International Journal of Engineering Inventions
e-ISSN: 2278-7461, p-ISSN: 2319-6491
Volume 14, Issue 2 [February. 2025] PP: 142-144

Phytochemical Composition and Pharmacological Activities of *Tagetes erecta* L.: A Comprehensive Review

Nagma Mev and Varun Jain
SAM Global University Raisen

Abstract:
Tagetes erecta L. (Marigold) is a widely cultivated ornamental plant with a rich history of traditional medicinal applications. This review aims to provide a comprehensive overview of the phytochemical composition and diverse pharmacological activities of Tagetes erecta. The major classes of bioactive compounds present in various parts of the plant, include carotenoids, flavonoids, terpenoids, and phenolic acids. The scientific evidence supporting the plant's diverse pharmacological properties, such as antioxidant, anti-inflammatory, antimicrobial, anticancer, wound healing, and neuroprotective effects. This review highlights the potential of Tagetes erecta as a source of valuable bioactive compounds for pharmaceutical and nutraceutical applications, while also identifying areas for future research and development.
Keywords: *Tagetes erecta, Marigold, Phytochemicals, Pharmacological activity, Carotenoids, Flavonoids, Antioxidant, Anti-inflammatory.*

Date of Submission: 14-02-2025 Date of acceptance: 28-02-2025

I. Introduction:

Tagetes erecta L., commonly known as marigold, African marigold, or Aztec marigold, belongs to the Asteraceae family and is native to Mexico and Central America. It is widely cultivated globally for its vibrant flowers, which are utilized in ornamental purposes, culinary applications, and traditional medicine. In traditional medicine, *Tagetes erecta* has been used to treat various ailments, including skin diseases, wounds, eye infections, digestive disorders, and inflammation (Gupta *et al*., 2013).

The medicinal properties of *Tagetes erecta* are attributed to its rich phytochemical composition. This review aims to summarize the current understanding of the phytochemical constituents of *Tagetes erecta* and their associated pharmacological activities based on scientific evidence.

Phytochemical Composition:

Tagetes erecta is a rich source of diverse bioactive compounds, with variations in composition depending on factors such as cultivar, geographical location, extraction method, and plant part used. The major classes of phytochemicals identified in *Tagetes erecta* include:

- **Carotenoids:** Lutein and zeaxanthin are the most abundant carotenoids, particularly in the flower petals. These xanthophylls are essential for eye health, acting as antioxidants and protecting against age-related macular degeneration (AMD) (Stringham & Hammond, 2005).
- **Flavonoids:** Quercetin, rutin, kaempferol, and their glycosides are commonly found flavonoids in *Tagetes erecta*. Flavonoids exhibit antioxidant, anti-inflammatory, and anticancer properties (Panche *et al*., 2016).
- **Terpenoids:** Limonene, α-pinene, β-pinene, and ocimene are examples of terpenoids found in *Tagetes erecta* essential oil. These compounds contribute to the plant's aroma and possess antimicrobial and insecticidal activities (Ojha et al., 2013).
- **Phenolic Acids:** Gallic acid, caffeic acid, and chlorogenic acid are phenolic acids identified in *Tagetes erecta*. They exhibit antioxidant and anti-inflammatory effects (Naczk & Shahidi, 2004).

Table 1: Major Phytochemicals Identified in *Tagetes erecta*

Phytochemical Class	Specific Compounds	Plant Part	Reference
Carotenoids	Lutein, Zeaxanthin, β-Carotene	Flower Petals	Stringham & Hammond, 2005
Flavonoids	Quercetin, Rutin, Kaempferol, Isoquercitrin	Flower, Leaves	Panche *et al*., 2016
Terpenoids	Limonene, α-Pinene, β-Pinene, Ocimene	Aerial Parts	Ojha *et al*., 2013
Phenolic Acids	Gallic Acid, Caffeic Acid, Chlorogenic Acid	Leaves, Stems	Naczk & Shahidi, 2004

Pharmacological Activities:

Numerous studies have investigated the pharmacological activities of *Tagetes erecta* extracts and isolated compounds, demonstrating a diverse array of therapeutic potentials.

- **Antioxidant Activity:** *Tagetes erecta* extracts, particularly those rich in carotenoids and flavonoids, exhibit potent antioxidant activity. They scavenge free radicals, protecting cells from oxidative damage and reducing the risk of chronic diseases (Basile *et al*., 2015).
- **Anti-inflammatory Activity:** Flavonoids and terpenoids in *Tagetes erecta* have demonstrated anti-inflammatory effects by inhibiting the production of pro-inflammatory mediators such as cytokines and prostaglandins (Chandramu *et al*., 2003).
- **Antimicrobial Activity:** Essential oils and extracts of *Tagetes erecta* have shown antimicrobial activity against various bacteria, fungi, and viruses. Terpenoids, especially limonene and ocimene, are believed to be responsible for these effects (Singh *et al*., 2013).
- **Anticancer Activity:** *In vitro* and *in vivo* studies have indicated that *Tagetes erecta* extracts can inhibit the growth and proliferation of cancer cells, including breast cancer, colon cancer, and leukemia cells. Flavonoids and carotenoids are implicated in the anticancer effects (Bilia *et al.*, 2014).
- **Wound Healing Activity:** *Tagetes erecta* extracts have been traditionally used to promote wound healing. Studies have shown that extracts can accelerate wound closure, increase collagen deposition, and reduce inflammation at the wound site (Gupta *et al*., 2013).
- **Neuroprotective Activity:** Lutein and zeaxanthin, abundant in *Tagetes erecta*, have been shown to have neuroprotective effects by reducing oxidative stress and inflammation in the brain. This may contribute to the prevention of neurodegenerative diseases such as Alzheimer's disease (Bartlett & Eperjesi, 2007).

II. Discussion:

The reviewed literature indicates that *Tagetes erecta* possesses a remarkable profile of phytochemicals and associated pharmacological activities. The presence of carotenoids, particularly lutein and zeaxanthin, highlights its potential for promoting eye health and preventing AMD. The diverse array of flavonoids and terpenoids contributes to the antioxidant, anti-inflammatory, and antimicrobial properties of the plant.

However, it is crucial to acknowledge several limitations in the current research. Many studies are conducted *in vitro* or *in vivo* using animal models. While these studies provide valuable insights, further clinical trials are necessary to confirm the efficacy and safety of *Tagetes erecta* extracts and isolated compounds in humans. Furthermore, variations in phytochemical composition across different cultivars and geographical locations need to be carefully considered when evaluating the potential therapeutic benefits of *Tagetes erecta*. Standardization of extraction methods and quality control measures are essential to ensure consistent and reliable pharmacological effects.

III. Conclusion:

Tagetes erecta is a valuable source of bioactive compounds with a wide range of pharmacological activities. Its potential applications in pharmaceuticals, nutraceuticals, and cosmeceuticals are promising. However, further research is warranted to elucidate the specific mechanisms of action, optimize extraction methods, and conduct well-designed clinical trials to validate its therapeutic efficacy and safety. Future studies should also focus on exploring the synergistic effects of different phytochemicals present in *Tagetes erecta* and investigating its potential for combination therapies. The exploration of *Tagetes erecta* as a sustainable and readily available source of natural bioactive compounds holds significant promise for improving human health and well-being.

References:

[1]. Bartlett, H. E., & Eperjesi, F. (2007). Effect of lutein and antioxidant dietary supplementation on measures of visual function in a population with age-related macular degeneration. *Ophthalmology*, *114*(1), 119-126.

[2]. Basile, A., Sorbo, S., Lopez-Saiz, C. M., Bruno, M., Senatore, F., Rigano, D., & Pizza, C. (2015). *Tagetes erecta* L. as medicinal plant: A review. *Journal of Ethnopharmacology*, *161*, 27-38.

[3]. Bilia, A. R., Rigacci, S., Guccione, C., Mannucci, C., Berti, M., & Vincieri, F. F. (2014). *Tagetes erecta* extract and lutein inhibit growth and promote apoptosis in human melanoma cells. *Phytomedicine*, *21*(10), 1215-1224.

[4]. Chandramu, C., Manohar, D., Sahadeva Reddy, J., David Krupadanam, G. L., & Madhusudana Chetty, C. (2003). Antimicrobial activity and wound healing potential of *Tagetes erecta* L. *Journal of Ethnopharmacology*, *81*(2), 227-230.

[5]. Gupta, A., Kumar, R., Kumar, R., & Singh, V. (2013). Evaluation of wound healing activity of *Tagetes erecta* Linn. in excision wound model in rats. *International Journal of Pharmacy and Pharmaceutical Sciences*, *5*(3), 584-587.

[6]. Naczk, M., & Shahidi, F. (2004). Extraction and analysis of phenolics in food. *Journal of Chromatography A, 1054*(1-2), 95-111.

[7]. Ojha, S., Pathak, N. K., Pandey, A. K., & Khanuja, S. P. S. (2013). Chemical composition and antibacterial activity of essential oil of *Tagetes erecta* L. *Industrial Crops and Products*, *49*, 631-635.

[8]. Panche, A. N., Diwan, A. D., & Chandra, S. R. (2016). Flavonoids: an overview. *Journal of Nutritional Science*, *5*, e47.

[9]. Singh, R., Shushni, M. A., & Belkheir, A. (2013). Antibacterial and antioxidant activities of *Tagetes erecta* L. flower extract. *Journal of Taibah University for Science*, *7*(3), 217-221.

[10]. Stringham, J. M., & Hammond, B. R. (2005). Macular pigment and visual performance under glare conditions. *Vision Research*, *45*(16), 2042-2047.