

Anti-inflammatory Activity of *Elaeocarpus tectorius*

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ABSTRACT

Elaeocarpus tectorius, belonging to the family Elaeocarpaceae, is reported for its potential medicinal values, particularly antioxidant, anti-inflammatory, and antimicrobial potentials. This paper, therefore, examines the bioactive properties of different extracts from *Elaeocarpus tectorius*, with more emphasis on leaf and stem extracts. In vitro assays such as DPPH radical scavenging, reducing power, and anti-inflammatory activities were conducted to determine the antioxidant and anti-inflammatory activities of these extracts. The results showed that methanol extracts from both leaf and stem showed significant antioxidant and anti-inflammatory activities, respectively, which were dose-dependent in all the assays conducted. The methanol leaf extract had the highest activity of anti-inflammation, which was even higher than that of the positive control, a standard anti-inflammatory drug called diclofenac, at some concentrations. This study scientifically validates the traditional use of *Elaeocarpus tectorius* in herbal medicine and points out its potential as a natural source in therapeutic application, especially in the management of diseases associated with oxidative stress and inflammation.

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Introduction

Medical plants have significantly shaped the development of ancient healing modalities across time. From mild ailments like colds and digestive issues to more severe diseases like infections, malignancies, and chronic inflammatory disorders, these plants have found use across many different civilizations to treat a broad spectrum of conditions. About half a million [1] species of medicinal plants—10% of all vascular plants [2]—between 350,000 [3]. Since antiquity and continuing today, plants have been utilized in medicine [4]. Therapeutic plants are utilized on the basis of centuries-old knowledge passed down over generations and often combine empirical results with religious ideas. With precise dose recommendations created by seasoned experts, these plants are often utilized in traditional medical systems as extracts, infusions, poultices, or decoctions. Though they have historical significance, the medicinal promise of many of these plants has only recently started to be carefully researched and verified by current pharmacological studies, which exposes a wealth of bioactive molecules that underlie their therapeutic effects.

Antioxidants are macromolecules capable of trapping free radicals, chelating metal ions, and thereby

guarding against oxidative stress by scavenging free radicals and preventing lipid peroxidation [5]. Antioxidants might originate either naturally or be synthesized. Plant-derived natural antioxidants, generated by plants [7], are more potent than those created artificially [6]. Carotenoids, flavonoids, tocopherols, beta carotene, lycopene, folic acid, and other antioxidants are among these. People have depended on plants as a source of herbal medicines to cure and treat human illnesses since ancient times. Plant phytochemicals, including alkaloids, flavonoids, phenols, and tannins, have a great capacity to scavenge free radicals and so prevent and lessen oxidative stress in a range of diseases, including cancer, atherosclerosis, and diabetes [8–11].

Human diseases caused by pathogen and toxin invasion of the body, as well as by immune regulation, set off a chain of inflammatory reactions in the body. These inflammatory events seek to begin and speed the healing process of body tissues [12]. Unregulated development of such pro-inflammatory actions as part of the human innate immune system has been connected to oxidative stress and other diseases, including cancer, diabetes, hypertension, septic shock, asthma, arthritis, arteriosclerosis, Parkinson's disease,

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and Alzheimer's disease. For instance, mast cell proteases release triggers a cascade of redox reactions brought on by reactive oxygen species (ROS) and free radicals, which are advantageous for cellular signal transduction and pathogen protection but become damaging when not controlled. Since it can reduce or eliminate severe neurodegenerative diseases [13,14], the management of pro-inflammatory processes and chronic inflammation has become increasingly important.

Antioxidants change the oxidant-antioxidant balance in biological systems by neutralizing pro-oxidant compounds [15]. Antioxidants have been associated with lower production of ROS, free radicals, susceptibility to lipid peroxidation, oxidative stress, post-translational modification of proteins, and DNA damage. These protective antioxidants mostly come from dietary and plant sources [16]. Expensive and frequently difficult to availability and adverse effects, synthetic antioxidants help to control unwanted redox reactions. Natural antioxidants have become increasingly well-known over time as they are less expensive, abound in many plants, and lack the negative effects of their synthetic equivalents [17]. Furthermore, improving the performance of innate immunity against inflammatory disorders is achieved with steroidal and non-steroidal anti-inflammatory drugs. Prolonged use of many of these medications causes unfavorable adverse effects. Long-term use of nonsteroidal anti-inflammatory medications (NSAIDs) such as aspirin and COX-2 inhibitors increases the risk of cardiovascular and gastrointestinal problems [18]. Natural product-based preparations have been suggested as one possible response to certain of these difficulties. Every plant extract has shown amazing anti-inflammatory and antioxidant capabilities. This research, therefore, gives scientific proof supporting the use of these plants in herbal treatments for inflammatory diseases as well as wound healing.

Among the *Elaeocarpaceae*, a traditional tree family whose members provide food for the tribal groups of the Western Ghats, *Elaeocarpus tectorius* is found. Prior studies have found that the *Elaeocarpaceae* family comprises a broad spectrum of active molecules, including alkaloids, tannins, indolizidine, flavonoids, and quercetin, thereby conferring useful pharmacological effects such as anti-inflammatory, antimicrobial, antidepressant, antiepileptic, and antitumor properties [19, 20].

Physical and Developmental Characteristics

- ❖ Habit is a multi-branched evergreen tree.

- ❖ Usually reaching 3 to 5 meters wide and 5–8 meters high.
- ❖ Foliage has thin, long leaves.
- ❖ Often found along streams in wet deciduous and evergreen forests, it bears blossoms and fruit.
- ❖ Harvested for its wood, which is fine and uniform and ranges in hue from light-yellowish white to pink-brown, wood is

Habitat and Distribution

- ❖ Habitat: Usually along streams, it can be found in damp deciduous, semi-evergreen, and evergreen woodlands.
- ❖ Found in the mountainous areas of Southeast Asia, including India, Myanmar, Thailand, Cambodia, Malaysia, and Sri Lanka.
- ❖ Members of this genus often grow well in full sun to moderate shade; they need rich, wet but well-draining soil.

Properties and uses

- ❖ Food: Though the fibrous sections are usually spat out, the fruit is edible and ingested by regional people in the Western Ghats region of India.
- ❖ Medicinally: Antioxidant, anti-inflammatory, and antimicrobial effects, among others, have been attributed to the fruit, leaves, bark, and stem.
- ❖ It is a timber source in some areas.

DPPH radical scavenging activity assay

The free radical scavenging ability of the fractions in vitro was assessed using the 2,2'-diphenyl-1-picrylhydrazyl (DPPH) assay as previously explained. To prepare a stock solution, 24 mg of DPPH were dissolved in 100 ml of methanol and kept at 20 °C till required. The DPPH solution was diluted with methanol to around 0.98±0.02 using a spectrophotometer at 517 nm. A 3 mL aliquot of this solution was then mixed with 100 mL of the sample at various concentrations (10–500 g/ml). The reaction mixture was thoroughly mixed and allowed to rest in the darkness at room temperature for 15 minutes. Following that, the absorbance at 517 nm was measured. The control itself was created in the same way, but without any sample. The percentage of DPPH radical scavenged was used to compute the scavenging activity using the following formula:

$$\% \text{Inhibition} = \frac{(\text{Absorbance of Control} - \text{Absorbance of Sample})}{\text{Absorbance of Control}} \times 100$$

Reducing power

The reduction of Fe (III) to Fe (II) by the solvent fractions provided the foundation for the estimation of its reducing capacity. The production of Perl's Prussian blue at 700 nm can be used to identify Fe(II). Varied amounts of the sample (2 mL) were combined with 2 mL of potassium ferricyanide (10 mg/ml) and 2 mL of phosphate buffer (0.2 M, pH 6.6). Following a 20-minute incubation period at 50°C, 2 mL of trichloroacetic acid (100 mg/L) was added to the mixture. The upper layer of the solution was acquired by centrifuging the mixture at 3000 rpm for 10 minutes. Two milliliters from each of the abovementioned combinations was combined with 2 ml of distilled water and 0.4 ml of 0.1% (w/v) freshly made ferric chloride. Ten minutes of reaction time were allowed before measurements of absorbance were recorded at 700 nm. Greater absorption of the reaction mixture points to a bigger reducing ability. TEAC was reported as mM/L Trolox. A Trolox curve was generated using a range of standard Trolox solutions from 31.25 µg/mL to 1.0 mg/mL to calculate TEAC (the standard curve equation: $y = 0.0007x + 0.0645$, $R^2 = 0.9998$). Each experiment was carried out in triplicate.

Anti-inflammatory activity - Membrane Stabilisation Assay

Preparation of suspensions of Red Blood Cells (RBCs)

The blood was taken from a sheep's red blood cells (SRBC) and placed in centrifuge tubes (containing EDTA, an anticoagulant) to conduct a membrane stabilization test. The blood was rinsed three times using an isotonic buffer solution of 154 mM NaCl in 10 mM sodium phosphate buffer at pH 7.4. After each wash, the blood was spun for five minutes at 3000 rpm. Heat-induced hemolysis

The extract was mixed with 2 mL of PBS (pH 7.4–10 mM/154 mM NaCl) at various concentrations (10–150 µg/mL), and then 200 µL of a 10% RBC suspension was added. The test sample in the control test tube was replaced with PBS. After incubation in a water bath at 56°C for 30 minutes, the reaction mixture was cooled under running tap water. The mixture was centrifuged for five minutes at 2500 rpm, and the absorbance of the resulting supernatants was measured at 560 nm. Aspirin, a standard reference medication, was used. The formula for the percentage inhibition of hemolysis was as follows:

$$\text{Haemolysis inhibition (\%)} = \frac{\text{Control} - \text{Sample}}{\text{Control}} \times 100$$

Results and Discussion

Results

1. DPPH radical scavenging activity assay

Table 1 represents the percentage inhibition of different leaf extracts, namely methanol, chloroform, ethyl acetate, and hexane, and one standard at different concentrations (20, 40, 60, 80, and 100 µg/mL). Herein is presented an interpretation of the data based on the % inhibition for each leaf extract and a standard at such concentrations. In all the leaf extracts and the standard studied here, the % inhibition increases as the concentration increases from 20 µg/mL to 100 µg/mL. This presents a dose-dependent response; that is, with increasing concentration of the extracts and standards, the inhibition becomes stronger. This is typical for bioactive compounds, where increasing the concentration improves the efficacy.

Table 1. Comparison of % of inhibition of the standard with the leaf extracts (Concentration in µg/ml).

S.No	Concentration(µg/ml)	% of inhibition	
		ML	CL
1.	20	14.53±0.18	11.48±0.21
2.	40	28.34±0.52	19.23±0.29
3.	60	39.62±0.22	28.39±0.56
4.	80	48.39±0.33	32.46±0.27
5.	100	60.32±0.58	39.64±0.45

The standard (probably a pharmaceutical or any known active compound) persistently has the highest inhibition at each concentration, ranging from 48% at 20 µg/mL to 94.21% at 100 µg/mL. Among leaf extracts, the methanol leaf extract exhibited the strongest inhibition. It increases steadily from 14.53% inhibition at 20 µg/mL to 60.32% inhibition at 100 µg/mL. Although this extract shows pretty promising activity, it is still behind the standard. Hexane leaf extract showed the least inhibition at all concentrations, from 8.34% at 20 µg/mL to 37.9% at 100 µg/mL. The aqueous leaf extract shows a moderate type of inhibition. The inhibition percentage goes from 18.83% at 20 µg/mL to 63.45% at 100 µg/mL for aqueous leaf extract, whereas, in the case of alcoholic leaf extract, it goes from 18.65% at 20 µg/mL to 59.51% at 100 µg/mL. The ethyl acetate leaf and chloroform leaf extract exhibited a moderate type of inhibition. The inhibition percentage for Ethyl acetate leaf varies from 12.68% at 20 µg/mL to 47.13% at 100 µg/mL, whereas for chloroform leaf extract, it varies from 11.48% at 20 µg/mL to 39.64% at 100 µg/mL.

Table 2 presents the percentage of inhibition at different concentrations (20, 40, 60, 80, 100 µg/mL) for four different stem extracts: methanol, chloroform, ethyl acetate and hexane and a standard substance, probably the reference compound against which

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comparison is sought. The increase in the extract's concentration is associated with a rise in the inhibition percentage—a typical behavior that points out the dose dependence in bioactivity experiments. In other words, higher concentrations of an extract lead to higher inhibitions. Methanol stem extract gives the highest inhibition throughout the tested concentrations, followed by ethyl acetate stem extract, while chloroform stem Extract and hexane stem extract represent the lowest inhibitions for most of the concentrations. The standard remains the most effective in inhibiting the target process, showing the highest inhibition percentage across all tested concentrations. For all of them, the rise in inhibitions comes with the increase in their concentration, thus supporting the idea of a positive dose-response relationship between the concentration of the extracts and the inhibitory activity.

Table 2. Comparison of % of inhibition of the standard with the stem extracts (Methanol, Chloroform, Ethyl acetate and Hexane) (Concentration in $\mu\text{g/ml}$).

S. No	Concentration($\mu\text{g/ml}$)	% of inhibition				
		MS	CS	ES	HS	Standard
1.	20	20.3 6 ± 0.14	8.34 ± 0.16	13.2 9 ± 0.55	10.2 6 ± 0.45	48 ± 0.51
2.	40	25.6 8 ± 0.42	17.3 4 ± 0.25	19.6 9 ± 0.48	18.6 5 ± 0.41	88.0 8 ± 1.0
3.	60	32.5 5 ± 0.18	23.8 9 ± 0.68	31.4 8 ± 0.25	25.3 1 ± 0.24	90.6 8 ± 0.35
4.	80	43.6 8 ± 0.02	29.2 6 ± 0.57	42.8 8 ± 0.47	29.2 6 ± 0.57	93.6 3 ± 0.54
5.	100	56.8 9 ± 0.33	37.9 ± 0.24	51.6 7 ± 0.95	45.6 9 ± 0.73	94.2 1 ± 0.34

Methanol stem extract always shows better activity compared with the other extracts at all concentrations. It appears that methanol extraction might be more efficient compared with the others in isolating bioactive compounds responsible for inhibiting. Hexane stem extract shows lower inhibition at most concentrations, indicating that hexane extraction might be less efficient compared with methanol extraction in isolating active compounds. The standard shows higher inhibition at all concentrations compared with the extracts, indicating that the standard compound used in the experiment might be more efficient compared with the stem extracts of *Elaeocarpus tectorius*. The

inhibition shown by the standard compound at 100 $\mu\text{g/ml}$ is higher at 94.21%, suggesting that it might be an efficient compound and might be used as a standard compound for comparing efficacy among the plant extracts.

2. Reducing power

Reducing power assay can be employed as a method for testing the electron donating capacity of an antioxidant compound [21]. The reducing capabilities of various extracts were assessed based on the reduction of Fe^{3+} ions to Fe^{2+} ions. The presence of antioxidants in the samples brought about a reduction of the ferric cyanide complexes (Fe^{3+}) to ferrous form (Fe^{2+}). Reducing power assays involved the reduction of the iron (III) ions to iron (II), hence making it change color from blue to green [22]. However, strong reducers produced Prussian blue and absorbed at 700nm.

Figure 1 depicts the reducing abilities of different leaf extracts of *Elaeocarpus tectorius* compared with ascorbic acid. The greater degree of absorbance shows an equal amount of reducing ability. Methanol leaf extract had some degree of electron donation. The reducing abilities of different extracts were dependent on the amount of extract present. Hexane leaf extract had less degree of Fe^{3+} ions reduction compared with methanol leaf extract. Reducing abilities were dependent on the following order: methanol leaf extracts, compared with ethyl acetate leaf extract and hexane leaf extract.

Figure 1: Comparison of absorbance at 700nm for standard and leaf extracts (Concentration in $\mu\text{g/ml}$).

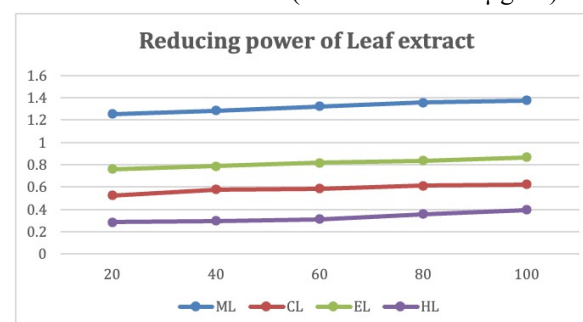
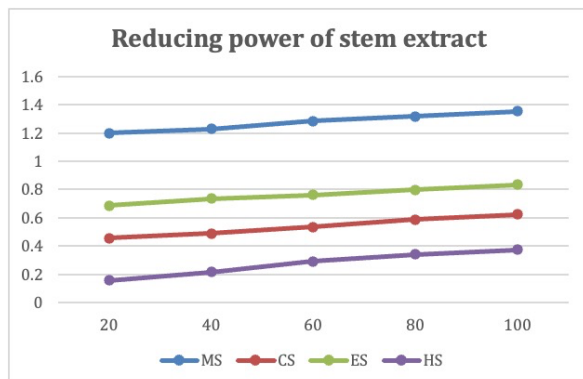


Figure 2 illustrates the reducing abilities of different stem extracts of *Elaeocarpus tectorius* compared with ascorbic acid standards. Reducing abilities were determined as follows: methanol extracts, followed by ethyl acetate extract, chloroform stem extract, and hexane stem extract. Notably, the rate of reducing ability of methanol extracts of leaf and stem samples at first accelerated sharply but then followed decreases. Consequently, it contains a larger quantity of reductones compared with hexane leaf and stem samples. As a result, methanol leaf and stem samples

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act as electron donors and would be capable of reacting with free radicals and converting them into more stable molecules and finally terminating the chain reactions caused by free radicals.

Figure 2: Comparison of absorbance at 700nm for standard and stem extracts (Concentration in $\mu\text{g/ml}$).



3. Anti-inflammatory activity

A table 3 below shows the anti-inflammation response caused by the leaf extracts of *Elaeocarpus tectorius* at differing concentrations, including the response obtained from a solution containing diclofenac, an anti-inflammation drug. These values are given as mean standard deviations, which are an average response at differing concentrations with a measure of dispersion. The unit measurements are different due to differing concentrations.

Concentration	Methanol extract	Aqueous extract	Diclofenac solution
10	5.93 \pm 1.51	3.62 \pm 1.58	20.18 \pm 1.24
25	12.36 \pm 1.16	11.36 \pm 1.62	43.58 \pm 1.44
50	29.31 \pm 1.02	21.45 \pm 1.56	58.13 \pm 1.75
100	59.27 \pm 1.33	46.87 \pm 1.23	77.41 \pm 1.23
150	89.8 \pm 1.23	81.6 \pm 1.01	92.26 \pm 1.41

Table 3. Anti-inflammatory results of *Elaeocarpus tectorius* leaf extracts (Concentration in $\mu\text{g/ml}$).

At lower concentrations (10 $\mu\text{g/ml}$), it can be seen that the anti-inflammation activity is highest for the methanol extract (5.93), followed by the aqueous extract (3.62), and then diclofenac solution (20.18). However, it should be noted that diclofenac solution will generally be more active. At higher concentrations (150 $\mu\text{g/ml}$), it can be seen that it is again the methanol extract that has shown the greatest anti-inflammation activity (89.8), followed by the aqueous extract (81.6), and then diclofenac solution (92.26). At higher concentrations, it can be seen that there are large

Methanol Extract The anti-inflammatory action increases with an increase in concentration. The result at 150 $\mu\text{g/ml}$ is remarkably high (89.8), almost reaching and even surpassing diclofenac. The aqueous extract increases with an increase in concentration but shows lower anti-inflammatory activity compared to the methanol extract at all concentrations. As expected, diclofenac acts as a standard for reference. Its activity increases with an increase in concentration, demonstrating a very high anti-inflammatory action at 150 $\mu\text{g/ml}$ (92.26), though slightly below that of the methanol extract.

A representation of the data on the anti-inflammatory activity of various concentrations of *Elaeocarpus tectorius* stem extracts and a diclofenac solution is given within Table 4. The data for these experiments are represented as the average value with a standard deviation.

Table 4. Anti-inflammatory results of *Elaeocarpus tectorius* stem extracts (Concentration in $\mu\text{g/ml}$).

Concentration	Methanol extract	Aqueous extract	Diclofenac solution
10	4.87 \pm 1.21	2.98 \pm 1.46	20.18 \pm 1.24
25	10.66 \pm 1.06	9.86 \pm 1.16	43.58 \pm 1.44
50	21.75 \pm 1.22	18.69 \pm 1.32	58.13 \pm 1.75
100	43.72 \pm 1.33	35.97 \pm 1.13	77.41 \pm 1.23
150	83.98 \pm 1.35	75.16 \pm 1.31	92.26 \pm 1.41

At Lower Concentrations (10 $\mu\text{g/ml}$), methanol extract exhibits moderate anti-inflammatory properties with an activity value of 4.87. Aqueous extract exhibits low activity with an activity value of 2.98. This shows less activity compared to methanol extract.

At mid-range concentrations (50 $\mu\text{g/ml}$), Methanol extract ranks higher with a pronounced increase in anti-inflammatory activity at 21.75. Although Aqueous extract maintains low activity (18.69), there is an increase compared to the 10 $\mu\text{g/ml}$ concentration. At higher concentrations (150 $\mu\text{g/ml}$), Methanol extract exhibits significantly high activity with an anti-inflammatory value of 83.98, almost comparable to that of diclofenac solution. Aqueous extract experiences a marked increase in activity with an anti-inflammatory value of 75.16, but lower compared to Methanol extract and diclofenac.

There is a visible enhancement in anti-inflammatory activity with an increase in concentration for the methanol extract, and the maximum value is 150 $\mu\text{g/ml}$ with 89.8%, almost comparable with diclofenac. The water extract displays an increase in anti-inflammatory activity with an increase in concentration but remains relatively less active compared to the methanol extract. The methanol extract obtained from the stem (Table 4) suggests that it has slightly less anti-inflammatory properties compared to the methanol extract obtained from the leaf of the plant (Table 3). Both sets of extracts have demonstrated that the methanol extract

has more anti-inflammatory properties compared to other extracts obtained. It can be suggested that methanol leaf extract from *Elaeocarpus tectorius* has slightly better effects compared to stem extracts. The aqueous extract obtained from the leaf contains more anti-inflammatory properties compared to the aqueous extract obtained from the stem. But all have low effects compared to methanol extracts. It seems that it would be more effective compared to aqueous extract obtained from the stem but less potent compared to methanol.

Discussion

The findings obtained from this research validate the conventional use of *Elaeocarpus tectorius* for the treatment of inflammation and oxidative stress-mediated disorders. The DPPH radical scavenging activity experiment clearly showed that all the extracts contained significant antioxidant properties, with the leaf methanol extract being more active. The finding obtained from this experiment implies that it is largely due to flavonoids and tannins, which are active components present in *Elaeocarpus tectorius*.

Likewise, the reducing power assay supported the fact that methanol extracts have a high electron donation capacity, thus emphasizing the antioxidant property of the plant. Notably, the leaf extract with methanol solution had a higher reducing power compared with the other three extracts, and hexane had the least antioxidant activity. All these findings confirm previous research emphasizing that methanol solution is an efficient solvent to be used for the extraction of active materials from plants.

Regarding anti-inflammatory effects, leaf and stem extracts showed dose-dependent hemolysis inhibition in the membrane stabilization assay. The most active agents were methanol extracts. Specifically, methanol leaf extract had anti-inflammatory activity comparable to diclofenac, an NSAID, at higher doses. Aqueous extracts also demonstrated anti-inflammatory activity but were consistently less active than methanol extracts. It appears that methanol could be more efficient at solubilizing anti-inflammatory compounds, which would be flavonoids, alkaloids, and similar biologically active molecules with recognized anti-inflammatory activity, because it is more polar.

Comparison between leaf and stem extracts showed that, even though there was significant bioactivity on the part of both extracts, leaf extracts were more active, particularly as anti-inflammatory agents. This could be due to the higher concentration of active ingredients within the leaf tissues or perhaps because leaves contain different biochemical from those in the stems.

Conclusion

Antioxidant and anti-inflammatory activities of *Elaeocarpus tectorius* thus confirm its traditional use in folk medicine. Of particular interest is the methanol leaf extract which evidences the highest antioxidant and anti-inflammatory activity, hence possessing potential as a natural alternative to synthetic antioxidants and anti-inflammatory drugs. Both leaf and stem extracts from this plant exhibited useful bioactivity; however, the leaf extracts, especially those extracted with methanol, were more active in most assays. Because this plant reduces both oxidative stress and inflammation, further studies need to be done to isolate and identify the specific bioactive compounds responsible for such therapeutic effects. Clinical trials will be required to establish the safety, efficacy, and possible therapeutic applications of *Elaeocarpus tectorius* in the treatment of inflammatory and oxidative stress-related disorders.

References

1. Pimm S.L., Jenkins C.N., Abell R., Brooks T.M., Gittleman J.L., Joppa L.N., Sexton J.O. The biodiversity of species and their rates of extinction, distribution, and protection. *Science*. 2014;344:1246752. doi: 10.1126/science.1246752. [DOI] [PubMed] [Google Scholar]
2. Fonnegra F.G. Plantas Medicinales Aprobadas en Colombia. University of Antioquia; Antioquia, Colombia: 2007. [Google Scholar]
3. Joppa L.N., Roberts D.L., Myers N., Pimm S.L. Biodiversity hotspots house most undiscovered plant species. *Proc. Natl. Acad. Sci. USA*. 2011;108:13171–13176. doi: 10.1073/pnas.1109389108. [DOI] [PMC free article] [PubMed] [Google Scholar]
4. Grover J.K., Yadav S., Vats V. Medicinal plants of India with anti-diabetic potential. *J. Ethnopharmacol.* 2002;81:81–100. doi: 10.1016/S0378-8741(02)00059-4. [DOI] [PubMed] [Google Scholar]
5. Wu Y-Y, Li W, Xu Y, Jin E-H and Tu Y-Y, Evaluation of the antioxidant effects of four main theroflavin derivatives through chemiluminescence and DNA damage analyses, *J Zhejiang Univ Sci B*, 2011, 12, 744.
6. Gulcin I, Antioxidant activity of food constituents: An overview, *Arch Toxicol*, 2012, 86, 345-391.
7. Fiedor J and Burda K, Potential role of carotenoids as antioxidants in human health and disease, *Nutrients*, 2014, 6(2), 466-488.

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8. Park E J and Pezzuto J M, Botanicals in cancer chemoprevention, *Cancer Metastasis Rev*, 2002, 21, 231-255.
9. Zhang Y J, Gan R Y, Li S, Zhou Y, Li AN, et al., Antioxidant phytochemicals for the prevention and treatment of chronic diseases, *Molecules*, 2015, 20(12), 21138-21156.
10. Liu F and Ng T B, Antioxidants and free radical scavenging activities of selected medicinal herbs, *Life Sci*, 2000, 66, 725-735.
11. Hu C and Kitts D D, Studies on the antioxidant activity of echinacea root extract, *J Agric Food Chem*, 2000, 48, 1466-1472.
12. Dadhich A, Rishi A, Sharma G and Chandra S, Phytochemicals of *elaecarpus* with their therapeutic value: A review, *Int J Pharm Bio Sci*, 2013, 4(3), 591-598.
13. Nathan, C. (2002). Points of control in inflammation. *Nature*, 420(6917), 846.
14. Caughey, G. H. (2016). Mast cell proteases as pharmacological targets. *European Journal of Pharmacology*, 778, 44–55.
15. Allavena, P., Garlanda, C., Borrello, M. G., Sica, A., & Mantovani, A. (2008). Pathways connecting inflammation and cancer. *Current Opinion in Genetics & Development*, 18(1), 3–10.
16. Ajith, Y., Dimri, U., Dixit, S. K., Singh, S. K., Gopalakrishnan, A., Madhesh, E., Rajesh, J. B., Sangeetha, S. G. (2017). Immunomodulatory basis of antioxidant therapy and its future prospects: An appraisal. *Inflammopharmacology*, 25(5), 487–498.
17. Sagin, F. G., & Sozmen, E. Y. (2004). Anti-inflammatory effects of dietary antioxidants. *Current Medicinal Chemistry - Anti-Inflammatory & Anti-Allergy Agents*, 3(1), 19–30.
18. Rivera, J. O., Loya, A. M., & Ceballos, R. (2013). Use of herbal medicines and implications for conventional drug therapy medical sciences. *Alternative & Integrative Medicine*, 2(6), 1–6.
19. Sostres, C., Gargallo, C. J., Arroyo, M. T., & Lanas, A. (2010). Adverse effects of non-steroidal anti-inflammatory drugs (NSAIDs, aspirin and coxibs) on upper gastrointestinal tract. *Best Practice & Research Clinical Gastroenterology*, 24(2), 121–132.
20. Prasannan P, Jeyaram Y, Pandian A, Raju R and Sekar S, A Review on taxonomy, phytochemistry, pharmacology, threats and conservation of *Elaeocarpus* L. (*Elaeocarpaceae*), *Bot Rev*, 2020, 86, 298–328.
21. Yildirim A, Mavi A, Oktay M, Kara AA, Algur OF, Bilaloglu V. Comparison of antioxidant and antimicrobial activities of *Tilia* (*Tilia argentea* Desf ex DC), sage (*Salvia triloba* L.), and Black tea (*Camellia sinensis*) extracts. *Journal of Agricultural and Food Chemistry*. 2000;48(10):5030–5034. doi: 10.1021/jf000590k.
22. Ferreira ICFR, Baptista P, Vilas-Boas M, Barros L. Free-radical scavenging capacity and reducing power of wild edible mushrooms from northeast Portugal: individual cap and stipe activity. *Food Chemistry*. 2007;100(4):1511–1516.