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Formulation And Evaluation Of Herbal Cream For Treatment Of Paronychia

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Abstract:
The purpose of this study was to create and evaluate a herbal cream that was intended to treat paronychia, with an emphasis on safety, stability, and effectiveness. The antibacterial property of some botanical extracts was utilized in the formulation of the cream. Antimicrobial activity against common microorganisms causing paronychia is assessed in order to evaluate effectiveness. To verify the cream's safety profile, safety evaluations included microbiological investigations, skin irritation testing, and assessments of allergic reactions. Studies on stability were carried out under various storage settings in order to evaluate the cream's long-term effectiveness and shelf-life. The herbal cream showed strong antibacterial and anti-inflammatory qualities in the results, while safety assessments revealed no unfavourable consequences. According to stability studies, the shelf life was good when stored according to recommendations. Additional clinical trials are necessary to validate the safety and efficacy of this herbal cream as a therapy for paronychia, as it exhibits promising results.

Objective:
The aim of the study was to design and develop a cream base drug delivery system containing combinational herbal drugs (cinnamon oil, neem oil, aloe vera gel and turmeric extract) for the effective treatment of Paronychia.

Result:
The formulated cream showed optimal physicochemical properties, significant antimicrobial activity against paronychia-causing pathogens, and accelerated wound healing in vivo.

Conclusion:
The herbal cream holds promise as an effective and safe treatment for paronychia, offering a natural alternative to conventional therapies. Further clinical validation is needed.

Keywords: *Paronychia, Herbal cream, Topical formulation, Neem oil, Turmeric extract, Cinnamon oil, Aloe vera gel, Antifungal study.*

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I. Introduction:

An infection of the proximal, lateral, and toenail folds, including the tissue encircling the nail's sides and base, is known as paronychia. This disorder may develop on its own, as a result of trauma or manipulation, or both. One of the most prevalent hand infections is paronychia. When the barrier that separates the nail from the nail fold is disrupted, germs are introduced, increasing the risk of infection and leading to paronychia. Acute paronychia often affects just one nail, but if it's brought on by drugs, it may affect many nails.

The ancient discipline of Ayurveda, or Kshudraroga Kunakha, is frequently associated with paronychia. One of the most prevalent outward manifestations of nail illness is kunakha, or nail discolouration. Sushruta Samhita, Astang Samgraha, Ashtang Hridaya, Bhavaprakash, and Sharangadhara Samhita elucidate Kunakha in Kshudraroga. Sushruta Samhita and Bhaishajya Ratanavali describe several local formulations for treating Kunakha, however in this instance, greater attention is placed on the internal administration of numerous medications, which aids in breaking the foundation Pathophysiology, in addition to exterior application.

With a female to male ratio of three to one, paronychia is more prevalent in women than in males. They typically affect those who perform manual labour or individuals who work in jobs where they must spend a lot of time in the water with their hands or feet immersed (like dishwashers). Females in their middle years are most vulnerable to infection.

These days, a variety of techniques are employed as diverse mechanisms for topical medications that may be administered directly to the body, such as spreading, rubbing, spraying, and instillation. One of the best ways to treat skin problems is by topical medication application, which can also improve systemic and non-systemic drug delivery. Nail matrix, nail plate, nail bed, cuticle, and nail folds make up the nail's structure (fig).

The two parts of the nail bed—the sterile matrix and the germinal matrix—are responsible for the migration, formation, and maintenance of nails.

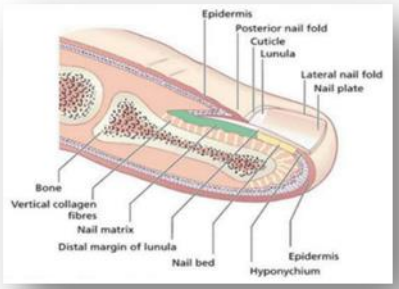

Figure 1 Longitudinal section of nail

An example of an inflammatory illness is paronychia, which affects the tissues around the nail plate. It is the most common illness affecting the hands. There are two basic forms of paronychia: acute and chronic. The most common causes of acute paronychia include manicures, long nails, and nail biters. The etiology of the condition is that this kind of infection will rupture the soft tissue seal on the dorsal side of the nail, allowing the offending organism to enter and establish colonies after an abscess has formed. The bacterium that causes the illness, Staphylococcus aureus, is what causes it to begin in the lateral nail folds and spread to other areas. Acute Paronychia is not the same as chronic Paronychia, which is a persistent type infection that mostly affects the eponychium. The majority of cases of paronychia occur in those who have regular exposure to alkali, water, etc. The genesis is comparable to acute paronychia. It is brought on by a bacterial infection, which is followed by a super infection and the development of an epithelial colony with a fungal like Candida albicans. Longitudinal grooves on the nail plate surface and long-term damage to the germinal tissues in the eponychium are the features that indicate chronic paronychia. Figure 2 shows the afflicted fingers for both acute and chronic Paronychia.

Figure 2 Acute and chronic paronychia affected fingers

II. Classification Of Paronychia

Depending upon the conditions Paronychia are classified as:

Acute Paronychia: -

The majority of individuals with acute paronychia gnaw their nails. Ed hot, sore nail folds with or without abscesses are its defining feature. The situation of acute paronychia is depicted in Figure 1 below. The main microbe that causes illness is Staphylococcus aureus, or S. aureus. Acute Paronychia can also be caused by pseudomonas and anaerobes. Acute paronychia symptoms arise on their own and are paronychial in nature. Usually, the area looks red and swollen.

Figure 3 Acute paronychia

Chronic Paronychia: -

An inflammation that lasts more than six weeks and is marked by redness, pain, swelling, fluid under the nail folds, and thick, discoloured nail is known as chronic paronychia. The state of chronic paronychia is seen in the image below. Nail plate may have longitudinal grooves and thickening. Recurrent edema, fibrosis, induration, and inflammation of the nail folds can result in a lack of an efficient seal, which prolongs moisture retention and allows organisms and irritants to enter the groves, eventually leading to chronic paronychia. Chronic paronychia is a persistent kind of illness that primarily affects those who have been clinically exposed to alkali, water, etc. Ninety percent of chronic paronychia is caused by Candida albicans, also known as C. albicans. Chronic paronychia can also be caused by other infections, such as atypical mycobacteria, Gram-negative rods, and Gram-negative cocci.

Classification also bases on type of microorganisms
Bacterial: **-** commonly staphylococci
Viral: - commonly Herpes simplex virus
Fungal: **-** commonly Candida species
Non-infectious causes of paronychia can include contact irritants, excessive moisture, and medication reaction.

Figure 4 Chronic paronychia

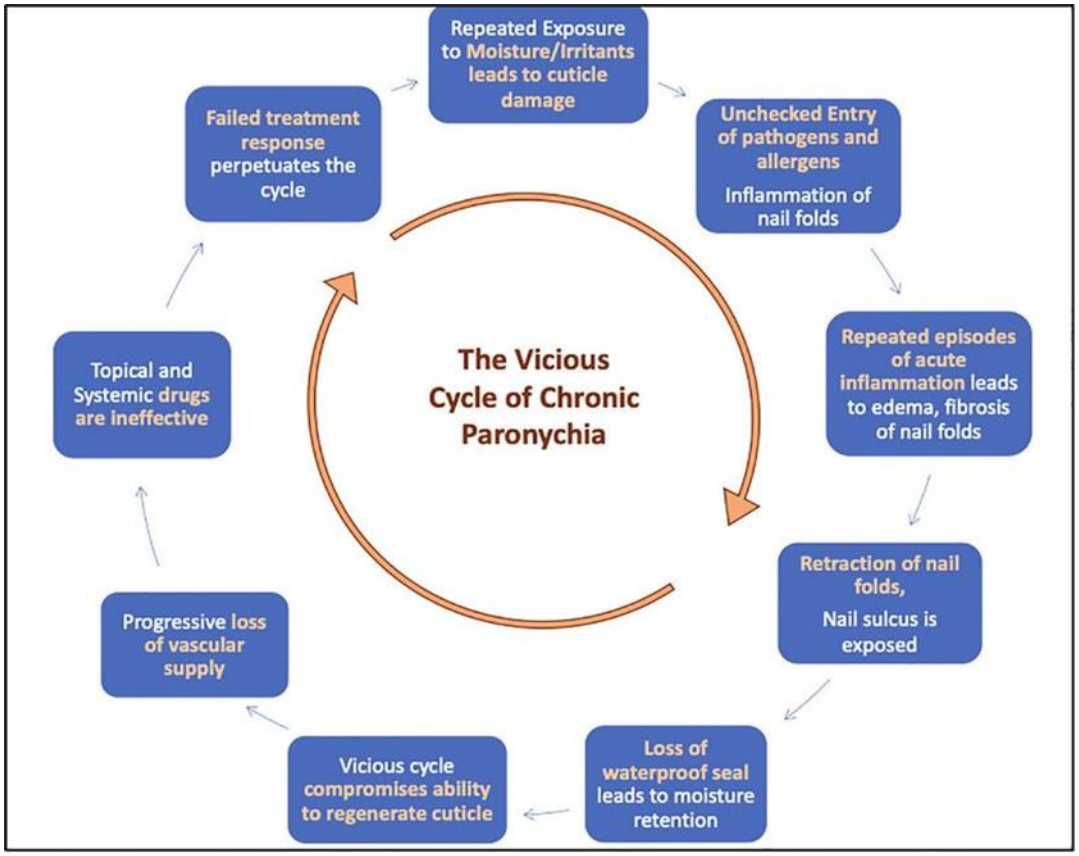

Figure 5 Pathophysiology of Paronychia

Pathophysiology: -

Causes Of Paronychia

- Cuts, broken skin or hangnails.
- Ingrown nails (this happens most often with ingrown toenails).
- Irritation from water or chemicals.
- Also cause by microbial infection like fungal, viral and bacterial.
- Trauma to the nailbed or cuticle area. Trauma can result from accidents, nail biting or frequent manicures or pedicures.
- Some medications can also cause paronychia. Some of these medications include retinoids, anti-cancer medications, HIV medications and some antibiotics.

DIAGNOSIS: -

- In most cases, a doctor can easily diagnose paronychia with a physical examination. They will also consider a person's medical history and look for risk factors, such as diabetes.
- In some cases, a doctor may require a sample of any pus that is present. They can send this to a laboratory for analysis to check whether bacteria or fungi are causing the infection.

PREVENTIVE MEASURES: -

- The patient should be instructed to wear light cotton gloves to avoid the contact with moisture, irritants etc.
- Use heavy waterproof gloves when performing "wet work" or handling irritants.
- Cosmetic nail products of all kinds should be avoided.
- Pushing the cuticles back aggressively and commercial cuticle treatments can be harmful to patients with paronychia.
- Gloves should be worn in cold, windy weather to avoid drying and chapping which may leads to paronychia.
- Provide warm soak for the fingers if any irritation or discomfort occurs in the nail.

Current treatment available for paronychia are:

Topical Therapy

There are several topical antifungal preparations available. Clotrimazole is primarily used for the management. The active antifungal agents in the preparation are either an imidazole, an allylamine or polyene or a preparation that contain a chemical with antifungal, antiseptic and keratolytic properties such as benzoic acid, benzyl peroxide. Topical therapy has the greatest potential as primary therapy in mild infection as prophylactic agents.

Oral Therapy

Oral antifungal agents have achieved greater success rate than topical therapies for the paronychia. Oral antibiotics like Clindamycin (Cleocin) and the combination of amoxicillin–clavulanate potassium (Augmentin) are effective against pathogens causing paronychia. Terbinafine are most commonly used antifungal to treat paronychia as well as dermatophyte infection and Griseofulvin was the first approved antifungal drug by US food and drug administration. Oral systemic antifungal therapy is limited by its toxicity, drug interactions, contraindications, high cost of medication, increased microbe resistance, a long duration of treatment, and relapse is very common.

The common side effects caused with the oral drug formulation are hypersensitivity reactions such as skin rashes, gastric effects such as nausea, head ache, vomiting, and upset of stomach and also cause changes in the menstrual periods.

Surgical avulsion

Surgical management is only indicated in recalcitrant cases of chronic paronychia, which does not respond to medical management and proper use of general measures. Surgical treatment involves the removal of the chronically inflamed tissue, which aids in effective penetration of topical as well as oral medications and regeneration of the cuticle. It should only perform under anaesthesia. The nail fold containing pus is incised with a no.11 or no.15 scalpel, towards the nail bed. Along with surgical management, oral antibiotics are also prescribed. The nail fold containing surgical avulsion is performed both distally and proximally. But this method showed to have high drop out and poor patient compliance.

Laser treatment

Laser makes use of photo selective effects to eliminate infection. Neodymium-doped yttrium aluminium garnet (Nd: YAG) laser is effectively used for the treatment of paronychia. The procedure was performed using long pulsed1064-nm Nd: YAG laser, at a rate of 70 to 80 J/cm2using a 2.5-mm spot size hand piece for 0.7ms. The Nd: YAG laser decreases inflammation by targeting water as chromophore and generate heat in the dermis via photo thermolysis. It also acts by suppressing interleukin IL- 8 and thereby causing alternation of vascular permeability and tissue permeation. The Nd: YAG laser treatment also act by direct fungicidal effects.

III. Creams

Cream is described as semisolid emulsions of the water in oil (w/o) or oil in water (o/w) type that are meant to be applied externally. Cream is divided into two categories: water in oil emulsion and oil in water. Its primary function is to stay longer at the application site when applied to the outer or superficial layers of the skin. A skin cream's purpose is to protect the skin from various environmental factors and weather conditions while also providing calming effects.

Herbal Cream:

The herbal cream is just an emulsion of water and oil. The following natural components were used to prepare the herbal cream: neem, papaya, aloe vera, Tulsi, and turmeric. These substances were selected based on their unique qualities.

Preparation Methods:

Preparation Method	Description
1. Infusion Method	This involves infusing dried herbs or botanicals in a carrier oil (such as olive oil, coconut oil, or almond oil) over a period of time to extract their beneficial properties. The infused oil is then combined with other ingredients like beeswax and essential oils to create a cream.
2. Double Boiler Method	In this method, herbal-infused oils and other ingredients are combined in a double boiler and gently heated until they melt and blend together. This ensures that the ingredients are heated evenly and prevents them from burning.
3. Emulsion Method	This method involves combining water-based ingredients (such as herbal teas or hydrosols) with oil-based ingredients (such as infused oils and beeswax) using an emulsifier (such as beeswax or vegetable-based emulsifying wax). The mixture is heated and blended until a creamy consistency is achieved.

4. Cold Cream Method	Cold creams are emulsions that do not require heat during preparation. Instead, they are made by blending oil-based ingredients with water-based ingredients using a high-speed blender or mixer until a smooth, creamy consistency is achieved.
5. Whipped Method	Whipped herbal creams are made by whipping together solid fats (such as shea butter or cocoa butter) with liquid oils (such as herbal-infused oils) using a hand mixer or stand mixer until a fluffy, whipped texture is achieved. This method creates a light and airy cream that is easy to apply.
6. Maceration Method	In this method, dried herbs or botanicals are macerated (crushed or ground) and then steeped in a carrier oil for an extended period to extract their properties. The infused oil is then strained and used as a base for the cream.

Plant Profile:

Figure 6 Neem

Neem

Synonyms: - Antelaea azadirachta, Arishta, Arishtha, Azadirachta indica, Bead Tree, Holy Tree, Huile de Neem, Indian Lilac, Indian Neem, Lilas des Indes, Lilas de Perse, Margosa, Margosa Tree, Melia azadirachta, Nim, Nimb, Nimba.

Botanical name: - Azadirachta indica A.

Family: - Meliaceae

Geographical source: - Neem is native to the whole Indian subcontinent; others attribute it to dry forest areas throughout all of South and Southeast Asia, including Pakistan, Sri Lanka, Thailand, Malaysia, and Indonesia. It is in India that the tree is most widely used.

Morphology: - Neem trees are attractive broad-leaved evergreens that can grow up to 30 m tall and 2.5 m in girth. Their spreading branches form rounded crowns as much as 20 m across. They remain in leaf except during extreme drought, when the leaves may fall off.

Active constituents: - The major phytochemicals present in Neem are glycoproteins, triterpenes, limonoids, flavonoids, phenols, tannins, nimbins, saponins, catechins, azadirachtin and gallic acid.

Plant part use: - All parts of the neem tree- leaves, flowers, seeds, fruits, roots and bark have been used traditionally for the treatment.

Medicinal uses: - Immunomodulatory, Anti-inflammatory, Antihyperglycemic, Antiulcer, Antimalarial, Antifungal, Antibacterial, Antiviral, Antioxidant, Antimutagenic and Anticarcinogenic.

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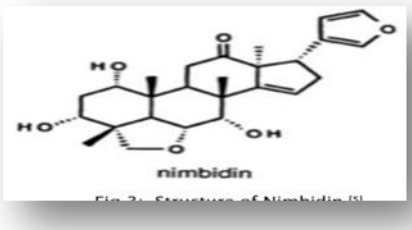

Figure 7 Structure of Nimbidin

NIMBIDIN

Chemical Structure:

Nimbidin is a complex tetranortriterpenoid. It consists of multiple functional groups, including hydroxyl (-OH), carbonyl (C=O), and double bonds, which contribute to its pharmacological activity.

Therapeutic Uses:

Skin Disorders: Nimbidin is used topically in the treatment of various skin conditions such as acne, eczema, psoriasis, and fungal infections.

Gastrointestinal Disorders: It may help alleviate symptoms of gastrointestinal disorders like ulcers, gastritis, and colitis.
Infectious Diseases: Nimbidin is effective against microbial infections including bacterial, fungal, viral, and parasitic infections.
Inflammatory Conditions: It is used to manage inflammatory conditions such as arthritis, rheumatism, and inflammatory bowel disease.
Diabetes: Nimbidin shows potential in managing diabetes by regulating blood sugar levels.
Liver Disorders: It is used to support liver function and treat liver disorders such as hepatitis and cirrhosis.
Cancer: Nimbidin is being investigated for its anticancer properties and its potential role in cancer prevention and treatment.

TURMERIC

Figure 8 Turmeric powder

Synonym: Curcumin, Curcuma, Curcuma aromatica, Curcuma domestica, Curcuma longa, Curcuma longae rhizome, Curcumin, Curcumin, Curcuminoid, Haldi. Common Turmeric, Indian Saffron.
Botanical name: - Curcuma longa
Family: - Zingiberacea
Geographical source: It is a perennial herb distributed throughout tropical and sub-tropical regions of the world including India, Pakistan, Bangladesh and Sri Lanka.
Morphology: Turmeric is a perennial herbaceous plant that reaches up to 1 m (3 ft 3 in) tall. It has highly branched, yellow to orange, cylindrical, aromatic rhizomes. The leaves are alternate and arranged in two rows. They are divided into leaf sheath, petiole, and leaf blade.
Active constituent: Curcuminoids, desmethoxycurcumin, and bisdemethoxycurcumin, as well as volatile oils, sugars, proteins, and resins.
Plant Part use: - Rhizomes or underground stems.
Medicinal properties: - Anticancer, Antimicrobial, Anti-inflammatory, Antidiabetic and Antioxidant, etc.

Drug Profile

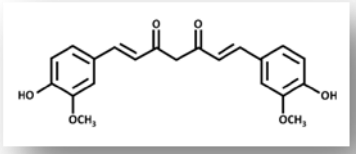

Figure 9 Chemical of curcumin

Curcumin
Chemical Structure:
Curcumin is a polyphenolic compound belonging to the curcuminoid family.

Its chemical structure consists of two methoxyphenol rings linked by a seven-carbon chain containing two conjugated double bonds (1,7-bis(4-hydroxy-3-methoxyphenyl)-1,6-heptadiene-3,5-dione).

Therapeutic Uses:
Anti-inflammatory Conditions: Curcumin is used to manage inflammatory conditions such as arthritis, rheumatism, and inflammatory bowel disease.
Antioxidant Support: It is used to combat oxidative stress and prevent age-related diseases associated with free radical damage.
Cancer Prevention and Treatment: Curcumin is investigated for its potential role in cancer prevention and adjunctive treatment due to its anticancer properties.
Neurological Disorders: It may help prevent or alleviate symptoms of neurodegenerative diseases like Alzheimer's and Parkinson's disease.
Cardiovascular Health: Curcumin supports heart health and may help prevent cardiovascular diseases.
Digestive Health: Curcumin aids digestion, supports gut health, and may alleviate symptoms of conditions like indigestion and irritable bowel syndrome.
Skin Conditions: It is used topically in skincare products for its anti-inflammatory and antioxidant properties, benefiting conditions like acne, eczema, and psoriasis.

Cinnamon

Figure 10 Cinnamon bark

Synonyms: - Ceylon cinnamon, Daalchini
Botanical name: - Cinnamomum zeylanicum
Family: - Lauraceae
Geographical source: - Cinnamon is native to Sri Lanka (formerly Ceylon), the neighbouring Malabar Coast of India, and Myanmar (Burma) and is also cultivated in South America and the West Indies.
Morphology: - Leaves on cinnamon plants are oval lanceolate, rough textured and short. The greenish flowers on the plant have a characteristic odor whereas the fruit is one-seeded berry of 1 cm size. Cinnamon is obtained in the form of quills (single or double) with longitudinal striations.
Active constituents: - Cinnamaldehyde, Cinnamate, Cinnamic acid, Minerals, Vitamins, and Essential oils etc.
Plant part use: - Bark and Leave's
Medicinal uses: - Antioxidant, Anti-inflammatory, Antidiabetic, Antimicrobial, Anticancer, Lipid-lowering, and Cardiovascular-disease-lowering compound.

Drug Profile

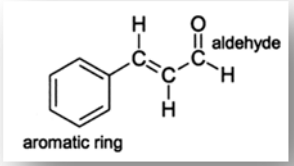

Figure 11 Cinnamaldehyde structure

Cinnamaldehyde
Chemical Structure:

Cinnamaldehyde is an aromatic aldehyde with the chemical formula C9H8O. Its chemical structure consists of a benzene ring substituted with an aldehyde group (-CHO) and an unsaturated hydrocarbon tail.

Therapeutic Uses:
Gastrointestinal Health: Cinnamaldehyde is used traditionally to alleviate digestive issues such as indigestion, bloating, and nausea.
Antimicrobial Applications: It is used as a natural preservative in food products to inhibit the growth of bacteria and fungi.
Dental Health: Cinnamaldehyde is found in some oral care products due to its antimicrobial properties and potential for combating bad breath.
Anti-inflammatory Remedies: It may be used to reduce inflammation associated with conditions like arthritis and inflammatory bowel disease.
Blood Sugar Regulation: Cinnamaldehyde supplements are sometimes taken to help manage blood sugar levels, particularly in individuals with diabetes or insulin resistance.
Cardiovascular Support: It is studied for its potential cardiovascular benefits, including its effects on blood pressure, cholesterol levels, and circulation.

Plant Profile

Figure 12 Aloe vera leaves

Aloe Vera
Synonym: - Acemannan, Aloe africana, Aloe barbadensis, Aloe capensis, aloe-coated gloves, Aloe mucilage, Aloe natalenis, Aloe Perfoliata, Aloe Perry Baker, Aloe Saponaria, Aloe spicata, Aloe vulgari, Aloe Vera Barbenoids, Aloe Vera Gel, Aloes, bitter aloe, Burn Plant, Cape Aloe.
Botanical name: - Aloe barbadensis miller.
Family: - Liliaceae
Geographical source: - Aloe species are mostly inhabitants of arid climates, and are widely distributed in Africa, India, and other arid areas.
Morphology: - The plant has triangular, fleshy leaves with serrated edges, yellow tubular flowers and fruits that contain numerous seeds.
Active constituent: - Vitamins, Enzymes, Anthraquinone, Minerals, Sugar, Lignin, Saponins, Salicylic acids and Amino acids.
Plant Part use: - Leaves
Medicinal uses: - Anticancer, Antioxidant, Antidiabetic, and Antihyperlipidemic, Anti-inflammatory, Anti-acne effect, Wound healing, Anti-aging effect, Moisturizing Effect.

DRUG PROFILE

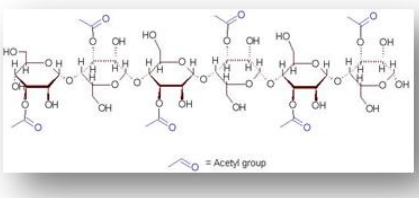

Figure 13 Structure of Acemannam

Acemannan
Chemical Structure: Acemannan is a complex polysaccharide composed mainly of mannose, glucose, and galactose molecules.
Therapeutic Class: Biologic response modifier, wound healing agent, immunomodulator
Mechanism of Action:
Wound Healing: Acemannan promotes wound healing by stimulating fibroblast proliferation, collagen synthesis, and angiogenesis (formation of new blood vessels). It also possesses antimicrobial properties, which help prevent wound infections.
Anti-inflammatory: Acemannan exhibits anti-inflammatory effects by inhibiting the production of pro-inflammatory cytokines and modulating the immune response.

IV. Extraction Of Neem Seed Oil: (Soxhlet Extraction Method)

Preparation of Neem Seeds: Neem seeds are collected from mature fruits and cleaned to remove any foreign matter like dust, dirt, or debris. This ensures that the extraction process is conducted with clean seeds.
Drying: The cleaned neem seeds are dried thoroughly to reduce their moisture content. Proper drying is crucial to prevent mold growth and to facilitate efficient oil extraction.
Grinding: The dried neem seeds are ground into a fine powder. Grinding increases the surface area of the seeds, facilitating better extraction of oil.
Weighing: A known amount of the ground neem seed powder is accurately weighed and placed into a cellulose thimble. The thimble prevents the powder from escaping into the solvent during extraction.
Assembly of Soxhlet Apparatus: The Soxhlet apparatus consists of a round-bottom flask, a condenser, and an extraction chamber. The thimble containing the neem seed powder is placed in the extraction chamber. The round-bottom flask is filled with a suitable solvent, typically petroleum ether or hexane, which has a lower boiling point than the oil being extracted.
Extraction: The apparatus is assembled, and the extraction process is initiated. The solvent in the round-bottom flask is heated, causing it to vaporize. The vapor rises through the Soxhlet arm and enters the extraction chamber, where it comes into contact with the neem seed powder. The solvent dissolves the oil present in the seeds and forms a solution.
Cycling: Once the solvent reaches the top of the Soxhlet extractor, it overflows into the round-bottom flask due to siphoning action. This cycle continues, with fresh solvent continuously being refluxed through the neem seed powder. This ensures thorough extraction of the oil from the seeds.
Concentration of Extract: The extracted oil-solvent mixture collected in the round-bottom flask is concentrated by evaporating the solvent under reduced pressure, typically using a rotary evaporator or a distillation setup. This leaves behind the crude neem seed oil.
Solvent Recovery (Optional): If desired, the solvent can be recovered from the crude oil using solvent recovery techniques like distillation, and reused in subsequent extractions to minimize waste and reduce costs.
Oil Refining (Optional): Depending on the desired quality of the neem seed oil, further refining steps may be employed to remove impurities, such as filtering, degumming, neutralization, bleaching, and deodorization.
Packaging and Storage: The extracted neem seed oil is packaged into suitable containers for storage and distribution. Proper packaging helps to protect the oil from light, heat, and air, which can degrade its quality over time.

Figure 14 Soxhlet Extraction

V. Extraction Of Curcumin: (Maceration)

Prepare the turmeric: Start with fresh turmeric roots or high-quality turmeric powder. If using fresh turmeric, wash and peel the roots.
Cut or grind: Chop the turmeric roots into small pieces or use a grinder to create a coarse powder. This increases the surface area and aids in extraction.
Choose a solvent: Common solvents for curcumin extraction include alcohol (such as ethanol or isopropanol), water, or oil (such as coconut oil or olive oil). Each solvent has its own advantages and yields different types of extracts.
Alcohol: Alcohol is often used for its efficiency in extracting curcumin. Use food-grade alcohol and ensure it's at least 60-70% alcohol by volume.
Water: Water extraction is milder compared to alcohol extraction and may not yield as potent an extract, but it's a good option if you prefer an alcohol-free extract.
Oil: Oil extraction is suitable for creating infused oils. It's not as efficient at extracting curcumin as alcohol, but it's a good option for culinary purposes or for making topical applications.
Combine turmeric and solvent: Place the chopped or ground turmeric in a clean, dry glass jar or container. Pour the solvent over the turmeric until it's fully submerged.
Mix and seal: Gently stir the mixture to ensure all the turmeric is in contact with the solvent. Seal the jar tightly with a lid.
Macerate: Place the sealed jar in a cool, dark place away from direct sunlight. Let it macerate for at least a few days to several weeks, shaking the jar occasionally to agitate the mixture.
Strain: After the desired maceration period, strain the mixture through a fine mesh strainer or cheesecloth to separate the liquid extract from the solid turmeric residue.
Store: Transfer the strained extract into a clean, dark glass bottle or container. Store it in a cool, dark place, away from sunlight and heat, to preserve its potency.
Optional: Evaporation: If using alcohol or water as the solvent, you can evaporate some of the solvent to concentrate the extract further. Use gentle heat (such as a double boiler) to evaporate the solvent slowly, taking care not to overheat or boil the extract.
Usage: Use the extracted curcumin as desired, whether in cooking, as a dietary supplement, or for topical applications.

Figure 16 Maceration of turmeric
Figure 15 Curcumin extract

VI. Extraction Of Cinnamon Oil: (Steam Distillation)

Preparation of Cinnamon Bark: Cinnamon bark is collected from cinnamon trees and cleaned to remove any dirt or debris. The bark is then dried to reduce its moisture content, which helps in the extraction process.
Grinding or Chopping: The dried cinnamon bark is typically ground or chopped into smaller pieces to increase the surface area available for steam penetration and oil extraction.
Loading the Distillation Apparatus: The ground or chopped cinnamon bark is placed in the distillation flask of the steam distillation apparatus. The flask is typically fitted with a side arm connected to a condenser.
Water Addition: Water is added to the distillation flask, enough to cover the cinnamon bark but not so much that it completely submerges it. The water serves as the medium for steam generation.
Heating: The distillation flask is heated, causing the water to boil and produce steam. The steam carries the volatile compounds, including cinnamaldehyde, from the cinnamon bark.

Steam Distillation: The steam, along with the volatile compounds, rises from the distillation flask into the condenser. The condenser cools the steam, causing it to condense back into liquid form. The condensed liquid, which now contains the essential oil of cinnamon, including cinnamaldehyde, is collected in a receiver flask.
Separation: Cinnamaldehyde, being less dense than water, floats on the surface of the collected distillate. It can be separated from the aqueous layer using a separating funnel.
Additional Purification (Optional): Depending on the desired purity of the cinnamaldehyde, further purification steps such as filtration, drying, or fractional distillation may be employed.
Packaging and Storage: The purified cinnamaldehyde is packaged into suitable containers for storage and distribution. Proper packaging helps to protect the oil from light, heat, and air, which can degrade its quality over time.

Figure 17 Steam distillation

VII. Extraction Of Acemannan:

Harvesting Aloe vera leaves: The first step is to select mature Aloe vera leaves from healthy plants. The leaves are usually harvested by hand to avoid damaging the plant.
Removing the outer skin: After harvesting, the outer skin of the Aloe vera leaves is removed to expose the inner gel. This can be done manually or with automated machinery.
Extracting the gel: The gel from the inner leaf is then extracted. This can be achieved through various methods such as crushing the leaves or using mechanical or chemical methods to separate the gel from the leaf matrix.
Purification: Once the gel is extracted, it undergoes purification to remove impurities and other components. This can involve filtration, centrifugation, or other separation techniques.

VIII. Formulation Of Herbal Cream:

Materials:

Herbal crud drugs are collected from different sites and extracted at the laboratory scale for further procedure and other required ingredients are check and weight in required quantity.

Formulation table:

Sr. No.	Ingredients	Quantity for F_1	Quantity for F_2
1.	Neem seed oil	01.50 ml	02.50
2.	Turmeric extract	01.50	02.50
3.	Aloe Vera Gel	01.50	01.50
4.	Cinnamon oil	01.50	02.50
5.	Liquid paraffin	15.00	12.00
6.	Bees Wax	04.50	04.50
7.	Borax	00.30	00.30
8.	Methylparaben	00.03	00.03
9.	Distilled water	04.02	04.02
10.	Orange oil	00.3	00.3

Method:

1. In a borosilicate glass beaker, heat the liquid paraffin and beeswax to 75 °C and keep it there (Oil phase).
2. Dissolve borax and methylparaben in distilled water in another beaker. Heat the beaker to 75 °C to dissolve the ingredients and get a transparent solution (aqueous phase).
3. Next, gradually mix the heated oily phase with this watery phase.
4. Next, add a measured amount of the Malabar Neem, Turmeric, and Aloe Vera extracts, and mix well until a creamy cream develops.

5. After that, apply a few drops of orange oil for scent.
6. Spread this cream out on the slab, stir it in a geometric pattern to include all the components and give it a smooth texture, and add a few drops of distilled water if needed.
7. This process of making cream is known as the slab technique or the impromptu approach.

IX. Evalution Of Herbal Cream:

Physical evaluation
In this test, the cream was observed for colour, odour, texture, state.

Irritancy
Mark the area (1 cm) on the left-hand dorsal surface. Then the cream was applied to that area and the time was noted. Then it is checked for irritancy after some time and reported

Wash ability
A small amount of cream was applied on the hand and it is then washed with tap water

pH
0.5 g cream was taken and dispersed in 50 ml distilled water and then pH was measured by using digital PH meter

Viscosity
Viscosity of cream was done by using Brooke field viscometer at a temperature of 25 ℃ using spindle No. 63 at 2.5 RPM

Phase separation
Prepared cream was kept in a closed container at a temperature of 25-100 ℃ away from light. Then phase separation was checked for 24 h for 30 d. Any change in the phase separation was observed/checked

Spread ability
The spread ability was expressed in terms of time in seconds taken by two slides to slip off from the cream, placed in between the slides, under certain load. Lesser the time taken for separation of the two slides better the spread ability. Two sets of glass slides of standard dimension were taken. Then one slide of suitable dimension was taken and the cream formulation was placed on that slide. Then other slide was placed on the top of the formulation. Then a weight or certain load was placed on the upper slide so that the cream between the two slides was pressed uniformly to form a thin layer. Then the weight was removed and excess of formulation adhering to the slides was scrapped off. The upper slide was allowed to slip off freely by the force of weight tied to it. The time taken by the upper slide to slip off was noted.

Spread ability= m × l/t
Where,
m= Standard weight which is tied to or placed over the upper slide (30g)
l= length of a glass slide (5 cm)
t= time taken in seconds.

Greasiness
Here the cream was applied on the skin surface in the form of smear and checked if the smear was oily or grease-like.

X. Result:

Identification test for Limonoids :(Triterpenoids)

Sr. No.	TEST	OBSERVATION	INFERANCE
1.	**Salkowski test:**1ml Malabar neem extract adds in Chloroform then add few drops of Sulfuric acid to it.	Redish brown colour was observed.	Presence of (terpenoid) Nimbidin was detected.
2.	**Iodine test:** 1ml Malabar neem extract adds in Chloroform then add few drops of Iodine solution to it.	Yellow color Precipitate was observed.	Presence of (terpenoid) Nimbidin was detected.
3.	**Vanillin test:**1ml Malabar neem extract add Glacial Acetic acid then add Vanillin reagent to it.	Bluish green colour was observed.	Presence of (terpenoid) Nimbidin was detected.

Identification test for Curcumin :(Resin)

Sr. No.	TEST	OBSERVATION	INFERANCE
1.	**Ferric Chloride test:** 1ml Turmeric extract add some of ferric chloride to it.	Greenish blue color was observed.	Presence of Curcumin (resin) was detected.
2.	**HCl test:** 1ml Turmeric extract add few drops of HCl to it.	Pink color was observed.	Presence of Curcumin (resin) was detected.
3.	**Boric acid test:** 1ml Turmeric extract add some of boric acid to it.	Redish brown color was observed.	Presence of Curcumin (resin) was detected.
4.	**Sulfuric acid test:** 1ml turmeric extract add few drops of H_2SO_4 to it.	Crimson color was observed.	Presence of Curcumin (resin) was detected.

Evaluation parameter for Herbal Cream:

Sr. No.	Evaluation parameter	Result F_1	F_2
1.	**Physical evaluation** a.Colour b.Odour c.Texture d.State	 o Faint yellow o Mild herbal o Smooth o Semi-solid	 o Faint yellow o Mild herbal o Smooth o Semi-solid
2.	**Irritancy**	No adverse effect observed	No adverse effect observed
3.	**Wash-ability**	Easily washable	Easily washable
4.	**pH**	Between 6 to 7	Between 6.5 to 7
5.	**Spread-ability (g** x cm/sec)	22.8	23.9
6.	**Phase separation**	No phase separation	No phase separation
7.	**Greasiness**	Non greasy	Non greasy
8.	**Homogeneity**	Uniform distribution of extract	Uniform distribution of extract

XI. Conclusion:

The formulated herbal cream containing Curcuma longa, Aloe barbadensis miller, cinnamon oil, and neem seed oil proved to be effective in the treatment of paronychia. It exhibited favourable physicochemical properties, significant antimicrobial activity against relevant pathogens, and demonstrated efficacy in promoting wound healing in vivo. These findings suggest that the herbal cream holds promise as a safe and efficacious topical treatment for paronychia, offering a natural alternative to conventional therapies. Further clinical studies are warranted to validate its efficacy and safety in human subjects.

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