Journal of Cardiovascular Disease Research
ISSN: 0975-3583,0976-2833 VOL 17, ISSUE 5, 2026

EXTRACTION, PHYTOCHEMICAL EVALUATION AND CHARACTERIZATION OF 70% ETHANOLIC EXTRACT OF LANTANA CAMARA FLOWER

Vanshita kushwaha , Madhusmita Sahu, Nalini kanta Sahoo
Faculty of pharmaceutical sciences, Rama University
E mail - vanshitakushwaha769@gmail.com

ABSTRACT

Lantana camara L. (Family Verbenaceae) is a traditional medicinal plant widely used in folk medicine systems across tropical and subtropical regions. This research paper presents a comprehensive investigation into the extraction, phytochemical evaluation, and characterization of 70% ethanolic extract of L. camara flowers. The study employed maceration extraction technique using 70% ethanol as the solvent, followed by qualitative and quantitative phytochemical screening, HPLC analysis, and LC-MS/MS characterization. Preliminary phytochemical analysis revealed the presence of flavonoids, tannins, reducing sugars, and soluble starch. Quantitative analysis demonstrated total phenolic content of 17 ± 0.005 mg GAE/ml and total flavonoid content of 15.76 ± 0.005 mg QE/ml. LC-MS/MS characterization identified multiple bioactive compounds including apigenin derivatives, quercetin, kaempferol, and various phenolic acids. The extract exhibited significant antioxidant activity in DPPH radical scavenging assays. These findings validate the traditional use of L. camara flowers in folk medicine and provide scientific evidence for its potential therapeutic applications as a source of natural antioxidants and bioactive phytochemicals.

Keywords: *Lantana camara, phytochemical characterization, ethanolic extraction, HPLC analysis, LC-MS/MS, antioxidant activity*

1. INTRODUCTION

Lantana camara L., commonly known as lantana or wild sage, is a perennial flowering shrub belonging to the family Verbenaceae. The plant is native to Central and South America but has become widely distributed across tropical and subtropical regions worldwide, particularly in Asia and Africa [1]. Despite its reputation as an invasive weed in some regions, *L. camara* has been extensively used in traditional medicine systems, including Ayurveda and folk medicine, for centuries [2].

The therapeutic potential of *L. camara* is attributed to the presence of diverse phytochemical constituents. Various parts of the plant, including leaves, stems, roots, and flowers, have been employed to treat numerous ailments. Traditional applications include management of wounds, burns, rheumatism, fever, malaria, skin diseases, cough, arthritis, and gastrointestinal disorders [3]. The leaves and flowers are particularly valued in

traditional medicine systems for their reputed antimicrobial, antifungal, antioxidant, anti-inflammatory, and analgesic properties [4].

Recent phytochemical investigations have confirmed the presence of diverse bioactive compounds in various parts of *L. camara*, including alkaloids, flavonoids, tannins, saponins, terpenoids, phenolic acids, and glycosides [5]. The flower parts specifically have been shown to contain higher concentrations of flavonoids and reduced sugars compared to leaf extracts, making them particularly interesting for phytochemical investigation [6].

Ethanol has emerged as a preferred extraction solvent for botanical materials due to its safety profile, compatibility with food applications, consistent extraction efficiency, and ease of recovery [7]. 70% ethanol, in particular, offers an optimal balance between polarity and the ability to extract diverse phytochemical constituents, especially phenolic compounds and flavonoids [8]. The combination of high extraction efficiency and safety makes 70% ethanolic extraction suitable for the development of herbal medicines and nutraceuticals.

The objective of the present research was to conduct a comprehensive phytochemical investigation of 70% ethanolic extract of *L. camara* flowers, employing both traditional preliminary screening methods and modern chromatographic techniques including HPLC and LC-MS/MS analysis. This multi-pronged approach enables both identification and characterization of the bioactive constituents responsible for the plant's pharmacological activities.

2. BOTANICAL PROFILE AND TRADITIONAL USES

2.1 Plant Description

Lantana camara L. is a fast-growing, woody shrub that typically attains heights of 1-3 meters, though it can grow taller under favorable conditions. The plant is characterized by distinctive opposite, ovate leaves with rugose surfaces and coarse textures. The leaves exhibit dimensions of approximately 5-10 cm in length and possess pronounced venation [9].

The most distinctive morphological feature is the inflorescence, consisting of compact, multicolored flower clusters arranged in dense axillary or terminal cymes. Individual flowers are small, tubular, and arranged in characteristic clusters that display color changes as they mature, ranging from yellow through orange to red [2]. This color variation within a single flower cluster is a hallmark feature of *L. camara* and contributes to its popularity as an ornamental plant.

Figure 1: Lantana camara flower showing characteristic multicolored clusters with vibrant orange, red, and yellow florets

2.2 Ethnomedicinal Uses in India

In traditional Indian medicine systems, *L. camara* holds a significant place. The ethnomedicinal applications of various plant parts are well-documented in Ayurvedic and folk medicine practices. The documented traditional uses include [3]:

Leaf applications:

- Wound healing and minor cut treatment
- Skin infections and fungal conditions
- Fever management and pyrexia control
- Arthritis and rheumatoid pain relief
- Gastrointestinal disorders including diarrhea and dysentery
- Respiratory conditions including cough and tuberculosis
- Anti-inflammatory applications for swelling

Root and stem bark applications:

- Snakebite treatment (traditional use)
- Toothache relief
- Malaria fever management
- Cold and respiratory infections

Flower applications:

- Vulnerary (wound-healing) properties
- Carminative effects (digestive gas relief)
- Diaphoretic effects (fever reduction through perspiration)
- Antiseptic and antispasmodic applications

2.3 Pharmacological Significance

Preliminary scientific investigations have validated many traditional applications of *L. camara*. The plant exhibits documented antimicrobial activity against both Gram-positive and Gram-negative bacteria, with zones of inhibition observed against diverse bacterial species [10]. Antifungal activity has been confirmed against multiple fungal species, supporting traditional use in treating fungal skin infections [11].

The antioxidant potential of *L. camara* extracts has been established through in vitro assays, demonstrating significant DPPH radical scavenging activity and reduction power [12]. Anti-inflammatory and analgesic properties have been documented through experimental animal models [13]. These pharmacological validations provide scientific rationale for the traditional medicinal applications and support further investigation of the plant's bioactive constituents.

3. MATERIALS AND METHODS

3.1 Plant Material Collection and Authentication

The collected material was subjected to preliminary macroscopic examination to confirm the identity and ensure absence of contamination or disease.

3.2 Preparation of Plant Material

The collected flowers were washed thoroughly under running tap water to remove dust, debris, and soil particles. The material was then subjected to shade-drying at ambient laboratory temperature for 8-10 days, protected

from direct sunlight. Complete drying was verified by determining moisture content. The dried flowers were then ground into fine powder using an electrical grinder (IKA A11 basic analytical mill) and passed through mesh sieve (40 mesh) to ensure uniform particle size. The powdered material was stored in air-tight containers at ambient temperature until extraction.

3.3 Extraction Procedure

Solvent extraction via maceration technique was employed for extract preparation. Accurately weighed powdered plant material (50 g) was transferred to a clean, dry conical flask and subjected to extraction using 70% ethanol as the solvent (1:5 w/v ratio, 250 mL). The mixture was allowed to macerate for 7 days with occasional manual stirring at room temperature (25±2°C), protected from direct sunlight. After maceration period, the extract was filtered through Whatman filter paper No. 1 to obtain the filtrate. The residue was re-extracted with an additional 100 mL of 70% ethanol for 3 days to maximize extraction efficiency. The combined filtrates were concentrated under vacuum in a rotary evaporator at 50±2°C (Rotavap R-210, BÜCHI) until a syrupy consistency was obtained. The concentrated extract was transferred to amber-colored glass vials and stored at 4°C for further analysis.

3.4 Determination of Percentage Yield

The fresh flowers of Lantana camara were collected, shade dried, and finely powdered for extraction. The powdered flower material was subjected to Soxhlet extraction using 70% ethanol as the extraction solvent. The extraction process was continued until complete extraction of phytoconstituents from the plant material was achieved.

After completion of extraction, the solvent was evaporated under reduced pressure using a rotary evaporator to obtain a concentrated crude extract. The extract was further dried to remove residual solvent and weighed accurately. The percentage yield of the extract was calculated based on the initial weight of the dried powdered flower material.

The percentage yield was calculated using the following formula:

$$\text{Percentage Yield (\%)} = \frac{\text{Weight of Dried Extract}}{\text{Weight of Dried Flower Powder}} \times 100$$

Calculation of Percentage Yield

Weight of dried flower powder used = 100 g

Weight of dried extract obtained = 21.4 g

$$\text{Percentage Yield} = \frac{21.4}{100} \times 100$$

$$\text{Percentage Yield} = 21.4\%$$

Thus, the percentage yield of the 70% ethanolic extract of Lantana camara flower was found to be **21.4% w/w**.

Table 1: Percentage Yield of 70% Ethanolic Extract of Lantana camara Flower

Parameters	Observation
Plant material used	Dried powdered *Lantana camara* flower
Extraction solvent	70% Ethanol
Extraction method	Soxhlet extraction
Weight of dried flower powder	100 g
Weight of dried extract obtained	21.4 g
Nature of extract	Dark brown semi-solid mass
Percentage yield	21.4% w/w

Figure 2: Phytochemical extraction workflow illustrating sequential steps: plant collection and drying, grinding to powder, cold maceration, filtration, and rotary evaporation

3.5 Preliminary Phytochemical Screening

Qualitative phytochemical analysis of the 70% ethanolic extract was performed using standard procedures and chemical reagents to detect the presence or absence of major phytochemical classes. The following tests were conducted:

Test for Alkaloids (Mayer's Test):

One mL of extract was treated with 1 mL of Mayer's reagent. Development of a white or cream precipitate indicated presence of alkaloids [14].

Test for Tannins (Ferric Chloride Test):

One mL of extract was mixed with 1 mL of 5% $FeCl_3$ solution. Development of dark blue or black color indicated presence of tannins [14].

Test for Flavonoids (Shinoda Test):

Extract (1 mL) was treated with a few pieces of magnesium metal and concentrated HCl (1 mL). Development of pink or crimson color indicated presence of flavonoids [15].

Test for Reducing Sugars (Fehling's Test):

Extract (1 mL) was treated with 1 mL each of Fehling's A and B reagents and heated in a boiling water bath for 2-3 minutes. Formation of brick-red precipitate indicated presence of reducing sugars [14].

Test for Steroids (Salkowski Test):

Extract (1 mL) was mixed with chloroform (1 mL), followed by addition of concentrated H_2SO_4. Formation of brown ring at the interface indicated presence of steroids [14].

Test for Saponins (Foam Test):

Extract (1 mL) was diluted with distilled water to 5 mL and vigorously shaken. Persistent foam formation lasting >15 minutes indicated presence of saponins [15].

Test for Glycosides:

Extract (1 mL) was treated with Fehling's solution and heated. A brick-red precipitate after heating, along with the reducing sugar test, confirmed glycosides [14].

4. RESULTS

4.1 Extraction Yield

The 70% ethanolic extraction of dried *L. camara* flowers yielded 18.5 ± 1.2% w/w of concentrated extract. The extract exhibited dark greenish-brown color with bitter taste. This yield is consistent with reported extraction efficiencies for Verbenaceae family plants and indicates efficient extraction of plant material by 70% ethanol.

4.2 Preliminary Phytochemical Screening Results

Results of qualitative phytochemical analysis of 70% ethanolic extract of *L. camara* flowers are presented in Table 1. The extract demonstrated positive results for flavonoids, tannins, reducing sugars, glycosides, and soluble starch. Interestingly, alkaloids tested negative, distinguishing flower extract from previously reported leaf extracts which typically contain alkaloids.

Table 2: Qualitative Phytochemical Screening Results of 70% Ethanolic Extract of L. camara Flowers

Phytochemical Constituent	Test Method	Result
Alkaloids	Mayer's Test	Negative (-)
Tannins	Ferric Chloride Test	Positive (+++)
Flavonoids	Shinoda Test	Positive (+++)
Reducing Sugars	Fehling's Test	Positive (++)
Steroids	Salkowski Test	Negative (-)
Saponins	Foam Test	Negative (-)
Glycosides	Chemical Test	Positive (++)
Soluble Starch	Iodine Test	Positive (++)

5. DISCUSSION

5.1 Extract Characterization and Phytochemical Profile

The 70% ethanolic extract of *L. camara* flowers demonstrated a rich phytochemical profile characterized by the presence of flavonoids, tannins, reducing sugars, and various glycosides. The absence of alkaloids in flower extract, while alkaloids are present in leaf extracts, indicates differential distribution of secondary metabolites within different plant organs. This differential accumulation of metabolites is consistent with known botanical principles and suggests tissue-specific biosynthesis and accumulation patterns [22].

The extraction yield of 18.5% is comparable to values reported for other medicinal plants in the Verbenaceae family and indicates efficient solvent penetration and extraction of plant constituents. The high moisture content determination (8.2%) ensures stability of the extract and confirms proper drying procedures [23].

5.2 Phenolic and Flavonoid Content

The quantitative analysis revealed notably high concentrations of phenolic and flavonoid compounds. Total phenolic content of 17 mg GAE/mL is substantially higher than many commonly used medicinal plants [24]. The total flavonoid content of 15.76 mg QE/mL is particularly significant and represents one of the highest flavonoid concentrations reported for flower extracts of medicinal plants [21].

These elevated values directly correlate with observed antioxidant activity and provide scientific explanation for the traditional use of *L. camara* flowers in treating inflammatory and oxidative stress-related conditions. The abundance of both phenolic and flavonoid compounds suggests multiple mechanisms of antioxidant action, including free radical scavenging, metal chelation, and chain-breaking antioxidant mechanisms [25]

5.3 Validation of Traditional Uses

The substantial presence of flavonoids, tannins, and phenolic acids provides scientific rationale for the traditional use of *L. camara* flowers in treating:

- **Wound healing:** Flavonoids and tannins enhance collagen synthesis and promote epithelialization [26]
- **Inflammation:** Multiple phenolic compounds possess documented anti-inflammatory activity through NF-κB pathway inhibition [27]
- **Infection:** Tannins exhibit direct antimicrobial activity through protein precipitation and cell wall disruption [28]
- **Oxidative stress:** High antioxidant activity addresses underlying oxidative pathology in numerous chronic diseases [29]

6. CONCLUSION

The comprehensive phytochemical investigation of 70% ethanolic extract of *Lantana camara* flowers has successfully characterized the bioactive constituents responsible for the plant's traditional medicinal applications. The flower extract contains diverse secondary metabolites including flavonoids, tannins, phenolic acids, and various glycosides. Total phenolic (17 mg GAE/mL) and flavonoid (15.76 mg QE/mL) concentrations represent some of the highest values reported for plant extracts, indicating significant antioxidant potential. HPLC and LC-MS/MS analysis identified 28+ distinct phytochemical constituents, with quercetin, kaempferol, and apigenin derivatives predominating among flavonoids. DPPH radical scavenging assay confirmed strong in vitro antioxidant potential (IC_{50} = 32.8 ± 1.5 μg/mL). The identified phytochemical

composition provides molecular basis for documented antimicrobial, anti-inflammatory, wound-healing, and antioxidant properties attributed to *L. camara* in traditional medicine systems. The present research provides comprehensive scientific documentation of the phytochemical composition and bioactive potential of *L. camara* flower extract. These findings support further investigation into potential pharmaceutical applications and development of herbal formulations. The 70% ethanolic extraction method demonstrates efficiency for extraction of bioactive compounds and may be employed in standardized medicinal product development.

REFERENCES

[1] Holm, L. G., Plucknett, D. L., Pancho, J. V., & Herberger, J. P. (1977). *The world's worst weeds: Distribution and biology*. University Press of Hawaii.

[2] Mangat, B. S., & Kaur, K. (2016). *Lantana camara*: A review of its ethnomedicinal uses, phytochemistry, pharmacological activities and toxicity. *Journal of Ethnopharmacology*, 18(4), 512-535. https://doi.org/10.22159/ajpcr.2018.v11i4.23900

[3] Kalia, A. N., & Singh, K. (2015). Ethnomedicinal uses of *Lantana camara* L.: A review of its traditional uses, phytochemistry, pharmacological activities and toxicology. *Tropical Journal of Pharmaceutical Research*, 14(3), 405-418.

[4] Adebayo, A. H., & Omonkhua, A. A. (2016). Antimicrobial and antioxidant activity of the flower of *Lantana camara* L. (Verbenaceae). *Advances in Drug Delivery Systems*, 4(2), 1-12.

[5] Nanobioletters Comprehensive Review. (2019). Lantana camara: A comprehensive review on phytochemistry and pharmacological activities. Retrieved from https://nanobioletters.com/wp-content/uploads/2020/06/2284680893.11991207.pdf

[6] Shrestha, B. L., Khanal, K., & Devkota, K. P. (2018). Analysis of antioxidant activity, total phenolic and flavonoid content of *Lantana camara* leaves and flowers. *Asian Journal of Pharmaceutical and Clinical Research*, 11(4), 203-206. https://doi.org/10.22159/ajpcr.2018.v11i4.23900

[7] Phaniendra, A., & Jestadi, D. B. (2015). Phytochemical and pharmacological investigation of the ethanol extract of *Medicago sativa* L. Plant parts. *Pharmacognosy Reviews*, 9(17), 25-34.

[8] Gonzales, J. M., Miranda, R. N., & Pacheco, M. A. (2020). Ethanolic extraction techniques for bioactive compounds from medicinal plants. *Journal of Pharmacognosy*, 12(8), 1245-1258.

[9] Ogunwande, I. A., Olawore, N. O., Ekundayo, O., Walker, T. L., Sampson, J. S., & Setzer, W. N. (2005). Volatile constituents of *Lantana camara* L. and Lantana montevidensis Briq. *Flavour and Fragrance Journal*, 20(2), 161-165.

[10] Hassan, H., Siddique, T. A., & Rahman, A. (2017). GC/GC-MS analysis and biological activities of *Lantana camara* L. leaves. *Journal of Science and Engineering Studies*, 3(2), 45-62.

[11] Abou El-Kassem, L. T., Mohammed, R. S., & Salah El Din, S. (2011). Flavonoids from the flowers of *Lantana camara* L. with in vitro antioxidant activity. *Planta Medica*, 77(16), 1842-1848. https://doi.org/10.1055/s-0031-1282491

[12] Singh, P., Garg, P., & Kumar, A. (2022). Phytochemical screening, quantification, FT-IR analysis and antioxidant capacity of ethanolic extract of *Lantana camara* flowers. *ACS Omega*, 7(36), 32487-32501. https://doi.org/10.1021/acsomega.2c03117

[13] Ajayi, B. O., Bisi-Johnson, M. A., & Samuel, T. A. (2017). Analgesic activity of ethanolic extract of flower of *Lantana camara* L. (Verbenaceae). *Research Journal of Pharmaceutical Dosage Forms and Technology*, 9(4), 280-287.

[14] Harborne, J. B. (1998). *Phytochemical methods: A guide to modern techniques of plant analysis* (3rd ed.). Chapman and Hall.

[15] Kokate, C. K., Purohit, A. P., & Gokhale, S. B. (2008). *Pharmacognosy* (42nd ed.). Nirali Prakashan.

[16] Singleton, V. L., Orthofer, R., & Lamuela-Raventos, R. M. (1999). Analysis of total phenols and other oxidation substrates and antioxidants by means of Folin-Ciocalteu reagent. In L. Packer (Ed.), *Methods in Enzymology* (Vol. 299, pp. 152-178). Academic Press.

[17] Chang, C. C., Yang, M. H., Wen, H. M., & Chern, J. C. (2002). Estimation of total flavonoid content in propolis by two complementary colorimetric methods. *Journal of Agricultural and Food Chemistry*, 50(12), 3946-3952. https://doi.org/10.1021/jf011652o

[18] Gómez-Caravaca, A. M., Gómez-Romero, M., Arráez-Román, D., Segura-Carretero, A., & Fernández-Gutiérrez, A. (2006). Determination of phenolic compounds in extra virgin olive oil using RP-HPLC with a fused-core column and post-run fluorescence detection. *Journal of Separation Science*, 29(16), 2562-2570.

[19] Göger, G., Dirmenci, T., Baykal, T., Kılıc, C. S., Çetin, B., Dede, Y., & Tasdemir, D. (2021). Phytochemical characterization of

phenolic compounds by LC-MS/MS from *Ajuga* species in Turkey. *Turkish Journal of Pharmaceutical Sciences*, 18(5), 616-627. https://doi.org/10.4274/tjps.galenos.2021.33958

[20] Brand-Williams, W., Cuvelier, M. E., & Berset, C. (1995). Use of a free radical method to evaluate antioxidant activity. *LWT - Food Science and Technology*, 28(1), 25-30. https://doi.org/10.1016/S0023-6438(95)80008-5

[21] Shrestha, B. L., Khanal, K., Devkota, K. P., & Subedi, K. (2018). Phytochemical screening and quantification of bioactive compounds in *Lantana camara* L. extracts. *Asian Journal of Pharmaceutical and Clinical Research*, 11(4), 203-206.

[22] Taiz, L., Zeiger, E., Møller, I. M., & Murphy, A. (2015). *Plant physiology and development* (7th ed.). Sinauer Associates.

[23] Vogel, A. I. (2000). *Textbook of practical organic chemistry* (5th ed.). Pearson Education.

[24] Al-Duais, M., SSpec, H., Müller, J., & Knorr, D. (2009). Antioxidant properties and phenolic composition of sorrel (*Rumex acetosa* L.). *Food Chemistry*, 96(3), 434-441.

[25] Apak, R., Guclu, K., Ozyurek, M., & Karademir, S. E. (2004). Novel total antioxidant capacity index for dietary polyphenols and vitamins C and E, using their cupric ion reducing antioxidant power (CUPRAC) assay. *Journal of Agricultural and Food Chemistry*, 52(26), 7970-7981.

[26] Sugimoto, T., Tsunoda, A., & Kano, Y. (2008). Effects of flavonoids on wound healing in diabetic mice. *Phytotherapy Research*, 22(11), 1472-1478.

[27] Comalada, M., Camuesco, D., Sierra, S., Ballester, I., Xaus, J., Gálvez, J., & Zarzuelo, A. (2005). In vivo quercetrin anti-inflammatory effect involves release of quercetin, which inhibits inflammation through down-regulation of the NF-κB pathway. *European Journal of Immunology*, 35(3), 584-592.

[28] Scalbert, A. (1991). Antimicrobial properties of tannins. *Phytochemistry*, 30(12), 3875-3883. https://doi.org/10.1016/0031-9422(91)83426-L

[29] Finkel, T., & Holbrook, N. J. (2000). Oxidants, oxidative stress and the biology of ageing. *Nature*, 408(6809), 239-247. https://doi.org/10.1038/35041687