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"Formulation And Evaluation of Herbal Antifungal & Anti Inflammatory Cream Using Guava Leaves"

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ABSTRACT:

Fungal infection is one of the major health concerns globally and varies from superficial to systemic infections. Psidium guajava Linn. leaf extract showed antifungal activity against wide range of fungi.

• The present research focuses on the development and investigation of cream with guava leaf extract. The traditional medical practice is an integral part of the culture and the interpretation of health by indigenous populations in most of the world. Guava (Psidium guajava L.) leaves have traditionally been used to manage several diseases such as rheumatism, diarrhea, diabetes mellitus, and cough. In this present investigation antifungal and antibacterial property of guava leaves were estimated using Bacillus subtilis (Gram positive bacterial strain), Escherichia coli (Gram negative bacterial strain), Saccharomyces cerevisiae (Yeast, fungal strain) and Aspergillus niger (Mould, fungal strain) strains.

• The growth of gram positive bacteria and fungal strains were inhibited strongly, whereas gram negative bacterial strain displayed less sensitivity against the antimicrobial (antifungal and antibacterial) property of guava leaf extract. Zone inhibition assay also confirmed the result. Phytochemical analysis (qualitative and quantitative) revealed that guava leaf extract was rich in wide range of poly phenols.

• It was found that guava leaves are rich in phenols, flavonoids and tannins whereas components like alkaloids, flavonoids, saponins and triterpenes are present in comparatively lesser amounts. As polyphenols have strong antimicrobial property, it can be concluded that rich source of phenols, flavonoids and tannins are the probable cause of anti microbial property of guava leaves.

Keywords: Antifungal, antibacterial, guava leaf, phytochemical, polyphenol

INTRODUCTION:-

Study of traditional medical practice, is an integral part of the culture and the interpretation of health by indigenous populations in many parts of the world. For example, Indian Ayurveda and traditional Chinese medicine are among the most enduring folk medicines still practiced. These systems try to promote health and improve the quality of life, with therapies based on the use of indigenous drugs of natural origin. Given that plants have been widely used as herbal medicines, several approaches are now being carried out to discover new bioactive compounds.

Psidium guajava L., popularly known as guava, is a small tree belonging to the myrtle family (Myrtaceae). Native to tropical areas from southern Mexico to northern South America, guava trees have been grown by many other countries having tropical and subtropical climates, thus allowing production around the world. Traditionally, preparations of the leaves have been used in folk medicine in several countries, mainly as anti-diarrheal remedy.

Guava leaf powder has shown promising potential as a natural antifungal agent, largely due to its rich content of bioactive compounds. Traditional medicine systems have used guava leaves to treat various infections, and modern studies support its antifungal properties, particularly against Candida, Aspergillus, and dermatophyte species.

➢ Fungal Infection:

Fungal infections, or mycoses, are caused by various fungi that can affect the skin, nails, mucous membranes, and internal organs. They range from mild superficial infections to severe systemic diseases, particularly in individuals with weakened immune systems.

➢ Common Types of Fungal Infections:

1. Superficial Fungal Infections: These affect the skin, hair, and nails.
    - Ringworm (Tinea corporis): Presents as a red, circular, itchy rash.
    - Athlete's Foot (Tinea pedis): Causes itching, burning, and cracked skin between the toes.
    - Jock Itch (Tinea cruris): Results in a red, itchy rash in the groin area.
    - Nail Fungus (Onychomycosis): Leads to thickened, discolored nails
2. Subcutaneous Fungal Infections: Occur when fungi enter the skin through cuts or wounds.
    - Sporotrichosis: Known as "rose gardener's disease," it causes nodular lesions along lymphatic channels.
3. Systemic Fungal Infections: These can be life-threatening and affect internal organs.
    - Aspergillosis: Caused by Aspergillus species, leading to lung infections.
    - Candidemia: A bloodstream infection caused by Candida species.
    - Cryptococcosis: Often affects the lungs and central nervous system.

➢ Symptoms to Watch For

- Skin Infections: Redness, itching, scaling, and ring-shaped rashes.
- Nail Infections: Discoloration, thickening, and brittleness.
- Oral Thrush: White patches in the mouth, soreness, and difficulty swallowing.
- Systemic Infections: Fever, cough, chest pain, fatigue, and shortness of breath.

➢ Diagnosis and Treatment

- Diagnosis: Based on clinical examination, skin scrapings, cultures, or blood tests.
- Treatment:
    - *Topical Antifungals*: Creams and ointments for skin infections.
    - *Oral Antifungals*: Pills for nail and systemic infections.
    - *Intravenous Antifungals*: For severe systemic infections.

Objective

Utilize herbal extracts with proven antifungal properties (e.g., Azadirachta indica (neem), Curcuma longa (turmeric), Ocimum sanctum (tulsi)) to inhibit or kill fungal pathogens like Candida, Aspergillus, or Trichophyton species.

• Include herbs with anti-inflammatory effects (e.g., Aloe vera, Calendula officinalis, Glycyrrhiza glabra) to relieve redness, swelling, itching, and discomfort commonly associated with fungal infections.

• Offer an alternative to synthetic antifungal agents (which may cause skin irritation, allergic reactions, or resistance) using natural, biocompatible ingredients that are generally well-tolerated.

• Provide a safer option for chronic or recurrent infections, particularly for sensitive populations (e.g., children, elderly, pregnant women) when prescribed appropriately.

❖ **DRUG PROFILE**

➢ Guava Leaf Powder:

1. Synonym

- Common Names: Guava, Apple guava
- Botanical Synonym: *Psidium pomiferum* L. (older name, less commonly used)

2. Family

- Myrtaceae (Myrtle family)

3. Biological Source

- The guava leaf powder is derived from the dried leaves of the plant:
    - Botanical Name: *Psidium guajava* Linn.
    - Part Used: Leaves (dried and powdered)

4. Description

Plant Description:

- Type: Evergreen shrub or small tree
- Height: 3–10 meters

- Leaves:
    - Shape: Oblong to oval
    - Size: 5–15 cm long
    - Texture: Leathery, with pronounced veins
    - Color: Green on top, paler underneath
    - Aroma: Strong, aromatic when crushed

Powder Description:

- Color: Greenish-brown or dark green
- Odor: Mild herbal or earthy aroma
- Taste: Bitter to slightly astringent
- Texture: Fine, dry powder
- Solubility: Partially soluble in hot water (for decoction or tea)

5. Medicinal Uses

- *Antimicrobial Properties*
    - Effective against fungi, bacteria, and viruses
    - Used in treating skin infections, oral infections, and wounds
- *Digestive Health*
    - Controls diarrhea, dysentery, and intestinal infections
- *Antifungal Agent*
    - Inhibits fungal growth such as *Candida* and *Aspergillus*
    - Applied as paste or tea for ringworm, athlete's foot, etc.
- *Antidiabetic Action*
    - Regulates blood sugar by inhibiting carbohydrate absorption
    - Improves insulin sensitivity
- *Antioxidant and Anti-inflammatory*
    - Reduces inflammation, joint pain, and skin irritation
    - Fights oxidative stress, helping prevent cell damage
- *Oral and Dental Health*
    - Guava leaf tea is used as a mouthwash for bad breath, swollen gums, and toothaches

EXCIPIENT PROFILE:-

1}Coco butter:

1. Synonyms

- Common Name: Cocoa butter
- Other Names:
    - Theobroma oil
    - Cacao butter
    - Cacao fat

2. Biological Name

- Botanical Source: *Theobroma cacao* Linn.
- Part Used: Seeds (specifically, the fat extracted from cocoa beans)

3. Family

- Malvaceae (formerly placed in Sterculiaceae)

4. Description

Plant Description:

- Type: Small evergreen tree
- Height: 4–8 meters
- Leaves: Large, dark green, oblong
- Flowers: Small, pale yellow or pinkish
- Fruits: Large pods (10–30 cm) containing 20–50 seeds (cocoa beans)

Cocoa Butter Description:

- Appearance: Pale yellow or off-white solid fat

- Odor: Pleasant, mild chocolate scent
- Taste: Mild chocolate-like flavor
- Texture: Hard at room temperature; melts at body temperature (~34–38°C)
- Solubility: Insoluble in water; soluble in oils and organic solvents
- Stability: Highly stable fat due to natural antioxidants

5. Medicinal Uses

🔸 *Skin Health*

- Moisturizer: Deeply hydrates dry or chapped skin
- Anti-aging: Contains antioxidants that help reduce fine lines and wrinkles
- Stretch marks: Often used in pregnancy creams to prevent or reduce stretch marks
- Soothing agent: Calms irritated or sensitive skin, including conditions like eczema and dermatitis

🔸 *Wound Healing*

- Helps protect and heal minor burns, cuts, and abrasions due to its emollient and barrier-forming properties

🔸 *Antioxidant Properties*

- Contains polyphenols that combat oxidative stress and may support skin repair and collagen production

2}Carnauba wax:

1. Synonyms

- Common Name: Carnauba wax
- Other Names:
  - Brazil wax
  - Palm wax
  - Cire de carnauba (French)
- Local Names (in some regions of India): Not widely known under local names due to being imported

2. Biological Name

- Botanical Source: *Copernicia prunifera* (syn. *Copernicia cerifera*)
- Part Used: Leaves (wax is obtained from the surface of dried leaves)

3. Family

- Arecaceae (Palm family)

4. Description

Plant Description:

- Type: Tall palm tree
- Height: Up to 15 meters
- Habitat: Native to northeastern Brazil
- Leaves: Fan-shaped, coated with a naturally occurring wax
- Collection: Wax is harvested by drying and beating the leaves to release the coating

Carnauba Wax Description:

- Appearance: Hard, brittle flakes or powder
- Color: Light yellow to pale brown
- Odor: Odorless or slightly earthy
- Taste: Tasteless
- Melting Point: 82–86°C (much higher than beeswax or cocoa butter)
- Solubility: Insoluble in water; soluble in alcohol and oils when heated
- Stability: Very stable; has a long shelf life and high melting point

5. Medicinal & Other Uses

🔸 *Pharmaceutical Uses*

- Used as a coating agent in tablets and pills for controlled or delayed release
- Provides water resistance and gloss to medicinal capsules

🔸 *Cosmetic Uses*

- Common in lip balms, lotions, creams, mascaras, and deodorants
- Provides texture, stability, and natural gloss

🔸 *Dental Care*

- Used in dental floss coatings to improve glide and durability

🔸 *Hypoallergenic Properties*

- Non-toxic, non-comedogenic, and suitable for sensitive skin

🔸 *Food Industry (Non-Medicinal)*

- Approved as a food-grade polish (E903) for candies, fruits, and tablets

🔸 *Protective Agent*

- Used in car polishes, furniture wax, leather finishes, and shoe polishes — forms a strong, water-resistant, glossy coating

3}Coconut oil:

1. Synonyms

- Common Name: Coconut oil
- Other Names:
    - Nariyal ka tel (Hindi)
    - Thengai ennai (Tamil)
    - Kobbari nune (Telugu)
    - Narikel tel (Bengali)
    - Copra oil
- Latin/Traditional Synonym: Oleum cocois

2. Biological Name

- Botanical Name: *Cocos nucifera* Linn.
- Part Used: Dried kernel of the fruit (copra)

3. Family

- Arecaceae (Palm family)

4. Description

Plant Description:

- Type: Tall, unbranched palm tree
- Height: 15–30 meters
- Leaves: Long, feather-shaped (fronds)
- Fruit: Large, fibrous drupe (coconut)
- Origin: Grown in tropical regions, especially coastal areas of India, Sri Lanka, the Philippines, and Indonesia

Coconut Oil Description:

- Appearance: Clear liquid at warm temperatures; solid white at temperatures below 24°C
- Odor: Pleasant, characteristic coconut scent
- Taste: Mild and nutty
- Solubility: Insoluble in water; soluble in alcohol and oils

- Types:
    - Virgin coconut oil – extracted without heat or chemicals
    - Refined coconut oil – processed for cooking and industrial use

5. Medicinal Uses

🔸 *Skin and Hair Care*

- Moisturizer: Used to hydrate dry skin
- Hair oil: Promotes hair growth and reduces dandruff
- Soothing agent: Useful in eczema, psoriasis, and dermatitis
- Lip balm: Used for chapped lips and cracked heels

🔸 *Antimicrobial and Antifungal*

- Rich in lauric acid, which has antibacterial, antifungal, and antiviral properties
- Helps treat skin infections, wounds, and fungal conditions like ringworm

🔸 *Digestive and Metabolic Health*

- Aids in digestion and absorption of fat-soluble vitamins
- MCTs (medium-chain triglycerides) boost metabolism and energy levels

🔸 *Wound Healing*

- Speeds up healing of minor cuts and burns
- Forms a protective layer to keep out dust and microbes

Safety and Suitability

- Generally safe for all skin types
- Non-comedogenic score: 4 (may clog pores in acne-prone skin)
- Edible, medicinal, and cosmetic applications are well-established

4}Peppermint oil:

1. Synonyms

- Common Names: Peppermint oil, Mentha oil
- Botanical Synonyms: *Mentha* × *balsamea* Willd., *Mentha* × *officinalis* Hull, *Mentha* × *piperita* L.

- Local Names in India:
    - Hindi: Pudina ka tel

2. Biological Name

- Botanical Name: *Mentha* × *piperita* L.
- Family: Lamiaceae (Mint family)
- Origin: A natural hybrid of watermint (*Mentha aquatica*) and spearmint (*Mentha spicata*)

3. Medicinal Uses

🔹 Digestive Health

- Irritable Bowel Syndrome (IBS): Peppermint oil, particularly in enteric-coated capsules, has been shown to alleviate symptoms of IBS, including abdominal pain and bloating. Indigestion and Nausea: Traditionally used to relieve indigestion, flatulence, and nausea.
- 🔹 Respiratory Relief
- Cough and Cold: The menthol in peppermint oil acts as a decongestant and can help relieve symptoms of colds and coughs.
- Sinus Relief: Inhalation of peppermint oil vapor can aid in clearing nasal congestion.

🔹 Pain and Muscle Relief

- Headaches: Topical application of diluted peppermint oil on the forehead has been found to reduce tension headaches.
- Muscle Aches: Due to its analgesic and anti-inflammatory properties, it's used in balms and ointments for muscle pain relief.

🔹 Skin Applications

- Antimicrobial Properties: Exhibits antibacterial and antifungal activities, making it useful in treating minor skin irritations.
- Itch Relief: Provides a cooling sensation that can alleviate itching from insect bites and rashes.

🔹 Aromatherapy and Mental Clarity

- Stress Reduction: The invigorating scent is used in aromatherapy to reduce stress and enhance mental clarity.
- Fatigue: Inhalation can help combat fatigue and improve alertness.

5. Safety and Precautions

- Dilution: Essential oil should be diluted before topical application to prevent skin irritation.
- Infants and Young Children: Should not be applied near the face of infants or young children due to the risk of respiratory issues.
- Pregnancy and Nursing: Consult a healthcare provider before use.
- Allergic Reactions: Patch testing is recommended to rule out allergic responses.

5}Borax:

1. Synonyms

- Common Names:
  - Borax
  - Sodium borate
  - Sodium tetraborate
  - Disodium tetraborate

2. Chemical/Biological Name

- Chemical Formula: $Na_2B_4O_7 \cdot 10H_2O$
- IUPAC Name: Sodium tetraborate decahydrate

3. Classification / Family

- Inorganic compound
- Belongs to: Borates (salts of boric acid)
- It is a naturally occurring mineral composed of sodium, boron, oxygen, and water.

4. Description

- Appearance: White crystalline powder or colorless crystals
- Solubility: Soluble in water; forms an alkaline solution
- Taste: Slightly sweet and alkaline
- Source: Naturally mined from boron-rich deposits (e.g., Turkey, USA, India)
- Other Forms: Available as powder, crystals, or pellets

5. Medicinal Uses

🔹 Traditional Ayurvedic and Unani Uses

- Used in fever, respiratory disorders, and urinary infections
- Applied as an ingredient in herbal formulations for sore throat and mouth ulcers

🔹 Topical Antiseptic

- Mouth Ulcers: Borax mixed with honey is used for healing
- Eye Wash: Mild borax solutions have been used as eye cleansers
- Skin Infections: Has mild antifungal and antibacterial properties

🔹 Other Uses

- Oral Rinses: Used in small doses for treating gum inflammation
- Buffering Agent: Used in pharmaceuticals and cosmetics to stabilize pH
- Anti-inflammatory: Traditionally used to reduce joint pain and inflammation

LITERATURE SURVEY:-

1. Perumal SR, Ignacimuthu S, et al. (2008).

Conducted initial screening of various ethnomedicinal plant used in Indian traditional medicine. Identified several plant species with promising pharmacological properties. Highlighted the potential of these plants for further investigation in drug discovery, including wound healing.

2. Fabricant DS, Farnsworth NR, et al. (2001).

Emphasized the significant contribution of traditional medicinal plants to modern drug development. Reported that over 25% of modern drugs are derived from ethnobotanical sources. Advocated for scientific validation of traditional knowledge to identify novel therapeutic agents.

3. Priya KS, Gnanamani A, et al. (2002).

Evaluated the wound healing effects of Datura alba in an animal model. Found that the plant extract significantly improved wound contraction and tissue regeneration. Provided experimental evidence supporting the traditional use of the plant in burn wound treatment.

4. Steenkamp V, Mathivha E, Gouws MC, et al. (2004).

Investigated South African medicinal plants for their wound healing-related properties. Demonstrated antibacterial and antioxidant activity, along with stimulation of fibroblast growth. Suggested that these effects are beneficial for wound healing and tissue repair.

5. Principe P, et al. (2005).

Discussed the economic importance of preserving and utilizing medicinal plants. Highlighted the potential of plant-based products in the pharmaceutical industry. Encouraged investment in bioprospecting and conservation to harness medicinal plant benefits.

MATERIALS AND METHODS:-

- Ingridients and role:-

Sr.no	INGREDIENT	ROLE
1	Guava leaf extract	antifungal
2	Water/ethanol	solvent
3	Carnauba wax	emulsifier
4	Coco butter	moisturizer
5	Coconut oil	Oil
6	Borax	vehicle
7	Peppermint oil	Flavouring agent

- Formulation table of ingridients :-

Sr.no	INGRIDIENTS	F1	F2	F3
1	Guava leaf extract	10ml	5ml	3ml
2	Ethanol/water	200ml	250ml	200ml
3	Carnauba wax	5gm	10gm	10gm
4	Coco butter	20gm	10gm	15gm
5	Coconut oil	10ml	5mlml	5ml
6	Borax	1gm	2gm	2gm
7	Peppermint Oil	1ml	2ml	1ml

- Method :

1] Preparation of guava leaf powder :

Fresh guava leaves were collected and air dried for 10 days. The dried leaves were then crushed and churned in a blender to form a coarse powder. The powder was collected in an air tight container and stored in a cool, dry place, away from sunlight.

2] Prepartion of ethanol/methanol/water extract of guava leaf powder :

(extraction was done by decoction method)

We have to extract flavonoid from the guava leaf. To extract this phytochemical we will require polar solvents,such as methanol,ethanol or water are suitable for extracting.

1. Now ,firstly prepare the setup for decoction extraction process.
2. Add required amount of polar solvent (250ml) in a round bottom flask.
3. Now, keep the flask on a heating mantle and heat it till it reaches the temperature of 60*-70*C temperature.
4. Now, add the weighed amount of guava leaf powder i.e 10-20 gm into the RBF and allow it to boil for 15-20 minutes at 80* C.
5. Stire the mixture while boiling.
6. After boiling switch off the heating mantel and remove the RBF and allow it to come in room temperature.

7.After cooling filter the mixture through filter paper or by vaccum filteration.

8.Now your extraction is ready.

3] Preparation of oil phase

1. Put the coco butter and carnauba wax in a small beaker as per given quantity and heat it at 50*C
2. Stire the mixture continuously until it melts down.
3. Now add the coconut oil in the mixture and stire it until it continuously mixses.
4. The oil phase is ready.

4] Preparation of water phase:

1. Take a required amount of borax in a small beaker.
2. Now add small quantity of water in it.
3. Now heat it on heating mantel for 1-2 minutes.

5] Addition of both the phase:

1. Now add the water phase in an oil phase slowly while continue stireing.
2. The mixture is ready.

6] Adddition of extraction:

1. Now add the given quantity of extraction in a cream base.
2. Now add the few drops of peppermint oil in a mixture.
3. Now stire the mixture continuously until it mixes well.
4. After that allow the mixture to cool at room temperature.

7] Packaging:

1. Now transfer the mixture in a small plastic container or in a tube after that store the product in a cool dry place and away from sunlight.

❖ **Evaluation Tests :**

1) Physical Evaluation**:** Physical parameters such as color, odor and consistency were checked visually.

- Color – The color of the formulations was checked by visual inspection.
- Consistency – The consistency of the formulations was checked by applying on skin.
- Odour – The odor of the formulations was checked by mixing the cream in water and observing the smell.

2) pH:
Measurement of pH The pH of the gel formulation were determined by using digital pH meter.1gm of gel was taken and dispersed in 10 ml of distilled water and keep aside for two hours . The measurement of pH of formulation was carried out in three times and the average values are reported.

3) Spread ability:
A glass plate with a circle that was already marked with a 1 cm diameter was coated with 0.5 g of gel to test the spreadability. 250g of weight was placed on the top glass plate and left there for five minutes.
The formula was used to calculate it is,

$$S = M \times L/T$$

L = Length of glass slide.
T = Time required to separate the slides.

RESULT AND DISCUSSION:-

Physical Evaluation:

Sr. no.	Test	Observation
1.	Colour	Pale yellow
2.	Odour	Pleasant
3.	Consistency	Semisolid

pH:
The Determination of pH of Formulated Ointment is 6.4.

Spreadability:

Sr. No.	Formulation	Spreadability
1.	2% w/w	Good

Discussion:

- Determination of Total Flavonoid Content

All prepared extracts were investigated for total flavonoid content against the calibration curve of rutin as a standard. Results are summarised and it indicated that hydro alcoholic extract contains the highest amount of rutin.

- Antifungal Test of Extract

After confirmation and determination of total content of f lavonoids in prepared extracts, an antifungal test was carried out by zone of inhibition. Test was performed to check effectiveness against Candida albicans. Results are shown in Figure 1 and summarized in . A hydroalcoholic extract found to be more effective as the highest zone of inhibition than other prepared extracts. Based on the obtained results, the hydroalcoholic extract showed maximum flavonoid content and highest zone of inhibition and henceforth it was considered as optimized extract and used for further evaluation.

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