



Review Article

Medicinal Values of Bael

(Aegle marmelos) (L.) Corr.: A Review

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Abstract:

In recent times, focus on plant research has increased all over the world and a large body of evidence has collected to show immense potential of medicinal plants used in various traditional systems. Over the last few years, researchers have aimed at identifying and validating plant derived substances for the treatment of various diseases. Similarly it has been already proved that various parts of plants such as Leaves, fruits, seeds etc. provide health and nutrition promoting compounds in human diet. The Bael (*Aegle Marmelos*) (L.) Corr.) is another Indian plant, which has enormous traditional uses against various diseases. The present review aims to compile medicinal values of *Aegle Marmelos* generated through the research activity using modern scientific approaches and innovative scientific tools.

Key Words: *Aegle Marmelos*, Pharmacological Activities, Medicinal Values

Introduction:

Indian Medicinal plants are considered a vast source of several pharmacologically active principles and compounds, which are commonly used in home remedies against multiple ailments.^[1, 2]

Bael (*Aegle marmelos*(L.) Corr.) is another indian medicinal plant; which has enormous traditional values against various diseases and many bioactive compounds have been isolated from this plant.^[3, 4]

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Plant Description:

Bael (*Aegle Marmelos* (Linn), family Rutaceae, is also known as Bale fruit tree, is a moderate sized , slender, aromatic tree, 6.0 -7.5 m in height, and 90 to 120 cm in girth, with a some what fluted bole of 3.0-4.5 meter growing wild throughout the deciduous forests of India, ascending to an altitude of 1200 meter in the western Himalayas and also occurring in Andaman island.^[5] This is generally considered as sacred tree by the Hindus, as its leaves are offered to Lord Shiva during worship. According to Hindu mythology, the tree is another form of Lord Kailashnath.^[6] Leaves, fruit, stem and roots of this tree at all stages of maturity are used as ethno medicine against various human ailments.



Figure. 1 Leaves and fruits of Bael

Chemical Constituents: Various phytoconstituents have been isolated from the various parts of *Aegle marmelos*, which may be categorized as;^[7]

Table1: Phytoconstituents isolated from various parts of *Aegle marmelos*

Sr. No.	Part	Phytoconstituents
1.	Leaf	Skimmianine, Aegeline, Lupeol, Cineol, Citral, Citronella, Cuminaldehyde, Eugenol, Marmesinine
2.	Bark	Skimmianine, Fagarine , Marmin
3.	Fruit	Marmelosin, Luvangetin, Aurapten, Psoralen, Marmelide, Tannin

Traditional Uses of Bael Tree Parts for Medicinal Purpose:

The different parts of Bael are used for various therapeutic purposes, such as for treatment of Asthma, Anaemia, Fractures, Healing of Wounds, Swollen Joints, High Blood Pressure, Jaundice, Diarrhoea Healthy Mind and Brain Typhoid Troubles during Pregnancy.^[8]

Aegle marmelos has been used as a herbal medicine for the management of diabetes mellitus in Ayurvedic, Unani and Siddha systems of medicine in India^[9], Bangladesh^[10] and SriLanka.^[11] The main usage of the parts of this tree is for medicinal purposes. The unripe dried fruit is astringent, digestive, stomachic and used to cure diarrhea and dysentery.^[12] Sweet drink prepared from the pulp of fruits produce a soothing effect on the patients who have just recovered from bacillary dysentery.^[13]

The ripe fruit is a good and simple cure for dyspepsia. The pulp of unripe fruit is soaked in gingelly oil for a week and this oil is smeared over the body before bathing. This oil is said to be useful in removing the peculiar burning sensation in the soles. The roots and the bark of the tree are used in the treatment of fever by making a decoction of them. The leaves are made into a poultice and used in the treatment of ophthalmia. The leaf part of the plants have been claimed to be used for the treatment of inflammation, asthma, hypoglycemia, febrifuge, hepatitis and analgesic. The mucilage of the seed is a cementing material. The wood takes a fine polish and is used in building houses, constructing carts, agricultural implements. A yellow dye is obtained from the rind of the unripe fruits. The dried fruits, after their pulp separated from the rind are used as pill boxes for keeping valuable medicines, sacred ashes and tobacco. In Homeopathic treatments it is largely used for conjunctivitis and styes, rhinitis, coccygodynia, nocturnal seminal emission with amorous dreams, chronic dysentery. Ayurveda prescribes the fruit of the herb for heart, stomach, intestinal tonic, chronic constipation and dysentery; some forms of indigestion, typhoid, debility, cholera, hemorrhoids, intermittent fever, hypocondria, melancholia and for heart palpitation. The unripe fruit is medicinally better than the ripe fruit. Leaf poultice is applied to inflammation; with black pepper for edema, constipation and jaundice.

Various proved therapeutic values of *Aegle marmelos*:

1. **Ant diabetic Activity:** Aqueous extract of *Aegle marmelos* leaves, was evaluated for hypoglycemic and antioxidant effect by Upadhya S et al (2004), by using alloxon induced diabetes in male albino rats and proposed AML may be useful in the long-term management of diabetes.^[14] Similarly, The anti hyperlipidaemic activity of aqueous extract of *Aegle marmelos* fruits was demonstrated by P.S. Marinzene *et al* (2005), using the streptozotocin-

induced diabetic wistar rats.^[15] Sunderam et al, (2009) worked on alcoholic extract of *Aegle Marmelos*, *Momordica Charantia* and *Eugenia Jambolana* separately; against Streptozotocine induced diabetic rats and confirmed their protective activity against laboratory induced cell necrosis,^[16] Where as, Kuttan & Sabu (2004) studied on leaf extract of *Aegle Marmelos* on Alloxane induced diabetes and reported that used extract was enough capable to reduce oxidative stress by scavenging lipid peroxidation and enhancing certain Anti oxidant levels which causes lowering of elevated blood glucose level.^[17] Beside of all above cited work, Hema & Lalithakumari (1999) had presented a tremendous results of *Aegle Marmelos* and documented its hypoglycemic action along with other pharmacological actions on molecular level.^[18]

2. **Hepatoprotective activity:** Singanan et al, (2007) worked on *Aegle Marmelos* leaf extract on alcohol induced liver injury in albino rats and presented data of excellent hepatoprotective effects.^[19] Similarly, Ramnik S (2008), also demonstrated that aqueous extract of bael fruit pulp and seeds are effective in the treatment and prevention of CCl₄ induced hepatic toxicity.^[20]
3. **Antimicrobial Activity:** Maheshwari et al, (2009) studied on ethnolic extract of dried fruit pulp of *Aegle Marmelos* against various intestinal pathogens i.e. *Shigella boydii*, *S. sonnei* & *S. Flexneri* and proposed that certain phytochemicals including Phenols, Tannins and Flavonoids were effective against all.^[21] It was also confirmed by Kaur et al, (2009) by getting treat *E. Coli* with *Aegle Marmelos* fruit extract.^[22] In consonance, Citarasu et al, (2003) also experimented *Aegle Marmelos* on certain pathogenic bacteria like *Salmonella typhi*, *Pseudomonas aeruginosa*, *Aeromonas hydrophyla* & *Vibrio sp.*, and concluded its positive bactericidal effects.^[23]
4. **Analgesic anti-inflammatory, & antipyretic Activity:** Arul et al, (2005) presented anti-inflammatory, antipyretic & analgesic properties of serial extract of leaves of *Aegle Marmelos*, and presented that most of the extract caused a significant inhibition of the carrageenan-induced paw oedema and cotton-pellet granuloma in rats. The extracts also produced marked analgesic activity by reduction the early and late phases of paw licking in mice. A significant reduction in hyperpyrexia in rats was also produced by the most of the extracts.^[24] Similarly, Ghangale G. R (2008) also evaluated aqueous extract of *Aegle marmelos* for anti inflammatory activity by using rat paw oedema model and proposed that *Aegle marmelos* possesses anti-inflammatory activity.^[25] Shankharanath V., (2007), demonstrated that methanolic extract of leaves of *Aegle marmelos* at a dose level of 200

and 300 mg/ kg show significant analgesic activity on acetic acid induced writhing and tail flick test in mice.^[26]

5. **Antifungal Activity :** Patil R. H (2009) reported the antifungal activity of ethanolic extract of the *Aegle marmelos* leaves including antidiarrhoeal, and antimicrobial, activities.^[27] Rana B. K. (1997) evaluated anti fungal activity of essential oils isolated from the leaves of Bael using spore germination assay. The oil exhibited variable efficacy against different fungal isolates and 100% inhibition of spore germination of all the fungi tested was observed at 500ppm.They proposed that essential oil from bael leaves may interfere with the Ca^{2+} -dipicolonic acid metabolism pathway and possibly inhibit the spore formation.^[28] Pitre S and Srivastava S.K., (1987), demonstrate the antifungal activity of ethanolic root extract against *Aspergillus fumigatus* and *Trichophyton mentagrophytes*.^[29]
6. **Anticancer Activity:** Leticia V and Costa L. (2005), evaluated the anticancer potential of folk medicine used in Bangladeshi and used extracts of *Aegle marmelos* for cytotoxic action using brine shrimp lethality assay; sea urchin eggs assay, and MTT assay using tumor cell lines. The extract of *Aegle marmelos* was found to exhibited toxicity on all used assays.^[30] Similarly, Jagetia G.C. et al (2005) reported the anticancer effect of hydroalcoholic extract of bael leaves in the animal model of Ehrlich ascites carcinoma and proposed that induction of apoptosis may be due the presence of skimmianine in extract.^[31]
7. **Radioprotective Activity :** Radioprotective effect of *Aegle marmelos extract* was studied by Jagetia GC and Venkatesh P (2005)., by exposing to different doses of gamma-radiation in mice and found that oral administration of extract resulted in an increase in radiation tolerance by 1.6 Gy.^[32] Again, Jagetia GC and coworkers (2006), studied effects of plant extract on the peripheral blood and small intestine of Swiss albino mice. They exposed the animals to gamma radiation and data were collected against radiation-induced changes in the peripheral blood, spleen colony forming units, and intestinal mucosa, reported that *Aegle marmelos* extract significantly reduces the deleterious effect of radiation in intestine and bone marrow of mouse.^[33]
8. **Antispermatogetic Activity:** Pramanik et al, (1999) reported antispermatogetic activity of ethanolic extract of *Aegle marmelos* leaves in rats.^[34] Again, the same workers, including Bhattacharya D. (2002) presented data of anti motility of rat sperms through *In Vitro* study.^[35] Similarly, Sharma R. C et al (2009),^[36] studied the effect of ethanol extracts of leaves of *A. marmelos* for their *in vitro* effect on sperm motility and was suggested that the extracts had a considerable effect on the motility of sperm. It was also proposed that an increase in concentration of the extracts decreased the motility of sperms.

9. **Antiulcer Activity:** Goel R..K (1997) reported that oral; administration of pyranocoumarin isolated from the seeds of *Aegle marmelos* Correa, showed significant protection against pylorus-ligated and aspirin-induced gastric ulcers in rats and cold restraint stress-induced gastric ulcers in rats and guinea pigs.^[37] Dhuley J. N; (2007), reported that pretreatment of rats with unripe bael fruit extract produce a significant inhibition of absolute ethanol induced gastric mucosal damage.^[38]

10. **Anti thyroid Activity:** Panda S, and Kar A. (2006), isolated, Scopoletin (7-hydroxy-6-methoxy coumarin) from *Aegle marmelos* leaves and evaluate for its potential to regulate hyperthyroidism. It was observed that scopoletin (at 1.00 mg / kg, p.o. for 7 days) to levothyroxine treated animals, decreased serum thyroid hormones level. It was also proved that the scopoletin have superior therapeutic activity than the standard antithyroid drug, propylthiouracil.^[39]

11. **Toxicity Studies:** Total alcoholic, total aqueous, whole aqueous and methanolic extracts were collected from the leaves of *A. marmelos* by the Veerappan A et al (2007) and studied in experimental rats for their toxicity. No histopathological changes were found when extracts of *A. marmelos* were administered intraperitoneally for 14 days successively at the dose of 50 mg/kg body wt. The collected data demonstrate that the extracts of the leaves of *A. marmelos* have a high margin of drug safety.^[40]

12. **Other reported medicinal values:** The antidiarrhoeal effect of aqueous extract of *Aegle marmelos* fruit have been reported by effecting outer membrane protein C of *Enteropathogenic Escherichia Coli*.^[41] Besides these activities, Insecticidal activity^[42], Anti-lipid peroxidative activity^[43] Antioxidant property^[44] have also been reported.

CONCLUSION

It is quite evident from this review that *Aegle marmelos* contains a number of phytoconstituents which reveals its uses for various therapeutic purposes. The Plant or its individual parts can be used for the treatment of various disorders in human being such as, diabetes, liver toxicity, fungal infection, microbial infection, inflammation, pyrexia and to relieve pain. Still, so much work is required with the *Aegle marmelos* to investigate the mechanism of actions with other therapeutic activities.

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