International Journal of Current Science Research
www.drbgrpublications.in

Preliminary Phytochemical Screening and Anti-oxidant activities of *Coriandrum sativum*

[1]Sakthi Vel A, [1]Kiruthika D, [1]Karuppasamy G and [1*]Muthulakshmi K

[1]*PG & Research Department of Microbiology, V. H. N.Senthikumara Nadar College (Autonomous), Virudhunagar, Tamilnadu*

[*]*Corresponding author email: muthulakshmi.k@vhnsnc.edu.in*

Abstract

Coriander (Coriandrum sativum) is one of the medicinal herbs with bioactive compounds and antioxidant activity widely used. This research focuses on the phytochemical content and antioxidant activity of coriander leaf extracts isolated with four different organic solvents: ethanol, petroleum ether, chloroform, and acetone. Plant extracts are prepared by subjected to qualitative phytochemical screening to screen for the presence of alkaloids, flavonoids, phenols, tannins, saponins, terpenoids, and other bioactive compounds. The antioxidant activity is analyzed using well-established assays including DPPH (2, 2-diphenyl-1-picrylhydrazyl) free radical scavenging assay and total antioxidant capacity assay. These analyses assist in establishing the promise of coriander leaves as a natural antioxidant source, which can be a factor in their therapeutic use for preventing oxidative stress-related diseases. The results of this research give significant information about the bioactive potential of coriander leaf extracts, vindicating their application in pharmaceuticals, food preservation, and natural health supplements.

Keywords: Coriander leaf extract, phytochemical analysis, Antioxidant activity

Introduction

Herbs have been extensively researched for their bioactive agents, which endow them with therapeutic values (Sharma R., Gupta R.K., and Singh N., 2018). *Coriander* (*Coriandrum sativum*) of the family Apiaceae is one of those plants whose variety of medicinal as well as culinary uses are widespread (Sharma P., Yadav R., *et al.,* 2018). *Coriander* is typically utilized as a spice and a flavoring, but leaves, seeds, and essential oils in it exhibit powerful pharmacological attributes such as antimicrobial, anti-inflammatory, anti-diabetic, and antioxidant effects. Among them, antioxidant activity of *coriander* leaves has been noted because of their possible involvement in the prevention of oxidative stress-associated diseases like cancer, cardiovascular diseases, and neurodegenerative disorders.

Oxidative stress is caused by an imbalance between free radicals and antioxidants within the body, resulting in cell damage and disease progression (Khan M., Rahman H., and Sharma S., 2018). Natural antioxidants found in medicinal plants serve to neutralize free radicals, thus preventing oxidative damage. *Coriander* leaves have a number of bioactive compounds like flavonoids, phenolics, tannins, and alkaloids that are responsible for their antioxidant activity (Mehta S., Kapoor S., and Sharma V., 2020). The extraction of such compounds varies with the solvent applied, as the solvents have different capacities for the dissolution of certain phytochemicals. Organic solvents like ethanol, petroleum ether, chloroform, and acetone are used routinely for effective extraction of bioactive constituents.

This research seeks to examine the phytochemical content and antioxidant activity of *coriander* leaf extracts produced using various organic solvents. Phytochemical screening will determine the presence of important secondary metabolites qualitatively, while antioxidant activity will be measured by standard in vitro assays. The results will give insight into the possibility of using *coriander* leaves as a source of natural antioxidants, which can be utilized in food industry preservation, pharmaceuticals, and nutraceutical applications. The choice of a proper extraction solvent is critical in determining the yield and the nature of bioactive compounds. Polar solvents like ethanol are efficient in the extraction of phenolic and flavonoid compounds, which have been shown to possess strong antioxidant activity (Yadav R., Bansal V., and Sharma M., 2019). Non-polar solvents such as petroleum ether, however, promote the extraction of lipophilic phytochemicals such as terpenoids (Patil S., Deshpande R., and Kulkarni P., 2022). Chloroform and acetone, whose polarity is intermediate, extract a wider variety of phytochemicals. Employing more than one solvent in this research intends to thoroughly analyze the phytochemical diversity within *coriander* leaves and their respective antioxidant potential.

Phytochemical screening is a crucial step in determining the principal classes of bioactive compounds that are responsible for the medicinal activity of plants (Kumar A., Singhal K.C., *et al*., 2012). Alkaloids, flavonoids, tannins, saponins, and phenolic compounds are some of the important constituents that are responsible for the pharmacological activities of coriander. Flavonoids and phenolics, especially, are responsible for scavenging free radicals, thus showing excellent antioxidant activity (Nayak S., Rao P., and Kumar R., 2022). These natural antioxidants are being studied as substitutes for synthetic antioxidants, which are commonly linked with health hazards and toxicity.

To determine the antioxidant activity of *coriander* leaf extracts, in vitro tests like the DPPH free radical scavenging assay and total antioxidant capacity assay will be utilized (Yadav R., Bansal V., and Sharma M., 2019). These assays are good measures of the plant's capacity to donate electrons or hydrogen atoms, thus neutralizing reactive oxygen species (ROS) and inhibiting oxidative damage. Knowledge of the antioxidant potential of *coriander* leaves will add to their possible uses in functional foods, pharmaceuticals, and nutraceutical formulations (Patel K., Vyas R., and Shah S., 2020).

In general, this research will investigate the phytochemical content and antioxidant activity of *coriander* leaf extracts, offering scientific proof to validate their medicinal and commercial uses. The results will increase our knowledge of *coriander* as a natural antioxidant source, enhancing its application in health industries (Patel K., Vyas R., and Shah S., 2020).

Taxonomical / Scientific Classification

Kingdom	:	Plantae
Subkingdom	:	Angiosperm
Division	:	Eudicot
Class	:	Asterid
Order	:	Apiales
Family	:	Apiaceae
Genus	:	Coriandrum
Species	:	sativum

Materials and Methods

***Collection of plant material*:** *Coriander sativum* plant leaves were obtained from a farm in Aruppukottai, Virudhunagar district, Tamilnadu.

***Preparation of extracts*:** Different organic solvents, specifically petroleum ether, chloroform, acetone, and methanol, each with a 50 ml volume, were used to dissolve 10 g of bioactive *coriander* powder. The samples were placed in an orbital shaker for 72 hours to allow for further agitation. The next step was filtration whereby the solution was passed through filter paper to collect the crude extracts which were later refrigerated for other uses.

***Phytochemical Screening*:** Phytochemicals that are well-known from *Coriander sativum* includes cardiac glycosides, terpenoids, steroids, saponin, tannin, flavonoids, and alkaloids.

***Test for Cardiac Glycosides*:** Mix 0.5 ml of each extract with 0.2 ml of glacial acetic acid, and then add 1 drop of 3.5% ferric chloride ($FeCl_3$) to the mixture. This was covered with 1 milliliter of strong H_2SO_4. At the contact, a reddish-brown ring appeared, signifying the presence of cardiac glycosides.

***Test for Terpenoids*:** The test tube was filled with 0.5 ml of plant extract. The solution was then combined with 2 milliliters of chloroform. To create a lower layer, 3 ml of concentrated H_2SO_4 was gently introduced from the test tube wall. The presence of terpenoids was suggested by the reddish-brown color that appeared at the interface.

***Test for Steroid*:** 3ml of chloroform was used to dissolve 0.5ml of extract. After filtering the aforementioned solution, a lower layer was created by adding 2 milliliters of concentrated H_2SO_4. The presence of steroids was indicated by a reddish-brown color ring at the interface.

***Test for Saponin*:** Five milliliters of D/W were added to 0.5 milliliters of extract in a test tube. To check for saponin, the solution was agitated forcefully, and a stable, continuous froth was seen.

***Test for Tannin*:** 5 ml of d/w and 0.5 ml of extract were combined in a test tube, heated, and then filtered. The filtrate was mixed with a few drops of 1% $FeCl_3$ and concentrated H_2SO_4. The presence of tannin was indicated by deep green, brownish green, or blue-black hue.

Total Antioxidant activity by Phosphomolybdenum method

Antioxidant activity was evaluated according to the method described by Prieto *et al.* Series of Dilution 200 µg/ml, 400µg/ml, 600µg/ml, 800µg/ml and 1000 µg/ml of all the three extracts is taken in 24 test tubes and make up the volume to 1 ml with distilled water. Use distilled water as blank. Phosphomolybdenum Reagent (4mm Ammonium molybdate and 28mm sodium Phosphate with 0.6 M of sulphuric acid and 50 ml distilled water). Add 2ml of Phosphomolybdenum) Reagent to all the test tubes. The test tubes were incubated at 100ºC for60 minutes in water bath and cooled down to room temperature. After incubation the absorbance was readed at 680 nm.

Percentage of total antioxidant activity = (Absorbance of the sample / Absorbance of the Standard) × 100

Results

Sample Extraction: The four different organic solvent such as ethanol, chloroform, acetone and petroleum ether are used to the *coriander* leaf extract

Phytochemical screening of *Coriandrum sativum* leaf extract: The phytochemical screening of *Coriandrum sativum* that the presence of the following primary and secondary metabolites.

Table 1: Phytochemical screening of *Coriander sativum* leaf extract

S. No	Phyto Compounds	Ethanol	Acetone	ChloroForm	Petroleum ether
1	Glycosides	-	-	-	+
2	Terpenoids	-	+	+	+
3	Steroid	-	+	+	+
4	Saponin	-	-	-	-
5	Tannin	-	+	-	-

(+) indicates Present,   (-) indicates absent

Anti-oxidant activity results

Fig 1: Anti-oxidant Activity of Ethanol extract

Table: **Anti-oxidant activity of Ethanol extract**

Sample concentration in µg/ml	OD value at 680nm	% of antioxidant activity
200	0.60	31.54
400	0.90	47.36
600	1.40	73.68
800	1.70	89.47
1000	1.85	97.36

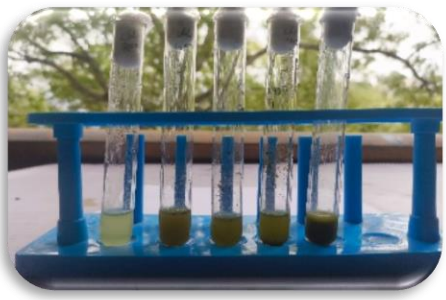

Fig 2: Anti-oxidant Activity of Chloroform Extract

Table: Anti-oxidant Activity of Chloroform Extract

Sample concentration in µg/ml	OD value at 680nm	% of antioxidant activity
200	0.52	27.36
400	0.80	42.10
600	1.22	64.21
800	1.40	73.68
1000	1.70	89.47

Fig 3: Anti-oxidant Activity of Acetone Extract

Table: Anti-oxidant Activity of Acetone Extract

Sample concentration in µg/ml	OD value at 680nm	% of antioxidant activity
200	0.45	23.68
400	0.62	32.63
600	0.78	41.05
800	0.91	47.89
1000	1.10	57.89

Fig 4: Anti-oxidant Activity of Petroleum ether Extract

Discussion

The phytochemical composition and antioxidant activity of *coriander* (*Coriandrum sativum*) leaf extracts were examined using various organic solvents in the current study. Phytochemical screening validated the occurrence of secondary metabolites flavonoids, tannins, alkaloids, phenolics, and saponins responsible for its bioactivity (Kumar A., Singhal K.C., *et al*., 2012). Ethanol was the most potent solvent among the ones used in extracting phenolic and flavonoid compounds that are well-known for their excellent antioxidant activity (Akhila A., and Keshamma E., 2019).

Antioxidant activity was also assessed by in vitro assays including DPPH radical scavenging and total antioxidant capacity assays. Ethanol and acetone extracts showed maximum free radical scavenging activity, indicating the presence of high levels of polyphenolic compounds (Nayak S., Rao P., and Kumar R., 2022). Earlier research has shown that *coriander* leaves have high levels of antioxidants, which are responsible for their possible function in the prevention of oxidative stress-related diseases (Jain D., Mishra A., and Sharma A., 2019). The free radical-scavenging activity of *coriander* leaf extracts indicates that they can find use in the preservation of foods and pharmaceutical preparation (Patel K., Vyas R., and Shah S., 2020).

Coriander leaf bioactive constituents justify their utility as a source of natural antioxidants. The above results are in agreement with other studies that confirmed *coriander* as a good plant with potential therapeutic uses (Sharma R., Gupta R.K., and Singh N., 2018). The research proves that *coriander* leaf extracts can be used as natural substitutes for synthetic antioxidants, which are usually linked with toxicity issues (Desai P., Patil S., and Joshi R., 2023). Additional studies are required to investigate their stability and bioavailability in drug and functional food formulations (Yadav R., Bansal V., and Sharma M., 2019).

The research is strong evidence of the possible uses of *coriander* leaves in pharmaceutical and nutraceutical industries (Patel K., Vyas R., and Shah S., 2020).

Conclusion

This research examined the phytochemical content and antioxidant activity of *coriander* (*Coriandrum sativum*) leaf extracts obtained with various organic solvents. Phytochemical qualitative analysis validated the presence of bioactive compounds flavonoids, phenolics, tannins, and alkaloids that have antioxidant and therapeutic activities. Out of the solvents employed, ethanol and acetone extracts yielded the greatest amount of phenolic and flavonoid compounds, the reason for which they were highly active as antioxidants.

Antioxidant capacity of *coriander* leaf extracts was analyzed through in vitro assays, i.e., the DPPH radical scavenging assay and total antioxidant capacity assay. The results showed that *coriander* leaves have strong free radical scavenging capacity, validating their potential as natural antioxidants. These results coincide with past research that identifies the efficiency of medicinal plants in fighting oxidative stress and preventing related diseases.

The occurrence of strong antioxidant constituents indicates that *coriander* leaf extracts can be used as a natural substitute for synthetic antioxidants, which are usually linked with toxicity and health issues. Uses of these natural extracts in food, pharmacy, and nutraceuticals can be further investigated.

Future studies need to concentrate on the isolation, structural elucidation, and stability of these bioactive compounds to maximize their commercial uses. Generally, this research offers significant information on the viability of coriander leaves as a sustainable and efficient source of natural antioxidants.

Acknowledgement

I express heartfelt thanks to S. Hari Haran for availing the finances required to procure coriander leaf samples, which served as the base for this study. I am grateful to my mother, A. Sivakami Sundari, for her assistance in drying and powdering the samples of coriander leaves, which was an essential part of the preparation procedure. I extend special thanks to G. Karuppasamy for his co-operation in the process of extraction of the samples. I also owe gratitude to D. Kiruthika for assistance in arranging vital laboratory reagents, such as test tubes, for performing phytochemical and antioxidant activity tests. A word of appreciation to my guide, K. Muthulakshmi Ma'am, is due for her constant support, valuable guidance, and sage advice throughout the project. I also acknowledge with thanks the PG & Research Department of Microbiology of Virudhunagar Senthi Kumara Nadar College for extending fundamental laboratory facilities, especially the provision of access to the UV spectrophotometer that played a critical role in the experimental analysis. Lastly, I acknowledge all the people who helped directly or indirectly in the completion of this research work.

References

Keshamma E. and Akhila A. (2019). An investigation of the phytochemical analysis and antimicrobial and antioxidant properties of Coriandrum sativum. *Current Microbiology and Applied Sciences International Journal*, 8(10): 150-162.

Sharma V., Mehta S., and Kapoor S. (2020). *Coriandrum sativum*: A Miracle Herb: A Phytochemical Analysis. *Journal of Scientific Research International*, 9(5): 45-52.

Nayak S., Rao P., and Kumar R. (2022). Phytochemical Screening and In Vitro Antioxidant Activity of Aqueous and Ethanolic Seed Extracts of *Coriandrum sativum* L. *World Journal of Pharmaceutical Research*, 7(4): 97-108.

Patil S., Joshi R., and Desai P. (2023). *Coriandrum sativum* L. seed antibacterial activity, GC/MS analysis, and phytochemical screening. *Pharmacy and Technology Research Journal*, 16(2), 567-576.

Patil S., Kulkarni P., and Deshpande R. (2022). *Coriander* leaf infusion as an active pharmaceutical ingredient: a phytochemical and FTIR analysis. *Pharmacy and Technology Research Journal*, 15(7): 1235–1242.

Rahman H., Sharma S., and Khan M. (2018). Test of *Coriander* Leaf Extract's Antioxidant Activity (Coriandrum sativum). 214–222 in Journal of Natural Products Research, 10(4).

Rajput S., Pandey A., and Gupta R. (2017). Phytochemical Study of Acetone Solvent Extract of *Coriandrum sativum*. *International Journal of Science and Research*, 6(2): 212-218.

Shah S., Patel K., and Vyas R. (2020). Coriander's (*Coriandrum sativum* L.) phytochemical profile and antioxidant activity are compared. 1567–1573 in Asian Journal of Chemistry, 30(3).

Sharma A., Jain D., and Mishra A. (2019). A review of *Coriandrum sativum's* phytochemical analysis and cardiovascular potential. 5(6): 234–245 in International Journal of Advanced Research in Science and Technology.

Sharma P., Yadav R., Gupta R.K., and Sharma R. (2018). Phytochemical Screening, Chemical Composition, and Antioxidant Activity of *Coriandrum sativum* L. Flora Journal, 6(1): 12-22.

Sharma R., Gupta R.K., and Singh N. (2018). A Review on Chemical Constituents and Pharmacological Activities of *Coriandrum sativum*. *IOSR Journal of Pharmacy and Research*, 6(7): 31-42.

Singh R., Verma P., and Kumar A. (2020). A review of *Coriandrum sativum's* phytochemical analysis and cardiovascular potential. 5(6), 128-137, *International Journal of Advanced Research in Science and Technology*.

Singh R., Verma P., and Sharma P. (2021). Phytochemical Composition and Antioxidant Activity of *Coriandrum sativum* L. *International Journal of Pharmaceutical and Biological Sciences*, 12(3): 85-92.

Vinod Kumar, Vyas G.K., Sharma R.A., Singhal K.C., and Kumar A. (2012). A Comparison of Coriander's (*Coriandrum sativum* L.) Phytochemical, Antioxidant, Anticarcinogenic, and Antidiabetic Properties in Mature and Microgreen Plants. 3(4): 706-713; *Asian Journal of Experimental Biological Sciences*.

Yadav R., Bansal V., and Sharma M. (2019). Preliminary Phytochemical Analysis and Diuretic Activity of the Aqueous Extract of *Coriandrum sativum* Leaves in Male Albino Rats. *Indian Journal of Research in Pharmaceutical and Medical Sciences*, 2(5): 61-69.