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Research Article

Formulation and Evaluation of Natural Healing Gel using *Curcuma longa* & *Phyllanthus emblica* for Mouth Ulcer

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ABSTRACT

Mouth ulcers are common painful lesions of the oral mucosa that can interfere with eating, speaking, and overall quality of life. Conventional treatments often provide only symptomatic relief and may cause side effects with prolonged use. Hence, there is a growing interest in herbal formulations due to their safety, efficacy, and biocompatibility. The present study focuses on the formulation and evaluation of a natural healing gel incorporating *Curcuma longa* (turmeric) and *Phyllanthus emblica* (amla), both of which possess well-known anti-inflammatory, antimicrobial, antioxidant, and wound healing properties. The gel was formulated using suitable gelling agents and excipients to ensure appropriate consistency, stability, and patient acceptability. Extracts of *Curcuma longa* and *Phyllanthus emblica* were incorporated in optimized concentrations. The prepared formulation was evaluated for various physicochemical parameters including pH, viscosity, spread ability, homogeneity. The results indicated that the formulated gel exhibited satisfactory physicochemical properties, good stability, and significant antimicrobial activity against oral pathogens. The presence of bioactive compounds such as curcumin and vitamin C contributed to enhanced healing and anti-inflammatory effects. The study concludes that the developed herbal gel can serve as a safe, effective, and economical alternative for the management of mouth ulcers.

INTRODUCTION

Gels are semi rigid structure of three dimensional network of particle or macro molecules of the dispersed phase. This 3D structure blocks the movement of the dispersing medium. The gel are

semisolid system containing either suspension of small inorganic particle or large organic molecule interpenetrated by a liquid. The gel mass has a network of small separate particle, thus is considered a two-phase system. ^[1]

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Oral ulcers are lesions that can be very painful and may considerably compromise the quality of life of an individual, thus being associated with a multitude of etiological factors. The present literature review aims to combine the newest findings regarding the etiology of oral ulcers, concentrating particularly on Oral Lichen Planus (OLP), Behçet's disease (BD), recurrent aphthous stomatitis (RAS), inflammatory bowel diseases (IBD), and the influence of systemic therapies including chemotherapy. From the diverse nature of these conditions, complexity in oral ulceration can be drawn with a basis for future research through revealed knowledge gaps. Oral ulcers represent one major category stemming from chronic inflammatory diseases Lichen Planus (LP) and Inflammatory Bowel Disease (IBD). In LP, a persistent inflammatory condition that involves the mucous membrane of the mouth, the involved

pathophysiology is T-cell mediated immune responses that can finally lead to erosive lesions.

1.1 Mouth ulcer:

A mouth ulcer (also termed an oral ulcer, or a mucosal ulcer) is an ulcer that occurs on the mucous membrane of the oral cavity. It is defined as “a break within the mucosal surface of the oral cavity” They are painful round or oval sores that form in the mouth, mainly on the inside of the cheeks or lips. The two most common causes of oral ulceration are local trauma (e.g. Rubbing from a sharp edge on a filling) and aphthous stomatitis ("canker sores"). Aphthous stomatitis or mouth ulcer is an ulcerative condition that is related to the oral mucosa and is characterised by repeating ulcers in the throat and oral c cavity. ^[2]



Image no 1: The common sites of ulcer caused in mouth ulcer

1.2 Medication-induced oral ulcers:

Oral ulcers can appear as an adverse reaction to drugs, which complicates treatment of the lesions. Drug-induced mucosal reactions should be in the knowledge base of oral health care providers so that they can intervene appropriately with specific managements directed towards the underlying causes of oral ulcers. Particularly those patients who are treated with targeted therapies and biologic agents may need a dual approach: relief of symptoms and modification of the causative medication. This awareness underlines the

necessity of knowing oral mucosal reactions to steer effective treatment strategies.

2. PLANT PROFILE

2.1 *Curcuma longa*

Turmeric is a plant that has a very long history of medicinal use, dating back nearly 4000 years. In Southeast Asia, turmeric is used not only as a principal spice but also as a component in religious ceremonies. Because of its brilliant yellow color, turmeric is also known as “Indian saffron.”

Modern medicine has begun to recognize its importance, as indicated by the over 3000 publications dealing with turmeric that came out within the last 25 years. This review first discusses in vitro studies with turmeric, followed by animal studies, and finally studies carried out on humans; the safety and efficacy of turmeric are further addressed.^[4]

Taxonomical classification

- **Kingdom:** Plantae
- **Subkingdom:** Tracheobionta



Image no 2: *Curcuma longa* rhizome stage

2.2 Chemical constituent

Proximate analysis (Fig. 1) of turmeric reveals that the herb contains 6–13% moisture, with 60–70% carbohydrate, 6–8% protein, 5–10% fat, 3–7% minerals (potassium sodium, calcium, iron, phosphorus), and trace amounts of vitamins. Essential oils obtained by steam distillation represent 3–7% of the turmeric rhizome and mainly consist of terpenoids, including sesquiterpenoids (e.g., α -phellandrene, zingiberene), monoterpenoids (e.g., sabinene, cineol), and norsesqui terpenoids. There is also 3–5% curcuminoids, which comprises more than 50 structurally related compounds; the three principal ones being curcumin, dimethoxy curcumin, and bis dimethoxy curcumin. In general, turmeric composition varies according to the soil conditions used in cultivation, with Indian turmeric being

- **Superdivision:** Spermatophyta
- **Division:** Magnoliophyta
- **Subclass:** Zingiberidae
- **Order:** Zingiberales
- **Family:** Zingiberaceae
- **Genus:** *Curcuma*
- **Species:** *longa*
- **Scientific name:** *Curcuma longa*



Image no 3 : *Curcuma longa* primary stage

regarded as having superior quality and high curcumin content. Curcuminoids and essential oils are classified as secondary metabolites produced by *Curcuma* plants, with well-defined bioactivity.^[4]

2.3 Medicinal use

- *Liver Diseases*
- *Cancer*
- *Atherosclerosis*
- *Osteoarthritis*
- *Bacterial Infection / Wounds*
- *Eye Disorder*
- *Other Health Disorders*

3. *Phyllanthus emblica*

Amla is a gift of nature to mankind. It is an indispensable part of the ayurvedic and unani system with amazing remedial qualities. In Sanskrit, it is called Amalaki or Dhartiphala. Amla is perhaps the single most often mentioned herb in "Charak Samhita", the Ayurvedic medicine literature (500 BC). Amla is a wonder herb and one of the precious gifts of nature to humans. Amla is known as "Divya" and "Amrut" or Amrit Phala in Sanskrit, which literally means fruit of heaven or nectar fruit. The Sanskrit name, Amlaki, translates as the Sustainer or The Fruit where the Goddess of Prosperity Resides. In Hindu religious mythology the tree is worshipped as the Earth Mother as its



Image no 4: Fruit of *Phyllanthus emblica*

3.1 Chemical constituent:

The fruit when blended with other fruits, boosted their nutritional quality in terms of Vitamin C content. Compounds isolated from EO were gallic acid, ellagic acid, 1-O-galloyl-beta-D-glucose, 3, 6-di-O-galloyl-D-glucose, chebulinic acid, quercetin, chebulagic acid, corilagin, 1, 6-di-O galloyl beta D glucose, 3-ethylgallic acid (3-ethoxy-4, 5-dihydroxy benzoic acid), and isostrictiniin. *P. emblica* also contains flavonoids, kaempferol-3-O-alpha-L-(6methyl) rhamnopyranoside, and kaempferol-3-O-alpha-L-(6''-ethyl)-rhamnopyranoside. A new acylated apigenin glucoside (apigenin-7-O-(6'' - butyryl-beta-glucopyranoside) was beisolated from the

fruit is considered to be so nourishing as to be the nurse of mankind .^[5]

Taxonomical classification

- Kingdom: Plantae
- Division: Flowering plant
- Class: Magnoliopsida
- Order : Malpighiales
- Family : *Phyllanthaceae*
- Tribe : *Phyllanthaeae*
- Subtribe : Flueggina



Image no 5: Whole plant of *Phyllanthus emblica*

methanolic extract of the leaves of *P. emblica* together with the known compounds; gallic acid, methyl gallate, 1, 2, 3, 4, 6-penta-O-galloylglucose, and luteolin-4'-O-neohesperidosid.^[5]

Medicinal Uses:-

Table No 1: Medicinal Uses

Sr. no	Medicinal used or cure the diseases	Part used
1)	Boils and spots	Fruit pericarp
2)	Constipation	Fruit it
3)	Diabetes	Fruit
4)	Diarrhoea	Fruit, bark, root
5)	Mouth ulcer	Root, bark , leaves
6)	Respiration problems	Fruit
7)	Gout	Fruit

4. OBJECTIVE:

- 1) To formulation of herbal healing gel.
- 2) To treat the mouth ulcer and decreases the agitation.
- 3) To decreases the oral inflammation.

5. MATERIALS AND METHOD

5.1. Materials

Table no 2: List of equipment's

Sr.no	Equipment & instrument
1)	Funnel
2)	Measuring cylinders
3)	Beaker
4)	Bunsen burner
5)	Test tubes
6)	Water bath
7)	PH meter
8)	Petri dish
9)	Glass sides

Table no 3: Ingredients used in formulation

Sr. No	Ingredients	Category
1)	Curcuma longa powder	Anti- Inflammatory
2)	Phyllanthus emblica extract	Emulsifier
3)	Agar	Thickening agent
4)	Starch	Moisturizing agent
5)	Castor oil	Hydration
6)	Distilled water	Vehicle

5.2. Method:

5.2.1. Collection, Identification and Authentication of plant material:

5.2.1.1 Collection of plant material:

Dried Root and rhizomes of *Curcuma longa* and dried leaves of *Phyllanthus emblica* from local area of loha

5.2.1.2. Authentication of plant material:

Dried Root and rhizomes of *Curcuma longa* and dried leaves of *Phyllanthus emblica* and were authenticated by Dr. Vishal R. Marathe, Associate professor and head of Botany, Science college, Nanded. Authentication of plant *Curcuma longa* and *Phyllanthus emblica* Collection, authentication Identification Processing and storage of *Curcuma longa* and *phyllanthus emblica* was be done according to standard procedure for the plant.



Image no 06: Authentication letter

5.2.2. Processing of crude drug :

Shade dried root and rhizomes of *Curcuma longa* and dried leaves was be used for extraction.

5.2.3. Preformulation study:^[15]

- a. Solubility
 - b. Ash value
 - c. Density
 - d. Organoleptic properties
- a. Solubility : it is the maximum amount of solute that can be dissolve in given amount of solvent.

- b. **Ash value:** measure of the inorganic residue left after a substance is completely incinerated.

Ash content (%) = (weight of ash residue)/(weight of original sample) x 100

- c. **Density:-** It is the ratio of mass and volume.

- Density = Mass/volume

- Bulk density = Bulk mass/Bulk volume

- Tapped density = Tapped mass/ Tapped volume

- Hausner's ratio = Tapped density / Bulk density

- Carr's index = $\frac{\text{Tapped density} - \text{Bulk density}}{\text{Tapped density}} \times 100$

d. **Organoleptic Properties:-** the sensory attributes of a substance such as colour, odour, test, texture and appearance that are pre-received and evaluated by the human senses.

e. **Angle of Respose:-** It is the maximum angle formed between the surface of the pile of powder and the horizontal plane when the powder is allowed to flow freely.

Formula : $\theta = \arctan(h/r)$

5.2.4. Extraction of plant material :

Selection of solvent :- The water is used as solvent for the extraction

Decoction method:

This technique is utilized for the extraction of those substances (obtained from crude drug) that are soluble in water and are thermostable. The crude drug is boiled in water for about 15 minutes then cooled, filtered and adequate quantity of water is added to it to make the required volume.^[9]



Image no 7 : Decoction

5.2.5 Physicochemical screening^[8, 14]

a) Physical evaluation of the plant material

- Ash value:

The traditional approach to determining ash values in pharmacognosy involves the incineration of plant material, followed by the quantification of the residual ash. This process typically takes place in a muffle furnace, where the plant material is subjected to high temperatures until all organic matter is burnt off, leaving behind inorganic minerals and salts. The total ash content is then measured, providing an estimate of the total mineral content of the plant.^[11]



Image no 8 :Ash value

b) Phytochemical qualitative test:^[8,14]

The confirmatory qualitative phytochemical screening of plant extracts was performed to

identify the main classes of compounds (tannins, saponins, flavonoids, alkaloids, phenols, glycosides, steroids, and terpenoids) present in the extracts following standard protocols.

- **Steroid and terpenoids Test:**

1. Test for Phenol

a) Ferric chloride test

Three millilitres of distilled water and a few drops of a 10 percent aqueous ferric chloride solution were added to one milliliter of the extract. The development of a green tint signifies the existence of phenols.

2. Test for Flavonoids

a) Shinoda test

To two milliliters ml of the extract, 1 ml of 1 percent ammonia solution was added. Appearance of yellow colour indicates the presence of flavonoids.

3. Test for Alkaloids

a)Mayer's test

One millilitre of the extract was combined with one millilitre of 0.008 M potassium ferricyanide and one millilitre of 0.02 M ferric chloride that contained 0.1 N HCl. The presence of tannins is indicated by a blue-black appearance.

5. Test for Carbohydrates

a) Fehling's test

Two millilitres of crude extract were added after equal volumes of Fehling A and Fehling B reagents were combined and heated slowly. The test tube's bottom developed a brick-red

precipitate, which is an indication that reducing sugars are present.

6. Test for Glycosides

a) Keller-Kiliani test for cardiac glycosides

Two millilitres of glacial acetic acid with one drop of ferric chloride solution were added to five millilitres of extract. This was combined with one millilitre of sulfuric acid concentration. A browning of the interface suggests that cardenolides have a deoxy sugar property. Beneath the brown ring, a violet ring can show up, and within the thin layer of acetic acid, a greenish ring might grow very gradually.

7. Test for Terpenoids

Salkowski test:-

Three millilitres of strong sulfuric acid were cautiously added to five millilitres of extract and two millilitres of chloroform to create a layer. The interface's reddish-brown coloration suggests the presence of terpenoids.

8. Test for Coumarin

a) Coumarins test

Chloroform was added to the extract along with 10% sodium hydroxide. The presence of coumarin is shown by the formation of yellow colour.

9. Test for Steroids

b) Salkowski test

A solution of 0.5 ml crude extract containing 2 ml sulfuric acid was mixed with 2 ml of acetic anhydride. When samples' colour shifts from violet to blue or green, steroids are present.

5.2.6 Formulation of herbal gel



▪ **Procedure:**

• **STEP-1- Preparation of gel base**

1. Weigh required quantity of agar
2. Dispense agar in small quantity of distilled water.
3. Heat the mixture at 80°-90°C until agar dissolves completely.
4. Allow it to cool (avoid solidification)

• **STEP-2- Preparation of Herbal extract mixture.**

1. Dissolve Curcuma longa & Phyllanthus emblica extract in small quantity of warm distilled water
2. Mix properly to obtain uniform solution.

• **STEP-3- Oil phase preparation-**

1. Measure required quantity of castor oil

2. Slightly warm if required.

• **STEP -4- Mixing-**

1. Add Herbal extract solution slowly into the agar gel base with continuous stirring....
2. Add castor oil & add triethanolamine dropwise to adjust P_H.

Makeup the final weight with distilled water.



Image no 9: Gel formulation

Batches formulation table:

Table no 4: Table Batches Formulation table

Sr. No	Ingredients	Quantity given	B1	B2	B3
1	Curcuma longa powder	5g	1g	1g	1g
2	Phyllanthus emblica extract	5.4g	1ml	1ml	1ml
3	Agar	2.0ml	0.75g	0.75g	0.75g
4	Starch	0.75g	1g	1g	1g
5	Castor oil	2.5ml	1.5ml	1.5ml	1.5ml
6	Distilled water	Upto 50ml	50ml	50ml	50ml

5.2.7. Evaluation of Herbal Gel:^[16, 17]

1. pH

1.0 g gel was accurately weighed and dispersed in 100 ml purified water. The pH of the dispersion was measured using digital pH meter, which was calibrated before use with standard buffer solution at 4.0, 7.0 and 9.0. The measurements of pH were

done in triplicate and average values were calculated.

2. Spreadability

One of the criteria for a topical formulation to meet the ideal qualities is that it should possess good spreadability. It is the term expressed to denote the extent of area to which formulation readily spreads on application to skin or affected part. The



therapeutic efficacy of a formulation also depends upon its spreading value. To determine the spreadability of formulation, 0.5 g of gel was placed within a circle of 1 cm diameter pre-marked on a glass plate of 20 × 20 cm, over which a second glass plate was placed.

A weight of 500 g was allowed to rest on the upper glass plate for 5 min. The increase in the diameter due to gel spreading was noted.

3. Homogeneity

The developed formulations were tested for homogeneity by visual inspection after the gel had been filled in the container. They were tested for their appearance and presence of any aggregates.

4. Visual Inspection

One of the most significant characteristics of ultrasound gels is clarity. The clarity of all prepared formulations was inspected visually against a white and black background. Other physicochemical properties such as appearance, transparency, and color were also evaluated by visual examination.

5. Skin Irritation Test

All formulations were put through a skin irritation analysis on human volunteers to see if any irritation issues would render them inappropriate for use. One gram of the gel sample was applied topically to a two square inch area of the hand. Observations were taken and recorded for any irritation, lesions, redness, or edema at periodic intervals for roughly 24h.

5. Viscosity Determination

The viscosity of commercial gel and prepared formulations were measured to choose the one formulation among all that had the best matching

viscosity with commercial gel. All measurements were taken by the rheometer (TA instruments, Model no. AR 1500 ex) and all experiments were performed at a 30 °C temperature. The sample was placed on the peltier plate or stationary plate whose temperature was set to 30 °C before starting the procedure. The measuring geometry used was a plate with a 40 mm diameter and a 2 mm gap. Then geometry was placed on the sample and started rotating from a minimum (0.05 rad/s) to a maximum (200 rad/s) angular frequency. Shear rate (1/s) was calculated. Gels. rom angular frequency by Equation (1) and dynamic viscosity (in Pa.s) was calculated by Equation (2).

$$\text{Shear rate} = r/h \times \Omega$$

$$\text{Dynamic viscosity} = \frac{\text{Shear stress}}{\text{Shear stress}}$$

where,

$$\text{shear Stress} = \frac{2}{\pi r^3} \times M$$

r = Radius of the plate geometry (m).

h = Gap between the plates (m).

M = Torque (Nm).

W = Motor angular velocity (rad/s).

6. Accelerated Stability Test

The accelerated stability test for a selected gel formulation was performed for a stable formulation by incubating it in an airtight bottle for 7 days at 70 °C temperature and 75% humidity. The suitable parameters such as color, pH, viscosity, and conductivity were also evaluated before and after the incubation period.



6. OBSERVATION & RESULT

Observation for qualitative test:^[8]

Table No 5: Qualitative Test for Phyllanthus Emblica

Test	Observation	Inference
1.Flavonide test a) Shinoda test	Yellow colour ppt	Flavonoids present
2.Carbohydrate test a)Fehling test	Brief red ppt	Carbohydrate present
3.Glycosides a) Sodium hydroxide	Yellow colour ppt	Glycosides present
4.Terpenoids a) Salkowski test	Redish Brown colour ppt	Terpenoids present
5.Coumarin test	Yellow colour ppt	Coumarin present

Table no 6: qualitative test for Curcuma longa

Test	Observation	Inference
1.Alkaloids a) Dragandraff's test	Yellow colour ppt	Alkaloids Present
2.Glycosides a) Killer Killani test	Brown colour ppt	Glycosides Present
3.Fehling test	Red ppt	Glycosides present
4.Flavonoides a. Alkylating reagent test:	Red/ yellow colour	Flavonoids present
5.Triterphenoids a. Salkowski test:	Reddish brown colour	Triterpenoids Presents



Image No 10: Phytochemical Test of Crude Drug

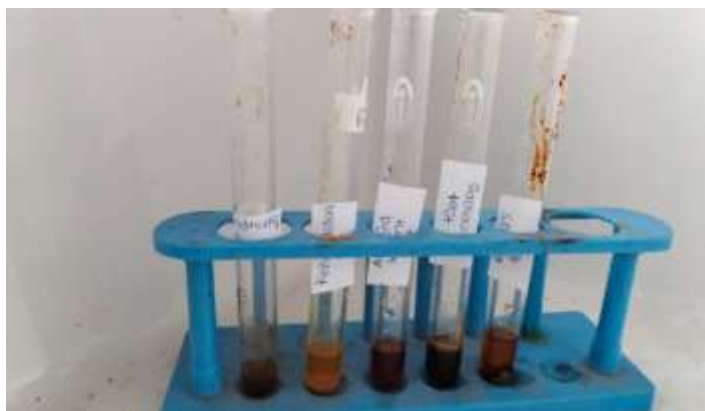


Image No 11: Phytochemical Test of Crude Drug

2. Observation table for physical evaluation:

• Organoleptic character:

Table no 7 : Organoleptic properties

Sr. no	Appearance	Description
1	Colour	Pale yellow to colorless
2	Oduor	Faint or nutty
3	Taste	Bland and Acrid

• Solubility:

Table No 8 : Solubility Table

<i>Phyllanthus emblica</i>	<i>Curcuma longa</i>
Water: 90%(Soluble)	Water: 90%(Soluble)
Ethanol: Highly soluble	Ethanol: Fully soluble
HCl: Highly soluble	H ₂ SO ₄



Image no 12: B1



Image no 13: B2



Image no14: B3

Observation:-

Table No 10 : Spread Ability

Batches	Spreadability
B1	Moderated
B2	Partially
B3	Easily spread



Image no 15:B1



Image no 16: B2



Image no17: B3

Table no 11 : pH test

Bathces	P ^H value
B1	7.18
B2	7.97
B3	7.97

• Ash value:

Ash value of *Phyllanthus emblica* its = 77%

Ash value of *Curcuma longa* its = 75%

• Density:

Table no 9 :Density

<i>Phyllanthus emblica</i>	<i>Curcuma longa</i>
Bulk density: 0.25g/ml	Bulk density: 0.21g/ml
Tapped density : 0.44 g/ml	Tapped density :0.39 g/ml

• Spreadability:

• pH test:

• Viscosity:



Image no 18: viscosity of gel (Oswald's viscometer)

Viscosity of gel:

- 0.446 cp (Dynamic & Absolute solubility)
- **Appearance and homogeneity:**



Image no 19: Homogeneity of gel

Table no 12: Appearance of homogeneity

Batches	Homogeneity
B1	Homogenous
B2	Homogenous
B2	Homogenous

- **Skin irritancy test**



Image No 20: Skin Irritancy Test

Table no 13 : Skin irritancy test

Batches	Viscosity
B1	No irritancy effect shown
B2	No irritancy effect shown
B3	No irritancy effect shown

9. CONCLUSION:-

The present study on the formulation and evaluation of a natural healing gel containing *Curcuma longa* and *Phyllanthus emblica* demonstrated promising results in the management of mouth ulcers. The herbal ingredients, known for their anti-inflammatory, antimicrobial, antioxidant, and wound healing properties, were successfully incorporated into a stable gel formulation.

The prepared gel showed satisfactory physicochemical characteristics such as appropriate pH, good homogeneity, spreadability, and viscosity, making it suitable for oral application. Evaluation studies indicated that the formulation was non-irritant, stable, and effective in promoting faster healing of mouth ulcers.

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