

# A study of Phytochemicals, Total Phenolic, Total Flavonoids in *Triphala* and its constituents extract for Importance in medicinal uses

Seema Jain\* and Ankit Agarwal

Rabindranath Tagore University, Bhopal (M.P.) India

(Received 9 August, 2025; Accepted 11 October, 2025)

## ABSTRACT

In this study, the phytochemical profile and total phenolic and flavonoid contents of triphala and its constituent parts, *Terminalia bellirica*, *Terminalia chebula*, and *Emblca officinalis*, were assessed. After preparing methanolic extracts from the dried fruits, the primary secondary metabolites were qualitatively screened. All samples tested positive for flavonoids, alkaloids, phenolics, and other bioactive compounds. Quantitative estimation was performed using colorimetric methods. The Total Phenolic Content (TPC) was highest in *E. officinalis* (117.50 mg GAE/g), while *T. bellirica* showed the highest Total Flavonoid Content (TFC) (104.39 mg QE/g). The *Triphala* extract demonstrated moderate levels of both phenolics (90.41 mg GAE/g) and flavonoids (51.04 mg QE/g), reflecting the cumulative contribution of its constituents. These findings support the antioxidant potential and therapeutic value of *Triphala* and its ingredients, justifying their traditional use in Ayurvedic medicine.

**Key words:** *Triphala*, *Emblca officinalis*, *Terminalia bellirica*, *Terminalia chebula*, Hytochemical screening

## Introduction

*Triphala*, a classical Ayurvedic formulation, is composed of the dried fruits of *Emblca officinalis* (Amla), *Terminalia bellirica* (Bahera), and *Terminalia chebula* (Haritaki) in equal proportions. It is widely recognized for its broad spectrum of therapeutic effects, including antioxidant, antimicrobial, anti-inflammatory, immunomodulatory, and adaptogenic properties (Sabu and Kuttan, 2022; Dutta *et al.*, 2023). The pharmacological potency of *Triphala* is attributed to the synergistic action of its bioactive constituents—predominantly phenolics, flavonoids, tannins, alkaloids, and vitamin C— which are well-documented for their free radical scavenging abilities and regulatory roles in various metabolic pathways (Yadav *et*

*al.*, 2021).

With increasing global interest in plant-based medicine, the standardization and scientific validation of formulations like *Triphala* have become imperative. Organoleptic evaluation, though qualitative, provides foundational data on sensory attributes, assisting in the authentication and preliminary quality assessment of herbal raw materials (Nayak *et al.*, 2020). Furthermore, modern analytical techniques such as UV-visible spectrophotometry, HPLC, and FTIR have enabled more accurate quantification of key phytochemicals like total flavonoid content (TFC) and total phenolic content (TPC), which are critical indicators of antioxidant potential (Kumar *et al.*, 2023; Shah *et al.*, 2022). Methanolic extraction is commonly employed in phytochemical

analysis due to its efficiency in isolating polar bioactive compounds, particularly polyphenols and flavonoids (Khalid *et al.*, 2023). Studies have shown that the individual fruits of *Triphala* possess distinct phytochemical profiles, and when combined, they offer enhanced pharmacological effects due to potential synergism (Srikumar *et al.*, 2007; Bhowmik *et al.*, 2022). *Triphala*'s effectiveness in managing oxidative stress, gastrointestinal disturbances, and metabolic syndromes has been supported by both traditional knowledge and contemporary pharmacological evidence (Anand *et al.*, 2024; Choudhury *et al.*, 2021).

Given its growing therapeutic importance and widespread use, especially in Ayurvedic and integrative medicine, a comprehensive assessment of *Triphala*'s organoleptic traits, extraction yields, and phytochemical characteristics is essential. Such studies not only support traditional claims but also help in developing standardized herbal formulations with consistent efficacy and safety profiles.

## Materials and Methods

### Materials

Dried fruits of *Emblica officinalis* (Amla), *Terminalia bellirica* (Bahera), and *Terminalia chebula* (Haritaki) were procured from a nearby local botanical garden. The plant materials were authenticated based on their morphological characteristics and cleaned thoroughly before use. All chemicals and reagents used in the study were of analytical grade.

- Dried fruits of *E. officinalis*, *T. bellirica* and *T. chebula*.
- Chemicals: Methanol, Folin–Ciocalteu reagent, Aluminium chloride, Sodium carbonate, Gallic acid, Quercetin.

### Organoleptic Evaluation

To perform the organoleptic evaluation of the dried fruits of *Emblica officinalis*, *Terminalia bellirica*, and *Terminalia chebula*, a systematic approach was followed.

First, the dried fruits were cleaned thoroughly to remove any dust or foreign material. For powder analysis, a small quantity of each fruit was ground using a clean grinder or mortar and pestle. The resulting powders were sieved if necessary to ensure uniform particle size and consistency.

For color evaluation, the whole fruits and their

respective powders were placed separately in clean petri dishes or on a white background. The color was observed in natural daylight or under white fluorescent lighting, and recorded carefully for each sample.

To assess the odor, a small portion of each powdered sample was gently smelled without deep inhalation. The type of odor (e.g., aromatic, pungent, astringent, or characteristic) and its intensity were noted and documented.

Taste evaluation was carried out only for the known edible and safe fruits. A small amount of each powder was placed on the tip of the tongue to determine whether the taste was sour, bitter, sweet, or astringent. The mouth was rinsed immediately after tasting.

For texture analysis, a pinch of each powder was rubbed gently between the fingers to assess the feel—whether it was fine, coarse, gritty, sticky, or fibrous.

Lastly, the general appearance of the samples was observed. This included evaluating the uniformity of the powder, presence of moisture or lumps, and any visible fibrous fragments. All these characteristics were recorded in detail for further comparison and standardization (Mishra *et al.*, 2022).

### Preparation of Extracts

The dried fruits sample (*Emblica officinalis*, *Terminalia bellirica*, and *Terminalia chebula*) were separately coarsely powdered using a mechanical grinder. Equal proportions (1:1:1 w/w) of each powdered fruit were mixed to prepare the *Triphala* formulation.

### Individual Extracts

- 50 g of each powdered fruit (Amla, Bahera, and Haritaki) was subjected to cold maceration with 500 mL of methanol in separate conical flasks.
- The mixtures were kept at room temperature (25 ± 2 °C) for 72 hours with occasional shaking.
- After maceration, the extracts were filtered using muslin cloth followed by Whatman No. 1 filter paper.
- The filtrates were concentrated under reduced pressure using a rotary evaporator at 40–45 °C and dried to obtain semisolid crude extracts.

### Triphala Extract

- An equal amount of each powdered fruit (total 50 g; 16.66 g each) was combined and extracted us-

ing the same cold maceration procedure as above with 500 mL methanol.

- The extract was filtered, concentrated, and dried similarly to obtain the *Triphala* extract.

### Qualitative Phytochemical Screening

Qualitative phytochemical analysis was conducted on the methanolic extracts of *Embllica officinalis*, *Terminalia bellirica*, *Terminalia chebula*, and the combined *Triphala* extract to identify the presence of various classes of bioactive compounds. Standard phytochemical tests were employed to screen for major secondary metabolites, including alkaloids, flavonoids, tannins, phenols, saponins, terpenoids, glycosides, and steroids. All tests were performed in triplicate to ensure accuracy and reproducibility (Kumar *et al.*, 2023; Dutta *et al.*, 2023; Saini *et al.*, 2022).

### Test Procedures

#### Test for Alkaloids (Dragendorff's Test)

A small amount of the methanolic extract was acidified with dilute hydrochloric acid and then treated with Dragendorff's reagent (a solution of potassium bismuth iodide). The formation of a reddish-brown or orange precipitate indicates the presence of alkaloids (Kumar *et al.*, 2023).

#### Test for Flavonoids (Shinoda Test)

To the extract, a few fragments of magnesium ribbon were added, followed by a few drops of concentrated hydrochloric acid. The development of a pink, red, or orange coloration indicates the presence of Flavonoids (Singh *et al.*, 2022).

#### Test for Tannins and Phenols (Ferric Chloride Test)

To 1 ml of extract, a few drops of 1% ferric chloride solution were added. A blue-black or greenish coloration confirms the presence of tannins or phenolic compounds.

#### Test for Saponins (Foam Test)

About 2 ml of extract was diluted with 10 mL of distilled water and shaken vigorously in a graduated cylinder for 30 seconds. The presence of persistent froth or foam (lasting more than 10 minutes and at least 1 cm high) indicates saponins (Rani *et al.*, 2022).

#### Test for Terpenoids (Salkowski Test)

To 2 mL of extract, 2 mL of chloroform was added,

followed by carefully layering 2 ml of concentrated sulfuric acid along the side of the test tube. A reddish-brown interface between the layers indicates the presence of terpenoids (Sharma *et al.*, 2023).

#### Test for Glycosides (Keller–Killiani Test)

To 2 ml of extract, 1 ml of glacial acetic acid and a few drops of ferric chloride were added, followed by 1 ml of concentrated sulfuric acid. Formation of a brown ring at the interface, and sometimes a bluish-green upper layer, confirms the presence of cardiac glycosides (Patel *et al.*, 2022).

#### Test for Steroids (Liebermann–Burchard Reaction)

To 1 mL of extract, 2 mL of acetic anhydride was added, followed by a few drops of concentrated sulfuric acid. The appearance of a blue, green, or purple coloration indicates the presence of steroids (Mehta *et al.*, 2023).

#### Total Phenolic Content (TPC)

For the estimation of total phenolic content in the plant extracts, 0.5 mL of each methanolic extract (prepared at a concentration of 1 mg/ml) was taken and mixed with 2.5 ml of 10% Folin–Ciocalteu reagent. After allowing the reaction to proceed for 5 minutes, 2.0 ml of 7.5% sodium carbonate solution was added to the mixture. The resulting solution was thoroughly mixed and incubated at room temperature for 30 minutes. Following the incubation period, the absorbance was measured at 765 nm using a UV-Visible spectrophotometer. The phenolic content was then calculated using the gallic acid standard calibration curve. To prepare the standard curve for total phenolic content estimation, a series of gallic acid standard solutions ranging from 10 to 100 µg/ml were prepared in methanol. From each standard solution, 0.5 mL was taken and mixed with 2.5 ml of 10% Folin–Ciocalteu reagent. After allowing the reaction to proceed for 5 minutes, 2.0 ml of 7.5% sodium carbonate solution was added to the mixture. The solutions were then thoroughly mixed and incubated in the dark at room temperature for 30 minutes. Following incubation, the absorbance of each solution was measured at 765 nm using a UV-Visible spectrophotometer (Yadav *et al.*, 2023). This data was used to plot a calibration curve of absorbance versus concentration, which served as the basis for quantifying phenolic content in the plant extracts. Calculation Formula for Total Phenolic Content (TPC):

$$\text{TPC} = [\text{C} \times \text{V}] / \text{M}$$

Where: C = Concentration of gallic acid from the standard curve (mg/ml), V = Volume of extract used in the assay (ml), M = Mass of plant extract used (g), GAE = Gallic Acid Equivalent

The result is expressed as milligrams of gallic acid equivalents per gram of dry extract (mg GAE/g).

#### Total Flavonoid Content (TFC)

To estimate the total flavonoid content (TFC) of the methanolic plant extracts, the aluminium chloride colorimetric method was employed. Quercetin was used as the standard for preparing the calibration curve. A series of quercetin standard solutions in methanol, ranging from 10 to 100 µg/ml, were prepared. For each standard, 1.0 mL was mixed with 1.0 ml of 10% aluminium chloride solution, 1.0 ml of 1 M potassium acetate, and 2.8 mL of distilled water (Verma *et al.*, 2021). The mixture was incubated at room temperature for 30 minutes, and the absorbance was measured at 415 nm using a UV-Visible spectrophotometer. For the sample preparation, 1.0 mL of each methanolic plant extract (1 mg/ml) was treated in the same manner as the standards. Specifically, to each extract, 1.0 ml of 10% aluminum chloride, 1.0 ml of 1 M potassium acetate, and 2.8 ml of distilled water were added. After incubation for 30 minutes at room temperature, the absorbance of the mixture was recorded at 415 nm. The flavonoid content was calculated from the quercetin standard curve and expressed as milligrams of quercetin equivalent per gram of dry extract (mg QE/g) (Das *et al.*, 2023). Calculation Formula for Total Flavonoid Content (TFC):

$$\text{TFC} = [\text{C} \times \text{V}] / \text{M}$$

Where: CCC = Concentration of quercetin from the standard curve (mg/mL), VVV = Volume of extract used in the assay (mL), MMM = Mass of plant

extract used (g), QE = Quercetin Equivalent

The final result is expressed as milligrams of quercetin equivalents per gram of dry extract (mg QE/g).

## Results

### Organoleptic Properties of *Triphala* Components

The organoleptic evaluation of the individual dried fruit powders used in the preparation of *Triphala-Emblica officinalis* (Amla), *Terminalia bellirica* (Bahera), and *Terminalia chebula* (Haritaki) was conducted based on parameters such as color, odor, taste, texture, and appearance. Organoleptic assessment, although subjective, remains a valuable initial step in the quality evaluation of herbal raw materials, especially when combined with microscopic and phytochemical analyses.

These differences in sensory attributes not only help in authenticating the individual components but also influence the palatability, consumer acceptability, and possibly the pharmacological effects of the *Triphala* formulation. For example, the strong astringency of *T. chebula* and the sourness of *E. officinalis* may contribute to the digestive and antioxidant properties traditionally attributed to *Triphala*.

### Percentage Yield of Methanolic Extracts of *Triphala* Components

The methanolic extracts of *Emblica officinalis*, *Terminalia bellirica*, *Terminalia chebula*, and the combined *Triphala* formulation were prepared using 50 grams of dried powder from each sample. The extraction was performed in triplicate, and the percentage yield was calculated based on the weight of extract obtained. The combined *Triphala* extract showed extract weights of 5.72 g, 5.75 g, and 5.78 g, corresponding to a mean percentage yield of 11.5 ±

**Table 1.** Organoleptic Properties of *Triphala* Components

S. No.	Parameter	<i>E. officinalis</i> (Amla)	<i>T. bellirica</i> (Bahera)	<i>T. chebula</i> (Haritaki)
1	Color	Light brown to yellowish-brown	Dark brown to greyish-brown	Brown to blackish-brown
2	Odor	Mild, characteristic	Slightly pungent, earthy	Astringent, slightly sour
3	Taste	Sour and astringent	Astringent and slightly bitter	Strongly astringent and bitter
4	Texture	Fine to moderately coarse powder	Fine powder	Moderately coarse powder
5	Appearance	Uniform and dry	Dry with slight clumps	Dry, fibrous fragments possible

0.03%. These results reflect consistent extraction efficiency across all three individual components and the *Triphala* formulation.

The consistency in extraction efficiency across all samples (low standard deviation) highlights the reproducibility and reliability of the extraction process. These yield values are significant for formulating standardized herbal products and for ensuring batch-to-batch consistency in *Triphala*-based preparations.

### Qualitative Phytochemical Screening of *Triphala* and its Component

The qualitative phytochemical screening of *Terminalia chebula*, *Terminalia bellerica*, *Emblia officinalis*, and the *Triphala* formulation revealed the consistent presence of key bioactive constituents across all samples. Notably, flavonoids, alkaloids, and phenolic compounds were detected in all three individual extracts and in the *Triphala* blend. These phytochemicals are known for their potent antioxidant, anti-inflammatory, and therapeutic activities, which support the traditional medicinal uses of these plants.

These phytochemicals are well known for their antioxidant, antimicrobial, and anti-inflammatory properties, supporting the traditional use of *Triphala* in Ayurvedic medicine. The consistent presence of these constituents in all three individual fruits and in *Triphala* suggests a synergistic effect that enhances

the pharmacological efficacy of the formulation.

### Calibration Curve Data for TFC Estimation

The calibration curve for Total Flavonoid Content (TFC), using quercetin as the standard, exhibited a consistent linear relationship between absorbance and concentration across the range of 20–100 µg/mL at 415 nm. This linearity confirms the suitability of the aluminum chloride colorimetric method for accurate estimation of flavonoids in plant extracts. The gradual increase in absorbance with concentration reflects the method's sensitivity to quercetin-like compounds. From the standard curve, the absorbance value 0.533 corresponds to a calculated total phenolic content of 90.41 mg GAE/g extract (expressed as milligrams of gallic acid equivalents per gram of extract).

### Total Flavonoid Content (TFC) of Extracts

The TFC results showed that *T. bellerica* had the

**Table 4.** Calibration Curve Data for TFC Estimation (Using Quercetin as Standard)

Concentration (µg/ml)	Absorbance (at 415 nm)
20	0.207
40	0.355
60	0.408
80	0.548
<b>100</b>	<b>0.663</b>

**Table 2.** Percentage Yield of Methanolic Extracts of *Triphala* Components

S. No.	Sample Name	Weight of Powder Taken (g)	Weight of Extract Obtained (g)	% Yield (Mean ± SD, n=3)
1	<i>Emblia officinalis</i>	50	6.28, 6.32, 6.35	12.6 ± 0.04
2	<i>Terminalia bellirica</i>	50	5.15, 5.18, 5.21	10.3 ± 0.03
3	<i>Terminalia chebula</i>	50	5.88, 5.91, 5.93	11.8 ± 0.03
4	<i>Triphala</i> (Combined)	50	5.72, 5.75, 5.78	11.5 ± 0.03

**Table 3.** Qualitative Phytochemical Screening of *Triphala* and Its Component

S. No.	Phytochemical Test	<i>T. chebula</i>	<i>T. bellerica</i>	<i>E. officinalis</i>	<i>Triphala</i>
1	Carbohydrate Test	Negative	Negative	Negative	Negative
2	Protein Test	Negative	Negative	Negative	Negative
3	Steroid Test	Negative	Negative	Negative	Negative
4	Glycosides	Negative	Negative	Negative	Negative
5	Flavonoids	Positive	Positive	Positive	Positive
6	Alkaloids	Positive	Positive	Positive	Positive
7	Phenolic Compounds	Positive	Positive	Positive	Positive
8	Organic Test	Positive	Positive	Positive	Positive
9	Inorganic Test	Positive	Positive	Positive	Positive

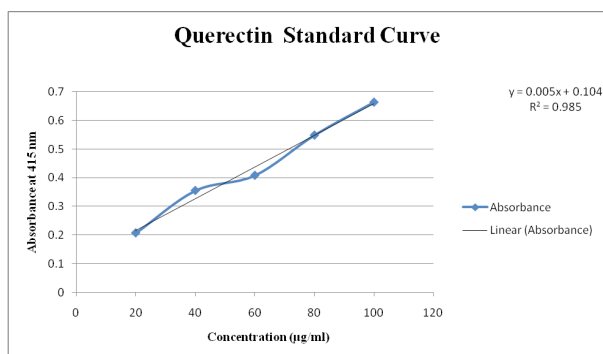


Fig. 1. Quercetin Standard Curve

highest flavonoid content (104.39 mg QE/g), followed by *T. chebula* (74.95 mg QE/g), and *E. officinalis* (48.90 mg QE/g). The combined *Triphala* extract had a lower value (51.04 mg QE/g), possibly due to dilution or interaction effects. These findings suggest that *T. bellerica* is the major contributor to the flavonoid content and potential antioxidant activity of *Triphala*.

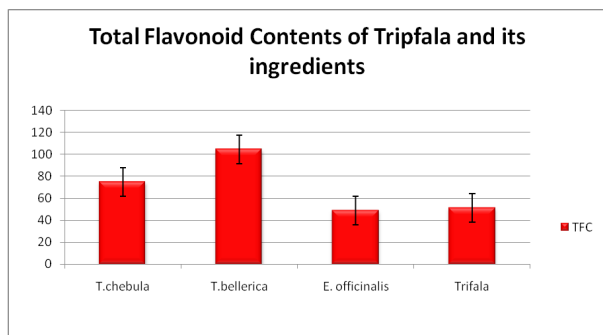


Fig. 2. Total Flavonoid Contents of Tripfala and its ingredients

**Calibration Curve Data for Total Phenolic Content (TPC)**

The calibration curve for TPC using gallic acid showed a linear increase in absorbance with rising concentrations (20-100 µg/ml), indicating good responsiveness of the Folin-Ciocalteu reagent to phenolic compounds. The strong linearity confirms the reliability of this method for estimating phenolic

Table 5. Total Flavonoid Content (TFC) of Extracts

Sample	TFC (mg QE/g extract)
<i>T. chebula</i>	74.95
<i>T. bellerica</i>	104.39
<i>E. officinalis</i>	48.90
<i>Triphala</i>	51.04

content in plant extracts. The increasing trend in absorbance reflects the proportional presence of phenolics, enabling accurate quantification in *Triphala* and its components.

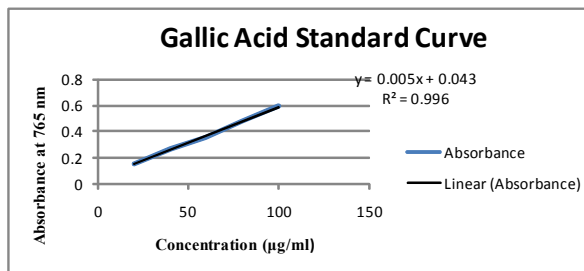


Fig. 3. Gallic Acid Standard Curve

Table 6. Calibration Curve Data for Total Phenolic Content (TPC) Using Gallic Acid as Standard

Concentration (µg/ml)	Absorbance (at 765 nm)
20	0.153
40	0.270
60	0.350
80	0.477
100	0.590

**Total Phenolic Content (TPC) of Tripfala**

The total phenolic content (TPC) of the methanolic extracts of *T. chebula*, *T. bellerica*, *E. officinalis*, and the combined *Triphala* formulation was determined using the Folin-Ciocalteu method and expressed as milligrams of gallic acid equivalents (mg GAE) per

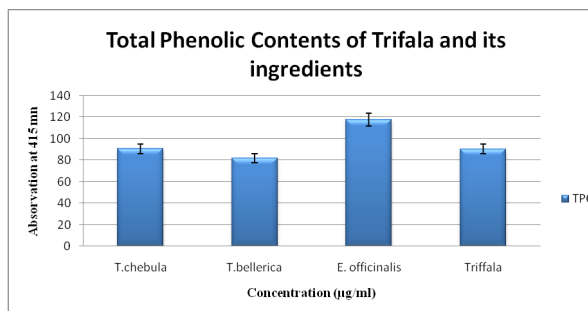


Fig. 4. Total Phenolic Contents of Trifala and its ingredients

Table 7. Total Phenolic Content (TPC) of Tripfala and Its Individual Components

Sample	TPC (mg GAE/g)
<i>T. chebula</i>	90.591
<i>T. bellerica</i>	81.745
<i>E. officinalis</i>	117.497
<i>Triphala</i>	90.407

gram of dry extract. Among the individual fruits, *E. officinalis* exhibited the highest phenolic content at 117.497 mg GAE/g, followed by *T. chebula* (90.591 mg GAE/g) and *T. bellerica* (81.745 mg GAE/g). The *Triphala* extract showed a TPC value of 90.407 mg GAE/g, indicating a strong cumulative presence of phenolic compounds from the three constituent fruits.

## Conclusion

The present study successfully evaluated the organoleptic characteristics, extraction yield, phytochemical profile, and quantified the total phenolic and flavonoid contents of the individual components of *Triphala-Terminalia chebula*, *Terminalia bellerica*, and *Emblica officinalis*-as well as their combined formulation. The methanolic extracts showed consistent yields, and qualitative phytochemical screening confirmed the presence of key secondary metabolites such as flavonoids, alkaloids, phenolic compounds, and both organic and inorganic constituents, while carbohydrates, proteins, steroids, and glycosides were absent.

Quantitative analysis revealed that *T. bellerica* exhibited the highest flavonoid content (104.39 mg QE/g), whereas *E. officinalis* contained the highest phenolic content (117.497 mg GAE/g). The *Triphala* formulation reflected the cumulative presence of these phytoconstituents, with moderate values due to possible interactions or dilution effects. These results affirm the antioxidant potential and therapeutic significance of *Triphala* and its components, supporting their traditional use in Ayurvedic medicine.

## Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this research work.

## References

- Anand, S., Singh, B. and Sharma, A. 2024. Antioxidant and antidiabetic potential of *Triphala*: A mechanistic insight. *Journal of Traditional and Complementary Medicine*. 14(1): 45-54. <https://doi.org/10.1016/j.jtcm.2023.10.003>
- Bhowmik, D., Tiwari, S. and Raychaudhuri, U. 2022. Therapeutic efficacy of *Triphala*: An evidence-based review. *Journal of Ethnopharmacology*. 294: 115366. <https://doi.org/10.1016/j.jep.2022.115366>
- Choudhury, D., Paul, S. and Mandal, S. 2021. Bioactive compounds in *Triphala*: Recent research and emerging applications. *Plant Foods for Human Nutrition*. 76(3): 345-356. <https://doi.org/10.1007/s11130-021-00900-1>
- Das, R., Ghosh, S. and Nath, S. 2023. Estimation of flavonoid content in herbal extracts using aluminum chloride colorimetric assay: Standardization and comparative study. *Phytochemistry Reviews*. 22(1): 145-154. <https://doi.org/10.1007/s11101-022-09863-2>
- Dutta, A., Banerjee, R. and Chakraborty, S. 2023. Polyphenol-rich Ayurvedic formulations: A review of *Triphala* and its therapeutic perspectives. *Frontiers in Pharmacology*. 14: 1212098. <https://doi.org/10.3389/fphar.2023.1212098>
- Khalid, M., Wani, T.A. and Alam, M. 2023. Extraction and characterization of polyphenols from traditional herbal formulations. *Phytochemistry Reviews*. 22(1): 89-104. <https://doi.org/10.1007/s11101-022-09835-6>
- Kumar, A., Sharma, R. and Singh, N. 2023. Standardized methods for preliminary phytochemical screening of medicinal plants. *Pharmacognosy Research*. 15(1): 45-50. [https://doi.org/10.4103/pr.pr.145\\_22](https://doi.org/10.4103/pr.pr.145_22)
- Kumar, S., Shukla, R. and Pandey, A. 2023. Modern phytochemical profiling techniques for herbal standardization: A case study on *Triphala*. *Analytical Letters*. 56(7): 1124-1138. <https://doi.org/10.1080/00032719.2022.2129645>
- Kumar, S., Shukla, R. and Pandey, A. 2023. Modern phytochemical profiling techniques for herbal standardization: A case study on *Triphala*. *Analytical Letters*. 56(7): 1124-1138. <https://doi.org/10.1080/00032719.2022.2129645>
- Mehta, M., Goyal, A. and Chauhan, N. 2023. Advances in qualitative phytochemical screening: Evaluation of bioactive metabolites in traditional medicinal plants. *Pharmacognosy Reviews*. 17(33): 85-91. [https://doi.org/10.4103/phrev.phrev\\_15\\_23](https://doi.org/10.4103/phrev.phrev_15_23)
- Mishra, R., Singh, V. and Chauhan, N. 2022. Organoleptic and macroscopic evaluation of herbal raw materials: A foundational tool for standardization. *Journal of Pharmacognosy and Phytochemistry*. 11(5): 152-158. <https://doi.org/10.22271/phyto.2022.v11.i5c.15532>
- Nayak, D., Rout, S. and Kar, D. 2020. Importance of sensory evaluation in herbal drug standardization. *Pharmacognosy Journal*. 12(6): 1369-1374. <https://doi.org/10.5530/pj.2020.12.188>
- Patel, H., Trivedi, R. and Desai, M. 2022. Qualitative phytochemical screening methods for secondary metabolites in medicinal plants: A comprehensive overview. *Journal of Pharmacognosy and Phytochemistry*. 11(4): 172-177. <https://doi.org/10.22271/phyto.2022.v11.i4c.15234>
- Rani, N., Chauhan, A. and Thakur, P. 2022. Qualitative analysis of phytochemicals in medicinal plants:

- Methods and significance. *Journal of Pharmacognosy and Phytochemistry*. 11(1): 23-28. <https://doi.org/10.22271/phyto.2022.v11.i1a.13659>
- Sabu, M.C. and Kuttan, R. 2022. Antioxidant and cytoprotective activity of *Triphala*. *Phytotherapy Research*. 36(2): 532-540. <https://doi.org/10.1002/ptr.7334>
- Saini, P., Yadav, R. and Chauhan, R. 2022. Phytochemical and pharmacological evaluation of traditional *Triphala* formulation: A scientific perspective. *Journal of Applied Pharmaceutical Science*. 12(5): 119-128. <https://doi.org/10.7324/JAPS.2022.120513>
- Shah, A., Patel, N. and Desai, T. 2022. Spectrophotometric estimation of phenolics and flavonoids in herbal extracts: Standardization of Ayurvedic formulations. *International Journal of Green Pharmacy*. 16(1): 52-57. <https://doi.org/10.22377/ijgp.v16i1.4713>
- Sharma, V., Kumar, R. and Yadav, N. 2023. Phytochemical evaluation of traditional medicinal plants: A review on techniques and bioactive indicators. *Asian Journal of Pharmaceutical and Clinical Research*. 16(2): 112-116. <https://doi.org/10.22159/ajpcr.2023.v16i2.46918>
- Singh, D., Verma, R. and Mishra, A. 2022. Evaluation of phytochemicals in medicinal plants: Current approaches and methods. *Journal of Herbal Medicine*. 33: 100556. <https://doi.org/10.1016/j.hermed.2022.100556>
- Srikumar, R., Jeya Parthasarathy, N. and Sheela Devi, R. 2007. Immunomodulatory activity of *Triphala* on neutrophil functions. *Biological & Pharmaceutical Bulletin*. 30(1): 139-145. <https://doi.org/10.1248/bpb.30.139>
- Verma, S., Gupta, A. and Singh, S. 2021. Evaluation radical scavenging activity of punica grantum and citrus plant waste peel hydro alcoholic extracts from improved. *Processing. American Journal of PharmTech Research*. 11: 99-104.
- Yadav, P., Srivastava, A. and Singh, R. 2023. Estimation of total phenolic and flavonoid contents in medicinal plant extracts using UV-Vis spectrophotometry. *Journal of Applied Research on Medicinal and Aromatic Plants*. 33: 100433. <https://doi.org/10.1016/j.jarmap.2023.100433>
- Yadav, V., Nema, R. and Rathore, M. 2021. Phytochemistry and pharmacological review of *Triphala*. *Asian Journal of Pharmaceutical and Clinical Research*. 14(3): 9-15. <https://doi.org/10.22159/ajpcr.2021.v14i3.40483>
-