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FORMULATION AND EVALUATION OF POLYHERBAL LOADED WITH EICHHORNIA CRASSIPES AND TRIPHALA EXTRACT FOR PSORIASIS

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ABSTRACT
Psoriasis is a chronic autoimmune disorder affecting millions worldwide, characterized by inflammation and abnormal skin proliferation. In this study, a polyherbal cream loaded with *Eichhornia crassipes and Triphala* extract was formulated and evaluated for its efficacy in managing psoriasis. The polyherbal cream was prepared using a suitable base incorporating standardized extracts of *Eichhornia crassipes and Triphala*, renowned for their Anti-inflammatory, Anti-oxidant and Immunomodulatory properties. Various physicochemical parameters including PH, viscosity, Spreadability and Stability were assessed to ensure the formulation quality and stability. The formulated polyherbal cream was tested for antibacterial and anti-fungal activity against the Bacteria Staphylococcus aureus and Fungi Candidaspecis. In summary our study is successful development of polyherbal cream Anti-microbial efficacy of Psoriasis.

KEYWORDS: Psoriasis, *Eichhornia crassipes and Triphala* Extract, Polyherbal cream, Bacteria Staphylococcus aureus, Fungi Candidaspecis.

INTRODUCTION
This study aims to deliver the formulation of a topical polyherbal cream incorporating *Eichhornia crassipes and Triphala* extracts, evaluating its efficacy and potential therapeutic benefits for psoriasis management. Through comprehensive evaluations encompassing physicochemical properties, stability assessments and in vitro studies, this research intends to contribute to the development of a novel, natural-based therapeutic approach for individuals grappling with psoriasis. *Eichhornia crassipes*, commonly known as water hyacinth, possesses bioactive compounds known for their anti-inflammatory and antioxidant properties. *Triphala* an Ayurvedic herbal formulation comprising three fruits *Emblica officinalis*, *Terminalia chebula* and *Terminalia belerica* has demonstrated anti-psoriatic effects due to its immunomodulatory and anti-inflammatory properties.

This novel approach aims to provide a safe, natural and potentially efficacious remedy for alleviating psoriatic symptoms. By integrating traditional botanical wisdom with modern scientific investigation, this research endeavours to contribute a promising alternative to conventional therapies, potentially enhancing the quality of life for individuals battling psoriasis. The formulation and evaluation of a polyherbal cream containing *Eichhornia crassipes and Triphala* extract for the treatment of psoriasis is a promising avenue in dermatological research. Traditional treatments often aim to alleviate symptoms rather than offer a complete cure, prompting the exploration of alternative natural remedies like herbal formulations.

Psoriasis
Psoriasis is a common, chronic, recurrent and immune-mediated inflammatory disorder characterised by circumscribed red, thickened plaques with an overlying silver-white scale. Psoriasis is divided into five types Gutate psoriasis, Inverse psoriasis, Plaque psoriasis, Pustular psoriasis and Erythrodermic psoriasis. The major characteristics are redness, irritation and blistering patches on the skin. It is an incurable disease only symptomatic relief can be achieved and severity can be lessened. Symptoms can be cleared for months or even years but it is a lifelong disease.

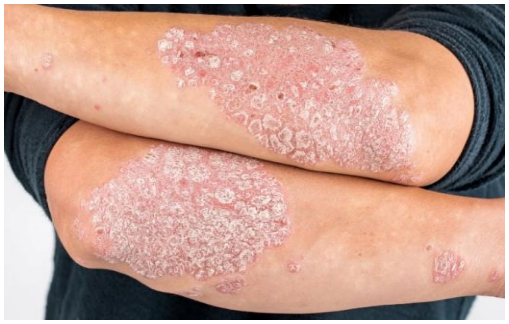

Fig 1: Psoriasis.

Plant profile
Eichhornia crassipes
Water hyacinth is classified as follows:
Domain: Eukaryotae
Kingdom: Plantae
Phylum: Spermatophyta
Subphylum: Angiospermae
Class: Monocotyledonae
Order: Pontederiale
Family: Pontederiaceae
Genus: Eichhornia
Species: Eichhornia crassipes

Water hyacinth (Eichhornia crassipes) is a vascular fast-growing floating aquatic plant which is commonly found in tropical and subtropical regions of the world with well-developed fibrous root systems and large biomass. Plants and hydrophytes (such as water hyacinth) have increasingly been shown to provide rich sources of natural bioactive compounds with antimicrobial, antitumoral, antiviral, and antioxidant activities. The use of plant extracts and phytochemicals, both with known antimicrobial properties, can be of great significance in treatments.

Fig. 2: Eichhornia crassipes.

Traditionally, the plant is used to treat gastrointestinal disorders, such as diarrhoea, intestinal worms, digestive disorders and flatulence. In addition, the beans were harnessed for healthy spleen functioning. The plant is also rich in various bioactive compounds that exhibit a wide array of pharmacological properties.

Triphala
Triphala is an herbal drug powder widely used in many disorders due to its various pharmacological activities. *Triphala* is composed of three active herbs such as myrobalans, *Terminalia chebula Retz (Haritaki), Terminalia bellirica Roxb (Bibhitaki) and Emblica officinalis Gaertn (Amalaki)* and one of the most commonly used ayurvedic preparation. The formulation generally consists of equal proportions of pericarps of this myrobalans.
Latin Name: *Terminalia chebula linn*
Family: *Combretaceae*
Classical Name: Haritaki
English Name: *Chebulic myrobalan*

Fig. 3: Haritaki.

The botanical name is *Terminalia chebula Retz*. It is conceived as one of the most significant ayurvedic herbaceous plants whilst it has an astringent and unpleasant taste. It is named as **"king of medicine"** in Tibetan medicine. Many delineations of the healing form show a handful of Haritaki. It is a potent anti-fungal, anti-bacterial as well as antiviral and also it is anti-inflammatory. It turns down the blood sugar levels and enhances insulin sensitivity. It is the best redressal for skin problems, hair loss and dandruff. It also treats constipation, dementia and diabetes.

It is believed to have
- A variety of positive health effects on the heart & and brain.
- It decreases stomach acidity and guards against ulcers.
- It reduces the risk of developing stomach ulcers because of the antioxidant properties of gallic acid and ellagic acid in it.

Bibhitaki
Latin Name*: Terminalia bellerica Roxb*
Family: Combretaceae
Classical Name: Bibhitaki
English Name: *Belleric myrobalan*

Fig. 4: Bibhitaki.

The botanical name is *Terminalia bellirica* and it is a strong laxative herbaceous plant. By nature, it is astringent, sweet and also heating. It is a restorative to "Kapha" and is believed to amend conditions of vitiated voice. Baheda is a potent ancient rejuvenator with detoxifying calibres on the body's muscles, blood, and tissues with fat in the body. It treats diabetes, high blood pressure, & and rheumatism. Bibhitaki is extremely feasible with circumstances necessitating redundant mucus tissue in the system and is also beneficial for featured bone formation.

Amalaki
Latin Name: *Emblica officinalis Garten*
Family: Euphorbiaceae
Classical Name: Amalaki
English Name: Indian gooseberry

Fig. 5: Amalaki.

Amla also known as Indian gooseberry, is identified botanically as *Emblica officinalis Gaertn and Phyllanthus emblica Linn*. In Sanskrit, it is also called Dhatri (the nurse) distinguished due to its incredible healing properties. Amla is also the most fertile natural source of vitamin C in the form of ascorbic acid containing 600 mg per 100 grams in an easily edible form. Amla is a superfood made up of over 80% water and it has very less calories. It has manifested to be an efficacious herbal medicine for the intervention and hindrance of eye disease, cancer, digestive problems, and diabetes. It also functions as a diuretic, liver tonic, restorative and anti-inflammatory. It also comprises protein, fibre, phosphorous, iron, carotene vitamin B complex and gallic acid according to the Indian Council of Medical Research. *"Emblica officinalis Gaertn* is an elegant tree typically a height of 18 m – 30 m. It disrobes in fragile flakes similar to that of guava trees and has reasonably pale greyish-brown smooth bark. It is deciduous, shedding its twigs as well as its leaves.

Cream
Creams are the topical preparations which can be applied on the skin. Creams are defined as "viscous liquid or semi-solid emulsions of either the oil-in-water or water-in-oil type" dosage forms which consistency varies by oil and water. Creams are used for cosmetic purposes such as cleansing, beautifying, improving appearances, protective or for therapeutic function. These topical formulations are used for the localized effect for the delivery of the drug into the underlying layer of the skin or the mucous membrane.

These products are designed to be used topically for the better site-specific delivery of the drug into the skin for skin disorders. Creams are considered as a pharmaceutical product as they are prepared based on techniques developed in the pharmaceutical industry; unmedicated and medicated creams are highly used for the treatment of various skin conditions or dermatoses. Creams can be ayurvedic, herbal or allopathic which are used by people according to their needs for their skin conditions. They contain one or more drugs substances dissolved or dispersed in a suitable base.

Creams may be classified as o/w or w/o type of emulsion on the basis of phases. The term 'cream' has been traditionally applied to semisolid formulated as either water-in-oil (e.g.: cold cream) or oil-in-water (e.g.: vanishing cream).

MATERIALS AND METHODS

Plant collection
Water hyacinth (E. crassipes) was collected from Kodiveri Dam, Sathya Mangalam, Erode, Tamil Nadu in July 2023. Triphala was collected from local Ayurvedic medical shops. It consists of Terminalia chebula Retz, Terminalia belerica linn, Emblica officinalis.

Plant authentication
The plant sample was authenticated by Dr.M. U. SHARIEF, SCIENTIST 'E' & HEAD OF OFFICE, Botanical Survey of India, TNAU Campus, Coimbatore, Tamil Nadu, India.

Shade drying
The plant materials (leaves) were washed with distilled water and dried under shadow then crushed into a fine powder with the help of a grinder.

Plant materials used
E. crassipes: Dried leaves
Triphala powder: Equal ratio of Phyllanthus emblica, Terminalia chebula and Terminalia bellerica.

Preparation of plant extract
For Eichhornia crassipes
Plant leaf extracts were prepared by using the Soxhlet extraction method, a quantity of 50g fine powder of leaves will be weighed and suspended with 250 ml of 80% ethanol for 6 to 8 hours at 50 ˚C to 80˚C. The green-coloured extract is formed. These extracts will concentrate to dryness at a controlled temperature (25˚-37˚C).

For triphala powder
A quantity of 50g fine powder will be fined and suspended with 250ml of 80% ethanol for 6 to 8 hours at 50 ˚C to 80˚C. A pale yellow-coloured extract is formed.

This extract is concentrated to dryness at a controlled temperature (25˚- 37˚C).

Preliminary phytochemical analysis

Preliminary phytochemical evaluation is an initial step in understanding the chemical composition of plant extracts. *Eichhornia crassipes* and *Triphala*, a succulent plant with traditional medicinal uses, has gained attention due to its reported pharmacological properties. The preliminary phytochemical analysis involves qualitative tests to identify various classes of secondary metabolites present in the plant.

Formulation of cream

The present research is the formulation of polyherbal cream by using the slab method. Water hyacinth extract, Triphala extract, Eugenia caryophyllus oil and beeswax were taken in the first beaker. Then heat on a water bath for uniform mixing. After a few minutes, the oil phase was formed. Distilled water, white soft paraffin and borax were taken in the second beaker. Mixing all the ingredients by heating on a water bath, the aqueous phase will form. The oil phase was added into the aqueous phase and continuously stirred at 70˚C until a semisolid mass was formed. The formed mass was taken on the slab and maintained its smooth consistency by rubbing a spatula on the slab. The formed cream was further evaluated.

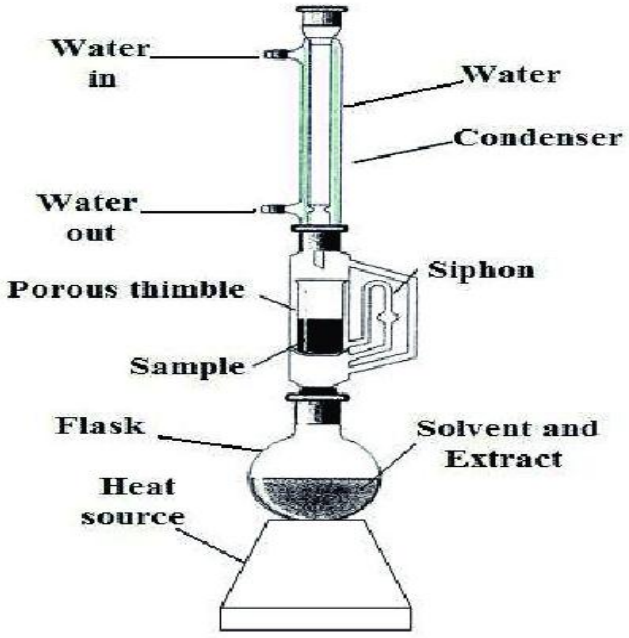

Fig. no. 7: Soxhlet apparatus.

Qualitative preliminary test

Table No. 1: Procedure for phytochemical test.

Test		Procedure	Observations (Indicating Positive Test)
Detection of Alkaloids			
1	Hager's test	Few ml filtrate + 1-2 mL *Hager's reagents*	A creamy white precipitate
2	Mayer's/ Bertrand's/ Valser's test	Few ml filtrate + 1-2 drops of *Mayer's reagent* (Along the sides of the test tube)	A creamy white/yellow precipitate
Detection of Flavonoids			
1	Alkaline Reagent test	1mL extract + 2mL of 2% NaOH solution (+ few drops dil. HCl)	An intense yellow colour becomes colourless on the addition of diluted acid
2	Sulphuric acid test	1mL plant extract + conc. H_2SO_4	A yellow
Detection of Phenolic compounds			
1	Ferric chloride test	Extract the aqueous solution with + a few drops of 5% ferric chloride sol.	Dark green/bluish-black colour
2	Liebermann test	Plant extract is dissolved in 5mL distilled water + conc. H_2SO_4 + $NaNO_3$	A red precipitate
Detection of Phytosterols			
1	Liebermann - Burchard's	50gm extract is dissolved in 2mL acetic	An array of colour solution

	test	anhydride + 1-2 drops of con. H_2SO_4 (along the side of the test tube	
Detection of Terpenoids			
1	Salkowski's test	2ml chloroform+ 5ml plant extract (evaporated on water bath) + 3ml of con. H_2SO_4 (boiled on water bath)	A grey coloured solution
2	Salkowski's test	Filtrate + few drops of con. H_2SO_4 (shaken well and allowed to stand)	Golden yellow layer (at the bottom)

Table no. 2: Formula of cream formulation.

S. No.	Ingredients	Quantity
1	Water hyacinth extract	300 ml
2	Triphala extract	5 ml
3	Bees wax	3.2 g
4	White soft paraffin	12 ml
5	Borax	0.3 g
6	Methyl paraben	0.03 g
7	Distilled water	q. s
8	Eugenia caryophyllus oil	10 ml

Evaluation of cream

Physical evaluation

Formulated herbal cream was further evaluated using the following physical parameters: colour, Odour, Consistency, and state of the formulation.

Colour

The colour of the cream was observed by visual examination.

Odour

The odour of cream was characteristic.

Consistency

The formulation was examined by rubbing cream on hand manually. The cream has a smooth consistency. The cream did not leave greasy substances on the skin surface after application.

State

The state of the cream was examined visually. The cream has a semisolid state.

pH

pH of prepared herbal cream was measured by using a digital pH meter. The cream solution was prepared using 100 ml of distilled water and set aside for 2 h. PH will be determined three times for the solution and the average value was calculated.

Spreadability

The Spreadability of formulated cream was measured by placing the sample in between two slides and then compressed to uniform thickness by placing a definite weight for a definite time. The specified time required to separate the two slides was measured as Spreadability. Spreadability was calculated by the following formula:

$$\text{Spreadability} = \frac{M \times L}{T}$$

Where,

S= Spreadability

M Weight tide to the upper slide

L= Length of glass slide

T= Time taken to separate the slides

Washability

The formulation was applied to the skin and then the ease of washing with water was checked.

Non- Irritancy test

The herbal cream formulation was evaluated for the non-irritancy test. Observation of the sites was done for 24 to 28 hours.

Viscosity

The viscosity of cream was done by using a Brooke field viscometer at the temp of 25 °C using spindle no. 63 at 5rpm.

Phase separation

The prepared cream was transferred to a suitable wide-mouth container. Set aside for storage, the oil phase and aqueous phase separation were visualised after 24hours.

Evaluation of antimicrobial activity

The formulated polyherbal cream was tested for antibacterial activity and antifungal activity against the bacteria- Staphylococcus aureus and fungi – Candida species.

Antibacterial activity

The antibacterial activity of the formulated cream was assessed using the disc diffusion method. A suspension of the tested microorganisms was uniformly swabbed on agar plates using sterile cotton swabs. Agar plates were prepared first using an agar nutrient medium. It is then poured into a petri dish. Sterile blank discs were individually impregnated with the different concentrations of formulated cream (10 and 15 mg/ml)

placed onto the inoculated agar plates. The plates were inverted and incubated at 37°C for 24 h. The antibacterial activity was evaluated by measuring the diameter of the resulting zone of inhibition against the tested microorganisms in mm.

Antifungal activity

Topical formulation with broad, non-resistance-promoting activity against Candida species can be of great use in dermatology preparation will infections are often mixed. Since the formulation contains an antifungal agent as an active moiety, it is likely to protect from fungal growth. To determine the activity of the formulation is subject to study the prepared formulation with the standard method called Disc diffusion method and the inhibition zone diameters were measured with the help of a zone reader.

RESULT AND DISCUSSION

Qualitative phytochemical Analysis

The phytochemical analysis was performed for Carbohydrates, Alkaloids, Flavonoids, Tannins, Phenolics, Reducing sugar, and Triterpenoids. As per the results shown in Table 3, the majority of tests were positive for plant juice, which means it contains the highest Phytoconstituents.

Table no. 3: Phytoconstituents present.

S. NO.	Phytochemical	Test	E. crassipes extract	Triphala
1	Alkaloids	Mayer's test	+	+
		Hager's test	-	+
2	Flavonoids	NaOH test	+	+
		Sulphuric acid test	+	+
3	Sterols	Lieberman Burchard test	-	-
4	Terpenoids	Salkowski test	-	+
5	Phenolic acid	FeCl3 & Liberman's test	+	+

Physical properties

The physical properties of formulated cream were judged by colour, Odour and texture.

Washability: The cream applied on skin was easily removed by washing with tap water. pH of the cream: The pH of the cream was found to be in range of 5.6 to 6.8 which is good for skin

pH: The herbal formulation was shown pH nearer to skin required i.e. pH 6.8.

Viscosity: Viscosity of formulated cream was determined by brook field viscometer at 20 rpm using spindle no. LV-4(64). The viscosity of cream was in the range of 499990 to 30000cp which indicates that the cream is easily spreadable by small amount of shear. The formulated cream shows the viscosity within range i.e. 48890cp.

Spread ability test: The spread ability test showed that the formulated cream has good spreadable property.

Irritancy test: The formulated cream shows no redness, edema, irritation and inflammation during studies. The formulated cream is safe to use.

Saponification value: The saponification value results of formulated cream was 22.4 and showed satisfactorily values.

Table no. 4: Summary of physical parameters.

S. NO.	Parameters	Results
1	Colour	Green
2	Odour	Characteristics
3	pH	6.4
4	Viscosity	39010 cps
5	Spreadability	7.4 g. cm/ sec
6	Washability	Easily washable
7	Non irritancy	Non irritant
8	Phase separation	No phase separation
9	State and consistency	Semisolid and smooth consistency

Table no. 5: Zone of inhibition of the polyherbal cream against the test organism (*Staphylococcus aureus*).

Different concentration of cream	Zone of inhibition
	Staphylococcus aureus
10%	10
15%	12
Standard Psorakot cream 15%	20

Pharmacological studies

Antibacterial activity[1,10,11,12]

The antibacterial activity of formulated polyherbal cream was checked against the staphylococcus aureus bacteria. Formulated polyherbal cream showed a significant inhibitory effect on bacteria.

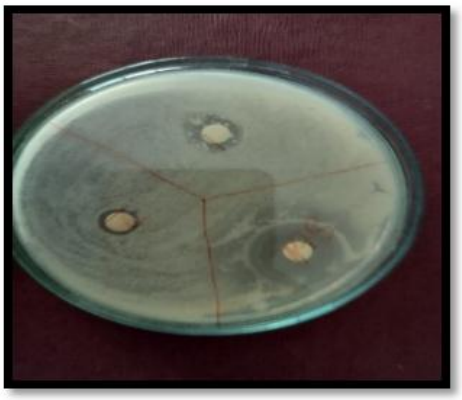

Fig. no. 8: Antibacterial activity for cream.

Antifungal activity

Petri dish is divided into 3 parts, in two parts sample discs such as 10µg, 15µg discs (discs are soaked overnight in sample solution) and another part Standard disc Psorakot 15µg is placed in the plate with the help of sterile forceps. Then Petri dishes are placed in the refrigerator at 4º C or at room temperature for 1 hour for diffusion. Incubate at 28 º C for 48hours. Observe the zone of inhibition produced by different samples. Measure it using a scale and record the average of two diameters of each zone of inhibition.

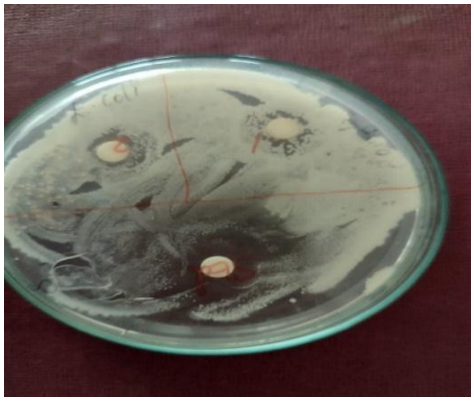

Fig. no. 9: Antifungal activity for cream.

Table no. 6: Zone of inhibition of the polyherbal cream against the test organism (*Candida albicans*).

Different concentration of Cream	Zone of inhibition *Candida albicans*
10%	7
15%	10
Standard Psariot cream 15%	20

CONCLUSION

In conclusion, our comprehensive study aimed to formulate and evaluate a polyherbal cream for the treatment of psoriasis, utilizing ethanolic extracts of Eichhornia crassipes and Triphala, both known for their antimicrobial properties. The objectives, ranging from plant extract preparation to cream formulation and subsequent evaluation, were meticulously executed.

The phytochemical analysis revealed the presence of significant phytoconstituents, confirming the rich composition of the plant extracts. Notably, the formulated polyherbal cream exhibited positive physical properties, including a pleasing color, characteristic odor, and desirable texture. Importantly, it demonstrated good washability, skin-friendly pH, optimal viscosity, and excellent Spreadability, emphasizing its practical suitability.

Furthermore, the cream underwent thorough testing for irritancy, and the results indicated its safety for use, devoid of redness, edema, irritation, or inflammation. The saponification value further affirmed the cream's quality, providing satisfactory results. of paramount importance, the formulated polyherbal cream showcased effective antifungal and antibacterial activities against Candida species and Staphylococcus aureus, respectively. This underscores its potential therapeutic efficacy in psoriasis treatment.

In summary, our study culminates in the successful development of a polyherbal cream with promising physical attributes and substantiated antimicrobial efficacy, marking a significant contribution to the field of dermatological care, particularly in the context of psoriasis management.

Future plan of work

1. Dermatological compatibility study

Investigate the compatibility of the polyherbal cream with various skin types. Perform patch tests on a diverse group of individuals to assess potential allergic reactions or irritations. This study will provide insights into the cream's broad applicability across different skin profiles.

2. Optimization of formulation

Refine the formulation of the polyherbal cream based on feedback from the initial study. Adjust concentrations of key ingredients, explore additional herbal components or modify the preparation method to enhance the cream's efficacy and user experience.

3. In-Depth mechanistic study

Conduct a more detailed investigation into the molecular mechanisms underlying the observed antimicrobial activities. Explore gene expression patterns, cytokine profiles, and immunomodulatory effects induced by the polyherbal cream. This will contribute to a deeper understanding of its therapeutic actions.

4. Treatment groups

Create different treatment groups, including a control group and groups treated with varying concentrations of

the polyherbal cream. Ensure a range of concentrations to observe dose-dependent effects.

5. Cell viability assay

Perform a cell viability assay (e.g., MTT assay) to evaluate the impact of the polyherbal cream on cell viability. Assess the cytotoxicity and confirm that the concentrations used are safe for skin cells.

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