A Review on Pharmacognostic and Anti-Acne Property of Bael [Aegle marmelos]-Gel Formulation and its Evaluation

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Abstract- **Many cultures have utilised medicinal plants as the source of a variety of drugs. Found in central and southern India, Aegle marmelos Linn. is a perennial tree in the Rutaceae family. In Hindi, Tamil, and Sanskrit, it is widely referred to as Bael, Vilvam, and Bilva. Ayurvedic practitioners and folk medicine employ the leaves and fruits of Aegle marmelos. It has been discovered that Aegle marmelos leaf extracts are antigen toxicants. Aegeline, Marmeline, Coumarin, Xanthotoxol, and Imperatorin are among the bioactive substances found in Bael's fruits, bark, leaves, seeds, and roots. A special fatty acid found in Bael seeds, 12-hydroxyoctadec-cis-9-enoic acid, also known as Ricinoleic acid, can be converted into biodiesel. South Asian nations underutilize the Bael fruit species. A. marmelos has been traditionally used to treat a variety of illnesses, such as Ulcers, Cholera, Diarrhoea, Gonorrhoea, Heart problems, Nerve disorders, Canine bites, Jaundice, and Snake bites. Along with these pharmacological activities, the plant also has properties that are Anti-inflammatory, Anti-viral, Anti-ulcer, Immunomodulatory, Anticancer, Antihyperlipidemic, Cytoprotective, Hepatoprotective, Antiproliferative, Antifertility, Analgesic, Antiarthritis, Antihyperlipidemic, Cardioprotective, Radio protective, Antiviral, Anti-ulcer, and Wound Healing. The use of herbal products has grown significantly in recent years due to negative effects reported with conventional products. The demand for herbal goods is rising globally. Uncontrollably causing pimples and patches on the face, shoulders, back, neck, chest, and upper arms, Acne is a persistent inflammatory skin disorder. In the current study, efforts were made to create and assess a topical herbal anti-acne gel including Bael, Neem, and honey extracts. The plants' strong Anti-aging, Anti-microbial, Antioxidant, Antiseptic, and Anti-inflammatory properties have been documented in the literature. Carbopol 940 is used as a gelling agent to prepare different formulation batches. A number of parameters are used to evaluate the prepared formulations, such as Skin Irritation test, Colour, Appearance, Consistency, Washability, pH, Spreadability, Grittiness, Viscosity, and Homogeneity. As a result, topical anti-acne gels can be applied to skin without causing irritation.**

Keywords: **Bael, Anti-acne, Therapeutic, Extraction, Evaluation, Gel, Formulation, Medication.**

I.INTRODUCTION:

Common names for Aegle marmelos include Bael, Indian quince, Bilva golden apple, and Stone Apple. Known as "Bhel" or "Bael" India, it is a traditional herbal remedy from South East Asia. When fully ripe, the fruit, called a "Stone Apple" in English, resembles pale yellow to golden orange colour. It is a fruit-bearing, subtropical, deciduous tree that grows in many sub-Himalayan regions, including Bangladesh, India, Nepal, and Sri Lanka. The only member of the genus Aegle, the tree grows wild in well-drained soil to a height of 12 to 15 metres even in harsh and arid environments. Although the plant can survive with shallow soil moisture, it can grow at high altitudes of up to 1,200 metres and can withstand temperatures as low as 7°C and as high as 50°C without experiencing significant growth retardation. However, in the event of severe droughts, fruiting may cease. It has a short, thick, soft stem with spreading, sometimes thorny branches that peel off the bark. The lower branches bend downward, but the spines of the young suckers are straight and rigid. It has sweet-smelling white flowers, while the Bael fruit's typical diameter ranges from 5 to 12 cm. Almost every part of this plant has been utilised in traditional medicine, and the ripe fruits of the plant can typically be used to treat chronic dysentery and diarrhoea. Fruits have a high nutritional value and are rich in vitamins, carbohydrates, proteins, oils, and a variety of curative elements. Bael is considered a fertility symbol and is considered a healing tree that provides nourishment to the body.

Taxonomical classification of A. marmelos

Kingdom: Plantae
Subkingdom: Tracheobionta
Super division: Spermatophyta
Division: Magnoliophyta
Class: Magnoliopsida
Subclass: Rosidae
Order: Sapindales
Family: Rutaceae
Genus: Aegle
Species: Aegle marmelos

1.1. Botanical description of A. marmelos

Aegle marmelos is a medium-sized, spiny tree in the Rutaceae family. It grows slowly. The plant can reach heights of 12–15 m and girths of 90–120 cm. The trunk has spreading, spiny branches and a short, thick, soft bark that flakes. There are long, acute, and axial spikes present.

(i) Leaves:

The leaves of A. marmelos are deciduous, alternating, trifoliate, aromatic, and borne as a single or compound. They are composed of three to five oval, pointed, shallowly toothed leaflets that measure four to ten centimetres in length and two to five centimetres in width. The terminal leaf has a long petiole, while the lateral leaf lacks one. Three to five leaflets make up a leaf. The petiole of a leaf is long and smooth. When mature leaves bruise, they release an unpleasant stench.

(ii) Flower:

Fragrant, 2 cm wide, upright, stalked, sweetly scented, and forming a cluster of 4–7 flowers, each with 4–5 fleshy petals that recur, a yellowish interior and a greenish exterior, and at least 50 greenish stamens. The capitate stigma ovary is oblong-ovoid, and the calyx is shallow with five short, broad teeth and slightly tapering thick, short style.

(iii) Fruit:

Fruits have a hard, smooth, woody shell called the pericarp and are pyriform, round, aromatic, pale orange, fibrous oval, oblong, and up to 20 cm in diameter. The crust is grey-green in the early stages, maturing to an orange or yellowish colour, and drying to a very hard, orange-red texture. Within the fruit is a hard core with eight to twenty faintly visible triangular segments surrounded by thin walls of dark orange colour. The fruit's pulp is astringent, sweet, aromatic, resinous, and pale orange in colour. The fruit ripens slowly; it may take a year for it to reach its full ripeness within.

(iv) Seed:

Hairy, flattened, oblong seeds, ranging in size from 10 to 50, are embedded in fruit pulp and sprout in two to three months. A sack of sticky, transparent mucilage encases the seed, and it solidifies after drying. The majority of seeds are abandoned during the growing process. There is white Testa.

1.2 Therapeutic value:

The Bael tree is used to make herbal medicines almost entirely, with gastrointestinal issues being the most common use for Bael. The medicinal properties of Aegle, such as its antidiarrheal, antidysenteric, antipyretic, antimicrobial, anticonvulsant, wound-healing, hepatoprotective, diuretic, antifertility, chemopreventive, radiopreventive, antioxidant, analgesic, and anti-inflammatory properties, are used in ethnomedicine to treat a variety of ailments. Offer anti-inflammatory, anti-tumour, anti-diabetic, anti-cancer, antimicrobial, and insecticidal properties. In addition, Bael is a species that is crucial for reforestation, particularly in marginally fertile areas. A special fatty acid found in Bael seeds, 12-hydroxyoctadec-cis-9-enoic acid, also known as Ricinoleic acid, can be converted into biodiesel. A. marmelos has been traditionally used to treat a wide range of illnesses, such as ulcers, cholera, diarrhoea, gonorrhoea, heart problems, dog bites, jaundice, snake bites, and many more.

The plant is also known to have a number of pharmacological properties, including anti-inflammatory, anti-viral, anti-ulcer, immunomodulatory, anticancer, antihyperlipidemic, cytoprotective, hepatoprotective, antiproliferative, analgesic, antiarthritis, contractile, antihyperlipidemic, cardioprotective, radioprotective, antiviral, anti-ulcer, and wound-healing qualities. Because it contains a variety of antioxidants, vitamins, and minerals, the plant's fruit is both edible and highly medicinal. The fruit's pulp is resinous, sweet, aromatic, and pale orange. The plant's immature fruit pulp is used to make murabba, pudding and juice.

II. METHOD AND PREPARATION:

(i) Gathering plant material and preparing the extract:

For the extraction process, Aegle marmelos leaves are shade-dried, powdered, and utilised. At room temperature for 24 hours, 5 g of the powdered sample is subjected to successive solvent extraction using 100 ml of methanol, ethanol, ethyl acetate, hexane, and chloroform, one at a time. For every solvent, 300 millilitres of solvent extract are collected after this is done three times. The resulting solvent extract is then vacuum-dried in a rotating evaporator at 40°C. After being lyophilized, the concentrated solvent extracts are kept as dry power for future research.

(ii) Yield Percentage:

Based on the product that remains after evaporation, the yield percentage of the leaf solvent extracts is determined.

2.1 Techniques for phytochemical screening:

Using a variety of qualitative chemical tests, the presence of different Phyto-constituents such as Anthraquinone, Glycosides, Saponins, Tannins, and Phytosterols is assessed in Agele marmalos methanol extracts. [25, 26]

(i) Examinations for Saponins:

For two minutes, 300 mg of the solvent extract and 5 ml of water were brought to a boil. After a thorough mixing and cooling process, the mixture was left for three minutes. A frothy formation suggests the presence of Saponins.

(ii) Test for Tannins:

Make 2% strength, an aliquot of the solvent extract was mixed with sodium chloride. After filtering, 1% gelatine solution was added. Tannins are indicated by precipitation.

(iii) Test for Triterpenes:

300 mg of extract and 5 ml of chloroform were combined, then the mixture was heated for 30 minutes in a water bath. Following proper mixing, a small amount of concentrated sulfuric acid is added to the chloroform solution. Triterpenes are indicated by the appearance of red colour.

(iv) Test for Alkaloids:

Alkaloids were tested by digesting 300 mg of extract with 2 M hydrochloric acid. After mixing this acidic filtrate with room-temperature amyl alcohol, the alcoholic layer was checked for the appearance of pink colour, which suggests the presence of alkaloids.

(v) Test for flavonoids:

Magnesium chloride, potassium hydroxide solution, concentrated hydrochloric acid, and 1% aluminium chloride solution in methanol were used to detect the presence of flavonoids.

(vi) Determination of DPPH Radical Scavenging Activity:

Using DPPH, the plant extracts' ability to scavenge free radicals was ascertained. Plant extracts were diluted serially (0.5µg to 8µg) and added to a 0.15% methanolic DPPH solution. The mixture is then incubated for around 10 minutes at room temperature. Using a spectrophotometer (Perkin – Elmer Lambda 20 UV – visible spectrophotometer), the absorbance of the aliquots was measured at 515 nm. As a standard, butylated hydroxy toluene (BHT) was employed as a control. Plotting the inhibition curve is allowed for the determination of IC50 values [27]. Three duplicate analyses were performed for every sample and every standard concentration.

(vi) Calculation of Total Phenolic Content:

Using pyrocatechol as a standard, the Folin-Ciocalteau reagent was used to determine the total soluble phenolic content in the methonolic extracts of the leaves. This procedure followed standard protocol. A precise 0.1 ml of the 1000 µg extract solution was taken and added to a volumetric flask to make 46 ml with distilled water. After that, 1 millilitre of Folin-Ciocalteau reagent was added, and the flask's contents were well combined. Precisely 3 millilitres of a 2% Na2CO3 solution were added after 3 minutes, and the mixture was left to stand with occasional shaking for two hours. At 760 nm, the absorbance was measured. The plant extracts' total phenolic compound concentration was calculated and represented in micrograms of equivalent pyrocatechol. Triple analysis was carried out.

2.2 Herbal Extract Preparation:

Herbal extract preparation involves washing the harvested herbs under running water and drying them in shaded areas of the sun. After which they were ground into coarse powders and sieved using a 60 mesh sieve. After that, the extracts were made using the decoction method, and they were kept in tightly sealed containers for storage.

(i)Process of decoction:

Decoction is an extraction technique in which plant material is boiled to dissolve its chemicals. This is the most widely used preparation technique in different herbal medicine systems. To extract different chemical substances from plant material, decoction involves first drying it, then mashing, slicing, or cutting it to allow for maximum dissolution, and finally boiling it in water.

(ii) Herb authenticity:

Every herb was assessed using the Indian Ayurvedic Pharmacopoeia.

(iii) Preparation of Gel Base:

The gel base is prepared by weighing, dissolving, and storing Carbopol 940 in water for an overnight soak. Stirring is necessary to combine the Carbopol 940 once it has swelled in order to form the gel.

(iv) Preparation of Formulation:

It involves adding precisely weighed amounts of neem and Bael extracts to the gel base. Rose water is added as a perfuming agent and honey as a humectant. Subsequently, triethanolamine is gradually added to the mixture to achieve the necessary pH (5–6). Preservatives such as propyl and methyl paraben are added.

2.3 EVALUATION PARAMETERS:

The drug release kinetics and consistency of the gel are examined in order to assess it. For three months, the gel's stability is monitored at a temperature of 40 °C and a relative humidity of 75%. Using the well diffusion method, the Antimicrobial activity of the gel was compared to a typical commercial formulation.

(i) pH:

1.0 g gel was precisely weighed and then mixed with 100 millilitres of distilled water. The digital pH metre was used to measure the dispersion's pH. It was calibrated with standard buffer solution at 4.0, 7.0, and 9.0 before use. The pH was measured three times, and the average values were determined.

(ii) Spread-ability:

Good spread-ability is one of the requirements for a topical formulation to satisfy the ideal attributes. This term refers to the area that a formulation easily spreads when applied to the skin or other affected part. The spreading value of a formulation also affects how effective it is as a medicine. In order to assess the formulation's spread-ability, 0.5 g of gel was spread out on a 20 × 20 cm glass plate, with a second glass plate placed on top. The circle's diameter was pre marked at 1 cm. For five minutes, a 500 g weight was left to rest on the upper glass plate. It was observed that the diameter increased as a result of gel spreading.

(iii) Excrudability:

A closed, collapsible tube containing formulation was firmly pressed at the crimped end to test the extrudability of the material. The formulation extruded until the pressure subsided after the cap was removed. The weight in grams needed to extrude the formulation in a 0.5 cm ribbon in 10 seconds was calculated. There was a reported average extrusion pressure in g.

(iv) Viscosity:

Using spindle #C 50-1 with a diameter of 50 mm and software RHEO3000, the viscosity of the formulations was measured as such without dilution using an R/S CPS Plus Rheometer (Brookfield Engineering Laboratories, Inc., Middleboro, MA, USA).

(v) Homogeneity:

When the gel was put into the container, the developed formulations were examined visually to ensure homogeneity. Their appearance and the existence of any aggregates were examined.

III.CONCLUSION:

It has been reported that several parts of A. marmelos are used by traditional healers to treat a variety of human ailments. Proliferative, Cytoprotective, Hepatoprotective, Antifertility, Analgesic, Antiarthritis, Contractile, Antihyperlipidemic, Cardioprotective, Radio-protective, Anticancer, Antiviral, Anti-ulcer, Immunomodulatory, and Wound Healing properties are among those these contain. Several chemically diverse compounds that are biologically active were isolated from different parts of A. marmelos. Alkaloids, Terpenoids, Vitamins, Coumarins, Tannins, Carbohydrates, Flavonoids, Fatty acids, Essential oils, and a few other unidentified substances are among the components that have been isolated. The majority of this review was devoted to a number of phytochemical and pharmacological investigations that have clarified the phytoconstituents and potential medicinal uses of A. marmelos.

A thorough understanding of the phytochemicals and diverse biological characteristics of plant extracts may offer convincing proof for the plant's application in a variety of therapeutic contexts. Aegle marmelos has been employed historically for a variety of ethnobotanical uses.

This study, which used Bael as a herbal remedy for acne, aims to have better therapeutic effects and fewer side effects than Allopathic Marketed Formulation.

IV. FUTURE SCOPE:

Aegle marmelos is now a significant source of medicine used to treat a variety of illnesses in both humans and animals. In addition to investigating the potential for utilising various plant parts of Aegle marmelos to prepare standardised drugs, commercial jam production using the fruits of the plant should be encouraged as a health tonic. Regretfully, the majority of the compounds have not been thoroughly assessed in order to find new lead molecules. Only a few bioactive compounds' mechanisms of action have been found so far. Therefore, a great deal of research is needed to determine the exact mechanisms of action, bioactivity, and medicinal value of the various phytochemicals found in Aegle marmelos. Extracts from Aegle marmelos may be further used as a source of beneficial phytochemical compounds and could be crucial to the treatment of a wide range of illnesses in the contemporary medical system.

V. ACKNOWLEDGEMENT

Thanking our Guide, Prof.P.R.N. For her constant support and guidance.

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