, C.-Z. Wang et al., "Curry leaf (*murraya koenigii* spreng) reduces blood cholesterol and glucose levels in ob/ob mice," *e American Journal of Chinese Medicine*, vol. 34, no. 2, pp. 279–284, 2006.
52. [74] A. Butt, N. Waris, K. Baqa et al., "Comparative effect of beta blocker-atenolol and *Murraya koenigii* (L.) spreng (curry leaves) on cardiac enzyme (CK-MB) level in male albino rats," *Pakistan Journal of Pharmaceutical Sciences*, vol. 32, pp. 1643–1648, 2019.
53. Vasudevan M., Parle M., Antiamnesic potential of *Murraya koenigii* leaves. *Phytother Res*. 2009; 23:3: 308-16
54. Sharma US., Invitro antihelmentic activity of *Murraya koenigii* Linn. leaves Extract, *Int J Pharm Biol. Sci.* 2010; 1:3: 1-4.



INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 9940 572 462  6381 907 438  [ijirset@gmail.com](mailto:ijirset@gmail.com)



[www.ijirset.com](http://www.ijirset.com)

Scan to save the contact details