

A Nutritional And Therapeutic Potential Of Aegle Marmelos:A Concise Review

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ABSTRACT: Aeglemarmelos(Beal) is a subtropical plant that can reach heights of up to 1200 metres above sea level. It is India's most significant medicinal fruit crop. India's states of Uttar Pradesh, Uttarakhand, Jharkhand, Madhya Pradesh, and Rajasthan are where beel is primarily grown. Each component of the plant, like Bael's leaves, roots, barks, seeds, and fruits, which are essential components of several anti-disease formulas from antiquity. Fruits like bael are a great source of vitamins, minerals, and other nutrients. The fruit is used to make items like jam, candies, and panjiri. It can be used to treat a variety of human health issues, including pyrexia, liver toxicity, inflammation, fungal infection, and diabetes. The pulp of the bael fruit contains a variety of useful and bioactive substances, such as carotenoids, phenolics, alkaloids, coumarins, flavonoids, and terpenoids, and is used in countless conventional therapeutic applications.

KEYWORDS: Aeglemarmelos, India, Vitamins, Candies, Diabetes, Human health.

INTRODUCTION

The Rutaceae family includes the subtropical fruit Aeglemarmelos, sometimes called Bael [1]. Despite being native to northern India, widespread cultivation is found throughout the country, including Bangladesh, Pakistan, Sri Lanka, Burma, Thailand, and Bangladesh [2]. In contrast, different languages give bael different names, such as Bilva and Shivaphala in Sanskrit, Vilvamarum in Tamil, Belo in Oriya, Bel in Assamese, and Marathi in India. In Sinhalese, BeLi, Matoom, and Bela, respectively [3]. Each tree produces 300–400 fruits on average [4]. The medium-sized Aeglemarmelos tree grows slowly and can reach heights of 12 to 15 metres. It has a short trunk, thick, soft, flaking bark, and spreading, occasionally spiky branches, with the lower branches drooping. A young sucker's spines are often stiff and straight. From broken branches, a

clear, gooey sap that resembles gum Arabic drips down in long threads and gradually solidifies. When first tasted, it is delicious but soon becomes throat-irritating. The deciduous, alternating leaves are borne single, in pairs, or in threes. They have three to five leaflets, each of which is 4 to 10 cm long and 2 to 5 cm wide. The terminal leaflet has a long petiole. Glossy and pinkish-maroon, the new leaf. When mature leaves are injured, an unpleasant stench is released. Fragrant blooms are found along the juvenile branchlets in clusters of four to seven. They have four fleshy, recurved petals that are green on the exterior and yellowish on the inside. The fruits are 5–20 cm in diameter, round, pyriform, oval, or oblong, with a more or less soft rind or a thin, hard, woody shell, and are gray-green until they are fully mature, at which point they turn yellowish. It is covered in tiny, fragrant oil glands. A firm central core and 8 to 20 barely discernible triangular segments with thin, dark-orange walls are present inside. The pulp inside is aromatic, light orange, pasty, sweet, resinous, and somewhat astringent. 10 to 15 flattened oblong seeds with fuzzy hairs that are about 1 cm long and embedded in the pulp are each protected by a sac of sticky, translucent mucilage that solidifies when dried [5]. Bael is a fruit that is good for the gut and is frequently used to cure several gut issues like diarrhoea, dysentery, and peptic ulcer. It functions somewhat laxatively as well. In addition, bael fruit has a number of additional health benefits, including antioxidants, anti-diabetic, heart-protective, gut-protective, anti-diarrheal, antiviral, and antibacterial properties. It also inhibits the breakdown of lipids and scavenges free radicals. Traditional medicine has a substantial reliance on bael and other plant parts. They have been used for a very long period in Ayurveda. They boost immunity and combat a range of illnesses, infections, and disorders. Bael is particularly beneficial since it contains a variety of minerals, phytochemicals, phenolic compounds, flavonoids,

and antioxidants. Numerous research have found that bael functions similarly to medicines while having no negative side effects. Let's examine the bael' nutritional makeup (Aegle Marmelos)[6].



FIGURE NO:1 AEGLE MARMELOS (BAEL FRUIT)

Al to imperatorin and B sitosterol are two more coumarins found in the fruits, along with marmorosin, which is the fruit's active ingredient and identical to imperatorin. Bael fruit pulp is used to make juice or what is often referred to as Bael sherbet. The pulp can also be consumed by itself. The pulp is often ground into a powder and used as medication to treat a variety of illnesses. The pulp of the mature Bael fruit is sweet and orangey, resembling a hybrid of papaya and tart limes or even mango. The phases of ripening determine the sweetness of the fruit. Bael may even taste sour if it hasn't fully ripened [7]. The fruit may be used to treat digestive disorders, illnesses like diabetes, cardiac problems, and issues associated to inflammation. radiation protection, wound healing, and Depression, microbes, and the generation of free radicals have also shown by bael. These documents attest to Bael's capacity for natural healing [8].

II. HISTORY

Indians have been using the bael (Aegle Marmelos) plant for 5000 years. It is an Indian medicinal plant that contains a number of bioactive substances that defend against and combat a number of ailments. Ayurveda uses the fruit, leaves, roots, bark, and seeds of the bael tree as a folk remedy to treat a variety of illnesses. In addition to having medical benefits, the bael (Bel or Bilva) fruit is frequently used to make puddings, drinks, and murabba (Bel Murabba). Bael is a fruit that is good for the gut and is frequently used to cure several gut issues like diarrhoea, dysentery,

and peptic ulcer. It functions somewhat laxatively as well. In addition, bael fruit has a number of additional health benefits, including anti-diabetic, heart-protective, gut-protective, anti-diarrheal, and antiviral properties[9]. The tree is indigenous to India and can be found growing wild throughout the Indian subcontinent in arid, hilly regions that rise as high as 1200 m in the western Himalaya[10].

III. PLANT PROFILE [AEGLE MARMELOS]



FIGURE NO: 2 AEGLE MARMELOS

Botanical Name : Aegle Marmelos(L.) Correa

Common Names: Stone Apple, Wood Apple, and Bili

Family of Plants: Rutaceae

Plant Type: tree

Occurrences in the following Sectors: 1, 4–8, 12–16, 19–25, 27

Gujarat Forestry Research Foundation, Indroda Park, Ayurvedic Udyan, Punit Van, Van hetana Kendra, Basan, and Aranya Van are places where it occurs.

Characteristics : A thorny deciduous tree with smooth, grayish-white or grayish-brown bark .

Stem: Branched, upright, woody, and cylindrical.

Leaves: Petiolate, compound, trifoliate, exstipulate, with ovate-elliptic or elliptic-lanceolate leaflets that are glabrous.

Florescence: Axillary panicles.



FIGURE NO: 3 LEAVES AND STEAM

Flowers :pentamerous, actinomorphic, hypogynous, and bracteate. Flowers might be creamy white or greenish.
Five gamosepalouscalyx.
Imbricate, 5-petaled, polypetalous corolla.
Polyandrous, ditheous, and with numerous stamens, introrse androecium.
Pentacarpellary, syncarpous, multilocular, superior, and axile placentation in the gynecium.
Time of Flowering and Fruiting: January through May, February through July.



FIGURE NO: 4 FLOWERS FOR AEGLE MARMELOS

Fruits: Globose or subglobose berries between 6 and 10 cm in diameter, having a rough peel that becomes yellow as they ripen.



FIGURE NO: 5 FRUITS FOR AEGLE MARMELOS

Seeds : Oblong or obliquely lenticular, wrinkled, light-brown, and glabrous .



FIGURE NO: 6 SEEDS FOR AEGLE MARMELOS

Signifies:

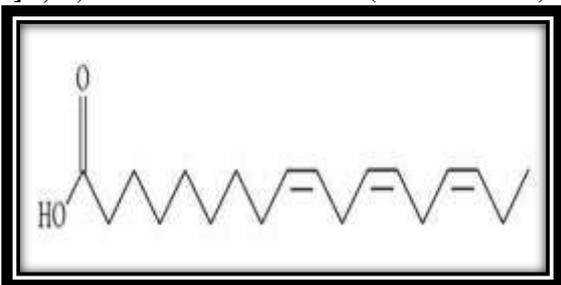
- 1.The tree's bark produces a yellow dye that has been used to colour wool and linen.
- 2.The tree produces high-quality wood, which is used to make bobbins, furniture, structures, and other things. Additionally, it makes excellent panelling and flooring material.
- 3.As an antiseptic, the bark is employed
- 4.In dysentery, the roots are used as an astringent.
- 5.Hindu marriage ceremonies attach religious importance to tree.
- 6.It is suitable for battery separators and works well for bobbins[11].

IV.PHYTOCHEMICAL CONSTITUENTS OF AEGLE MARMELOS

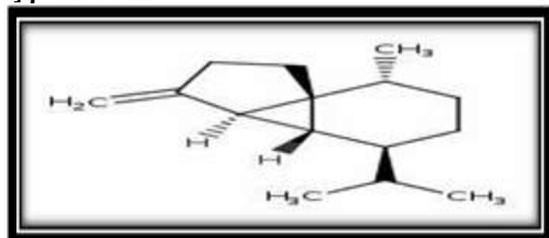
After numerous attempts to separate and separate the components in the mixture from various concentrations of Aeglemarmelos (L.), a substantial number of The plant contains chemicals that are physiologically active, like different organic acids, such as tartaric, malic, oxalic, and ascorbic acid, different phenolics found in fruit, including chlorogenicellagic acid (248.5 g/g), ferulic acid (98.3 g/g), and acid (136.8 g/g) protocatechuic acid (47.9 g/g), gallic acid (873.6 g/g), and as well as quercetin (56.9 g/g). In addition to all of these, compounds such as 1-Butanol, 3-methyl-, 1-Dodecanol, 1-1-Tetradecanol , acrylate, 1,3,4,5-Heptadecanol (1-Eicosanol),Quinic acid (tetrahydroxy cyclohexane carboxylic acid); 1,3-Cyclohexadiene,2-methyl-5-(1-methylethyl)-(1-Phellandrene);Allo imperatorin, Cubebene, Tocopherol, Verbenone,The plant contains vitamin E[13,14,15]

Some Structures :

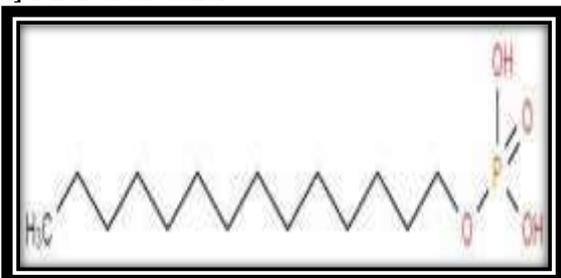
1] 9,12,15-Octadecatrienoic acid(Linolenic acid)



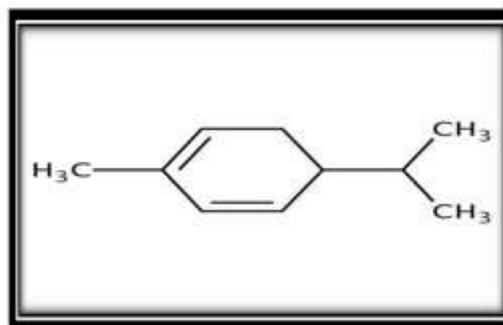
2] β-cubebene



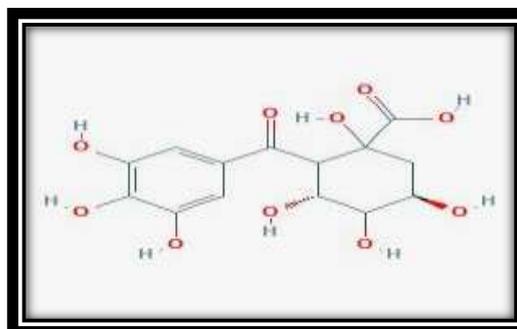
3] 1-1-Tetradecanol



4]1,3-Cyclohexadiene,2-methyl-5-(1-methylethyl)-(1-Phellandrene)



5] 1,3,4,5-Heptadecanol (1-Eicosanol),Quinic acid (tetrahydroxy cyclohexane carboxylic acid)



V.PHARMACOLOGICAL ACTIVITIES OF AEGLE MARMELOS

antidiabetic qualities:

Aeglemarmelos is said to possess anti-diabetic qualities. In a study by [16], it was discovered that lectinThis plant's extract has an anti-diabetic effect on alloxan- and glucose-induced diabetes [17, 18]. IN hyperglycemia brought on by alloxan, methanolic extract (120 mg/kg body Aeglemarmelos leaves' weight, ip) reduces sugar blood level is at. Day 6 and day 7 both revealed this decrease. Day 12, the sugar level dropped to 54%. [19] Once more, have also a root extract has been reported to have hypoglycemic effects in diabetes-induced rats using alloxan. Furthermore, fruit extracts , as well as seeds, have demonstrated hypoglycemic effects is diabetic rats produced by streptozotocin .Additionally, it is observes Aeglemarmelos alters pancreatic beta cell function prevents buildup[20].

Anti-diarrheal properties

Chloroform was discovered to be toxic in an in vitro and in vivo investigation by [21] .antidiarrheal action is detected in root extract. in vitro .According to a study, this extract was similar to that of ciprofloxacin. It typically works to stop the strains of Escherichia coli (E. coli), Vibrio

cholerae, and AShigella sp. Additionally, the fruit's ethanolic extract reduced the rats' intestinal propulsion [22,23]

Antibacterial activity:

Fruits and leaves of plants have antibacterial properties. and Aeglemarmelos barks were claimed by disc and tested Staphylococcus aureus and Bacillus subtilis diffusion technique aureus, E coli, Proteus mirabilis, Klebsiellapneumoniae, A and B Salmonella paratyphi b-type Salmonella paratyphi Chloroform and methanol extract are examples. , water-methanol extract had noticeably strong activity. in opposition to bacteria [24]. Cold-pressed leaf extracts such as hexane Additionally, ciprofloxacin, hot methanol, and methanol exhibited antimicrobial effectiveness [25,26].

Antiviral :

This plant extract affected people negatively. B1–B6 coxsackieviruses. It has even demonstrated a negative impact. Shrimp with IC150 levels of white spot syndrome .anti-oxidant activity Antioxidants' function is to scavenge free radicals from cells, which helps to avoid cell damage.It could cause a serious health issue. Since the Due to the Bael plant's chemical composition, it provides impact of antioxidants. These substances, flavones, flavonoids, anthocyanins, coumarinlignans, isoflavones,- and -catechins [27]. In a contrast-comparison According to a study, immature fruits have a greater capacity to reduce the effects of ripe fruit free radicals. Utilizing the DPPH radical Methanol and aqueous extracts were used in the scavenging technique. Both were evaluated and shown typical antioxidant activity [28].

VI. USES AND BENEFITS OF AEGLE MARMELOUS

According to Indian Ayurveda, bilva has been utilised extensively in the treatment of diabetes and dysentery.

Following are some uses for aeglemarmelos:

1. Among the uses for Aegle Marmelos are the dried fruit pulp that is used in various regions of India to make summer beverages that prevent sunburn.
2. Salads are prepared using bael leaves.
3. The pulp of the bael fruit absorbs the toxins released in the intestine by bacteria and other pathogens, aiding in the treatment of dysentery.

4. Ayurvedic medications for appetite loss can be formulated with bel.
5. To treat respiratory issues, bael extract oil is used.
6. The bael fruit is used to make pulp powder, sweets, squash, toffee, and other edible goods.
7. Aegle Marmelos is naturally anti-inflammatory. When administered to an exposed area, its extracts can treat inflammation.
8. Fever can be treated with aeglemarmelos leaf juice and honey.
9. Tuberculosis can be treated with Aegle Marmelos.
10. Antioxidants found in abundance in aeglemarmelos aid in insulin secretion, which lowers blood sugar levels.
11. Bark has reportedly been shown to help with diabetes.[29]

VII. NUTRITIONAL FACTS OF AEGLE MARMELLOS

Alkaloids, polysaccharides, antioxidants, beta carotene, vitamin C, vitamin B, and other biochemical compounds are abundant in aeglemarmelos. Additionally, it includes fibre, protein, phosphate, calcium, iron, and tannins. 100 grammes of AegleMarmelos or bael fruit contain the following nutrients:

- Energy: 137 cal
- Moisture: 61gm
- Protein: 2gm
- Fat: 0
- Mineral: 2gm
- Fiber: 3gm
- Carbohydrate: 32gm
- Calcium: 85mg
- Phosphorus:50 mg
- Iron: 1 mg [30].

VIII. AYURVEDIC PROPERTIES OF AEGLE MARMELLOS[31]

1. HINDI /SANSKRIT :

Rasa	Katu ,tikta ,kashaya
Guna	Grahi ,snigdha , tikshna
Virya	Ushna
Vipaka	Katu

2. ENGLISH :

Taste	Pungent , bitter , astringent
Physical property	Absorbent ,unctuous,sharp

Potency	Hot
Metabolic property	Pungent

TABLE NO: 1 AYURVEDIC PROPERTIES OF AEGLE MARMELOS

IX.SIDE EFFECTS AEGLE MARMELOS

All Ayurveda herbs are plant-based, and they don't have any side effects but they may react with some allopathy or homeopathy medicine. It is better to consult the doctor if you are on any medications or have special health issues. Below are a few adverse consequences.

1.Obtain medical advice if you are nursing.

2.If you are pregnant, do not take without a prescription from a doctor.

3.If you take medicine for your hypertension or diabetes. Before ingesting, see a physician.

4.A feeling of heaviness in the stomach may result from consuming too many stone apples.

5. Before using any Ayurvedic herbs, talk to your doctor first. Sometimes, they may interact negatively with allopathy or homeopathy.

6.Consult your doctor before using it if you are on blood thinners.

7.If you are having surgery, discontinue using Aegle Marmelos two weeks before to the procedures.

X.VARIOUS MARKETED PRODUCTS OF AEGLE MARMELOS[33]

MARKETED FORMULATION	MANUFACTURING	USE
	Himalaya WELLNESS	Bowel wellness
	SBL world class homeopathy	Refresh stomach
	Fruit powder capsules	Fight diarrhea

TABLE NO: 2VARIOUS MARKETED PRODUCT MADE FROM AELGEL MARMOLOUS PLANT

XI. DIFFERENT WAYS TO CONSUME AEGLE MARMELOS

- For diarrhoea and dysentery, dried pulp (without the seeds) or its powder works wonders.
- Asthma can be effectively treated by combining one teaspoon of honey and five grammes of ground bael leaves.
- By crushing an equal amount of bael leaf, pulp, roots, and rind, you may make bael juice at home. This juice should be combined with two teaspoons of honey. This juice speeds up the healing of wounds.
- People who have high blood pressure or hypertension should consume bael leaves in the morning.
- You may also extract the juice from the leaves, add honey, mix well, and drink it every day in the morning.
- To stop vomiting during pregnant, take one teaspoon of raw bael fruit pulp twice day.
- Consume a mixture of ripe bael fruit, unsalted butter, or white butter, and sugar to increase focus.
- When combined with cow's milk, the dried and powdered pulp of bael fruit is effective in treating anaemia.

Patients without diabetes can also consume Bel (Bael) Murabba.[34]

XII. CONCLUSION

Aeglemarmelos(Bael) is both a cultural and therapeutic fruit. The fruit is used to make items like jam, candies, and panjiri. Farming using bales can be carried out in several silos. Chemicals that are derived from bael leaves, fruits, and seeds are used to treat diseases. Alkaloids, terpenoids, steroids, phenols, glycosides, and tannins are the main compounds found in plants. It can be used to treat a variety of human health issues, including diabetes, liver toxicity, fungal infection, microbial infection, inflammation, pyrexia, and more. By cultivating it, the farmer can get more money for less money spent.

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