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RESEARCH ARTICLE

LEAF TO RELIEF: PHYTOCHEMICAL SCREENING OF POMEGRANATE'S LEAF (METHANOLIC EXTRACTION)

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ABSTRACT

Pomegranate (*Punica granatum* L.), a deciduous shrub from the Lythraceae family, is native to Central Asia, notably the Middle East, Iran, Turkmenistan, and northern India. While its fruit is widely consumed and valued for its health benefits, recent studies have explored the medicinal potential of its leaves. This study investigates the phytochemical composition and pharmacological activities of methanolic extracts of pomegranate leaves. The leaves were collected from Kundrathur, Chennai, shade-dried, powdered, and extracted using methanol. Phytochemical screening confirmed the presence of alkaloids, flavonoids, tannins, saponins, phenolics, terpenoids, steroids, and glycosides, identified using standard qualitative tests. These bioactive compounds contribute to various pharmacological properties, including antioxidant, anti-inflammatory, antibacterial, antifungal, antidiabetic, antihypertensive, anticancer, neuroprotective, and wound-healing activities. Additionally, pomegranate leaf extract has shown specific therapeutic potential in conditions like conjunctivitis, diarrhea, and skin infections due to its astringent, antimicrobial, and healing effects. Toxicity studies suggest that the extract is safe for use in animal models, further supporting its application in health formulations. Emerging uses of pomegranate leaf extract include its incorporation in herbal teas, liver detox supplements, and eco-friendly botanical pesticides. These applications reflect its growing relevance in both medical and agricultural fields. Overall, the study highlights *Punica granatum* leaves as a promising source of natural compounds with multifaceted therapeutic properties and excellent safety profiles. The findings support the continued exploration of pomegranate leaves in traditional and modern medicine, nutraceuticals, and sustainable product development. In conclusion, pomegranate leaves are a rich source of natural medicine. With further research, they may be widely used in health supplements, skincare, and even in farming as a natural alternative to chemicals. This study supports the growing interest in using plant-based remedies for health and environmental benefits.

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INTRODUCTION

Pomegranate (Punica granatum L.), a fruit from the Lythraceae family, is native to Central Asia, especially regions like the Middle East, Iran, Turkmenistan, and northern India. It grows as a small tree or shrub reaching heights of around 5 to 7 meters, and comes in a wide variety of types. Research over the past few decades — both in lab (in vitro) and live animal (in vivo) studies — has shown that various parts of the pomegranate plant have strong antioxidant, anti-inflammatory, antibacterial, antifungal, and antimicrobial properties. Animal studies have also suggested that pomegranate may help lower blood pressure (anti-hypertensive effect) and may help in slowing or preventing abnormal cell growth (antiproliferative effect). Additionally, pomegranate juice and extracts have shown promising results in pre-clinical and clinical studies for treating a wide range of health issues, including:

- Respiratory conditions
- Digestive disorders
- Neurodegenerative diseases
- Metabolic problems
- Cancer

- Osteoarthritis
- Skin conditions

Taxonomical classification of Punica granatum : (Table-1)
The different parts of punica grantum observed in fig-1(1)

Materials and Methods of extraction: Collection of Pomegranate leaves from Kundrathur, Chennai, Tamilnadu, India. Then leaves were washed in distilled water and shade dried for 10 days. The dried leaves were powdered and soaked in methanol for 72 h. The supernatant was filtered by filter paper and condensed by a rotary evaporator at 50 ºC, which yields greenish gummy extract (2) The image of leaves of punica grantum observed in fig-2(8)

Phytoconstituents

- **Alkaloids –** Detected through Mayer's and Wagner's tests, alkaloids are known for their antimicrobial, analgesic, and anti-inflammatory properties.
- **Flavonoids –** Abundantly present, flavonoids exhibit strong antioxidant activity and contribute to anti-cancer, cardioprotective, and neuroprotective effects.
- **Tannins –** Identified using ferric chloride or gelatin tests, tannins have astringent and antibacterial properties, useful in treating skin and eye infections.
- **Saponins –** Detected via the foam test, saponins are responsible for antifungal, anti-inflammatory, and immune-boosting actions.
- **Phenolic compounds –** These are widely present in the extract and are well known for their antioxidant and anti-aging roles.
- **Terpenoids and Steroids –** These compounds are associated with anti-inflammatory, hepatoprotective, and hormonal effects.
- **Glycosides –** Present in smaller amounts, glycosides contribute to cardiac and antioxidant functions.

The identification of above mentioned are observed in Table-2
The graphical representation of phytochemical screening of leaf extract shown in Fig-3 (9)

Pharmacological uses

- **Anti-inflammatory Activity**: Extract reduces inflammation by inhibiting pro-inflammatory cytokines and enzymes like COX and LOX.
- **Antibacterial Activity**: Extracts show strong antibacterial effects against pathogens such as *E. coli*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa*.
- **Antifungal Activity**: Extracts inhibit the growth and spore germination of fungi like *Candida albicans*.
- **Antioxidant Activity**: Rich in flavonoids and phenolics, the extract scavenges free radicals and protects cells from oxidative stress.
- **Anti-conjunctivitis Activity**: When applied as a paste, the extract reduces eye inflammation, redness, and microbial load in conjunctivitis cases.
- **Anti-cancer Activity**: Extracts induce apoptosis and inhibit proliferation in various cancer cell lines.
- **Anti-diabetic Activity**: Extract lowers blood glucose and improves insulin sensitivity in diabetic models.
- **Anti-hypertensive Activity**: The extract may aid in lowering blood pressure by promoting vasodilation and reducing oxidative stress.
- **Neuroprotective Activity**: Antioxidant-rich components help protect neurons from degeneration and oxidative damage.
- **Wound Healing Activity**: Accelerates wound closure by promoting tissue regeneration and controlling microbial infection.
- **Toxicity Studies**: Acute and sub-chronic toxicity studies reveal that pomegranate leaf extract is generally safe in animal models

Table 1. Taxonomical classification of Punica granatum

TAXONOMICAL RANK	TAXON
Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Order	Myrtales
Family	Lythraceae
Sub-Family	Punicoideae
Genus	Punica
Species	P.granatum
Common Name	Pomegranate

Table 2. Identification of phytoconstituents

Phytochemical	Test Used	Observation
Alkaloids	1.Mayer's Test 2.Wagner's Test	1.Creamy white 2. reddish-brown precipitate
Flavonoids	1.Lead Acetate Test 2. Alkaline Reagent Test	1.Yellow precipitate 2.Intense yellow color change
Tannins	1.Ferric Chloride Test 2.Gelatin Test	1.Blue-black 2.greenish-black color
Saponins	Foam Test	Persistent foam formation
Phenolic Compounds	Ferric Chloride Test	Dark green or bluish-black coloration
Terpenoids	Salkowski's Test	Reddish-brown interface
Steroids	Liebermann–Burchard Test	Green or blue color formation
Glycosides	Keller-Killiani Test	Reddish-brown ring with bluish-green upper layer

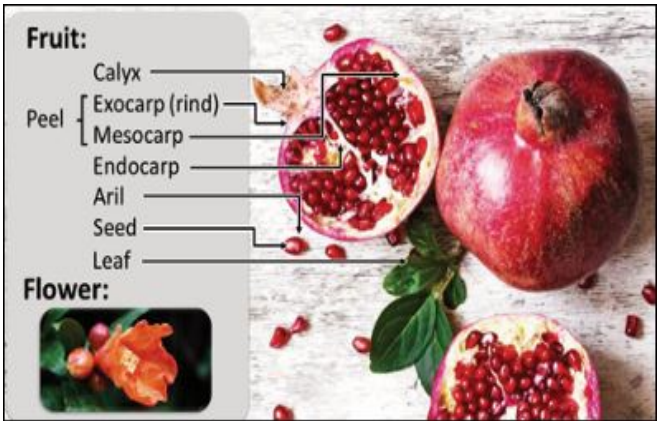

Fig. 1. Different parts of Punica granatum (1)

- **Anti-diarrohea** : Action due to tannins and saponins, which reduce intestinal inflammation and fluid secretion.
- **Skin-protective** : Come from flavonoids and tannins, which promote wound healing and prevent microbial infections.

Latest uses of this extract

- **Herbal Tea & Supplements:** Pomegranate leaf tea is gaining popularity for managing blood sugar, cholesterol, and digestive health.
- **Liver Detox Formulas:** Used in liver health supplements for its hepatoprotective and antioxidant actions.
- **Eco-friendly Pesticides:** Investigated for use as a botanical pesticide due to its antifungal and antibacterial effects on crops.

Fig. 2. Leaves of Punica granatum (8)

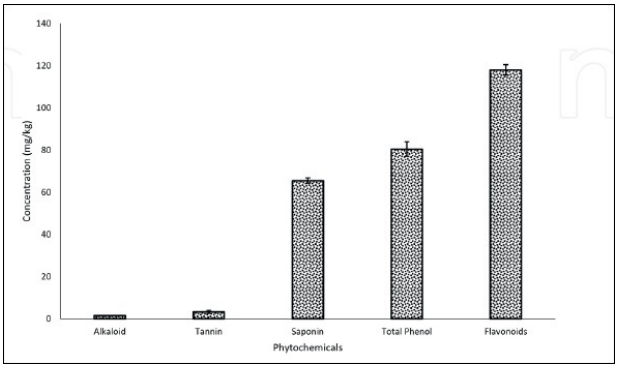

Fig. 3. The graphical representation of phytochemical screening of leaf extract (9)

CONCLUSION

Pomegranate (*Punica granatum* L.), a plant rich in medicinal value, has gained considerable attention in modern research due to its wide range of pharmacological and therapeutic benefits. Traditionally recognized for its nutritional fruit, the plant's leaves also possess significant medicinal potential. Phytochemical screening of pomegranate leaf extract reveals the presence of key bioactive compounds including alkaloids, flavonoids, tannins, saponins, phenolics, terpenoids, and glycosides. These constituents are responsible for various biological effects such as antioxidant, anti-inflammatory, antimicrobial, and wound-healing actions. The methanolic extract of pomegranate leaves has demonstrated promising pharmacological activities like antibacterial, antifungal, anti-diabetic, anti-cancer, anti-hypertensive, and neuroprotective effects in both in vitro and in vivo studies. Notably, its use in conjunctivitis treatment by topical paste application showcases its anti-inflammatory and antimicrobial action directly on the affected area. The extract is also gaining popularity for its hepatoprotective properties, anti-diarrheal effects, and skin-protective abilities, attributed to the combined action of tannins, flavonoids, and phenolic compounds. Recent applications have expanded into herbal teas, liver detox supplements, and eco-friendly botanical pesticides, reflecting its adaptability in both health and environmental sectors. Toxicological studies suggest that the extract is generally safe when used in appropriate doses. In summary, pomegranate leaf extract stands out as a valuable natural remedy with a diverse pharmacological profile and low toxicity. Its therapeutic potential not only supports traditional medicinal uses but also paves the way for future pharmaceutical, nutraceutical, and cosmetic applications.

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