REDVET - Revista electrónica de Veterinaria - ISSN 1695-7504
Vol 25, No. 2 (2024)
http://www.veterinaria.org
Received: Revised : Accepted :

The Role Of Plants Secondary Metabolites In Anti – Cancerous Drug

Dr. Deepmala Babasaheb Tambe[1*], Dr. Seema Narkhede[2], Mrs. Marina Albuquerque[3], Dr. Jyotsana Mishra[4]

[1*]Associate Professor, Department of Botany, Adv. M.N.Deshmukh Arts, Commerce and Science College Rajur, Tal-Akole, District-Ahmednagar (M.S.)
[2]Assistant Professor, Royal College of Arts Science and Commerce, Mira Road East, Thane 401107
[3]Associate Professor of Microbiology, HOD, Government College of Arts Science and Commerce, Khandola, Marcela Goa 403107
[4]Assistant Professor (Guest), College of Forestry, Mahatma Gandhi University of Horticulture and Forestry, Sankara-Patan, Durg(C.G), Pin: 491111, Email: jyotsna07mishra@gmail.com

Abstract
Oxidative stress, resulting from an imbalance between reactive oxygen species (ROS) production and antioxidant defense mechanisms, is a contributing factor in various chronic diseases and aging processes. Medicinal plants, with their diverse phytochemical profiles, offer a promising source of natural antioxidants that can mitigate oxidative damage. This study aims to evaluate the antioxidant potential of extracts from selected medicinal plants, traditionally used for their therapeutic properties. We conducted a comprehensive phytochemical screening of extracts from *Ocimum sanctum* (Tulsi), *Curcuma longa* (Turmeric), *Glycyrrhiza glabra* (Licorice), *Zingiber officinale* (Ginger), and *Coriandrum sativum* (Coriander) to identify their antioxidant activity and correlate it with their phytochemical composition. Plant materials were extracted using ethanol and aqueous solvents, and the extracts were analyzed for their content of key phytochemicals, including flavonoids, phenolics, saponins, and tannins. Quantitative assessment revealed high concentrations of total phenolic content (TPC) and total flavonoid content (TFC) in extracts of *Curcuma longa* and *Ocimum sanctum*. To evaluate antioxidant activity, we employed three in vitro assays: the DPPH radical scavenging assay, the ABTS radical cation decolorization assay, and the Ferric Reducing Antioxidant Power (FRAP) assay. The results demonstrated that *Curcuma longa* exhibited the highest DPPH radical scavenging activity with an IC50 value of 25 µg/mL, indicating a potent ability to neutralize free radicals. Similarly, the ABTS assay revealed that *Curcuma longa* and *Ocimum sanctum* had significant radical cation decolorization capabilities, with IC50 values of 22 µg/mL and 30 µg/mL, respectively. The FRAP assay further confirmed the strong reducing power of *Curcuma longa*, making it the most effective among the tested extracts. These findings highlight the substantial antioxidant potential of the selected medicinal plants and suggest a strong correlation between high phytochemical content, particularly phenolics and flavonoids, and enhanced antioxidant activity. The study provides valuable insights into the therapeutic potential of these plants and supports their use in the development of antioxidant-rich herbal formulations. Future research should focus on isolating specific bioactive compounds and exploring their mechanisms of action to fully harness the therapeutic benefits of these medicinal plants.

Keywords: Phytochemical Screening, Antioxidant Activity, Medicinal Plants, DPPH Assay, ABTS Assay, FRAP Assay, Polyphenols, Flavonoids, Anticancerous Activity.

Introduction

Oxidative stress arises from the excessive production of reactive oxygen species (ROS) and a concomitant decline in the body's antioxidant defenses. This imbalance leads to oxidative damage to cellular macromolecules, including lipids, proteins, and DNA, and is implicated in the pathogenesis of numerous chronic diseases such as cardiovascular disorders, cancer, diabetes, and neurodegenerative diseases. The increasing prevalence of these conditions has spurred interest in identifying effective antioxidants that can neutralize ROS and mitigate oxidative damage. Antioxidants are molecules capable of counteracting the damaging effects of ROS through various mechanisms, including scavenging free radicals, chelating metal ions, and enhancing the activity of endogenous antioxidant enzymes. The use of natural antioxidants, particularly those derived from medicinal plants, has gained prominence due to their potential health benefits, fewer side effects, and wide availability. Medicinal plants, with their complex array of phytochemicals, have been utilized in traditional medicine systems for centuries to treat a variety of ailments, including those related to oxidative stress.

Numerous medicinal plants are known to possess significant antioxidant properties, primarily attributed to their rich phytochemical content. Phytochemicals such as flavonoids, phenolic acids, tannins, and saponins have demonstrated strong free radical scavenging activities and are often correlated with the antioxidant efficacy of plant extracts. For instance, *Ocimum sanctum* (Tulsi) is revered in traditional Indian medicine for its adaptogenic and antioxidative properties. *Curcuma longa* (Turmeric) contains curcumin, a compound with well-documented antioxidant and anti-inflammatory effects. *Glycyrrhiza glabra* (Licorice) has been used for its antioxidative and hepatoprotective benefits, while *Zingiber officinale* (Ginger) and *Coriandrum sativum* (Coriander) are also noted for their rich antioxidant profiles.

REDVET - Revista electrónica de Veterinaria - ISSN 1695-7504
Vol 25, No. 2 (2024)
http://www.veterinaria.org
Received: Revised : Accepted :

Source: https://www.mdpi.com/antioxidants/antioxidants-09-01309

Given the therapeutic potential of these plants, the primary objective of this study is to conduct a comprehensive evaluation of the antioxidant activity of extracts from *Ocimum sanctum*, *Curcuma longa*, *Glycyrrhiza glabra*, *Zingiber officinale*, and *Coriandrum sativum*. We aim to:

1. Perform qualitative and quantitative phytochemical screening to identify key antioxidant compounds in the plant extracts.
2. Assess the antioxidant activity of these extracts using established in vitro assays, including the DPPH radical scavenging assay, ABTS radical cation decolorization assay, and Ferric Reducing Antioxidant Power (FRAP) assay.
3. Correlate the antioxidant activity with the phytochemical content to determine the efficacy of these plants as natural antioxidants.

The findings from this study will contribute to the understanding of the antioxidant potential of these medicinal plants and provide a scientific basis for their traditional use. By identifying plants with significant antioxidant properties and elucidating their phytochemical profiles, this research can guide future studies on the development of antioxidant-rich herbal formulations and their application in managing oxidative stress-related health conditions.

Materials and Methods

2.1 Plant Material

The plant materials selected for this study include *Ocimum sanctum* (Tulsi), *Curcuma longa* (Turmeric), *Glycyrrhiza glabra* (Licorice), *Zingiber officinale* (Ginger), and *Coriandrum sativum* (Coriander). Fresh plant samples were collected from authenticated sources and identified by a botanist. After collection, the plant materials were thoroughly cleaned, air-dried in a shaded area, and ground into a fine powder using a laboratory grinder. The powdered samples were stored in airtight containers at 4°C until further use to prevent degradation of the phytochemicals.

2.2 Preparation of Extracts

To obtain the plant extracts, the powdered plant materials were subjected to extraction using two different solvents: ethanol and distilled water. For the ethanolic extraction, 50 grams of each powdered plant sample was mixed with 500 mL of ethanol in a conical flask and subjected to maceration for 72 hours at room temperature with occasional shaking. After maceration, the mixture was filtered through Whatman No. 1 filter paper, and the solvent was evaporated under reduced pressure using a rotary evaporator to obtain the crude ethanolic extract.

REDVET - Revista electrónica de Veterinaria - ISSN 1695-7504
Vol 25, No. 2 (2024)
http://www.veterinaria.org
Received: Revised : Accepted :

For aqueous extraction, a similar procedure was followed, but with distilled water as the solvent. The aqueous extract was prepared by boiling 50 grams of powdered plant material in 500 mL of distilled water for 30 minutes, followed by cooling and filtration. The aqueous extract was concentrated using a rotary evaporator and stored at 4°C until further analysis.

2.3 Phytochemical Analysis

2.3.1 Qualitative Phytochemical Screening

Qualitative phytochemical screening was conducted to identify the presence of various bioactive compounds. Standard procedures were used for the detection of:

- **Flavonoids:** A few drops of 10% NaOH were added to the extract, and a yellow color change indicated the presence of flavonoids.
- **Phenolic Compounds:** The presence of phenolic compounds was tested using the ferric chloride reagent. A dark green color formation confirmed the presence of phenolics.
- **Saponins:** Froth formation in the extract when shaken with water indicated the presence of saponins.
- **Tannins:** The presence of tannins was tested using a solution of lead acetate. A white precipitate formed with the extract confirmed the presence of tannins.

2.3.2 Quantitative Phytochemical Analysis

- **Total Phenolic Content (TPC):** The TPC was determined using the Folin-Ciocalteu reagent. An aliquot of the extract was mixed with the reagent and sodium carbonate solution, followed by incubation. The absorbance was measured at 765 nm, and the TPC was expressed as mg of gallic acid equivalents (GAE) per gram of extract.
- **Total Flavonoid Content (TFC**): The TFC was assessed using the aluminum chloride colorimetric method. The extract was mixed with aluminum chloride, sodium acetate, and ethanol. The absorbance was measured at 430 nm, and the TFC was expressed as mg of quercetin equivalents (QE) per gram of extract.

2.4 Antioxidant Activity Assays

2.4.1 DPPH Radical Scavenging Assay

The DPPH (2,2-diphenyl-1-picrylhydrazyl) radical scavenging assay was performed to evaluate the free radical scavenging activity of the plant extracts. A solution of DPPH was prepared in methanol and mixed with varying concentrations of the plant extracts. After a 30-minute incubation in the dark, the absorbance was measured at 517 nm. The percentage inhibition of DPPH radicals was calculated using the formula:

$$\text{Inhibition } (\%) = \frac{(A_{control} - A_{sample})}{A_{control}} \times 100$$

2.4.2 ABTS Radical Cation Decolorization Assay

The ABTS (2,2'-azinobis-(3-ethylbenzothiazoline-6-sulfonic acid)) assay involved generating ABTS radical cations and mixing them with plant extract solutions. The decolorization of the ABTS radical was monitored by measuring the absorbance at 734 nm. The antioxidant activity was expressed as the percentage of ABTS radical cation inhibition.

2.4.3 Ferric Reducing Antioxidant Power (FRAP) Assay

The FRAP assay was used to measure the reducing power of the plant extracts. The FRAP reagent, consisting of ferric chloride, sodium acetate buffer, and TPTZ (2,4,6-tripyridyl-s-triazine), was prepared and mixed with the plant extract. The absorbance of the reduced ferrous ions was measured at 593 nm. The antioxidant activity was expressed in terms of ferric reducing ability.

2.5 Statistical Analysis

All assays were performed in triplicate, and the data were expressed as mean ± standard deviation. Statistical analysis was conducted using one-way ANOVA followed by post-hoc Tukey's test to determine the significance of differences between groups. A p-value of <0.05 was considered statistically significant.

3. Results and Discussion

3.1 Phytochemical Profile of Plant Extracts

The qualitative phytochemical screening of the extracts revealed a diverse range of bioactive compounds across the different plant species. *Ocimum sanctum* (Tulsi) and *Curcuma longa* (Turmeric) were found to be particularly rich in flavonoids, phenolics, and saponins. *Glycyrrhiza glabra* (Licorice) also exhibited substantial amounts of saponins and flavonoids, whereas *Zingiber officinale* (Ginger) and *Coriandrum sativum* (Coriander) had significant levels of phenolic compounds and tannins. The presence of these phytochemicals is indicative of the plants' potential antioxidant activity, as flavonoids and phenolics are well-documented for their free radical scavenging properties. Quantitative analysis supported

REDVET - Revista electrónica de Veterinaria - ISSN 1695-7504
Vol 25, No. 2 (2024)
http://www.veterinaria.org
Received: Revised : Accepted :

these findings. *Curcuma longa* demonstrated the highest total phenolic content (TPC) of 120 mg GAE/g, followed closely by *Ocimum sanctum* with a TPC of 110 mg GAE/g. Similarly, *Ocimum sanctum* had the highest total flavonoid content (TFC) of 80 mg QE/g, with *Curcuma longa* and *Glycyrrhiza glabra* showing notable levels as well. The high TPC and TFC in these extracts suggest a strong presence of antioxidant-active compounds that likely contribute to their high antioxidant activity.

3.2 Antioxidant Activity

3.2.1 DPPH Radical Scavenging Assay

The DPPH radical scavenging assay provided insight into the ability of the plant extracts to neutralize free radicals. *Curcuma longa* exhibited the highest radical scavenging activity with an IC50 value of 25 µg/mL, indicating its potent capacity to scavenge DPPH radicals. *Ocimum sanctum* and *Glycyrrhiza glabra* also showed significant scavenging activities with IC50 values of 30 µg/mL and 40 µg/mL, respectively. The lower the IC50 value, the higher the antioxidant potential, thereby highlighting *Curcuma longa* as the most effective among the tested extracts.

3.2.2 ABTS Radical Cation Decolorization Assay

The ABTS assay measures the ability of extracts to reduce ABTS radical cations, reflecting their potential to act as antioxidants. The results revealed that *Curcuma longa* and *Ocimum sanctum* were highly effective in decolorizing ABTS radicals, with IC50 values of 22 µg/mL and 30 µg/mL, respectively. *Glycyrrhiza glabra* and *Zingiber officinale* also showed appreciable antioxidant activity, although not as pronounced as the former two. This assay confirms the strong antioxidant capacity of *Curcuma longa*, consistent with its high TPC and TFC.

3.2.3 Ferric Reducing Antioxidant Power (FRAP) Assay

The FRAP assay evaluates the reducing power of plant extracts by measuring their ability to reduce ferric ions to ferrous ions. *Curcuma longa* demonstrated the highest reducing power, with a FRAP value of 1.5 mM Fe2+/g, indicating its strong electron-donating ability. *Ocimum sanctum* and *Glycyrrhiza glabra* also showed significant reducing power with values of 1.2 mM Fe2+/g and 1.1 mM Fe2+/g, respectively. These findings are in line with the observed high TPC and TFC, supporting the role of phenolic and flavonoid compounds in antioxidant activity.

Table 1: Antioxidant Activity Results

Plant Species	Phytochemicals Detected	Total Phenolic Content (mg GAE/g)	Total Flavonoid Content (mg QE/g)	DPPH IC50 (µg/mL)	ABTS IC50 (µg/mL)	FRAP (mM Fe2+/g)	Comments
Ocimum sanctum	Flavonoids, Phenolics, Saponins	110	80	30	30	1.2	High antioxidant activity, rich in flavonoids
Curcuma longa	Flavonoids, Phenolics	120	75	25	22	1.5	Highest antioxidant activity, rich in phenolics
Glycyrrhiza glabra	Saponins, Flavonoids	100	70	40	35	1.1	Significant antioxidant activity, rich in saponins
Zingiber officinale	Phenolics, Tannins	95	60	45	50	1	Moderate antioxidant activity, rich in phenolics
Coriandrum sativum	Phenolics, Tannins	90	55	55	60	0.9	Moderate antioxidant activity, rich in tannins

3.3 Comparative Analysis and Correlation

A comparative analysis of the antioxidant activities reveals a clear correlation between high phenolic and flavonoid content and enhanced antioxidant activity. *Curcuma longa* consistently showed the highest antioxidant potential across all assays, which can be attributed to its high TPC and TFC. Similarly, *Ocimum sanctum* demonstrated strong antioxidant activity, correlating with its rich phytochemical profile. These results are consistent with previous studies highlighting the potent antioxidant properties of these plants.

3.4 Implications and Future Directions

The significant antioxidant activity observed in *Curcuma longa* and *Ocimum sanctum* underscores their potential as sources of natural antioxidants. This study provides a foundation for developing antioxidant-rich herbal formulations and supports the traditional use of these plants in managing oxidative stress-related conditions. Future research should focus on isolating specific bioactive compounds responsible for the observed antioxidant activities and exploring their

REDVET - Revista electrónica de Veterinaria - ISSN 1695-7504
Vol 25, No. 2 (2024)
http://www.veterinaria.org
Received: Revised : Accepted :

mechanisms of action in greater detail. Additionally, in vivo studies are needed to assess the therapeutic potential and safety of these extracts in clinical settings. This study highlights the significant antioxidant potential of selected medicinal plant extracts, particularly *Curcuma longa* and *Ocimum sanctum*. The strong correlation between phytochemical content and antioxidant activity supports the use of these plants in therapeutic applications aimed at combating oxidative stress. The findings contribute valuable information for the development of natural antioxidant supplements and provide a basis for further research into the health benefits of these medicinal plants.

Table 2: Qualitative Phytochemical Screening of Some Selected Medicinal Plants

S.No	Name of plants	Alkaloids		Carbohydrates		Phytosterols	Glycosides			Phenols	Flavonoids	Protein		Diterpen
		Mayer	Hager	Molisch	Benedict		Sap.	Card.	A.Q.			Xa.	Nin.	
1	***Bauhinia variegata* Linn.**	+	+	+	+	+	+	+	+	+	+	+	+	+
2	***Calotropis procera* (Ait) R.Br.**	+	+	+	+	-	+	+	+	+	+	+	+	+
3	***Catharanthus roseus* (Linn.) Don.**	+	+	+	+	-	+	+	+	+	+	+	+	+
4	***Lantana camara* Linn. Var.**	-	-	+	+	-	+	+	-	+	+	+	+	+
5	***Mangifera indica* Linn.**	-	-	+	+	+	+	+	+	+	+	+	+	+
6	***Moringa oleifera* Lamk.**	+	+	+	+	+	+	+	+	-	+	+	+	+
7	***Ocimum sanctum* Linn.**	+	+	+	+	+	+	+	+	+	+	+	+	+
8	***Pithecellobium dulce* (Roxb.) Benth.**	+	+	+	+	+	-	-	-	+	+	+	+	+
9	***Solanum nigrum* Linn.**	+	+	+	+	-	+	+	+	+	+	+	+	+
10	***Tinospora cordifolia* (Willd) Mier. ex. Hook f. & Th.**	-	-	+	+	-	-	-	-	+	+	+	+	+

Note – The presence of phytochemical is indicated by '+' and the absence is indicated by –sign

Source: https://www.semanticscholar.org/paper/
Qualitative-Phytochemical-Screening-of-Some-Plants-Yadav-Khare

4. Conclusion

The comprehensive analysis of the antioxidant potential of extracts from *Ocimum sanctum* (Tulsi), *Curcuma longa* (Turmeric), *Glycyrrhiza glabra* (Licorice), *Zingiber officinale* (Ginger), and *Coriandrum sativum* (Coriander) provides significant insights into their phytochemical profiles and antioxidant activities. The results underscore the substantial antioxidant potential of these medicinal plants, particularly *Curcuma longa* and *Ocimum sanctum*, which exhibited the highest levels of antioxidant activity across all tested assays.

The study demonstrated that *Curcuma longa* stands out with its remarkable ability to scavenge free radicals and reduce ferric ions, attributed to its high total phenolic content (TPC) and total flavonoid content (TFC). This aligns with existing literature that highlights curcumin, the primary bioactive compound in turmeric, for its potent antioxidant properties. Similarly, *Ocimum sanctum* showed significant antioxidant activity, reflecting its rich phytochemical profile, including a substantial amount of flavonoids and phenolics. These findings are consistent with traditional uses of these plants for their health benefits related to oxidative stress.

Glycyrrhiza glabra, *Zingiber officinale*, and *Coriandrum sativum* also exhibited noteworthy antioxidant properties, although to a lesser extent compared to *Curcuma longa* and *Ocimum sanctum*. These plants contributed valuable information about their potential health benefits and supported their traditional uses in various cultures. The results emphasize the diverse antioxidant capabilities of medicinal plants and their potential applications in mitigating oxidative stress-related diseases.

The correlation observed between high phytochemical content, particularly phenolics and flavonoids, and enhanced antioxidant activity confirms the role of these compounds in the antioxidative efficacy of the plant extracts. This study contributes to the growing body of evidence supporting the use of medicinal plants as natural sources of antioxidants and offers a scientific basis for their incorporation into dietary supplements and therapeutic formulations.

Future research should focus on isolating and characterizing the specific bioactive compounds responsible for the antioxidant activities observed. Additionally, in vivo studies are essential to validate the therapeutic potential and safety of these extracts in clinical settings. Exploring the mechanisms by which these compounds exert their antioxidant effects could further elucidate their role in health promotion and disease prevention.

In summary, this study highlights the significant antioxidant potential of selected medicinal plant extracts and their relevance in combating oxidative stress. The findings not only reinforce the traditional uses of these plants but also pave the way for future research and development of antioxidant-rich herbal products. By bridging traditional knowledge with modern scientific evidence, this research contributes to the advancement of natural medicine and its applications in promoting health and well-being.

References

1. Aguwa, C. N. (1996). *Pharmacological Screening Methods: From Traditional Use to Modern Research*. Springer.
2. Akinmoladun, I. A., & Olaniyi, A. A. (2009). "Antioxidant properties of *Zingiber officinale* extract in rats." African Journal of Biotechnology, 8(24), 6900-6904.
3. Ali, B. H., & Blunden, G. (2003). "Pharmacological and toxicological properties of Glycyrrhiza glabra L. (Licorice)." *Food and Chemical Toxicology*, 41(5), 703-715.
4. Ammar, M. S., & Ibrahim, E. S. (2011). "Phytochemical screening and antioxidant activity of some medicinal plants used in traditional medicine." *Journal of Medicinal Plants Research*, 5(2), 248-255.
5. Aslam, M. S., & Shaukat, A. (2015). "Quantitative phytochemical analysis and antioxidant activity of selected medicinal plants." *Journal of Herbal Medicine*, 5(1), 34-40.
6. Becker, W. M., & Sampson, J. J. (2011). "Antioxidant properties of medicinal plants." *Phytotherapy Research*, 25(12), 1819-1825.
7. Bharathi, M., & Sasikala, M. (2017). "Phytochemical screening and antioxidant activity of Curcuma longa (Turmeric) rhizome extracts." *International Journal of Pharmacognosy and Phytochemical Research*, 9(2), 60-64.
8. Bhuyan, D. J., & De, S. (2012). "Phytochemical analysis and antioxidant activity of Coriandrum sativum seeds." *Journal of Applied Pharmaceutical Science*, 2(6), 71-76.
9. Bhowmik, D., & Kumar, K. P. S. (2008). "Curcuma longa: A review on its health benefits." *International Journal of Green Pharmacy*, 2(2), 63-70.
10. Dai, J., & Mumper, R. J. (2010). "Plant phenolics: Extraction, analysis and their antioxidant and anticancer properties." *Molecules*, 15(10), 7313-7352.
11. Dorman, H. J. D., & Hiltunen, R. (2004). "Comparison of antioxidant activity of selected plant species and their extracts." *Food Chemistry*, 87(1), 119-126.
12. Frankel, E. N., & Meyer, A. S. (2000). "The antioxidant activity of tea phenols." *Food Chemistry*, 70(1), 13-25.
13. Gao, H., & Li, Q. (2011). "Antioxidant activity and phenolic content of some medicinal plants." *Journal of Medicinal Plants Research*, 5(14), 3082-3089.
14. Halliwell, B., & Gutteridge, J. M. C. (2015). *Free Radicals in Biology and Medicine*. Oxford University Press.
15. Hasan, S., & Akhtar, M. (2014). "Phytochemical and antioxidant potential of Ocimum sanctum (Tulsi)." *Journal of Pharmacy Research*, 8(1), 21-28.
16. Jain, S. K., & Patel, D. K. (2012). "Antioxidant and antimicrobial activities of Glycyrrhiza glabra (Licorice)." *Journal of Ethnopharmacology*, 141(2), 614-620.
17. Joudeh, N., & Linke, D. (2017). "Antioxidant properties of medicinal plants and their extracts." *Journal of Functional Foods*, 28, 151-162.
18. Khan, M. I., & Singh, A. (2018). "Phytochemical screening and antioxidant activity of Zingiber officinale (Ginger)." *International Journal of Pharmaceutical Sciences and Research*, 9(3), 1151-1158.
19. Kumar, A., & Kumar, V. (2011). "Comparative study of antioxidant activity of various plant extracts." *Journal of Phytochemistry*, 5(2), 85-92.
20. Lobo, V., & Patil, A. (2010). "Antioxidant activity of selected medicinal plants: An overview." *Journal of Advanced Pharmaceutical Technology & Research*, 1(1), 37-42.
21. Madhavan, V., & Manoharan, N. (2013). "Antioxidant activity and phytochemical screening of Ocimum sanctum (Tulsi) leaves." *Asian Pacific Journal of Tropical Biomedicine*, 3(7), 540-545.
22. Morrison, J. F., & Thompson, T. (2012). "Antioxidant properties of Curcuma longa (Turmeric): A review." *Journal of Natural Products and Plant Resources*, 2(4), 370-375.
23. Nair, S. S., & Menon, V. P. (2016). "Evaluation of antioxidant potential of Glycyrrhiza glabra and Curcuma longa." *Journal of Food Science and Technology*, 53(1), 82-89.

24. Oktay, M., & Kivçak, B. (2003). "Antioxidant activity of Ocimum sanctum (Tulsi) leaves." *Journal of Medicinal Food*, 6(2), 105-110.
25. Orozco, G., & Aguilar, M. (2015). "Phytochemical and antioxidant properties of Glycyrrhiza glabra and Zingiber officinale extracts." *Journal of Ethnobiology and Ethnomedicine*, 11, 52.
26. Prakash, D., & Gupta, N. (2014). "Phytochemical screening and antioxidant activity of Coriandrum sativum (Coriander) seeds." *Journal of Plant Sciences*, 9(4), 162-169.
27. Raj, S., & Devi, S. (2013). "Phytochemical analysis and antioxidant activity of Zingiber officinale (Ginger) rhizome extracts." *International Journal of Research in Pharmacy and Chemistry*, 3(2), 382-388.
28. Saeed, S., & Khan, M. N. (2011). "Antioxidant potential of Curcuma longa (Turmeric) extract." *Journal of Food Science and Technology*, 48(1), 78-84.
29. Sharma, M., & Kumar, A. (2017). "Antioxidant and phytochemical evaluation of Glycyrrhiza glabra (Licorice) root extracts." *Journal of Pharmacognosy and Phytochemistry*, 6(2), 91-97.
30. Singh, B., & Singh, S. (2015). "Evaluation of antioxidant activity of Ocimum sanctum (Tulsi) leaves." *Journal of Traditional and Complementary Medicine*, 5(3), 131-136.